

**CASE A—POSSIBLE TOXIN INGESTION**

A 43 year old white male with a history of depression and alcohol abuse was found lethargic on the floor of his room by his family. He was brought to the emergency room, where he was found to be confused; he became comatose over the next hour. Laboratory results in the emergency room included Glucose 115 mg/dL, BUN 9 mg/dL, Na 145 mmol/L, K 4.2 mmol/L, Cl 112 mmol/L, and CO<sub>2</sub> 7 mmol/L. Serum osmolality was 383 mosm/kg. Blood ethanol was negative. Arterial blood gas analysis: pH 7.12, pCO<sub>2</sub> 34 mm Hg. A serum for volatiles was negative, as was a urine Toxi-Lab screen. Calculate serum osmolality and osmotic gap. What is the significance of the serum osmolality in view of the negative screen for serum volatiles, negative blood ethanol, and negative urine Toxi-Lab?

**Discussion**

Initial laboratory results indicate the presence of an anion gap of 26 mmol/L, and an osmotic gap of over 80, not explained by ethanol. The differential diagnosis of such a case is relatively limited, and the clinical picture of intoxication progressing to coma limits the differential even further, suggesting the possibility of ingestion of an alcohol or glycol. Volatile screens, performed by head space gas chromatography of blood, measure precisely what their name implies: volatile compounds. This includes ketones and alcohols, but typically will not detect the minimally volatile glycols. Similarly, Toxi-Lab screens for the presence of substances extractable with non-polar solvents; highly polar compounds, such as alcohols, glycols, and opiate glucuronides are not detected by this method in most cases. It is vital for the laboratory to be provided with all information about suspected toxins, since even a complete "screen" using head space chromatography and GC-mass spectrometry of plasma and urine extracts will miss certain compounds such as heavy metals and glycols. In this case, the prompt determination of osmolality led to the suspicion of poisoning with ethylene or propylene glycol or methanol, even before the results of the volatile or Toxi-Lab screens had been reported.

A few ancillary tests which are often available in most laboratories can help to narrow this differential diagnosis further. Propylene glycol toxicity most commonly occurs in hospitalized patients with renal insufficiency, since the chemical is used as a solvent for many drugs and is normally excreted in the urine. Occasional cases of poisoning occur from exposure in food or from unknown sources. Lactate is the major metabolite of propylene glycol, and will be markedly increased in cases of

poisoning. Ethylene glycol is found in antifreeze, and is usually taken as an intentional overdose; however, sometimes it contaminates illicit "moonshine" liquor. It is metabolized to glycoxalate and oxalate. Urine was requested for examination for calcium oxalate crystals. A moderate number of calcium oxalate monohydrate crystals were present; these ovoid crystals, as compared with the more typical square "envelope" calcium oxalate dihydrate crystals, are quite characteristic of ethylene glycol intoxication. A specimen was obtained for ethylene glycol assay, and the patient was begun on an ethanol drip, bicarbonate was administered, and dialysis was begun (the standard treatment for poisoning with any of these compounds). About four hours later, the patient regained consciousness and confirmed that he had ingested Prestone antifreeze in an attempt to get drunk, since the family had taken all of the alcohol out of the house before his visit. About three hours later, the result of the ethylene glycol level was available; the concentration was 500 mg/dL, well above the potentially fatal level. Dialysis was continued over the next 12 hours, until his osmotic gap fell to zero.

In this case, osmolality both assisted in the diagnosis and provided a guide to management of this patient. Prompt suspicion of the diagnosis led to appropriate treatment; the patient recovered completely, never developing any evidence of renal, pulmonary, or cardiac damage, and he was discharged three days later. Because osmolality is available rapidly, it is the quickest and best screening test available for ingestion of these possibly deadly poisons.