(Assessment/Communication/Problem Solving/Goal Setting/Teaching-Learning)

CRITICAL THINKING EXERCISES: **(Renal)**

Explain and/or Discuss the following points:

1. Predisposing factors that placed Nelson into ARF
   - On aminoglycosides—unsure if peak and trough ordered or what the baseline BUN/Creat was
   - Already has a UTI
   - Aggravated by large doses of NSAID
   - Age
2. Physiological changes related to the physical assessment data
   - Retaining H_2O / U/O ↓/moist breathsounds--
     - Related to that renin-angiotensin system is messed up—body can't get rid of fluid and too many vasopressors are released
     - poor perfusion and filtration through damaged kidneys
     - at risk for CHF, edema, HTN, ascites
     - renin-angiotensin-aldosterone system axis--NORMAL
       - **remember in normal kidneys**: ↑ BP inhibits renin secretion by the kidneys. When BP ↓ or volume drops, the kidneys release renin. Renin is sensitive to changes in Na concentrations, levels of vasopressin, and catecholamines in the blood. Renin is released into the blood→it then acts on angiotensin I(weak vasoconstrictor)→converted to angiotensin II in the lungs (powerful vasoconstrictor) this stimulates production of aldosterone from the adrenal glands. Aldosterone causes kidney to retain Na and water increasing plasma volume → The ↑ in volume and vasoconstriction increases B/P
   - neuro changes (restless, apprehensive and behavioral changes) are due to:
     - electrolyte imbalance (low sodium, low calcium)
     - metabolic acidosis
     - water intoxication
   - Kussmaul resp--air hunger (blowing off hydrogen)
   - Metabolic acidosis—refer to ABGs
   - pruritis--- dry skin, calcium-phosphate deposits in skin,
   - metallic taste---related to increased urea deposits

3. ABG and Lab results and implications
   - elevated K^+
     - may be related to poor aldosterone secretion, excessive intake of potassium, infection, acidosis, hyponatremia
     - may lead to cardiac arrythmias
   - low Na^+ (mild)--
     - dilutional and inability to absorb sodium
     - central nervous system signs/symptoms for hyponatremia--know assessment findings for hyponatremia
   - high Cl^-
     - chloride is inverse to bicarb. The renal failure pt does not produce enough bicarb
     - chloride is significant for maintenance in acid-base balance and contributes to gastric acid for digestion

        - major anion in the extracellular fluid
        - in failure, it is poorly excreted
    - low CO_2
        - used to measure acid-base balance—serum carbon dioxide is an indicator of bicarb (HCO_3^-) in the blood
    - Anion Gap---the difference between the + ions sodium and potassium (cations) and the - ions chloride and bicarbonate (serum CO_2) (anions) to determine if an acid-base imbalance occurs (metabolic)

      FORMULA: $(Na^+ + K^+) - (Cl^- + CO_2) =$ anion gap (not tested on this—just want you to understand when MD orders it)
        - In this case, the anion gap is >17 meaning a metabolic acidosis
    - metabolic acidosis---kidneys can't excrete H^+ ions because of decreased reabsorption of sodium bicarbonate and decreased formation of dihydrogen phosphate and ammonia----this problem worsens the hyperkalemia and reabsorption of calcium from the bones
        - loss of the ability of the renal tubules to excrete hydrogen ions
        - failure to form bicarbonate
        - low serum CO_2 an indicator of metabolic acid/base balance in the blood
        - S/S of metabolic acidosis
        - Tries to compensate by blowing off H^+ (kussmaul respiration)
        - Serum chloride level (↑) is always opposite of the bicarb level (↓)
    - ↑ phosphorous ↓ calcium
        - decreased filtration through glomerulus
        - reduced renal synthesis of vitamin D which decreases the absorption of Ca^{++} from the intestines
        - ↑ parathormone due to ↓ calcium levels (inappropriately, calcium leaves the bone causing renal osteodystrophy)
    - anemia
        - inadequate erythropoietin (stimulates bone marrow production of RBC) production
            - short lifespan of RBCs
            - nutritional deficits
            - uremic pts. tendency to bleed due to impaired platelet aggregation & impaired release of platelet factor 3
            - causing possible angina (poor myocardial oxygenation, SOB, fatigue
    - BUN ↑ (end-product of protein metabolism—too much)
    - Creat ↑ (indicator of renal damage)

4. Why peritoneal dialysis would be chosen over hemodialysis and their differences

   In this case, Nelson did not want hemodialysis but willing to do peritoneal dialysis. Typically, a temporary catheter for hemodialysis would be inserted and hemodialysis would be started. As you note on the comparison below, hemodialysis will lower B/P. If the patient starts with a very low BP, the patient may not be a candidate for hemodialysis because he/she is not hemodynamically stable.

(both types of dialysis filter the kidney)

Peritoneal Dialysis	**Hemodialysis**
slower fluid/electrolyte/metabolic shift	more severe hypotension
no vascular access needed (peritoneal catheter needed)	graft/fistula/or external catheter
diffusion/osmosis via the perineum as the membrane	diffusion/osmosis via an external membrane
36-48 hours (to accomplish the same lab results as hemo)	4-8 hours
peritonitis/cramping	air embolism, blood leak, graft and fistula complications
altered lifestyle	altered lifestyle

5. Rationale for the medication orders (including the dialysate solution)
   - Kayexalate: potassium exchange agent--short term treatment (approx 6 hrs)
   - dialysate solution or bath
     - 1.5% glucose will remove less H_2O than some of the other solutions
     - the higher the glucose content (2.5%, 4.5%), the more "hypertonic" the dialysate bath is and therefore the more fluid that is "pulled off" or removed
       - if the patient retains lots of fluid and BP is elevated, then a more hypertonic "bath" would be used in order to "pull off" more fluid
     - Heparin: added to the dialysate or bath to minimize chances that debris (fibrin) will obstruct the catheter
   - Epogen: stimulate erythropoietin production
   - TUMS: phosphate binder to decrease phosphate level--<u>it won't work if not given with food</u>
   - Ferrous Sulfate: build iron stores to increase hemoglobin

6. Rationale for the dietary prescription
   - as per nutrition book and 2nd semester notes on Renal Diet
   - (remember that a diet is different for the patient who is in renal failure and not dialyzed vs. the patient who is dialyzed. There are also differences in diet needs between the peritoneal dialysis patient and hemodialysis patient
   - typically at pt who is medically managed for renal failure will be on a strict protein restriction. If they are on hemodialysis, the protein restriction may be less severe or none at all. If they are on peritoneal dialysis, the pt loses protein through the semi-permeable membrane and they will be allowed to eat much more protein. You will continue to restrict Na, K, and fluid intake just to maintain a balance.

7. Rationale for strict I & O and daily weight
   - must monitor fluid balance carefully and daily due to the fluids given (IV or PO) and the fluids that are removed with peritoneal dialysis plus any urine output. Is Nelson gaining wt? (a sign of fluid retention----1 kg of weight gain = 1 liter of fluid)

8. Nurses role during peritoneal dialysis (fill time—dwell time—emptying) Include trouble shooting interventions to promote filling and draining

FYI--To be a candidate for peritoneal dialysis, the pt. CANNOT (1) have peritoneal adhesions or scarring because this would reduce the permeability of the peritoneal membrane or (2) be in a hyper-catabolic state

- dialysate bags need to be at room temperature or placed in a warmer
  - use a warming pad not warm water (the bags are permeable)
  - if too cold, the pt. will c/o cramps and hypothermia
- STERILE TECHNIQUE---**INCLUDING MASK**
- # of bags
- prime bag/tbg.
- weigh the pt. every AM (higher dialysate concentration produces > wt loss)—use the same scale and amount of clothing for an accurate wt.
- attach tbg. to the catheter

(continuation of question 8)

Doing the Exchange:

3 steps

Fill approx. 10-15 min.

Dwell approx. in this case 6 hours so Nelson's peritoneal cavity would essentially never be empty because he would then be ready for another exchange (4x/day) (ask Nelson if he is cramping)

Drain/Emptying approx. 15-20 min. to drain bag

- in this case, you would then start the process over with a new bag (4x/day is the order)
- monitor V/S and accurate I&O
- chart color and clarity of drainage

- **Trouble shooting:** What abnormal assessment findings could relate to filling/dwelling/emptying of the peritoneal catheter?

TROUBLE-SHOOTING

What's Wrong	Why	What can the RN try
Poor filling—drips instead of flows	Kinked tubing	• check clamps • check tubing and catheter • turn Nelson side to side • raise or lower bed to help w/ gravity
Poor drainage—drips instead of flows (the amount that went "IN" is > than the "OUTPUT" from the dialysis catheter into the empty bag)	• Kinked tubing • Tubing is up over side rails, so fluid is draining against gravity	• check tubing • Turn Nelson side to side to try & remove more fluid • raise or lower bed • move tubing around edge of side rail
Nelson has cramps	• Fluid not warm enough • Too rapid filling	• warm the solution • decrease flow rate
Bloody drainage	Blood-tinged-probably trauma	• observe and call MD if it doesn't clear
Cloudy drainage	Possible infection	• obtain C and S • Call MD, he may add antibiotics to the dialysate
Increased shortness of breath	Too much volume instilled	• Call MD, he may have to decrease dialysate amount for each exchange

9. Why is site care of the peritoneal catheter so important for the client in renal failure
   - Site care is important to prevent infection----if not treated, infection can tunnel resulting in abscess formation possible peritonitis and need for removal of the peritoneal catheter
   - The renal patient has an altered immune response caused by the increased nitrogenous waste products in the blood. There is a high mortality rate in ARF pts due to increased risk of infection

10. Refer to the CAPD Record below. What correlation do you notice between times of each dialysis run and when Nelson is weighed. Why does it say "full" after the weight?
    - You want to weigh the patient at the same time, same scale, same amount of clothing each day. In this case, the weight reflects that Nelson is “full” with the dialysate when weighed—so his weight will be a little heavier BUT consistent every day if always done at 0600, with a hospital gown and full of dialysate.

11. Why do you think the Physician ordered you to change the dialysate bag to 2.5% on 7/5 @ 06?
    - The higher the dextrose content in the bag, in this case 2.5%--concentrated the more H_2O that is removed---this order would depend on Nelson's I and O and he gained 2 pound = 1kg = 1 liter of fluid. The MD chose to pull off more fluid by using a hypertonic dialysate bag (2.5%) in order to reduce water weight and decrease BP

12. Nelson presents the following problems. Why do you think Nelson is showing these signs or complaints and provide nursing interventions with rationale:
    - C/O of pruritis
      - review above rationale (under explanation of assessment findings)-- don’t use alcohol products (drying)
    - C/O leg cramps
      - Osmolality changes of the body fluids—Nelson needs educating. Might need to call the Physician regarding muscle relaxers (Quinine is common); also could be related to low calcium level but the other answers are more accurate
    - At 7/5 0035 you note cloudy dialysate drainage and his abdomen is rigid upon palpation —Nelson is complaining of abdominal tenderness—what do you do?
      - Signs of Peritonitis—notify Physician immediately (educate Nelson)
      - Monitor for elevated temp, elevated WBC, and N/V
      - MD may order IV antibiotics and/or may order for antibiotics to be directly placed in the dialysate solution and instilled into the peritoneal cavity.

SAMPLE Continuous Ambulatory Peritoneal Dialysis (CAPD) Record for Nelson

Date	Time	Daily Weight	Temp, pulse & B/P	Solution % & cc's	Additives	Drain Amount	Comments
7/4	0005		98.7-115-179/91	1.5% 2000cc	heparin 500units	1400	+ 600 fluid retained **cl.** yellow
7/4	0600	123# (full)	98.6-116-168/99	1.5% 2000cc	heparin 500units	2350	- 350 (removed) cl. yellow
7/4	1755		96.8-122-160/82	1.5% 2000cc	heparin 500units	2600	- 600 (removed) cl. yellow
7/5	0035		98.5-125-150/75	1.5% 2000cc	heparin 500units	2350	- 350 (removed) **cloudy** yellow—abd. cramping
7/5	0600	125# (full)	98.6-120-160/88	2.5% 2000cc	heparin 500units	2900	- 900 (removed) **cl.** yellow

Be brief but descriptive