Glyoxylic Acid in Ethylene Glycol Poisoning

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Sir,

Hemodialysis and hemoperfusion

Glyoxylic acid (GA) is a metabolic intermediate of ethylene glycol which is implicated in a number of biochemical reactions by virtue of its aldehyde group and, together with glycolaldehyde, glyoxal and glycolic acid, is held to contribute significantly to mortality in ethylene glycol poisoning [1]. However, even if the toxic effects of aldehydes are well known, there is a surprising lack of information on the actual magnitude of their accumulation in body fluids after ethylene glycol poisoning and on the effectiveness of their removal by dialytic treatment.

Recently a 36-year-old man was referred to us for ingestion of 500 ml of a window cleaner containing 12.5% ethylene glycol and 200 ml raw alcohol containing 95% ethanol, 4.4% methanol and 0.5% pyridine. Curiously, in his suicidal attempt, the patient had ingested both ethylene glycol and its antidote, ethanol, which is known to compete for metabolic pathways with ethylene glycol. 8 h after the ingestion the patient was admitted to another hospital where treatment was started with gastric lavage and intravenous fluids. 24 h after the ingestion the patient remained lethargic and was sent to our hospital. On admission blood pressure was 100/65 mm Hg; pulse 104; hematocrit 33%; hemoglobin 11.3 g%; urine examination showed microscopic hematuria and proteinuria (0.5 g/l); creatininewas 115 µmol/l; urea 10.7 mmol/l; glucose 10.4 mmol/l; Na+ 135; K+ 3.3; Cl 96 mEq/l; HC03 22.8 mmol/l; anion gap 16; Ca 5.1 mg%; pO2 82 mm Hg; pH 7.406; pCO2 36.7 mm Hg. A single session of hemodi-alysis (parallel plate dialyzer; cuprofan membrane 10 µm, surface area 1.1 m2) with simultaneous hemoperfusion over microincapsulated charcoal was performed.
100 min 20 h

Fig. 1. Effect of hemodialysis and hemoperfusion on whole blood glyoxylic acid levels.

GA was determined in whole blood by high performance liquid chromatography, following the procedure of Hemming and Gubler [2] as modified in our laboratory. Notwithstanding the amount of ethanol ingested was theoretically more than sufficient to achieve effective enzymatic blockade of ethylene glycol [3], basal levels of GA were 62.9 µmol/l (fig. 1), a value greatly exceeding both the levels reported in normal subjects in plasma (1 ± 1.5 µmol/l) [4] and those found in our laboratory in whole blood in healthy volunteers (3.1 ± 2.0 µmol/l). GA levels decreased only slightly after 1 h and more markedly (-81%) after 3 h of hemodialysis/hemoperfusion (fig. 1). This decrease was accompanied by a strong improvement in the patient’s mentation. Mean GA dialysance was 71 ml/min, a value lower than that reported for urea and creatinine, which have comparable molecular weights. GA dialysance was 44, 40 and 61% only with respect to the

dialysance of creatinine at 15, 60 and 180 min, respectively. These data suggest that GA binds to proteins. It is conceivable that the removal of metabolic precursors of GA, such as ethylene glycol and glycolaldehyde can also account for the decrement in GA levels observed at the end of treatment. It is interesting that a considerable production of this metabolite persisted after dialysis, given the fact that 20 h after the end of treatment, a new rise in GA levels was observed (fig. 1). However, the patient continued to show improvement without further dialysis and progressively regained normal mental status and neurologic function. He was discharged on the 15th hospital day.

Taken together these data indicate that after ethylene glycol poisoning high levels of GA are found, even if ingested together with large amounts of ethanol. Hemodialysis and hemoperfusion are important therapeutic procedures in order to remove GA from blood and to decrease the production of this aldehyde.

References


