

Profile of Suicidal Poisoning Deaths: An Autopsy-Based Observational Study at a Tertiary Care Centre

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ABSTRACT

Background: Suicidal poisoning remains a major public health and medicolegal concern in India, particularly due to the widespread availability of highly toxic pesticides. Autopsy-based studies provide reliable information regarding the epidemiological profile, poisoning agents, and medicolegal characteristics of fatal suicidal poisoning, thereby facilitating effective prevention strategies. **Materials and Methods:** A cross-sectional descriptive autopsy-based observational study was conducted in the Department of Forensic Medicine and Toxicology, SMS Medical College, Jaipur, during 2024–2025. A total of 58 confirmed fatal suicidal poisoning cases were included. Data regarding demographic profile, type of poison, precipitating factors, autopsy findings, cause of death, and survival period were collected from postmortem records, police inquest reports, hospital records, and toxicological reports. Descriptive statistical analysis was performed using frequencies and percentages. **Results:** Young adults aged 21–30 years constituted the largest proportion of victims. Males and rural residents predominated. Aluminium phosphide (34.48%) was the most commonly consumed poison, followed by organophosphorus compounds (20.69%). Love affair-related problems (26%), financial stress (23%), and academic failure (19%) were the leading precipitating factors. Congestion of internal organs was the predominant autopsy finding (98%), while shock (60%) was the most common immediate cause of death. Most victims survived for 12–24 hours after poison ingestion. **Conclusion:** Fatal suicidal poisoning predominantly affects young rural males and is mainly associated with the ingestion of highly toxic agricultural pesticides. Restricting access to hazardous poisons, strengthening mental health services, and ensuring prompt emergency management are essential to reduce poisoning-related mortality.

Keywords: Suicide; Poisoning; Aluminium phosphide; Organophosphorus compounds; Autopsy; Forensic medicine.

INTRODUCTION

Poisoning is one of the leading methods of suicide worldwide and represents a significant public health and medicolegal challenge, particularly in low- and middle-income countries. The World Health Organization (WHO) defines suicide as death resulting from self-directed injurious behaviour with the intent to die and

recognizes it as a major cause of preventable mortality.^{1,2} Among the various methods of suicide, poisoning remains one of the most commonly employed because of the widespread availability of toxic substances, ease of access, and the perception of a relatively painless death.³ Globally, approximately 700,000–900,000 people die by suicide each year, with nearly three-fourths of these deaths occurring in low- and middle-income countries.^{4,5}

In India, suicide continues to be an important public health problem, with 170,924 suicides reported in 2022, corresponding to a suicide rate of 12.4 per 100,000 population.^{6,7} Although hanging has emerged as the most common method of suicide nationally, poisoning remains one of the leading methods, particularly in rural and agricultural communities where highly toxic pesticides are readily available.⁸

The epidemiology of suicidal poisoning is influenced by multiple factors, including age, gender, occupation, socioeconomic status, educational level, psychiatric illness, substance abuse, interpersonal conflicts, financial difficulties, and accessibility of poisonous substances. Aluminium phosphide, organophosphorus compounds, herbicides, rodenticides, and pharmaceutical drugs are among the commonly implicated poisons in India.⁹ The easy availability of these toxic agents, especially agricultural pesticides, has contributed substantially to poisoning-related mortality.

From a forensic medicine perspective, fatal poisoning cases require meticulous medicolegal investigation, including detailed history, scene examination, postmortem examination, viscera preservation, and comprehensive toxicological analysis to establish the nature of poisoning, identify the toxic agent, determine the cause and manner of death, and exclude accidental or homicidal poisoning. Autopsy-based studies provide reliable epidemiological and medicolegal information regarding the demographic characteristics, types of poisons consumed, precipitating factors, autopsy findings, and causes of death. Such evidence is essential for guiding poison control policies, regulating access to highly hazardous pesticides, improving emergency medical care, and developing effective suicide prevention strategies.

In view of the increasing burden of poisoning-related suicides and the limited autopsy-based data from Rajasthan, the present study was undertaken to evaluate the demographic profile, types of poisons consumed, medicolegal characteristics, autopsy findings, and causes of death among fatal suicidal poisoning cases undergoing medicolegal autopsy at SMS Medical College, Jaipur.

To the best of our knowledge, this is one of the few recent autopsy-based studies from Rajasthan comprehensively evaluating demographic characteristics, poisoning agents, precipitating factors, autopsy findings, survival period, and causes of death among fatal suicidal poisoning cases.

Aim

To evaluate the demographic profile, poisoning agents, autopsy findings, and medicolegal characteristics of fatal suicidal poisoning cases.

Objectives

- To study demographic characteristics.

- To identify commonly used poisons.
- To analyse precipitating life events.
- To evaluate autopsy findings and causes of death.
- To assess medicolegal significance.

MATERIALS AND METHODS

A cross-sectional descriptive autopsy-based observational study was conducted in the Department of Forensic Medicine and Toxicology, SMS Medical College, Jaipur, Rajasthan, India, a tertiary care teaching hospital catering to medico-legal cases from Jaipur and adjoining districts.

Study Duration

The study was conducted during 2024–2025 until the required sample size was achieved.

Sample Size:

As this was an autopsy-based observational study, all confirmed fatal suicidal poisoning cases received during the study period and fulfilling the eligibility criteria were included. Therefore, no formal sample size calculation was performed.

Study Population

The study included all confirmed fatal suicidal poisoning cases brought for medico-legal autopsy during the study period. Of the 100 suicidal deaths included in the parent study, 58 cases of suicidal poisoning were analysed.

Sampling Technique

Consecutive sampling was used, and all eligible fatal suicidal poisoning cases fulfilling the inclusion criteria during the study period were included.

Inclusion Criteria

1. Confirmed suicidal poisoning cases subjected to medico-legal autopsy at SMS Medical College, Jaipur.
2. Cases with a definite history of suicidal poisoning supported by police investigation, hospital records, circumstantial evidence, autopsy findings, and toxicological examination.
3. Written informed consent obtained from the legally authorized representative of the deceased.

Exclusion Criteria

1. Accidental and homicidal poisoning cases.
2. Suicidal deaths due to methods other than poisoning (e.g., hanging, burns, railway injuries).
3. Cases with inconclusive or disputed manner of death.
4. Decomposed bodies in which the cause of death could not be established.

Data were collected using a predesigned proforma from postmortem reports, hospital case records, police inquest papers, forensic science laboratory reports, and suicide notes, wherever available. Additional information regarding demographic characteristics, occupation, socioeconomic status, educational status, marital status, recent significant life events, psychiatric illness, substance abuse, and previous suicide attempts was obtained from interviews with relatives and investigating officers.

Detailed autopsy findings, including external and internal examination, type of poison consumed, viscera preservation, toxicological analysis, cause of death, and survival period, were recorded according to standard forensic protocols.

The variables studied included age, sex, residence, religion, marital status, educational status, occupation, socioeconomic status, type of poison consumed, precipitating life events, past medical and behavioural history, autopsy findings, cause of death, and survival period. The collected data were entered into Microsoft Excel, cleaned, and analysed using descriptive statistical methods. The results were expressed as frequencies and percentages and presented in appropriate tables and figures.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics version 26.0 (IBM Corp.,

Armonk, NY, USA). Categorical variables were expressed as frequencies and percentages. Associations between categorical variables were analysed using the Chi-square test or Fisher's exact test wherever applicable. A p-value of <0.05 was considered statistically significant.

This study has been prepared and reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional observational studies.

RESULTS

A total of **58 fatal suicidal poisoning cases** were included in the study.

The majority of victims belonged to the **21–30 years age group**, indicating that young adults were the most affected population. Males constituted the majority of cases, demonstrating a marked male predominance. Poisoning was the leading method of suicide in both sexes, although females showed a relatively higher proportion of poisoning-related suicides than other methods.

Statistical analysis demonstrated a significant association between gender and age distribution among suicidal poisoning cases (p<0.05). However, no statistically significant association was observed between residence and type of poison consumed (p>0.05).

Table 1: Association of Age Distribution with Gender among Suicidal Death Cases

Age Distribution (in years)	Female Cases	Male Cases	Total cases
11-20	8	14	22
21-30	9	28	37
31-40	4	13	17
41-50	1	12	13
51-60	0	6	6
>60	0	5	5
Total	22	78	100

Most victims were **rural residents**, suggesting the influence of agricultural exposure and easier accessibility to toxic substances. The majority were **single**, followed by married individuals. Graduates constituted the largest educational group, while **students and unemployed individuals** represented the most affected occupational categories. Most victims belonged to the **middle socioeconomic class**.

Aluminium phosphide was the most commonly consumed poison (**34.48%**), followed by **organophosphorus compounds (20.69%)**. Barbiturate/benzodiazepine overdose and copper sulphate each accounted for **15.52%** of poisoning cases, while **phenol** constituted **8.62%**, indicating that agricultural pesticides were the predominant toxic agents.

Table 2: Distribution of Poisoning Cases According to Type of Poison Consumed

Poisoning Cases	No. of Subjects	Percentage
Aluminium Phosphide	20	34.48%
Barbiturates/Benzodiazepines/drug overdose	9	15.52%
Copper sulphate	9	15.52%
Corrosive	1	1.72%
Dhatura	1	1.72%
OPC	12	20.69%
Phenol	5	8.62%
Toilet cleaner (HCl)	1	1.72%
Total	58	100.00%

Regarding precipitating factors, **love affair-related problems (26%)** were the most frequent recent significant life event, followed by **financial difficulties (23%)** and **academic failure (19%)**. Family conflicts and marital issues contributed to a smaller proportion of cases.

Mental illness and alcohol use were each documented in **15%** of victims, while **8%** had a history of previous suicide attempts, indicating the presence of important behavioural and psychiatric risk factors.

At autopsy, congestion of internal organs was observed in 98% of cases, while 2% of cases showed pallor of internal organs. The findings indicate that visceral congestion was the predominant autopsy finding among the suicidal death cases.



Image 1: Perforation of Intestine in case of Corrosive Poisoning (PMR No 3098 Dated 21/08/2024)



Image 2: Congestion of Stomach Mucosa in case of Poisoning (PMR No. 3338 Dated 11/09/2024)

Shock (60%) was the leading immediate cause of death, followed by asphyxia. Most victims survived for 12–24 hours, while a considerable proportion died within 12 hours of poison consumption, indicating that the majority of deaths occurred during the first 24 hours after exposure.

These findings demonstrate that fatal suicidal poisoning predominantly affects young adults, particularly males, and is closely associated with psychosocial stressors, easy accessibility of highly toxic pesticides, and delayed survival following poison ingestion.

DISCUSSION

In the present study, the majority of fatal suicidal poisoning victims belonged to the 21–30-year age group, indicating that young adults are the most vulnerable population. This finding is consistent with the studies conducted by Barman et al. and Sharma et al., who also reported the highest incidence of suicidal poisoning among individuals in the third decade of life. Similar observations were reported in a retrospective study from Southern India, where the majority of victims were young adults in their third decade of life.^{13-14,19}

A marked male predominance (78%) was observed in the present study. Similar findings have been reported by Bhullar et al., Barman et al., and Sharma et al., who attributed the higher incidence among males to greater occupational stress, financial responsibilities, substance abuse, and increased accessibility to agricultural poisons.^{15,13,14}

More than half of the victims in the present study belonged to rural areas, which is comparable to the findings of Sharma et al. and Bhullar et al., who reported a rural predominance in fatal suicidal poisoning. This may be explained by the widespread availability of agricultural

pesticides, lower socioeconomic status, and delayed access to specialized medical care in rural communities. Students and unemployed individuals constituted the largest occupational groups in the present study. Similar observations have been reported by Barman et al. who suggested that academic stress, unemployment, and economic insecurity are important contributors to suicidal behaviour among young adults.¹³

Aluminium phosphide (34.48%) was the most commonly consumed poison, followed by organophosphorus compounds (20.69%). Similar findings have been reported by Kapoor et al., Meena et al., and Chugh, who identified aluminium phosphide as the predominant suicidal poison in North India because of its low cost, easy availability, and extremely high fatality.^{16,17,18}

The common precipitating factors in the present study were love affair-related problems (26%), financial difficulties (23%), and academic failure (19%). Comparable psychosocial factors have been reported by Sharma et al., Aaron et al., and the JIPMER suicidal poisoning study, where interpersonal conflicts, financial stress, family disputes, and educational problems were major triggers for suicide.¹⁴

Mental illness and alcohol consumption were present in 15% of victims each, while 8% had a previous history of suicide attempts. Similar observations have been documented by the WHO and previous Indian studies, emphasizing that psychiatric disorders, substance abuse, and previous suicide attempts substantially increase the risk of completed suicide.¹⁻⁴

Most victims survived for less than 24 hours after poison consumption. This finding is consistent with previous studies, which reported that poisoning with aluminium phosphide and organophosphorus compounds is associated with rapid clinical deterioration and high mortality because of cardiovascular collapse and multiorgan failure.^{7,8}

Shock was the leading immediate cause of death in the present study. Similar observations have been reported in previous autopsy-based poisoning studies, where refractory shock, severe metabolic disturbances, and multiorgan dysfunction were the principal mechanisms responsible for death following ingestion of highly toxic pesticides.⁶⁻⁸

Overall, the present study highlights that fatal suicidal poisoning predominantly affects young rural males, with aluminium phosphide and organophosphorus compounds being the principal toxic agents. The findings underscore the need for stricter regulation of highly hazardous pesticides, strengthening of poison information centres, timely emergency medical management, and improved mental health services to reduce poisoning-related mortality.

The findings of the present study have important public health implications. Easy accessibility of highly hazardous agricultural pesticides, particularly aluminium phosphide and organophosphorus compounds, continues to contribute substantially to suicide-related mortality in rural India. Restricting access to these toxic agents, strengthening poison control centres, improving emergency medical services, and expanding community-based mental health interventions may significantly reduce preventable deaths.

Strengths of the Study

- Autopsy-based study with confirmed medicolegal diagnosis.
- Toxicological confirmation was available in the majority of cases.
- Comprehensive evaluation of demographic profile, poisoning agents, precipitating factors, autopsy findings, and causes of death.
- Standardized data collection using postmortem records, police investigation reports, hospital records, and toxicological reports.
- Provides valuable regional epidemiological evidence useful for poisoning prevention and public health policy formulation.

CONCLUSION

The present autopsy-based study demonstrates that fatal suicidal poisoning predominantly affects young adults, particularly males from rural areas, with the 21–30-year age group being the most vulnerable. Aluminium phosphide was the most commonly implicated poison, followed by organophosphorus compounds, reflecting the easy accessibility of highly toxic agricultural pesticides in the study region. Psychosocial factors, especially love affair-related problems, financial stress, and academic failure, emerged as important precipitating circumstances associated with suicidal poisoning.

The findings emphasize that suicidal poisoning is a multifactorial problem influenced by demographic, socioeconomic, and psychological factors. Strengthening mental health services, restricting access to highly hazardous pesticides, improving public awareness, and ensuring timely emergency medical care may substantially reduce poisoning-related mortality. Autopsy-based epidemiological studies continue to provide valuable evidence for understanding the pattern of suicidal poisoning and for formulating effective prevention strategies.

Clinical and Public Health Implications

Early identification of individuals at risk of suicide, strict regulation of highly hazardous pesticides, establishment of poison information centres, strengthening emergency toxicology services, and expansion of community-based mental health programmes are essential strategies for reducing poisoning-related mortality.

Limitations of the Study

- The study was conducted at a single tertiary care centre, limiting the generalizability of the findings to the wider population.
- The sample size was relatively small (58 poisoning cases), which may not represent all patterns of suicidal poisoning in Rajasthan.
- Information regarding psychosocial factors depended primarily on police records and interviews with relatives, making recall and reporting bias possible.
- Detailed psychiatric evaluation and long-term medical history of the deceased were unavailable in many cases.
- Quantitative toxicological analysis and poison concentration could not be evaluated in all cases because of variations in laboratory reporting.
- Being a cross-sectional observational study, causal relationships between risk factors and suicidal poisoning could not be established.
- Selection bias cannot be completely excluded because only autopsied cases from a tertiary care centre were included.

- Multivariable statistical analysis could not be performed because of the relatively small sample size.

Future Recommendations

- Multicentric studies with larger sample sizes should be conducted to determine the epidemiological pattern of suicidal poisoning across different regions of India.
- Prospective studies incorporating psychiatric, psychological, and socioeconomic assessments should be undertaken to identify modifiable risk factors.
- Strict regulation of the sale, storage, and availability of highly hazardous pesticides, particularly aluminium phosphide and organophosphorus compounds, should be strengthened.
- Community-based suicide prevention programmes, including mental health counselling, crisis intervention, and awareness campaigns, should be expanded, especially among adolescents and young adults.
- Early diagnosis, rapid referral, and improved emergency management of poisoning cases should be strengthened at primary and secondary healthcare facilities to reduce mortality.
- A comprehensive poison surveillance system integrating hospital records, forensic departments, toxicology laboratories, and public health agencies should be developed to facilitate evidence-based policy making.
- Further research should evaluate the effectiveness of restricting access to lethal poisons and strengthening mental health interventions in reducing suicide-related deaths.
- Establishment of poison information centres and strengthening toxicovigilance programmes may improve early diagnosis, treatment, surveillance, and prevention of poisoning-related deaths.

Ethics Approval

The study was approved by the Institutional Ethics Committee (IEC) and Research Review Board of S.M.S. Medical College, Jaipur, Rajasthan, India. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and applicable national ethical guidelines.

Consent for Publication

As this study involved medicolegal autopsy cases, informed consent for publication was waived by the Institutional Ethics Committee. Confidentiality and anonymity of all subjects were maintained.

Data Availability Statement

The datasets generated and analysed during the current study are available from the corresponding author upon reasonable request. Data are not publicly available because of medico-legal confidentiality.

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Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this study

Author Contributions

Dr. Dhanpat Godara: Conceptualization, Data Collection, Literature Review, Data Analysis, Manuscript Writing.

Dr. R. K. Punia: Study Design, Supervision, Critical Revision, Final Approval.

Dr. Mahesh Soni: Data Collection, Statistical Analysis, Manuscript Editing, Final Review.

Abbreviation Full Form

WHO	World Health Organization
ICD-10	International Classification of Diseases, Tenth Revision
NCRB	National Crime Records Bureau
SMS	Sawai Man Singh
FMT	Forensic Medicine & Toxicology
IEC	Institutional Ethics Committee
OPC	Organophosphorus Compound
ALP	Aluminium Phosphide

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