

# Innovations

## Histopathological Changes in Liver, Kidney, Lungs, and Heart Due to Agricultural Poisons

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**Abstract:** *Poisoning is a significant global public health problem and the third leading cause of death worldwide after road traffic accidents and fire arm injury. According to WHO, in 2012 an estimated 193,460 people died worldwide from unintentional poisoning. Of these 84% occurred in developing countries. The incidence of poisoning in India is among the highest in the world. It is estimated that more than 50,000 people die every year from toxic exposure. **Objective:** To determine and associate the histopathological changes in liver, kidney, lungs and heart associated with agriculture poisons. **Material and Methods:** This is a cross-sectional study conducted among poisoning cases were brought to R.L. Jalappa hospital mortuary, Kolar. Institutional central ethical clearance was obtained. The cases were brought to the mortuary for medico-legal autopsy, out of which, death resulting from either suicidal, homicidal or accidental poisoning were identified and selected for this study. **Results:** The present study included 32 cases in the age group of 20-60 years with the mean age of 44 years. The most common poison used was organophosphorus compound. Histopathological changes in visceral organs were studied and the most common changes were centrilobular necrosis, sinusoidal dilation and congestion in liver, acute tubular necrosis in kidney and pulmonary congestion and oedema in lungs. **Conclusion:** Histopathological changes in major organs where poison acts, either by absorption or eliminated may be helpful in deciphering the cause of death based on the organ failure.*

**Key Words:** *Histopathological changes, agricultural poisons, liver, kidney, heart and lungs.*

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**Introduction:** Poisoning was a significant global public health problem and the third leading cause of death worldwide after road traffic accidents and fire arm injury. According to WHO data, in 2012 an estimated 193,460 people died worldwide from unintentional poisoning. Of these deaths, 84% occurred in developing countries. The incidence of poisoning in India was among the highest in the world. It was estimated that more than 50,000 people died every year from toxic exposure. According to the National Poisons Information Centre, New Delhi, analysis of poisoning calls showed that the highest incidence of poisoning was due to household agents (44.1%) followed by drugs (18.8%), agricultural pesticides (12.8%), industrial chemicals

(8.9%), animals bites and stings (4.7%), plants (1.7%), unknown (2.9%) and miscellaneous groups (5.6%). **(1)** The commonest cause of poisoning in developing countries was pesticides which includes organophosphates, carbamates, chlorinated hydrocarbons, pyrethroids and aluminum or zinc phosphide. The reason behind this upsurge was the agriculture-based economics, poverty, unsafe practices, illiteracy, ignorance and easy availability of highly toxic pesticides. Majority of victims of poisoning were from lower socio-economic status. **(2)** In developing countries like India major source of human poisoning was through agricultural poisons. **(3)** Most common route of administration was ingestion. After ingestion, most of the poisons are rapidly absorbed throughout the gastrointestinal tract and it was carried to the liver by the portal vein for metabolism and excreted through renal system. It was known that most of the compounds which were toxic to liver can cause liver and renal dysfunction. **(4)** With the help of histopathological changes and the clinical symptoms the probable cause of death could be delineated, but the final report will be based on the toxicological report. **(5)** However, there were limited studies about the gross and histopathological changes in liver in autopsy. Hence, we are conducting the present study in the Kolar district where the burden of agricultural poisoning is more and limited data is available regarding the histopathological changes in liver, heart, lungs, and kidneys due to agricultural poisons.

**Objectives:**

1. To determine the spectrum of poisons used for suicide, homicide and accidental.
2. To determine the histopathological changes in liver, kidney, lungs and heart.

**Materials and Methods:** This was a prospective study conducted among victims of suicidal, homicidal and accidental poisoning which were brought to R.L.Jalappa hospital mortuary, Kolar. Institutional central ethical clearance was taken. The cases were brought to the mortuary for medico-legal autopsy, out of which, death resulting from either suicidal, homicidal or accidental poisoning were identified and selected for this study.

**Inclusion criteria:**

All the cases brought with suicidal, homicidal and accidental poisoning were included.

**Exclusion criteria:**

1. Deceased who had consumed poison along with alcohol.
2. Deceased who were chronic alcoholics.
3. Deceased with history suggestive of chronic liver disease.
4. Deceased with history of chronic renal failure.

The cases which fulfilled above criteria were included in the study. A detailed history was taken from inquest report and relatives in all types of poison cases, type of exposure, manner of death and treatment history was taken from the hospital records. During autopsy the external and internal post-mortem changes were recorded. Viscera were collected, packed and sealed along with sample seal sent to the forensic science laboratory for chemical analysis. Random portion of liver, heart, brain, lungs and kidneys was collected for histopathological examination and was fixed in 10% neutral buffered formalin. Tissue sections were stained with hematoxylin and eosin stain and the findings were tabulated.

**Analysis and Statistical Methods:** Data was entered into Microsoft excel data sheet and was analyzed using SPSS 22 version software. The categorical data was represented in the form of frequencies and proportions.

**Results:** This study included total 32 cases, out of which males were 19 (59.3%) in number were 13 (40.6%) were females, in the age group of 20 to 60 years with mean age of 44 years. Males were more affected compared to females in both type of poisoning with male to female ratio of 1.4:1. Organophosphorus poisoning was the most common type followed by phosphide. About 65.5% succumbed to death due to organophosphorus poisoning and 34.3% due to phosphide poisoning.

**Table: 01 Histopathological changes in relation to type of poison**

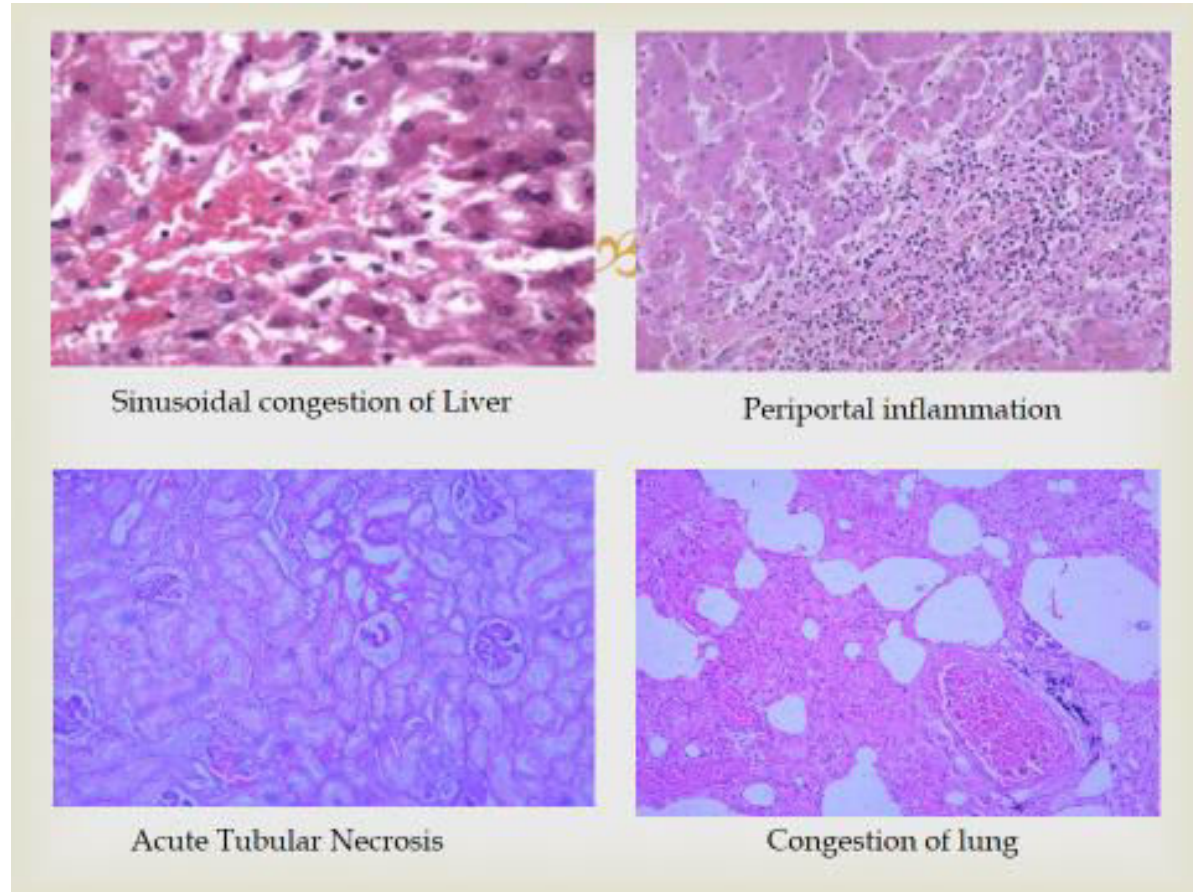
Chemical analysis report	No: cases	Histopathological changes			
		Liver	Kidney	Lung	Heart
Organophosphorus poisoning	21	Sinusoidal dilatation,centrilobular necrosis,fatty changes and congestion	Acute tubular necrosis	Congestion,emphysematous changes,pulmonary edema,brochopneumonia,carbon particles carbon laden macrophages and congestion of blood vessels	Normal
Phosphide	11	Centrilobular necrosis	Acute tubular necrosis	Congestion	Normal

Table 01: depicts the histopathological changes in vital organs like liver, lung, kidney and heart among agricultural poisoning cases. Liver demonstrated congestion in 11(52.3%) cases, fatty changes in 5(23.8%) cases, sinusoidal dilatation in 3(14.38%) cases and centrilobular necrosis in 2(9.52%) cases. Whereas among phosphide poisoning the only finding was centrilobular necrosis. Kidney showed acute tubular necrosis and congestion in most of the cases of OP poisoning and phosphide cases. Congestion of the lungs was predominantly, observed in all cases along with this there were other associated features like emphysematous changes and pulmonary edema and congestion of blood vessels, whereas only congestion was seen in phosphide. No histopathological changes were seen in the heart in any of the cases.

**Table 02: Shows number of day's treated and histopathological changes**

No of cases	No of days treated	Histopathological changes in liver (>90%)	Histopathological changes in Kidney (>90%)	Histopathological changes in lungs (>90%)	Histopathological changes in Heart (>90%)
08	Brought dead	Fatty changes, congestion, sinusoidal dilation	Acute tubular necrosis with congestion	Emphysematous changes ,carbon particles and carbon laden macrophages, bronchopneumonia	Normal
11	Less than 12 hours	Congestion with mild periportal infiltration of lymphocytes	Acute tubular necrosis	Pulmonary edema	Congestion with ventricular hypertrophy
13	2-5 days	Centrilobular necrosis	Acute tubular necrosis	Pulmonary edema and pulmonary hemorrhage	Normal

Table: 02 depicts histopathological changes in liver, kidney, lung and heart with number of days of survival. Out of 32 cases, 08 cases were brought dead and histopathological changes observed were congestion, fatty changes and sinusoidal dilation in liver, acute tubular necrosis and congestion in kidney, emphysematous changes and pneumonitis in lungs. 11 cases who died less than 24 hours after consumption of poison, showed congestion with periportal infiltration of lymphocytes in liver, acute tubular necrosis in kidney, pulmonary edema in lungs, congestion with ventricular hypertrophy in heart. Those who succumbed to death in 2 to 5 days after consumption of poison showed centrilobular necrosis in liver, acute tubular necrosis in kidney, pulmonary edema and pulmonary hemorrhage. Histopathological changes in liver, kidney and lung.



**Discussion:** The present study was conducted to understand the histopathological changes in vital organs among cases of various agricultural poisoning. The most common type of poison ingested was organophosphorus compound followed by phosphide. In the present study ingestion of Organo Phosphorus compound with suicidal intention was more common among males compared to females and this is in similar lines with Viswanathan et al (9) contrary to the study of Balasubramanian et al (4) where females outnumbered males. The average age of cases who ingested agricultural poisoning was 44 years which is similar to the study of Shareef et al. (10) Table 01 depicts the histopathological changes in vital organs like liver, lung, kidney and heart among agricultural poisoning cases. Liver demonstrated congestion in 52% cases, fatty changes in 21% cases, sinusoidal dilatation in 14% cases and centrilobular necrosis in 9% cases.

Whereas among phosphide poisoning the only finding was centrilobular necrosis, the findings were similar to the study of Kundal et al (8). The most common histopathological changes in kidney was acute tubular necrosis. Similar changes were observed by Waghmare et al in 2014 with tubular necrosis seen in 36.36% of cases. The present study the incidence of tubular necrosis was 82%. Therefore histopathological changes in the kidney were mainly acute kidney injury changes which provide a vital clue as to the cause of death of poisoning. (3, 11) The most common histopathological finding in lung were congestion, pulmonary edema and emphysematous changes. The findings of this study were comparable to the lung changes seen by Jagadish et al (12). Poison and toxin which are released during metabolism and hemolysis results in organ failure as a consequence of ARDS in lungs, Centrilobular necrosis in the liver and acute tubular necrosis of the kidneys were other findings. Release of cytokines such as activated macrophages and activated neutrophils results in formation of hyaline membrane resulting in a stiff lung

**Conclusion:** The present study was mainly concentrated on the histopathological findings in vital organs (liver, lung, kidney and heart). It was noticed that histopathological examination showed effect of poison ingested. The liver is the main organ for detoxification of poison and the kidneys are the main organ to excrete. The fact was evident from the congestion, centrilobular necrosis and fatty infiltration in the liver. Kidney showed acute tubular necrosis and lungs showed congestion and features of ARDS. This study will help clear the findings among autopsy surgeons to give the final cause of death. A clear and specific opinion on cause of death can be given based on the histopathological changes. In cases showing features of Adult Respiratory Distress Syndrome, death can be attributed to respiratory failure and in cases showing Acute Tubular Necrosis the cause of death can be opined as acute kidney injury.

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