

# Toluene Poisoning Presenting as Bilateral Basal Ganglia Haemorrhage

Sunil Mahavar<sup>1</sup>, Ashutosh Chaturvedi<sup>2</sup>, Aradhna Singh<sup>1</sup>, Ramesh Kumar<sup>3</sup>, Sher Singh Dariya<sup>4</sup>, Raman Sharma<sup>5</sup>

## Abstract

Toluene is an aromatic hydrocarbon that is often used as a solvent in paints, paint thinners, glues, disinfectants and as an industrial solvent for the manufacturing of pharmaceuticals, paints and chemicals. Metabolic acidosis is a recognized complication of toluene poisoning. However, we here report an unusual case of toluene poisoning presenting with bilateral intracerebral haemorrhage.

## Introduction

Toluene (Structural formula:  $C_6H_5CH_3$ ) is also known as toluol, phenylmethane, methylbenzol, methyl-benzene, monomethyl benzene, and methacide. Several studies have examined the absorption of toluene and other organic solvents following oral ingestion and nasal inhalation and have found that once absorbed into the blood it is distributed throughout the body, preferentially to well perfused lyophilised tissue such as brain, liver, lungs and adipose tissue. Data from literature suggests that after oral ingestion, toluene accumulates in the liver, while after inhalation, it accumulates in the brain. Acute intoxication affects the central nervous system (CNS), leading to euphoria, confusion, depression, headache, vertigo, hallucinations, seizures, ataxia, and finally, stupor and coma.

Toluene has been known to cause increased anion gap acidosis and

hypokalemia. But we hereby report an unusual case of toluene ingestion presenting with severe metabolic acidosis and bilateral basal ganglia bleed which has never been reported.

## Case Report

A young 25 year old male, working in the glass industry, was referred to our emergency department with alleged history of accidental ingestion of approximately 100 ml of paint thinner two days back, following which the patient became drowsy and complained of headache, but continued with his daily activities. Suddenly after two days of ingestion, patient developed shortness of breath and loss of consciousness when he was brought to the emergency department. There was no history of any fever, trauma or seizure preceding the loss of consciousness. The patient was non-hypertensive, non-diabetic.

At the time of presentation to the emergency department, the patient was gasping and was immediately intubated and ventilatory support initiated. His ABG showed severe metabolic acidosis.

A thorough examination done after stabilising the patient revealed a blood pressure of 120/80 mmHg; pulse rate of 90/minute; a normal cardiac examination. There were crepitations bilaterally suggesting aspiration pneumonitis. The pupils were sluggishly reactive and the

patient was unconscious (E1M1V1) with plantar reflex mute bilaterally.

Basic laboratory studies revealed an haemoglobin level of 15.0gm%; TLC of 9100/cumm with 84% neutrophils, 10% lymphocytes, 4% monocytes and 2% eosinophils; platelet count of 1,52,000/cumm; PCV of 49%; S. Sodium 140mEq/L; S. Potassium 7.2mEq/L; Blood urea 30 mg/dl; Serum creatinine 1.1mg/dl; Serum uric acid 8.9mg/dl; serum calcium 9.8 mg/dl; serum phosphorus 2.8mg/dl; Serum magnesium 2.4 mg/dl; PT INR of 1.1; random blood sugar of 103mg/dl; serum bilirubin 0.4mg/dl; SGOT 52 U/L SGPT 26 U/L; Alkaline phosphatase of 183 U/L; serum LDH 1152 IU/L (Normal 240 to 480IU/L); Serum CPK 1291 IU/L (normal 25 – 190 IU/L); serum protein 6.6 gm/dl; serum albumin 4.2gm/dl; serum globulin 2.4gm/dl. ECG done at time of admission showed tall T waves suggestive of hyperkalemia for which appropriate treatment was started immediately. A chest radiograph revealed bilateral infiltrates.

ABG revealed an high anion gap metabolic acidosis with Ph of 7.06,  $HCO_3$  of 6.1mmol/l; S. Sodium 140 meq /L and S. Chloride 106 meq/L. NCCT head showed bilateral basal ganglia bleed (Figure 1).

The patient was managed for intracranial bleed, aspiration pneumonitis and metabolic acidosis with a tracheostomy, ventilator support, intravenous fluids, cerebral decongestive therapy, broad spectrum antibiotics, steroids and bicarbonate infusions with daily monitoring of metabolic parameters. However despite treatment, the patient suffered a cardiac arrest and despite best efforts at resuscitation, the patient expired.

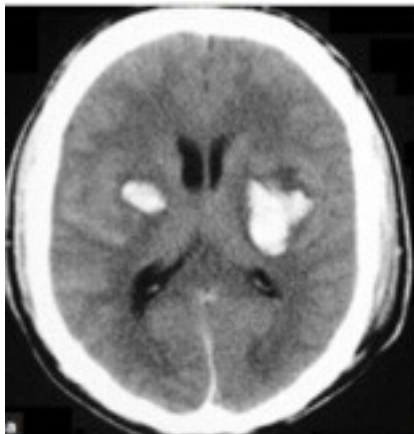


Fig. 1: NCCT Head showing bilateral basal ganglia haemorrhage

<sup>1</sup>Assistant Professor, <sup>2</sup>Ex. Senior Resident, <sup>3</sup>Resident, <sup>4</sup>Medical Officer, <sup>5</sup>Senior Professor, Dept. of Medicine, SMS Medical College and Hospital, Jaipur, Rajasthan

Received: 14.02.2017; Accepted: 07.02.2018

## Discussion

Toluene is one of the main compounds of glue, gasoline, acrylic paints, varnishes, lacquer, paint thinners, adhesives, and so forth. Toxicity can occur either from accidental or deliberate inhalation or direct absorption through the skin, but the most frequent and widespread cause of intoxication is glue sniffing.

### Distribution in Body

Toluene that is absorbed into the blood is distributed throughout the body. Ameno et al. reported that in a 51-year-old man who died from accidental oral overdose, the highest toluene concentrations (per gram tissue) were in the liver, followed by pancreas, brain, heart, blood, fat, and cerebrospinal fluid.<sup>1</sup> However, Paterson and Sarvesvaran reported that a 16-year-old male who was found dead, presumably due to inhalation overdose of toluene, had greater concentrations in the brain than the liver.<sup>2</sup> Within the brain of a 31-year-old man who was found dead in a room full of toluene vapor, the highest concentrations of toluene were found in the corpus callosum, with the lowest in the caudate-putamen.<sup>3</sup>

Thus, the available human data suggest that more toluene accumulates in the brain than in the liver following inhalation exposure, whereas following oral exposure, the liver contains the greatest concentrations of toluene. Our patient during the course of his occupation had probably been exposed to fumes containing toluene and had also had an acute exposure following oral ingestion.

Acute toluene exposure can provoke disorientation, euphoria, exhilaration, and tinnitus. Higher levels cause disinhibition, decreased level of consciousness, hallucinations, nausea, and fatigue. Electrolyte and acid/base abnormalities after toluene exposure have been reported.

## Clinical Manifestations of Toluene Poisoning

Toluene intoxication leads to metabolic acidosis either with a normal anion gap or an increased anion gap. It is metabolized to hippuric acid by way of benzoic acid, both of which are found in the serum of patients who abuse toluene. If renal elimination of hippuric acid is impaired or hippuric acid production is high relative to renal elimination, the molecule accumulates and produces an elevated anion gap metabolic acidosis.

Hypokalemia has been reported in patients of toluene poisoning possibly because of increased urinary excretion due to the presence of poorly reabsorbed anions and low urinary chloride concentration as seen with urinary excretion of hippurate and benzoic acid accompanied by volume contraction.<sup>4</sup> However, in our patient the serum potassium levels were high and ECG showed tall T waves. This could be due to renal failure and rhabdomyolysis.

Cardiovascular side effects in acute toluene poisoning appear as a result of direct negative effects on cardiac automaticity and conduction or oversensitization of the heart to endogenous catecholamines, which itself can lead to sudden cardiac death.<sup>5</sup> Other cardiac abnormalities, which have been reported in association with toluene toxicity are recurrent myocardial infarction, dilated cardiomyopathy, and coronary vasospasm.

The central nervous system abnormalities described in toluene poisoning patients include ataxia, tremors, temporal lobe epilepsy, decreased intelligence quotient, paranoid psychosis, hallucinations, nystagmus, cerebral atrophy, abnormal EEG record and impaired speech, hearing, and vision.<sup>6</sup>

Organic solvents readily cross

the blood-brain barrier following inhalation and produce CNS effects similar to those of alcohol and benzodiazepines. Positron Emission Tomography (PET) studies have indicated that solvents have rapid entry into the brain, short half-lives, and high rates of metabolism and clearance.<sup>7</sup>

Little is known about the mechanisms by which toluene produces acute effects but it is reasonable to assume that its toxic effects are due, at least in part, to its general characteristics as a solvent. Because of its lipophilic character, toluene has a serious impact in the brain and in other parts of the nervous system. It acts as a central nervous system depressant and this is the most common cause of death in toluene ingestion.<sup>8</sup> The presence of solvent molecules in cholesterol-filled interstices between phospholipids and sphingolipids changes membrane fluidity, thereby altering intercellular communication and normal ion movements.<sup>9</sup> The lipid solubility, volatility, and route of exposure of the compound enhances its toxicity.

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