Ethanol/Ethylene Glycol Interaction on aca

To the Editor:

Administration of ethanol is a principal mode of treatment for ethylene glycol poisoning (1,2). Adequate concentrations of ethanol in the blood inhibit the metabolism by alcohol dehydrogenase (EC 1.1.1.1) of ethylene glycol to toxic aldehydes and acids. In this setting, “therapeutic drug monitoring” requires accurate measurements of blood ethanol. The target value of ethanol, approximately 1.0 g/L, can be achieved by a rapid intravenous infusion of ethanol and then maintained by a continued infusion. The saturation (zero-order) kinetics of ethanol elimination require frequent monitoring to ensure therapeutic concentrations without toxicity. The extent to which ethylene glycol interferes in the ethanol assay must therefore be assessed.

The Du Pont aca, widely used for ethanol measurements, involves use of alcohol dehydrogenase and thus has a potential interference from ethylene glycol. Data provided by Du Pont indicated that each 100 mg of ethylene glycol produced an apparent ethanol of 2-5 mg by this method. This small positive interference is of little consequence at even very high concentrations of ethylene glycol in plasma (1.0-2.0 g/L) at therapeutic concentrations of ethanol (1.0 g/L). A more important question is whether ethylene glycol can inhibit the oxidation of ethanol in the assay and produce spuriously low measured concentrations of ethanol.

To study this, we prepared a solution that contained, per liter, 1.5 g of ethanol and 1.65 g of ethylene glycol. The aca result for ethanol for this solution was 1.61 g/L. This result was close to the predicted value of 1.58 g/L calculated from the concentration of added ethanol and the predicted positive interference from ethylene glycol.

We have used the aca to monitor ethanol therapy of a patient undergoing treatment for acute exposure to ethylene glycol; the results were within 5% of results by gas chromatography, when the plasma concentrations of ethylene glycol were as high as 1.10 g/L.

Since this patient was monitored, however, Du Pont has modified the aca ethanol procedure by decreasing the amount of enzyme involved from 600 to 85 U. We have therefore re-evaluated the aca procedure by preparing more solutions of ethanol and various concentrations of ethylene glycol (up to 2.75 g/L) and assaying in triplicate. The measured ethanol increased linearly with increasing ethylene glycol concentrations. Least-squares analysis demonstrated that each 1.00 g/L increment of ethylene glycol produced an apparent increase in the ethanol of 9 mg/L. Thus the interference of ethylene glycol in the newer aca ethanol packs poses no serious problems and appears to be less than in the previous packs.

These findings suggest that the aca method for ethanol can be used for therapeutic drug monitoring in patients poisoned with ethylene glycol.

References


David E. Bruns
David A. Herold
M. Geraldine Savory
James R. Shipe, Jr.
Daniel A. Spyker

Clin. Lab., Dept. of Pathol. Univ. of Va. Med. Center Box 168 Charlottesville, VA 22908