

## Diabetes and Hypothyroidism

Aaron Rockoff MD  
Fellow in Endocrinology, UC-Irvine

## Topics

- 1) Function of the thyroid
- 2) Autoimmune thyroid disease and Type 1 DM
- 3) Thyroid disease's effect on diabetes
- 4) Clinical presentation of thyroid dysfunction
- 5) Diagnosis
- 6) Treatment
- 7) Practice guidelines

## Thyroid



- One of the largest endocrine organs
- Functions to regulate energy expenditure of different organs in the body
- Regulated by feedback inhibition at the pituitary gland

From Netter's  
anatomy

## Thyroid Hormone

- Work to stimulate cell metabolism and activity
- Key for cell maturity and differentiation
- Two major forms are Thyroxine (T4) and Triiodothyronine (T3)
  - T4 has a half life of 6.7 days and T3 around 18 hours

## Thyroid Hormone

- About 80% of T3 in circulation comes from conversion of T4 into T3
- Iodine necessary for production
- Daily Intake 150 mcg/day
  - Amiodarone contains 500x that in each 200mg pill

## Autoimmune Thyroid Disease

- The prevalence of AI thyroid disease in diabetic patients is 10.8% vs. 6.6% in the general population
- Thyroid disease more common with women
  - 30% of T1DM women have thyroid disease
  - The rate of postpartum thyroiditis 3x higher in diabetic patients

## Causes of Hypothyroidism

- Iodine deficiency or excess
- Radiation
- Surgery
- Medications: Lithium, amiodarone
- Hypothalamic-Pituitary dysfunction

## How will it affect my Diabetes?

- Hyperthyroidism
  - Causes increased gluconeogenesis, rapid GI absorption of glucose, and increased insulin resistance
  - May unmask latent diabetes
  - Also hyperglycemia may resolve when euthyroid

## How will it affect my Diabetes?

- Hypothyroidism
  - Lowered insulin degradation may lead to lower exogenous insulin needs
  - Decreased carbohydrate metabolism
  - Worsening dyslipidemia
    - Elevated LDL and triglycerides

## Case

- A 53 woman with T2DM and obesity comes into her doctor's office. She has avoided switching to insulin and her A1c has risen to 9.8% and she has lost 15lbs. She complains of fatigue, insomnia and feels anxious thinking she may have cancer.

## Case

- 67 male with T2DM and COPD admitted to the MICU for community acquired pneumonia. Due to some tachycardia, thyroid function tests were ordered and patient found to have a suppressed TSH of 0.8 with a normal FT4 level of 1.1.

## Clinical Presentation Difficulties

- Clinical signs such as weight loss, fatigue and increased appetite can go with Graves' disease or uncontrolled diabetes
- Signs and symptoms like edema, pallor, weight gain and fatigue could lead to diabetic neuropathy being mistaken for hypothyroidism

## Testing Difficulties

- Thyroid function tests are necessary, but can be misleading
- Non-thyroidal illness refers to any medical problem causing a temporary change in thyroid function not related to true thyroid disease

## Making the Diagnosis

- TSH is still the initial test unless pituitary dysfunction is suspected
- Free T4 is the additional test most often used in evaluating hypothyroidism
- FT4 and total T3 are used with hyperthyroidism

## Making the Diagnosis

- Antibodies are useful for predicting the chance of developing hypothyroidism or confirming the diagnosis in Graves' disease
- TPO antibodies predominantly used to predict hypothyroidism
- Thyroid Stimulating Immunoglobulins are helpful in the diagnosis of Graves' disease

## Making the Diagnosis

- When is subclinical hypothyroidism (mild TSH elevation and normal T4 and T3 levels in asymptomatic patient) important?
- Subclinical hypothyroidism can make a substantial impact on dyslipidemia
- TPO antibodies are positive
- Make sure patient is not just recovering from non-thyroidal illness or thyroiditis

## Implications of Hyperthyroidism

- One patient's presenting with diabetes when hyperthyroid, may have resolution of diabetes when hyperthyroidism is treated
- Worsening hyperthyroidism will cause deterioration of glucose control
- Treatment may cause improvement in insulin sensitivity, and needs to be anticipated

## Implications of Hypothyroidism

- Increased LDL levels will make physicians want to increase statins and other lipid lowering medications
- First treat the hypothyroidism to goal
- Hypothyroidism should not be a cause of hypoglycemia unless related to a pituitary dysfunction and accompanied by adrenal insufficiency

## Treatment of Hypothyroidism

- All hypothyroid patients should be treated with levothyroxine (T4)
- Dessicated thyroid hormone (Armour and Nature thyroid) should be avoided due to their high and unpredictable amount of T3
- Very few people have a problem with conversion of T4 to T3 in the body
- Can not do genetic testing at this time

## Case

- 38 female with hypothyroidism comes in for evaluation. States she is looking for a new physician because her last doctor switched her from Nature thyroid to Synthroid. She has gained weight and feels very fatigued, states she must be a "non-converter"
- What can we do?

## Treatment of Hypothyroidism

- Daily replacement dose can be calculated using 1.6mcg/kg
- Titrate the dose to goal TSH every 6-8 weeks
- When dealing with the elderly or patients with risk factors for heart disease, **start low and go slow**
  - Normal TSH at age >70 may be 5-7.5

## Treatment of Hypothyroidism

- If having trouble getting the patient to the normal TSH range, and requiring higher than expected amounts of levothyroxine:
  - Consider celiac disease (look for other vitamin deficiencies)
  - Make sure patient taking the medication appropriately
  - Tell patient to take a double dose if he/she misses one day of medication

## Treatment of Hyperthyroidism

- Definitive treatment includes radioactive iodine ablation and surgery
- Anti-thyroid medications have rare but severe risk factors
  - Remission rates for Graves' with medication alone is <40%

## American Thyroid Association Guidelines

- Check TPO antibodies
  - For subclinical hypothyroidism
  - For recurrent miscarriages
- Use Free T4 in addition to TSH
  - Unless pregnant when total T4 used
- Avoid testing TSH in hospital unless very suspicious for thyroid disease

## American Thyroid Association Guidelines

- In central hypothyroidism - only check FT4
- Check TSH every 4-8 weeks when initiating levothyroxine or titrating dose
- TSH should be checked every 6-12 months once on a stable dose
- Thyroid hormone replacement should not be used for obesity or depression

Questions?