METHYL ALCOHOL POISONING
A REPORT OF 20 CASES

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INTRODUCTION

LITTLE WAS known about the toxicity of methyl alcohol until the turn of the century and it was reported as late as 1910 that many wines, whiskeys and brandies sold on New York East Side contained between 24 to 43% of methyl alcohol. In 1914 even Ehrlich used methyl alcohol as a solvent for Salvarsan and until Reif demonstrated in 1923 that a group of dock-workers in Hamburg had been poisoned by chemically pure methyl alcohol that the toxicity of wood alcohol was generally accepted as a fact.

Ingestion is not the only cause of morbidity. Brown (1911) described a case where a factory worker spilled a gallon of methanol down his trouser leg was dizzy the next day and woke up after a nap, totally blind. Inhalation also has its dangers.

Pure methanol is colourless and smells differently from ethanol with a specific gravity of 0.81 and boils at 65°C. The extreme variation in the dosage which causes death is one of the main reasons why methanol was only recognised as toxic since the beginning of this century. The ingestion of 4 litres of 40% methanol by six Russians caused only slight gastro-intestinal irritation but no deaths or blindness. Wood and Buller pointed out that two teaspoon has caused blindness though Duke-Elder (1945) mentions blindness after only 4 millilitres. One report has 12 deaths in 200 cases and only 50 of the 200 became ill.

The remarkable variation in dose-toxicity has not yet been explained. This report is based on 20 cases admitted to Seremban General Hospital in January 1977. Of these, 15 were very ill on admission and died within 24 hours of admission and had blood methanol levels of 65 mg.% to 180 mg.%. There were 5 survivors all of whom were admitted in a satisfactory condition.

THE CASES

The youngest victim was 33 years of age and the oldest was 68. There were 15 males and 5 females and all of them were Indians including one Indian Moslem. Of those that died, the shortest time interval between admission and death was 20 minutes and the longest 24 hours. In those whom the blood was estimated for methanol the highest recorded was 180 mg.% and the lowest was 65 mg.%. In one of the survivors both ethanol and methanol were present in the blood.

THE CLINICAL SIGNS AND SYMPTOMS IN GENERAL

In six cases no history was available at all either from the relatives or friends as they were comatose. In the 14 who gave history only 9 said that they had taken any alcoholic drinks prior to admission. Five patients denied taking alcohol. However, this is not unusual as alcohol drinking is frowned upon and denial frequent.

The commonest symptoms were blurring of vision, abdominal pain including back pain, vomitting and diarrhoea. Giddiness, headache and chest pain were not common even though one early case was diagnosed as myocardial infarct on the basis of his chest pain and cold and clammy extremities but the E.C.G. was normal. The presence of unspecified

aches and pains in most parts of the body including a severe abdominal and back pain which some observers attribute to pancreatitis is one of the features which these unfortunate victims present.

Table I

Symptoms among the 14* patients admitted for Methyl Alcohol poisoning

Symptom	No. of patients with symptom
Giddiness	4
Blurring of vision	8
Vomitting and/or diarrhoea	10
Abdominal pain	7
Headache	3
Chest pain	3

* 6 were comatose and no history was available.

Most of the patients were cold and clammy on admission even in those who later survived and this does not mean that they were in shock as other features like the pulse and blood pressure were within normal limits.

Those who admitted to alcohol imbibing claimed to have taken the alcohol at least the night before, some the day before (that is about 24 hours earlier). This latency in the toxic manifestations is one feature which points to the metabolic byproducts of methanol rather than methanol as the toxic agent.

In the study carried out by Chew *et al.* (1946) on 26 cases, the time between ingestion and onset of symptoms was from one to 40 hours.

Of the 14 patients who gave any history 8 patients had complaints of blurring of vision. Of 58 severely acidotic patients seen by Roe (1946), 45 complained of cloudy or diminished vision. Among 26 survivors reported by Chew *et al.* (1946) visual disturbance was a symptom in 15 but permanent impairment in the form of contracted fields or scotomata remained in only two patients. The five patients who survived in our series showed no permanent visual impairment. The development of visual disturbances in any person after a drinking bout should immediately arouse the suspicion that methanol has been ingested.

Methyl alcohol exerts a profound effect upon the central nervous system producing symptoms ranging from those of an ethanol "hangover" to convulsions or profound coma. Three of our patients had generalised fits and 6 were comatose.

Headache was a complaint in 62% of the 323 cases reported by Bennett *et al.* (1953) and dizziness in 30%. Headache and dizziness were present in 3 of our 14 patients who could give any history. Even though focal neurologic disturbances have been reported, we found no instance of these in our cases. Many reviews emphasised amnesia as a feature but we did not ask the patients about this and we are unable to give the incidence.

Even though Bennett *et al.* (1953) reports that constipation were common and actual emesis is rare, we noted that 10 of our 14 patients who gave history either had vomitting and diarrhoea or diarrhoea per se. Roe (1946) comments that vomitting often becomes persistent and violent and we agree with him.

Headache was present in 3 of 14 patients whereas abdominal pain sometimes very severe was present in 7 and chest pain in 5. In the series by Bennett *et al.* (1953), 67% had severe excruciating upper abdominal pain.

The association of Kussmaul respiration with acidosis is well known and this was noted in two patients. We did not have the opportunity to measure the bicarbonate level in our cases but Bennett *et al.* (1953) observed that dyspnoea is a poor indication of the severity of acidosis and that Kussmaul respiration were unusual even in patients with marked reductions of serum bicarbonate.

PHYSICAL FINDINGS

As in the series by Bennett *et al.* (1953), we noted that the skin was cool with profuse perspiration and in the comatose patients, moist, clammy extremities suggested profound shock but generally cardiovascular functions were well-maintained until terminally. Kussmaul respiration was infrequent and only 25% of patients with plasma bicarbonate of less than 10 mg. had sighing respirations.

Dilated, poorly reactive pupils were present in most of our cases as in the other series. Opthalmoscopic examination were done in only a few of our patients and there was hyperaemia of the optic disc and retinal oedema in six patients. Disc injection subsides after about 3 days and the swelling is peripapillary and spreads radially as grayish streaks throughout the retina. We did not have any case of blindness in our five survivors.

CARDIOVASCULAR

The pulse rate was within normal limits in most patients and the blood pressure levels were within normal limits in all patients until terminally.

The description by Merritt and Brown (1941) is typical; "On arrival the patient was still in a state resembling shock. He was cyanotic and his extremities were cold. The systolic blood pressure was 160 mm of Mercury and the diastolic 100 mm."

NEUROLOGIC SIGNS

Changes in the sensorium were frequent in the acidotic patients and confusion amnesia, lethargy, stupor and deep coma are among the common neurologic disturbances. Thirteen of our patients were comatose on arrival. One of the early cases with vomitting, neck stiffness, Kussmaul respiration was diagnosed as encephalitis and a lumbar puncture done. The cerebro-spinal fluid was normal.

MODE OF DEATH

Bennett *et al.* (1953) observed that the prime cause of death was a peculiar cessation of respiration. Coma deepened and respirations gradually become shallower and less frequent and despite clammy extremities there was normal blood pressure with full volume pulses. Manual artificial respiration, tracheostomy and endotracheal intubation were found ineffective by Bennett *et al.* (1953) when respiration ceased and seven of their patients admitted in coma and treated with alkali and supportive measures failed to recover consciousness and all died within three to seven days with signs of massive cerebral damage.

TREATMENT

Massive alkalinization is the mainstay of treatment in methanol poisoning and Bennett *et al.* (1953) noted that even though seven of their severely acidotic patients died despite relief of acidosis, in every other instance in which plasma bicarbonate was restored to normal their patients survived.

In our series, patients were given 7.5% sodium bicarbonate by intermittent injections intravenously. Overtreatment with sodium bicarbonate may give rise to intense thirst and transient numbness and tingling of the fingers and lips.

ETHYL ALCOHOL

Chew *et al.* (1946) administered whiskey to 26 patients in his series and all recovered. Agner *et al.* (1948) reported that in both their patients the blood methanol concentration remained relatively constant under the influence of ethyl alcohol. Bennett *et al.* (1953) administered ethyl alcohol to one patient and use only alkalinization as the mainstay of treatment. In this series we use a dilute 5 to 10% ethanol in conjunction with alkalinization.

Spinal drainage, injections of A.C.T.H. or B.A.L. were not found to have any value in the series by Bennett *et al.* (1953). A fair number of our cases had blood glucose determination and none were hypoglycaemic but intravenous glucose were administered in some patients without any effect.

LAB FINDINGS

In the cases where the haemoglobin, electrolyte, blood urea and blood sugars were determined they were normal. However, as noted previously, we were unable to determine the carbon dioxide combining power.

The review of all electrocardiographic tracings showed that they were within normal limits in our cases.

PATHOLOGY

No pathological findings were made available to this author. Reviewing the literature, we find that there are no pathognomonic lesions but variable cerebral oedema with meningeal and subarachnoid petechiae, congestion of lungs, epicardial haemorrhages, occasional mild fatty infiltration of the liver, gastritis and general congestion of the abdominal viscera. Bennett *et al.* (1953) also noted pancreatic necrosis in 13 of the 17 cases examined at necropsy and are of the opinion that the pancreatic damage was secondary to vascular injury and damage.

THEORETICAL CONSIDERATION OF THE MECHANISM OF METHANOL POISONING

When methanol is ingested, it can persist for one week in the body with body distribution corresponding to that of water. High levels are attained in the humours of the eye, the cerebrospinal fluid and gastric secretions. Methyl alcohol is oxidized in the body at less than one-fifth the rate of ethyl alcohol with a small proportion excreted unchanged in the urine and a larger proportion lost in the expired air.

Oxidation of methanol proceeds to formic acid, probably via formaldehyde. Pohl showed in 1893 that wood alcohol ingestion increased urinary formic acid and various workers have confirmed this finding. Bartlett (1950) found that the rate of destruction of methanol labelled with C^{14} was 25 mgm per kilo of rat per hour as contrasted with 175 mgm of ethanol per kilo per hour. Within 48 hours, about 86 per cent of the administered dose was recovered, 65 per cent as carbon dioxide in expired air, 14 per cent as methanol in expired air, 3 per cent as formic acid in urine and 4 per cent fixed in the tissues.

It has been shown that if ethanol and methanol are injected simultaneously into rabbits, the concentration of methanol in the blood remains almost unchanged until the ethanol has been oxidized. It has also been demonstrated that alcohol dehydrogenase is able to oxidize methanol at one-ninth of the rate for ethanol and ethanol in equimolar concentration completely inhibits the oxidation of methanol and there is increased urinary methanol when volunteers are given ethanol and methanol.

Using C^{14} labelled methanol in rats, Bartlett (1950), showed that ethyl alcohol produced a striking depression of the oxidation of methanol in the intact animal as well as in isolated liver slices. This has formed the basis of treatment in human beings.

The acidosis produced by methyl alcohol is very severe and in the Atlanta outbreak there were 30 patients with plasma bicarbonate below 10 m Eq. and in 4 patients the plasma CO_2 combining power by the Van Slyke and Neil method (1924) was zero. The mechanism of acidosis is not clear and formic acid only accounts for a fraction of the acidosis. Other organic acids like lactic acid were demonstrated in the urine and blood of methanol poisoned patients. Van Slyke and Neil (1924) noted increased urinary excretion of lactic as well as formic acid in a patient but most of the urinary acids were unidentified. Ketosis has been suggested as playing a role in the acidosis and in the Atlanta cases, of 43 patients tested, acetonuria was present in 10 cases.

We would like to conclude our article with a few comments which the author himself cannot elucidate:

(a) This is the third time an epidemic of methanol poisoning has occurred in Seremban whereas moonshine liquor can be found throughout Peninsular Malaysia.

(b) There must have been sporadic cases of methanol poisoning which are missed and in fact the author is of the opinion that had only two or three cases been admitted the diagnosis would not have been made.

(c) Methanol is added to give a better "kick" but why should only drinkers in Negri Sembilan be involved most of the time?

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