**ETHYLENE GLYCOL INTOXICATION**

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**PRESENTING COMPLAINT:** alteration in level of consciousness, nausea, vomiting

**FINDINGS**

- **A** Check airway
- **B** ↑ RR
- **C** ↑ HR, ↓/N BP
- **D** Coma, depressed level of consciousness or seizures might occur
- **E** Nonspecific
- **U<sub>PC</sub>** pulmonary edema
- **L<sub>PC</sub>** CBC, ↓ glucose, ↑ lactate, ↓ calcium, ABG: ↓ pH, ↓ CO<sub>2</sub>, ↓ HCO<sub>3</sub>

* PC: (point-of care)

**OTHER HISTORY**

**Signs & Symptoms:**

Depends on the time of exposure to ethylene glycol:

- During the first 12 hours the patient can present with signs of inebriation related to the parent alcohol
- As the parent alcohol is metabolized (12-36 hr) with generation of organic acids, symptoms are characterized by tachycardia, hyperventilation, and muscle spasm
- Calcium oxalate precipitation in the renal tubules (24-48 hr) results in acute kidney injury, and oliguria/anuria
- Delayed neurologic findings (> 1 week after ingestion) include elevated ICP, papilledema, and abducens (CN VI) palsy.
History

- Time from exposure and amount of poisoning are important
- A toxic dose requiring medical treatment varies but is considered more than 0.1 mL per kg body weight (mL/kg) of pure substance. That is roughly 16 mL of 50% ethylene glycol for an 80 kg adult and 4 mL for a 20 kg child
- Poison control centers often use more than a lick or taste in a child or more than a mouthful in an adult as a dose requiring hospital assessment
- The orally lethal dose in humans has been reported as approximately 1.4 mL/kg of pure ethylene glycol. That is approximately 224 mL (7.6 oz.) of 50% ethylene glycol for an 80 kg adult and 56 mL (2 oz.) for a 20 kg child.

Predisposing Conditions:

- Exposure can be through ingestion inhalation, or dermal penetration from automotive antifreeze and de-icing solutions, windshield wiper fluid, solvents, cleaners, and fuels.

DIFFERENTIAL DIAGNOSIS

- Metabolic acidosis
- Methanol intoxication
- Ethanol intoxication

OTHER INVESTIGATIONS

- Labs:
  - Fingerstick glucose to rule out hypoglycemia
  - ABG, electrolyte panel CBC, ethylene glycol level, serum lactate, ketones, serum osmolarity, urinalysis with microscopy for calcium oxalate crystals
  - Calculation of osmolar gap – commonly used surrogate marker but neither sensitive nor specific. A normal osmolar gap cannot exclude ethylene glycol poisoning
Imaging:
  - Chest X-ray for signs of pulmonary edema
  - CT scan for cerebral edema.

THERAPEUTIC INTERVENTIONS

General:
  - Airway protection, consider intubation in patients severely intoxicated.
  - If patient is hypotensive give IV fluids, followed by vasopressors if needed.
  - Ethylene glycol is rapidly absorbed and does not bind to activated charcoal. As a liquid, gastric lavage and whole bowel irrigation have no role in management.

Antidotes:
  - Give fomepizole or ethanol if;
    - Ethylene glycol on serum is >20 mg/dL, or history of ingesting toxic amount of ethylene glycol and serum osmolality gap>10, or strong clinical suspicion of ethylene glycol poisoning and at least 2 of the following:
      - Arterial pH<7.3
      - HCO3<20 mEq/L
      - Osmolar gap >10
      - Oxalate crystals present on urine.
    - Fomepizole 15 mg/kg IV loading dose followed by 10 mg/kg q12hr x 4 doses; at that point, increase dose to 15 mg/kg IV q12hr. Dosing schedule should be increased to Q4hr if patient receiving hemodialysis.
    - If patient is allergic to fomepizole or it is unavailable give ethanol 10 ml/kg of a 10% of ethanol solution, followed by 1 mL/kg of 10% ethanol solution infused per hour. Titrate to serum ethanol concentration of 100 mg/dL.
  - Adjunctive antidotes include thiamine 100 mg IV daily and pyridoxine 100 mg IV daily.
  - Sodium bicarbonate should not be routinely administered and reserved for patients with severe metabolic acidosis, as a temporizing measure prior to hemodialysis.
  - If patient presents with seizures, treat with benzodiazepines.
Contact/Consult:

- American Association of Poison Control at (800)222-1222, 24 hours, 7 days a week
- Nephrology consultation

ONGOING TREATMENT

Follow-Up:

- Monitor serum ethylene glycol
- Monitor lactate, ABG
- Urinalysis for oxalate crystals
- Monitor urine output- Renal function (creatinine)

Manage Complications:

- Hemodialysis:
  - Metabolic acidosis, regardless of drug level
  - Elevated ethylene glycol levels >8.1 mmol/L, unless arterial pH is above 7.3
  - Evidence of end-organ damage (e.g.: renal failure)

CAUTIONS

- Complications:
  - Irreversible severe renal failure
  - Death
REFERENCES & ACKNOWLEDGEMENTS

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