CASE REVIEW

DOI: jist.org.in/10.31736/2019v15i1/p45

Fat Sample as an Ideal Toxicological Tool in Delayed Deaths due to Pesticides

Journal Homepage: www.jist.org.in; Email: article@jist.org.in

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ARTICLE INFO

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How to Cite this Article: : Gouda HS. Fat Sample as an Ideal Toxicological Tool in Delayed Deaths due to Pesticides. Journal of Indian Society of Toxicology 2019;15(1):45-47. DOI: jist.org.in/10.31736/2019v15i1/p45

Keywords:
fat; poisoning; pesticide; organophosphate; thin layer chromatography.

Conflicts of Interest and Fundings: Nil.

Received – 9th Mar 2019
Accepted – 12th May 2019
Published – 30th Jun 2019

ABSTRACT

Determination of cause of death in fatal poisoning cases primarily depends on post-mortem findings and chemical analysis report. At times, poison may not be detected in routinely preserved viscera in cases of ingested poisoning. One of the reasons for negative chemical analysis is metabolism of the poison. However, the pesticides, especially organophosphorus compounds can also be detected in fatty tissues even in delayed deaths. But, only few literatures are available with reference to storage of pesticides in the body following acute poisoning. In this paper, a fatal case of organophosphorus poisoning is reported wherein the deceased died 9 days after the consumption and chemical analysis was negative for routine viscera, but, positive for fat tissue.

INTRODUCTION

In India, it is estimated that about 50,000 people die every year from toxic exposure and the commonest poisons involved are pesticides, sedative drugs, chemicals, alcohol, plant toxins and household poisons. [1] Organophosphates form the largest bulk of pesticide poisoning.[2] Determination of cause of death in fatal poisoning cases primarily depends on post-mortem findings and chemical analysis report. At times, poison may not be detected in routinely preserved viscera during chemical analysis in cases of ingested poisoning. One of the reasons for negative chemical analysis is metabolism of the poison which occurs when the victim dies a few days after consumption. In such cases, the cause of death can be opined considering clinical features, treatment history and postmortem findings. However, the pesticides, especially organophosphorus compounds can also be detected in fatty tissues of the body even in delayed deaths. In this paper, a case of organophosphorus poisoning is reported in which the deceased died 9 days after the consumption and chemical analysis was negative for routine viscera, but, positive for fat tissue.

CASE REPORT

A 39 year old female was referred to our hospital after six days of alleged consumption of unknown pesticide. She was initially treated at Taluka Hospital. She was referred to our hospital as she developed jerky movements of upper and lower limbs. At admission, patient was in coma with Glassgow Coma Scale Score of 3. Unfortunately, she died on the 3rd day of admission. As per the discharge summary from the Taluka Hospital, the deceased had features of organophosphorus compound poisoning and was treated accordingly. The case was booked as unnatural death under 174 Criminal Procedure Code and medico-legal autopsy was requested by the police and accordingly autopsy was conducted. Salient post-

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mortem findings were yellowish discoloration of sclera of both eyes, collection of 150 ml of pale yellow fluid in the pleural cavities, diffuse submucosal hemorrhages in the stomach and congestion of all the viscera. Right lung weighed 682 gram and left lung 578 gram. Weight of other organs was within normal limits. For chemical analysis, in addition to routine viscera (stomach and proximal part of duodenum with contents, about 500 g of liver, half of both kidneys and 100 ml of blood) and subcutaneous fat from abdominal wall was also preserved. Preservative used was sodium fluoride for blood and saturated solution of sodium chloride for other samples. As per Chemical analysis report from the Regional Forensic Science Laboratory, color test and Thin Layer Chromatographic methods of analysis have responded for the presence of Organophosphorus compound in the subcutaneous fat from abdominal wall. No poison was detected in other viscera, blood and the preservative used. In addition to the present case, pesticides were also detected in the subcutaneous fat from abdominal wall in another seven cases of poisoning. Out of these seven poisoning cases autopsied in our centre, organophosphates were detected in four cases, paraquat in three cases and carbamate in one case. However, in these cases, poisons were also detected in stomach, liver, kidney and blood.

DISCUSSION

Organophosphorus compounds are among the most popular and most widely used insecticides in India.[1] And also, these are one of the commonly used suicidal poisons in India. Organophosphorus compounds are absorbed by inhalation, through the skin, mucous membrane and the gastrointestinal tract. Metabolism occurs in the liver. Detoxification occurs via P_{450} monooxygenase. Excretion of metabolites occurs in the urine.[2] Poisoning due to organophosphorus compounds could be acute or chronic. Acute poisoning manifest as features of cholinergic excess and CNS effects in initial period. Delayed complications of acute poisoning are intermediate syndrome and delayed syndrome. Intermediate syndrome occurs one to four days after acute exposure due to prolonged cholinesterase inhibition and delayed syndrome occurs one to four weeks after acute exposure due to nerve demyelination.[1] As per Nandy A, parathion is stored in the body fat and is slowly released in the circulation, prolonging the duration of its toxic action. Parathion may be retained in the body for a period of about one week and malathion for a period of more than a week.[3] According to Taylor P, Lipid soluble organophosphorus compounds have ubiquitous effects at both peripheral and central cholinergic sites, and may be sequestered in lipids for long periods of time.[4] According to one more source of literature, certain organophosphorus are prone to get stored in fat tissue and released back into the circulation.[5] Davies JE et al reported a case wherein fat soluble organophosphorus compound (dichlofenthion) was detected in fat after 54 days. And, also they postulated that the mechanism of protracted intoxication is a slow release of dichlofenthion from adipose reservoirs.[6] Highly lipophilic carbamates also redistribute into fat stores from the extracellular fluid quickly and will have decreased clinical effects initially.[7] In the study conducted by Dale WE et al., 48 autopsy samples (non-poisoning deaths) and 56 surgical samples of body fat of Indians from different geographic areas were analysed for chlorinated insecticides. The study revealed the presence of dichlorodiphenyltrichloroethane (DDT) related compounds in significant number of samples.[8] In another study, 100 samples of human body fat, 50 autopsy (non-poisoning deaths) and 50 biopsy, were collected from a semi-rural area in south-eastern England. The specimens were analysed for the presence of organo-chlorine insecticides and the concentrations were determined. Organochlorine compounds were found in majority of the samples.[9] The results of these studies indicate that some amount of compounds are present in the fat of normal individuals. Hence, in cases of fatal poisoning, quantitative analysis of the samples (especially the fat) could be of more help rather than the qualitative analysis. In a study done to evaluate the characteristics of 39 insecticides (among those registered in Brazil for agriculture use) on tissue distribution and accumulation, it was found that fat and muscles were the main compartments tending to accumulate insecticides.[10] In cases with negative Chemical analysis report, cause of death can be opined based on post-mortem features, treatment history and histo-pathological examination. But, opinion can be made more conclusive if there is a positive chemical analysis report. Chemical analysis of fat tissue may be of help particularly in delayed death due to pesticide poisoning.

CONCLUSION

During autopsy, it is always better to obtain evidences from all possible sources to support the gross findings. This will help the autopsy surgeon to explain the court about his/ her findings in a clear way, but, also help in arriving at the cause of death especially when gross findings are obscure. Another reason for reporting this

case is to update available information about preservation of viscera in fatal poisoning cases especially in delayed deaths. In the present scenario, research is the need of the hour. Studies need to be conducted in collaboration with Forensic Science Laboratory personnel to find out suitable additional tissues for chemical analysis in delayed deaths due to consumption of poisons.

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