1. Which of the following is not correct?

A. Most cases of thyrotoxicosis are due to autoimmune disease.
B. Hypothyroidism is more common than hyperthyroidism.
C. Thyrotoxicosis is less common in men.
D. Mental status changes distinguish between hyperthyroidism and thyrotoxicosis.
E. Both Amiodarone and Lithium can cause a drug-induced thyrotoxicosis.
2. Which of the following statements regarding thyroid storm is correct?

A. Administration of iodinated contrast material is a precipitating factor.
B. An elevated thyroxine-stimulating hormone level is expected.
C. Corticosteroid administration is contraindicated.
D. Iodine should be given before propylthiouracil.
E. Lithium is relatively contraindicated
3. A 24 year old female presents with an acute overdose of her mother’s synthroid. She has a normal mental status V/S : BP 176/90, P-130 reg, Temp= 99.0 
Which of the following does not have a role in her treatment?

A. Testing for co-ingestions
B. PTU
C. Inderal
D. Steroids
E. Cholestyramine
4. Which is the best ED screening test for hypothyroidism?

• A. T3
• B. T4
• C. TSH
• D. TBG (thyroid binding globulin)
5. When treating a patient with diagnosed myxedema coma which is not correct?

• A. Accucheck and airway management are paramount.

• B. Steroids may play a role in treatment

• C. IV T4 should not be used in older patients.

• D. IV T3 should not be used in older patients.

• E. The precipitating event is important to identify and treat.
6. A 65 year old female on chronic steroids presents to the ED with altered mental status and hypotension, which is true?

- A. She is more likely to have a low sodium and a high potassium, and a low glucose.
- B. She is more likely to have a low sodium and a normal potassium, and a low glucose.
- C. She is more likely to have a low sodium, high potassium, and normal glucose.
7. A 4 year old female with congenital adrenal hyperplasia presents to the ED with altered mental status and hypotension, which is true?

- A. She is more likely to have a low sodium and a high potassium, and a low glucose.
- B. She is more likely to have a low sodium and a normal potassium, and a low glucose.
- C. She is more likely to have a low sodium, high potassium, and normal glucose.
8. An 85 year old male presents with 7 days of constipation and bloating. He does not have any pain, which test should be done first to rule out an acute life threat?

• A. Portable flat plate of the abdomen
• B. Portable 3-way of the abdomen
• C. Bedside ultrasound
• D. CT scan of the abdomen
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9. An 85 year old female presents to the emergency department with acute abdominal pain. Which is correct?

• A. Her chance of having a surgical cause of her pain is 2 X that of a younger patient.
• B. The most common cause in her age group is appendicitis.
• C. An EKG is not necessary
• D. The presence of a fever doesn’t help distinguish between infectious and non-infectious causes in the elderly.
10. The most common atypical presentation of an acute MI in the elderly is:

• A. Dizziness
• B. Shortness of breath
• C. Nausea and vomiting
• D. Fatigue/weakness
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Meet your thyroid!

• **Purpose**
  - To influence the metabolism of cells by increasing their basal metabolic rate
  - Other roles:
    - Protein synthesis
    - Synergistic with other hormones (i.e. Human growth hormone)

• **Cool fact:**
  - ~100 days of thyroid hormone is stored in the thyroid
Hyperthyroidism

• Condition caused by overproduction and increased circulation of thyroid hormone
Causes of TRH release
- Low T3 T4
- Exercise
- Stress
- Sleep
- Malnutrition
- Hypoglycemia
Thyroid Hormone

• Triiodothyronine (T3)
  – Only 20% of circulating T3 was secreted
  – 80% peripheral conversion from T4 (liver and skeletal muscle)
  – T3 is the biologically active hormone

• Thyroxine (T4)

• 99% of thyroid hormone is protein bound
  – Most to Thyroid binding globulin (TBG)

• Only Free T3 and T4 are clinically relevant
Beta Receptor Effect

• Beta agonist effect-dramatic increase in response
  – Increases the expression of Beta receptors
  – Increase Sensitivity of receptors
Spectrum of Hyperthyroid Disease

Sub-clinical Thyrotoxicosis Thyroid Storm
Causes of Hyperthyroidism

• Grave’s Disease
  – Most common form of hyperthyroidism
  – Antibodies formed to the TSH receptor

• Toxic Mutinodular Goiter
  – 2\textsuperscript{nd} leading cause of hyperthyroidism
  – Multiple autonomously functioning nodules
  – Females age > 50
  – Milder than Graves and more gradual in onset
Causes of Hyperthyroidism

• Toxic Adenoma- hot nodule
• Thyroiditis
  – Hashimoto’s
  – Post-partum thyroiditis
    • 5-10% of pregnant pts.
    • 6 wks- 6 months postpartum NB !
  – Trauma
  – Subacute (viral)
  – Suppurative – septic, anterior neck pain
  – Drug-induced- Amiodarone and Lithium
  – Factitious
Thyrotoxicosis Sx’s

- Constitutional
- Hypermetabolic
- CV
- Psychiatric
- Muscular/Neuro
  - Proximal muscle groups
  - Poor exercise intolerance
  - Thyrotoxic periodic paralysis
- Ophthalmologic
- Dermatologic (pretibal edema)
Cardinal Exam Findings

• V/S: Tachycardia (most common rhythm disturbance), widened pulse pressure
• CV: Systolic flow murmur, Afib, systolic rub
• Ophthalmologic: lid lag, globe lag, proptosis
• Neuro: Tremor, Proximal muscle weakness
• Dermatologic: warm, moist skin brittle hair
• Neck: thyroid enlargement
• Ext: Pre-tibial edema
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C. Corticosteroid administration is contraindicated.

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Thyroid Storm

• Definition

NB! — Thyrotoxicosis with mental status changes
DDX for Thyroid Storm

- Sepsis
- Sympathomimetic ingestion
- Heat Stroke
- DT’s
- MH
- Neuroleptic malignant syndrome
- Pheochromocytosis
- Withdrawl syndrome
Can’t Miss
Precipitants of Thyroid Storm

• STEMI
• Sepsis
• Stroke
• Hypoglycemia/DKA
• Mesenteric Ischemia
• Toxemia
• PE
Other important precipitants

• Iodinated contrast agents
• Drugs
  – Amiodarone
  – Lithium
  – Anesthetic agents
  – Pseudoephedrine
  – ASA
• Post-partum
• Blunt trauma/Vigorous palpation
• Burns
Diagnosis

• Primary clinical
• Persistent tachycardia
• Lab testing in the ED
  – Low TSH
  – Free T3 Free T4 not necessary for us
Thyroid-Directed Treatment
4 Goals

- Identify and treat precipitant
- Reduce thyroid hormone production
- Prevent release
- Block peripheral conversion
Treatment of Thyroid Storm

• Supportive
  – Airway management
  – Cooling (no ASA)
  – Fluids
  – Glucose and electrolyte controls

• Aggressive search for precipitating event
Symptomatic Treatment

Beta blockade – blocks adrenergic effects

- **Propanolol**
  - 60-80 mg po q 6-12 hours
  - IV test dose 0.5-1.0 mg slow IV then 1-2mg q 15 min until HR normal.
  - Added benefits of blocking peripheral conversion and of being non-selective (helps with tremor)

- Esmolol

- Metroprolol
Inhibition of Thyroid Hormone Synthesis

• Propylthiouracil or methimazole
  – Blocks synthesis
  – PTU also blocks peripheral conversion
  PTU Dose= 600-1000mg loading dose
  – Then 300 mg q 6 hrs.
Inhibition of thyroid hormone release

• Iodine
  – SSKI 5 gtts PO/NGT/PR

• Lithium for Iodine allergic or best for:
  – IV contrast
  – Amiodarone

• Steroids
Blocking peripheral conversion

- Corticosteroids
  - Adrenal insufficiency can be seen in thyroid storm because of increased cortisol clearance
  - Hydrocortisone 100mg IV

- Propranolol

- PTU
3. A 24 year old female presents with an acute overdose of her mother’s synthroid. She has a normal mental status
V/S : BP 176/90, P-130 reg, Temp= 99.0
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B. PTU
C. Inderal
D. Steroids
E. Cholestyramine
Factitious Thyrotoxicosis (Thyrotoxicosis Factitia)

• Self-ingested hormone
• Beta blockers
• Cholestyramine to block GI absorption
• No role for PTU
4. Which is the best ED screening test for hypothyroidism?

- A. T3
- B. T4
- C. TSH
- D. TBG (thyroid binding globulin)
Hypothyroidism

- Most common functional disorder of the thyroid
- 5 times more common than Hyperthyroidism
- More common in women
Hypothyroidism
Pathophysiology

• Primary
  – Intrinsic gland failure 95-99% of cases
  – Previous treatment of hyperthyroidism

• Central hypothyroidism
  – Euthyroid sick syndrome
  – Pituitary disease (adenoma, hemorrhage, infiltrative)
  – Hypothalamic disease
Thyroid physiology in pregnancy

• Increased estrogen \(\rightarrow\) increased TBG and lowered T4 levels

• HCG and TSH have identical subunits
  – Initially an increase in T3 and T4,
  – Decreased TSH @ 8 wks
Hypothyroidism

- Constitutional
- Hypometabolic
  - Cold intolerance
  - Weight gain, but increased appetite
- Proximal myopathy
- Hung-up reflexes
Myxedema Coma

• Elderly female in the winter
• Hypothermia
• Altered mental status
• Hypotension
• Bradycardia
• Other clues:
  – Thyroid scar, myxedema facies (puffy eyelids, large tongue, etc)
Can’t Miss Precipitants of Myxedema Coma

- STEMI
- Sepsis (especially pneumonia)
- Stroke
- Hypoglycemia/DKA
- GI Bleed
When treating a patient with diagnosed myxedema coma which is not correct?

- A. Accucheck and airway management are paramount.
- B. Steroids may play a role in treatment
- C. IV T4 should not be used in older patients.
- D. IV T3 should not be used in older patients.
- E. The precipitating event is important to identify and treat.
Treatment of Myxedema

• Airway and supportive
  – IV fluids
  – Passive warming

• Seek out and treat underlying cause!

• Thyroid hormone replacement
  – IV Synthroid- T4 (CV risk factors and elderly)
    • 300-500 microgram bolus
  – IV Liothyronine-T3 (younger patient)
    • 10-20 microgram bolus

• Hydrocortisone
Adrenal Insufficiency

Cortex: Cortisol

Medulla: Release of EPI/NE
Adrenal Gland

• **Medulla**
  – Controlled by sympathetic NS
  – Secretes epi and NE

• **Cortex**
  – Secrete corticosteroids
    • Glucocorticoids-Cortisol (ACTH)
    • Mineralcorticoids (Renin-angiotensin system, ACTH)
    • Adrenal androgens (ACTH)
6. A 65 year old female on chronic steroids presents to the ED with altered mental status and hypotension, which is true?

• A. She is more likely to have a low sodium and a high potassium, and a low glucose.
• B. She is more likely to have a low sodium and a normal potassium, and a low glucose.
• C. She is more likely to have a low sodium, high potassium, and normal glucose.
7. A 4 year old female with congenital adrenal hyperplasia presents to the ED with altered mental status and hypotension, which is true?

• A. She is more likely to have a low sodium and a high potassium, and a low glucose.
• B. She is more likely to have a low sodium and a normal potassium, and a low glucose.
• C. She is more likely to have a low sodium, high potassium, and normal glucose.
Adrenal Insufficiency

- **Primary** – More pronounced clinical symptoms
  - Addison’s
  - Failure of the adrenal gland to produce cortisol, aldosterone, or both
  - Intact HPA axis
  - Low cortisol, high ACTH (melanocyte stimulating hormone stimulated)
  - Elevated potassium in 65%

- **Secondary**
  - Impaired stimulation of the adrenals
  - Disruption of normal secretion of ACTH or Corticotropin-releasing hormone by hypothalmus.
  - Low cortisol and low ACTH
  - Potassium normal
Acute vs. Chronic

• Acute
  – Most common cause is exogenous administration of glucocorticoids which suppresses the HPA axis.
  – Can occur in lower doses but should be expected in 30mg/day over 3 weeks
  – Etomidate-transient
  – Other stressors: sepsis, infection, etc.
Hypothalamic-pituitary-adrenal axis

Stress → Activation → Hypothalamus → Corticotropin-releasing hormone (CRH) → Anterior pituitary → Adrenocorticotropic hormone (ACTH) → Adrenal gland → Cortisol

Primary adrenal insufficiency

Stress → Hypothalamus → Increased CRH* → Anterior pituitary → Increased ACTH → Adrenal gland → Decreased cortisol

Causes

- Acute onset
- Adrenal hemorrhage or Infarction
- Slow onset
- Autoimmune disease
- Adrenalitis
- Infectious disease
- Tuberculosis
- AIDS-related infections
- Cancer
- Lymphoma
- Metastases
- Drugs
- Ketoconazole
- Etomidate
- Other
- Congenital adrenal hyperplasia
- Adrenoleukodystrophy (males)
Secondary adrenal insufficiency

**Hypothalamic etiology**

- Stress
  - Hypothalamus
    - Decreased CRH
      - Pituitary gland
        - Decreased or inappropriately normal ACTH
          - Adrenal gland
            - Decreased cortisol

**Pituitary etiology**

- Stress
  - Hypothalamus
    - Increased CRH
      - Pituitary gland
        - Decreased or inappropriately normal ACTH
          - Adrenal gland
            - Decreased cortisol

**Causes**

- **Acute onset**
  - Pituitary apoplexy
  - Pituitary or hypothalamic surgery

- **Slow onset**
  - Traumatic brain injury
  - Autoimmune disease
  - Lymphocytic hypophysitis
  - Infectious disease
  - Tuberculosis
  - Cancer
  - Pituitary or hypothalamic tumors
  - Lymphoma
  - Trauma or other injury
  - Subarachnoid hemorrhage
  - Radiation

- **Drugs**
  - Megestrol acetate

- **Other**
  - Discontinuation of exogenous glucocorticoids
  - Sarcoidosis
  - Empty sella syndrome

*Although CRH in the hypophyseal portal system cannot be measured, it is likely increased.
Clinical presentation

- General
  - Weakness, fatigue
- GI:
  - N/V
  - Anorexia
  - Abdominal pain/ cramps
- Dizziness
Labs in Adrenal Insufficiency

• K+
  – Elevated in Primary (65%)
  – Not elevated in secondary

• Glucose
  – Primary- mild
  – Secondary-more severe

• Hyponatremia
  – Seen in both (90%)
Adrenal Crisis

• Refractory hypotension is the hallmark of Adrenal Crisis
  – Sometimes the only clue

• Treatment
  – Hydrocortisone 100 mg IV
  – Dexamethasone 4 mg IV

• IV fluids
• Correction of electrolyte/glucose abnormalities
• Seek out and treat precipitating illness
Elderly

- Problem of Polypharmacy
- Physiologic changes of aging
- Cardnial presentations not present
  - Sepsis
  - MI
- Abdominal pain often surgical
- Trauma patients have worse outcomes
9. An 85 year old female presents to the emergency department with acute abdominal pain. Which is correct?

• A. Her chance of having a surgical cause of her pain is 2 X that of a younger patient.
• B. The most common cause in her age group is appendicitis.
• C. An EKG is not necessary
• D. The presence of a fever doesn’t help distinguish between infectious and non-infectious causes in the elderly.
Physiology of aging

• CNS
  – B/B barrier ---risk of meningitis
  – Impaired thermoregulation
  – Altered autonomic nervous system

• Sensory deprivation
  – Hearing, vision

• CV
  – Decreased contractility and ability to increase HR
  – Poorer organ perfusion
Physiology of aging

• Pulmonary
  – Decreased
    • Vital capacity
    • Compliance
    • Chemoreceptor response to hypoxia/hypercapnea
    • Ventilation drive

• Renal
  – Less mass
  – Decreased drug elimination
  – Altered pharmokinetics

• GI
  – Increased risk of gastric ulcer
  – Increased risk of perforation
  – Longer healing times
Psychosocial Issues

• ETOH dependence
• Depression
  – Manifests as agitation or somatic complaints
• Sundown syndrome
  – Sensory deprivation
Pharmacy issues in elderly

• Polypharmacy
  – Elders consume 30% of the drugs in the US
  – Drug-drug interactions

• 12-30% of elderly admissions are due to adverse drug reactions

• Altered pharmokinetics
  – GI blood flow
  – Renal clearance
  – Decreased lean body mass
  – Decreased hepatic flow
Inappropriate Medications

• Narcotics (tylenol is best for pain)
• NSAIDS
• Muscle relaxers
• Any sedative hypnotics
• Antihistamines
Unique Clinical Aspects

• Hx
  – Cognitive defects
  – Sensory impairment
    • Loss of high-frequency hearing
  – Physical impairments
    • Previous stroke
Exam

- Tachycardia often absent
- Blunted response to infection
  - 30% no fever
  - Rectal temps
- When fever present, 89% have infectious cause—Pulmonary > Urinary > others
10. The most common atypical presentation of an acute MI in the elderly is:

- A. Dizziness
- B. Shortness of breath
- C. Nausea and vomiting
- D. Fatigue/weakness
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Specific Conditions

• MI
  – Painless presentation increases with age
  – Acute onset of dyspnea
  – Syncope
  – Weakness/dizziness
  – N/V

• Abdominal pain
  – Badness!!!
  – Cholecystitis most common cause of an acute abdomen

• Major Trauma
  – Higher morbidity and mortality
An 85 year old male presents with 7 days of constipation and bloating. He does not have any pain, which test should be done first to rule out an acute life threat?

• A. Portable flat plate of the abdomen
• B. Portable 3-way of the abdomen
• C. Bedside ultrasound
• D. CT scan of the abdomen
• E. Rectal exam to rule out fecal impaction
Constipation