e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2024; 16(4); 649-652

Original Research Article

A Two-Year Assessment of Histological Changes in Liver Due to Poisoning: A Retrospective Study

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Received: 11-02-2024 / Revised: 15-03-2024 / Accepted: 27-04-2024
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Conflict of interest: Nil

Abstract

Aim: The aim of the present study was to assess histological changes in liver due to poisoning.

Material & Methods: A two-year retrospective study on assessment of histopathological changes in liver due to agricultural poisoning cases was studied amongst autopsies conducted in the Department of Forensic Medicine and Toxicology, SKMCH Muzaffarpur, Bihar India from May 2018 to April 2020. In the present study, a total of 1785 autopsies were conducted. Of the total, 500 cases with the history of poisoning were studied in that 300 cases were females and 200 cases were male.

Results: Age of the individuals varied from 7 years to 65 years amongst 51% of cases was in the age group of 25 to 35 years. Of 500 cases in 350 cases poisons were confirmed by chemical analysis of state forensic science laboratory, in that 200 cases were organo phosphorus compound, 100 cases were aluminium phosphide and zinc phosphide, 50 cases were Pyrethrin compounds and in remaining cases poison was not detected by chemical analysis. Of 500 cases, 200 were organophosphorus compound in that Congestion, sinusoidal dilatation, mononuclear and neutrophilic infiltration (Group I) were predominantly seen. 100 cases are phosphide compounds in that Cytoplasmic vacuolization, hydronic degeneration, Patchy or centrilobular necrosis and patchy haemorrhages (group II & III) were predominant. In 50 cases of Pyrethrin compound group I & II changes were predominantly, in remaining unidentified poison cases mixed feature was observed. Amongst 500 cases, 325 cases were hospitalized for 0 – 1 day. In that group I histological feature were predominantly seen, 100 cases were hospitalized for 2-5 days; in that group II changes were predominant, 75 cases were hospitalized for 5- 10 days; in that group III changes were seen.

Conclusion: By knowing the exact histopathological changes in these organs, it is easier to attribute death to a failure of one of these organs as a consequence of organophosphate consumption. Knowing the rapidity of involvement of an organ is beneficial to the treating physician as well thereby helping him reduce the morbidity and hence mortality.

Keywords: Agricultural poisons, Organophosphorus compounds, Phosphates, and Pyrethrin.

Introduction

Organophosphates constitute a heterogeneous category of chemicals specifically designed for the control of pests, weeds or plant diseases. Their application is still the most effective and accepted means for the protection of plants from pests, and has contributed significantly to enhance agricultural 1 productivity and crop yields. [1]

Acute poisoning by Pesticide compounds is a major global clinical problem, with thousands of deaths occurring every year. Most of these pesticide poisoning and subsequent deaths occur following an intentional self-ingestion of the poison. [2] The potential adverse impact on human health from pesticides exposure is likely to be higher due to easy availability of highly hazardous products. In developing countries like India major source of human poisoning is through agricultural poisons. The problem is getting worse with time as newer drugs and chemicals are developed in vast numbers. The commonest pesticides agents in India appear to be organophosphates, carbamates, pyrethroids and aluminium/zinc phosphide. [3] Most of the pesticide poisoning and subsequent deaths occur in developing countries following a deliberate self-ingestion of the poison. It is roughly estimated in India that 5 to 6 people per lakh population die due to poisoning every year and the most common cause of poisoning in India and other developing countries is organophosphorus compounds. [4] After ingestion, most of the poisons are rapidly absorbed throughout the gastrointestinal tract and it is carried

to the liver by the portal vein for metabolism and excretion. It is known that most of the compounds are toxic to liver can cause liver dysfunction. [5]

Respiratory failure is the most common complication of OP poisoning leading to death. In most of the cases death may occur immediately due to respiratory centre and muscle paralysis after consuming poison or may be delayed for days or weeks together. Delayed causes of death may be due to ARDS, respiratory paresis, liver failure and renal failure. In the latter cases the determination of exact cause of death may be difficult as external appearance may not give any clue and the internal examination may sometimes not reveal anything much on gross examination. [6] Histopathological examination can reveal such pathologies in major organs like lungs, liver and kidneys where the poison acts, gets absorbed and is finally eliminated. Hence a study was conducted to assess histological changes in liver due to poisoning.

Material & Methods

A two-year retrospective study on assessment of histopathological changes in liver due to agricultural poisoning cases was studied amongst autopsies conducted in the Department of Forensic Medicine and Toxicology, SKMCH Muzaffarpur, Bihar India from May 2018 to April 2020. In the present study, a total of 1785 autopsies were conducted. Of the total, 500 cases with the history of poisoning were studied in that 300 cases were females and 200 cases

Exclusion Criteria

In the present study decomposed bodies, death due to other disease condition and cases with the history of chronic alcohol intake, hepatitis, poisoning due to other

Methodology

A detailed history was taken from inquest report and from relatives in all cases type of exposure, manner of death and treatment history were taken from hospital case records. Further, type of poison was confirmed by toxicological evaluation reports. During Autopsy detailed internal and external examinations were done and random portion of Liver were collected for histological examination and fixed in 10% formalin and stained with Haematoxylin and eosin and the findings recorded. Histological features were grouped based on degree of damage to hepatic tissue.

Results

Table 1: Number of cases with particular age groups

Age group	No of cases
7 -25 years	140
25 -35 years	255
35 – 65 years	105

Age of the individuals varied from 7 years to 65 years amongst 51% of cases was in the age group of 25 to 35 years.

Table 2: Number of cases detected by chemical analysis

Type of poison detected bychemical analysis	No of cases
Organ phosphorus compounds	200
Aluminum and zinc phosphates	100
Pyrethrin compounds	50
Unknown / not detected by chemical analysis	150

Of 500 cases in 350 cases poisons were confirmed by chemical analysis of state forensic science laboratory, in that 200 cases were organophosphorus compound, 100 cases were aluminium phosphide and zinc phosphide, 50 cases were Pyrethrin compounds and in remaining cases poison was not detected by chemical analysis.

Table 3: Histological classification

Histological classification	Histological features
Group I	Congestion, sinusoidal dilatation, mononuclear and neutrophilic infiltration.
Group II	Nuclear fragmentation, Cytoplasmic vacuolization and hydropic degeneration.
Group III	Patchy or Centrilobular necrosis and patchy hemorrhages

Histological changes in liver were classified based on the degree of damage to hepatic tissue caused by agricultural poisonous substance were grouped into I, II & III. Group I include Congestion, sinusoidal dilatation, mononuclear and neutrophilic infiltration, group II include Cytoplasmic vacuolization and hydronic degeneration, group III include Patchy or centrilobular necrosis and patchy haemorrhages.

Table 4: Types of poisons detected by chemical analysis and there histological changes

Type of poison detected by chemicalanalysis	No ofcases	Histologicalchanges noted
Organ phosphorus compounds	200	Group I
Aluminum and zinc phosphates	100	Group II & III
Pyrethrin compounds	50	Group I, II
Unknown / not detected by chemicalanalysis	150	roup I, II& III

Of 500 cases, 200 were organophosphorus compound in that Congestion, sinusoidal dilatation, mononuclear and neutrophilic infiltration (Group I) were predominantly seen. 100 cases are phosphide compounds in that Cytoplasmic vacuolization, hydronic degeneration, Patchy or centrilobular necrosis and patchy haemorrhages (group II & III) were predominant. In 50 cases of Pyrethrin compound group I & II changes were predominantly, in remaining unidentified poison cases mixed feature was observed.

Table 5: Number of days treated and there histological changes

No of cases	No of daystreated	Histological changes (> 90%)
325	0-1 days	Group I
100	2- 5 days	Group II
75	5- 10 days	Group III

Amongst 500 cases, 325 cases were hospitalized for 0 – 1 day. In that group I histological feature were predominantly seen, 100 cases were hospitalized for 2-5 days; in that group II changes were predominant, 75 cases were hospitalized for 5- 10 days; in that group III changes were seen.

Discussion

It has been estimated that pesticides were directly or indirectly is responsible for more than 1 million illnesses worldwide annually, and this figure could be just the tip of the iceberg since most cases of poisoning actually go unreported, due to Inadequate Poison Information Centres, Forensic laboratories, and lack of knowledge in utilizing the pesticides, toxicological studies. [1] In developing countries like India major source of human poisoning is through agricultural poisons. The problem is getting worse with time as newer drugs and chemicals are developed in vast numbers. The commonest pesticides agents in India appear to be organophosphates, carbamates, pyrethroids and aluminium/zinc phosphide.

Of the total, 500 cases with the history of poisoning were studied in that 300 cases were females and 200 cases were male. This is comparable with other studies, and shows that married persons may become victims of greater stress than single individuals in their day-to-day lives. The different causes of the stress culminating in poisoning ranged widely from marital and family discords to financial and job related problems to educational and other matters. [7] Age of the individuals varied from 7 years to 65 years amongst 51% of cases was in the age group of 25 to 35 years. Of 500 cases in 350 cases poisons were confirmed by chemical analysis of state forensic science laboratory, in that 200 cases were organophosphorus compound, 100 cases were aluminium phosphide and zinc phosphide, 50 cases were Pyrethrin compounds and in remaining cases poison was not detected by chemical analysis. Suicide was the most common mode of poisoning in this study. Among agricultural poisons organo-phosphorus compound was the most common type of poison consumed. Studies from other regions from India have also reported organophosphates as common causes of poisoning due to easy availability in the market leads to more number of poisoning cases. [1] In most cases poisonous compound was undetected due to prolonged treatment, poisons were metabolized and excreted from the body, and lack of collecting stomach wash contents at casualty makes most of the poisons undetected.

Liver is the organ where bio-activation and detoxification of poisonous compounds takes place. However, many studies have been conducted in past on animals and humans to assess the effect of different types of pesticides on the histology of cells and tissues. In present study we found several histopathological changes in victims of fatal pesticide poisoning and the findings were grouped based on degree of damage to the liver tissue. Of 500 cases, 200 were organophosphorus compound in that Congestion, sinusoidal dilatation, mononuclear and neutrophilic infiltration (Group I) were predominantly seen. 100 cases are phosphide

compounds in that Cytoplasmic vacuolization, hydronic degeneration, Patchy or centrilobular necrosis and patchy haemorrhages (group II & III) were predominant. In 50 cases of Pyrethrin compound group I & II changes were predominantly, in remaining unidentified poison cases mixed feature was observed. Amongst 500 cases, 325 cases were hospitalized for 0 – 1 day. In that group I histological feature were predominantly seen, 100 cases were hospitalized for 2-5 days; in that group II changes were predominant, 75 cases were hospitalized for 5- 10 days; in that group III changes were seen.

Organophosphates act as irreversible cholinesterase inhibitors. The inhibition of cholinesterase activity leads to the accumulation of acetylcholine at synapses, causing overstimulation and subsequent disruption of transmission in both the central and peripheral nervous systems. [8] This leads to hyper secretion and paralysis of respiratory muscles. Liver is the organ where bio activation and detoxification of OP compounds takes place. Group 2 and 3 changes were predominant in phosphates and Pyrethrin compound poisoning due to direct action of poison in liver leads to inhibition of cytochrome C oxidase and subsequent generation of reactive oxygen species causes hydronic degeneration and Centrilobular necrosis. [9] In a study conducted by M Kumar et al [10] on pesticide poisoning, common microscopic finding were portal and sinusoidal congestion (60%), micro vacuolization (52%), hydronic degeneration (44%) and mononuclear infiltration (48%), micro & macro-vesicular steatosis (44%). Interesting feature observed in the present study was the histological changes in the liver vary based on duration of treatment in most of the group I changes were predominant amongst cases were treated less than one day, group II were predominant if they treated up to five days, if more than five days group III were predominant.

Conclusion

In the present study organophosphorus compound was most commonly used and female victims in middle age group were predominant and the histopathological findings were grouped based on the degree of damage to the hepatic tissue and there incidence were identified based on type of agricultural poison and duration of treatment. Group I histological changes were predominantly seen among organophosphorus compound and the persons who are treated less than one day, group II &III changes were predominant among phosphates, Pyrethrin compounds and the persons who were treated more than two to five days.

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