

Case Study #3: Renal Disease

50 points

1. Please be concise and use only the space provided.
2. Please cite sources as necessary.
3. You may use your textbook, the pocket resource, and drugs.com

Part I: Initial Presentation

Chief Complaint: progressive anorexia with N/V, 5 kg weight gain in the past 10 days, edema, fatigue, worsening SOB with 2 pillow orthopnea, pruritus, and inability to urinate.

Patient History: BK is a 42-year-old female. She was diagnosed with type 2 DM at age 12 but has had poor adherence to treatment recommendations. She lives with her husband and children. Her husband also has type 2 diabetes. Her kidney function has been declining for the last 5 years with anemia, decreased GFR, and increased creatinine, phosphate and urea. BK is being admitted in preparations for kidney replacement therapy.

Onset: Dx: CKD 3 two years ago. Acute symptoms x 10 days

Tx: prepare for kidney replacement therapy and nutrition consult

PMH: Gravida 3/para 2. Both infants weighed more than 11 lbs

Meds: Lasix, Metformin, Vasotec (has not refilled Vasotec prescription, inconsistent Metformin and Lasix use)

Family hx: Mother, sister and two brothers have type 2 DM

Physical Exam:

General appearance: Overweight female, appears older than her age. Lethargic, c/o N/V

Vitals: Temp 98.6 F, BP 220/80 mm Hg, HR. 86 BPM, RR 25

Extremities: muscle weakness, 3+ pitting edema

Chest/lungs: Rhonchi with rales

Ht: 5'2" wt: 158 lbs.

Nutrition History:

General: Reports appetite is usually good but has been reduced recently because of the N/V. Attended a 4 week course through the hospital 8 years ago to learn type 2 DM management, but said she is so busy with her family that she doesn't have time to plan her meals.

Usual dietary intake

Breakfast: 2 eggs, 3-corn tortilla, ham or bacon. 8 oz. Tampico

Morning snack: 4 orange juice, banana

Lunch: 1 cup homemade chicken soup, 2 quesadillas 12 oz. Tampico

Afternoon snack: 12 oz apple juice, 4 cookies

Dinner: 6 oz. Rice, 6 oz. beans, 2 oz. cheese, 2 oz. salsa, 4 oz. chicken, 4 corn tortillas 8 oz. whole milk

Evening Snack: 8 oz. ice cream

Food allergy/intolerance- NKFA

Dx: Chronic kidney disease; hypertension; type 2 DM; hyperlipidemia

Tx Plan:

Renal diet 2 gm sodium, 2 gm potassium, and 1 gm phosphorus diet
 1.5 L fluid restriction. CBC,
 blood chemistry
 Vitamin/mineral supplement
 Metformin, Lasix, Vasotec, Phos Lo, Sodium Bicarbonate, EPO, Iron

Laboratory:

Lab	Value	Interpretation
GFR	15 mL/min	Low Stage 4 CKD
BUN	90 mg/dL	High
Serum creatinine	14 mg/dL	High
Creatinine clearance	17.0 mL/min	High
Serum sodium	142 mEq/L	WNL-high end
Serum potassium	5.7 mEq/L	High
Serum albumin	2.8 g/dL	Low
Hgb /Hct	11.5 g/dL/28%	Low
Serum transferrin	155 mg/dL	Low
BP	160/100, standing, right arm	High-Stage2 HTN
Urine pH	7.31	WNL- low end
Serum phosphorus	5.0 mg/dL	High
PTH	100 pg/mL	High
Urine volume	450-mL/24 h	Low

*NPR online 35-40

1. In the table of laboratory values above, for the column labeled “Interpretation”, indicate whether the values are high (↑), low (↓), or within normal limits (wnl). (7 points)
2. Briefly explain how type 2 DM can lead to chronic kidney disease. (3 points)

The glomerulus is responsible for filtering the waste products from the blood and body fluids to form urine for excretion. In diabetic patients, hyperglycemia and a change in the basement membrane of the tissue that occurs, leading to thickening of the glomerulus. As the glomerulus becomes thicker, the kidney may allow more protein to be excreted in the urine. Whereas the amount of protein secreted in the urine is initially small (microalbuminuria), as diabetic nephropathy progresses, the number of functioning nephrons decreases, and more albumin is secreted in the urine. Subsequently, body fluid concentration increases as the remaining nephrons reach their threshold to clear the increased solute load. This results in an increasing presence of high blood nitrogen waste products (uremia and azotemia) and, along with increased protein excretion, is further indicative of diabetic nephropathy, which in turn leads to CKD.

NTP 527

3. Although BK c/o anorexia and weight loss, today’s weight shows that she has actually gained weight. Explain this discrepancy in subjective versus objective information. (1 point)

Subjectively, BK feels as if she has lost weight because of her loss of appetite. Due to her progressive anorexia and muscle weakness, BK may have lost *dry* weight. However, as the objective physical exam shows, BK has actually gained weight (5kg in past 10 days). This weight gain is due to her 3+ pitting edema. Given that we have her total weight gain and are aware of her presence of edema, we can more accurately analyze her physical examination data and make proper recommendations by adjusting her body weight to become edema free. It is imperative that we both take into account the subjective complaints (anorexia, fatigue) and the objective data (edema, weight gain) from lab values and physical examination in order to get the full spectrum of information on the contributors of her change in weight status. We can now objectively prove that she has gained weight due to her severe fluid retention (edema), and her subjective complaint of anorexia aids in proving this.

4. Which foods in her usual diet are contributing most to: (2 points)

a) **Phosphorous levels:** Quesadillas, beans, cheese, whole milk, ice cream, corn tortilla, Tampico, bacon/ham, cookies *NTP 543

b) **Potassium levels:** Orange juice, banana, beans, whole milk, tomato, quesadilla, cheese, ice cream, Tampico *NTP 540

5. Explain the rationale for the following interventions: (4 points)

a) **Phosphate binder**

Damaged kidneys may not be able to excrete phosphorus, leading to high serum phosphorus levels in the blood. CKD patients, in addition to dietary restriction of phosphorus, use phosphate binders to help aid in preventing the gastrointestinal absorption of phosphorus. High phosphorus levels are associated with an increased risk of mortality and myocardial infarctions. Thus, to decrease these risks, phosphate binders to inhibit absorption of phosphorus are necessary. *NTP 541

b) **Calcium supplement**

Due to the fact that CKD patients have altered vitamin D metabolism, decreased absorption of calcium from the gut and increased serum phosphate levels, patients with CKD have higher calcium requirements. CKD patients are unable to convert Vit D into active form to suppress PTH to regulate calcium and phosphorus- (low PTH suppresses bone growth and high PTH extracts more calcium from the bone.) Also, foods high in calcium are generally restricted because they also tend to be high in phosphorus. To get sufficient calcium that cannot be attained through diet, CKD patients will need calcium supplements to aid in restoration of normal calcium levels for bone density and blood. *NTP 541

c) **Iron and EPO**

Due to the fact that CKD patients are unable to synthesize adequate amounts of erythropoietin for RBC production, red blood cell counts are low. Also, due to dialysis procedures, HD patients will have increased blood loss. CKD patients need enough iron and EPO to allow for sufficient RBC production. Most patients will receive iron supplementation, and require supplementation to meet their needs. This can be achieved intravenously with rHuEPO (recombinant human erythropoietin) during dialysis. *NTP 544-545

d) **Vitamin supplement containing only water soluble vitamin:**

Water-soluble vitamins are deficient in dialysis patients due to anorexia and sub-optimal dietary intake that is usually associated with a renal diet (low in fresh fruits and vegetables, whole grain and dairy products) and complications due to decreased renal functioning (altered metabolism, impaired synthesis, decreased intestinal absorption, and resistance to the actions of some vitamins). Thus, because of these increased losses, CKD patients undergo water-soluble vitamin dietary supplementation. Preparations that include fat-soluble vitamin A or high doses of vitamin C should be avoided, however. *NTP 544

6. Explain the purpose of each of the following interventions, *and list the data* (laboratory parameters, symptoms, etc.) indicating the need for treatment. (8 points)

a) **Protein restriction:** As kidney function deteriorates, kidneys are unable to excrete the metabolic products of protein. Thus, protein restriction is necessary for patients with CKD and GFR <25 who are not on dialysis. Protein restriction, according to the most recent evidence, is associated with slowed renal disease progression and a delayed need for renal replacement therapy. Her GFR is 15, showing that she has decreased renal function. Additionally her high BUN of 90mg/dL shows that protein restriction is necessary. *NTP 534

b) **Phosphorus restriction:** Damaged kidneys are not able to excrete phosphorus properly, leading to high serum phosphorus levels-which are associated with increased mortality and myocardial infarction risk. When the GFR falls between 20-30 mL/min/1.73m, hyperphosphatemia is evident and phosphorus restriction is recommended. Given that BK has high serum phosphorus levels (5.0mg/dL) and a GFR of 15, indicating kidney function decline and CKD, she will need to restrict phosphorus through her diet and with phosphate binders. *NTP 541

c) **Potassium restriction:** Under normal conditions the kidney excretes 80-90% of a person's normal potassium intake. However, as renal functions begin to decline in patients with CKD, potassium is accumulated, leading to hyperkalemia (elevated blood potassium). Elevated potassium levels can cause potentially fatal heart arrhythmia. Other factors that lead to hyperkalemia are GI bleeding, acidosis, and hyper-aldosteronism. Thus, in order to reach the target range for patients with above serum potassium levels >5.0 mEq/L, potassium is usually restricted in the diet to 2-3 g/day. BK has hyperkalemia (5.7mEq/L), and thus should restrict potassium in her diet. *NTP 539

d) **Fluid and/or sodium restriction:** As kidney function deteriorates, fluid excretion diminishes. Thus, to avoid hypotension and drastic blood volume changes, fluid must be restricted in patients with CKD. Additionally, most patients have very low urine output during the first 12 months of hemodialysis, so the standard recommendation is 2g Na with a maximum fluid intake of 1L/day. BK has +3 pitting edema a GFR of 15 (indicative of decreased kidney function) and high BP 160/100, indicative of hypertension. Thus, it is

7. Complete an ADIME note for BK at this point in time (12 points) including the Renal Diet Pattern for BK to use after she returns home and begins regular dialysis treatment. Create an appropriate and a well-balanced Renal Diet for her to follow using the attached renal diet pattern document. (8 points)

A: BK is an overweight 42 y/o female with Type 2 DM dx at 12 y/o and CKD 3 two years ago. Acute symptoms and 5kg edema weight gain x 10 days. C/o progressive anorexia, N&V, edema, fatigue, worsening SOB w/2 pillow orthopnea, pruritis, and inability to urinate. 3+ pitting edema, muscle weakness and rhonchi with rales. Currently on Lasix (inconsistent), Metformin (inconsistent) and Vasotec. Tx prepare for HD.

Anthropometrics	Lab Values			Current Intake
BK, 42 y/o female Height: 5'2, 62 inches, 157.48cm, 1.57m Current BMI: 29.20 (overweight) Adjusted BMI: 27.16 (overweight) UBW: 147#, 66.82kg CBW: 158#, 71.82kg IBW: 110#, 50kg SBW: 134#, 61kg ABW: 143.81#, 65.37kg %IBW: 134%*	Lab	Value	Interpretation	Energy: 3450kcal Protein: 145g, 17% Carbohydrates: 416g, 48% Fat: 134g, 35%kcal Potassium: 3557mg Sodium: 5515mg Phosphorus: 2735mg Fluids: 1875mL Calcium: 2226mg
	GFR	15 mL/min	Low-CKD	
	BUN	90 mg/dL	High	
	Ser Creatinine	14 mg/dL	High	
	Creat Clearance	17.0	High	
	Serum K	5.7 mEq/L	High	
	Serum albumin	2.8 g/dL	Low	
	Hgb/Hct	11.5	Low	
	Serum transferrin	155 mg/dL	Low	
	BP	160/100	High-Stage 2	
	Serum Phos.	5.0 mg/dL	High	
	PTH	100 ng/mL	High	
	Urine Volume	450mL/24h	Low	
Sodium	142mEq/L	WNL-High End		
<u>Requirements</u>				
Energy: 2288 kcal/day*				
Protein: 78.44g/day**, 14%kcal				
CHO: 322g, 56%kcal				
Fat: 76g, 30%kcal				

**Based on HD recommendations (protein: 1.2g/kg day ABW)

Energy: 35kcal/kg/day *%IBW-used edema free weight (UBW)

*NPR online 35-40

D: Altered nutrition related laboratory values (high serum phosphorous and high serum potassium NC 2.2 R/T excess intake of minerals (phosphorus and potassium) and dietary choices high in potassium and phosphorus AEB Serum K 5.7 mEq/L, and Serum Phosphorus 5.0mg/dL and self-report potassium intake of 3.5g and phosphorus intake of 2.7g/day from 24-hr dietary recall.* NPG 149

I: **Recommendations:** At start of HD begin on Phoslo 667mg tablet to take with meals daily. Starting today, take her off Lasix. Starting tomorrow take Vasotec as prescribed with glass of water. Starting now (and daily)-avoid alcohol. Take Metformin with food daily as prescribed. Limit dietary intake to 2g K, 2g Na and 1g (Follow renal exchange dietary pattern given to her on back) at initiation of HD and daily thereafter. Provide reference list of foods high and low in K and phosphorus for home before hospital discharge. Before discharge: give BK pamphlet with tips (and discuss ways) to lower K and Phosphorus (eliminate Tampico and processed foods, watch dairy consumption) discuss implications of non-adherence to renal diet, and educate patient on use of Phos-Lo and purpose of phosphate binders. **Goals:** Starting at initiation of HD, patient will begin adhering to newly recommended diet pattern. Starting now, patient will begin tracking food and medication intake through upkeep of food journal. Lower serum potassium to normal range of 3.5-5.5 mEq/L and lower serum phosphorus levels to 3.0-4.5 mg/dL by 2 weeks from today. Full adherence to daily medication intake and fluid intake as prescribed by beginning of next week. *drugs.com, NTP 537

M/E: **Monitor:** Lab values: serum Ca, serum Na, UNN, weight, serum K, serum phosphorus, anemia lab values, GFR, BUN, creatinine clearance, CBC, GFR, urine volume and pH, and PTH at next visit and every month. Take BP every hour on HD. Daily reported dietary and medication intake through food journal at next visit and following. **Follow up/Evaluation:** Next appointment 2 weeks from today. (Home HD treatment every 2 days.) Evaluate patient adherence to diet and medication intake through patient report of dietary intake at next appointment. Evaluate patient adherence to self-monitoring through food/med journal upkeep or lack thereof at next appointment. Discuss obstacles to behavior change at next appointment. Assess and adjust diet and medications as needed to reach desirable lab values for normal persons at appointment next week and following appointments.

Follow up visit 1 month later

	Feb 25	Feb 27
BUN, mg/dL	97.0	99.0
Body wt, kg	68.2	69.4
UUN, g/24 hr	7.1	7.4

8. BK has been on HD for a month now. At her dialysis visit with you the RD, she tells you that she has been noticing that her weight has been fluctuating. What can you tell her about potential weight changes in-between HD sessions? (2 points)

Hemodialysis treatment entails removing the fluid and waste products from the body that the kidney cannot filter and remove itself. When BK is removed from hemodialysis, she weighs in at her edema-free dry weight. Because hemodialysis will occur every 2 days, BK has this time to gain back the fluid weight that her damaged kidneys cannot filter out themselves. Thus, in between her dialysis treatments, her fluid is being retained and her weight gain in between treatments is due to her fluid retention. BK can be on treatment for an extended period of time and will still gain fluid weight between treatments. To ensure that this is no longer a concern of BK's, I would explain this to her and use this information to further reinforce the importance of adherence to her dietary and more specifically, fluid recommendations.

*NTP 538

9. You interview BK at some length. She assures you that she is following her diet. Based on her UUN, is she consuming the amount of protein you recommended on her diet pattern? Show calculations to back up your conclusion. (3 points)

UUN= 7.1

N balance = 0

N balance = protein intake (g) / 6.25 – (UUN + 4)

$$0 = x/6.25 - (7.4 + 4)$$

$$0 = x/6.25 - 11.4$$

$$11.4 = x/6.25$$

$$x = (11.4)(6.25)$$

x = 71.25g/day of protein

* Based on the calculation above, BK is not following the protein requirements recommended for her in her diet pattern. The diet pattern I made for her yields between around 78g protein/day, whereas her current intake is showing that she is only consuming ~ 71 g/day. There is only a slight discrepancy between her estimated needs and her current intake, however, it is imperative that BK follows her diet and meets her protein needs to ensure adequate nutritional status while on hemodialysis. She should be getting her 78g/day of protein.

10. The patient tells you she sometimes uses a salt substitute. Is this appropriate and why or why not? (1 point)

No. Salt Substitutes should not be used because they are concentrated sources of potassium. They can have 300-800mg potassium. As a patient trying to limit potassium, this would be detrimental to her goal of reaching normal potassium levels. *NTP 539

Renal Diet Pattern

Diet prescription- Include 2 gm sodium, 2 gm potassium, and 1 gm, phosphorus diet with a 1.5 L fluid restriction

Food (# choices)	Kcal	Pro (g)	Na (mg)	K (mg)	Phos (mg)
Meat x 4	400	32	400	280	280
Milk x 4	600	32	400	800	400
Bread x 4	600	8	480	200	80
Vegetable x 3 (Low)	75	3	75	300	60
Fruit x 3 (Low)	300	3	30	300	30
Fat x 5	225	0	275	50	25
Extra High Cal x 1	60	0	15	20	5
Flavoring x 1	20	0	250	20	100
Fluids (from milk- 946mL)	Total extra= 554mL needed= 1500mL				
TOTAL	2280kcal	78g	1925mg	1970mg	980mg