Renal Fabs

Sodium:

- Purpose: Most important electrolyte of the **brain.**
- Stimulant of the brain
- Hangovers are most likely related to hyponatremia.
- Related to water balance because sodium attracts your water.

Potassium

- Most important electrolyte of the **heart**
- Promotes your **neuromuscular contractility**
- Hyperkalemia: Overworking of the heart
    - It could lead to the possibility of cardiac arrest

Chloride

- Has the same function as sodium
- Not really a priority.

Calcium

- For the **bones and teeth**
- Significantly for the: neuromuscular contractility
- Muscles are related to the calcium
- Hypocalcemia: muscles will not contract
- **Indirectly** related to **phosphate**

Magnesium

- Depressant
- OD: Pre-eclampsia
- Preeclampsia has a risk for seizures so we can use magnesium to prevent it.
- Magnesium sulfate toxicity must be monitored.
    - Symptoms:
        - Decreased tendon reflexes
        - Heart rate RRBP: Decreased
        - Urine output: Decreased
- Antidote:
    - Calcium gluconate: Antagonist
    - Calcium decreases your magnesium levels

Hypomagnesemia	**Hypermagnesemia**
Konti depressant **(Up Symptoms)**	Marami depressant **(Down symptoms)**
Altered LOC (Confusion, Irritability)	Altered LOC (Stupor, Obtunded, Lethargy, Coma)
Deep tendon reflexes: Increased, hyperreflexia	Deep tendon reflexes: Decreased, hyporeflexia
Seizures, Muscles cramps, Tremors	Muscle weakness
Insomnia, Increased RR HR	Drowsiness, Decreased HR RR BP
Cause: Alcoholism, decreased intake in the diet Magnesium in diet: Fiber, grains, legumes, spinach, nuts.	**Cause:** Magnesium sulfate toxicity, renal failure (down glomerular filtration rate): increased waste and fluids
MGT: Least to most invasive - Oral magnesium rich foods - Oral magnesium supplements	**MGT:** Magnesium is eliminated via saline diuresis (urination), we can give diuretics and replace lost fluid via IV fluid

If magnesium is critically low: **Intravenous** Observe magnesium sulfate toxicity	Renal failure: decreased functional nephrons: diuretics are no longer effective (Dialysis) Antidote to hypermagnesemia: Calcium gluconate, will be given via IV

Hyperkalemia:

- Most important electrolyte in the heart.
- Cause metabolic acidosis
- "The body **CARED** too much about K+"
    - **C**ellular movement of K+ from intracellular to extracellular (burns, tissue damage, etc)
        - The potassium goes out of the cell to the blood. The sodium goes in to the cells
        - Burns: HYPERkalemia
            - Sodium: HYPOnatremia
    - **A**drenal insufficiency with Addison's disease
        - Addison's disease: Decreased aldosterone levels (Aldosterone: promotes water and sodium retention)
        - Decreased aldosterone: decreased sodium leading to HYPOnatremia, leading to HYPERkalemia
    - **R**enal failure: Decreased filtration rate
        - Increased electrolytes because blood cannot be filtered
        - Hyperkalemia, Hypernatremia, Hypocalcemia, Hyperphosphatemia, Hypermagnesemia
    - **E**xcessive potassium intake
        - Increased fluid or supplement
    - **D**rugs:
        - Potassium sparing drugs
            - Spironolactone
            - ACE inhibitors
                - Lisinopril
                - Captopril
            - NSAIDs
                - Take with food because they are gastric irritants
- **Signs and symptoms of Hyperkalemia "MURDER"**
    - **M**uscle weakness
        - Too much contraction weakens the muscle.
    - **U**rine output little or none (renal failure)
    - **R**espiratory failure (due to muscle weakness)
        - Strongest respiratory muscle: Diaphragm
        - It may cause cardiac arrest
    - **D**ecreased cardiac contractility
        - Weak pulse or Low HR
    - **E**arly: muscle twitches and cramps
        - Early signs and symptoms causes cramps but if late, it gets tired and leads to muscle weakness
    - **R**hythm changes
        - Tall peaked T waves, prolonged PR interval

- **Management of critical hyperkalemia**
  - Initial management:
    - 10% **Calcium gluconate**: protects myocardium
    - Not related to potassium
  - Fastest way to decrease your potassium
    - **Glucose insulin:** stimulate uptake of glucose with potassium
      - Insulin (Through IV)
        - Given for the hyperkalemia
      - Side effect of insulin: HYPOGLYCEMIA
      - Therefore giving glucose to the patient to counteract the side effect of the insulin
      - For DM Type I: Insulin with Potassium because side effect of insulin in patients with DM is hypokalemia.
  - **Sodium bicarbonate (Alkaline in nature)**
    - Correct metabolic acidosis to lower plasma K+
      - Metabolic acidosis: Increased potassium
    - Renal failure: Metabolic acidosis
    - Usually VIA IV drips
  - **Kayexelate**
    - Via Enema or oral
    - Sodium rich
    - Sodium potassium exchange
  - **Potassium restriction**
    - Low potassium in the diet
  - **Potassium wasting diuretics**
    - Loop diuretics
    - Thiazide diuretics (Microcide)

HYPOKALEMIA

- **Causes**

  "Your body is trying to **DITCH** K+"
  - **D**rugs:
    - Loop diuretics : Wasting
      - Furosemide
    - Laxatives: Wasting
  - **I**nadequate consumption of K+
  - **T**oo much water intake
  - **C**ushing's syndrome
    - Endocrine problem
    - Increased aldosterone
      - Increased sodium
      - HYPERnatremia causing HYPOkalemia
  - **H**eavy fluid loss
    - Nasogastric tube suction
    - Vomiting
    - Diarrhea
    - Wound drainage
- **Signs and symptoms**
  - **Asymptomatic:** Late nadedetect
  - **7Ls (7 Lows)**
    - Lethargic
    - Low shallow respirations…failure
      - Failure in muscle
    - Lethal Cardiac dysrhythmias

        - ST depression
        - **Shallow** T wave
        - Projecting U wave
            - Earliest symptom of Hypokalemia
            - But cannot be seen by the naked eye
            - Needs ECG
    - Lots of urine (Frequent and large amount)
        - Problems with fluid loss
    - Leg cramps
    - Limp muscles
    - Low blood pressure (Severe)
        - Decreased contractility of heart
- **Management**
    - IV potassium replacement
        - Not more than 10-20 mEq/hr
        - Critically low
        - Incorporated: mix with IV fluid
        - But if doctor's order is more than 20, it is required to have Cardiac monitor and infusion pump
    - High potassium diet
    - Oral potassium replacement
        - For stable patients
        - It should be given with juice to increase palatability
    - Monitor cardiac rhythm

SODIUM

- Sodium is the most important electrolyte of the brain
- Has a stimulant effect
- **Signs and Symptoms of Hypernatremia**
    - Usually caused by dehydration
    - **FRIED SALT**
        - **F**lushed skin and fever (low grade)
        - **R**estless, irritable, anxious and confused (Up symptoms)
        - **I**ncreased blood pressure and fluid retention
        - **E**dema, peripheral and pitting
            - Third spacing (Fluid entered interstitial space)
        - **D**ecreased urine output
            - Can be related to dehydration, decreased urine output because it is conserving fluid concentration in the blood
        - **S**kin flushed
        - **A**gitation
        - **L**ow grade fever
        - **T**hirst
    - Management:
        - I/O : Watch out for fluid volume deficit
            - Urine specific gravity: concentration of the urine (NV: 1.010-1.030)
            - Dehydrated: Concentrated: Higher SG (>1.025) "Mabigat"
            - Neck veins: Flat
            - Weak and thready pulses
            - Increased HR and RR
        - Altered LOC (Up symptoms)

        - Anxious
    - Weight
        - Most sensitive indicator of fluid volume
        - In case of hypernatremia, there will be weight loss
    - Dry Mouth/Mucosa
        - Poor skin turgor
- How do we remove sodium?
    - Via diuresis with replacement of fluid
    - Low sodium diet
        - Canned food
        - Condiments
        - Instant foods, processed food

- **HYPONATREMIA**
    - Down symptoms
    - **"SALTLOSS"**
    - **S**tupor
    - **A**norexia
        - Nausea and vomiting
        - Decreased stimulant
    - **L**ethargy
    - **T**endon Reflexes
    - **L**imp Muscles
    - **O**rthostatic Hypotension
        - Drop in DP
        - With respect with rapid change in position
        - There will be dizziness and risk for falls
        - Management:
            - Change position slowly, sit at the bed side
    - **S**eizures/Headache
        - Related to severe sodium losses
    - **S**tomach cramping
        - Abdominal discomfort related to nausea and vomiting
    - **Management of Hyponatremia**
        - Related to overhydration
        - Diluted sodium
        - I/O: Monitor for overhydration
        - Specific gravity: <1.010 urine is diluted "Magaan"
        - Bounding pulses
        - Distended neck veins
        - BP: Increased BP, HRRR: Increased (Vascular resistance)
        - Altered LOC: Down symptoms
            - Weight gain because of overhydrated status
        - **Sodium tablet**
        - **0.9 NaCl PNSS**
        - **Electrolyte drinks**

CALCIUM

HYPERCALCEMIA

"BACKME"

- **B**one pain
- **A**rrhythmias
- **C**ardiac arrest
- **K**idney stones
- **M**uscle weakness
    - Late symptom of late hypercalcemia because of the increased contractility

- **E**xcessive urination
    - Osmotic diuresis
    - With the effort to remove the calcium
- Parathormone (Katabi ng thyroid)
    - Promote calcium balance
    - Promotes bone decalcification or bone resorption (Sisirain ang buto para lumabas ang calcium from the bone to the blood)
    - Calcitonin: from thyroid
        - Promotes calcium uptake of the bone (Pinapapasok si calcium sa boto)
    - Calcitonin and Parathormone has opposite effect
- Hyperparathryoidism (Tumor)
    - Increased parathormone
        - Increased bone decalcification
        - Increased calcium in the blood
            - Hypercalcemia
            - That may lead to kidney stones
            - Increased contractility of the heart, causing overworking of the heart that will cause ARRHYTHMIAS that would lead to Cardiac Heart
        - Weak brittle bones
        - Prone to pathologic fracture
- **Nursing Management for Hypercalcemia**
    - Promote calcium excretion via the urine
    - Loop diuretic
        - Furosemide
        - Ethacrynic acid
        - Hydration to 3000 to 4000 mL to flush calcium and to decreased renal calculi formation
    - Synthetic calcitonin can be given to lower calcium levels
        - Monitor I and O, vital signs, muscle weakness and heart rate and rhythm
    - Calcitonin:
        - To promote calcium from the blood to the bone

HYPOCALCEMIA

- Signs and symptoms: **“CATS”**
    - **C**onvulsions
        - Can lead to cerebral edema
        - Decreased contractility
        - Increased ICP
    - **A**rrhythmias
        - Decreased calcium leads to decreased contractility of the heart
    - **T**etany
        - Numbness and stiffness of the muscles due to loss of ability to contract
    - **S**tridor and Spams
        - Weakness of diaphragm
- Hypoparathyroidism
    - Related to accidental removal of parathyroid (Post thyroidectomy)
    - Unexpected
    - Hypocalcemia is lifetime
    - Malpractice of the doctor
- Calcium is for **contractility**

- Trousseau's sign : Severe
    - Induction of carpopedal spasms by inflation of a sphygmomanometer above SBP for 3 minutes
    - Response:
        - Carpopedal spasms characterized by
            - Adduction of thumb
            - Flexion of metacarpophalangeal joints
            - Extension of interphalangeal joints
            - Flexion of the wrist
- Chvotek's sign
    - Contraction of the ipsilateral facial muscle elicited by tapping the facial nerve just anterior to the ear
    - Response:
        - Twitching of the lip to spasm of all facial muscles
- **Nursing management for Hypocalcemia**
    - IV: Calcium gluconate
        - Vesicant solution
            - Irritating to the vein causing extravasation (Nasunog ang ugat)
            - Can lead to Phlebitis
            - Management: Use bigger veins
                - More blood, better dilution
            - Bleeding gums and mucosa
                - Calcium is related to your clotting factors
            - Watch out for: **Cardiac Monitor**
                - Possible mapagod si heart if dumami si calcium bigla
    - Other Management
        - IV: Main
        - **High calcium diet of the filipinos (Sardines)**
        - **High calcium diet of the world (Anchovies)**
        - Vitamin D Supplements
            - Promotes calcium absorption

KIDNEYS

Mnemonic for functions "WET BREAD"

Function of the kidney	Renal Failure	Management
Water Balance	Hypervolemia : it can cause cerebral edema, congestive heart failure, portal hypertension, pulmonary hypertension	Fluid restriction (1 to 1.5 L/day) Diet: Low sodium diet Diuretics : for **acute renal failure,** reversible, high percentage of functioning nephrons **Chronic renal** failure:

		Irreversible, decreased functioning of nephrons, diuretics are no long effective
Electrolyte balance	Hypernatremia Hyperkalemia Hypocalcemia, Hyperphosphatemia Hypermagnesemia	Restrict Na in the diet Insulin with glucose Sodium bicarbonate can be given Phosphate binders to decrease phosphate (Ex. Alum hydroxide, Antacids) Calcium gluconate: Severe cases
Toxin Removal Urea (Ntirogen - byproduct of protein)	Urea build up (Uremia) Nitrogen build up (Azotemia) Urea build up: can cause renal encephalopathy:	Low protein source from high biologic source : Low nitrogen byproduct, white meat, Poultry, Dairy, Tofu

	Altered LOC: Different focusing, seizures, coma Uremic Frosts (Acid): Itchy skin	Renal Encephalopathy: Safety is priority Calamine lotions, antihistamines, oatmeal bath, cocoa butter lotions, cut fingernails short, sodium bicarbonate Dialysis
Blood pressure control	Hypertension because of fluid volume excess	Calcium channel blockers Betablockers
RAAS system: Renin and angiotensin aldosterone system Aldosterone: sodium and water retention	Increased aldosterone: hypernatremia and hypervolemia	ACE inhibitors- causes hyperkalemia ARBS: Angiotensin receptor blockers (Sartans): Prevents aldosterone formation: Decreased Sodium and water retention
Erythropoietin :	Decreased	Synthetic

Stimulates RBC production	erythropoietin: Decreased RBC production (Decrease oxygenation, easy fatigability, activity intolerance)	erythropoietin : stimulates RBC production
Acid balance	Hyperkalemia causes metabolic acidosis : Cardiac arrest	Sodium bicarbonate drip
D- Vitamin D : promotes absorption of calcium	Hypocalcemia : Hyperphosphatemia	Vitamin D supplements

Causes:

- Acute renal failure
    - High reversible in nature
    - Goal: to preserve kidney functioning
- Acute renal failure would cause chronic renal failure
    - Chronic renal failure: Irreversible

Causes of Renal Failure	Examples
Prerenal failure (before the kidneys), decreased perfusion status - decreased filtration status - little to none urine production	Decreased cardiac output or related to heart future Hemorrhage Sepsis
	Hypertension DM: decreased blood flow because viscous
Intrarenal failure: Inside the kidneys Nephron, glomerular, tubular damage : Decreased filtration rate, decreased urine production	Glomerulonephritis, nephrotoxic drugs, dye/contrast medium: Tubular necrosis (Tissue death) Tubular sclerosis (Tissue scarring)
Post renal failure (After the kidneys), with urine production but OBSTRUCTED	> Renal calculi > Benign prostatic hyperplasia > Bladder cancer > Bladder failure

Stages of Chronic Kidney Disease

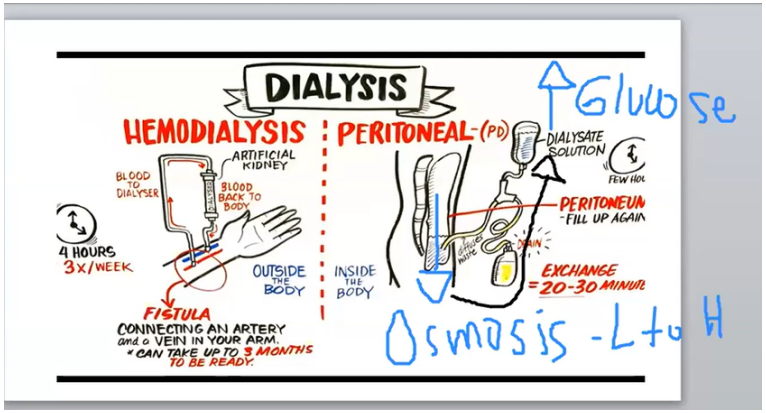
- Stage 1: Kidney damage with normal or increased EGFR
    - Normal EGFR: 90 to 125mL/min
- Stage 2: Mild
    - Weakness
    - Nausea and vomitin
- Stage 3: Moderate
- Stage 4: Severe
- Stage 5: Kidney failure

Renal transplant: High risk for rejection

- By the immune system

- Management: immunosuppressants
    - Ex. Azathioprine, steroids, cyclosporine
    - High risk for infection
- Symptom of kidney rejection
    - Oliguria
    - Flank pain
    - Renal encephalopathy

DIALYSIS

- Hemodialysis
    - Dialyzer serves as the kidney
- Peritoneal
    - Dialysate : high in glucose
    - Osmosis: from lower to higher concentration
- 

Hemodialysis Vs. Peritoneal dialysis

Hemodialysis	Peritoneal dialysis
Uses dialyzer to filter blood and remove waste (More efficient)	Dialysate: high in glucose that would cause hyperglycemic, hyperosmolar ultrafiltration
Access points: AV fistula (takes 3 months to be prepared), if not yet available, intrajugular catheter	Access point: Peritoneum (Between umbilicus and suprapubic area) (More accessible)
For severe cases with decreased renal functioning	For young, milder cases, ambulatory with high renal functioning
AV fistula care: Keep it clean and dry, avoid BP taking, phlebotomy, at the affected site Check patency: Present bruit > (Aucultate: Whooshing sound) and thrill (palpate : machine like vibrations)	Dialysate: rich in glucose, watch out for hyperglycemia
Prio complication: Disequilibrium syndrome WHAT: It offers you cerebral edema - increased ICP - Altered LOC, BP decreased, HRRR increased, possible for coma and seizures WHY:Rapid removal of nitrogen waste related to	Prio complication: Peritonitis Clinical symptoms: Rigid boardlike abdomen, fever, increased HR RR Why? Dialysate -Rich in glucose - attracts infection Management: Report, medical emergency, it may

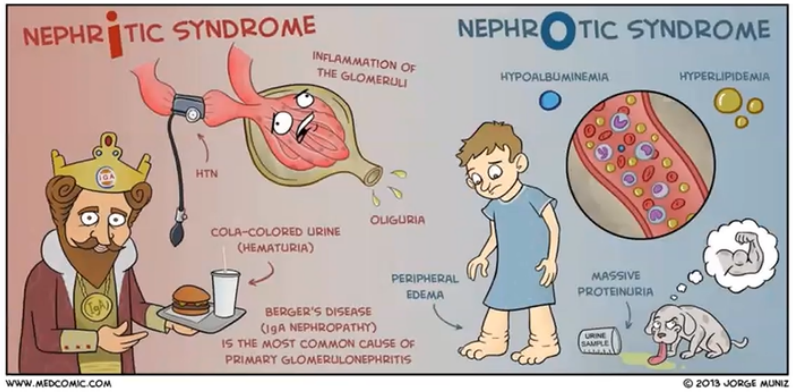
rapid rate of HD Management: Stop, report	lead to septic shock Patient home based Teach sterile technique
AV Fistula: Large blood vessels, high chance of bleeding	Peritoneum: risk of bowel perforation
WOF: Muscle cramps. That is caused by rapid removal of fluid and sodium Management: administer fluid and sodium (PNSS)	

GLOMERULONEPHRITIS

- Inflammation of glomerulus inside the nephron
- Usually caused by *Staphylococcus* spp.
- Decreased EGFR: will cause increased fluid and waste
    - Acute renal failure (Irreversible)
    - Long term, it will lead to chronic renal failure
- Headache and lethargy: renal encephalopathy (increased urea)
    - Urea: highly toxic to your brain
- Hypertension and Edema
    - Related to fluid retention
- Fever
    - Related to inflammatory responses
- Proteinuria
- Decreased albumin, down oncotic pressure, third spacing (Edema, Ascites, Anasarca)
- Cause:
    - Infections
        - Post GABS (Group A Beta hemolytic Strep) : history of strep throat infection or rarely impetigo
        - Bacterial endocarditis
        - Viral:HIV hepa B, Hepa C
    - Autoimmune disorders
        - SLE: Systemic lupus erythematosus
            - Systemic inflammation
        - Good pasture's syndrome
            - Mimics pneumonia, causes bleeding in the lungs or glomerulus
            - With secretions
        - IgA nephropathy
            - D/T recurrent episodes of blood in the urine, can be asymptomatic for years
            - Beurger's disease: cola-colored urine : hematuria
    - Other conditions
        - High BP
        - Diabetic nephropathy
        - Focal segmental glomerulosclerosis: scattered scarring of glomeruli either pathologic or idiopathic

    - Intraproblem
- Diagnostics:
    - Urine: presence of RBCs, red cell casts, WBCs, elevated creatinine and urea
    - Blood tests: Elevated BUN and Creatinine
    - Kidney UTz, Xray, CT scan
    - Kidney biopsy
- Treatment
    - General goal is to treat underlying cause and preserve kidney function
    - To prevent the progression to chronic renal failure
    - For GABS
        - Might improve without treatment, **antibiotics** can also be used
    - For autoimmune DO
        - Corticosteroid or immunosuppressants
    - For DM
        - Blood sugar control via insulin or OHA
    - For hypertension
        - Sodium restriction and loop diuretics
    - Dietary protein and potassium restriction for BUN elevation, carbohydrates given liberally
    - Fluid balance is utmost priority

<u>NEPHROTIC VS NEPHRITIC SYNDROME</u>



- Collection of symptoms
- Nephritic syndrome:
    - Inflammation of the glomerulus
    - HIHO
        - **H**TN
        - **I**nflammation of glomerulus
        - **H**ematuria
        - **O**liguria
- Nephrotic syndrome
    - Hypoalbuminemia: oncotic pressure problem > Third spacing,
        - Ascites
    - Hyperlipidemia
        - Cholesterol
        - Oh my god! Ang taas ng cholesterol!
        - Oil or Olesterol
    - Proteinuria
        - Foamy urine
    - OEdema

- Weight gain
- Periorbital

- **Causes of nephrotic syndrome**
  - DM
  - Chronic GN
  - SLE
  - Multiple myeloma
    - Cancer of the plasma
    - Causes an abnormal globulins
  - Amyloidosis of the kidneys
    - Accumulation of amyloid proteins in the kidney
  - Renal vein thrombosis
    - Emboli formation
  - Infections (HIV, Hepa B and C, Malaria)
- **Complications**
  - Blood clots: due to poor filtration that leads to loss of protein needed to prevent clotting
    - Aspirin or anticoagulants
  - High BP and triglycerides: loss of albumin stimulates liver to produce albumin and produce cholesterol and trigly consequently
  - Poor nutrition
  - Acute kidney injury
  - Chronic kidney disease
  - Higher risk of infection
- Diagnostics
  - Urine test for albumin levels: Low, hypoalbuminemia
  - Blood tests for albumin, cholesterol and trigly
  - Kidney biopsy
- **Management**
  - Objective is to preserve renal function and prevent complications
  - Diuretics , ACE inhibitors, ARBS : To decrease BP
  - Antineoplastics : Multiple myeloma
  - Immunosuppressants : Autoimmune disorders
  - Corticosteroid: Autoimmune disorders
  - Blood thinners: Prevents risk of clots
  - Low sodium diet
  - Dietary restrictions of protein and cholesterol

Nephritic Syndrome

- Inflammation of glomerulus
- Down GFR
- Acute
- Major cause of Beurger's disease
- **Diagnostics**
  - Urine tests for hematuria, dark colored urine
  - Blood tests for uremia or azotemia
    - Uremia: increased urea in the blood
    - Azotemia: increased nitrogen in the blood
  - Kidney biopsy
- **Treatment**
  - Bed rest

- A diet that is restricted in salt, potassium and fluid
- Medication to control BP
- Medication to reduce inflammation
- Medication to remove fluids from the body
- Dialysis to replace kidney function in severe cases

Benign Prostatic Hyperplasia

- FUN-WISE
- Irritative symptoms
  - **F**requency
  - **U**rgency
  - **N**octuria
- Obstructive symptoms
  - **W**eak stream
  - **I**ntermittency
  - **S**training
  - **E**mptying incomplete
- Prostate gland: produces glucose and fluid for the sperm to survive
- Aging men: decreased sexual practice
- BPH: causes obstruction of urine
  - Postrenal failure
  - Increased frequency and urgency to void
- Diagnostics
  - Digital Rectal Exam
    - 1 finger, gloved with lubricant
    - Poc: left side lying, with knees flexed/Sim lateral position, straighten the colon
  - PSA
    - Manageable
- Management
  - Alpha blockers: relax bladder neck muscles and muscle fibers of prostate, making urination easier
    - Examples: alfuzosin, doxazosin, tamsulosin, and silodosin
    - Side effects: dizziness and harmless condition in which semen goes back into the bladder instead out of the tip of the penis **(Retrograde ejaculation)**
      - Priority is safety
  - 5-alpha reductase inhibitors
    - Shrink your prostate by preventing hormonal changes that cause prostate growth
    - Examples: Finasteride and dutasteride
    - Side effect: Retrograde ejaculation
  - Tadalafil
    - Studies suggest this medication
    - Often used to treat erectile dysfunction
    - Can also treat prostate enlargement
    - Sildenafil: Purpose: Vasodilator
      - To decrease BP
      - SE: Penis erection
      - WOF: Hypotension

- Surgical procedures: Prostatectomy
    - TURP: Transurethral resection of prostate gland (No incision)
        - Faster recovery
        - Risk for bladder clots and bleeding
            - Perform cystoclysis/ continuous bladder irrigation
    - Radical prostatectomy
        - With incision
        - Via the rectum
        - Slower recovery

Cystoclysis

- Three way foley catheter
    - Inflow port
    - Outflow port
    - Anchor
- Urobag:
    - Below the bladder because it works via gravity
- Solution
    - Ideally PNSS (with sodium)
        - Equal concentration with bladder as bladder has sodium
        - Prevents water toxicity
        - No osmosis (no movement of water)
    - If distilled water, without sodium (Lower conc)
        - There will be osmosis
        - Promotes water toxicity
- Priority
    - Patent system
        - Flush out clots and electrolytes
- Normal within 24 hours
    - Pinkish red because there is still bleeding (Increased flow rate)
- Normal after 24 to 48 hrs
    - Clear na dapat (Decreased flow rate)