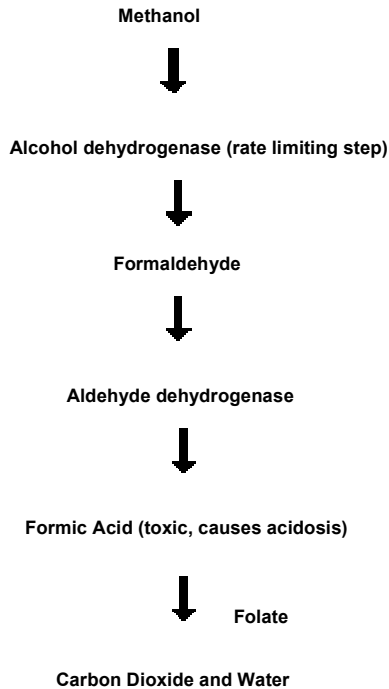


## Methanol

Methanol (CH<sub>3</sub>OH) also referred to as methyl alcohol or wood alcohol is widely used in commercial and industrial settings. Methanol is found as a component of many paint removers, varnishes, shellacs, windshield washing fluid and antifreeze. Methanol is derived as a by-product of wood distillation. Poisoning occurs with consumption of contaminated whiskey, accidental ingestion's, and suicide attempts. Toxicity of methanol is due to the formation of toxic metabolites; formaldehyde and formic acid.

### **Metabolism:**



### **Pathophysiology:**

Methanol is a colorless, volatile liquid with distinct odor. Methanol is absorbed well in the GI tract with peak levels attained in 30-90min. Serum half-life ranges from 14-20 h. Methanol volume of distribution ranges from 0.6-0.7 L/kg. Methanol is primarily eliminated by liver through metabolism but a small percentage (2-5%) is renal excreted. Toxicity comes from the formation of formaldehyde and formic acid through hepatic alcohol dehydrogenases. The onsets of symptoms are associated with the accumulation of formic acid. Formate inhibits mitochondrial respiration leading to tissue hypoxia and lactate formation. Formaldehyde production occurs in the retina and may lead to optic papillitis and retinal edema. Toxicity varies but it is excepted that 30ml of a 40% solution is considered the minimal lethal dose.

### **Clinical Features:**

Initial symptoms may develop anywhere from 40 minutes to 72 hours after ingestion. The usual latent period is 12 to 18 hours. Coingestion with alcohol may delay symptoms. These signs and symptoms include:

- CNS: Headache, vertigo, lethargy, confusion, coma, and seizures. Initial symptoms may resemble ethanol intoxication.
- Ocular: "Looking into a snow field", blurred vision, decreased visual acuity, diplopia, and photophobia.
- GI: Nausea, vomiting, abdominal pain, and pancreatitis.
- Cardiac: Hypotension and bradycardia are late findings and suggest poor prognosis.
- Laboratory: Metabolic acidosis secondary to the production of formic acid, elevated osmolar gap, and elevated anion gap.

### **Treatment:**

Support vital functions. Concerns include a decreased level of consciousness and a need to protect the airway from aspiration. GI decontamination with charcoal is not effective unless other co-ingestants are involved. Gastric lavage can be used if done immediately after ingestion.

Monitor arterial blood gases and electrolytes. They serve as a guide to the severity of the poisoning, but are a poor screening test. Use sodium bicarbonate to correct the acidosis to a pH of 7.2. The usual dose is 1meq/kg every 1 to 2 hours as needed. Calculate an anion gap and osmolar gap. Obtain a blood methanol level. Levels of methanol > 50mg/dl are associated with severe intoxication.

Fomepizole (4-methylpyrazole) has been FDA approved as the specific antidote for the treatment of methanol toxicity. It works by inhibiting the enzyme alcohol dehydrogenase which is responsible for the conversion of methanol to its toxic metabolites formic acid and formaldehyde. Indications for fomepizole therapy include a history of methanol ingestion with an anion gap acidosis > 20, a suspected methanol ingestion with an osmolar gap > 10, a blood methanol level > 20 mg/dl, a symptomatic patient with history of methanol ingestion or a methanol level that is not readily available and suspect concurrent ethanol ingestion, which may be masking symptoms. The initial IV loading dose is 15mg/kg with a maintenance IV dose of 10mg/kg every 12 hours for four doses. Infusions should be done over 30 minutes

Ethanol therapy may be used in the absence of fomepizole therapy. The initiation criteria is the same as for fomepizole. The objective is to maintain an ethanol level of 100-150mg/dl The oral loading dose is 0.6-0.8 gm/kg. This can be achieved by using 20% to 50% solutions for load per NG tube (2cc/kg of 50% gives 0.8 gm/kg) or use commercial whiskey (40%) (2cc/kg undiluted gives 0.6gm/kg). Then use a maintenance dose such as mixing 95% ethanol 1:1 with water (to avoid gastritis) and giving 0.33cc/kg per hour. An IV loading dose of 0.6-0.8 gm/kg of 10% ethanol in D5W at 10cc/kg via a central line over one hour can be used. The IV maintenance dose is 0.11 gm/kg per hour using 1.6 cc/kg per hour of 10% solution via central line. During dialysis ethanol should be given at 0.24 gm/kg per hour by increasing the above recommendations proportionately. Ethanol levels should be monitored frequently to make sure that they are therapeutic (100-150 mg/dl).

Monitor blood glucose, especially in children. Ethanol can cause hypoglycemia. Adjunct therapy with folate and folic acid can be initialized. This will metabolize any formed formic acid to carbon dioxide and water. Initial dosing is Leucovorin 50mg IV followed by Folate 50mg IM or IV q 4h. Folic acid (Leucovorin) is the active form of folate. Hemodialysis is effective at removing methanol from the blood. Ethanol therapy must be increased proportionately. Indications for hemodialysis include methanol level of 50 mg/dl or greater, retractable metabolic acidosis, visual disturbances or renal failure.

### ***Disposition :***

Patients with serious signs and symptoms associated with methanol intoxication or a history of significant ingestion even in the absence of symptoms should be admitted to an intensive care setting. Fomepizole, ethanol, or dialysis therapy should be continued to serum methanol levels of zero and acidosis has resolved. Suicidal patients should receive psychiatric evaluation prior to discharge.

### **References:**

Tintinalli J: Emergency Medicine, A Comprehensive Study Guide. Fifth Edition. 2000; 13:1105-1108.  
Burns MJ, Gaudins A, Aaron CK, et al: Treatment of methanol poisoning with intravenous 4-methylpyrazole. Ann Emerg Med 30: 829, 1997.  
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If you have any questions regarding exposure to and/or treatment for Methanol, please call the poison center at **1-800-222-1222** ...24 hours a day, 7 days a week.