Hypothyroidism and Hyperthyroidism: Review Questions

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QUESTIONS

Choose the single best answer for each question.

1. A 33-year-old woman presents to the clinic with a positive home pregnancy test. The patient has a history of Hashimoto's thyroiditis, which has been successfully managed with levothyroxine 125 µg daily for the past 4 years; serum thyroid-stimulating hormone (TSH) levels have been between 0.5 and 1.5 µIU/mL (normal, 0.3–5.5 µIU/mL). She has a family history of thyroid disease, and her mother also takes levothyroxine. In the office, the pregnancy test is confirmed; this is her first pregnancy. To remain biochemically and clinically euthyroid, how should this patient be managed?

(A) Levothyroxine should be increased
(B) Levothyroxine should be decreased
(C) Triiodothyronine (T_3) should be taken in addition to levothyroxine
(D) The pregnancy should be terminated

Questions 2 and 3 refer to the following case.

A 65-year-old man returns to the clinic 3 months after routine blood tests revealed a serum TSH level of 0.08 µIU/mL. The patient has been feeling well and denies cold or heat intolerance, palpitations, diarrhea, neck pain, and skin/hair changes. The patient recalls being told that he has lumps in his thyroid. He has no family history of thyroid disease, is a nonsmoker, and takes only a daily aspirin. On today's examination, a 2-cm nodule in the left lobe of the thyroid is palpated, but the rest of the thyroid does not appear enlarged or tender to palpation. The patient's reflexes are within normal limits. There is no lid lag or signs of exophthalmos. Laboratory results obtained during this presentation reveal the following: TSH, 0.05 µIU/mL; free thyroxine (T_4), 1.56 ng/dL (normal, 0.8–1.8 ng/dL); total T_4, 9.3 µg/dL (normal, 4.5–12 µg/dL); and total T_3, 103 ng/dL (normal, 80–181 ng/dL).

2. What is this patient's most likely diagnosis?

(A) Euthyroid sick syndrome
(B) Subacute thyroiditis
(C) Subclinical hyperthyroidism (SCH) from Graves' disease
(D) SCH from a toxic adenoma

3. What is the most appropriate next step in the management of this patient?

(A) Order a radioactive iodine uptake (RAIU) and scan
(B) Radioactive iodine to ablate the thyroid gland
(C) Reexamine the patient in 1 year
(D) Referral to a surgeon for total thyroidectomy

Questions 4 and 5 refer to the following case.

A 38-year-old woman presents to the clinic with gradual-onset fatigue and weight gain. Two years ago, she was told that she had an enlarged thyroid. She has since relocated and has not seen a physician until now. The patient describes a 10-lb weight gain in the past year and states that her mother and aunt both have thyroid problems for which they take medication. The patient does not smoke and otherwise feels well. On examination, the only abnormal finding is a firm, nontender thyroid gland two-fold larger than normal. She has slightly delayed relaxation of her deep tendon reflexes. Initial laboratory results reveal the following:

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serum TSH, 18.3 μIU/mL; serum free T_4, 0.8 ng/dL; and serum thyroid peroxidase antibodies, 636 IU/mL (normal, < 10 IU/mL).

4. All of the following could explain this patient's elevated serum TSH level EXCEPT
(A) Excess exogenous thyroid hormone
(B) Primary hypothyroidism
(C) Recovery from nonthyroidal illness
(D) Subacute thyroiditis

5. The patient is diagnosed with Hashimoto's thyroiditis and levothyroxine 125 μg daily is initiated. All of the following medications have been shown to interfere with the absorption of levothyroxine EXCEPT
(A) Aluminum hydroxide (antacids)
(B) Calcium carbonate
(C) Ferrous sulfate
(D) Potassium chloride

Questions 6 and 7 refer to the following case.

A 35-year-old woman presents to the clinic with a 6-week history of palpitations, tremor, and nervousness. She states she has no medical problems, does not smoke, and denies taking any prescription medications. She reports a recent 7-lb weight loss, which she attributes to the herbal weight loss supplement she has been taking. On examination, the patient's heart rate is 104 bpm, blood pressure is 124/68 mm Hg, and body mass index is 26 kg/m^2. The patient clinically appears hyperthyroid and has an enlarged, very firm, nontender thyroid gland, no thyroid ophthalmopathy, and a tremor.

6. Which of the following is the best initial test to evaluate this patient's hyperthyroidism?
(A) Serum total T_3
(B) Serum total T_4
(C) Serum TSH
(D) Thyroid-stimulating immunoglobulin

7. A thyroid RAIU and scan is performed, which shows absent iodine uptake throughout the thyroid gland. A serum thyroglobulin level is undetectable. What is this patient's most likely diagnosis?
(A) Exogenous thyrotoxicosis
(B) Graves' disease
(C) Hashimoto's thyroiditis
(D) Toxic multinodular goiter

ANSWERS AND EXPLANATIONS

1. (A) Levothyroxine should be increased. During the first trimester of pregnancy, serum estradiol concentration increases and the amount of thyroxine-binding globulin approximately doubles. Thus, an increase in total T_4 is required to maintain free T_4 within normal range. Human chorionic gonadotropin from the placenta typically stimulates the thyroid to increase production of T_4. However, women with primary hypothyroidism cannot keep up with the increased demands on the thyroid during pregnancy, often resulting in maternal hypothyroxinemia in the first trimester, which may lead to impaired intellect and cognition in offspring.[1] Hypothyroidism can be safely treated during pregnancy with levothyroxine. Levothyroxine dose should be increased by about 30% to 50% early in the first trimester in order to maintain serum TSH concentration between 0.5 and 2.0 μIU/mL and serum free T_4 concentration within the upper third of normal.[2] There is no role for treatment with T_3 during pregnancy.

2. (D) SCH from a toxic adenoma. SCH is defined as suppressed serum TSH (below the lower limit of the reference range) in the setting of normal serum free T_3 and T_4. In the United States, SCH has a prevalence between 0.7% and 15.4%, depending on the regional dietary iodine intake and age of the population.[3] Given the presence of a nodule in the gland, a likely cause of SCH in this patient is a toxic uni- or multinodular goiter. Although Graves' disease, subacute thyroiditis, and drug-induced thyroiditis are potential causes of SCH, they are not likely the cause of this patient's hyperthyroidism. Graves' disease is less likely given the presence of a nodule; subacute thyroiditis is unlikely because the timing of disease onset is not consistent with thyroiditis and the thyroid was not tender on physical examination; and drug-induced thyroiditis is unlikely given that the patient only takes aspirin, which is not associated with thyroiditis. SCH must be carefully differentiated from euthyroid sick syndrome by repeated monitoring of serum TSH levels over time. Most patients with SCH present without symptoms.

3. (A) Order a RAIU and scan. The next most appropriate step in this patient's management is obtaining a RAIU and scan to differentiate between the causes of hyperthyroidism. The thyrotoxic phase of subacute thyroiditis is associated with decreased uptake throughout the thyroid, whereas patients with Graves' disease have increased uptake throughout the thyroid. This patient with a toxic adenoma was found to have decreased or absent uptake throughout the thyroid except for 1 area of increased uptake that corresponded to the location of the left lobe nodule that was palpated on physical examination. Due to

increased morbidity in certain populations, including increased risk of cardiac complications (eg, atrial fibrillation) in older patients[4,5] and increased skeletal resorption in postmenopausal women (leading to low bone density and fractures),[6] treatment of SCH may be required. Treatment should be considered when serum TSH is less than 0.1 μIU/mL.[7]

4. **(A) Excess exogenous thyroid hormone.** The differential diagnosis for an elevated serum TSH level includes primary hypothyroidism; the hypothyroid phase of subacute thyroiditis; recovery from nonthyroidal illness; drugs, including dopamine antagonists, amiodarone, and oral cholecystogram dye (sodium ipodate); TSH-producing pituitary adenoma; adrenal insufficiency; and generalized thyroid hormone resistance. Ingestion of excess exogenous thyroid hormone would suppress the TSH level.

5. **(D) Potassium chloride.** Levothyroxine is used in patients who are thyroid hormone–deficient. Approximately 80% of the total levothyroxine dose is absorbed by the jejunum and ileum within the first 3 hours of administration. Because there is a narrow therapeutic window for levothyroxine dosing, patients require frequent TSH monitoring to maintain a biochemical euthyroid state. Those who absorb less levothyroxine may have incompletely treated hypothyroidism. Drugs that have been shown to decrease the absorption of levothyroxine include antacids that contain aluminum hydroxide,[8] bile acid sequestrants,[8] calcium carbonate,[9] and ferrous sulfate.[8] Potassium chloride has not been shown to interfere with the absorption of levothyroxine.

6. **(C) Serum TSH.** When evaluating a patient with suspected thyroid dysfunction, serum TSH concentration should be the initial screening test. If the TSH is low or low to normal, elevations in peripheral serum thyroid hormone levels can help confirm the diagnosis of hyperthyroidism. Subsequently, a 24-hour thyroid RAIU and scan can be ordered to determine the cause of the hyperthyroidism. Serum T_3 and T_4 levels should not be used as an initial diagnostic test. Thyroid-stimulating immunoglobulin elevations may be seen in patients with Graves' disease, but this test is very insensitive.

7. **(A) Exogenous thyrotoxicosis.** Exogenous thyrotoxicosis refers to excessive thyroid hormone from an extrathyroidal source. Specifically, thyrotoxicosis factitia describes thyrotoxicosis that is a result of excessive ingestion of thyroid hormone.[10] The herbal weight loss supplement that this patient was taking was found to contain both T_3 and T_4. Patients with exogenous thyrotoxicosis can present similarly to those with hyperthyroidism from other causes.[11] Results of this patient's RAIU and scan demonstrate that both Graves' disease and toxic multinodular goiter are unlikely, as increased uptake in a homogenous or heterogeneous pattern, respectively, would be expected. The serum thyroglobulin level may help differentiate between endogenous (associated with elevated thyroglobulin) and exogenous (associated with decreased or undetectable thyroglobulin) hyperthyroidism. Hashimoto's thyroiditis is typically not associated with symptoms of thyrotoxicosis.

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