BLOCK P RENAL MEDICINE

by Fatima Haider

- The best initial therapy for hypertensive crisis is IV labetalol or nitroprusside or hydralazine.Because nitroprusside needs monitoring with an arterial line, this is not usually the first choice.
- Nodular glomerulosclerosis (Kimmelstiel-Wilson Nodules): Hyaline deposition in one area of the glomerulus (usually due to efferent involvement of destruction/sclerosis)→ seen in DM
- Assessment of acid base abnormalities: typically done using arterial blood gases (ABG)
- Alveolar Hypoventilation → Accumulation of CO2 → Increases in PaCO2 → Respiratory acidosis → pH decreases.
- Signs of acute CO2 retention: headaches, confusion, and papilledema, flapping tremors
- Alveolar hyperventilation → increased wash out CO2 → decrease in PaCO2 → increased pH.
- alkalosis promotes the binding of calcium to albumin, resulting in a reduction in ionised calcium concentrations, hence Trousseau's sign and Chvostek's sign may be positive
- Anion gap - The difference between primary measured cations (Na+ and K+) and the primary measured anions (Cl- and HCO3-) in serum
- DKA: caused by insulin deficiency & exacerbated by catecholamine & stress hormone excess → lipolysis → formation of acidic ketones (acetoacetate, 3-hydroxybutyrate, acetone)
- RTA should be suspected when there is a hyperchloraemic acidosis with a normal anion gap in the absence of gastrointestinal disturbance.
- Oliguria: < 400 ml/cc urine output in 24 hours.
- Anuria: < 100 ml/cc urine output in 24 hours.
- Glycosuria - Occurs when blood glucose levels exceed 180 mg/dL
- Proteinuria > 150 mg protein/day in the urine
- urine pH usually ranges from 4.5–8
- Hematuria: the presence of red blood cells (RBCs) in the urine
- Hematuria with proteinuria is considered glomerulonephritis until proven otherwise.
- A positive result for heme on urine dipstick does not confirm hematuria because the test does not distinguish between the presence of RBCs, hemoglobin, and myoglobin.
- Urine that is positive for heme on dipstick but shows no RBCs on microscopy indicates hemoglobinuria or myoglobinuria.
- Acute kidney injury (AKI) is a sudden loss of renal function with a subsequent rise in creatinine and blood urea nitrogen (BUN).
- While ultrasound is the initial test of choice to assess for urinary tract obstruction, CT has greater sensitivity for detecting obstructions and stones.
- Urine osmolality is a measure of urine concentration. The higher the osmolality, the more concentrated the urine.
- In the early phase of AKI, the most common mortal complications are hyperkalemic cardiac arrest and pulmonary edema.

- Indications for urgent dialysis often remembered by “AEIOU” mnemonic: Acidosis, Electrolytes, Intoxications (such as in overdoses), volume Overload, Uremia
- Chronic kidney disease (CKD) is defined as either decreased kidney function (GFR <60 mL/min) or kidney damage (structural or functional abnormalities) for at least 3 months, regardless of cause
- Uremia is defined as the accumulation of toxic substances due to decreased renal excretion. These toxic substances are mostly metabolites of proteins such as urea, creatinine, β2 microglobulin, and parathyroid hormone.
- Uremia refers to the signs and symptoms associated with accumulation of nitrogenous wastes due to impaired renal function. It is difficult to predict when uremic symptoms will appear, but it rarely occurs unless the BUN is >60 mg/dL.
- Uremic fetor: characteristic ammonia- or urine-like breath odor
- Uremic frost: uremia leads to high levels of urea secreted in the sweat, the evaporation of which may result in tiny crystallized yellow-white urea deposits on the skin.
- Kidney OUTAGES: hyperKalemia, renal Osteodystrophy, Uremia, Triglyceridemia, Acidosis (metabolic), Growth delay, Erythropoietin deficiency (anemia), Sodium/water retention (consequences of chronic kidney disease)
- Correct hyperphosphatemia with calcium citrate (a phosphate binder).
- Diabetes and hypertension are the most common causes of ESRD.
- Nephrotic syndrome - Urine protein excretion rate >3.5 g/24 hours
- Microalbuminuria can be an early sign of diabetic nephropathy and often presents before any other laboratory abnormalities or overt signs or symptoms.
- Hematuria is defined as >3 erythrocytes/HPF on urinalysis.
- Nephritic syndrome—hematuria, HTN, azotemia
- Nephrotic syndrome—proteinuria, edema, hypoalbuminemia, hyperlipidemia
- Nephrotic range proteinuria is pathognomonic for glomerular disease
- GN is usually caused by immune-mediated mechanisms
- FSGS is classically not associated with immune complex deposition.
- The glomerular basement membrane (GBM) contains a negative charge produced by heparan sulfate.
- A balance of intracellular Mg^{2+} and extracellular Ca^{2+} is required to maintain normal neuromuscular activity.
- Crystalloids: solutions that contain small molecular weight solutes (e.g., minerals, dextrose)
- Colloids: solutions that contain larger molecular weight solutes (e.g., albumin and starch)
- Balanced IV fluid solutions: crystalloids or colloids that do not significantly alter the homeostasis of the extracellular compartment
- Fluid resuscitation - the use of glucose-free isotonic fluid boluses to replenish the intravascular fluid compartment.
- Diabetes is the most common cause of CKD
- CKD stages by GFR: Stage 1 (>90), Stage 2 (60-89), Stage 3 (30-59), Stage 4 (15-29), Stage 5 (<15).
- SGLT2 inhibitors (e.g., Empagliflozin, Dapagliflozin) have shown significant benefit in reducing heart failure hospitalizations and cardiovascular mortality.

- Advanced CKD leads to phosphate retention (Hyperphosphatemia), which precipitates calcium, leading to Hypocalcemia. This triggers secondary hyperparathyroidism.
- Cardiovascular disease is the leading cause of morbidity and mortality in patients with Chronic Kidney Disease, significantly higher than the general population.
- Renal Cell Carcinoma (RCC) is a well-known cause of paraneoplastic syndromes, most commonly producing Erythropoietin, leading to polycythemia.
- The 1mg overnight dexamethasone suppression test (ODST) is a standard first-line screening test for Cushing's syndrome.
- ACE inhibitors (and ARBs) are preferred in CKD with hypertension because they reduce intraglomerular pressure and have antiproteinuric effects, slowing disease progression.
- In Acute Tubular Necrosis (ATN), the tubular cells are damaged and cannot reabsorb sodium properly. This leads to a high urine sodium (>40 mEq/L) and a high Fractional Excretion of Sodium (FeNa >2%). FeNa <1%, specific gravity >1.030, and BUN:Cr >20:1 are characteristic of pre-renal AKI.
- A positive nitrite test strongly suggests Gram-negative enterobacteriaceae like E. coli (which converts nitrate to nitrite).
- External Cephalic Version (ECV) is typically performed at or after 37 weeks (term).
- The NICE classification for Caesarean urgency is: Type 1 (Immediate threat to life), Type 2 (Maternal/fetal compromise, not immediately life-threatening), Type 3 (Needs early delivery but stable), Type 4 (Elective/Planned). A case with no risk represents an elective procedure (Type 4).

Diabetes drugs

- Diet and exercise
- Oral hypoglycemic drugs
    - Metformin - initial drug therapy
    - SGLT2 inhibitors (glifozins) - in high risk CVD patients
    - Sulfonylureas
    - GLP 1 agonists
- Insulin

To diagnose Cushing Syndrome

- Dexamethasone Suppression Test - failure to suppress cortisol means the patient has Cushing syndrome
    - Overnight Dexamethasone suppression test
    - 48 hour low dose Dexamethasone suppression test
- 24 hour urinary free cortisol
- Late night salivary cortisol

To determine cause of Cushing Syndrome

- measure plasma ACTH level
- If plasma ACTH is low
    - ACTH independent Cushing syndrome
    - Source is adrenal gland

    - confirm by CT or MRI of adrenals
- If plasma ACTH is normal or high
    - ACTH dependent Cushing syndrome
    - Pituitary ACTH producing tumor
    - Ectopic ACTH production

To differentiate between pituitary and ectopic source of ACTH

- 48 hour High dose Dexamethasone test
    - If high dose suppress ACTH - source is pituitary gland
    - If fails to suppress - source is ectopic
- Corticotrophin releasing hormone (CRH) test
    - Positive when source is pituitary gland - >20% rise of cortisol or 50% rise of ACTH (confirm by doing pituitary MRI. If MRI cannot detect tumor (<6 mm), the next step is Bilateral inferior petrosal sinus venous sampling BIPSS for ACTH measurement
    - Negative when source is ectopic ACTH production.

Primary Hyperaldosteronism

- Elevated aldosterone and decreased plasma renin
- Plasma aldosterone to renin ratio > 20
- Sodium suppression test = fails to suppress aldosterone after sodium load

Secondary Hyperaldosteronism

- Elevated aldosterone
- Elevated plasma renin
- seen with activation of RAAS (e.g renovascular HTN or CHF)

Primary Adrenal Insufficiency

- decrease cortisol and/or aldosterone
- increased ACTH
- Adrenal cortex injury (decreased adrenal hormones lead to increased ACTH)
- Hyperpigmentation and hyperkalemia
- Acute cause - Waterhouse-Friderichsen syndrome
    - due to Adrenal hemorrhage
    - associated with
        - Neisseria meningitis septicemia
        - hypotension leading to shock
        - DIC with widespread purpura
- Chronic cause - Addison's disease
- Hydrocortisone is the drug of choice
- Mineralocorticoid can be used

Secondary Adrenal Insufficiency

- decrease cortisol

- decreased ACTH (decreased Pituitary ACTH production)
- Normal aldosterone bcz it is not stimulated by ACTH
- No skin hyperpigmentation
- No Hyperkalemia
- Causes
    - Hypopituitarism
        - Sheehan syndrome
        - Pituitary apoplexy
        - Pituitary Macroadenoma (>10 mm)
    - Pituitary suppression - chronic steroids
    - Rapid withdrawal of long term glucocorticoid therapy
- Only glucocorticoids (hydrocortisone) is used

Diagnosis of Adrenal Insufficiency

- Short ACTH stimulation test aka Synacthen test
    - IM injection of ACTH
    - cortisol fails to increase at 0 and 30 min
    - Primary adrenal insufficiency will have high ACTH
    - Secondary adrenal insufficiency will have low ACTH

Pituitary Gland

- Anterior Pituitary - ACTH, TSH, FSH, LH, GH, prolactin
- Posterior Pituitary - ADH, oxytocin

Prolactinoma

- most common functioning Pituitary adenoma
- Prolactin is antagonist of GnRH and therefore decrease FSH and LH
- Dopamine is antagonist of prolactin
- Prolactinoma can compress optic chiasm and result in bitemporal hemianopia
- Diagnosis
    - Serum prolactin levels
    - MRI of Pituitary gland
- Medical management
    - Dopamine agonists are first line therapy - Bromocriptine, Cabergoline
- Surgical Management
    - Trans sphenoidal surgery

Growth Hormone adenoma

- Gigantism - occur before closure of epiphysis
- Acromegaly occur after closure of epiphysis
- MCC of death - heart failure from cardiomyopathy
- Diagnosis
    - Elevated serum GH and IGF 1
    - Elevated prolactin levels

    - MRI Brain to evaluate for tumor
    - Oral glucose tolerance test is very sensitive test for acromegaly. In acromegaly, GH fails to suppress (or paradoxically rise) in response to glucose
    - Screening for colon cancer with colonoscopy

Hypopituitarism

- occurs when 75% of Pituitary parenchyma is lost or absent
- MCC in adults - Non functioning adenoma
- MCC in children - craniopharyngioma (a benign tumor derived from vestigial remnants of Rathke's pouch)
- Empty sella syndrome - classically seen in obese women with hypertension and multiple pregnancies
- Pituitary apoplexy - sudden hemorrhage into pituitary gland, often occurring into pituitary adenoma. It is a true neurosurgical emergency
- Sheehan syndrome - post partum necrosis of anterior Pituitary

Remember

- Most common intra sellar tumors - Pituitary Macroadenoma
- Most common supra sellar tumors - Craniopharyngioma
- Most common para sellar tumors - Meningioma