Mr. Lester, a 57-year old man, presents as a new patient to your office. He is here for a routine check-up. Upon asking about his medical history, he tells you he was diagnosed with type 1 diabetes at the age of 14 and has kept it in control for most of his life. He had a myocardial infarction 2 years ago, for which he has been taking aspirin daily every since. He does not drink alcohol, smoke or use any illicit drugs. He is retired and lives at home with his wife. Two weeks later, Mr. Lester was admitted to the local hospital for pneumonia. Upon admission, he was suffering from nausea, vomiting, and lethargy, in addition to his pneumonia symptoms. Mr. Lester's physical exam and laboratory tests revealed the following:

- pH, 7.21
- [HCO3-], 10 mEq/L
- [Na], 125 mEq/L
- [Cl], 90 mEq/L
- Glucose, 400 mg/dL
- Urine, glucose and ketones present

Based on the information provided, which of these findings is most likely to be found in this patient?

- a) hypertension
- b) hyperventilation
- c) mid-systolic click
- d) decreased anion gap
## Learning Objectives

**The listener should be able to:**

1. Describe the mechanism of metabolic disturbance based on clinical history and lab values.
2. Explain the physiological processes that accompany metabolic disturbances.
3. Predict clinical findings in a patient based on medical history and lab values.

## Key Teaching Points

- Correct answer: b) hyperventilation
- Based solely on the information given, the most likely conclusion is that the patient will present with hyperventilation as a compensatory response to his metabolic acidosis. The metabolic acidosis was created from his state of diabetic ketoacidosis. Prior to being hospitalized with pneumonia, it is most likely Mr. Lester's diabetes was not controlled due to his illness. As a result, he became hyperglycemic and eventually ketotic. The ketones in his blood were buffered by HCO3, decreasing his plasma concentration of HCO3, and leading to a metabolic acidosis. He would not be hypertensive because the excess glucose in his blood would cause an osmotic diuresis, leading to hypovolemia and hypotension. This is why patients with metabolic acidosis, due to diabetic ketoacidosis, are treated with fluid replacement in addition to insulin. There is no evidence that a mid-systolic click would result from his condition. Mr. Lester's anion gap would actually be increased. Anion gap = [Na] - ([Cl] + [HCO3]), with the normal range being 8 - 16 mEq/L. His anion gap is 25 mEq/L.

## Comments

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## Keywords

Geriatrics, USMLE step exam, metabolic disturbance, diabetes, hyperventilation

## References
