

## Methanol poisoning: 27 years' experience at a tertiary care hospital

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### Abstract

Methanol toxicity can result in serious morbidity and mortality without timely diagnosis and treatment. Many cases of methanol poisoning outbreaks have been noted in our population but no study has been performed to estimate methanol exposure and its outcomes and complications. A retrospective study was conducted to review all the cases of methanol poisoning admitted from January 1988 to December 2015 at the Aga Khan University Hospital. A total of 35 methanol poisoning cases were reported. All the patients were male, and the mean age was  $36.2 \pm 8.6$  years. The mean Glasgow Coma Scale score on presentation in the emergency was  $10.4 \pm 4.4$ . Blurring of vision was present in 17 (48%) patients while 10 (28%) had complete blindness. Mean arterial pH was  $6.8 \pm 0.5$  on arrival. Ethanol was given to 30(88%) patients and 12(32%) patients received bicarbonate for immediate treatment. A total of 15 (42.8%) patients underwent dialysis, out of which only 5 (33.3%) patients survived. Overall, 19 (54.3%) patients expired secondary to methanol ingestion.

**Keywords:** Methanol, Poisoning, Tertiary healthcare, Morbidity, Mortality.

### Introduction

Methanol is a clear, colourless, and volatile liquid, and is used as an industrial solvent, and in a variety of commercial products including windshield washer fluids.<sup>1</sup> As it is cheap and easy to obtain, it is used in production of illegal alcoholic beverages in Turkey.<sup>2</sup> Poisoning due to methanol is relatively uncommon in forensic practice,<sup>1</sup> however methanol-related deaths have been reported in literature,<sup>3</sup> and several epidemics have been seen.<sup>4</sup> The toxicity of methanol is due to its metabolites, formaldehyde and formic acid. Formic acid induces severe metabolic acidosis which can be fatal and is the primary agent responsible for ocular toxicity.<sup>5,6</sup>

Signs and symptoms of acute methanol poisoning include weakness, blurring of vision, nausea, vomiting, headache, epigastric pain, dyspnoea and cyanosis. If an increased amount of methanol has been ingested, the outcomes can include stupor, coma, convulsions, hypothermia, and death.

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Blindness may result if the person survives.<sup>7</sup> Poisoning with methanol may be due to accidental or intentional ingestion, including suicidal intent, abuse or misuse.<sup>8,9</sup>

As these alcoholic drinks are inexpensive, they are easily accessible for people with low incomes. The aim of this study was to find out the incidence, clinical presentation and outcome of methanol poisoning at a tertiary care centre in Karachi, Pakistan.

### Methods and Results

A retrospective study was conducted of all the patients admitted to Aga Khan University Hospital with the diagnosis of methanol poisoning during period of January 1988 to December 2015. Patients with recent history of ingesting toxic amounts of methanol and having osmolal gap of more than 10 mOsm/kg H<sub>2</sub>O were included. Other inclusion criteria comprised of history of or strong clinical suspicion of methanol poisoning and at least two of the following criteria: arterial pH < 7.3; serum bicarbonate < 20 meq/L (mmol/L); or osmolal gap > 10 mOsm/kg H<sub>2</sub>O. Patients who were transferred out or left against medical advice were excluded from our study.

The study was approved by institutional ethical review committee. Medical records of all the admitted patients with the final diagnosis of methanol poisoning or with other forms of alcohols including methanol were reviewed and data were recorded on pre-designed performa. The form included the patient's age, gender, clinical presentation, initial laboratory workup, management and outcomes. SPSS (version 19.0) was used for data analysis.

A total of 35 patients presented to our institute with methanol poisoning. All of the patients were male with mean age of  $35.5 \pm 8.6$  years and belonged to low socioeconomic class. The mean Glasgow Coma Scale (GCS) score on presentation in the emergency was  $10.4 \pm 4.4$ . Most of the patients were symptomatic with 19 (76%) patients reporting visual symptoms, making it the single most common clinical feature. Out of these, 17(48%) patients presented with blurry vision, 10 (28%) with complete blindness while 8 (24%) had no visual symptoms. Most of the patients presented with severe metabolic acidosis with mean pH of  $6.86 \pm 0.5$ .

Most of the patients received ethanol 30(88%) as an

antidote, and 12(32%) patients received bicarbonate as immediate treatment. A total of 15 (42.8%) patients received dialysis out of which only 5 (33.3%) patients survived.

Overall, a total of 19 (54.2%) patients expired secondary to methanol ingestion.

## Discussion

Methanol, also known as wood alcohol, is a constituent of many commercially available industrial solvents and alcoholic beverages. It remains a common source of alcohol ingestion and poisoning among members of low socioeconomic class. Although it has a relatively low toxicity, the adverse effects result from accumulation of formic acid, a metabolite of methanol metabolism.

Our study evaluated 35 patients with methanol poisoning. Methanol causes visual impairment ranging from blurry vision, or defects in colour vision to complete blindness in severe poisoning.<sup>11</sup> In our study, 17(48%) of the patients presented with blurry vision, 10(28%) with complete blindness while 8(24%) had no visual symptoms.

Most of the patients in our setup received ethanol as an antidote as fomepizole is not available. Fomepizole is the first line antidote recommended for methanol poisoning,<sup>12</sup> although ethanol was traditionally administered for this purpose. Fomepizole has 500-1,000 times higher affinity for alcohol dehydrogenase than ethanol and has been shown to decrease and reverse visual impairment despite its potential to inhibit retinol dehydrogenase, an alcohol dehydrogenase isoenzyme that is essential to vision, after methanol poisoning.<sup>13,14</sup>

A total of 19 (54.2%) patients had expired. It is evident from this study that methanol poisoning still has a high mortality rate despite improved treatment. This is mainly due to delayed hospitalisation and presentation, leading to an increased accumulation of formic acid formed from methanol metabolism.

Our data does not reflect the actual incidence of methanol poisoning in our country as majority of the patients refer to government hospitals and most of the patients die before seeking any medical treatment.

## Conclusion

Methanol poisoning has a high mortality and morbidity rate in our setting despite advanced treatment options likely due to late presentation and degree of metabolic acidosis. The use of buffer, antidotes and haemodialysis is efficient if initiated early. For this reason, public education about the consequences of methanol consumption

should be highlighted and government should take necessary steps to control illicit activities.

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## References

1. Azmak D. Methanol related deaths in Edirne. *Leg Med.* 2006; 8:39-42.
2. Yayci N, A?ritmi? H, Turla A, Koç S. Fatalities due to methyl alcohol intoxication in Turkey: an 8-year study. *Forensic Sci Int.* 2003; 131:36-41.
3. Elif D, Akgür SA, Oztürk P, Sen F. Fatal poisonings in the Aegean region of Turkey. *Vet Hum Toxicol.* 2003; 45:106-8.
4. Mittal BV, Desai AP, Khade KR. Methyl alcohol poisoning: an autopsy study of 28 cases. *J Postgrad Med.* 1991; 37:9-13.
5. Kruse JA. Methanol poisoning. *Intensive Care Med.* 1992; 18: 391-7.
6. Massoumi G, Saberi K, Eizadi-Mood N, Shamsi M, Alavi M, Morteza A. Methanol poisoning in Iran, from 2000 to 2009. *Drug Chem Toxicol.* 2012; 35: 330-3.
7. Paasma R, Hovda KE, Moghaddam HH, Brahmi N, Afshari R, Sandvik L, et al. Risk factors related to poor outcome after methanol poisoning and the relation between outcome and antidotes - a multicenter study. *Clin Toxicol (Phila).* 2012; 50:823-31.
8. Lee CY, Chang EK, Lin JL, Weng CH, Lee SY, Juan KC, et al. Risk factors for mortality in Asian Taiwanese patients with methanol poisoning. *Ther Clin Risk Manag.* 2014; 10: 61-7.
9. Shadnia S, Rahimi M, Soltaninejad K, Nilli A. Role of clinical and paraclinical manifestations of methanol poisoning in outcome prediction. *J Res Med Sci.* 2013; 18: 865-9.
10. Sharma R, Marasini S, Sharma AK, Shrestha JK, Nepal BP. Methanol poisoning: ocular and neurological manifestations. *Optom Vis Sci.* 2012; 89: 178-82.
11. Zakharov S, Navratil T, Pelcova D. Fomepizole in the treatment of acute methanol poisonings: experience from the Czech mass methanol outbreak 2012-2013. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub.* 2014; 158: 641-9.
12. Lachance P, Mac-Way F, Desmeules S, De Serres SA, Julien AS, Douville P, et al. Prediction and validation of hemodialysis duration in intentional methanol poisoning. *Kidney Int.* 2015; 88: 1170-7.
13. Roberts DM, Yates C, Megarbane B, Winchester JF, Maclaren R, Gosselin S, et al. Recommendations for the role of extracorporeal treatments in the management of acute methanol poisoning: a systematic review and consensus statement. *Crit Care Med.* 2015; 43: 461-72.