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Research Article

Medicolegal Aspects of Deaths Due to Poisoning Occurred In Cities of Punjab and the State Of Himachal Pradesh

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Introduction

A poison is a substance capable of causing illness or harm to a living organism upon contact or introduction to the body. Toxins and venoms are poisons of biological origin, with the latter usually reserved to describe the bites or stings of poisonous animals. In India, the suicide rate is 18.5 suicide deaths for every 100,000 people. The majority (79%) of suicides occur in low- and middle-income countries. Ingestion of poison is one of the most common modes of suicide in low and middle-income countries such as India [1].

Among poisons, pesticides contribute to most cases of poisoning in India [2]. Pesticide poisoning in India is highly prevalent due to the widespread use of pesticides for agricultural and household activities. One of the major poisonings recorded in studies from India is the organophosphorus compounds [3-10]. The other common poisoning reported is aluminum phosphide [11-14]. The pattern of poisoning varies across geographical regions of the country. The study from the Andaman and Nicobar Islands observed paraquat poisoning as the major contributor to poisoning deaths [15]. Other poisoning agents include household agents, envenomations, and drugs. Agricultural or household pesticides and drugs are taken intentionally, whereas intake of corrosives, kerosene, and other miscellaneous agents, as well as animal bites, occurs accidentally. Understanding the geographical patterns of poisoning in a country can help identify risk factors. This, along with the integration of preventive and promotive health services, may help reduce morbidity and mortality.

Owing to the lack of comprehensive scientific data on the prevalence of poisoning and its variation with age and region, preventive, curative, and rehabilitation measures are poorly implemented in India. Therefore, this review was performed to study the prevalence of various types of poisoning in Punjab and Himachal Pradesh, along with their variations with age and region.

Materials and methods

In this systematic review, we assessed and evaluated various observational studies on the prevalence of poisoning across India and compared them with those of Punjab and Himachal Pradesh. Corrosives, irritants, depressants, insecticides, pesticides, metal phosphides, and other miscellaneous agents were considered in this review as poisons.

Eligibility criteria

To analyze the prevalence of poisoning, studies with participants exposed to acute poisoning, irrespective of outcome, were included in the analysis. We included observational studies (retrospective/prospective/cross-sectional) published in English in India between 2001 and 2024.

Information sources

A literature search was done using MeSH terms such as 'prevalence,' 'poison,' 'poisoning,' 'pesticides,' 'organophosphate,' 'corrosives,' 'drugs,' and 'India' in two databases (PubMed Central and Google Scholar). Additional studies were identified by cross-referencing the selected articles.

Cases involving insect or animal bites were not included in the study. Cases with incomplete or missing data were not included in the study.

The present review has been undertaken in an exploratory as well as analytical manner while keeping the relevance of forensic toxicology in the Indian criminal justice system

intact. Both primary and secondary sources were proposed for use in the present study. Also, the information has been gathered personally from the highly designated hospitals, the Chemical Examination Laboratory, and the Forensic Science Laboratory of Punjab on cases where the deaths were caused by the administration of poisonous substances, and the cases had fallen under the criminal justice system. Due to the legality involved, the researcher had limited success in collecting field data from the respondents due to minimal access to the records and persons by the concerned authorities. Sincere efforts have been made to explore relevant secondary sources such as law commission reports, research reports, research papers, law reviews, articles, handouts, books, theses, internet editorials of newspapers, and reports written by distinguished academics, journalists, legal jurists, and enactments related to forensic toxicology and forensic science with special reference to the criminal justice system in India.

The analysis has been compiled from the above-mentioned sources on the poisoning trends in the regions of Punjab, Chandigarh, and Himachal Pradesh systematically. In the bar graphs, the elements of the study include the frequency of poisoning cases due to the above-mentioned poisons. The percentage method was used for the analysis and presentation of data in the graphics.

Study selection and data collection process

Studies were selected based on the predefined eligibility criteria. All eligible articles were taken for further screening after removing duplicates and those unrelated to the study's inclusion criteria. Studies that were included after the review of abstracts were evaluated by screening the full text. Data on authorship, year of publication, study design, study population (patients who ingested poisons), baseline characteristics (age, sex, marital status, educational status, type of family, etc.), list of poisons included in the study, total study population, and any other relevant outcomes essential for data synthesis were extracted from the selected studies. Study selection and data collection were performed independently by two authors, and the data were compiled after complete data retrieval. If any conflict existed, a third author revised and resolved it.

Patient and public involvement: There was no patient or public involvement in the study.

Results

Among the corrosive and irritant poisoning cases reported in previous studies, the incidence of such poisoning was higher in Chandigarh (Seven in 2001 and 22 in 2003) than in other regions of Punjab. However, none of these poisoning cases were reported in Chandigarh in 2005 and in Patiala in 2011. This implies that the use of corrosives and irritants is not resorted to much by the people in this area. Only two cases were reported each Amritsar in 2005 and Punjab and Himachal Pradesh in 2022, respectively. However, only six such poisoning cases were reported in Punjab in 2018. It is observed that Chandigarh alone represents 74.35% of all corrosive and irritant poisoning cases (Figure 1).

Many individuals resort to depressants to find solace or sedate themselves, but if the said compound is taken in excess, it can lead to death. The largest number of cases have been reported in Chandigarh in 2003 (n = 32) and 2005 (n = 89). It represents 93.07% of all depressant poisoning cases. The trend shows a voluminous increase in the number of cases from 2001 - 2005 in Chandigarh. However, not even a single depressant poisoning case has been reported in Patiala in 2011. It may be due to the reason that people living in Chandigarh are well-sophisticated and well-educated, but very sensitive to real-life situations, where they resort to consuming depressants (Figure 2).

Insecticides and pesticides represent a group of compounds that can lead to the death of living beings, if inhaled or swallowed, directly or indirectly, in excess amounts. The analysis of insecticide/pesticide poisoning incidences in reported studies showed that 80 cases in 2001, 78 cases in 2003, and 186 cases in 2005 were reported in Chandigarh. In Amritsar, 127 cases were reported in 2005, while in Patiala, 54 cases were reported in 2011. However, in the whole of Punjab, 382 cases were reported in 2018. In addition to this, only 8 cases were reported in Punjab and Himachal Pradesh in 2022. A rise in the number of cases has been observed in Chandigarh from 2001 to 2005, and the highest number of

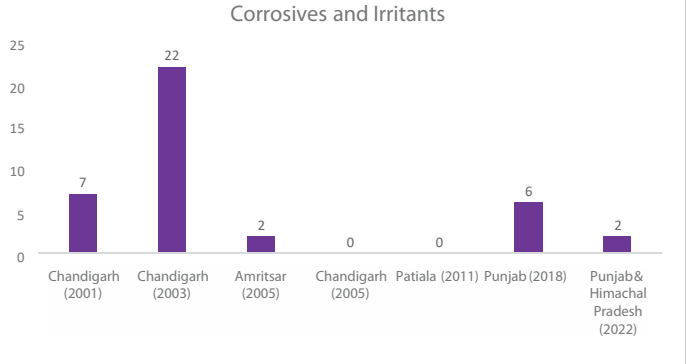

Figure 1: Distribution of corrosive and irritant poisoning cases in reported studies.

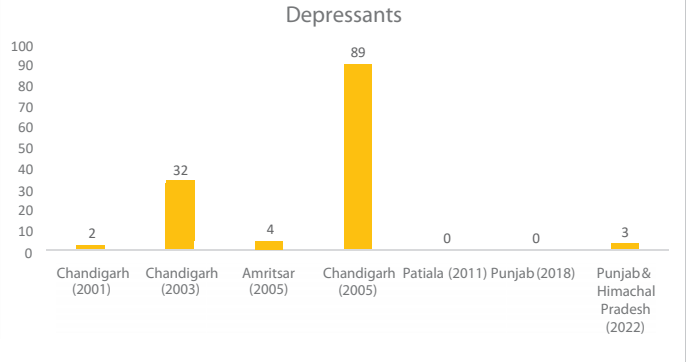

Figure 2: Distribution of depressant poisoning cases in reported studies.

cases was reported in Punjab in 2018. The belt of Punjab and Chandigarh is one where there are a large number of farmer inhabitants who have to spray insecticides and pesticides to cure the crops and vegetables from infectious insects. Thus, unintentional inhaling of these poisonous compounds is a common practice. High toxicity, cost-effectiveness, and easy availability of these compounds for sale at the prescribed agro-centers can be the major cause of poisoning incidents due to insecticides and pesticides (Figure 3).

Metal phosphide includes both aluminum phosphide and zinc phosphide. In Chandigarh, metal phosphide incidences constituted 54.35%, 70.00%, and 40.00% of total poisoning cases in 2001, 2003, and 2005, respectively. In Patiala, Punjab, and Himachal Pradesh, metal phosphides represent 50.90%, 51.70%, and 51.50% of total cases in 2011, 2018, and 2022, respectively. In comparison to this, a few cases of metal phosphide poisoning were reported in Amritsar (31.80%) in 2005. It is observed that metal phosphide poisoning cases are more frequent than other types of poisoning cases in all regions of Punjab, irrespective of time. It may be due to the easy availability of these chemicals, without rigorous regulations, to individuals, especially farmers of the region (Figure 4).

Discussion

One of the major causes of death in rural and agricultural areas across the world is acute pesticide poisoning [6,7], with developing countries reporting high fatality rates from poisoning following pesticide consumption. The most commonly employed pesticides in India are organophosphorus and aluminium phosphide compounds [8-10]. Our study also revealed the same findings. The rampant use of pesticides in our country, the ease of their availability, and their low cost are probably some of the reasons for such findings [20-24].

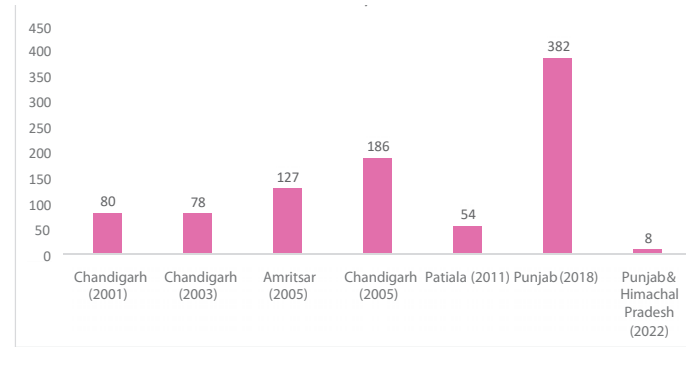

Figure 3: Distribution of insecticide/pesticide cases in reported studies.

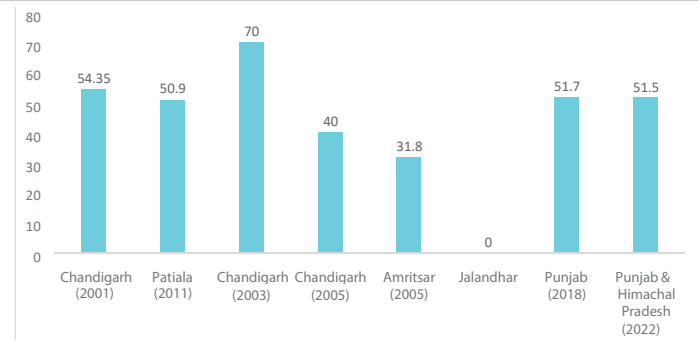

Figure 4: Distribution of metal phosphide poisoning incidences in reported studies.

These results are contrary to the study conducted by Singh et al., where drug consumption (46.4%) is the most common form of poisoning when compared with ingestion of pesticides (4.3%) [25]. Tablet consumption ranks as the second most common contributing factor among women [26,27]. Hair dye and other household chemicals have emerged as an important contributor in recent years [28].

There are very few studies that have reported a higher relative contribution of acute corrosive poisoning [29]. Several previous studies reported associations between increased prescribing of antidepressant drugs and decreases in suicides and antidepressant poisoning deaths [30].

In poisoning cases, the treatment plan is determined by the type of poisoning agent and duration of ingestion. The most common treatments included gastric lavage, PAM, sodium bicarbonate, atropine, MgSO4, dopamine, mechanical ventilator, and other supportive therapy [31,32].

Poisoning, intentionally or unintentionally both are dangerous. Once it occurs, it has to be identified, evaluated by poisoning severity score, and intervene rapidly where the primary care physician, nurses, or other health care provider needs to render first aid care and insist on family/friend for rapid transport to the tertiary care center where poisoning cases can be managed with advanced health care facilities [33].

Strengths and limitations of this study

The results were represented as type, manner, demographic pattern, and prevalence rate of various cases of poisoning, as well as persons at high risk of poisoning with particular agents. The data presented in this study may be under-reported as only moderate to severe poisoning cases are reported to hospitals. There was no analysis of the medical outcomes of patients, thereby restricting the scope of analysis.

Conclusion

The establishment of specialized toxicological units at all hospitals and primary healthcare centers to identify and manage cases of poisoning could considerably minimize the morbidity and mortality associated with poisoning. Similar to developed countries, the region must develop a database on regional poisoning statistics for proper management of poisoning and open poison information centers to share such poisoning data. Adequate preventive measures with stable

employment opportunities and bridging the sociocultural gap between men and women, along with proper supervision and care of children, can reduce cases of poisoning in India.

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