Extreme Hypernatremia with Markedly Increased Anion Gap

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CASE DESCRIPTION
During a routine visit for nail care and diabetic neuropathy evaluation, laboratory tests were ordered for a 64-year-old man with a history of diabetes mellitus and hypertension. At the time, he had no symptoms of any acute problem. A serum separator tube was received and revealed sodium 162 mmol/L, potassium 3.8 mmol/L, chloride 88 mmol/L, CO₂ 20 mmol/L, and anion gap 54 mmol/L with normal blood urea nitrogen (BUN), creatinine, and glucose.

QUESTIONS
1. What are the most common causes of hypernatremia and high anion gap?
2. Are the laboratory results physiologically plausible in an asymptomatic patient?
3. What types of conditions or situations could cause such a result?

The answers are below.

ANSWERS
Hyponatremia is most commonly caused by dehydration, here ruled out by normal BUN and creatinine. Sodium > 160 mmol/L without dehydration may be due to sodium citrate anticoagulant, which also causes disproportionately low chloride, markedly increased anion gap, and negative osmolar gap (1). Citrate also causes normal prothrombin time, which would not be expected in serum, and low calcium. Further testing revealed calcium 5.6 mg/dL and normal prothrombin time (international normalized ratio 1.0). Repeat basic metabolic profile testing the same evening had all normal results. The source of the citrate contamination was not determined.

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