World Health Organization

Information note

Methanol poisoning outbreaks

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Key facts

- Methanol is a widely available chemical with a range of uses including as a solvent, in chemical synthesis and as a fuel.
- Methanol has a relatively low intrinsic toxicity, however, it is metabolised to highly toxic compounds, which can cause blindness, coma and metabolic disturbances that can be life-threatening[1].
- Victims often only seek medical care after a significant delay, mainly because there is a latent period between ingestion and toxic effects. Late medical care contributes to the high level of morbidity and mortality seen in many methanol poisoning outbreaks[2].
- Outbreaks of methanol poisoning occur when methanol is added to illicitly- or informally-produced alcoholic drinks.
- Because patients with methanol poisoning often need intensive medical care, outbreaks of methanol poisoning can rapidly overwhelm medical facilities[3].
- Outbreaks have occurred in all regions in recent years.

Methanol (also known as methyl alcohol, wood alcohol, wood spirits and carbinol), is a widely available chemical. Methanol has many industrial applications and is also found in a number of household products including varnishes, antifreeze, windscreen wash, and fuel for model aircraft. Globally, approximately 225 million litres of methanol is used each day[4].

Outbreaks of methanol poisoning arise from the consumption of adulterated counterfeit or informally-produced spirit drinks. There have been numerous outbreaks in recent years, including in Cambodia, Czech Republic, Ecuador, Estonia, India, Indonesia, Kenya, Libya, Nicaragua, Norway, Pakistan, Turkey and Uganda. The size of these outbreaks has ranged from 20 to over 800 victims, with case fatality rates of over 30% in some instances.

How does methanol come to be in alcoholic drinks?

Trace amounts of methanol are found naturally in fruit juices - this is non-toxic. Methanol is also a product of fermentation and is found in both alcoholic and non-alcoholic fermented drinks. Concentrations of 6-27 mg/L have been measured in beer and 10-220 mg/L in spirits[5]. In these concentrations methanol is not harmful. Problems arise when higher concentrations are formed during incorrectly managed distillation processes, but more

particularly when methanol is deliberately added to fortify informally-produced spirits and illicit alcoholic drinks.

The informal and illicit production of alcoholic drinks is practised in many parts of the world, including in countries where alcohol is banned. Some common names for these drinks include: hooch/ moonshine (USA), chang'aa/kumi kumi (Kenya), tonto/waragi (Uganda), tuak/tapai (Malaysia), samogon (Russia), and talla (Ethiopia). Often such drinks are sold in unlabelled containers in markets and in illegal drinking venues. Illicitly- or informally-produced alcohol may also be sold in legitimate bars, particularly in some tourist areas[6,7]. Consumers may choose these drinks because of their low cost compared to taxed alcohol.

Some illicitly-produced drinks are made to appear legitimate through bottle design and labelling and consumers can be misled into believing they are buying a genuine brand of alcohol. Bottles may be sold in shops, markets and bars, often at a 'bargain' price.

Who is at risk?

Unregulated alcoholic drinks are generally very cheap and are therefore attractive to people with low incomes, particularly those who are alcohol dependent. Tourists may also be at risk, especially in holiday settings where high alcohol consumption is encouraged. Capacities for the early diagnosis and appropriate medical treatment of methanol poisoning may be unavailable in low-resource settings which consequently leads to high mortality and morbidity.

Toxicity

Methanol is well-absorbed through the gastrointestinal tract and is also absorbed through the skin and by inhalation. Methanol is only mildly inebriating; its toxic effects arise from its metabolism to formaldehyde and formic acid. Humans have limited ability to detoxify formic acid and this metabolite therefore accumulates and causes toxic effects[1].

The toxic dose of methanol varies depending on the individual and on the provision of treatment. Blood methanol concentrations above 500 mg/L are associated with severe toxicity, and concentrations above 1500-2000 mg/L will lead to death in untreated patients[5].

Signs and Symptoms

The major toxic effects do not manifest until methanol has been metabolized to formic acid and this has accumulated to toxic levels. There is, therefore, a latent period between the consumption of methanol and the onset of symptoms and signs. Co-ingestion of ethanol will delay metabolism and further delay the onset of toxicity for many hours[1].

In the first few hours the patient may become drowsy, unsteady and disinhibited; however, since poisoning often occurs in the context of drinking alcohol this may not be noticed. After a variable period of time victims start to develop headache, vomiting, abdominal pain and vertigo. They may start to hyperventilate and feel breathless. Vision is often affected, with blindness in severe cases. Coma, convulsions, and death from respiratory arrest may ensue[3,5]. Patients who survive may suffer permanent visual impairment[7,8].

Diagnosis

Measurement of the serum methanol concentration confirms the diagnosis but this analysis is often not available, particularly in an emergency[9]. The presence of methanol increases the osmolality of serum (a measure of the amount of chemicals dissolved in the fluid part of the blood), however, ethanol has the same effect and is frequently a co-ingestant. This means that the measurement of serum osmolality alone is not a reliable test for methanol ingestion.

As poisoning progresses the serum concentration of methanol decreases and that of its metabolites, including formate, increases. A metabolic acidosis with a high anion gap (a measure of the difference between positively charged ions and negatively charged ions in plasma) is typical of methanol poisoning. The measurement of formate is a simpler analysis than that of methanol[9,10]. Diagnosis can, therefore, be made from a combination of the history, the signs and symptoms mentioned above, and the following laboratory findings[5]:

- metabolic acidosis
- elevated anion gap
- elevated osmolal gap (the difference between measured and calculated osmolality)
- positive serum methanol and/or serum formate assay.

Treatment

The main principles of treatment are to prevent further metabolism of methanol, correct metabolic abnormalities and provide other supportive care. Metabolism can be blocked by the administration of ethanol or fomepizole. Supportive measures may include the correction of acidosis with sodium bicarbonate, intubation and mechanical ventilation and the use of extracorporeal elimination such as haemodialysis[11].

Fomepizole was added to the WHO Essential Medicines List in 2013.

Prevention and control

- **What can individuals do to protect themselves?**
  - Refrain from purchasing or producing illegal alcoholic drinks.
  - Be suspicious about alcoholic drinks offered for sale in informal settings that are not licensed to sell alcohol, e.g. market stalls, and/or that are offered at a cheap price.
  - Do not buy alcoholic drinks sold in unlabelled containers.
  - Check branded products for labels that are poorly printed or with typographical errors, or bottles with broken seals. Do not buy these.
  - Be aware of the symptoms of methanol poisoning and seek medical attention immediately.

- **What measures can countries take?**
  - Put in place a national strategy and legal framework to reduce the harmful use of alcohol (see below).
  - Use public health campaigns to promote awareness of the dangers of informally-produced and illicit alcoholic drinks. These can be targeted towards particular high-risk groups e.g. alcohol-dependent individuals, tourists.

- Since early recognition of an outbreak is vital to improve outcome, ensure that medical professionals are trained in the diagnosis and management of methanol poisoning.
- Where mass methanol poisonings recur establish a protocol for the management of these outbreaks.
- Ensure accessible and affordable treatment is available for all.
- Provide support to victims particularly those at risk of recurrent events e.g. alcohol-dependent individuals.

WHO response

WHO is committed to reducing the health burden resulting from the harmful use of alcohol. In 2010 the World Health Assembly endorsed a global strategy to reduce the harmful effects of alcohol. Ten recommended target areas were identified, including one addressing the need to reduce the public health impact of illicit alcohol and informally produced alcohol. A number of policy options and interventions are suggested, including:

- developing good quality control with regard to production and distribution of alcoholic beverages;
- regulating sales of informally produced alcohol and bringing it into the taxation system;
- creating an efficient control and enforcement system, including tax stamps;
- developing or strengthening tracking and tracing systems for illicit alcohol;
- ensuring necessary cooperation and exchange of relevant information on combating illicit alcohol among authorities at national and international levels;
- issuing relevant public warnings about contaminants and other health threats from informal or illicit alcohol.

Information on consumption and patterns of alcohol drinking, health consequences and policy responses in Member States can be found in the WHO Global Status Report on Alcohol and Health.

Links

Alcohol fact sheet http://www.who.int/mediacentre/factsheets/fs349/en/index.html

Global strategy to reduce harmful use of alcohol http://www.who.int/substance_abuse/activities/gsrhua/en/index.html

Global Status Report on Alcohol and Health 2014 http://www.who.int/substance_abuse/publications/global_alcohol_report/en/index.html

IMAI district clinician manual: Hospital care for adolescents and adults, Vol 1 (Chapter 3.8 concerns management of poisoning) http://apps.who.int/iris/bitstream/10665/77751/1/9789241548281_Vol1_eng.pdf?ua=1

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