Endocrine and Metabolic disorders II

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Part II

- Thyroid disease
  - Hypothyroidism/Myxedema coma
  - Hyperthyroidism/Thyroid storm
- Adrenal disease
  - Adrenal insufficiency (Addison’s)
  - Hyperadrenalism (Cushing’s)
- Sodium (just ‘cause)
- SIADH/DI
- Acid/Base (just a bit)

Thyroid hormones

- Hypothyroidism
  - TSH High
  - T4 Low
  - T3 Low
- Hyperthyroidism
  - TSH Low
  - T4 High
  - T3 High

Remember

- Feedback loop:
  - For TSH, ACTH and PTH
  - If both TSH AND T4/3 the same? Pituitary.
- Peripheral conversion:
  - T4 (thyroxine) to T3 (triiodothyronine)
Hyperthyroidism

- **Graves disease** is most common:
  - Autoimmune illness: TS-Ig
- Exophthalmos
- Goiter, bruit?
- Lid lag
- Myxedema
  - pretibial

Exophthalmos

Myxedema- “pre-tibial”

- UNcommon
- NOT “Myxedema coma”

Hyperthyroidism- other causes

- Thyroiditis (viral)
- Adenoma- “hot nodule”
- Multinodular goiter
- Medication overuse
- Excess iodine in diet
- Pituitary adenoma
  - Secondary hyperthyroidism
  - TSH High AND T4/T3 High

Hyperthyroidism- sx

- What you’d expect
  - Tachycardia
  - Heat intolerance
  - Weight loss
  - Diarrhea
  - Palpitations
  - Anxiety
  - Diaphoresis
- Keyword
  - Tremor
  - Hair loss
  - Brittle hair
  - Goiter/bruit
  - Exophthalmos
  - Pretibial myxedema

Labs

- TSH LOW
- T4/T3 High
- Glucose high
- Low cholesterol
- Other labs? Not classically abnl
- Check K for weakness complaint
  - PHKP
Endocrine & Metabolic Disorders, Part 2

Treatment
- Symptomatic: Beta-blockade
  - PROPRANOLOL
  - Prevents peripheral conversion of T4 to T3
- Antipyretic
- Hormone synthesis blocker:
  - PTU, methimazole
- Radioactive iodine – 131 (Graves)
- Surgery (adenoma/multinodular goiter)

Weird hyperthyroidism
- Apathetic thyrotoxicosis
- Lab values (TSH) and vital signs (HR) signal hyperthyroidism
- Clinically flat affect, lethargy, looks hyPOthyroid(?)
- Might think delirium, infection, psych
- Tx for hyperthyroidism, look for inciting infection

Thyroid Storm
- Severe, life-threatening, high mortality
- Many manifestations of hyperthyroid but MUST include AMS
- Often febrile, tachycardic, tremulous
- CHF- tachycardic, “high output”
- Precipitants?
  - INFECTION, MEDICATION (CONTRAST)
  - CVA/ACS, Pregnancy

Thyroid Storm labs
- MUCH more likely to be abnl than thyrotoxicosis
- TSH low, T4/T3 high
- Glucose high, Chol low
- Calcium? (High)
- LFT’s? (High)

Thyroid Storm Treatment
- Use all of these, order matters!
- Propranolol 1mg doses
- PTU >> methimazole
- Iodine AT LEAST 1 hour after PTU
- Steroids? Yes! Often dexamethasone
- ASA? NO!
- Beta, PTU, steroids, iodine
- Beta, steroids, PTU, iodine

Thyroid Storm Treatment
- Hashimoto’s thyroiditis
  - Auto-immune destruction
- Radioactive iodine tx for Grave’s
- Lithium, Amiodarone
- Medication non-compliance
- Iodine deficiency (hx- goiter)
- Pituitary
  - Secondary hypothyroidism
  - TSH Low AND T4/T3 Low

Hypothyroidism
Hypothyroidism - symptoms

- What you’d expect:
  - Fatigue
  - Weight gain
  - Cold intolerance
  - Constipation
  - Dry skin
  - Bradycardia
  - Myxedema (nonpitting)

- Weird or keyword
  - “Coarse” facies
  - Loss of 1/3 of eyebrows(!)
  - “Hung up” reflexes
  - Scant pubic hair
  - CHF/effusion
  - AMS or psychosis

Myxedema

Labs

- TSH HIGH
- T4/T3 Low
- Na low (inc. free water, effusion)
- Hgb low but not typically severe
- Glucose low (Temp low?)
- Chol and Triglycerides HIGH

Treatment

- Typically oral hormone replacement therapy
- Weight based
- Look for precipitants
  - Infection, Medications
- Very slow change in lab values, don’t repeat for 4-6 weeks

Myxedema “Coma”

- Severe hypothyroidism:
  - hypothermia, hypotension, hypoxemia
- Increasing mortality
- Precipitants:
  - INFECTION, MEDICATION
  - ACS/CVA, Trauma
  - Winter(?!)
- Co-existing adrenal insufficiency?
  - Can contribute to hypotension/low glu

Myxedema Coma Treatment

- Replace hormone with IV therapy
  - Poor GI absorption
  - IV T4: thyroxine or levothyroxine
  - 500 to 900mcg IV

Steroids: 100mg Hydrocortisone
Stress dose vs. Adrenal failure
Adrenal or Epi-nephric glands

- Cortisol
  - Sugar, metabolism
- Epinephrine
  - Sympathetic response, BP
- Aldosterone
  - Na/K

Adrenal insufficiency

- Weakness
- Hypotension (refractory)
- Fever (!)
- Vomiting
- Abdominal pain
- Can look like sepsis. You also tx sepsis because you recall PRECIPITANTS
- Other endocrine failure? Think steroids.

Adrenal insufficiency

- MOST COMMON?
  - Adrenal atrophy
  - MEDICATION: sudden stoppage of longstanding steroid therapy treating
    - Lupus
    - COPD
    - Less common with topical/inhaled

Adrenal failure

- Addison’s disease
  - Autoimmune, idiopathic, assoc. w thyroid
- Infiltrative causes (TB, amyloid)
- Infarction (Waterhouse-Friderichsen)
- Hemorrhage
- Medication (etomidate)
- Secondary adrenal failure
  - Hypopituitarism
  - Sheehan’s syndrome

Labs

- Hypoglycemia
- Hyponatremia*
- Hyperkalemia*
  - Low aldosterone: orthostasis common

- NOT very sensitive for the condition
- Except on the board exam

Adrenal insufficiency

- MOST COMMON?
  - Adrenal atrophy
  - MEDICATION: sudden stoppage of longstanding steroid therapy treating
    - Lupus
    - COPD
    - Less common with topical/inhaled
Primary adrenal failure

- Hyperpigmentation from HIGH ACTH
- Structurally related to melatonin-stim hormone

Secondary vs. Primary

- ACTH Stim test
- Check a cortisol
- Give cosyntropin (ACTH) and repeat free cortisol levels
  - If it stays pretty flat? No response, primary failure
  - If it rises, (>9?) Response! Adrenal works so secondary to lack of ACTH

Adrenal failure - Tx

- BP low? Give fluids
- Sugar low? Give sugar
- No steroids? Give steroids
  - 100mg Hydrocortisone
  - CAN give dexamethasone if wanting to preserve ACTH Stim test
  - MAY need MORE!
  - Fludrocortisone if BP still refractory

Hyperadrenal (Cushing’s)

- Cushing’s syndrome?
  - ALL Hyperadrenal
  - OR
- Cushing’s disease?
  - Pituitary ACTH tumor

Hyperadrenalsim

- Excess cortisol
  - Iatrogenic most common
  - Prolonged steroid use
  - Adrenal or Pituitary adenoma
  - Neoplastic causes
    - Small cell lung
    - Carcinoid

Hyperadrenal

- JUST LIKE Adrenal Failure
  - Primary Adrenal adenoma is less common than secondary to ACTH output
Hyperadrenalism

- Typical symptoms
  - Truncal obesity
  - "Moon facies"
  - "Buffalo hump"
  - Purple striae
  - Peripheral edema
  - Hirsutism
  - Contrast w/ skin hyperpigmentation!

Hyperadrenalism

- Hyperaldosterone state
  - SO:
    - HIGH Na
    - LOW K

Hyperadrenalism - Tx

- Stop steroids/Wean off
- Find cancer
- Look at pituitary

Pheochromocytoma

- RARE: Pressures are high AND labile
- Episodic "paroxysms"
  - Pain: Headache, CP
  - Palpitations
  - Perspiration
  - Pressure (BP)
  - Pallor
- Dx: 24 hr Urine test: VMA

Now on to a few last items

- Na: mostly low
- SIADH/DI
- Acid/Base: not easy but the easy version for today
Sodium

Sodium is a reflection of water > lytes
- High sodium? Dry.
- Yep, that’s pretty much it.
- Too little fluid in relation to lytes.

Hypernatremia- Tx

- Hmmm. Dry. So… give fluid?
- Yep. How much?
- Problem with correcting hypernatremia?

Hypernatremia- Tx

- Worrisome complication is cerebral edema
- What’s going on?
  - High sodium wants to suck water out of the brain.
  - Brain builds protein “idiogenic osmols”
  - When sodium drops too quickly, water wants to go INTO the brain

Hyponatremia- Hypovolemic

- Vol overload most common
  - Renal, cardiac, liver
  - Decreased free water excretion
- Sodium diluted by water
- Mostly restrict free water
Hyponatremia - Hypovolemic
- Clinically dry but low Na
  - Loss of Na exceeded loss of water
- GI losses: acute vomiting/diarrhea
- Renal losses: Diuretics
- Skin losses: Burns
- Treatment: IVF of course!

Hyponatremia - Euvolemic
- SIADH
- Psychogenic polydipsia
- Hypothyroidism
- Mostly free water restriction
- Boards LOVE SIADH

SIADH
- “Euvolemic” with low sodium
- Don’t pee much, so holding onto too much free water

Pseudohyponatremia
- Value is low, but does not reflect volume/hydration
- Due to:
  - Sugar- (1.6 x every 100 > normal)
  - Lipids
  - Proteins

Syndrome of Inappropriate ADH
- ADH should only go up when dry
- Serum osm is LOW (not high)
- Urine osm is HIGH, (concentrated)
- Brain stuff
- Lung stuff
- Meds- Chlorpropamide, diuretics, chemotherapy

DI- Diabetes insipidus
- Opposite of SIADH: not working
  - Brain: no ADH from hypothalamus
  - Kidney: no response to ADH
- Trauma can cause- severe hypothalamic input to ant. pituitary so central DI
- Lithium can cause- nephrogenic DI
- Hypercalcemia
DI
- Check urine osm
- Stim test? Give ADH (vasopressin), recheck urine osm
  - If better, central
  - If not better, nephrogenic

Hyponatremia- severe
- Once the pt. has a CNS c/o you’re in life-threatening areas.
  - Seizure, confusion, focal deficits
- Sx typically occur at < 120 mEq/L
- Related to rapidity of drop
- Many patients asymptomatic at lower (scary) numbers

Hyponatremia- treatment
- Treatment is geared to raise the serum sodium to the 120mEq threshold
- As with correction of hypernatremia, no more than 0.5-1mEq/hr.
  - IF seizing or known to be rapid fall, can increase to 1-2mEq/hr.
- Hypertonic saline (3%)

Complications?
- Central Pontine Myelinolysis
- Central Myelinolysis
- Osmotic Demyelination Syndrome
- Sudden "brain shrinkage"
- Pons- dysphagia, dysarthria, diplopia, quadriparesis
- No cure or treatment exists

Take Home
- Know the difference between cerebral edema and myelinolysis in correcting sodium
- Most low sodium tx is free water restriction
- SIADH= euvolemic low Na, look for Brain/Lung stuff

Acid-Base
- pH 7.4/ pCO2 40/ HCO3 24
- Metabolic acidosis
- Metabolic alkalosis
- Respiratory acidosis
- Respiratory alkalosis
### Acid-Base

- Every one of the 4 disturbances has its own DDx.
- So clinical presentation guides the reason that the disturbance is present.
- EVEN when “mixed.”

### Metabolic Acidosis

- **MUDPILES**
  - Methanol
  - Uremia
  - DKA
  - Phenformin/Paraldehyde
  - Iron/INH
  - Lactic acidosis
  - Ethylene glycol
  - Salicylates

### Metabolic Alkalosis

- **HARDUP**: GI and renal losses of HCO3
  - Hypoaldosteronism
  - Acetazolamide
  - Renal tubular acidosis
  - Diarrhea
  - Ureterosigmoidostomy
  - Pancreatic fistula

### Respiratory Alkalosis

- Breathing too fast?
  - PE
  - Hypoxia/lung issue
  - Hyperventilation/Anxiety
  - Brain issues: hyperpneic breathing
  - Meds:
    - ASA!
- Dreaded triple threat

### Respiratory Acidosis

- Can’t breathe?
  - COPD
  - Resp failure: PNA, asthma
  - Sedation: narcotic or sedative OD
  - Brain problem: CVA/brainstem out
  - Neuromuscular weakness: Myasthenia
  - “Steel Chest”: Fentanyl

### Anion GAP Metabolic Acidosis

- **MUDPILES**
  - Methanol
  - Uremia
  - DKA
  - Phenformin/Paraldehyde
  - Iron/INH
  - Lactic acidosis
  - Ethylene glycol
  - Salicylates

- **CAT-MUDPILES**
  - Carbon Monoxide
  - AKA
  - Toluene
Acid-base: Is it mixed?

- Metabolic acidosis exists:
  - How much has the bicarb dropped?
    - HCO₃ 10, it dropped by 14
  - How much has the gap widened?
    - AG is 30, it widened by 20

- Are they different? That’s “Delta Gap”
  - 14 does not equal 20

Acid-base Pearls- is it mixed?

- Metabolic acidosis:
  - Last 2 digits of pH should be ~ pCO₂
  - Winter’s formula:
    \[ 1.5 \times (\text{HCO}_3^-) + 8 \approx \text{pCO}_2 \] (within 2)

- Respiratory acidosis:
  - Every 0.1 pH drop mirrored by a 10 point pCO₂ increase

Take Home

- Take a deep breath.

- Is there something else going on?
  - If Winters works (calc pCO₂ = pCO₂)
  - Then no.

- Winters doesn’t work? Delta Gap

THANKS

- For enduring endocrine, metabolism and electrolytes!

- P. Mukherji
- @ercowboy

KEEP CALM AND SAY GOODBYE