1. Describe the physiological functions of the kidneys.

The main function of the kidneys is to sift out waste products and extra water from the blood. These waste products and excess water become urine which flows to the bladder through ureters. The bladder stores urine until it is released through urination. The removal of wastes occurs in the millions of nephrons found inside the kidneys. In the nephron, a glomerulus intertwines with a tubule. The glomerulus acts as a sieve and keeps normal proteins and cells in the bloodstream, allowing extra fluid and wastes to pass through. Waste materials and water leave the blood and enter the urinary system through a complicated chemical exchange. The tubules receive a combination of waste materials and chemicals the body can still use. The kidneys measure out chemicals like sodium, phosphorus, and potassium and release them back to the blood to return to the body. This is the way that kidneys regulate the body’s level of these substances. The kidneys also secrete hormones including erythropoietin for red blood cell production and urodilation for natriuresis mediation, and convert vitamin D₃ to its active form. The kidneys also have several homeostatic functions including acid base balance, blood pressure, and plasma volume.

<http://kidney.niddk.nih.gov/kudiseases/pubs/yourkidneys/#renal>

2. What diseases/conditions can lead to chronic kidney disease (CKD)?

The two most common causes of kidney disease include diabetes and high blood pressure. There is also a risk for those people with a family history of kidney disease.

Diabetic kidney disease is caused by glucose staying in the blood instead of being broken down which can act like a poison and cause damage to the nephrons. Some ways to prevent diabetic kidney disease are to keep blood glucose levels down and to use angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARBs) as a way to treat high blood pressure.

High blood pressure can cause kidney disease because the pressure can damage the small blood vessels in the kidneys which inhibit their function to filter wastes from the blood. The National Heart, Lung, and Blood Institutes of Health recommend that people with diabetes or reduced kidney function keep their blood pressure below 130/80.

Glomular diseases are another group of diseases that affect the kidneys and include autoimmune diseases, infection-related diseases, and sclerotic diseases. In this group of diseases the glomeruli are attacked within the kidneys. The most common primary glomerular diseases include membranous nephropathy, IgA nephropathy, and focal segmental glomeruosclerosis. Signs of glomerular disease can include proteinuria, hematuria, or both. Glomerular diseases can slowly destroy kidney function and blood pressure control is important with any kidney disease. Treatments for glomerular diseases include immunosuppressive drugs or steroids to reduce inflammation and proteinuria depending on the specific disease.

Some other causes of kidney disease are autoimmune diseases, systemic infections, urinary tract infections, kidney stones, cancer, low birth weight, inherited and congenital, poisoning, and trauma. Inherited and congenital kidney disease result from hereditary factors and a common example is polycystic kidney disease. Trauma, such as a direct forceful blow to the kidneys can lead to kidney disease. Regular use of over-the-counter pain killers can poison the kidneys and lead to disease.

<http://kidney.niddk.nih.gov/kudiseases/pubs/yourkidneys/#renal>

3. Explain how type 2 diabetes mellitus can lead to CKD.

Type 2 diabetes decreases the body’s ability to use glucose as it normally should. Instead of being broken down to be used as energy, glucose remains in the blood stream; having high levels of sugar in the blood can lead to changes in the nephrons, starting with thickening of glomeruli to destruction. As the glomerulus is compromised, larger amounts of protein are allowed to pass from the blood into the urine for excretion. High levels of sugar can also damage the kidney cell; when this happens the waste products that are usually filtered out start to build up in the blood. High levels of sugar in the blood can also damage the blood vessels that bring oxygen and nutrients to the kidneys. The kidneys can stop working if blood sugar levels have been too high for too long.

<http://kidney.niddk.nih.gov/kudiseases/pubs/yourkidneys/#renal>

4. Outline the stages of CKD, including the distinguishing signs and symptoms.

Kidney function is assessed based on the glomerular filtration rate, or GFR. The GFR is reflected in clearance tests that measure the rate at which substances are cleared from the plasma by the glomeruli.

There are five stages of kidney disease. Stage 1 is defined as kidney damage with normal or increased GFR of > 90 mL/min; in this stage blood flow through the kidney increases and the kidneys increase in size, but there are usually no outward signs. Stage 2 is defined as kidney damage with mild decrease in GFR of 60-89 mL/min. Stage 3 is kidney disease is defined as kidney damage with a moderate decrease in GFR of 30-59 mL/min. Stage 4 is defined as advanced kidney damage with GFR of 15-29 mL/min; nephropathy is present, there is a large amount of protein in the urine, blood pressure increases, and new symptoms present like nausea, changes in taste, uremic breath, anorexia, difficulty concentrating, and numbness in the fingers and toes. Stage 5 is end-stage renal disease and GFR is < 15 mL/min; at this stage kidneys fail so toxins build up in the blood. Symptoms of this stage of kidney disease include anorexia, nausea and vomiting, headache, fatigue, anuria, swelling around eyes and ankles, muscle cramps, tingling in the hands or feet, and changes in skin color and pigmentation.

Early signs and symptoms of CKD include high blood pressure, blood and/or protein in the urine, a creatinine blood test greater than 1.2 for women and 1.4 for men, a GFR less than 60, frequent urination, especially at night, difficulty or painful urination, puffiness around the eyes, and swelling of hands and feet. Later signs include nausea and vomiting, poor appetite, hiccups, weight loss, abnormal bleeding, trouble sleeping, itching, cramping at night, swelling, and trouble breathing.

<http://www.kidney.org/patients/plu/plu_intro/pluo_4.cfm>

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5. From your reading of Mrs. Joaquin’s history and physical, what signs and symptoms did she have?

The signs and symptoms that Mrs. Joaquin complained about upon arriving at the hospital included loss of appetite, nausea and vomiting, edema in her extremities, face, and eyes, malaise, shortness of breath, shortness of breath, pruritus, muscle cramps, and an inability to urinate. She was also diagnosed with type 2 diabetes 11 years ago and has not been compliant with her prescribed treatment. Decline in GFR, increased creatinine and urea concentrations, elevated serum phosphate, as well as normochromic and normocytic anemia have all been documented.

From the patient history Mrs. Joaquin was diagnosed with type 2 diabetes at age 13, she was non-compliant with her prescribed treatment plan, her GFR has been declining over the years, she has increased creatinine and urea concentrations, and her serum phosphate levels are elevated.

From her physical exam, she has muscle weakness, high blood pressure, and has 3+ pitting edema to the knees which means there is a deep indentation when a finger is pressed into the skin and it takes 30 seconds for the skin to rebound.

6. What are the treatment options for stage 5 CKD?

Stage 5 CKD is defined as kidney function that is inadequate to sustain life and requires initiation of renal replacement therapy. Hemodialysis, peritoneal dialysis and kidney transplantation are the treatment options for stage 5 CKD.

Kidney transplant is the most preferred treatment option and involves surgical transplantation of a donor kidney from a living related donor, a living non-related donor, or a cadaver. Dialysis is a renal replacement procedure that removes excessive and toxic by-products of metabolism from the blood.

7. Describe the differences between hemodialysis and peritoneal dialysis.

In hemodialysis, blood is filtered by a semipermiable membrane outside the body whereby wastes and uremic toxins are filtered and removed by the dialysis fluid. The clean blood is then returned to the body. A patient on hemodialysis usually spends 3-4 hours per treatment at a dialysis center and typically has treatments three times per week. Peritoneal Dialysis uses the lining of the abdominal cavity to filter the blood. A special fluid is put into the abdomen that absorbs waste products from the blood as it passes through small blood vessels in the peritoneum. This process occurs either every night while the patient sleeps or through regular exchanges throughout the day.

<http://www.nationalkidneycenter.org/chronic-kidney-disease/symptoms/?gclid=CJaOodem5bMCFcN_QgodWW0A4Q>

<http://www.nkdep.nih.gov/living/kidney-failure/dialysis.shtml>

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8. Explain the reasons for the following components of Mrs. Joaquin’s medical nutrition therapy.

|  |  |
| --- | --- |
| Nutrition Therapy | Rationale |
| 35 kcal/kg | Adequate energy intake is important in order to prevent catabolism and achieve optimal nutrition status. Sufficient kcal from CHO and fat may help to prevent muscle and visceral protein from being utilized as energy. This intake provides adequate calories to prevent excessive protein loss through catabolism and malnutrition. Both the National Kidney Foundation and the Kidney Disease Outcomes and Quality Initiative guidelines advise that nondialyzed and hemodialysis patients to calculate energy intake of 35 kcal/kg/day for patients younger than 60. |
| 1.2g protein/kg | To ensure adequate intake of essential amino acids; 50% of protein should be of high biological value. Restrictions in protein help the kidneys to work less which helps to delay the progression of CKD by controlling uremia. Special care has to be taken when calculating needs for patients who are being treated with hemodialysis as this treatment leads to losses of protein. The patient should be provided with adequate protein to prevent protein energy malnutrition and to conserve serum protein. |
| 2 g K | Restriction of dietary potassium is needed because the kidneys cannot remove potassium. Risk of hyperkalemia, excess potassium in the blood. Can cause suppression of electrical activity of the heart and can cause the heart to stop beating. Hyperkalemia can also interfere with the functioning of the skeletal muscles |
| 1 g phosphorus | Restrictions of phosphorus are related to the kidney’s diminished ability to remove excess phosphorus from the blood. Prevents hyperphosphatemia which is an abnormally elevated level of phosphate in the blood. Excess ingested phosphate is usually excreted by the kidneys to maintain a proper balance. Short-term complications of hyperphosphatemia include acute hypocalcemia with possible tetany and rarely acute deposition of calcium/phosphate complexes into joints, subcutaneous tissue, or other soft-tissue areas. |
| 2 g Na | Limiting sodium intake helps to limit fluid intake, fluid retention, and in controlling high blood pressure. |
| 1,000 mL fluid + urine output | High fluid gains can lead to sudden changes in blood volume and hypotension during hemodialysis treatment. Most patients become oliguric (low output of urine) or anuric (absence of urine formation) within the first 12 months of hemodialysis, so it is very important to recommend a 2 gram sodium diet with a fluid allowance of not more than 1 L daily. Fluid retention is common and leads to increase in blood pressure, weight gains, and congestive heart failure. |

<http://emedicine.medscape.com/article/241185-overview#a0199>

<http://www.medicinenet.com/hyperkalemia/article.htm>

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9. Calculate and interpret Mrs. Joaquin’s BMI. How does edema affect your interpretation?

Height: 5’ = 2.322 m²

Weight: 170 lbs. = 77.3 kg.

BMI = 77.3/2.322 = 33.3 kg/m² so she falls in the obese category. Edema is the accumulation of fluid around the interstitial spaces that surrounds the cells. Mrs. Joaquin reported having edema in her extremities, face and eyes in her patient history. Because of this edema, Mrs. Joaquin’s weight may be inflated and her BMI may be overestimated. Based on an edema-free adjusted body weight of 140 lbs her BMI would be

BMI = 63.6/2.322 = 27.4 kg/m²

10. What is edema-free weight? The following equation can be used to calculate the edema-free adjusted body weight

aBWef=BWef + [(SBW – BWef) x 0.25]

Where BWef is the actual edema-free body weight and SBW is the standard body weight as determined from the NHANES II data.

Calculate Mrs. Joaquin’s edema-free weight. Is this the same as dry weight?

Edema-free weight is weight without the excess fluid that builds up between dialysis treatments. It is the lowest weight you can safely reach after dialysis without developing symptoms of low blood pressure which can occur when too much fluid is removed.

Adjusted body weight = 165 + [(65 – 165) x 0.25] = 165 + [(-100) x 0.25] = 165 + (-25) = 140.

<http://www.aakp.org/aakp-library/Dry-Weight/>

11. What are the energy requirements for CKD?

According to the National Kidney Foundation sufficient evidence indicates that a diet providing about 35 kcal/kg/day is necessary to maintain neutral nitrogen balance, to promote higher serum albumin concentrations and more normal anthropometric parameters, and for better protein utilization.

Energy expenditure of nondialyzed individuals with CRF is similar to that of healthy individuals, metabolic balance studies of these individuals indicate that a diet providing about 35 kcal/kg/day engenders neutral nitrogen balance and maintains serum albumin and anthropometric indices. For individuals who are 60 years old and older, a lower energy intake of 30-35 kcal/kg/day is acceptable as these individuals ten to be more sedentary.

12. Calculate what Mrs. Joaquin’s energy needs will be once she begins hemodialysis.

Energy Requirement: 35 kcal/kg SBW

140 lbs/2.2 = 63.6kg

Total Energy Needs: 63.6kg x 35 = 2,226 kcal

13. What are Mrs. Joaquin’s protein requirements when she begins hemodialysis?

Protein Requirement: 1.2 g/kg SBW

140 lbs/2.2 = 63.6

aBWef x 1.2gm/kg protein = 63.6 kg x 1.2 = 76.32g protein per day.

14. What is the rationale? How would these change if she were on peritoneal dialysis?

The energy requirement for patients who are on hemodialysis and peritoneal dialysis are the same; however when estimating a peritoneal dialysis patient’s energy requirements the kcals absorbed from the glucose in the dialysate should be taken into account. If Mrs. Joaquin were on peritoneal dialysis her protein requirement would be higher because protein is lost through the peritoneal membrane and patients on peritoneal dialysis are at risk for infection. According to the National Kidney Foundation and the K/DOQI guidelines, dietary protein intake should be no lower than 1.2 g/kg/day and unless a patient demonstrates adequate protein nutrition status on a 1.2g protein/kg/day diet, 1.3 g protein/kg/day should be prescribed. It is also recommended that at least 50 percent of the dietary protein should be of high biological value.

<http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_a16.html>

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15. Are there any potential benefits of using different types of protein, such as plant protein rather than animal protein, in the diet for a patient with CKD? Explain.

As already mentioned, protein sources should be of high biologic value, meaning they contain the essential amino acids in a proportion similar to that required by humans. It is also important to adjust protein recommendations for each client. Animal proteins like meat, milk, and eggs are good protein sources, but also high in fat which is not good for individuals with CKD since they are already at an increased risk for cardiovascular disease. Lean chicken, lean cuts of meat, fish, soy and other plant proteins should be stressed. Pairing plant proteins with low fat meats is also an option as plant proteins typically have a lower biologic value. All protein sources vary in sodium, potassium, phosphorus, and fluid concentrations, so it is important to read product labels.

<http://www.eufic.org/page/en/page/faq/faqid/biological-value-protein/>

16. Mrs. Joaquin has a PO₄ restriction. Why?

Phosphorus will build up in the blood as kidneys proceed to fail. In early CKD hyperphosphatemia is prevented by an adaptive increase in renal excretion and decreased phosphate reabsorption. Hyperphosphatemia is evident when GFR falls between 20 and 30 mL/min/1.73m² which indicates diminished kidney function. Mrs. Joaquin’s PO₄ restriction is implemented in order to prevent hyperphosphatemia which can cause more harm to the kidneys and also cause renal osteodystrophy; a condition in which kidneys fail to maintain proper levels of calcium and phosphorus in the blood which leads to abnormal bone hormone levels. The condition slows bone growth and causes deformities so it is most serious in children. One deformity occurs when the legs bend inward toward each other, or outward away from each other. If the condition is not treated the bones will gradually become thinner and weak which will lead to bone and joint pain and it also increases the risk of bone fractures.

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<http://kidney.niddk.nih.gov/kudiseases/pubs/CKD_Mineral_Bone/>

17. What foods have the highest levels of phosphorus?

High phosphorus beverages include: ale, chocolate drinks, drinks made with milk, canned iced teas, beer, cocoa, and dark colas.

High phosphorus dairy products include: cheese, custard, milk, cream soups, cottage cheese, ice cream, pudding, and yogurt.

High phosphorus protein products include: carp, beef liver, fish roe, oysters, crayfish, chicken liver, organ meats, and sardines.

High phosphorus vegetables include: dried beans and peas, baked beans, chick peas, kidney beans, limas, pork ‘n beans, soy beans, black beans, garbanzo beans, lentils, northern beans, and split peas.

Other high phosphorus foods include: bran cereals, caramels, seeds, whole-grain products, brewer’s yeast, nuts, and wheat germ.

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18. Mrs. Joaquin tells you that one of her friends can drink only certain amounts of liquid and wants to know if that is the case for her. What foods are considered to be fluids? What recommendations can you make for Mrs. Joaquin?

Foods that are considered to be fluids are soups, popsicles, ice cream, sherbet, yogurt, custard and gelatin. Recommendations made include:

1. Limit high-salt foods you will have less thirst

2. Take pills with mealtime liquids, applesauce, or pureed fruits, as allowed

3. Drink from small glasses and cups

4. Drink only when thirsty. Reach for very cold beverages. Beverages that are less sweet will quench thirst

5. Weigh-in everyday. Weight gain should not be more than the prescribed number of pounds each day

6. Use sour candy or sugar-free gum to moisten the mouth. There are special thirst-quencher gums in the market that may be useful

7. Add some lemon juice to water or ice. The sour taste helps to quench thirst

8. Try swishing very cold water or low-alcohol mouth wash when thirsty, but don’t swallow it

9. Brush teeth often

10. Keep lips moist with lip balm or moisturized lipstick

11. Use ice cubes instead of liquids. One cup of ice is equal to ½ cup of water/juice and it will last longer

12. Freeze grapes and eat them throughout the day as one fruit serving.

13. Try frozen blueberries and pineapple tidbits, fruit cocktail, and other recommended fruits

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19. If a patient must follow a fluid restriction, what can be done to help reduce his or her thirst?

The following can help reduce thirst in a CKD patient:   
1. Limit high-salt foods

2. Use sour candy or sugar-free gum to moisten the mouth

3. Add lemon juice to water or ice as the sour taste will help to quench thirst

4. Swish very cold water or low-alcohol mouthwash in the mouth when thirsty, but don’t swallow

5. Use ice cubes instead of liquids

6. Freeze grapes and eat them throughout the day

7. Try frozen blueberries, pineapple tidbits, fruit cocktail, and other recommended fruits

20. Identify nutrition problems within the intake domain using the appropriate diagnostic term.

Inadequate energy intake (NI-1.4)

Inadequate oral food/beverage intake (NI-2.1)

Excessive mineral intake (specify) (NI-55.2)

* High potassium food choices
* High phosphorus food choices
* High sodium food choices

21. Several biochemical indices are used to diagnose chronic kidney disease. One is glomerular filtration rate (GFR). What does GFR measure?

GFR measures the rate at which blood passes through the glomeruli each minute.

<http://www.nlm.nih.gov/medlineplus/ency/article/007305.htm>

22. What test is usually done to estimate glomerular filtration rate?

A creatinine clearance is used to estimate GFR. A blood sample is obtained and sent to the lab where creatinine levels are tested. The lab specialist will combine creatinine levels and several other factors to estimate the GFR. There are two commonly used tests to test the GFR: The Cockcroft-Gault Modification of Diet in Renal Disease (MDRD) and the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI). These tests use serum creatinine, adjusted by the effects of age, sex, and body weight to estimate creatinine clearance.

<http://cjasn.asnjournals.org/content/5/6/1003.full>

23. Mrs. Joaquin’s GFR is 28 mL/min. What does this tell you about her kidney function?

Mrs. Joaquin’s GFR is 28 mL/min which means that she is in stage 4 chronic kidney disease. Her kidney function has severely decreased.

24. Evaluate Mrs. Joaquin’s chemistry report. What labs support the diagnosis of stage 4 CKD?

|  |  |  |  |
| --- | --- | --- | --- |
| Lab Test | Normal Range | Patient Value | Significance of Abnormal |
| Albumin  (g/dL) | 3.5-5.0 | 3.7 | Low albumin reflects protein losses in urine. This value is within normal range, but on discharge her levels had declined even further |
| Sodium  (mEq/L) | 136-145 | 130 L | Low sodium reflects losses in urine or fluid retention. It can be caused by a number of factors including nephritis, diabetic acidosis, and hyperproteinemia |
| Potassium  (mEq/L) | 3.5-5.5 | 5.8 H | High serum potassium indicates compromised filtration in the kidneys |
| PO₄  (mg/dL) | 2.3-4.7 | 9.5 H | High serum phosphate indicates compromised filtration in the kidneys |
| Total CO₂  (mEq/L) | 23-30 | 20 L | Low CO₂ indicates compromised acid-base balance has been used to assess malnutrition. |
| Glucose  (mg/dL) | 70-110 | 282 H | High blood glucose indicates uncontrolled DM |
| BUN  (mg/dL) | 8-18 | 69 H | High blood urea nitrogen indicates insufficient filtration in the kidneys |
| Creatinine  (mg/dL) | 0.6-1.2 | 12.0 H | High creatinine levels indicate impaired renal function |
| Calcium  (mg/dL) | 9-11 | 8.2 L | Low serum calcium reflects insufficient vitamin D. Vitamin D is converted to its active form in the kidneys. Insufficient active vitamin D prevents calcium reabsorption in the intestines |
| Cholesterol  (mg/dL) | 120-199 | 220 H | Inflammation of the glomerulus can cause altered lipid metabolism, causing high levels of cholesterol and triacylglyerol |
| TG  (mg/dL) | 35-135 | 200 H | Inflammation of the glomerulus can cause altered lipid metabolism, causing high levels of cholesterol and triacylglyerol |
| HbA₁c  (%) | 3.9-5.2 | 8.9 H | HbA₁c indicates long-term uncontrolled hyperglycemia indicating diabetic nephropathy as the likely cause of the patient’s chronic kidney disease |
| Protein urine  (mg/dL) | Negative | 2+ H | High level of protein in urine indicates protein losses, a strong predictor of renal disease progression |

25. Examine the patient care summary sheet for hospital day 2. What was Mrs. Joaquin’s weight post dialysis? Why did it change?

Mrs. Joaquin’s post dialysis weight was 165 lbs, a decrease of five pounds from the day before. Dialysis helped to filter the blood to remove excess fluid built up due to diminished kidney function.

26. Which of Mrs. Joaquin’s other symptoms would you expect to begin to improve?

I would expect Mrs. Joaquin’s edema to improve as well as her shortness of breath. She should also have improved appetite and decreased nausea and vomiting.

27. Explain why the following medications were prescribed by completing the table.

|  |  |  |
| --- | --- | --- |
| Medication | Indications/Mechanism | Nutritional Concerns |
| Vasotec | Used to treat high blood pressure. It works by decreasing certain chemicals that tighten the blood vessels, so blood flows more smoothly and the heart can pump blood more efficiently. Used to treat diabetic nephropathy. | Insure adequate fluid intake, it may be recommended to decrease sodium and calcium intake, salt substitutes should be avoided and potassium supplementation should be cautioned. Concerns with anorexia and weight loss |
| Erythropoietin | Replaces the hormone that is secreted by the kidney that stimulates the production of red blood cells by bone marrow | May need to supplement iron, vitamin B 12, and/or folate. ESRD diet compliance is mandatory. May cause nausea, vomiting, and/or diarrhea |
| Vitamin/mineral supplement | Increased fluid losses during dialysis, anorexia, low dietary intake necessitates supplementation of water soluble vitamins (the B vitamins, folic acid, and vitamin C). Individuals on dialysis commonly suffer from deficiencies of vitamin C, folate, vitamin B₆, calcium, vitamin D, iron zinc, and possibly selenium. As a result of restricted intake of many foods and losses of water soluble vitamins during dialysis, patients are usually given specially formulated vitamins. Intravenous forms of vitamin D analogues and iron are typically given to patients. Supplementation of iron should be done if needed. | Water soluble vitamins should not be supplemented at recommended doses  Iron should be taken with water or juice on an empty stomach or with food to decrease GI distress, it should be taken with vitamin C to increase absorption, and carbonate antacids should be taken separately. |
| Calcitriol | A form of vitamin D that is used to treat and prevent low levels of calcium in the blood of patients whose kidneys are not working normally. It works by helping the body to use more of the calcium found in foods or supplements | Don’t take with a vitamin D or magnesium supplement, with dialysis; do not take with excessive calcium or low phosphorus, increases calcium absorption. Concerns for anorexia, weight loss and increased thirst |
| Glucophage | Used to treat type 2 diabetes by helping to control the amount of glucose in the blood. It decreases the amount of glucose you absorb from your food and the amount of glucose made by the liver. It also increases the body’s response to insulin. | Anorexia; decreases folate and vitamin B 12 absorption. Use caution with severe decreased renal function |
| Sodium bicarbonate | Can be used to make blood and urine less acidic. | Increases sodium in body, consider a low sodium diet. May increase thirst and may increase water retention and water weight. Use caution with severe decreased renal function |
| Phos Lo | Phosphate binder used to reduce blood levels of phosphate. It works by preventing absorption of phosphate from food in the stomach | Take with meals, avoid Ca supplements or antacids; decreases iron absorption. Concerns with anorexia, nausea, vomiting and constipation |

<http://www.ncbi.nlm.nih.gov/pubmedhealth/PMH0000865/>

<http://www.nlm.nih.gov/medlineplus/ency/article/003683.htm>

<http://www.nlm.nih.gov/medlineplus/druginfo/meds/a682335.html>

<http://www.nlm.nih.gov/medlineplus/druginfo/meds/a696005.html>

<http://www.nlm.nih.gov/medlineplus/druginfo/meds/a682001.html>

<http://www.nlm.nih.gov/medlineplus/druginfo/meds/a605015.html>

<http://www.nutritionmd.org/health_care_providers/renal/renal_nutrition.html>

28. Identify nutrition problems within the clinical domain using the appropriate diagnostic term.

* Overweight/obesity (NC-3.3)
* Impaired nutrient utilization including glucose (NC-2.1)
* Altered nutrition-related laboratory values including elevated potassium, phosphorus, creratinine, and diminished GFR (NC-2.2)

29. What health problems have been identified in the Pima Indians through epidemiological data?

NIDDK research conducted on the Pima Indians has shown that obesity is a major risk factor in the development of diabetes. One-half of adult Pima Indians have diabetes and 95% of those with diabetes are overweight. Many of the Pima Indians who have diabetes also have the complications associated with the disease like kidney disease, eye disease, and nerve damage.

<http://diabetes.niddk.nih.gov/dm/pubs/pima/obesity/obesity.htm>

30. Explain what is meant by the “thrifty gene” theory.

The “thrifty gene” theory was proposed in 1962 by geneticist James Neel to help explain why many Pima Indians are overweight. The theory is based on the fact that for thousands of years the Pima population relied on hunting, fishing, and farming for food. They would experience alternating periods of feast and famine. Neel hypothesized that in order to adapt to these extreme changes in caloric needs, the people developed a gene that would allow them to store fat during times of plenty so they would not starve in times of famine. As the Pima Indians adopted a Westernized way of life with less physical activity and a continuous food supply, their once protective gene has predisposed them to developing chronic diseases.

<http://diabetes.niddk.nih.gov/dm/pubs/pima/obesity/obesity.htm>

31. How does nephropathy affect Pima Indians?

Statistically, Pima Indians develop diabetes at a much younger age than the Caucasian population; 35 years old and 60 years old respectively. This means that the Pima Indian population lives with the disease for a greater amount of time and has a greater likelihood of developing other complications associated with diabetes. Research has shown that Pima Indians have over 20 times the rate of new cases of kidney failure as the general US population, and 90 percent of the time diabetes is the underlying cause. Furthermore, kidney disease is the leading cause of death from disease among Pima Indians who have diabetes. Recent research has shown that keeping blood sugar as close to normal as possible can slow and even prevent complications of diabetes.

<http://diabetes.niddk.nih.gov/dm/pubs/pima/kiddis/kiddis.htm>

32. Choose two high-priority nutrition problems and complete a PES statement for each.

* Altered nutrition-related laboratory values including elevated serum potassium (NC-2.2) as related to dietary choices high in potassium as evidenced by serum potassium of 5.8 mEq/L and self-reported potassium intake of 4.3g.
* Excessive sodium intake (NI-5.10.2) as related to fluid retention and usual intake of foods high in sodium as evidenced by reported intake of 3.3g of sodium and 3+ pitting edema to the knees.

33. For each PES statement, establish an ideal goal (based on the signs and symptoms) and appropriate intervention (based on etiology).

|  |  |
| --- | --- |
| Goals | Intervention |
| Lower serum potassium to normal range of 3.5 – 5.5 mEq/L | Conduct nutrition counseling on strategies for self-monitoring (C-2.3)   * Track dietary intake including potassium   Modify distribution, type, or amount of food and nutrients within meals or at specified time (ND-1.2)   * Limit dietary potassium to 2 g/day   Deliver initial nutrition education on priority modifications (E-1.2)   * Educate on health implications of consuming excess potassium * Provide sample meal plan to help aid in adherence to dietary goals * Educate on foods high and low in potassium |
| Reduce fluid retention to acceptable range (2-5% body weight) per dialysis treatment | Modify distribution, type, or amount of food and nutrients within meals or at a specified time (ND-1.2)   * Limit dietary sodium to 2 g/day * Limit fluid intake to 1000mL + output/day   Deliver initial nutrition education on priority modifications (E-1.2)   * Educate on health implications of consuming excess sodium and fluid * Educate on foods high and low in sodium and fluids * Provide sample meal plan to help aid in adherence to dietary goals   Conduct nutrition counseling on strategies for self-monitoring (C-2.3)   * Track dietary intake including sodium and fluids |

34. When Mrs. Joaquin begins dialysis, energy and protein recommendations will increase. Explain why.

Protein needs are higher in patients undergoing dialysis due to amino acid removal that occurs during dialysis as well as the inflammatory response which increases protein requirements. Adequate carbohydrate and fat intake is essential in order for protein to be used for growth and repair. If insufficient protein is available, it will be used to provide energy for the body. For these reasons the patient is predisposed to protein calorie malnutrition, so as a preventative measure protein and energy requirements are increased.

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<http://www.nutritionmd.org/health_care_providers/renal/renal_nutrition.html>

35. Why is it recommended for patients to have at least 50% of their protein from sources that are of high biological value?

High biological proteins are food stuffs that contain all the complete essential amino acids essential to the human body. High biological proteins are easily broken down by the body and assimilated into body tissue. Examples of high biological proteins include meat, milk, cheese, yogurt, poultry, and fish. Plants, grains, nuts, legumes, seeds and vegetables contain low biological proteins. Protein metabolism produces urea which healthy kidneys typically remove, but patients with CKD are unable to efficiently remove it. Therefore, consuming at least 50% of protein from high biological proteins protect and conserve body protein and minimizes urea generation.

<http://www.kidney.org/professionals/kdoqi/guidelines_updates/nut_a08.html>

36. The MD ordered daily use of a multivitamin/mineral supplement containing B-complex, but not fat-soluble vitamins. Why are these restrictions specified?

Mrs. Joaquin has an increased need of water soluble vitamins because of the increased fluid loss through dialysis. Water soluble vitamins do not remain in the body, they are typically removed from the body through urination, and they have to be replaced daily. Mrs. Joaquin will likely be given a specialized vitamin which will provide the extra water soluble vitamins that are needed; B1, B2, B6, B12, folic acid, niacin, pantothenic acid, biotin, and vitamin C.

Fat soluble vitamins remain in the body and are not necessary to replace daily or supplement unless prescribed by the kidney doctor.

37. What resources would you use to teach Mrs. Joaquin about her diet?

There are many online resources to help patients with CKD; Medline Plus has as sight which has recommendations for carbohydrates, fats, protein, calcium, phosphorus, fluids, salt or sodium, potassium, and iron; the National Kidney Foundation also has a web page that is very thorough and explains the stages of kidney disease, and explains why getting the right amount of calories and protein is important. It also discusses why sodium, phosphorus, calcium, potassium, fluid, and vitamins and minerals are important in the diet. It deals with special diet needs like diabetes or vegetarianism as well as how nutrition is tested. Both of these resources can be used by Mrs. Joaquin at home if she has internet access, but she should also be given some pamphlets or brochures that she can take home so she has information at her fingertips if she needs it. The National Renal Diet has set standard dietary recommendations for patients with kidney disease and those on dialysis which can be used to set guidelines and menus for Mrs. Joaquin.

<http://www.nlm.nih.gov/medlineplus/ency/article/002442.htm>

<http://www.kidney.org/atoz/pdf/nutri_chronic.pdf>

38. Using Mrs. Joaquin’s typical intake and the prescribed diet, write a sample menu. Make sure you can justify your changes and that it is consistent with her nutrition prescription.

|  |  |  |  |
| --- | --- | --- | --- |
| **Meal** | **Diet PTA** | **Sample Menu** | **Justification** |
| Breakfast | Cold cereal – ¾ cup  Bread – 2 slices or Fried potatoes – ¾ cup  Fried egg – 1 (occasionally) | Rice Krispies – 1 cup  Milk (1%) – ½ cup  ½ English muffin  Margarine, whipped – 2t.  Scrambled egg – 1 g  Water – 2 fluid ounces | Rice Krispies are low in potassium and phosphorus  Limit milk to ½ cup  Omit potatoes due to high potassium  Add ½ English muffin with whipped margarine for energy  Add scrambled egg, no fat, for protein and energy  Add limited fluids |
| Snack | None | Quinoa salad – ½ cup  Apple sauce – ½ cup  Water – 2 fluid ounces | Add snack to increase energy  Include foods low in potassium and phosphorus  Add limited fluids |
| Lunch | Sandwich:  White bread – 2 slices  Bologna – 2 slices  Mustard  Potato chips – 1 oz.  Coke – 12 fluid oz. | Baked chicken – 2 ounces  Coleslaw – ½ cup  Carrots, cooked – ½ cup  White rice – ½ cup  White bread – 1 slice  Margarine, whipped – 2t  Sprite – 8 fluid ounces | Changed lunch meat to low sodium meat  Replace potato chips with crispy coleslaw to reduce potassium  Chose a different option for low sodium starch  Added white bread with margarine for added energy  Replaced dark cola with clear cola to reduce phosphorus |
| Snack | None | Blueberries – 1.5 oz | Add afternoon snack for additional energy and diet balance |
| Dinner | Chopped beef – 3 oz  Fried potatoes – 1 cup | Roast pork – 2 ounces  Noodles, reduced sodium – ½ cup  Mixed vegetables (as allowed) – ½ cup  Dinner roll – 1  Margarine, whipped – 2t  Angel food cake – 1 slice  Water – 2 ounces | Replace chopped beef with leaner meat  Replaced potatoes with reduced sodium noodles to reduce potassium  Added mixed vegetables (as allowed) to increase energy and balance diet  Added dinner roll with whipped margarine to increase energy  Added desert for energy |
| Snack | Saltine crackers – 6  Peanut butter – 2 Tbs | Saltine crackers, low sodium – 6  Peanut butter, unsalted – 1 T  Tangerine – 1 whole  Water – 2 ounces | Replaced regular saltine crackers with low sodium  Replaced peanut butter to sodium-free peanut butter and reduced to 1 T  Added tangerine for energy and diet balance |
|  | **Current Diet** | **Recommended Diet** | **Goals** |
| Energy | 1,629 kcal | 2,091 kcal | 2,226 kcal |
| Protein | 67.1 g | 79 g | 76 g |
| Sodium | 4,045 mg | 2,646 mg | 2,000 mg |
| Potassium | 2,653 mg | 2,100 mg | 2,000 mg |
| Phosphorus | 1,032 mg | 1,298 mg | 1,000 mg |
| Water | 860 mL | 1,261 mL | 1,300 mL |

39. Using the renal exchange list, plan a 1-day diet that complies with your diet order. Provide a nutrient analysis to assure consistency with all components of the prescription.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Energy**  **(kcal)** | **Fat**  **(%)** | **Protein**  **(g)** | **Na**  **(mg)** | **P**  **(mg)** | **K**  **(mg)** | **Water**  **(mL)** |
| Breakfast:  Corn flakes, 1 oz  Milk 1% 4 fl oz  White bread, 1 slice  Margarine, whipped, 2 tsp  Tangerine, 1 med  Water, 2 fl oz  Meal total | 102  51  67  45  47  0  312 | 1.4  20.3  10.8  99.4  0.3  0  21.1 | 1.9  4.1  1.9  0  0.7  0  8.6 | 205  54  170  2  2  2  8.6 | 10  116  25  0  18  0  169 | 11  183  25  1  146  0  378 | 166  110  9  1  75  59  255 |
| Snack:  Bagel, white 1 small  Raspberries, ½ cup  Light cream cheese, 1 T  Water, 2 fl oz  Meal total | 177  16  35  0  228 | 5.7  10.5  67  0  15.3 | 6.9  0.4  1.6  0  8.9 | 309  0  44  2  356 | 60  9  22  0  91 | 52  46  25  0  123 | 25  26  10  59  120 |
| Lunch:  Rotini, 2 oz  Olive oil, 1 T  Chicken breast, 2 oz  Broccoli, cauliflower, carrots with olive oil, 1 cup  Plum, 1 med  Water, 2 fl oz  Meal total | 246  119  98  64  30  0  558 | 4.9  100  23.5  64.7  5.1  0  35.4 | 9.0  0  17.5  2.2  0.5  0  29.2 | 2  0  44  19  0  2  66 | 90  0  122  35  11  0  259 | 69  0  140  143  104  0  456 | 97  0  37  91  58  59  341 |
| Snack:  Popcorn, unsalted 1 oz  Margarine  Water  Meal total | 146  67  0  214 | 56.1  99.4  0  69.8 | 2.4  0  0  2.4 | 1  3  2  6 | 66  0  0  66 | 61  2  0  61 | 1  2  59  61 |
| Dinner:  Salmon, 3 oz  Rice, white, 1 cup  Margarine, whipped, 1 T  Green beans, canola oil, 1 cup  Roll, white, 1 med  Margarine, whipped, 2 tsp  Water, 2 fl oz  Meal total | 134  205  67  78  112  45  0  641 | 36.1  1.8  99.4  54  18.8  99.4  0  35.3 | 20.1  4.3  0.1  2.0  3.9  0  0  30.3 | 56  2  0  1  193  2  2  259 | 230  68  0  39  44  0  0  382 | 471  55  2  215  50  1  0  794 | 58  108  2  123  10  1  59  362 |
| Snack:  Angel food cake, 1/10  Blueberries, ½ cup  Water, 2 fl oz  Meal total | 169  42  0  211 | 0.7  4,8  0  1.6 | 4.2  0.5  0  4.8 | 447  1  2  450 | 12  9  0  21 | 123  57  0  180 | 30  62  59  151 |
| Day total | 2,164 | 31.3 | 84.1 | 1,867 | 989 | 1,993 | 1,291 |
| Dietary goals | 2,226 | 30.0 | 76.3 | 2,000 | 1,000 | 2,000 | 1,300 |

40. write an initial medical record note for your consultation with Mrs. Joaquin.

Assessment

Mrs. Joaquin is a 24 year old obese Pima Indian female (60”, 170 lbs, BMI 33). Her BWef is 165 lbs and her aBWef was calculated as 140 lbs. she was diagnosed with type 2 diabetes mellitus at age 13 and with stage 3 chronic kidney disease two years ago. Her kidney function has progressively declined and she was admitted to the hospital for preparation for kidney replacement therapy. She has elevated serum phosphorus, potassium, creatinine, and low GFR, which places her at stage 4 CKD. She reported a usual dietary intake high in potassium, phosphorus, sodium, and energy. Due to anorexia, nausea, and vomiting, her recent intake has been poor.

Diagnosis

1. Altered nutrition-related laboratory values including elevated serum potassium (NC-2.2) as related to dietary choices high in potassium as evidenced by serum potassium of 5.8 mEq/L and self-reported potassium intake of 4.3 g.

2. Excessive sodium intake (NI-55.2) as related to fluid retention and usual intake of foods high in sodium as evidenced by reported intake of 3.3 g of Na⁺ and 3+ pitting edema to the knees.

Intervention

Establish the following goals with the client:

Goal 1: lower serum potassium to normal range of 3.5-5.5 mEq/L.

* Modify distribution, type, or amount of food and nutrients within meals or at specified time (ND-1.2)
  + Limit dietary potassium to 2 g/day
* Deliver initial nutrition education on priority modifications (E-1.2)
  + Educate on health implications of consuming excess potassium
  + Educate on foods high and low in potassium
  + Provide sample meal plan to help aid in adherence to dietary goals
* Conduct nutrition counseling on strategies for self-monitoring (C-2.3)
  + Track dietary intake including potassium

Goal 2: reduce fluid retention gains to acceptable range (2-5% body weight) per dialysis treatment

* Modify distribution, type, or amount of food and nutrients within meals or at specified time (ND-1.2)
  + Limit dietary sodium to 2 g/day
* Deliver initial nutrition education on priority modifications (E-1.2)
  + Educate on health implications of consuming excess sodium and fluid intake
  + Educate on foods high and low in sodium and fluids
  + Provide sample meal plan to help aid in adherence to dietary goals
* Conduct nutrition counseling on strategies for self-monitoring (c-2.3)
  + Track dietary intake including sodium and fluids

Monitoring and Evaluation

Behavior regarding self-reported adherence (BE-2.4.1) to dietary requirements

Behavior regarding self-monitoring ability (BE-2.8.1) related to recording foods and beverages

Mineral intake including potassium and sodium (FI-6.2)

Oral fluid amounts (FI-2.1.1)

Electrolyte and renal profile including potassium (S-2.2.7) and sodium (S-2.2.5)