Ministry of Health and Medical Education

Clinical Guideline for

Treatment of Methanol Poisoning

Substance Abuse Prevention and Treatment Office

Bureau of Psychosocial Health and Addiction

Deputy for Health

Characteristics of Document

Aim	To provide clinical guideline for management and treatment of methanol poisoning mass epidemics for general physicians working in emergency rooms and health managers.
Title	Clinical Guideline for Treatment of Methanol Poisoning
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Publication Date	Summer 2009
Target Audience	General physicians working in emergency rooms, physicians working in toxicology emergency rooms, managers of health sector and substance abuse treatment providers
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Executive Summary

This is an executive summary for "***Clinical Guideline for Treatment of Methanol Poisoning***" that has been produced for use as a quick reference in critical situations. To study in more details, refer to the full guideline on methanol poisoning. To report mass epidemics of methanol poisoning and to get any technical support contact **Bureau of Psychosocial Health and Addiction** Tel. No 021-66707063. For emergency consultation please contact with **Drug and Poison Information Center** Tel. No 021 55422020 or 09646 (24 hours service) or email us at hassanian@sbmu.ac.ir.

- Due to the epidemic of methanol poisoning in different cities of the country, all health professionals should be familiar with principles of diagnosis and treatment of methanol poisoning. On time diagnosis, proper case finding and standard treatment have an essential role to reduce mortality and morbidity of methanol poisoning, particularly blindness and other physical and psychological disabilities.
- The most common cause of methanol poisoning in I R Iran is adulteration of alcoholic drinks.
- Methanol is used as a solvent in printing and copy solutions, adhesives, paints, polishers and stabilizers. It is also used for window cleaners, antifreeze, as a fuel in alcoholic lamp and as an additive in gasoline. Methanol is known as an industrial alcohol and is mixed up with ethanol that is used for medical purposes. The so called standard alcoholic drinks that are sold in black markets in Iran may have methanol. The traditional herbal extracts in the country contain methanol due to cellulose fermentation of the stalks and seeds of the herbs.

Absorption, Distribution and Metabolism

Methanol as an alcohol is rapidly absorbed through gastro-intestinal tract, so the average absorption half - life is 5 minutes and reaches maximum serum concentration within 30 – 60 minutes and well dissolves in body water. Methanol is not toxic by itself, but its metabolites are toxic. Methanol metabolized in different phases mainly in the liver. The initial enzyme in its metabolism is alcohol dehydrogease.

Clinical Manifestations

- Clinical manifestations of poisoning with methanol alone initiate within 0.5 – 4 hours of ingestion and include nausea, vomiting, abdominal pain, confusion, drowsiness and central nervous system suppression. Patients usually do not seek help at this stage.
- After a latent period of 6 – 24 hours that depends on the dose absorbed, decompensate metabolic acidosis occur which induces blurred vision, photophobia, changes in visual field, accommodation disorder, diplopia, blindness and less commonly nistagmus.

- Blurred vision with unaltered consciousness is a strong suspicious for methanol poisoning.
- Co-ingestion of ethanol, delayed methanol poisoning features for more than 24 hours and sometimes up to 72 hours. The clinical pictures that were observed several times in I R Iran.
- Severe metabolic acidosis with anion gap and increased osmolality strongly suggest methanol and or ethylene glycol poisoning. Severity of clinical manifestations and mortality associated well with severity of central nervous system depression and metabolic acidosis, but not with serum methanol concentration.

Important differential diagnosis

An important point in management of toxic alcohols, particularly methanol poisoning, is proper and early diagnosis. Since emergency estimation of serum methanol concentration is not available in most parts of the country, clinical differential diagnosis is very important.

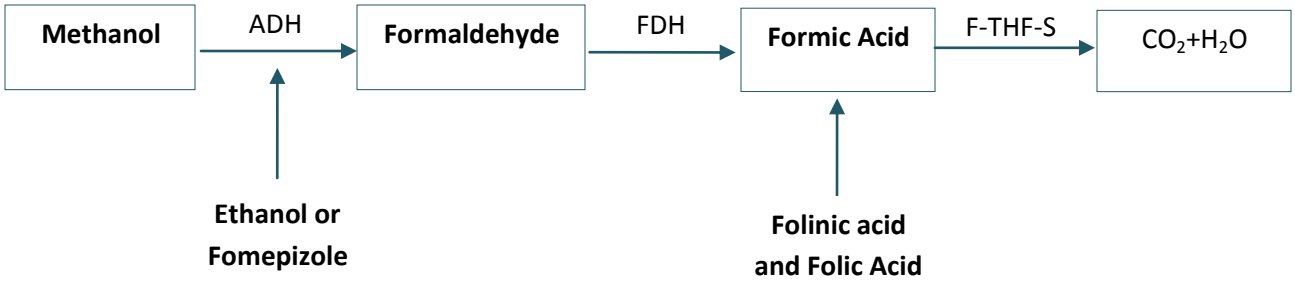
- Time of admission and patient's condition: Ethanol (alcohol in drinks) is rapidly absorbed and clinical features after overdose such as flashing, drunk, central nervous depression and gastrointestinal dysfunction occur within 1-2 hours. In this poisoning, the patient's condition is gradually improved, whereas in toxic alcohols especially methanol, it will be detoriated over the time, even after 24 hours.
- Drunkenness and vasodilatation: In ethanol poisoning, the patient is drunk with flashing, talkative and aggression, whereas in toxic alcohols, no sign of drunk is observed and a state of shock with chill and cold extremities are noted.
- Ophthalmic manifestations: In ethanol intoxication, pupils are usually meiotic and there is no visual defect, whereas in methanol poisoning pupils are mydriatic and there is a retard or no response to light.
- Smell of alcohol: Smell of alcohol is less noted in toxic alcohols than in ethanol intoxication.
- Convulsions and central nervous symptoms: Central nervous symptoms, particularly convulsions are the signs of severity of toxic alcohol intoxications.
- Tachypnea and academia: Acidemia is of good laboratory finding in differential diagnosis of toxic alcohol and the non-toxics. The body respond to acidemia is tachypnea and hyperventilation. However, in ethanol poisoning, mild acidemia may occur, but is usually self limited and is improving with supportive treatment.
- Serum alcohols levels: Estimation of serum alcohol level is probably important in early hours of intoxication, but practically is less important as the time passes (hours after) and even may be confusing. Since the toxic metabolites are responsible for the complications, the time that patient refer to the clinic, methanol concentration may be decreased and the toxic metabolites have been

increased. In addition, improper sampling such as using alcohol as a skin disinfectant may show false increase in alcohol level.

- Blood glucose and electrolytes: There is usually hypoglycemia in ethanol poisoning, and hyperglycemia in methanol intoxication. Hyperkalemia due to acidosis is observed in methanol poisoning, whereas hypokalemia due to vomiting may occur in ethanol intoxication. These findings should be evaluated together with the other manifestations and observations.

Treatment

- In case of methanol intoxication, to find other patients or victims actively and identification of the origin via the patients is very important, which require also inter sectoral co-operations.
- Initial evaluation should be towards the improving of vital signs; airway, respiration and circulations. Thus, management should be focused on correction of metabolic acidosis, coma and eye complications. These could be prevented by inhibition of methanol metabolism.
- In case of metabolic acidosis, sodium bicarbonate in sufficient amount should be administered. Basic antidotes that may be useful in different phases have been shown in below figure.



ADH: alcohol dehydrogenase **FDH**: formaldehyde dehydrogenase **F-THF-S**: 10-formyl tetrahyrofolate synthetase

The table A shows indications for ethanol and fomepizol. In case of hemodialysis, ethanol doses should be increased up to two folds. In table B, algorithm of standard treatment of methanol poisoning is illustrated.

Approach to Methanol Poisoning Epidemics

- By definition, occurrence of more than three cases of methanol poisoning in one area within 24 hours is suggesting of methanol poisoning epidemics. In this case, public awareness of the epidemic should be considered. Experiences of the medical sciences Universities of IR Iran revealed that delayed public information for more than 24 hours leaded to more mortality.
- Rapid diagnosis of methanol poisoning incidence and public information through local media could play an important role in prevention of methanol poisoning morbidities and mortalities. Emergency

physicians should be asked to inform the University patient's referral committee. Co-operation and education of the committee members and all authorities are required.

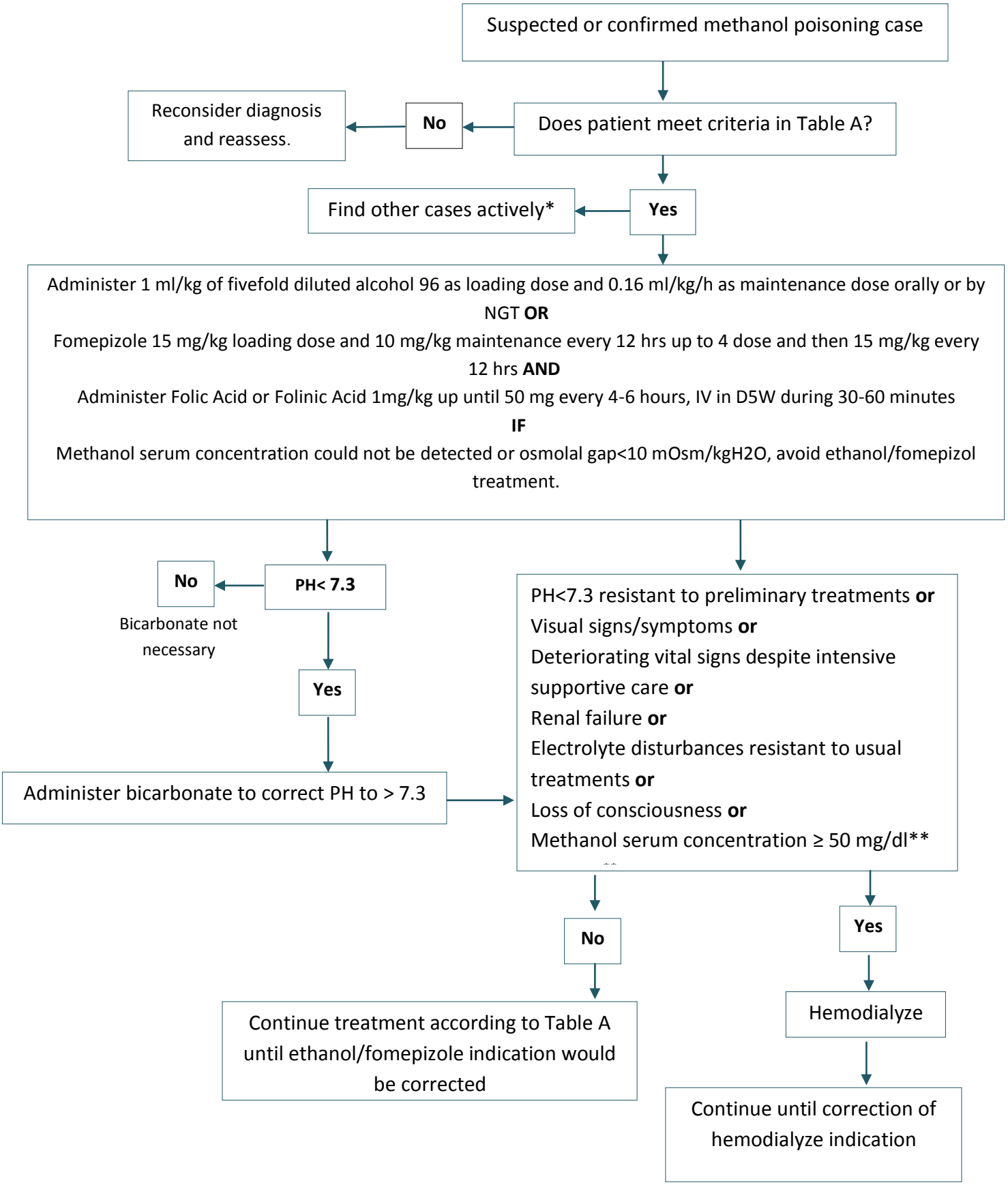
- In order to educate and harmonies the management of methanol poisoning, this executive summary must be distributed in all medical emergency centers and hospital libraries. Also, a day workshop for the health professionals and staff of the emergency centers of all hospitals is recommended.

Table A- **Indications of ethanol and fomepizol for methanol poisoning**

Criteria
Serum methanol concentration of > 20 mg/dL **or**
History of toxic dose of methanol ingestion and osmolal gap >10 mOs/kg H2O **or**
History or high suspicious* of methanol poisoning in case that patient admit within 72 hours of ingestion and had two of following:
A. arterial pH <7.3
B. Serum bicarbonate <20 mEq/L.
C. Osmol gap > 10 mOsm/kgH2O

*The authors of this monograph recommend that in case of methanol poisoning epidemic, in any clinical suspicious, treatment should be initiated.

Table B- **Algorithm of Methanol Poisoning Treatment**



*The aim of case finding is to access at risk patients who did not refer to a hospital. This could be performed via consultation with patient or the relatives confidentially. The patients and their relatives should be educated about the risk of methanol poisoning, and ask them to help in finding new possible patients who might have ingested toxic alcohol. Every suspected or confirmed methanol poisoning case should be reported to the University patients' referral committee.

**Although serum methanol concentration higher than 25 mg/dL in ethanol treated patents is an indication for hemodialysis, the fomepizol treated patients could be delayed for hemodialyze. However, it may prolong hospitalization.

This algorithm is a general guide for treatment. However, it is up to the physician in charge to decide for the treatment based on his/her clinical judgment.