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Death Due to Solvent Abuse - A Case Report

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Abstract

The deliberate inhalation of solvents among children and adolescents for "Kicks" is becoming more common in our country. The particular agent abused seems to be largely a function of availability. The typical inhalant abuser is a teenage male who is attracted to solvent because of their euphoric and hallucinogenic properties and the fact that they are cheap, legal and easily obtainable.[1] It is generally regarded as a relatively harmless practice and consequently little attention had been paid to the isolation of the toxic agent from the variety of substance used.[2] It is well recognized that solvent abuse results in sudden death due to plastic bag suffocation but one such case not associated to it but has resulted in death due to aspiration is being discussed

Key words: Solvent abuse, Toluene, aspiration.

Introduction

Solvent abuse is the inhaling of solvents in some glues, aerosols, correction ink, petrol etc. to get a feeling of intoxication. Solvent abuse is more common among younger people because they use substance that is easily available. Solvent abuse is not a new problem recreational solvent abuse was recognized before of other most popular in England during the 1890. In several different areas of the world inhalant abuse is "ubiquitous and Epidemic most notably among street children living in Brazil, Cambodia, India, Mexico, Peru and Russia.[3]

Toluene is the major active component in many of the agents listed below and the agent most likely to be responsible in cases of fatal intoxication and is a lypophilic compound it binds strongly to the myelin and other lipid contains organs which is why it tends Concentrate in brain.[4] Kids knew it will give them a 'high' but do not realize it will kill them. Solvent sniffing began as an American epidemic among adolescent males in California in the 1950s and then spread to the mid western and eastern US over the next decade. Initially the solvents were thought to be relatively non toxic and sudden death seen occasionally in the abusers was attributed to the suffocation while inhaling solvent from a plastic bag. However in 1970 Bass reported 110 cases of sudden sniffing death that were not associated with plastic bag suffocation.[5]

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The goal of Post mortem drug testing is to establish as to whether the drugs were the cause or a contributing factor in death. Many fatalities are caused by accidental or deliberate drug over doses. The tasks of the Forensic Pathologist is to explain what comes under his or her jurisdiction and to determine the manner of death.[6]

Volatile substance of Abuse commonly found in Commercial products

Glues & Adhesives
Toluene
Acetone
n – Hexane
Benzene
Xylene
Trichloroethylene

Cleaning Fluid
Carbon Tetra chlorides
Benzene
Trichloroethylene
Trichlorethanol

Type writer correction fluids
Trichloroethylene
Trichlorethanol
Perchlorethylene

Refrigerants
Fluorocarbons (Ferons)

Shoe Polish
Toluene

Room Deodorizers
Amyl nitrite
Isobutyl nitrite
Butyl nitrite

Fuels
Gasoline
Aliphatic hydrocarbons
Alkyl nitrites
Ethers

Paints
Mineral spirits
Turpentine

Case Description

The deceased a native of Jharkand was pursing his 3rd semester Mechanical Engineering was residing with friends at Bangalore and was known to abuse "Erazex" (typing correcting fluid)(fig 1). On 21/10/2008 at around 8.15 p.m. was found in an unconscious state by his friends with plastic cover over his head and empty bottles of Erazex around, was immediately shifted to N.R.R. Hospital where he was declared brought dead. The body was subjected for post mortem examination at M.S. Ramaiah Medical College on 24/10/2008.

Post-mortem Findings

On external examination, dead body that of a male aged about 20 years, moderately built and nourished, measuring 5 feet 10 inches in length. Light brown in complexion. Rigor mortis well appreciated all over the body and postmortem staining purplish blue in colour, present over back of the chest and abdomen ,fixed, absent over areas of contact flattening. Eyes closed conjunctivae congested. Pupils dilated and fixed. Nail bed bluish discolored, face, neck and

upper part of the chest show intense congestion, white powdery flakes adherent at places over face and chest (fig 2). Defibrillator mark (Ring contusion) two in number present over the front of the chest. Intravenous injection mark present over the back of right hand.

Fig 1: Abused solvent and materials found along with the victim

Internal Examination show both lungs are oedamatatous. Right lung weight 590 grams. Left lung weight 640 grams. C/s exudes frothy fluid blood. Trachea contains froth and semi digest food particles. On dissection aspirated material present up to the terminal bronchioles. The walls of which are congested. Brain, Heart, liver, spleen and kidney were congested. Stomach contains

Fig 2: Vomitus present around the mouth and nostrils and white flakes of solvents seen at places over the face.

Fig 3: Aspirated food particles seen around laryngeal inlet.

variably digested rice and vegetable meal. No unusual smell mucosa normal. Bladder contains 50 ml of cloudy colour urine.

1. Brain, lung and heart sent for Histopathological examination
2. Blood urine and viscera sent for chemical analysis.

Histopathological Examination Report revealed Lung parenchyma & alveolar lumen filled with edema fluid. Alveolar septa widened and shows a few haemosiderin laden macrophages. The bronchiole shows aspirated material comprised of vegetable matter.

Impression

Chronic venous congestion of lungs, evidence of aspiration, heart, liver & brain were unremarkable.

FSL OPINION Gas chromatographic methods have responded for the presence of Toluene in stomach, Small Intestine, Liver, Kidney and Urine.
On perusal of the chemical analysis report, histopathology report and autopsy findings it was opined that " Death was due to Pulmonary Edema as a result of aspiration of gastric content in the respiratory passage consequent upon inhalation of substance containing Toluene".

Discussion

Sniffing solvents may cause intoxication similar to the effects of alcohol. So a sniffer may become drowsy. Confused aggressive and may take risks than they would when sober and so on.

Accidents are therefore quite common and some times death results, Inhalant abuse can cause death by:

- Asphyxiation from repeated inhalation which lead to high concentration of inhaled fumes displacing the available oxygen in the lungs.
- Suffocation from blocking air from entering the lungs when inhaling fumes from a plastic bag placed over the head.
- Choking from inhalation of vomit after inhalant use.
- Convulsions or Seizures caused by abnormal discharge in the brain
- Coma, Brain shuts down all but the most vital functions.[7]

There are several techniques that the solvent abusers use to increase the dose absorbed by inhalation. "sniffing" involves inhaling directly from an open container "huffing refers to inhalation through a piece of cloth soaked in solvent and held over the mouth and nose "Bagging "describes breathing vapor of from a plastic bag containing the solvent resulting in exposure to very high concentration of toxin.[6] Some of the techniques especially (Bagging") cause Hypercarbia and Hypoxia. All the volatile substances of abuse cause central Nervous depression. Research shows that Toluene produce headache, euphoria, giddy feeling and in ability to coordinate movements. Exposure to high doses can cause confusion and delirium, nausea and vomiting are other common side effects.

The case reported here that the deceased was found in an unconscious state, a plastic cover over his head and empty bottles of erazex were found. Autopsy findings revealed aspirated material up to the terminal bronchioles and their walls were congested. Histopathoplogical report shows the evidence of the aspirated food particles and hence the theory of the agonal artifact was ruled out and the chemical analysis suggestive of Toluene inhalation. The deceased has sniffed a high concentrated Toluene which is a potent central nervous depressant enters the brain rapidly suggesting a toxic effect. During re breathing the oxygen tension will fall and Carbon dioxide tension increases and the deceased may have become unconscious, nauseated, vomited and has aspirated due to a central depression of reflexes. Further, vomiting while the effects of the solvent incapacitates the victim sufficiently to prevent his reflexes from protecting or clearing his glottis or air- passages [8]

Pathophysiology

Toluene is highly lypophilic which accounts for its primary effects in the central nervous system. After crossing the Blood Brain barrier toluene has been previously thought inhibits neuronal transmission by causing a change in the membrane or membrane protein conformation. Recent research has shown that interactions with several key Brain neurotransmitters, namely: Y – Amino butyric acid (A) (GABA). A lesser degree glycine and possibly dopamine are responsible for the clinical effects seen.[9]

Epidemiological survey in Britain attributed death to direct toxic effects in 51% asphyxia in 21% and aspiration of vomitus in 18% and trauma in 1%.[10] Deaths sometimes occur from vomiting and aspiration suffocation by plastic bags, accidents, Violence or suddenly without any apparent cause. If the solvent concentration reaches the brain sufficiently high levels fatal respiratory depression could occur asphxial death from vomiting with aspiration is common. Flagon and Ives (1994) reported that aspiration was the cause of death in 20 to 30% of all solvent related deaths.

Solvent sniffing is a major social problem because young addicts can ruin their health and their future at an early age. Sudden death is a recognized hazard of volatile substance abuse. One of the manner of death due to plastic bag suffocation can be caused by vomiting causing aspiration of gastric contents in the respiratory passage. Specific postmortem features have to be identified either macroscopically or microscopically in the volatile substance abuse deaths. Toxicological analysis is hence necessary for identification of cause of death. Information about the dangers of solvent sniffing is the major important in prevention.

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