

## The Case of Carlos Mendes: Complications Grid Answer Key

For additional information, see noted modules and slides from the *CKD Nutrition Management Training Program*, available at <http://nkdep.nih.gov/identify-manage/ckd-nutrition/training-modules.shtml>.

Issue	Kidney function / kidney disease	Diet	Medications
<p><b>eGFR is decreasing.</b></p> <p><i>For additional information, see module 1 slides 65, 71, 75, 93.</i></p>	<p>Estimated glomerular filtration rate (eGFR) is used to assess and monitor kidney function. His eGFR is declining; this may indicate progression.</p>	<p>Sodium restriction is key to blood pressure control in chronic kidney disease (CKD).</p>	<p>Medications to control blood pressure, diabetes, lipids, and complications may slow eGFR decline over the long term.</p>
<p><b>UACR is elevated but decreasing.</b></p> <p><i>For additional information, see module 1 slides 79, 84, 89, 94 and module 2 slides 34, 37.</i></p>	<p>An elevated UACR marks kidney damage.</p>	<p>Weight loss, sodium restriction, adequate protein may lower UACR.</p>	<p>He takes enalapril to control blood pressure and to lower urine albumin excretion.</p>
<p><b>Blood urea nitrogen is increasing.</b></p> <p><i>For additional information, see module 4 slide 33.</i></p>	<p>An eGFR of 22 is evidence of reduced kidney function which may result in reduced urinary excretion of nitrogenous waste products.</p>	<p>He reports eating foods with protein, including refried beans and beef.</p>	<p>Medications do not control BUN levels.</p>

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<p><b>Serum potassium is elevated.</b></p> <p><i>For additional information, see module 1 slides 34-38; module 2 slides 80, 81; module 3 slides 47-53; and module 5 slides 38, 44, 49, 53, 67.</i></p>	<p>An eGFR of 22 is evidence of reduced kidney function which may result in reduced urinary excretion of potassium. His serum bicarbonate level is low and this may drive potassium out of the cells and into the extracellular compartment.</p>	<p>He is drinking more orange juice to treat hypoglycemia and has potassium-rich foods such as refried beans and coffee.</p> <p>Potassium restriction is indicated.</p>	<p>He takes enalapril which lowers potassium excretion; he will start furosemide which increases potassium excretion. Treating acidemia may reduce potassium; his bicarbonate level is low. Treating hyperglycemia with insulin may lower potassium, he is not hyperglycemic.</p>
<p><b>Serum bicarbonate is low.</b></p> <p><i>For additional information, see module 3 slides 76, 79-82, 87.</i></p>	<p>Reduced bicarbonate synthesis by the kidneys and reduced urinary excretion of hydrogen ion (acid) may lead to lower serum bicarbonate levels in CKD.</p>	<p>He reports he still eats meat which is a source of metabolic acid. Reducing dietary protein may increase serum bicarbonate levels.</p>	<p>If level remains low, the physician may prescribe supplemental base such as sodium bicarbonate.</p>
<p><b>Serum calcium is low.</b> Corrected calcium = serum calcium + [0.8 (4.0 – serum albumin)] <i>Corrected Ca = 9.6</i></p> <p><i>For additional information, see module 3 slides 87, 88, 97, 101, 102, 110, 114.</i></p>	<p>Abnormal metabolism of calcium may develop in CKD due to inadequate activation of vitamin D by the kidneys. This may result in reduced calcium absorption and hypocalcemia. Parathyroid hormone controls serum calcium; levels may be impacted in CKD.</p>	<p>Intake is low, and calcium-rich foods do not control serum calcium</p>	<p>Use of supplemental Vitamin D with calcium-based phosphate binders may increase serum calcium in CKD.</p>

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<p><b>Serum phosphorus is within range.</b></p> <p><i>For additional information, see module 3 slides 87, 98, 100, 101, 105-107, 110, 114.</i></p>	<p>Abnormal metabolism of phosphorus may develop in CKD due to a variety of factors. Fibroblastic growth factor-23 controls serum levels. Parathyroid hormone increases urinary phosphorus excretion; as a result serum phosphorus levels may be within range until eGFR is very low.</p>	<p>He eats refried beans, meat and drinks colas. Absorption of phosphorus varies by dietary source. Phytates reduces absorption, not all is absorbed from animal proteins, and food additives are absorbed more readily.</p>	<p>Phosphate-binding medications may be prescribed, and may include calcium supplements. Vitamin D supplements increase risk of hyperphosphatemia, as vitamin D enhances both calcium and phosphorus absorption.</p>
<p><b>Serum albumin is low.</b></p> <p><i>For additional information, see module 3 slides 64, 67, 68, 84.</i></p>	<p>Albumin is normally reabsorbed within the tubules. His urine-albumin-to-creatinine ratio is elevated indicating kidney damage and some loss of albumin into the urine.</p>	<p>He reports he still eats protein-rich foods and had more calories from orange juice and regular pop.</p>	<p>Angiotensin converting enzyme inhibitors or angiotensin receptor blockers used to reduce urine albumin may impact serum albumin levels to some degree. Treating metabolic acidosis (evidenced by low serum bicarbonate) with supplemental base may increase albumin. Treating infections may reduce inflammation and improve albumin.</p>
<p><b>LDL cholesterol is elevated.</b></p> <p><i>For additional information, see module 2 slides 107, 109, 111, 116, 117.</i></p>	<p>Reduced kidney function may contribute to accumulation of pro-inflammatory cytokines and increased inflammation. LDL particles may be smaller and denser, and more prone to oxidation and accumulation in vessel walls.</p>	<p>He eats fast foods and foods fried in lard. His intake includes foods with soluble fiber that contain potassium.</p>	<p>He takes lovastatin to control LDL cholesterol.</p>

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<p><b>25(OH) vitamin D was low and is increasing.</b></p> <p><i>For additional information, see module 3 slides 94-96 101, 114.</i></p>	<p>The kidneys produce the 1-alpha hydroxylase enzyme that changes 25 hydroxy vitamin D to 1,25 dihydroxy vitamin D, the active form. Inadequate levels of vitamin D and reduced kidney function may result in abnormal mineral metabolism and bone disease in CKD.</p>	<p>His diet as recalled does not contain significant amounts of vitamin D.</p>	<p>He takes a vitamin D supplement which may increase calcium and phosphorus absorption; his serum levels are increasing.</p>
<p><b>Parathyroid hormone (PTH) level is within range.</b></p> <p><i>For additional information, see module 3 slides 97-99, 101.</i></p>	<p>PTH increases calcium reabsorption and increases phosphorus excretion in the kidney.</p>	<p>There are no dietary sources. Hypocalcemia may stimulate secretion.</p>	<p>Vitamin D supplements may reduce PTH levels in CKD.</p>
<p><b>A1C decreased from 11.4 to 6.6, and more frequent hypoglycemia.</b></p> <p><i>For additional information, see module 2 slides 64-67, 78-81.</i></p>	<p>The kidneys metabolize insulin and many medications. Hypoglycemia may warrant a change in diabetes medications.</p>	<p>He has increased intake of carbohydrates, including orange juice and regular colas to treat and prevent hypoglycemia.</p>	<p>Glipizide XL, a medication that stimulates insulin secretion, has been discontinued to prevent hypoglycemia. An improvement in diabetes control without a change in therapy may indicate CKD progression.</p>

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<p><b>Hemoglobin level is lower than normal for a man.</b></p> <p><i>For additional information, see module 3 slides 14, 15, 22, 26-34.</i></p>	<p>The kidneys produce erythropoietin needed for red blood cell synthesis. Anemia may develop earlier in people with diabetes. Hepcidin, the hormone that regulates iron absorption, may accumulate in CKD and reduce iron absorption.</p>	<p>He reports he is still eating meat. He is not taking supplemental iron.</p>	<p>Oral iron supplements may be prescribed. Parenteral iron is used infrequently due to potential damage to kidney tubules. An injectable erythropoiesis-stimulating agent may be used; people must be advised of adverse risks associated with its use - stroke, hypertension and loss of vascular access.</p>



For more information, visit [www.nkdep.nih.gov/nutrition](http://www.nkdep.nih.gov/nutrition) or call 1-866-4 KIDNEY (1-866-454-3639).

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