

FACTORS INFLUENCING THE POSTMORTEM DIAGNOSIS OF POISONING

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ABSTRACT

Background: Postmortem diagnosis of poisoning is one of the biggest challenges faced by the autopsy conducting medical officer in day to-day medico-legal practice. A number of factors have been implicated which influence the vividness of post mortem findings.

Aim of the study: To evaluate the various factors that determine the post mortem findings thus influencing the diagnosis of poisoning during post mortem examination.

Materials and methods: A Total of 388 cases of deaths due to poisoning subjected to medico legal autopsy during the stipulated time period of 3 years were studied based on information in the documents (Hospital records, Inquest report and Dead body chalan) and the facts incorporated in the respective autopsy reports especially the positive findings suggestive of poisoning.

Results: Out of 388 cases, 65.46% cases were insecticidal deaths, 9.02% cases due to Zinc phosphide, 7.47% cases due to alcoholic intoxication, 4.38% and 3.09% due to glycosides and medicinal drugs respectively. In 7.21% cases the type of toxic agent could not be ascertained. Positive post mortem findings of poisoning was found in 77.16% cases of insecticide, 77.14% zinc phosphide poisoning and 62.06%, 41.17%, 40% and 33.33% deaths caused by alcohol, glycosides, corrosives and medicinal drugs respectively. Even after hospital treatment positive post mortem findings corroborative of poisoning was detected in 42.51% cases of death due to insecticide and 42.85% cases of zinc phosphide poisoning. But in corrosive poisoning it was 80%. In 75% cases characteristic odour of the poison was found in the organs of the deceased where the survival time was less than 12 hours. The probability and intensity of the characteristic odour of poison in the viscera of the deceased gradually declined to 46.15%, 32.72% and 26.19% cases with increasing survival time from 12 hours to 1 day, 1 to 2 days and 2 to 3 days respectively. After 3 days characteristic smell of poison was not found in a single case. The probability of detection of the poison during chemical analysis of viscera of the deceased declined from 97.2% with less than one day survival to 33.4% when survival time was more than 14 days.

Conclusion: Post mortem diagnosis of deaths due to poisoning is influenced by factors like hospital treatment, positive external and internal post mortem findings, survival time and viscera analysis report.

Keywords: autopsy; diagnosis; death; poison; viscera.

APPLY TO ALL CITATIONS

Everyday around the world almost 700 people die of poisoning and several thousands more are affected by poisoning. It has been estimated that about 5-6 persons per lakh of population die due to poisoning every year^[1]. Due to rapid development in science and technology and vast growth in the Industrial and agricultural sector, the incidence of poisoning is spreading like a wild fire. A number of chemical substances, which are, developed to save the agriculture products from rodents and pests,

so as to protect the human beings from starvation, are in fact, themselves proving to be man-eaters^[2]. Postmortem diagnosis of poisoning is one of the biggest challenges faced by the autopsy conducting medical officer in day to-day medico-legal practice. Moreover, early and precise opinion is usually sought by the investigating officers for quick disposal of cases and delivery of justice. In every case of poisoning death, it is the job of the toxicologist to determine exact causes of death by analysis of postmortem remains^[3]. After death the positive proof of poison rests

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in detection of poison in the samples at the Forensic Science Laboratory. Negative report shall always be supplemented with clinical/ postmortem findings and circumstantial evidences^[4]. Toxic effect of the poison on the body is demonstrated by identifying toxic substances or its byproduct through chemical analysis in the tissues or body fluids^[5]. It is often seen that some poisoning deaths may mimic features similar to a disease process where careful examination and interpretation of post mortem findings becomes very important. A number of factors have been implicated which influence the validity of post mortem findings. The objective of this study is to evaluate the various factors that determine the post mortem findings thus influencing the diagnosis of poisoning during post mortem examination.

MATERIALS AND METHODS

This cross-sectional study was conducted in the department of Forensic Medicine, at Berhampur in Odisha, India, during a span of 3 years from 01-01-2014 to 31-12-2016. A total 445 deaths due to poisoning were subjected to medico legal autopsy during the stipulated time period of 3 years. Out of 445 cases of poisoning, we have excluded cases (n=57) with unclear records, deaths due to snake bite and other animal bites and cases where the entry of poison was other than the oral route. The remaining 388 cases was chosen as the study sample. Ethical approval was obtained from Institutional ethical Committee. The study is based on information in the documents (Hospital records, Inquest report and Dead body chalan) submitted by the investigating police at the time of autopsy of the dead bodies and the facts incorporated in the respective autopsy reports especially the positive findings suggestive of poisoning. Positive external post mortem findings include a history of ingestion of poison, characteristic external post mortem findings like odour of poison, froth or secretion from mouth/nosstrils, staining, sub-conjunctival haemorrhage and corrosion around oral cavity. Positive Internal findings like characteristic smell of poison in the organs, ulceration/softening/perforation or excoriation of gastric and/or intestinal mucosa, haemorrhage in the vital organs like lungs, liver and heart, and features of acute tubular necrosis of kidney were noted. Also, detailed information regarding the circumstance of the death, type of poison, nature of poison, treatment with gastric lavage and administration of antidotes, survival time from point of ingestion of poison, viscera examination, and mode of

poison administration was also sought from the police, victim's relatives and friends. The data collected was compiled using EpiData version 3.1. Frequency and mean was analysed using statistical package SPSS v.24 (2016). This study is in accordance with ICMR ethical guidelines and is approved by our Institutional ethical Committee.

RESULTS

Out of 388 cases of deaths subjected to autopsy during the 3 year study period 254 cases were due to insecticides followed by rat poison, i.e. zinc phosphide in 35 cases. Deaths due to alcoholic intoxication were found in 29 cases. Deaths due to glycosides and medicinal drugs accounted for 17 and 12 cases respectively. In 28 cases the type of toxic agent could not be ascertained.(Table-1). In 197 cases of insecticide and 27 zinc phosphide poisoning deaths, positive post mortem findings corroborative of poisoning was detected. In cases of deaths caused by alcohol, glycosides, corrosives and medicinal drugs, positive postmortem findings of poisoning were observed in 18, 07, 02 and 04 cases respectively. Characteristic post mortem findings were found in 12 cases of unknown poisoning deaths. However, in deaths caused by kerosene and copper sulphate poisoning, only one case each was found to have positive post mortem findings.(Table-2). In 108 cases of death due to insecticide and 15 cases of zinc phosphide poisoning, positive post mortem findings corroborative of poisoning was detected even after hospital treatment. However, in deaths due to alcohol, glycosides and medicinal drugs, after hospital treatment the post mortem findings reduced to 10, 03 and 02 cases respectively. But in corrosive poisoning it was very high with 4 out of 5 cases showing positive findings of poisoning.(Table-3). Characteristic odour of the poison was found upto 3 days following ingestion of the poison. Hence, cases brought for autopsy after 3 days were not considered for studying the relationship of survival time with respect to presence of characteristic odour in the viscera of the deceased. Out of total 356 such cases which were brought within 3 days, it was observed that in 48 cases characteristic odour of the poison was found in the viscera of the deceased where the victim survived for less than 12 hours following ingestion of the poison. The probability and intensity of the characteristic odour of poison in the viscera of the deceased gradually declined to 90, 18 and 11 cases with increasing survival time from 12 hours to 1 day, 1 to 2 days and 2 to 3 days respectively. (Table-4). Similarly, the probability of detection of the poison during chemical analysis of viscera of the

deceased declined from 97.2% with less than one day survival to 33.4% when survival time was more than 14 days. (Figure-1).

DISCUSSION

Figure 1 Chemical analysis of viscera in relation to survival Period

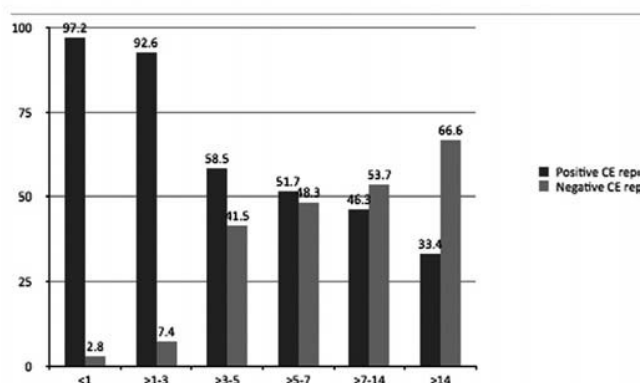


Table 1: Distribution of reported cases according to the types of toxic agents.

Name of Poison	Number of Cases	Percentage
Insecticides	254	65.46
Zinc phosphide	35	09.02
Alcohol	29	07.47
Glycosides	17	04.38
Medicinal drugs	12	03.09
Corrosives	5	01.28
Kerosene	4	01.03
Copper sulphate	4	01.03
Unknown	28	07.21
Total	388	100

Postmortem diagnosis of poisoning cases basically depends upon history, Hospital records, postmortem findings and detection of toxic substance in the body fluid and or viscera. Out of those except history, all the above-mentioned variables vary with the survival time of the person after consumption of the poison [3]. In

Table 2: Distribution of cases according to the types of toxic agents which showed Positive postmortem findings.

Name Of Poison	Number of Cases with positive features of poisoning	Percentage
Insecticides	196/254	77.16
Zinc phosphide	27/35	77.14
Alcohol	18/29	62.06
Glycosides	7/17	41.17
Medicinal drugs	4/12	33.33
Corrosives	2/5	40.00
Kerosene	1/4	25.00
Copper sulphate	1/4	25.00
Unknown	12/28	42.85
Total	268/388	69.07

addition, in this study we have found that the presence of positive post mortem findings during autopsy is influenced by the type of poison and hospital treatment. Out of 388 cases, it was found that 65.46% cases were insecticidal deaths followed by deaths caused by Zinc phosphide in 9.02% cases. Deaths due to alcoholic intoxication were found in 7.47% cases. Deaths due to glycosides and medicinal drugs accounted for 4.38% and 3.09% cases respectively. In 7.21% cases the type of toxic agent could not be ascertained. Our findings were similar with findings of Senanayake N et al [6], Murari A et al [7], Elif D et al [8] and Dash SK et al [9]. But the study in other countries by Leveridge YR [10] & Hansen AC [11] showed medicinal drugs as common agent causing poisoning deaths. This can be explained by the fact that use of agricultural poisons in this part of the world is rampant of which insecticides and rodenticides are widely used and easily available at chief price. Moreover, there is lack of enforcement of stringent legislations meant for storage, distribution and sale of these toxic agents. In the present study positive post mortem findings of poisoning was found in 77.16% cases of insecticide and 77.14% zinc phosphide poisoning deaths. In cases of deaths caused by alcohol, glycosides, corrosives and medicinal drugs, positive postmortem findings of poisoning were observed in 62.06%, 41.17%,

Table 3: Distribution of fatal cases with positive postmortem findings subsequent to Hospital admission.

Name Of Poison	Number of Cases with positive features of poisoning	Percentage
Insecticides	108/254	42.51
Zinc phosphide	15/35	42.85
Alcohol	10/29	34.48
Glycosides	3/17	17.64
Medicinal drugs	2/12	16.66
Corrosives	4/5	80.00
Kerosene	1/4	25.00
Copper sulphate	1/4	25.00
Unknown	10/28	35.71
Total	154/388	39.69

40% and 33.33% cases respectively. Characteristic post mortem findings were found in 42.85% cases of unknown poisoning deaths and 25% deaths caused by kerosene and copper sulphate poisoning. Our findings are consistent with findings of Pillay VV [12] and other authors [13,14]. This may be attributed to the fact that insecticides and zinc phosphide are highly irritant and potent toxic agents with ability to cause maximum lethality. Moreover, these agents are rapidly absorbed into the circulation and widely distributed in the body tissues. In our study, 42.51% cases of death due to insecticide and 42.85% cases of zinc phosphide poisoning, positive post mortem findings corroborative of poisoning was detected even after hospital treatment. However, in deaths due to alcohol, glycosides and medicinal drugs, after hospital treatment the post mortem findings reduced to 34.48%, 17.64% and 16.66% cases respectively. But in corrosive poisoning it was very high with 80% cases showing positive findings of poisoning. In a study by Kwong et al [15] on organophosphorus poisoning patients who receive treatment promptly usually recover from acute toxicity but may suffer from neurologic sequelae. The higher probability of detection of positive post mortem findings with treatment in insecticides and zinc phosphide poisoning compared to other agents may be linked to enzyme mediated metabolism in the body tissues and

Table 4: The duration of post-mortem detection of odour (characteristic of poisons in stomach contents).

Survival time	Number of cases	Characteristic odour present	percentage
<12 Hours	64	48	75.00
>12Hours - 1 Day	195	90	46.15
>1-2days	55	18	32.72
>2-3 days	42	11	26.19
Total	356	167	46.91

their competitive inhibition by antidotes at the target receptor sites which is a slow process. Moreover, at times the damage to the tissues in these cases are irreversible. Whereas, in agents like alcohol, glycosides and medicinal drugs, antidote administration coupled with gut lavage helps effective wiping out of both absorbed and unabsorbed poison from the body, thus reducing the post mortem findings to a larger extent. But corrosive poisons having predominant local effect on tissues continue to manifest the signs even after administration of hospital treatment for a long time. In this study, out of total 356 cases which were brought within 3 days after ingestion of poison, in 75% cases characteristic odour of the poison was found in the viscera of the deceased where the victim survived for less than 12 hours following ingestion of the poison. The probability and intensity of the characteristic odour of poison in the viscera of the deceased gradually declined to 46.15%, 32.72% and 26.19% cases with increasing survival time from 12 hours to 1 day, 1 to 2 days and 2 to 3 days respectively. After 3 days characteristic smell of poison was not found in a single case. Mohanty et al [4] and Nandedkar SB et al. also detected similar findings with respect to kerosene odour in the stomach. In another study by Datir SB et al [16,17] conducted on acute poisoning, kerosene like smell in the stomach was detected in 83.93% cases. The chemical examiner's report for viscera in relation to survival time, it was seen that in maximum number of cases chemical analysis report showed positive for a poison within first three days of survival. Thereafter, if the person survived for more than 3 days, chance of detection of poison in viscera gets reduced to almost 60%. And after 5 days it is almost 50%. The probability of detection of the poison during chemical analysis of viscera of the deceased declined from 97.2%

with less than one day survival to 33.4% when survival time was more than 14 days. Similar result was found in another study by Mohanty et al [3]. This may be because during the period of survival, the poison is excreted or is completely metabolized to a byproduct that is no longer demonstrable during analysis ^[5].

CONCLUSION

Post mortem diagnosis of deaths due to poisoning is not easy when the survival time is beyond 3 days as a number of factors influence the post mortem findings. Therefore, a detail history of circumstances of poisoning, history of hospital treatment especially administration of antidotes and stomach wash coupled with positive external and internal post mortem findings and careful interpretation of viscera analysis report is advisable, more so in delayed deaths.

LIMITATIONS OF STUDY

1. The study is confined within a particular geographical area.
2. Out of 388 cases of poisoning deaths, in 165 cases the police produced the chemical analysis report for final diagnosis at the time of collection of data.

Conflicts of interest & funding:

Declared none.

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