

Methanol outbreak in the district of Hulu Langat, 2018

Muhammad Adil Zainal Abidin, MPH^{1,2,3}, Nur Zawani Jalaluddin, MBBS¹, Hazariah Abd Halim, MD¹, Gunenthira Rao, MPH^{1,2}, Mohd Nasir Habib, MPH¹, Zailiza Suli, MPH¹

¹Hulu Langat District Health Office, Ministry of Health Malaysia, Kajang, Selangor, Malaysia, ²Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor, Malaysia, ³Department of Community Medicine, Kulliyah of Medicine, International Islamic University Malaysia, Kuantan, Pahang, Malaysia

ABSTRACT

Introduction: A methanol outbreak occurred in the district of Hulu Langat on 16 September 2018. The Hulu Langat District Health Office received 25 notifications of a suspected methanol poisoning from Kajang and Ampang Hospital. An outbreak investigation was done to determine the source followed by a preventive and control measure.

Method: Active case detection was done on cases living quarters and workplaces. Patients were interviewed, and their blood and urine samples were sent for methanol analysis. Samples of suspected alcoholic beverages were also sent for analysis. A suspected case was defined as any person presented with clinical symptoms with a history of consuming alcoholic beverages within five days before symptoms and high anion gap metabolic acidosis. A confirmed case was defined as a suspected case with positive blood and urine methanol.

Results: In total, there were 25 suspected cases, of which 12 cases were confirmed. The calculated attack rate was 48%. There were six mortalities (50%) secondary to severe metabolic acidosis. The most common presenting symptom was vomiting (75%) and abdominal pain (41.7%). These cases were linked to consumption of illicitly produced alcohol. Samples of the alcoholic drinks were positive containing high level of methanol.

Conclusion: The methanol outbreak in the Hulu Langat was successfully managed. Appropriate control and prevention measures were taken, including health promotion and joint enforcement activities. Steps were taken successfully through collaborations with multiple agencies and cooperation with Selangor Health Departments and the Ministry of Health. Continuous surveillance on the product of liquor, and health promotion are essential to prevent a similar outbreak from happening again in future.

KEY WORDS:

Methanol, poisoning, outbreaks, alcoholic beverages

INTRODUCTION

Methanol is the purest form of alcohol. Methanol is usually used in industries as a component of commercial products such as solvents, pesticides, and as an alternative source of fuel.¹ Methanol, also known as methyl alcohol, is a colorless, volatile, flammable, and poisonous liquid. Methanol has a

distinctive odor similar to ethanol but far more toxic than ethanol.²

Sometimes, methanol is mixed with ethanol as alcoholic beverages as an inexpensive substitute for ethanol to increase profit.^{3,4} Additionally, methanol is naturally generated in alcoholic drinks in trace amounts without a potential to cause harm. Reports say that methanol can be found in distilled spirits as much as 10-220mg/L, 6/27mg/L in beer and 96-321mg/L in wine.⁵ However, illicitly produced alcoholic beverages contain a high level of methanol and can most likely cause severe morbidity and mortality. European Union has set a general limit for the amount of methanol in vodka, which is 10 grams per hectoliter of 100% vol. alcohol (100mg methanol per liter of liquor or 30mg in 1L of 30% spirits).⁶

Methanol ingestion usually occurs accidentally or as a suicidal attempt. However, in some unfortunate isolated cases, it may turn out to be an outbreak. Methanol poisoning occurs once there is contamination, or in poorly homemade liquor. Usually smuggled alcohol tend to precipitate as an outbreak.^{7,8} Accidental epidemic methanol poisoning often occurs probably due to distilling and fermenting errors or beverage contamination. The exact lethal dose of methanol for a human is unknown, but the level considered to be more than 0.3 to 1g/kg or blood methanol concentrations above 1500-2000mg/L.⁹ However, ocular toxicity complication can occur at a minimum ingestion level of 30ml. Once consumed, it is rapidly absorbed into the gastrointestinal tract and metabolised in the liver into formic acid. The peak serum concentration of methanol usually occurs within 30 to 90 minutes upon oral intake.² Accumulated formic acid often accounted for high anion gap metabolic acidosis symptoms and effect the central nervous system (CNS).¹⁰

Globally there more than 50 methanol poisoning outbreak has been reported between the year 2000 to 2012, involving 5000 acute cases and 2000 mortality.¹¹ In Malaysia, less than 15 cases of methanol poisoning were reported annually for the last five years.¹² The biggest outbreak of methanol poisoning was reported in 2013 in Selangor and Kuala Lumpur with a total of 44 cases and 29 mortalities.¹² Following that, a national guideline was produced for the outbreak management of methanol poisoning.¹² Worldwide, methanol poisoning cases usually occur among the poor and vulnerable populations because of their lack of knowledge regarding methanol.¹³ The case fatality rates were reported to

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Corresponding Author: Dr. Muhammad Adil Zainal Abidin

Email: adilzainal@gmail.com

be between 10% in Libya and up to 83% in South Nigeria.^{13,14}

On the 16 September 2018, the Hulu Langat district health office received online notifications of suspected methanol poisoning from hospital Kajang public health unit. An outbreak was declared, and the epidemiological investigation team was alerted. This paper aims to describe the outbreak management of methanol poisoning that occurred there.

METHODS

The team followed the guidelines from the CDC and the Ministry of Health for methanol poisoning for managing of this outbreak.^{12,15} The district health office received the first notification on 16 September 2018 from Kajang Hospital and alerted on similar cases reported in Cheras and Petaling district. Upon receiving the notification, rapid assessment team (RAT) and a rapid response team (RRT) from the district disease control division and the non-communicable disease unit were activated for verification and initial assessment. Case definition was established to facilitate the epidemiological investigation. Once the outbreak was verified and confirmed, an operation room was opened at the district level for the coordination and management of the outbreak.

Case definition

A suspected case is defined as any person who presented to any healthcare facilities with clinical symptoms, history of consuming alcoholic beverages within five days before symptoms, and with high anion gap metabolic acidosis. The clinical symptoms is then identified by observing the condition of the patient. Patient present either by gastrointestinal system symptoms (nausea, vomiting or abdominal pain), central nervous system symptoms (headache, confusions, seizure, loss of consciousness or coma), blurring of vision or any combinations of these symptoms. High anion gap metabolic acidosis is confirmed when any of the two criteria were fulfilled. The criteria are, arterial pH lesser than 7.3, bicarbonate serum level lower than 20mmol/L or osmolality gap was more than 10mOsm/L. A confirmed case is confirmed when level of methanol was positive for either in the blood or urine.

Epidemiological investigations

Based on the above case definition, an epidemiological investigation team was initiated for active case detection at the residences of the victims and their working places. Also all other government and private healthcare facilities in Hulu Langat were alerted to notify any other suspected cases. During the investigation period, appropriate control and preventive measures were undertaken to control the outbreak.

During the active case detection, demographic data, clinical details, and history of consumption of alcoholic beverages were gathered. Besides, cases that fit our criteria were referred to the hospital for further medical treatment and laboratory investigations. Throughout this critical time, the district health office liaised with the state health department and the headquarters of the Ministry of Health for a daily update of the outbreak.

Laboratory investigations

Samples of blood, urine, and alcoholic beverage were sent for methanol analysis to the Chemistry Department in Petaling Jaya and National Public Health Laboratory (NPHL) in Sungai Buloh for further analysis. A minimum of 3ml of blood samples in sodium fluoride vacutainer and 3ml of urine samples in sodium chloride vacutainer or 25ml of urine in a universal bottle with 1% sodium chloride was sent. Samples of the alcoholic beverage not less than 250ml were obtained from either the patients or their respective employers and their colleagues and sent to the National Public Health Laboratory (NPHL) in Sungai Buloh for methanol analysis.

Data management

Line listing data of all notifications was collected and analysed using Microsoft Office Excel. Daily updates regarding the line listing data were given to the Selangor Health Department and Ministry of Health. Descriptive analysis was utilized to explain the distribution of cases.

RESULTS

Descriptive epidemiology

The first notifications at Kajang Hospital lead to the first suspected area in Semenyih. The onset of the outbreak was reported among a few foreign workers in a cemetery located in Semenyih. They had had a few drinking sessions at their living quarters during a long weekend break. Further investigation led to three other suspected areas. Active case detections were done at a respected area and led to a total of 25 suspected cases. However, only 14 cases were admitted the Kajang Hospital except one to the Ampang Hospital. Other patients were given outpatient treatment and followed up often. In total, there were six mortalities reported from hospital Kajang. Five were secondary to severe metabolic acidosis, and one victim was brought in dead. Figure 1 below displays an epidemic curve of the outbreak. The first case was reported on 14 September 2018, the highest peak was on 16 September 2018, and the last reported case was on 25 September 2018.

From the 25 suspected case, only 12 were categorised as confirmed cases upon positive methanol in either blood or urine samples. Thus, the attack rate was 48% (12/25) with a case fatality rate of 50% (6/12). Table I describes the sociodemographic characteristics. In total, 35 foreign workers who worked in four different locations, namely Semenyih, Bangi, Kajang, and Sungai Buloh districts were the patients. There was only one Malaysian patient who worked in the cemetery located in Semenyih. All of them were males, and their ages were ranged between 21 and 48 years old, with a mean age of 33.2 years (SD 8.4). The consumption of beverage took place between 14th and 24th September 2018. They lived in living quarters near their workplace, where they consumed alcoholic liquor. Table II describes the symptoms of distributions among the cases.

Laboratory result

Methanol analysis of the blood and urine samples of the 25 suspected case was obtained. Twelve samples were positive in both the blood and urine sample. Remaining 12 samples

Table I: Sociodemographic characteristics (n=25).

	Characteristics	Cases (n = 12)	Non-cases (n=13)	Total
Age	20-29	4 (33.3)	4 (30.8)	8 (32)
	30-39	6 (50)	5 (38.4)	11 (44)
	40-49	2 (16.7)	4 (30.8)	6 (24)
Gender	Male	12 (100)	13 (100)	25 (100)
Nationality	Non-Malaysian	12 (100)	12 (92.3)	24 (96)
	Malaysian	0 (0)	1 (4.2)	1 (4)
Occupation	Cemetery worker	8 (66.7)	13 (100)	21 (86)
	Manufacturing worker	1 (8.3)	0 (0)	1 (4)
	Cement factory worker	2 (16.7)	0 (0)	2 (8)
	Wood factory worker	1 (8.3)	0 (0)	1 (4)

Table II: Distributions of symptoms among cases (n=12)

Symptoms		N (%)
Gastrointestinal symptoms	(Any symptoms)	11 (91.7)
	Nausea	3 (25)
	Vomiting	9 (75)
	Abdominal pain	5 (41.7)
Central Nervous System symptoms	(Any symptoms)	12 (100)
	Headache	4 (33.3)
	Confusions	4 (33.3)
	Seizures	4 (33.3)
	Loss of consciousness	2 (16.7)
	Coma	2 (16.7)
Blurring of visions		2 (16.7)

Table III: Methanol analysis results.

Sample	Mean (SD)
Blood methanol level (mg/100ml)	101.2 (100.6)
Urine methanol level (mg/100ml)	117.8 (90.8)
Liquor methanol level (mg/L)	
- Sample 1	172100
- Sample 2	198700
- Sample 3	169300
- Sample 4	695
- Sample 5	15740

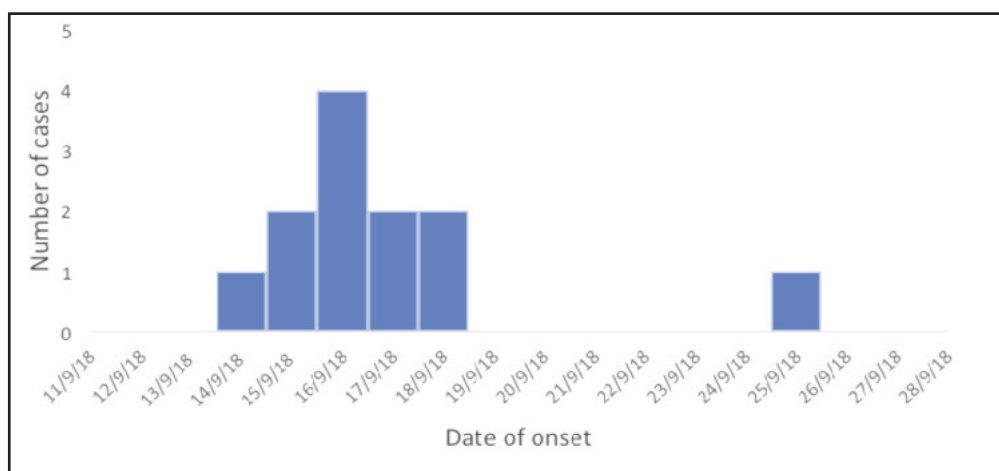


Fig. 1: Epidemic curve of the outbreak showing the onset date of cases.



Fig. 2: Timeline of key events.

were found to be negative, and one sample was rejected. The mean blood methanol level was 101.2mg/100ml (SD 100.6) which range from 10mg to 352mg/100ml. The mean urine methanol levels were 117.8mg/100ml (SD 90.8) ranging from 11mg to 255mg/100ml. The mean blood methanol level among the mortality case was higher at 153.8mg/100ml (SD 133.1) compared to 63.6mg/100ml (SD 52.9) among those who survived. The mean urine methanol level among those who died was also higher at 163.4mg/100ml (SD 115.6) compared to 85.1mg/100ml (SD 56.7) among those who survived. A total of 7 samples of alcoholic beverages were confiscated from the patients. Four suspected alcohol brands were identified, and further investigations were carried out by the police. Two of the samples were rejected due to insufficient quantity while the rest were positive with methanol ranging from 695mg/L to 198,700mg/L. Three of the samples could not be matched to relevant patients since the patients lived scattered in the residential quarters. However, two of the samples that could be matched with the patients did not correlate with the methanol levels of the patients. The first sample contained 695mg/L of methanol with the respected patient's blood and urine levels of 1140mg/L and 1640mg/L, respectively. The other liquor contained 15740mg/L of methanol with the patients' blood and urine levels of 100mg/L and 110mg/L, respectively. Based on their history of drinking, these cases were wherein methanol was with either soft drinks or plain water. Table III below describes the results of methanol analysis.

DISCUSSION

This was a larger numbers methanol poisoning outbreak that occurred in Hulu Langat District which lasted for ten days. Compared to the earlier reported outbreak in the year 2013, the current epidemic was more widespread involving more victims. The rate of case fatality was higher (50%) compared to the outbreaks in other countries such as the Czech Republic (34%), Kenya (29%) and Libya (10%).^{13,16} Patients mostly had clinical symptoms such as vomiting (75%) and abdominal pain (41.7%) but some presented with a blurring of vision. There were four different brands of whiskey in different packaging which includes long can, 375ml bottle and 700ml liquor bottles, which were further investigated by police and customs department for their authenticity.

There was also an observed relationship between nature of drinking and the severity of the symptoms. Those who consumed alcoholic beverages directly and with larger quantity exhibited more severe symptoms compared to those who took in smaller quantity or diluted methanol with water or soft drinks. Most of the patients consumed alcohol on a few occasions from 14th to 17th September 2018. There was a long holiday break and thus they were celebrating some of their friends who were going back to their native countries. Later on, some who were known to be alcoholic consumed more privately with their other peers. They bought the liquor through phone call delivery from illegal liquor shops operating nearby. Foreigners managed these liquor shops, and they also provided a home delivery service. They were mostly regular customers, but without any reported methanol poisoning incidence earlier. Further investigations on the source of alcoholic drinks and the liquor shops were taken over by the police. Based on the police investigations, most of the alcoholic beverages were produced illegally.

The high number of mortalities occurred possibly due to the amount of alcohol consumed and also the late presentations to the health facilities. As all the fatal cases involved foreign workers, they were reluctant to get initial treatment. The current outbreak was due to illicitly produced alcoholic beverages by illegal shops. Generally, all the victims came from a low socioeconomic background and probably had little awareness and knowledge level regarding illicitly produced alcohol. The original products available in the market are costly for them. Hence, they were bought counterfeit ones.

Outbreak response by the district health office was successful due to the cooperation from multiple agencies. Preventive and control measures included case management, health education, police report and investigations, and enforcement activities. Case management involved both clinical management at the hospital and active case detection at the workplace and residence quarters of workers. Apart from that, all healthcare facilities were alerted for detection and notification of suspected cases. Clinical and alcoholic drink samples were sent for confirmation of methanol content. The public health unit at the hospital was responsible for all notifications from the hospital and updates of the condition of the patients in the wards. Figure 2 summarises the key events during the outbreak.

Health promotion activities were conducted among the population at risk. Due to the language barrier, an interpreter from the United Nations High Commissioner for Refugees (UNHCR) was sought. The health promotion was given to all concerned at the working places and living quarters. Educational materials such as pamphlets and flyers in a few foreign languages were distributed, and small group discussion on the dangers of consuming illegal alcohol was conducted. The population at risk was foreign workers from the affected workplaces and their living quarters. Support from the employer ensures a rapid active case detection process and health promotion activity so that it can be delivered efficiently. The district health office also collaborated with the municipal council's industrial committee for networking with employer and employee for effective health promotion coordination.

Police reports were made both for the outbreak and individual cases for the police to take over the investigations. Information gathered by the district health office was shared with the police. Multi-agencies enforcement activity involving the customs department, municipal council, and district police was conducted, which led by the Hulu Langat District Office at premises selling alcohol. The District Health Office also conducted routine surveillance at premises selling alcohol and sent samples for methanol analysis. The operational room held a daily meeting to monitor the progress and officially closed ten days after the last reported case.

Although the current outbreak mainly involved illegal shops, routine enforcement, and surveillance activities should be instituted. This is to ensure no illicitly produced alcohol is present in the market. The surveillance should also include formal sampling for methanol analysis.

STRENGTHS AND LIMITATIONS

There were some strength and limitation in this outbreak investigation that need to be addressed. A self-administered questionnaire was used, which can potentially lead to recall biases. The outbreak also occurred in nearby districts and neighboring states. As this report came from one district, caution must be made towards interpreting the outbreak in Malaysia during the period. Nonetheless, we used only verified data from the laboratory before conclusions in which the data themselves were validated.

CONCLUSION

This methanol outbreak was caused by illicitly produced liquor, which contained a high levels of methanol. Possible factors were the volume and nature of the consumed alcoholic drinks and low level of awareness among the foreign workers. A few valuable lessons can be learned from

this outbreak, including challenges in the management and ensuring routine surveillance to prevent any future outbreak. The limited awareness ultimately delayed the initiation of treatment and warnings to the public and other healthcare facilities. However, these challenges were overcome by a joint effort between multi-agencies, including police, local authority, state health department, and the Ministry of Health of Malaysia.

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