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ORIGINAL RESEARCH

A Three-Year Study on Acute Poisoning Cases Brought for Medico-Legal Autopsy in a North-Eastern City of India

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Purpose: Death due to acute poisoning is one of the significant health challenges to cope-up. It is imperative to know the death victims' pattern due to acute poisoning to prepare the relevant preventive and remedial measures. Therefore, the present study aimed to assess the pattern of the dead victims of acute poisoning in a tertiary care centre.

Materials and Methods: It is a hospital record-based study and conducted in a tertiary care centre. Descriptive statistics to study the distribution of the cases among different age groups, sex, type of poison compounds was computed and analysed using SPSS software version 20.

Results: The present study detected poisonous substances in 244 (41.8%) cases out of 584 death cases of suspected acute poisoning with the male preponderance of 62.29%. A higher incidence of acute poisoning was noticed among the young age group 21–30 years (33.6%) with 48 (31.6%) cases among males and 34 (36.9%) cases of the female. The Organophosphates (OP) was the main compound found in 151 (61.9%) fatal cases, followed by Carbamate in 45 (18.4%) cases. We also observed a maximum, 76 (36.2%) cases of suicidal victims in the age group of 21–30 years. Children and lower age group were more vulnerable to accidental poisoning as 26.5% cases of accidental death were reported in both the age group of 0–10 and 11–20 years respectively, gradually declining and practically found nil in above 60 years group. These differences of frequencies were found statistically significant ($p < 0.0001$), $\chi^2 = 55.1$.

Conclusion: The results suggest due consideration to the young adolescents' groups without any sexual discrimination to define guidelines for appropriate handling, storage and transportation of the poisonous compounds. Organophosphate's involvement as the most preferred agent in acute poisoning is to be remembered to help manage poisoning cases.

Keywords: organophosphates, socio-demographic variation, nature of poisoning, agriculture poisoning

Introduction

The recent literature review revealed acute poisoning as one of the most typical causes of hospital admission in the emergency department[1,2] and a leading cause of morbidity and mortality in India and also a significant health problem worldwide.[3–6]

The act of deliberate self-harm or accidental or homicidal ingestion of harmful substances that causes ill-health, injury or death into the body by different means may cause acute poisoning. Many preferred to die by poisoning for a peaceful death instead of passing by hanging or burning.[4] Still, it could have been avoided with the

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appropriate intervention if measures are taken to avert them.[7] On usual, the yearly worldwide suicide rate is 10.5 per lakh population.[8] Most of the review shows insecticides and pesticides to be the most widely used agents for poisoning.[4]

Further, the North-eastern state being agriculture-based, pesticides are readily accessible, which also help many to a preferred mode of death. Rapid industrialisation and progress in the agricultural field have also made several other insecticides available, and exposure to these substances may cause poisoning.[9,10] For enabling prevention and proper life-saving measures, the knowledge of the intention of the act and the type of poisoning is essential.[3]

Moreover, death due to poisoning is regarded as unnatural and requires medico-legal investigation and a post-mortem examination.[11] The socioeconomic status, religious and cultural influences, and the availability of poisons determine the pattern of poisoning, which will help to manage the poisoning cases.[2]

The current knowledge base for acute poisoning cases is still inadequate in this region. The research done, even-if exemplified an essential aid to our knowledge on the issue of acute poisoning, does not resolve the difficulties faced by us in determining the detailed profile of poisoning over a different population. We, therefore, evaluated the pattern of the subjects following acute poisoning in this underdeveloped region.

Materials and Methods

A retrospective hospital record-based study design was conducted on 584 death victims of suspected acute poisoning carried by the police to the Department of Forensic Medicine and Toxicology, Gauhati Medical College, Guwahati for the required medico-legal autopsy. The samples (viscera and blood) collected during the autopsy were sent for chemical analysis to the State Government Directorate of Forensic Science Laboratory (DFSL) to detect poison. The poisoning data acquired from the reports generated by DFSL. Socio-demographic data were obtained from the autopsy report and other medical records.

Inclusion and Exclusion Criteria of Autopsy Reports for the Study

All those cases which belonged to the Greater Kamrup region of Assam, India, with the features of acute poisoning were included in this study. Decomposed bodies, subjects with concomitant fatal injuries or co-morbidities were excluded from this study.

Detection of Poison in the Laboratory

The analysis was primarily done on viscera samples for the detection of poison. The blood samples were preserved of the patient hospitalised, prolonging the death that resulted in the ingested poison's metabolism. Also, blood samples preserved in suspected cases of drug and alcohol poisoning.

The types of poison consumed by the victim were determined using presumptive tests (colour tests and Thin Layer Chromatography-TLC) followed by confirmation using Gas Chromatography-Mass Spectrophotometry (GC-MS). Determination of alcohol in blood was done by head space gas chromatographic method. The same GC-MS drug-testing approach, known as "Gold standard", was used to confirm drug ingestion. Before this process, rapid immunoassay method was used to eliminate most of the negative samples. Methods used were validated and the laboratory results thus generated at DFSL are accepted by the courts of law in India.

Status of Laboratory Reporting on the Detection of Poison

Positive: The samples gave a positive test result for poison. Negative: No toxin was detected in the preserved samples, despite having positive autopsy findings for acute poisoning. The reasons for negative laboratory result of clinically positive cases of poisoning in this part of India are as follows:[12] (i) Late examination because of the cases' long pendency. The long-time gap between sample collection and the laboratory analysis results in converting the original compound into undetectable by-product. (ii) Inappropriate preservation of the samples. (iii) Wastage of time on transportation in high temperature and humid environment spoiling the samples. (iv) Use of incorrect analytical methods. (v) Initial decomposition of poisons. (vi) Full metabolism of toxins before death. (vii) Presence of a negligent amount of poison in the samples due to initial treatment and (viii) Lack of infrastructures or equipment for testing certain toxins. Unknown: Unknown status of poisoning due to pending reporting of samples. Due to the samples' massive rush to the only authorised laboratory in this region, it takes time to examine and document.

Manner of the Death

The manner of death of these cases of death in the current study whether it is suicidal, homicidal or accidental was decided based on the (i) history given by the patients at the time of admission, (ii) history from the deceased relatives

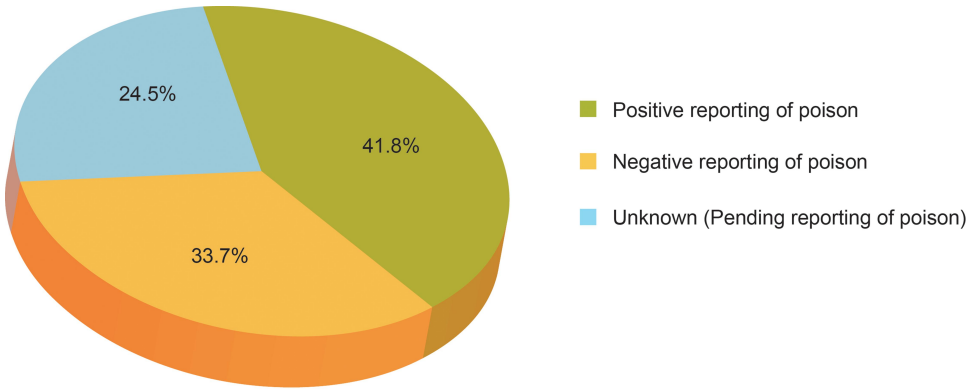

Figure 1 Distribution of cases with their status of poisoning report.

in cases of brought dead, (iii) autopsy findings, (iv) type of the poison detected and (iv) police investigation report.

Statistical Analysis

Detailed statistical analysis of the socio-demographic variables was done using Statistical Package for the Social Sciences (SPSS) software version 20. Descriptive statistical methods were used to study the incidence pattern of acute poisoning cases among different demographic and epidemiological variables. The chi-square test was used to test significant differences among categorical variables under study. A p-value of less than 0.05 was considered statistically significant. The ethical clearance was taken from the ethics committee, viz., "Institutional Ethics Committee" of Gauhati Medical College and Hospital, Guwahati, Assam and India (MC/190/2017/Pt-1/IEC/11 dated 05/04/2018) before collecting the data.

Results

Out of 584 reported suspected acute poisoning cases, 244 (41.8%) were confirmed for poisoning by laboratory tests. At the same time, 33.7% of cases were negative for poisonous substances at laboratory tests though they were found positive at autopsy findings. Also, 24.5% of the suspected poisoning cases were awaiting laboratory test reports, and their status was unknown during our study period, as shown in Figure 1. The present study considered the 244 laboratory-confirmed acute poisoning cases for further analysis.

Males subject was predominant in acute poisoning cases with 152 (62.29%) out of 244 cases compared to females 92 (37.7%).

The analysis reports the highest incidence of acute poisoning cases among young individuals as 82 (33.6%) positive cases of acute poisoning belonged to the age group of 21–30 years with 48 (31.6%) male and 34 (36.9%) females. However, the differences in frequency between males and females among different age groups were not statistically significant ($p = 0.84$), $\chi 2 = 2.7$ (Table 1).

Table 2 shows the types of poisons detected on laboratory examination of the viscera and blood samples preserved during dead victims' autopsy following acute poisoning. Organophosphate was accounted for most acute poisoning deaths in 151 (61.9%) cases followed by carbamate compound in 45 (18.4%) cases.

Table 1 Age-Wise Distribution of Positive Cases of Poisoning

Age in Years	Total No. of Cases	Male	Percentage %	Female	Percentage %	Total %
0–10	9	7	4.6	2	2.1	3.7
11–20	23	15	9.9	8	8.7	9.4
21–30	82	48	31.6	34	36.9	33.6
31–40	70	43	28.3	27	29.3	28.7
41–50	47	29	19.1	18	19.6	19.3
51–60	8	6	3.9	2	2.2	3.3
>60	5	4	2.6	1	1.1	2.0
Total	244	152	100	92	100	100

Table 2 Type of Poisons Detected During the Chemical Examination

Types of Poison	Number of Cases	Percentage (%) of Cases
Organophosphates	151	61.9
Carbamate	45	18.4
Organochlorine	23	9.4
Nitric Acid	17	7.0
Oxalic acid	08	3.3
Total	244	100

The maximum number of 76 (36.2%) cases was suicidal and found in 21 to 30 years. Higher deaths [n=9 (26.5%)] following accidental poisoning were seen in the age group of 0–10 and 11–20 years, gradually declining and practically found nil in above 60. Unintentional death cases were observed mostly among lower age groups, whereas most suicidal poisoning cases were observed among young and adult age groups. These differences of frequencies were found to be statistically significant ($p < 0.0001$), $\chi 2 = 55.1$. We did not find homicidal cases in the present study (Table 3).

Figure 2 shows the socio-demographic distribution (location) of the cases of poisoning. Majority of the poisoning cases belong to the rural areas, i.e., 154 (63.1%) outnumbered 90 (36.9%) of the urban regions.

Figure 3 represents the seasonal variation of acute poisoning cases. The current study reported a maximum of 91 (37.3%) cases of death in the summer season, followed by the autumn season for 70 (28.7%) cases.

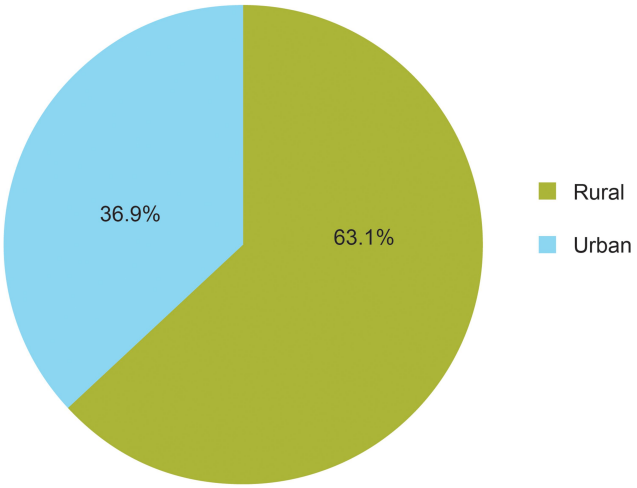

Figure 2 Socio-demographic distribution (location) of the cases of acute poisoning.

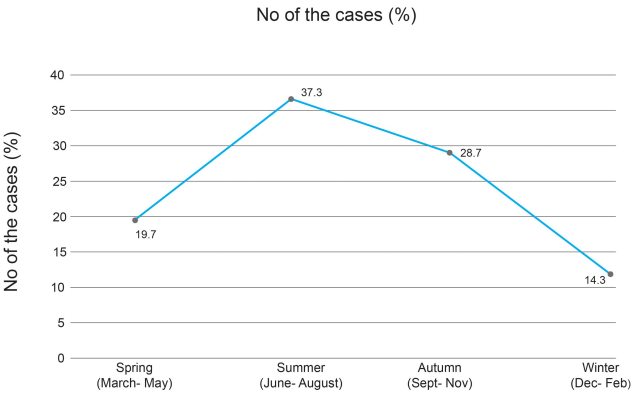

Figure 3 Seasonal variation of the poisoning cases.

Discussion

India's north-east part is an agricultural and developing region with many rural inhabitants where the agricultural poisons are readily available. It may be the root cause of this higher frequency of death due to poisoning.

Table 3 Manner of Death of the Acute Poisoning Cases

Age in Years	Accidental Poisoning	%	Suicidal Poisoning	%
0–10	09	26.5	0	0
11–20	09	26.5	14	6.7
21–30	06	17.6	76	36.2
31–40	06	17.6	64	30.5
41–50	03	8.8	44	20.9
51–60	01	2.9	07	3.3
> 60	0	0	05	2.4
Total	34	100	210	100

The current study's male preponderance has some support from recent reviews,[4,11] which reported a similar distribution of male and female subjects with acute poisoning. However, some other studies said a higher male and female ratio of 3:1.[13,14] Contradict to our result, Nepal[15] has shown M: F =1:2, Albania[16] as M: F =0.09:1 and in Turkey and Ethiopia[17,18] the M: F is about 1:1.47.

Many recent studies[4,13,16,19] have reported younger age groups' involvement with acute poisoning similar to our results. This period of life is highly productive, as well as stressful. In this age group, individuals get an education and begin to earn to feed their family and be exposed to hazardous and stressful life challenges such as new jobs, settlement in marriage, and other social security causing psychological disturbances. Many times, due to the young adult's inability to cope with the increased stress and personality factors, they may cause deliberate self-harm.

In contrast, another review[20] revealed a high prevalence of death in 40–49 years of age.

Like the current study, Organophosphate as the commonly involved pesticide accounted for poisonous deaths compared to other compounds has also reported in some other reviews.[13,21,22] Dash et al also observed the same result in his research on poisoning.[21] In contrast, in a study conducted at New Delhi, India reported the drugs (18%) and insecticides (12.80%) as the ordinary agents in the poisoning cases. Other than the insecticide group, Carbamate formed the most extensive group, followed by Organophosphate, and organochlorine compounds have been revealed in that study.[23] These variances in frequencies may be due to the differences in the pattern of use and the availability of poisonous substances.

The findings from other studies[14,15,17,24] have supported a higher incidence of suicidal cases of the current study. However, a study has reported 72.02% of suicidal, 25.88% accidental and 2.10% of cases unknown,[25] dissimilar to our result. The higher prevalence of cases from the rural areas reported in the present study well tallied with a review.[21] This may be because of the playful handling of pesticidal substances because agriculture is a significant occupation for the people living in this rural region.

The seasonal variation of deaths found in the current study has some supportive reviews. A similar study,[26] revealed that the highest number of cases occurred in the summer season[11] with 48.51% cases followed by the winter season with 29.78% cases.[26]

This study has some limitations for being retrospective and record-based and has missed some valued information like time-lapse to reach the hospital and a thorough psychiatric history.

Conclusion

Health education and strict legal intervention regarding storage, handling and transportation of poisonous substances to restrict the easy availability should be mandatory. Due consideration to the young adolescents' groups is to be made while preventive measures are defined. For quick and better management of the acute poisoning cases, a poison detection centre should be mandatory for each tertiary care centre with all modern machinery and trained staff.

Finally, there is a need to study further the high mortality rates associated with acute poisoning in this region. The concerned authority should also initiate suicide prevention policies for the adolescence and middle-aged people.

Ethical Corrections

All data of the cases were treated with confidentiality, following the declaration of Helsinki.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

Disclosure

The authors report no conflicts of interest in this work.

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