

# Poisoning deaths at a Medical college in Rural Area of Northern India: A Five-year Retrospective Autopsy-based Study

Vipan Bhandari<sup>1</sup>, Nitin Malik<sup>2</sup>, Kanika Kohli<sup>3</sup>, K.K Aggarwal<sup>4</sup>

<sup>1</sup>ASMO Civil Hospital Ambala Cantt., Haryana, India, <sup>2</sup>Junior Resident, <sup>3</sup>Professor, <sup>4</sup>Professor & Head, Department of Forensic Medicine and Toxicology, Maharishi Markandeshwar Institute of Medical Sciences And Research, Mullana (Ambala), Haryana, India.

**How to cite this article:** Vipan Bhandari, Nitin Malik, Kanika Kohli et. al. Poisoning deaths at a Medical college in Rural Area of Northern India: A Five-year Retrospective Autopsy-based Study. Indian Journal of Forensic Medicine and Toxicology/Volume 19 No. 4, October-December 2025.

## Abstract

One of the most important issues facing public health is mortality after acute poisoning. The current study intends to evaluate the trends in poisoning-related deaths in a tertiary care facility and investigate the results of autopsies on these deaths. This retrospective study, which is based on autopsies, was carried out with institutional ethical committee approval. Version 20 of the SPSS software was used to evaluate and analyze descriptive data in order to investigate the distribution of cases among various age groups, genders, and toxic chemical kinds. A total of 94 cases were recorded. The majority were young adults of 21-30 years (36.2%). Males were predominantly involved (58.5%). A majority (91.5%) were living in the rural areas. Most of the patients were hospitalized (72.3%). 98.9% of the dead bodies showed no sign of decomposition but showed signs of cyanosis. Congested gastric mucosa was seen in 37.2% of the cases. Also, 37.2% of the cases showed congested gastric mucosa with a garlicky smell. In most cases, the poisonous compound was aluminum phosphide (70.2%). Suicidal deaths contributed to the higher frequency of the cases (91.5%). The findings imply that recommendations for the proper handling, storage, transportation, and selling of poisonous compounds should be defined while taking into account the groups of young teenagers without considering their sexual orientation.

**Keywords:** Acute poisoning, organophosphates, Aluminium Phosphide, Autopsy.

## Introduction

Worldwide, poisoning, whether deliberate or unintentional, increases mortality and morbidity. Within a certain area, depending on several factors like the population's socioeconomic status, the availability of various poisons, and cultural and religious influences. One of the top three causes of

mortality worldwide is suicide. Intentionally taking poisons or overdosing on drugs, often impulsively due to psychological distribution or some disputes, is termed deliberate poisoning. Suicide utilizing poisoning is less prevalent in developed countries than in developing countries.<sup>1</sup>

“A poison is a substance that can cause harm or

**Corresponding Author:** Nitin Malik, Junior Resident Department of Forensic Medicine and Toxicology, Maharishi Markandeshwar Institute of Medical Sciences And Research, Mullana (Ambala), Haryana, India.

**E-mail:** nitinmalik4358@gmail.com

**Submission date:** May 6, 2025

**Acceptance date:** July 5, 2025

**Published date:** October 13, 2025

This is an Open Access journal, and articles are distributed under a Creative Commons license- CC BY-NC 4.0 DEED. This license permits the use, distribution, and reproduction of the work in any medium, provided that proper citation is given to the original work and its source. It allows for attribution, non-commercial use, and the creation of derivative work.

death when ingested, inhaled, absorbed, or injected into a living organism." It can act locally, systemically, or both. However, this definition of poison is not satisfactory, as the same substance that causes toxic effects can also be beneficial in particular doses, as in the case of many drugs used for treatment, it can cause toxicity in higher doses. The founder of contemporary toxicology, Paracelsus, has stated, "All things are poison, and nothing is without poison. It is the dose that determines them as poison."<sup>2</sup>

The type of poisoning differs by country and even within similar locations such as states and districts.<sup>3</sup> Pesticides are the most common cause of poisoning in developing countries, including India. It is known to be because of the agriculture-based economy since 1985. In India, aluminum phosphide is the most common substance causing poisoning, which was barbiturates and copper sulfate in the seventies and organophosphorous compounds (OPCs) in the eighties.<sup>4</sup> Different parts of the nation have different poisoning patterns.

In rural India poisoning deaths are a significant public health problem, but most researches tends to be conducted in urban populations. There is a paucity of data on rural Northern India patterns, causes, and outcomes. This study was conducted in order to gain further understanding of the widespread health and social issue of poisoning deaths. The actual situation of self-poisoning in the area would be illustrated by the present trends of poisoning deaths in the rural districts of this region, This study aims to fill the research gap in this region of India to provide an improved understanding of local trends and to inform successful prevention, treatment, and policy initiatives. The current study sought to evaluate the trends in poisoning-related mortality at a tertiary care facility and examine the results of autopsies on poisoning deaths.

## Material and Methods

It is an autopsy-based retrospective study. The data was collected from the reports of the autopsies conducted on the dead bodies of deaths due to poisoning from the postmortem record maintained in the Department of our institution, during 5 years from 01 January 2016 to 31 December 2020. Using a variety of statistical methods, a thorough statistical

analysis of the sociodemographic factors was conducted. Descriptive statistical methods were used to analyse various epidemiological and demographic parameters. Before using the available data, ethical approval was acquired from MMIMSR's Institutional Ethics Committee in Mullana, Ambala, Haryana, under project number IEC 19P dated 19/01/22.

## Results

### According to Age

The study comprised 94 deaths due to poisoning out of which one (1.1%) was in the age group <10 years; 12 (12.8%) in 11-20 years; 34 (36.2%) in 21-30 years; 21 (22.3%) in 31-40 years; 15 (16%) in 41-50 years; 8 (8.5%) in 51-60 years; and 3 (3.2%) in > 60 years. Most of the deceased were in the age range of 21-30 years, followed by 31-40 years (Table 1)

**Table 1: Shows the distribution of poisoning deaths by age.**

| Age         | n (%)        |
|-------------|--------------|
| 0-10 years  | 1 (1.1%)     |
| 11-20 years | 12 (12.8 %)  |
| 21-30 years | 34 (36.2 %)  |
| 31-40 years | 21 (22.3 %)  |
| 41-50 years | 15 (16.0 %)  |
| 51-60 years | 8 (8.5 %)    |
| >60 years   | 3 (3.2 %)    |
| Total       | 94 (100.0 %) |

### According to Gender

The gender distribution of enrolled patients comprised 39 (41.5 %) females and 55 (58.5 %) males.

### According to Residence

The data showed that out of 94, 86 (91.5%) lived in rural areas, and 8 (8.5%) were domiciled in urban areas.

### According to Hospitalization

The data showed that out of 94 cases, 68 (72.3%) were hospitalized and 26 (27.7%) were brought dead to the hospital.

### Distribution according to Internal findings

Congested gastric mucosa was seen in 35 (37.2%), congested gastric mucosa with the smell of garlic was

seen in 35 (37.2%), congested gastric mucosa with the smell of kerosene was seen in 10 (10.6%), congested gastric mucosa with smell of alcohol was seen in 4 (4.3%), congested gastric mucosa with blackish fluid was seen in 4 (4.3%), congested gastric mucosa with other findings was seen in 3 (3.2%), congested gastric mucosa with greenish fluid was seen in 2 (2.1%), and congested gastric mucosa, with smell of garlic and presence of blackish fluid was seen in 1 (1.1%) patient (Table 2).

**Table 2: The table shows allocation according to internal findings of the stomach.**

| Internal findings of Stomach   | Number (Percentage %) |
|--|-----------------------|
| Gastric mucosa congested   | 35 (37.2%)            |
| Gastric mucosa congested, garlic smell present                         | 35 (37.2 %)           |
| Gastric mucosa congested, kerosene smell present                       | 10 (10.6 %)           |
| Gastric mucosa congested, alcohol smell present                        | 4 (4.3 %)             |
| Gastric mucosa congested, blackish fluid present                       | 4 (4.3 %)             |
| Gastric mucosa congested, others                                       | 3 (3.2 %)             |
| Gastric mucosa congested, greenish fluid present                       | 2 (2.1 %)             |
| Gastric mucosa congested, garlic smell present, blackish fluid present | 1 (1.1 %)             |
| Total  | 94 (100.0 %)          |

#### *According to cause of death/type of poison*

The cause of death in 66 (70.2%) patients was aluminum phosphide. In 22 (23.4%), it was OPC poisoning. In 4 (4.3%), it was alcohol intoxication. In 1 (1.1%), it was naphthalene poisoning, and in 1 (1.1%) it was kerosene poisoning.

#### *Distribution according to manner of death*

Accidental death was seen in 8 (8.5%) patients, and suicidal death in 86 (91.5%) patients. No homicidal poisoning cases were reported in the present study (Table 3).

**Table 3: The table displays the allocation of cases based on the type and manner of fatal poisoning.**

| Type of Fatal Poison             | Manner of Poisoning |                  |
|----------------------------------|---------------------|------------------|
|                                  | Suicidal (N=86)     | Accidental (N=8) |
| Aluminum phosphide (N=66)        | 65                  | 1                |
| Organophosphate poisoning (N=22) | 20                  | 2                |
| Alcohol intoxication (N=4)       | 0                   | 4                |
| Naphthalene poisoning (N=1)      | 0                   | 1                |
| Kerosene poisoning (N=1)         | 1                   | 0                |

### Discussion

During these five years, 793 autopsies were done, from which 94 cases (11.8%) were of deaths due to poisoning taken in this study. Most cases were in the age group of 21-30 years, accounting for 36.2%. Similar age-group were reported by other studies involving fatal poisoning.<sup>5-7</sup> Whereas, a study by Pan et al. on poisoning deaths found maximum fatalities in the age group of 31-40 years.<sup>8</sup> The higher prevalence of poisoning among young adults is indicative of their susceptibility to stress, which may be brought on by relationship or exam failure or dissatisfaction, maladjustment, or an inability to handle their parent's high expectations. Overall, young adults are emotionally unstable and immature enough to tolerate extreme mental or physical trauma. Males were predominant in our study. Similar findings were noted in most of the studies on fatal poisoning.<sup>8-10</sup> The males are considered breadwinners in the families and rural areas, whereas culturally, females are considered to take care of the household. Males get overburdened and stressed, accounting for the majority of the cases.

We encountered the majority of the cases from rural areas, accounting for 91.5% of the cases. Similarly, Pan et al. and Mehrpour et al. showed a higher frequency of poisoning cases in rural areas. On examination in our study, the condition of the body was found to be cyanosed in 98.9% of the cases. From our extensive research, we could not find

studies with similar findings. Chavan et al. noticed cyanosis in 30% of the deaths.<sup>12</sup> In the present study, the most common internal autopsy finding was only gastric mucosal congestion and gastric mucosal congestion with garlic smell present accounting for 37.2% of the cases each. Similarly, Chavan et al. and Job et al. observed gastric mucosal congestion in most cases.<sup>12,13</sup>

Aluminium phosphide constituted 70.2% of the fatal poisoning in the present study. Similarly, Parel et al., Singh et al., and Garg et al. also majorly observed aluminium phosphide poisoning.<sup>14-16</sup> However, OPCs were the major culprit in several studies.<sup>17-24</sup> These variations in frequency could result from variations in the availability of the toxic drugs and their patterns of usage.

The majority of cases were due to deliberate consumption of poison. Similar findings were noticed in the majority of the studies.<sup>8,14,19-23,25,26</sup> The majority of the cases were hospitalized before death. Similarly, Pan et al. observed most of the poisonings underwent treatment before death.

### Conclusion

The study highlights that poisoning remains a significant cause of unnatural death, particularly among young adults aged 21-30 years, with males from rural backgrounds being the most affected. The high incidence among young individuals suggests underlying psychosocial stressors and emotional vulnerability. Aluminium phosphide emerged as the most common toxic agent, reflecting its accessibility in rural settings. Most poisonings were deliberate in nature, and the majority of victims received medical attention before death. In our study we observed the findings of cyanosis in most of the cases of fatal poisoning. All the cases had gastric mucosal congestion and more than half of the cases had peculiar smell on opening the stomach. These findings underline the urgent need for mental health support, stricter regulation of toxic substances, and improved healthcare access in rural regions to mitigate fatal poisoning incidents. Every tertiary care facility should be required to have a poison detection center with all the latest equipment and skilled personnel for prompt and improved handling of acute poisoning situations. Government agencies

should create awareness about various substances that can cause fatal poisoning. Precautions related to handling, transportation, and storage of toxic materials should be taken.

**Limitations:** In our available records data, regarding how the deceased accessed the poison was not available uniformly.

**Funding:** This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

**Conflict of interest:** The authors have no conflict of interest to declare.

**Ethical Approval:** The ethical approval for the study was obtained from the Institutional Ethics Committee, Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana, Ambala, Haryana, India (IEC-19 P/MMIMSR).

**Authors Contributions:** All authors have contributed equally to the study and approved the final draft of the manuscript.

**Acknowledgment:** The authors would like to thank the office staff and mortuary assistants of the Department of Forensic Medicine and Toxicology, Maharishi Markandeshwar Institute of Medical Sciences and Research (MMIMSR), Mullana, Ambala, Haryana, India, for their help in accessing the medicolegal autopsy records.

### References

1. Kannan K. Toxicology. In: Modi A Textbook of Medical Jurisprudence and Toxicology. 26<sup>th</sup> ed, Gurgaon, India, 2012, Lexis Nexis (A Division of RELX India Pvt Ltd); 2019: 13.
2. Dikshit PC. General Toxicology. In: Textbook Of Forensic Medicine And Toxicology Principles And Practice. 2<sup>nd</sup> ed, New Delhi, India: Peepee Publishers And Distributors (P) Ltd; 2013: 438-9.
3. Bhowmick K, Ghosh B, Pain S. A Study on Deliberately Self-Poisoned In-Hospital Patients in a Tertiary Health Care Center in Northeast India: A Cross-Sectional Review. *J Emerg Med.* 2019;56(5):512-18.
4. Prajapati T, Prajapati K, Tandon NR, Merchant S. A study of acute poisoning cases excluding animal bites at Civil Hospital, Ahmedabad. *J Indian Acad Forensic Med.* 2013;35(2):120-2

5. Curran WJ. The Medico-legal autopsy and Medicolegal investigation. *Bull N Y Acad Med.* 1971;47(7):766-75.
6. ME Bansude, Kachare RV, Dode CR. Trends of unnatural deaths in latur district of Maharashtra. *Journal Forensic Med.* 2012;21(2):7-9.
7. Zhao CJ, Dang XB, Su XL, Bai J, Ma LY. Epidemiology of Suicide and Associated Socio-Demographic Factors in Emergency Department Patients in 7 General Hospitals in Northwestern China. *Med Sci Monit.* 2015;21:2743-9.
8. Pan AK, Malle AK, Hamza NC, Das A. Profile Of Fatal Poisoning In Autopsy Cases At A Tertiary Care Hospital In Port Blair (Andaman And Nicobar Islands): A Seven-Year Retrospective Study. *J Forensic Med Toxicol.* 2024;41(2):172-8.
9. Dash SK, Aluri SR, Mohanty MK, Patnaik KK, Mohanty S. Sociodemographic profile of poisoning cases. *J Indian Acad Forensic Med.* 2005;27:133-8.
10. Chatterjee S, Verma VK, Hazra A, Pal J. An observational study on acute poisoning in a tertiary care hospital in West Bengal, India. *Perspect Clin Res.* 2020;11(2):75-80.
11. Mehrpour O, Akbari A, Jahani F, Amirabadizadeh A, Allahyari E, Mansouri B, Ng PC. Epidemiological and clinical profiles of acute poisoning in patients admitted to the intensive care unit in eastern Iran (2010 to 2017). *BMC Emerg Med.* 2018 19;18(1):30.
12. Datir SB, Petkar M, Farooqui JM, Makhani CS, Hussaini SN, Chavan KD, Bangal RS, Datir S, Center P, Farooqui J, Hussaini SN. Study of outcome in acute poisoning cases in rural region of Western Maharashtra. *J Forensic Leg Med Title.* 2015;24:1-7.
13. Job C: A retrospective study of poisoning cases in Thrissur district of Kerala for the year 1995. *Journal of Indian Society of Toxicology.* 2009;5(1):23-27
14. Parekh U, Gupta S. Epidemio-toxicological profile of poisoning cases-A five years retrospective study. *J Forensic Leg Med.* 2019 1;65:124-32.
15. Singh SP, Aggarwal AD, Oberoi SS, Aggarwal KK, Thind AS, Bhullar DS, Walia DS, Chahal PS. Study of poisoning trends in north India—a perspective in relation to world statistics. *Forensic Leg Med.* 2013 1;20(1):14-8.
16. Garg V, Verma SK. Trends of poisoning in rural area of South-West, Punjab. *Journal of Indian Academy of Forensic Medicine.* 2010;32(3):189-93.
17. Singh DP, Aacharya RP. Pattern of Poisoning Cases in Bir Hospital. *J Inst Med.* 2007;28(1):3-6.
18. Kanchan T, Menezes RG. Suicidal poisoning in Southern India: gender differences. *J Forensic Leg Med.* 2008;15(1):7-14.
19. Maharani B, Vijayakumari N. Profile of poisoning cases in a tertiary care hospital, Tamil Nadu, India. *J Appl Pharm Sci.* 2013;3(1):91-4.
20. Bhagora RV, Parmar DJ, Desani CA, Doctor R. Fatal Poisoning Cases Brought for Postmortem Examination at Mortuary Profile Study of Fatal Poisoning Cases Brought for Postmortem Examination at Mortuary of Sir Takhtsinhji General Hospital, Bhavnagar (Gujarat). *Int J Res Med.* 2015;4(3):59-63.
21. Pipaliya KN, Aghera VJ, Patel MN, Vaghela RD, Masharu RK. Profile of Fatal Poisoning Cases in and Around Rajkot Region: A 3 Years Retrospective Study. *Indian Journal of Forensic Medicine and Pathology.* 2016;9(3):101-4.
22. Gouda S, Rao MS. Profile of Poisoning Cases in a Tertiary Care Hospital. *Medicolegal Update.* 2017;17(1):234-7.
23. Poluru VV, Mamatha K. A Study of Common Type of Poisoning in the Cases Referred for Medicolegal Autopsy at Sri Venkateswara Medical College, Tirupati. *Medico-Legal Update.* 2017;17(1):151-6.
24. Mugadlimath A, Kadagoudar S, Sheelvant S, Bambeshwar K. Profile of Medicolegal Autopsy Cases at Tertiary Care Centre in Bagalkot, Karnataka. *Indian Journal of Forensic Medicine and Pathology.* 2017;10(2):63-6.
25. Goswami O, Mahanta P, Kalita D, Konwar R, Yadav DS. A Three-Year Study on Acute Poisoning Cases Brought for Medico-Legal Autopsy in a North-Eastern City of India. *Open Access Emerg Med.* 2021 12;13:45-50.
26. Patel DJ, Tekade PR. Profile of organophosphorus poisoning at maharani hospital, Jagdalpur, Chhattisgarh: a three years study. *J Indian Acad Forensic Med.* 2011;33:102-105.