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Case Report

A 16-Year-Old Lady with Transformer Oil Poisoning in Intensive Care Unit of Enam Medical College Hospital

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Abstract

Transformer oil is one kind of highly refined oil which is used as coolant and heat exchanger in different electronic equipments. Poisoning with this oil is a rare type of chemical poisoning as it is not easily available for household purpose. The main constituent of transformer oil is polychlorinated biphenyl (PCB) which is responsible for producing toxicity in humans. Chronic exposure with PCB may cause some toxicity such as hepatotoxicity and neurotoxicity. Here we present a case of acute toxicity with transformer oil of a rural woman in Bangladesh who ingested this oil as suicidal attempt. She was managed efficiently through conservative treatment along with artificial ventilation.

Key words*: Transformer oil; PCB toxicity; Transformer oil poisoning*

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Introduction

Transformer oil is one kind of highly refined oil which is stable at high temperature. It has excellent electrical insulating properties[1] and serves as a coolant for transformer. It is used in oil-filled transformers, fluorescent lamp ballasts and some types of high voltage capacitors, switches and circuit breakers. Besides serving as insulator and coolant, it acts as safety device for heavy duty electrical transformers. In addition, it acts as oil to water heat exchanger.[2]

The main constituent of transformer oil is polychlorinated biphenyl (PCB). PCB is a synthetic organic, chemical compound of 2–10 chlorine atoms attached to biphenyl molecule composed of two benzene rings. The chemical formula of PCB is $C_{12}H_{10-x}Cl_y$ (Fig 1).[5] It contains some toxic compounds known as 2,3,7,8-tetrachlorodibenzo[p]dioxin (TEF).[3] A Food and Drug Administration (FDA) study in 1991 estimated dietary intakes of PCBs for infants (6 months) and toddlers (2 years) of less than 0.001 and 0.002 µg/kg/day.[4]

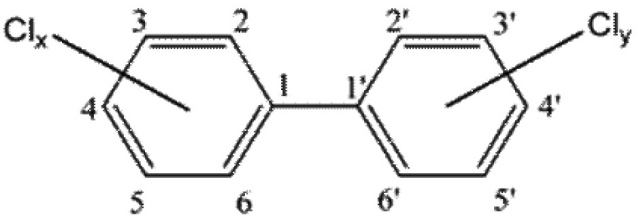

Fig 1. Chemical structure of PCB

Most PCBs are tasteless, odourless, clear to pale yellow viscous liquids. Some are more viscous and deeper yellow in colour. It has high fat solubility but low water solubility and low vapour pressure.

In spite of having several usages, PCB has several adverse effects as it contains some toxic compounds.

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For instance, it's immediate adverse effects are headache, nausea, vomiting, irritation to skin and eye.[4] Small doses of PCB have no significant effects, but large dose may cause acute poisoning. Besides these, in the long run chronic exposure may cause carcinoma. Such as, carcinoma in liver and malignant melanoma.[6] It can also cause endocrine disruption and inhibition of estradiol which may lead to serious developmental problems both in males and females including sexual, skeletal, and mental development.[6] In case of pregnancy, it may lead to abortion or miscarriage.[7] Study suggests that it can cause hepatotoxicity and neurotoxicity.[8]

Individuals can be exposed to PCBs through breathing contaminated air, consuming contaminated foods and skin contact with old electrical equipments containing PCBs. Once PCB enters into the body, there is no way to remove it. It will be slowly eliminated naturally. PCBs are excreted in faeces or it may remain in a person's body adipose tissue or other organs for months.[4] It can also be excreted through breast milk.[7] Clinical features of PCB poisoning can be chlorachne, rashes or sores[7], ocular lesion, irregular menstrual cycle, fatigue, headache, cough, low birth weight in pregnancy[7], abnormality in motor skills and decrease in short term memory which may last for several years.

No specific treatment exists for PCB accumulation and there is no antidote for PCB and no specific measures are available to reduce respiratory tract absorption and therefore treatment is supportive.[9] So patients should avoid further PCB exposure. For acute exposure, skin and eye should be treated immediately by flushing with copious amounts of water. Contaminated clothing should be discarded properly. Careful observation of patients is needed with inhalation exposure for any systemic signs or symptoms of toxicity. The value of administering activated charcoal after ingestion is unknown. Exposed persons should have periodic follow-up examinations with particular attention to hepatic function and dermal lesions.[9]

Case report

A 16-year-old housewife hailing from Ghurat, Ashulia, Dhaka was admitted to a local community based hospital with history of ingestion of about 100 mL transformer oil and presented with nausea and several episodes of vomiting. After two hours of admission she developed respiratory distress and subsequently was referred to Enam Medical College Hospital for better management. On examination, she was found semi-conscious, ill looking, her Glasgow Coma Score (GCS) was 7 out of 15 ($E_3M_3V_1$), heart rate was 104 beats/min, blood pressure was 110/70 mm of Hg, respiratory rate was 44 breaths/min, oxygen saturation (SPO_2) was 90%, pupils were normal in size and reacting to light. On auscultation, crepitation and rhonchi were found in both lung fields.

Her arterial blood gas (ABG) analysis showed pH 7.581, pCO_2 12.6 mm Hg, pO_2 219 mm Hg, TCO_2 12.2 mmol/L, HCO_3 11.8 mmol/L, BEb (base excess in blood) 6.4 mmol/L, BEecf (base excess in extracellular fluid) 10.2 mmol/L and SO_2 (oxygen saturation) 99.9%. Her blood picture showed increased total WBC count (13,500/μL), ESR 12 mm in 1st hour, neutrophil 74%, lymphocyte 22%, monocyte 3%, eosinophil 1% and basophil 0%. Absolute indices of RBCs were MCV 95.6 fL, MCH 31.7 pg, MCHC 33.2 g/dL and HCT/PCV 36.8%. Serum electrolytes were as follows: sodium 139.3 mmol/L, potassium 3.31 mmol/L, chloride 109.8 mmol/L and TCO_2 22.0 mmol/L. Her SGPT was 107 U/L and serum creatinine was 57 μmol/L.

Her ECG showed sinus tachycardia. Chest radiography revealed haziness and increased vascularity of both lung fields due to pulmonary congestion. She was given third generation cephalosporin, omeprazole, ondansetron and metronidazole in injectable form, oral cytoprotective agent, nebulization with mixture of salbutamol and 0.9% NaCl and injectable furosemide for three days. Her respiration was supported with mechanical control mode ventilation. Gradually, her condition improved and next day she was withdrawn from ventilator support. After weaning her vitals remained stable. She was then discharged home after 3 days and was advised to consult with a psychiatrist. One week later she was followed up again and found haemodynamically stable. A second follow-up was ensured after one month and she was found quite normal.

Discussion

Transformer oil poisoning is a rare type of chemical poisoning. Most common features are chronic and it affects mostly electric pole workers, people living near

incinerators and other PCB-disposal facilities and fishermen may receive higher PCB exposure than the general population.[10] This type of acute poisoning cases is not widely seen in medical practice. However, transformer oil is easily available in South East Asian sub-continent as it is used to relieve joint pain and also sometimes used as cooking oil for food adulteration.[11]

There is history of PCB intoxication in large scales. There was an accidental contamination of edible rice oil by PCB through leak in a heat exchange system in the oil manufacture in Fukuoka, Japan in 1968 and in Taiwan in 1979. In Japan, famously known as 'Yusho accident' (Yusho is "rice oil" disease in Japanese) involved at least 1788 and in China the 'Yucheng accident' (yuchang is "oil disease" in Chinese) involved more than 2000 clinical cases of intoxication by heat degraded technical PCB mixture.[12] They also developed similar acne like skin eruptions, skin and nail pigmentation, eyelid swelling along with fatigue, headache, nausea and weight loss. Yushu patients also suffered from long lasting airway disorders like chronic bronchitis (cough, expectoration, dyspnoea) and neurological diseases. Respiratory distress was often exacerbated by viral or bacterial infection and persisted for more than a half year and respiratory distress improved gradually.

Another 'cooking oil' disaster occurred as an epidemic outbreak in Spain in 1981 which was the most devastating food poisoning in modern European history.[13] At that time more than 1000 people died and more than 25000 were seriously injured and many of them were permanently disabled. The initial symptoms were nausea, vomiting, flu-like fever and breathing difficulties which ultimately led to pulmonary oedema, skin rashes and muscle pain.

We are highlighting this case as transformer oil poisoning is a rare event. In our sub-continent, in ICU the most common types of poisoning cases are OPC poisoning, drug poisoning, stupefying poisoning, harpic, savlon, kerosine poisoning etc. There is no specific treatment or antidote currently available, so only supportive treatment was given. Usually, this type of poisoning does not produce any immediate adverse effects, but in our case it produced acute fatal symptoms which were managed immediately in the intensive care unit of EMCH and the life of victim was saved.

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