

Endocrinology I

- A thyroid scan can differentiate between causes of thyrotoxicosis. Beta blockers can treat adrenergic symptoms in all forms of thyrotoxicosis while anti-thyroid drugs are used to treat hyperthyroidism from toxic nodules or Grave's disease.
 - Prompt treatment is important to reduce the risk of thyroid storm which has a high mortality rate.
- Overt hypothyroidism is treated with oral levothyroxine 1.6 ug/kg/day in younger healthy adults while lower doses can be initiated in older adults or those with increased cardiovascular risk. Thyroid hormone should be taken 60 minutes before a meal or 4 hours after the last meal and separated from substances that may interfere with absorption. Thyroid nodule evaluation includes measurement of thyroid function and uptake scan for evaluation of a hot nodule only if TSH is suppressed. In the setting of a thyroid nodule with normal thyroid function, ultrasonography should guide decision on thyroid nodule FNA.
- In the evaluation of thyrotoxicosis, thyroid uptake and scan is the best diagnostic test to determine etiology. High uptake is consistent with true hyperthyroidism (thyroid hormone overproduction) while low uptake is consistent with excess thyroid hormone from thyroid inflammation/destruction and/or nonthyroidal sources (e.g., exogenous thyroid hormone administration).
 - The scan portion of the test will help differentiate between high uptake causes like Graves' (diffuse uptake), toxic adenoma (single focused area of uptake), and toxic multinodular goiter (patchy uptake).
- Women with preexisting hypothyroidism who learn they are require an immediate dose increase in thyroid hormone (30-50%) when pregnancy is confirmed. This helps ensure high enough T4 levels to help avoid neonatal hypothyroidism and counteracts the notable increase in thyroxine-binding globulin caused by the high-estrogen state of pregnancy.

- Adrenal incidentalomas are common. Hormone evaluation should include a 1 mg-dexamethasone suppression test, plasma or urine metanephrines and catecholamines if Hounsfield Unit score is ≥ 10 and aldosterone concentration/plasma renin activity if hypertension or hypokalemia. Adrenalectomy should be considered if size ≥ 4 cm, suspicious radiographic features or functioning tumor.
 - Patients with a lipid-rich adrenal incidentaloma (low Hounsfield units, e.g., < 10 HU) do not require screening for pheochromocytoma. Pheochromocytomas will always have much higher HU.

Endocrinology II

- Ninety percent of type 1 diabetes is related to autoimmune destruction of β cells and is associated with autoantibodies to β cells (insulin antibodies, IA-2, GAD-65 and ZnT8 autoantibodies) and insulin dependence.
 - Diabetic ketoacidosis (DKA) can result when insulin is omitted or in the setting of a precipitating factor such as infection and often presents with nausea, vomiting, abdominal pain and deep respirations but can progress rapidly and lead to hypotension and shock if not treated promptly with insulin and fluids.
 - Potassium requires close monitoring and replacement in DKA
- Diagnosis of diabetes is established by clinical symptoms of hyperglycemia with random glucose > 200 mg/dL, or in the absence of symptoms, two of the following abnormal tests: fasting glucose levels > 126 mg/dL, 2-hour plasma glucose during OGTT > 200 mg/dL, HbA1c $> 6.5\%$.
 - A single glucose 200 mg/dL or higher in the presence of classic hyperglycemic symptoms or hyperglycemic crisis (DKA or HHS) is sufficient for diagnosis and does not require confirmatory testing. All other diagnostic tests (fasting glucose, HbA1c, and 2-hour OGTT) require confirmation.
- Initial therapy for type 2 diabetes is metformin if GFR is > 45 with additional agents based on ASCVD risk and CKD with GLP-1RA and SGLT-2 inhibitor usually being preferred if no contraindications.
- Screening for microvascular complications (retinopathy, neuropathy, nephropathy) of diabetes should occur 5 years after the diagnosis of type 1 diabetes and then yearly and at the time of diagnosis for type 2 diabetes and then yearly.

- Optimization of glucose control reduces the risk of microvascular complications. Macrovascular complications are reduced through weight loss, Mediterranean diet, smoking cessation, lipid management, increased physical activity and blood pressure control.
- Moderate intensity statin is indicated in patients with diabetes between the age of 40-75 years. GLP1-RA and SGLT-2 inhibitors can reduce cardiovascular risk in patients with type 2 diabetes. Patients with diabetic ketoacidosis require potassium supplementation starting when the potassium level is NORMAL - although they can present with hyperkalemia, they are total-body potassium-depleted, and the initiation of insulin will rapidly drive extracellular potassium intracellularly and will rapidly drive down serum potassium levels.
- In choosing medications for patients with type 2 diabetes mellitus, a comorbidity-driven approach is now common. For example, patients with congestive heart failure and/or diabetic chronic kidney disease may benefit most from an SGLT2-inhibitor. Patients with ASCVD and/or diabetic chronic kidney disease may benefit most from a GLP-1 receptor agonist.

Endocrinology III

- Evaluation of hypercalcemia requires confirmation of hypercalcemia and measurement of PTH to determine if PTH-mediated or non-PTH mediated. Treatment of severe hypercalcemia requires IV normal saline, bisphosphonate therapy and calcitonin to bridge to the effect of bisphosphonate (48 hours). Other treatments are based on the cause of hypercalcemia (i.e., steroids for increased 1- α -hydroxylase) and the response to therapy (denosumab for refractory hypercalcemia). Patients with hyperparathyroidism should undergo surgery if serum calcium is 1 mg/dL above ULN, skeletal involvement, kidney involvement, age <50 years and symptoms.
- Women ≥ 65 should be screened for osteoporosis or <65 if risk factors. First line therapy for the management of osteoporosis (defined by a T score < -2.5 or a fragility fracture) is bisphosphonate therapy. Denosumab, PTH/PTHrp analogues and romosozumab are second line treatment options. More aggressive first line therapy (denosumab or PTH/PTHrp analogue) is indicated in glucocorticoid induced osteoporosis for those >40 years with high risk of fracture.

- A morning cortisol <3ug/dL is diagnostic of adrenal insufficiency while a cortisol >15-18ug/dL rules out adrenal insufficiency. A cosyntropin stimulation test is necessary to rule out adrenal insufficiency in those with indeterminate morning cortisol values (3-15ug/dL). ACTH levels differentiate between primary and secondary adrenal insufficiency.
- Patients with primary adrenal insufficiency require glucocorticoid and mineralocorticoid replacement while those with secondary adrenal insufficiency require only glucocorticoid replacement.
- LH levels measured with testosterone can help differentiate between primary and secondary hypogonadism. Evaluation of secondary hypogonadism includes serum prolactin, medication review, iron studies, OSA screen and MRI in those with serum testosterone <150ng/dL, other pituitary deficiencies or elevated prolactin.
 - Acute gynecomastia requires work up in men including LH, FSH, estradiol, testosterone, TSH, FT4, prolactin, hCG. An elevated estradiol or hCG should prompt imaging to rule out malignancy.
- In generally well outpatients, primary hyperparathyroidism is far and away the most common cause of hypercalcemia. If you confirm high calcium and high PTH (or even high-normal PTH) on multiple occasions, substantial testing for other etiologies becomes unnecessary.
 - Besides primary hyperparathyroidism, the only other diagnosis that will give you a pattern of high PTH and high calcium is the rare genetic disorder, familial hypocalciuric hypercalcemia (FHH).
 - Primary hyperparathyroidism (normal to high urinary calcium excretion) can be distinguished from FHH (very low urinary calcium excretion) in most cases with a 24-hour urine calcium measurement.
- Secondary hyperparathyroidism, in which PTH is high but the calcium is normal or low, is NOT treated with parathyroidectomy. Rather, the approach should be to identify the underlying cause (e.g., what is stimulating PTH, such as dietary calcium deficiency or malabsorption or progressive CKD with loss of renal activation of vitamin D) and treat that.
- The diagnosis of osteoporosis can be made with bone densitometry if the patient has suffered a fragility fracture, including hip or vertebral body fractures suffered from low or no trauma (e.g., less than or equal to fall from standing height).
 - Bone densitometry should still be performed to assess the severity and guide treatment, and to serve as a treatment baseline, but obtaining this should not substantially delay treatment, as all patients who have suffered a fragility fracture are at high to very high risk of subsequent fractures.

Endocrinology IV

- Low HDL is not linked to increased risk of ASCVD and should not be treated with medication to raise HDL.
- Despite the prevalence and success of weight loss medications, ALL patients with obesity should receive comprehensive lifestyle modification efforts, including calorie restriction (>500 kcal per day reduction), moderate intensity exercise (at least 150 minutes per week), and behavioral counseling.
 - All FDA-approved weight loss medications are contraindicated in pregnancy. For non-pregnant adults, the choice of medication class can be made by balancing adverse effect profile and contraindications, route of administration, cost, and degree of weight loss desired. For example, while GLP-1 receptor agonists tend to result in the greatest weight loss, injections may be less desirable for certain patients, these medications may be more costly than others, and others and may be contraindicated in those patients at risk for pancreatitis or medullary thyroid cancer.
 - Bariatric surgery is indicated for BMI ³>35 or ³>30 with diabetes.
- It is recommended to screen all people age 40-75 for ASCVD risk calculation. Treatment includes non-pharmacologic measures such as dietary modification, exercise (150 minutes/week), weight loss and smoking cessation in addition to pharmacologic therapy.
 - Those at intermediate risk or diabetes age 40-75 years should receive moderate intensity statin. Those with high-risk, LDL >190 mg/dL, or diabetes with multiple ASCVD risk factors should receive high intensity statin (ACC/AHA recommendations).
- Treatment of hypertriglyceridemia includes lifestyle interventions, treatment of reversible causes, statin if 10-year ASCVD risk >7.5%. When Triglycerides are >500mg/dL, treatment should be a very low-fat diet, omega-3 fatty acid consumption, and avoidance of carbohydrates and alcohol. Medication treatment options include isocapent ethyl and fenofibrate.