“The primary objective of this study was to compare the efficacy of IO delivery of hydroxocobalamin to intravenous (IV) injection for the management of acute cyanide toxicity in a well-described porcine model.” Bebarta et al (2014).

Reference:


Intraosseous versus intravenous infusion for the treatment of cyanide toxicity
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Abstract:

OBJECTIVES: Easily administrated cyanide antidotes are needed for first responders, military troops, and emergency department staff after cyanide exposure in mass casualty incidents or due to smoke inhalation during fires involving many victims. Hydroxocobalamin has proven to be an effective antidote, but cannot be given intramuscularly because the volume of diluent needed is too large. Thus, intraosseous (IO) infusion may be an alternative, as it is simple and has been recommended for the administration of other resuscitation drugs. The primary objective of this study was to compare the efficacy of IO delivery of hydroxocobalamin to intravenous (IV) injection for the management of acute cyanide toxicity in a well-described porcine model.

METHODS: Twenty-four swine (45 to 55 kg) were anesthetized, intubated, and instrumented with continuous mean arterial pressure (MAP) and cardiac output monitoring. Cyanide was continuously infused until severe hypotension (50% of baseline MAP), followed by IO or IV hydroxocobalamin treatment. Animals were randomly assigned to receive IV (150 mg/kg) or IO (150 mg/kg) hydroxocobalamin and monitored for 60 minutes after start of antidotal infusion. The primary outcome measure was the change in MAP after antidotal treatment from onset of hypotension (time zero) to 60 minutes. A sample size of 12 animals per group was determined by group size analysis based on power of 80% to detect a one standard
deviation of the mean MAP between the groups with an alpha of 0.05. Whole blood cyanide, lactate, pH, nitrotyrosine (nitric oxide marker) levels, cerebral and renal near infrared spectrometry (NIRS) oxygenation, and inflammatory markers were also measured. Repeated-measures analysis of variance was used to determine statistically significant changes between groups over time.

RESULTS: At baseline and at the point of hypotension, physiologic parameters were similar between groups. At the conclusion of the study, 10 out of 12 animals in the IV group and 10 out of 12 in IO group survived (p = 1.0). Both groups demonstrated a similar return to baseline MAP (p = 0.997). Cardiac output, oxygen saturation, and systemic vascular resistance were also found to be similar between groups (p > 0.4), and no difference was detected between bicarbonate, pH, and lactate levels (p > 0.8). Cyanide levels were undetectable after the hydroxocobalamin infusion throughout the study in both groups (p = 1.0). Cerebral and renal NIRS oxygenation decreased in parallel to MAP during cyanide infusion and increased after antidote infusion in both groups. Serum nitrotyrosine increased during cyanide infusion in all animals and then decreased in both study arms after hydroxocobalamin infusion (p > 0.5). Serum cytokines increased starting at cyanide infusion and no difference was detected between groups (tumor necrosis factor-α, interleukin -1β, IL-6, and IL-10).

CONCLUSIONS: The authors found no difference in the efficacy of IV versus IO hydroxocobalamin in the treatment of severe cyanide toxicity in a validated porcine model.

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