EXAMPLE OF A MEDICAL KNOWLEDGE EXAMINATION QUESTION

Please select the best answer for the following clinical question:

A 68-year-old female who has known diabetes type II presents to the emergency department for evaluation due to fatigue. She takes metformin and another pill for diabetes that she cannot recall the name of. She also has a history of hypertension which is managed with a thiazide diuretic and hypothyroidism which is managed with oral thyroid replacement therapy. On examination, she appears tired with stable vital signs other than a respiratory rate of 24. Lungs are clear and there is an S4 gallop heard. The abdomen is nontender and there is +1 pedal edema. Laboratory results include +3 urine ketones and the following venous blood results: creatinine 1.4, sodium 142, random blood glucose 170, and CO2 9. An arterial blood gas reveals pH 7.22, pCO2 20, bicarbonate 12, and normal oxygenation. Which is the most likely acid-base condition that is present?

A. **Primary respiratory acidosis due to hyperventilation.**
B. **Primary respiratory acidosis with a partial compensatory metabolic mechanism.**
C. **Primary metabolic acidosis with partial respiratory compensation.**
D. **Primary metabolic acidosis due to inadequate bicarbonate intake or excess excretion of bicarbonate.**

Answer Key:

The correct answer is C.

This patient likely has diabetic ketoacidosis due to poor insulin production. We know that the acid-base condition is a primary acidosis because the pH is below normal. The primary condition (acidosis or alkalosis) almost always matches the arterial pH, which in this case is acidotic. This is a metabolic acidosis based on the metabolic values (venous CO2 and arterial bicarbonate) which are in the acidotic range, along with the finding that the overall arterial pH is acidotic. This is not a respiratory acidosis, because the respiratory status is trying to partially offset the metabolic acidosis; the low arterial pCO2 due to the patient's hyperventilation tell us that the patient is "blowing off" carbon dioxide (to try to raise the pH) in an attempt to compensate for the metabolic acidosis.

Choice A is incorrect because this is not respiratory acidosis. Hyperventilation results in the lowering of arterial pCO2, which creates respiratory alkalosis rather than acidosis.

Choice B is incorrect as explained above for choice A. Also, choice B is incorrect because there is no compensatory metabolic alkalosis. If there were a primary respiratory acidosis (which there is not), the metabolic compensatory mechanism would be alkalotic; however, the metabolic values (the venous CO2 and arterial bicarbonate) are acidotic so they are not compensating for overall acidosis.

Choice D is incorrect because there is nothing in the patient medical history that indicates poor bicarbonate intake nor an underlying condition that would result in bicarbonate wasting (excess loss).