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NTR 404: Case Study 19 (renal)
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Case Questions for *Medical Nutrition Therapy: A Case Study Approach* 4th ed.

Title: Case 19 – Chronic Kidney Disease: Peritoneal Dialysis

Questions:

1. Describe the major exocrine and endocrine functions of the kidney. The main function of the kidney is to maintain the balance of electrolytes, fluids and organic solutes (Mahan et al., 2012, p. 799). This task is accomplished by the continuous filtration of the blood with alterations in secretion and reabsorption of this filtered fluid (Mahan et al., 2012, p. 800). The kidney excretes the following metabolic waste:

- urea
- creatinine
- uric acid
- ammonia
- oxalate

The kidney also secretes the following hormones:

- **erythropoietin (EPO)** – a critical determinant of erythrocyte activity in the bone marrow (controls RBC production). Deficiency of EPO is the main cause of anemia in patients with chronic renal disease (Mahan et al., 2012, p. 801).
- **Calcitriol (active vitamin D)** – promotes efficient absorption of calcium by the gut and is one of the substances necessary for bone remodeling and maintenance. (helps regulate calcium-phosphorous homeostasis). Suppresses PTH production (which mobilizes calcium from bone).

The kidney secretes the enzyme rennin via the glomerlui in response to decreased blood volume. Renin is a proteolytic enzyme that acts on angiotensinogen in the plasma to form angitensin I, which is converted to angitensin II, a powerful vasoconstrictor and potent stimulus of aldosterine secretion by the adrenal gland (Mahan et al., 2012, p. 801). As a result sodium and fluid are reabsorbed, and blood pressure is returned to normal (Mahan et al., 2012, p. 801).

2. What is glomerulonephritis and how can it lead to kidney failure? Glomerulonephritis is a renal disease characterized by diffuse inflammatory changes in the glomeruli. (http://www.kidney.org/atoz/content/glomerul.cfm). When the kidney is injured, it loses its ability to effectively excrete wastes and get rid of extra body fluid. If this condition persists, the kidneys lose their function all together, leading to kidney failure.

3. What laboratory values or other tests support Mrs. Caldwell's diagnosis of chronic kidney disease? List all abnormal values and explain the likely cause for each abnormal value.

	Ref. Range	Patient's Results	Likely Cause for Abnormal Value
Chemistry			
Sodium (mEq/L)	136-145	130 ↓	Reduction in kidney function
Bicarbonate (mEq/L)	21-32	16 ↓	Reduction in kidney function
BUN (mg/dL)	8-18	124 ↑	uremia
Creatinine serum (mg/dL)	0.6-1.2	6.8 ↑	uremia
Est GFR (ml/min/1.73 m2)	61-589	6 ↓	Reduction in kidney function

Phosphate, inorganic (mg/dL)	2.3-4.7	11.9 ↑	Reduction in kidney function
Calcium (mg/dL)	9-11	8.3 ↓	Reduction in kidney function
Anion gap (mmmol/L)	10-20	22 ↑	Reduction in kidney function
Protein, total (g/dL)	6-8	5.9 ↓	
Albumin (g/dL)	3.5-5	3.4 ↓	
Coagulation (Coag)			
PT (sec)	12.4-14.4	16.9 ↑	
INR	0.9-1.1	1.4 ↑	
Hematology			
RBC (x106/mm3)	4.2-5.4 F	2.33 ↓	anemia of chronic disease
Hemoglobin (Hgb, g/dL)	12-15 F	6.6 ↓	anemia of chronic disease
Hematocrit (Hct, %)	37-47 F	19.0 ↓	anemia of chronic disease
Mean cell volume (µm3)	80-96	65.3 ↓	anemia of chronic disease
Mean cell Hgb (pg)	26-32	21.5 ↓	anemia of chronic disease
Mean cell Hgb content (g/dL)	31.5-36	19.5 ↓	anemia of chronic disease
RBC distribution (%)	11.6-16.5	16.8 ↑	anemia of chronic disease
Transferrin (mg/dL)	250-380 F	219 ↓	
Ferritin (mg/mL)	20-120 F	5 ↓	

4. **This patient has had two previous kidney transplants. What are the potential sources for a donor kidney? How is rejection prevented after a kidney transplant? What does it mean when the physician states she is experiencing acute rejection?** The potential sources for a donor kidney are living donors and brain dead donors (related or unrelated). To prevent rejection, patients and donors are screened and matched. The more similar the antigens between the donor and recipient, the less likely the organ will be rejected (http://www.nlm.nih.gov/medlineplus/ency/article/000815.htm). The match is usually not perfect, as no two people (except identical twins) have the exact same antigens. Doctors use medicines to suppress the recipient's immune system. The goal is to prevent the immune system from attacking the newly transplanted organ when the organ is not closely matched. If these medicines are not used, the body will almost always launch an immune response and destroy the foreign tissue (http://www.nlm.nih.gov/medlineplus/ency/article/000815.htm). Acute rejection refers to rapid reaction against allograft (transplant tissue) that is not compatible with the recipient.
5. **Based on the admitting history and physical, what signs and symptoms does this patient have that are consistent with acute rejection of the transplant**? Elevate BUN and creatinine – indicating possible uremia. Nausea.
6. **Mrs. Caldwell has requested that she restart peritoneal dialysis. Describe the basic concepts of this medical treatment and how it differs from hemodialysis**. Hemodialysis uses a man made membrane or dialyzer to filter wastes and remove excess fluid from the body (by diffusion, ultrafiltration, osmosis). In contrast, peritoneal dialysis makes use of the body's own semi-permeable membrane, the peritoneum (Mahan et al., 1012, p. 815). A catheter is surgically implanted in the abdomen and into the peritoneal cavity. Dialysate containing high-dextrose concentration is instilled into the peritoneum, where diffusion carries waste products from the blood through the peritoneal membrane and into the dialysate, water moves by osmosis (Mahan et al.,

2012, p. 815). The fluid is then withdrawn and discarded, and new solution is added. Outpatient hemodialysis usually requires treatment 3-5 hours three times per week in a dialysis unit. Peritoneal dialysis is more ambulatory.

7. **This patient was prescribed the following diet in the hospital: 1500 kcal, 75 g pro, 3000 mg Na, 3500 mg K, 1000 mg P, 2000 cc fluid. Explain the rationale for each component of her nutrition therapy Rx. How might this change once she has started peritoneal dialysis?**

Nutrition Rx	Rationale	Changes once PD initiated
1500 kcal	Spare protein for tissue repair and maintenance	↑ to 1700 – 1900 kcals (30-35 kcal/kg AjBW)
75 g protein	Limit to prevent further decline of kidney function	↑ 86 g/kg (57 kg x 1.5)
3000 mg Na	Control edema; manage electrolytes	↓2000 mg
3500 mg K	Supplementation if patient on diuretic (potassium wasting) medications	↓3000 mg
1000 mg P	Control to prevent hyperparathyroidism and bone disease	0.8 – 1.2 g/day
2000 cc fluid	Limit to avoid excess build up of fluid in body. Manage to control electrolytes, minerals etc	About the same

8. **Assess Mrs. Caldwell's height and weight. Calculate her BMI and her % usual body weight. How would edema affect your interpretation of this information? Using the KDOQI guidelines, what is Mrs. Caldwell's adjusted body weight?** Presence of edema would inflate BMI etc. due to excess fluid build up in the body.
    - **Height = 157.4 cm**
    - **Weight = 77.1 kg**
    - **BMI = 31**
    - **% UBW = 104%**
    - **AjBW = IBW + 0.25(ABW – IBW) = 125 lbs. (57 kg)**
9. **Determine Mrs. Caldwell's energy and protein requirements. Explain the rationale for the method you used to calculate these requirements.** Based on AjBW (57 kg) and the recommendations in Krause (p. 822) of 1.2 to 1.5 g/kg of body weight:
    - **1.2 x 61 kg = 68.4 g**
    - **1.5 x 61 = 85.5 g**

So protein requirements would be a range between 68 and 86 grams/day.

10. **List all medications that Mrs. Caldwell is receiving. Determine the action of each medication and identify any drug–nutrient interactions that you should monitor for.**

Medication	Mode of Action	Poss. Drug-Nutrient Interactions
Procardia (nifedipine)	Antianginal/ antihypertensive drug/calcium channel blocker	Not with grapefruit/related citrus ↓ Na, ↓ Ca may be recommended. Avoid natural licorice, avoid ginger,

		ginko, ginseng
Carvedilol	Antihypertensive, non-selective beta-blocker & alpha1 blocker	↓ Na, ↓ Ca may be recommended. Avoid natural licorice
Catapres (clonidine)	Antihypertensive, analgesic	↓ Na, ↓ Ca may be recommended. Avoid natural licorice. Insure adequate fluid intake
CellCept (mycophenolate)	Immunosuppressent – used to prevent renal transplant rejection	Take on empty stomach
Fish Oil	Supplement	
Lasix (furosemide)	Diuretic, antihypertensive	↑ K, ↑ Mg (or K, Mg suppl) ↓ Na, ↓ Ca may be recommended. Disc. Na restriction if hyponatremia occurs. Avoid natural licorice.
Prednisone	Corticosteroid	Take with food to ↓ GI distress, limit caffeine to ↓ GI distress, caution with grapefruit/citrus, ↓Na, ↑ Ca, ↑ Vit D, ↑ pro; may need to ↑K, ↑ vits A, C, ↑ P 9or suppl)
Gengraf	Immunosuppressent	Take on empty stomach
Prinivil	Antihypertensive	Take on empty stomach, avoid salt subst, insure adequate fluid intake, caution with K suppl, caution w/Mg suppl, ↓ Na, ↓ Ca may be recommended.
Sodium Bicarbonate	Antacid, Alkalinizing agent	↓ Na diet, take Fe separately, caution w/milk intake or high Ca intake
Calcitriol	Ca regulator, active vit D	Not with vit D or Mg supplement
Renal Caps	Combo B vits used to treat deficiency related to disease state	
Renvela	Phosphate binder	Take w/meal. Low P diet

11. **Mrs. Caldwell's laboratory values that you discussed previously in this case indicate she has anemia. Why do renal patients suffer from anemia? How is this typically treated in dialysis patients?**

12. **What factors in Mrs. Caldwell's history may affect her ability to eat? What are the most likely causes of these symptoms? Can you expect that they will change**? The patient may be suffering from uremia due to the rejection of the transplant. Uremia may cause taste aberrations – often to meat – which may make eating difficult and achieving the recommended high biological value protein intake (Mahan et al., 2012, p. p. 822). In addition, taste may be altered due to medications. Once the uremia is under control and dialysis is initiated, the symptoms may subside.

13. **Evaluate Mrs. Caldwell's diet history and 24-hour recall. Is her usual diet consistent with her inpatient diet order?** According to Super Tracker her usual diet contains more calories than her inpatient diet order. In addition her sodium intake is higher than the inpatient order. Potassium is about the same (slightly over), as wis phosphorous. Protein intake is higher than the inpatient order (~94 g as opposed to the recommended 75 g). The patient's fluid intake is less than the inpatient diet order.

14. **Identify the pertinent nutrition problems and the corresponding nutrition diagnoses.** *See attached NCP form.

15. **Write a PES statement for each high-priority nutrition problem.** *See attached NCP form.

16. **Mrs. Caldwell was discharged from the hospital and was prescribed the following regimen of peritoneal dialysis to begin at home: CCPD daily. Ca 2.50; Mg 0.5, Dextrose 2.5%. Total fills (or exchanges) = 3 (3 fills/cycle @2500 mL). Total fill volume/24 hours: 10000 mL. Determine the amount of energy that Mrs. Caldwell's PD prescription will provide each day. How will this affect your nutrition recommendations?**

17. **Using the KDOQI adult guidelines for peritoneal dialysis patients, determine Mrs. Caldwell's nutrition prescription for outpatient use. (Include energy, protein, phosphorus, calcium, potassium, sodium, and fluid.)**

Energy (kcals)	**1700 – 1900 kcals**
Protein	**86 g/day**
Phosphorous	**0.8 – 1.2 g/day**
Calcium	**No more than 2000 mg/day**
Potassium	**3000 mg/day**
Sodium	**2000 mg/day or less**
Fluid	**2000 ml/day +**

18. **Using the identified nutrition problems (and with the understanding that Mrs. Caldwell has received a significant amount of nutrition education in the past), what would you determine to be the most important topics for nutrition education when she returns to the PD clinic?**

19. **List factors that you would monitor to assess Mrs. Caldwell's nutritional status when she returns to the PD clinic.**