

An observational study on acute poisoning in a tertiary care hospital in West Bengal, India

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Abstract

Aim: Poisoning is a preventable cause of morbidity and mortality in India. We undertook a prospective observational study to estimate the incidence, nature, severity and treatment outcome trends of acute poisoning in a tertiary care hospital in eastern India.

Methods: All patients, admitted during the study period with acute poisoning, drug overdose and envenomation, were enrolled. Food poisonings, animal bites, chronic drug or chemical poisonings were excluded. Medical records were scrutinized and caregiver interviews served as source documents. Demographics, nature and circumstances of the poisoning event, treatment offered, duration of hospitalization and outcome data were collected.

Results: Over 18 months, 592 cases of acute poisoning, accounting for 0.63% of all hospital admissions, were enrolled. Males comprised 57.09%, median age was 22 years, and 52.20% hailed from rural area. Occupation-wise, excluding students and children, patients were mostly daily wage workers followed by housewives, service holders and farm workers. Snake bites comprised the largest category of cases at 264 (44.6%) followed by corrosives (13.68%), sedatives/hypnotics (13.18%), pesticides (12.16%), hydrocarbon oils (8.61%) and others. Majority (60.64%) of the cases was accidental and occurred at home (66.72%) and most (87.33%) were referred from primary health centers. Median time between event and arrival at primary care center was 1 hour while median time to arrival at the hospital was 11 hours. There were 89 deaths (mortality 15.03%) in the series. Male gender, rural residence, referred status and non-use of specific antidotes had negative impact on survival.

Conclusion: This large prospective study from eastern India from a hospital perspective, has captured data not only on the incidence and nature of poisoning but also on treatment trends and mortality outcomes. Field studies conducted in the light of these results will clarify additional issues.

Keywords: Corrosive, India, pesticide, poisoning, snakebite

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INTRODUCTION

A poison is a substance that is capable of causing illness or harm to living organisms on contact or upon introduction

into the body and may be used deliberately with this intent. Toxins and venoms are poisons of biological origin, with the latter term usually reserved for those injected by the bite or sting of a poisonous animal.^[1]

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According to the World Health Organization (WHO),^[1] nearly 200,000 people die worldwide from accidental poisoning and around 84% of them occur in low- and middle-income countries. In 2012, unintentional poisoning led to loss of over 10.7 million years of healthy life in terms of disability-adjusted life years. Of the nearly million suicides recorded each year, the WHO estimates^[1] that deliberate pesticide ingestion accounts for 370,000 deaths. Snakebites are an important public health problem in many countries, with rough estimates of about 5 million snakebites every year, resulting in up to 2.5 million envenomations, up to 100,000 deaths, and up to 300,000 cases of amputations and other permanent disabilities.^[1] However, the nature, intent, severity and outcome of poisonings, and envenomations vary widely across nations, and often, in large countries, there are large regional disparities as well.

In India, according to the National Crime Records Bureau reports, poisoning was estimated to contribute 4.6% of the 451,757 accidental deaths recorded in the country in 2014 and 6.3% of the 413,457 accidental deaths in 2015.^[2,3] Food poisoning and snakebites caused an estimated 1624 and 8554 deaths, respectively, in 2015.^[3] Among modes adopted to end life by suicide victims, poisons contributed to 26.0% (34,254) and 27.9% (37,232) of total cases in 2014 and 2015, respectively, with another 0.5% in both years being contributed by sleeping pills.^[3]

Various studies on poisonings and suicides have been done in India and summed up in a recent paper by Chary *et al.*^[4] However, majority of these studies are based on hospital or institutional records rather than being prospective in nature, and there are only a few studies from eastern India.^[5,6] Most of these studies have not looked at the type, and outcome of treatment received or attempted identification of factors which can reduce morbidity and mortality. We, therefore, undertook a descriptive longitudinal observational study to estimate the incidence, nature, severity, and treatment outcome trends associated with acute poisoning, including drug overdose and venomous snakebites, in a tertiary care teaching hospital in West Bengal.

MATERIALS AND METHODS

Patients admitted to the hospital with a clinical diagnosis of any acute poisoning with drugs or chemicals, snakebite, and scorpion sting were the study participants irrespective of age and sex. Cases of food poisoning, dog or other animal bites, and chronic drug or chemical poisoning (e.g., arsenicosis) were excluded. Those unwilling to provide written informed consent were also excluded. The

Institutional Ethics Committee approval was obtained, and the study was registered with the Clinical Trial Registry of India (No. CTRI/2015/09/006227).

The recruitment period was 18 months. Observations were carried out either in the emergency department itself or subsequently in the wards where they were admitted. Baseline demographic and clinical data of each participant were collected, and they were followed up till discharge or death. Medical records of the participants were scrutinized, and caregivers were interviewed where required. Information was collected on the following parameters: age, sex, occupation, family structure, past medical history, type of poison, route of exposure, time lag between poisoning event and hospital admission, events occurring in the interim period, potential nature of poisoning (accidental, suicidal, and homicidal), and circumstances leading to the event. Data on treatment offered, duration of hospitalization, mortality, and morbidity outcome (such as ventilatory support, dialysis, and complications) were collected and analyzed. The incidence of acute poisoning among all emergency hospital admissions was calculated.

Data analysis was done using GraphPad Prism version 6.01 (La Jolla, California: GraphPad Software Inc., 2012) software. In addition to descriptive statistics, subgroup comparisons were done and associations between categorical predictors were explored. Unpaired *t*-test, Fisher's exact test, or Pearson's Chi-square test as appropriate was used for inferential statistics. Odds ratios (ORs) with its 95% confidence intervals (CI) have been calculated as an estimate of risk of mortality for categorical predictors.

RESULTS

During the study period of 18 months, 592 cases of acute poisonings were enrolled out of 94,575 admissions in our hospital, giving a proportion of 0.63% (95% CI: 0.58–0.68%) among all hospital admissions. Excluding venomous bites/stings, all poisonings cases were due to oral exposures.

The median age of the enrolled participants was 22 (interquartile range [IQR]: 10–35) years with 57.09% males and 52.20% hailing from rural background. The majority belonged to lower socioeconomic classes, with 7.26% belonging to the lowest of seven income categories in the 2012 Modified Kuppuswamy's Socioeconomic Scale^[7] (monthly family income below Indian rupees 1589) and 2.70% belonging to the fifth category on this scale (over rupees 11,817/month), the highest in our series.

Regarding family structure, 56.93% hailed from nuclear families while most of the rest were from joint families. Occupation-wise, if we exclude 208 students and children, poisoning was commonly found among daily wage workers (43.41%), followed by homemakers (16.72%), service holders (13.00%), and farmers/farm workers (1.86%).

Table 1 depicts the various types of poisoning and characteristics of the cases. Snakebite comprised the largest fraction of cases (44.6%), followed by corrosives (13.68%), sedatives/hypnotics (13.18%), and pesticides (12.16%). In the category “others,” there were 46 cases who had ingested any of the following: mosquito repellants, rat or lice killers, copper sulfate, nail polish remover, petrol, heroin, and

Table 1: Types and characteristics of the poisoning cases (n=592)

	Number of cases (%)	Mortality (percentage; 95% CI)
Gender of case		
Male	338 (57.09)	63 (18.64; 14.85-23.1)
Female	254 (42.91)	26 (10.24; 7.08-14.58)
Type of poisoning		
Venomous snakebite	264 (44.59)	46 (17.42; 13.32-22.45)
Corrosives	81 (13.68)	13 (16.05; 9.63-25.55)
Sedative/hypnotics	78 (13.18)	3 (3.85; 1.32-10.71)
Pesticides	72 (12.16)	25 (34.72; 24.75-46.24)
Hydrocarbon oils (kerosene)	51 (8.62)	-
Others	46 (7.77)	2 (4.35; 1.21-14.54)
Mode of poisoning		
Unintentional (accidental)	359 (60.64)	48 (13.37; 10.23-17.28)
Intentional (suicidal)	232 (39.19)	41 (17.67; 13.30-23.09)
Homicidal	1 (0.17)	-
Place of poisoning		
Indoor	395 (66.72)	53 (13.42; 10.41-174.14)
Outdoor	197 (33.28)	36 (18.27; 13.50-24.26)
Referral status		
Primary case	75 (12.67)	1 (1.33; 0.23-7.17)
Referred case	517 (87.33)	88 (17.02; 14.03-20.55)
Seasonal trend		
Summer (April-June)	222 (37.50)	25 (11.26; 7.74-16.09)
Monsoon (July-September)	192 (32.43)	27 (14.06; 9.85-19.68)
Autumn (October-November)	68 (11.49)	14 (20.59; 12.68-31.64)
Winter (December-January)	40 (6.76)	9 (22.50; 12.32-37.50)
Spring (February-March)	70 (11.82)	14 (20.00; 12.30-30.82)

The percentage and confidence interval figures in the mortality column are with respect to the total number within the respective subgroup. CI=Confidence interval

chloroxylenol-based antiseptic solutions. The median time interval between poisoning event and arrival at the health center was 1 h (IQR: 1–2 h), while the median time to arrival at the tertiary care hospital was 11 h (IQR: 5–26 h).

Table 2 presents a summary of the age and gender distribution and mortality trends. The median age of all deaths was 31 years (IQR: 18–48 years). Only one among the 89 deaths was a primary one whereas rest was referred from primary care centers.

Regarding treatment and outcome, 342 (57.77%) received specific antidote, i.e., antsnake venom for snakebites, atropine, and oximes for pesticide poisoning. Ninety-two patients needed dialysis whereas 16 were put on ventilation. The median duration of hospitalization was 4 days (IQR: 2–6 days). Among all recruited participants, 72.13% recovered without sequelae, 2.87% recovered with sequelae, 9.97% left against medical advice, whereas 15.03% died.

Univariate analysis of potential mortality determinants showed the following factors as statistically significant: gender ($P = 0.005$; OR of male versus female: 1.82 with 95% CI: 1.19–2.79), referral status ($P < 0.001$; OR of referred versus primary case: 15.18 with 95% CI: 2.08–110.71), residence ($P < 0.001$; OR of rural versus urban: 3.50 with 95% CI: 2.10–5.91), and specific antidote treatment ($P < 0.001$; OR of specific antidote versus nonesuch: 0.23 with 95% CI: 0.13–0.41). There were no statistically significant differences in age or in the median time to presentation at primary treatment center or to referral center between survivors and nonsurvivors.

We did separate analysis of the poisonous snakebite cases as they constituted the largest subcategory among the poisoning types. Results are depicted in Table 3. A seasonal variation was noted with 40.91% cases reported during monsoon and 37.88% during summer. The median time interval between bite and arrival at primary health center was 2 h (IQR: 1–2 h), while the corresponding time interval for arrival at the tertiary care center was 12 h (IQR: 7–27 h).

Table 2: Age and gender distribution of the poisoning cases with mortality trends

Age (years)	n	Male	Female	Poisoning mode			Number of deaths
				Accidental	Suicidal	Homicidal	
1-10	149	93 (62.41)	56 (37.59)	149 (100.0)	-	-	6 (4.03)
11-20	124	55 (44.35)	69 (55.65)	55 (44.35)	69 (55.65)	-	19 (15.32)
21-30	133	64 (48.12)	69 (51.88)	47 (35.34)	85 (63.91)	1 (0.75)	19 (14.29)
31-40	76	47 (61.84)	29 (38.16)	42 (55.26)	34 (44.74)	-	16 (21.05)
41-50	52	36 (69.23)	16 (30.77)	33 (63.46)	19 (36.54)	-	11 (21.15)
51-60	43	32 (74.42)	11 (25.58)	25 (58.14)	18 (41.86)	-	16 (37.21)
61-70	10	6 (60.00)	4 (40.00)	5 (50.00)	5 (50.00)	-	-
71-80	5	5 (100.0)	-	3 (60.00)	2 (40.00)	-	2 (40.00)
Total	592	338 (57.09)	254 (42.91)	359 (60.64)	232 (39.19)	1 (0.17)	89 (15.03)

Values in parentheses denote percentages

Table 3: Summary of the snakebite cases (n=264)

	Number of cases (%)	Mortality (%; 95% CI)
Gender of case		
Male	179 (67.80)	38 (21.23; 15.88-27.79)
Female	85 (32.20)	8 (9.41; 4.85-17.48)
Residence		
Rural	210 (79.56)	41 (19.52; 14.73-25.41)
Urban	54 (20.44)	5 (9.26; 4.02-19.91)
Time of bite		
Daytime	145 (54.92)	24 (16.55; 11.38-23.45)
Nighttime	119 (45.08)	22 (18.49; 12.54-26.41)
Place of bite		
Indoor	73 (27.65)	20 (27.40; 18.49-38.57)
Outdoor	191 (72.35)	26 (13.61; 9.46-19.20)
Referral status		
Primary case	8 (3.03)	-
Referred case	256 (96.97)	46 (17.97; 13.75-23.14)
Seasonal trend		
Summer (April-June)	100 (37.88)	12 (12.00; 6.63-19.81)
Monsoon (July-September)	108 (40.91)	18 (16.67; 10.81-24.82)
Autumn (October-November)	27 (10.23)	6 (22.22; 10.61-40.75)
Winter (December-January)	11 (4.17)	3 (27.27; 9.74-56.56)
Spring (February-March)	18 (6.88)	7 (38.89; 20.31-61.38)

The percentage and confidence interval figures in the mortality column are with respect to the total number within the respective subgroup. CI=Confidence interval

Table 4: Summary of corrosive and pesticide poisoning cases

	Corrosive poisoning (n=81)	Pesticides poisoning (n=72)
Age (year), median (IQR)	22 (15-30)	26.5 (20-40)
Gender (%)		
Female	61.73	41.67
Male	38.27	58.33
Residential status (%)		
Rural	4.94	90.28
Urban	95.06	9.72
Referral status (%)		
Referred from primary health-care facility	82.72	93.06
Primary cases	17.28	6.94
Mortality rate, % (95% CI)	16.05 (9.63-25.55)	34.72 (24.75-46.24)

IQR=Interquartile range, CI=Confidence interval

Out of 264 snakebite cases, 223 (84.45%) received specific antidote. The median duration of hospitalization was 5 days (IQR: 3–7 days). The case fatality rate was 17.42% (95% CI: 13.32%–22.45%). Interestingly, all patients who succumbed had received polyvalent antsnake venom. Univariate analysis of potential mortality predictors showed statistically significant differences between survivors and death cases in gender distribution ($P = 0.01$) and time to arrival at primary care center ($P = 0.02$), but differences were not observed for age ($P = 0.65$) and time to arrival at tertiary care center ($P = 0.09$).

Table 4 depicts the summary of the cases with corrosive and pesticide poisoning. Corrosives constituted 13.68% of

the acute poisoning cases. The median duration of hospital stay was 4 days (IQR: 2–7 days). Univariate analysis of mortality in corrosive poisoning cases indicated female sex and time taken to reach primary treatment center as significant predictors.

Pesticides constituted 12.16% of the total cases. A seasonal variation trend was noted with 40.28% during summer, 22.22% in monsoons, 16.67% in spring, 13.89% in autumn, and 6.94% in winter. About 98.61% received specific antidote in the form of atropine for organophosphorus poisoning. Univariate analysis of mortality in pesticide poisoning cases indicated that delay in getting primary care increased mortality.

DISCUSSION

The prospective observational study over a period of 18 months is its strength. Longitudinal observation allowed us to interact directly with patients and caregivers and cross-check information against appropriate source document. Majority of the cases we studied were referred from primary care centers as is to be expected in an apex teaching hospital in a metropolitan city. In this study, majority (56.25%) of the cases were in the age group of 11–40 years. Our series included a somewhat higher proportion of males (around 57%) than females (around 43%). Similar demographic profiling has been observed in an earlier study from eastern India.^[8] Contrary to the trend with snakebites and pesticide poisonings, majority (around 95%) of the corrosive poisoning cases hailed from urban background. This is possibly due to easy availability of corrosives in urban markets.^[9]

In the present study, if we exclude venomous snakebites, which accounted for 44.59% cases, corrosives (13.68%), sedatives (13.18%), and pesticides (12.16%) accounted for nearly equal proportion of the various types of poisonings encountered. Although pesticides and medicinal substances feature prominently in all poisoning series reported from Indian hospitals,^[10-14] there are geographical variations in the relative incidence. For instance in a recent retrospective observational study on pattern of acute poisoning in an emergency department of a tertiary care hospital Karnataka,^[15] pesticide poisoning accounted for 62.8% of the cases with snakebite coming next at 18.2%. In a large 5-year retrospective study on hospitalized patients admitted with poisoning in Kerala,^[16] poisoning by pesticides and other nonmedicinal substances accounted for 45.5% of the cases. These differences in the type of poisoning may partly stem from the varying catchment areas of the concerned hospitals.

In our study, 60.64% of the cases were exposed accidentally whereas 39.18% consumed poisons with suicidal intent. A study conducted in the age group of 15–65 years at Kathmandu reported that 97% of the poisoning cases admitted in the hospital were due to suicidal attempt.^[17] However, this study did not include snakebite cases and children whereas our study comprised 264 snakebites and 164 children. On the other hand, a report from the National Poisons Information Centre at AIIMS, New Delhi, covering all age groups highlighted that nearly half (47%) of poisoning cases were accidental.^[10] This study, like our study, had included both snakebite cases and children, and the counts are more in conformity with our results.

Seasonal variation affects poisoning statistics. More cases of poisoning were reported during summer season (37.5%), followed by rainy season (32.4%) in this series. This is similar to trends reported in a study from South India.^[18] In Kathmandu, Nepal, the incidence was highest during rainy season.^[19] The water scarcity during summer leads to crop failure and financial losses which perhaps contribute as stressors to provoke suicide. Grains are preserved during summer season for which pesticides are procured. This increases the ready availability of poisons and indirectly may contribute to the higher incidence during summer. Snakebite cases peak during the monsoon seasons when flooded nesting holes force the reptiles to seek shelter closer to human habitation.

In this study, many cases were found among daily wage workers and homemakers as these groups are more vulnerable and easily exposed to poisonous agents. Similar finding was observed in a study done in Tamil Nadu.^[20] Reasons for deliberate self-harm behavior have been explored in field studies in the catchment area of our hospital.^[21,22] Poverty, usually the result of a combination of lack of skills, limited job opportunities, and monsoon failure, coupled with easy access to pesticides, are believed to be responsible for high incidence of suicidal poisoning among daily wage workers and farmers. Psychosocial stressors such as conflict with guardian, husband, or in-laws, economic distress, and failed love affairs are common underlying reasons for relatively high incidence of poisoning among homemakers and young women. Failure in examinations or inability to cope up with high expectations from parents has increased the incidence of poisoning among students. It is logical to expect similar causes, including general lack of awareness regarding the dangers of pesticides, to operate in other parts of India too.

In most instances, victims were taken to nearby primary care centers relatively rapidly. Unfortunately, the same is not true regarding time taken to reach the referral center.

Estimate of the latency of treatment is a novel aspect of our study, made possible because of the prospective design, and analyses indicate that delay in reaching treatment centers, particularly primary care, can negatively impact outcome. However, it is also to be noted that despite interaction with patients and caregivers, we were unable to know the exact time of administration of the specific antidote in many cases. Therefore, we could not explore latency with respect to antidote administration as one of the outcome predictors. This has been a study limitation. About 58% of the victims received specific antidotes; 15.5% patients (most of these being snakebite cases) needed dialysis whereas 2.70% (again most of them snakebites) were put on ventilation. This indicates that both dialysis and ventilatory support are required for management of snakebite cases referred from primary care, where the management primarily involves antivenin administration.

The overall mortality of 15.03% (95% CI: 12.38–19.13%) in our series compares well with other Indian studies, such as one done at a tertiary care hospital in Mangalore which reported overall mortality to be 15.4%^[23] and an older study where it was 17.3%.^[24] However, our figure is nearly three times the mortality rate of 5.34% reported by a large retrospective study in adults in Bangladesh.^[25] The case fatality rate of 17.42% in snakebite cases was marginally higher than the overall mortality. It is noteworthy that all fatal snakebite cases had received antisnake venom. This calls for an analysis of antivenom use in the field to ascertain if the deaths are primarily due to severity of the envenomation or may partly be attributed to delay in presentation to centers where antivenom is available.

In pesticide poisoning, the mortality rate was considerably higher at 34.72%. This figure is at variance with other Indian studies. A recent study from Uttar Pradesh^[26] reported mortality rate of only 4.28% among 140 cases of poisoning due to pesticides, drugs and herbal products, and household chemicals and corrosives. An older series^[27] in hospitalized patients from Andhra Pradesh reported 22.6% mortality rate. Several approaches have been proposed to reduce pesticide poisoning and related mortality,^[28] including improved clinical management, counseling services for vulnerable individuals, restricted access to toxic substances to prevent acts of deliberate self-harm, and improved storage to prevent accidental exposure. The latter approaches are emerging as the favored ones but are yet to be given adequate attention in India.

CONCLUSION

We can say that our study has contributed a large prospective profile on poisoning in India, albeit from a hospital

perspective. Male gender and longer event-to-treatment latency at primary care levels had a negative impact on survival. The study reveals some issues that require attention from planners and policy-makers such as greater awareness among the public regarding the importance of prompt transfer to hospital for all poisoning cases, measures to expedite the transfer of serious patients to tertiary care centers, and setting up of specialized poison units in secondary and tertiary care hospitals. Field studies on poisoning are difficult to organize but if conducted in the light of these hospital-based results will clarify some issues that have not been addressed such as the underlying reasons that lead to the poisonings, reasons for delay in seeking treatment, and the extent of ignorance regarding the safe use of pesticides.

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Conflicts of interest

There are no conflicts of interest.

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