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Original Research Article

A cross sectional study of various types of acute poisoning; pharmacological management and their outcome in a tertiary care hospital

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ABSTRACT

Background: Acute poisoning is a common and life-threatening crisis, leading to serious complications and death of patients. Poisoning may be due to self-consumption, accidental exposure of chemical compounds, medications and poisonous animal bites/stings. Aim of current study was to investigate the pattern of drug utilization, poisoning agents and outcome in patients with acute poisoning treated at a tertiary care teaching hospital, Vadodara, Gujarat.

Methods: This prospective cross-sectional study was done on patients of acute poisoning admitted in emergency department, SSG Hospital during August 2021-March 2022.

Results: 400 patients were enrolled during the study, from which 262 (65.50%) were male and 138 (34.50%) were female. Mean age of patients was 30.30 ± 13.79 years. The commonest mode of poisoning observed was Suicidal (66.25%). The most common cause of poisoning was due to Pesticides (33.25%), followed by venomous animal exposures (30.75%). Death was recorded in 53 (13.25%) patients with highest number seen in suicidal poisoning (14.34%) compared to accidental poisonings (11.19%). Mainly, multivitamins (19.03%), Antimicrobials (16.65%), Proton Pump Inhibitors (15.85%) and Antiemetics (11.10%) were prescribed. Antidotes used were Atropine (4.81%), Pralidoxime (4.46%) and Anti-snake venom (2.80%). Median number of drugs per patient was 8; range: 2-25.

Conclusions: Pattern and magnitude of poisoning are multidimensional and demand multi-sectoral approach for facing this problem. Due to high incidence of snakebites, hospital stockpiles should be regularly checked for availability of antivenom. There is a need for stringent pesticide regulation laws, counselling and training programs to reduce incidence of poisonings and deaths due to it.

Key words: Poisoning, Pesticide, Snakebite, Organophosphorus

INTRODUCTION

As per the quotation of Paracelsus, “all things are poison, and nothing is without poison only the dose permits something not to be poisonous” so the risk of exposure to chemical substances is always there. Acute poisoning is nowadays a serious medical & social challenge everywhere in the world. Acute poisoning contributes a wholesome to serious health issues, mortality and burden on health services.¹ A poison is defined as, “A substance

which when administered, inhaled or swallowed is capable of acting deleteriously on the body by affecting one or more vital function.” The mode of poisoning may be suicidal, homicidal, stupefying or accidental.²

World health organization WHO data of 2019 showed that nearly 2,00,000 people die worldwide from accidental poisoning out of which, around 84% of them occur in low and middle socio-economic countries. According to data published in 2020, unintentional poisoning has led to loss

of over 10.7 million years of healthy life in terms of disability-adjusted life years. Of nearly million suicides recorded each year, the WHO estimates that pesticide ingestion accounts for 3,70,000 deaths.³

Toxins and venoms are poisons of biological origin, with the later term usually reserved for those injected by the bite or sting of a poisonous animal.⁴ According to the data published in 2019, snakebite is also a major problem worldwide. There is evidence of 4.5-5.4 million snakebite cases in a year, out of which 1.8–2.7 million of them develop clinical illness envenoming after snakebite and the death toll ranges from 81,000 to 1,38,000. In India, it has been estimated that as many as 2.8 million people are bitten by snakes and 46,900 people die from snakebite every year.⁵ In India, the exact incidence of acute poisoning problem remains unclear. But it is estimated that out of 10-15 million cases of poisoning reported every year, 50,000 are fatal. Acute poisoning cases account for 2-3% of all hospital admissions in India. However, in India the suicide rate is almost double 18.5 suicide deaths for 1,00,000 population. Cases of poisoning are more common in India than western countries, which can be due to increasing use of chemicals for industrial purpose and domestic quack remedies containing poisonous drugs and frequent occurrences of bites by venomous snakes.⁶ The management of acute poisoning depends upon the availability of antidotes, essential drugs & emergency protocols. Antidote is a natural or a synthetic compound that interacts with the action of toxin in the body. More than 30 antidotes in different categories have been known in the world. Assessment of accessibility and utilization of antidotes has a great impact for policy makers because procurement of them is costly for government and it is very important to evaluate them in terms of availability, accessibility, affordability and their rationality of use.⁷

It is necessary for each academic medical setting to regularly evaluate drug utilization in different departments and review institutional therapeutic protocols to rationalize drug use and enhance patients' outcome.⁸ Various studies on poisonings have been done in India and summed up in a recent paper by Chary et al.⁹ However, 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. There is also a need to evaluate annual epidemiologic data on acute poisoning treated at each medical setting for better handling and managing drug and antidote stockpiles. The colossal burden of poisoning and snakebite cases requires comprehensive strategies for reducing deaths. Thus, there is a need to collect accurate data on different aspects of acute poisoning. Hence this study was designed to estimate the incidence, nature, severity, pattern of drug utilization, causative agents and treatment outcome associated with acute poisoning cases, including drug overdose and venomous snakebites and also to suggest strategies to reduce associated morbidity and mortality in a tertiary care teaching hospital in Vadodara.

Aim and objectives

The aim of the present study was to investigate the pattern of drug utilization, identifying poisoning agents and resulted outcome in patients with acute poisoning treated at a tertiary care teaching hospital, Vadodara, Gujarat. Objectives were to study the drug utilization pattern of acute poisoning cases, to study the types of causative agents and mode of poisoning, to study the age and gender wise distribution of acute poisoning cases and to study the availability of drugs as per National list of essential medicines (NLEM)-2022 and to study the outcome of cases in terms of morbidity and mortality.

METHODS

Study design, site and duration

This Cross-sectional observational study was conducted at Sir Sayajirao general hospital, a tertiary care teaching hospital attached to medical college Baroda. The study was carried out from August 2021 to March 2022.

Inclusion criteria

All patients of acute poisoning, admitted to emergency ward of Emergency Medicine and Medicine, Surgery and Pediatric inpatient departments of SSG Hospital, Vadodara were included in the study. Diagnosis was made by the treating clinicians on the basis of history and clinical findings and in some cases through routine laboratory investigations, as well were included.

Exclusion criteria

Patients with uncertain diagnosis as well as those patients in which, it was not possible to take consent for participation were excluded from the study.

Informed consent process

Written informed consent was obtained from either the patient or their relatives if patient was not in a condition to give consent. In case of children below 13 years of age, assent was taken from parents. A written permission was taken from the respective heads of the emergency medicine, medicine, surgery and pediatric department.

Data collection procedure

All the inpatients diagnosed for acute poisoning were screened and data comprising of total 400 cases was collected and entered in a case record form approved by IECBHR (institutional ethics committee for biomedical and health research) of medical college and SSG Hospital, Baroda. The confidentiality of patients' personal information was maintained. These cases were evaluated and observed in the Emergency wards, Intensive Care Units (ICUs) and Unit wards of respective departments and followed up till their outcome.

Data analysis

The data obtained was subsequently analyzed using Microsoft Excel 2019. The results were expressed as percentage and mean±standard deviation.

RESULTS

Out of 400 poisoning cases treated at SSG hospital, 262 (65.50%) were male and 138 (34.50%) were female. Male: Female ratio was 1.89:1. Most of the cases, i.e., 140 (35%) belonged to the age group of 21-30 years. In all, 18 poisoning cases below 13 years of age were admitted with diagnosis of acute poisoning in paediatric emergency. Paediatric poisoning contributed for 4.5% of total poisoning cases (18 of 400) during the study period. Mean±SD of age of all patients was (30.30±13.79) years. Mean±SD of age of male and female patients were (30.34±13.82) years and (30.35±13.82) years respectively. Ingestion was the commonest route of poisoning in 277 (69.25%) cases, followed by Dermal (in cases of animal bites) 123 (30.75%).

Table 1: Causative agents in poisoning cases.

Causative agents	N (%)
Pesticides	133 (33.25)
Poisonous Animal Bites	123 (30.75)
Phenyl	47 (11.75)
Unknown compounds	44 (11)
Acid	21 (5.25)
Drugs	16 (4)
Kerosene	3 (0.75)
Miscellaneous	13 (3.25)

Suicide was the commonest mode of poisoning recorded in 264 (66%) cases, followed by accidental poisoning, recorded in 135 (33.75%) cases. There was only 1 case (0.25%) of Homicidal poisoning. Different causative poisoning agents observed during this study. The commonest causative agents in majority of cases were Pesticides 133 (33.25%) cases, followed by Poisonous Animal Bites in 123(30.75%) cases. Among the Pesticides 133 (33.25%), the most commonly consumed were Organophosphates 64 (16%), Insecticides 25 (6.25%), Rat killing compounds 18 (4.5%), Cotton spraying compounds 12 (3%), Herbicides 8 (2%) and Pyrethroid compounds 6 (1.5%) (Table 1). Poisonous animal bites included Snake bites-105 (85%), Scorpion bites-5 (4%) and Unknown bites-13 (11%). Phenyl and Unknown compounds were accounted for 47 (11.75%) and 44 (11%) cases respectively, followed by Acid- 21 (5.25%), Therapeutic drugs- 16 (4%), Kerosene- 3 (0.75%) and Miscellaneous agents- 13 (3.25%). The most frequently observed symptoms among the 400 cases of poisoning in chronological order were: Vomiting in 199 (49.75%) cases, Local Symptoms (Cases of Bites) in 116 (29%) cases, Altered Sensorium in 46 (11.5%) cases, Nausea in 41 (10.25%) cases, Giddiness in 36 (9%) cases,

Abdominal Pain in 31 (7.75%) cases and Loss of Consciousness in 29 (7.25%) cases.

Table 2: Drugs used for symptomatic treatment of poisoning cases.

Drugs	N (%)
Nutritional Supplements	665 (19.03)
Antimicrobials	581 (16.62)
PPIs	554 (15.85)
Antiemetics	388 (11.10)
IV Fluids	326 (9.33)
Analgesic	170 (4.86)
Glucocorticoids	58 (1.66)
Vasopressor/Inotropic agents	54 (1.55)
Tetanus toxoid (TT)	47 (1.34)
Neostigmine	15 (0.43)
Calcium	12 (0.34)
Benzodiazepines	7 (0.20)
Anticoagulants	6 (0.17)
Others	168 (4.81)

Drugs used for symptomatic treatment were Nutritional Supplements- 665 (19.03%), Antimicrobials- 581 (16.62%), Proton Pump Inhibitors (PPIs)- 554 (15.85%) and Antiemetics- 388 (11.10%) (Table 2). Average number of drugs per case was 8.73. For specific management specific antidotes; Atropine in 168 (4.81%) cases, Pralidoxime (PAM) in 156 (4.46%) cases, Anti Snake Venom (ASV) in 98 (2.80%) cases, Glycopyrrolate in 17 (0.49%) cases and N-acetyl cysteine in 4 (0.11%) cases were prescribed (Table 3).

Table 3: Drugs used as specific antidote in poisoning cases.

Drugs	N (%)
Atropine	168 (4.81)
PAM (Pralidoxime)	156 (4.46)
Anti-snake venom (ASV)	98 (2.80)
Glycopyrrolate	17 (0.49)
N-acetyl cysteine (NAC)	4 (0.11)

Other than these, vasopressor agents, Inotropic agents, Analgesics, Inj. tetanus toxoid, glucocorticoids, benzodiazepines and anticoagulants were also prescribed. In all 400 cases, antimicrobial agent/s was/were prescribed in 308 (77%) cases, while the remaining 92 (23%) cases did not require any antimicrobial agent. The most frequently prescribed antimicrobials were Metronidazole 175 (30.12%) followed by Penicillins 172 (29.60%) and third generation cephalosporins 145 (24.96%) (Table 4). In this study, 57 (68.67%) drugs were prescribed by generic name while 22 (26.21%) drugs were prescribed by brand name. 70 (84.33%) drugs were prescribed from the National list of essential medicines (NLEM 2022). Average number of days of hospitalization in this study was 4.44 days per case, while median of days of hospitalization was 3 days. Maximum days of

hospitalization recorded was 55 days in a case of snakebite (Table 5).

Table 4: Prescribing frequency of different antimicrobials.

Antimicrobials	N (%)
Metronidazole	175 (30.12)
Penicillin	172 (29.60)
Amoxicillin+Clavulanic Acid	125 (21.51)
Piperacillin=Tazobactam	47 (8.09)
Cephalosporins	145 (24.96)
Ceftriaxone	83 (14.29)
Cefotaxime	48 (8.26)
Cefixime	14 (2.41)
Amikacin	36 (6.2)
Meropenem	33 (5.68)
Azithromycin	14 (2.41)
Linezolid	1 (0.17)
Colistin	1 (0.17)
Tigecycline	1 (0.17)
Doxycycline	1 (0.17)
Cefosulbactam (Cefoperazone+Sulbactam)	1 (0.17)
Sulfamethoxazole+Trimethoprim	1 (0.17)

Table 5: Prescribing indicators for drugs used in poisoning cases.

Parameters	Observation
Total number of drugs prescribed	3495
Average number of drugs per case	8.73
Percentage of drugs prescribed from nlem (%)	84.33
Percentage of drugs prescribed by generic name (%)	68.67
Average number of days of hospitalization	4.44
Median of days of hospitalization	3
Maximum days of hospitalization (snakebite)	55

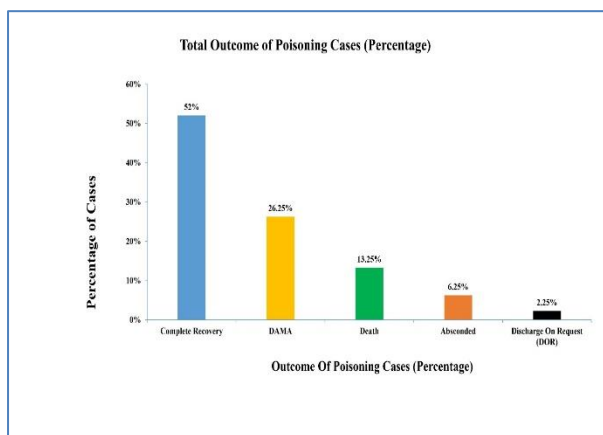


Figure 1: Total outcome of poisoning cases.

Complete recovery was recorded in 208 (52%) of cases (Figure 1). Death was recorded in 53 (13.25%) cases, in which, 38 (14.34%) were due to Suicidal poisoning and 15 (11.19%) were due to Accidental poisoning (Table 6). The causative agents in these death cases were organophosphate compounds- 25 (39.06%) deaths, Snake bite- 13 (12.38%) deaths, Unknown compounds- 6 (13.64%) deaths, Herbicides- 2 (25%) deaths, Cotton spraying compounds- 2 (16.67%) deaths, Acid- 1 (4.76%) death, Scorpion bite- 1 (20%) death, Insecticides- 1 (3.57%) death, Rat killing Compounds- 1 (5.56%) death and Unknown bite-1 (7.69%) death.

DISCUSSION

In the current study, evaluation of causative agents, clinical presentation, pharmacological management and outcome of acute poisoning cases of different age groups in terms of morbidity and mortality was analyzed. The reporting of 400 cases of acute poisoning in a single hospital over a period of 8 months emphasizes the seriousness of the problem of acute poisoning prevalent in this area. In the current study, most of the acute poisoning cases were between 11-40 years of age 75.75%, from which 35% patients belonged to 21-30 years of age group. A similar trend of 57.58% male predominance was reported in the study done by Prashant Gupta et al. in a rural tertiary care center in Northern India.¹⁰ Khan et al also observed highest incidence 41% of acute poisoning in 21-30 year age group in their study.¹¹ This conclusion can be rationalized from the certitude that the age group of 21-30 year is the critical interval of life. These people are more prone to traumatic affairs, career, unemployment, relationship turmoil, loneliness, financial crisis, fear of failure or failure itself, life settlement factors, etc. These are few of the various triggers that particularly makes this age group vulnerable to commit suicide impromptu.

In this study, majority of patients were male 65.5%. A study on toxicological pattern of poisoning in urban hospitals of Western India done by Raut Asawari et al. also reported male predominance of 56.24% and a male to female ratio of 1.3:1 in acute poisoning cases.¹² In many other studies also, male predominance was observed in acute poisonings 8-13 A. This trend may be due to increased occupational hazards and exposure of men to stress as they are in majority of the cases, the only earning members of the family.^{13,14} The commonest mode of poisoning was suicidal 66.25%, followed by accidental 33.5% and homicidal 0.25%. On the same lines, the study done by Maheshwari et al. reported that 79.2% of the cases were of suicidal poisoning and 20.8% cases were of accidental poisoning.¹⁵ Similarly, 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 suicide attempts.³

In this study, the most common poisoning agents were pesticides 33.25%, followed by Poisonous animal bites 30.75%. India being an agricultural nation, handling of

pesticides is a routine practice by farmers and their family members. Increased number of cases due to pesticide poisoning can be due to the easy availability of these agents and lack of knowledge to support their safe residential use.¹⁶ Among pesticides, organophosphorus compounds were the most common pesticides 16%, followed by Insecticides 6.25%, Rat killing compounds 4.5%, Cotton spraying compounds 3%, Herbicides 2% and Pyrethroid compounds 1.5%, respectively. Organophosphorus compounds are easily available and often stored in an improper manner due to lack of facilities and awareness of their hazards among rural people.¹⁷ The same trend was seen in a study carried out by Maharani et al where the commonest poisoning agent was Organophosphorus compounds 58.66% followed by rat killing compounds 11.33%; while Ramesha et al reported, 36% and 16.2% cases of organophosphates poisoning and Snake bite, respectively.^{18,19} Following pesticide poisoning, venomous animal bites were the second most frequent toxic exposure, responsible for 30.75% cases. Similar results were seen in a study conducted by Banerjee et al, in which venomous bites were responsible for nearly 30% of cases.²⁰ The high incidence of snake bite cases in the present study could be explained either by the fact that the hospital is located in the Central Gujarat where incidence of snake bite is high and the study duration coincided with the harvesting season of the farm workers.

Total 3495 drugs in the present study were prescribed in 400 patients of acute poisoning. The average number of drugs per encounter was 8.73. Providing symptomatic and supportive care was the mainstay of management in all patients of poisoning cases. The main aim of supportive care is to treat the symptoms rather than the poison itself especially when the poison is unknown or the specific antidote is not available. Treatment modalities for any poisoning during the study period were found to be almost similar. It included preventing the further absorption, increasing the elimination of the poison, administering specific substance that eliminates, inactivates or counteracts the effect of poison like antidote if available. Drugs used in majority, for symptomatic treatment were Nutritional Supplements 19.03%, Antimicrobials 16.62%, Proton Pump Inhibitors PPIs 15.85% and Antiemetics 11.10%. Among the specific antidotes, Atropine 4.81%, Pralidoxime PAM 4.46%, Anti Snake Venom ASV 2.80%, Glycopyrrolate 0.49% and N- acetyl cysteine 0.11% were prescribed for the related poisoning cases.

The most frequently prescribed antimicrobials in the present study were Metronidazole 30.12% followed by Penicillins 29.60% and Third generation Cephalosporins 24.96%. In a similar study done by Asari et al most frequently used antimicrobials were Third generation Cephalosporins 49.4%, followed by Metronidazole 34.4% and Penicillins 33.5%.²¹ Antimicrobials are common irrationally used medicines in low- and middle-income countries.²² Antibiotic resistance poses a serious threat to humans and undermines global economy. Various clinical trials did not prove any benefit of antibiotic therapy for

acute poisonings especially in snakebites and organophosphate poisoning.^{23,24} In the present study, 68.67% drugs were prescribed by generic name and 26.51% were prescribed by brand name. Drugs prescribed more by brand names adds more cost to the patient and hospital. Increasing generic prescribing would rationalize the use and reduce the cost of the drug. In a study carried out by Aravind et al for assessing the pattern of acute poisoning admissions in the MICU of a tertiary care hospital in Karnataka, prescription audits were done and reported that almost 60% of the prescriptions comprised of generic drugs.¹ In present study, 84.33% drugs were prescribed from the National List of Essential Medicine NLEM, 2022. Prescription of 15.66% drugs other than present in NLEM could be due to non-availability of drugs and clinicians' preference. The morbidity and mortality in any case of acute poisoning depends on the number of factors such as the nature of poison, dose consumed, level of available medical facilities and the time interval between intake of poison and provision of medical help. In the present study complete recovery was seen in 52% of cases, while 13.25% of the acutely poisoned patients succumbed to death. Other outcomes of poisoning were Discharge against medical advice DAMA 26.25%, Absconded 6.25% and discharge on request DOR 2.25%.

The proportion of death that occurred in this study was smaller than study done in Bengal 15.03%³, study by Vaidya et al 20%, Ramesha et al 15.4% and Singh et al 17.3%, respectively.¹⁹⁻²⁶ One of the reasons for the lesser mortality reported probably could be due to the fact that the outcome of patients, who took premature discharge is unknown and could not be taken for analysis like in cases of DAMA and Absconded. The mortality rate in this study was higher than study done in Maharashtra and Andhra Pradesh with 9.8% and 8.47% mortality rate, respectively.^{27,28} High mortality in this study could be due to various reasons like long time interval between toxic exposure and hospital arrival, lack of information regarding the poison agent and the dose/amount consumed in some cases, lethal snakebite envenomation, highly toxic pesticide ingestions and finally lack of specific antidotes. In addition, many patients were referred from private hospitals with a delay when their conditions had become worse. In general, however, the majority of the patients recovered, which indicates good emergency and intensive care management in our setting. It is suggested that a poisoning center in tertiary care hospitals will help decrease morbidity and mortality.²⁹ In some cases, mode of poisoning could not be reported correctly as these patients tried to conceal the history or gave false information. Poisonous agent abused by some of the patients was not clearly mentioned by them. Wrong diagnosis was unavoidable in few cases due to improper history and overlapping of the symptoms. In accidental animal bite cases, there was confusion between snake bite and other poisonous insect bite, thus such cases were included in group of unknown bite. Most of the cases of snake bite were reported very late, due to poor transportation facilities and people having more belief

over local quacks. Some patients were discharged against medical advice and some were absconded. Such cases were excluded from study as the outcome was impossible to be traced. Lastly, this study was done in Sir Sayajirao General Hospital only. Because of limitations, private hospitals were not included in the study. Inclusion of data from the private hospitals would have helped to get an idea of actual incidence of acute poisoning cases in this region. Increased intentional poisoning in younger age group emphasize on importance of counseling and awareness about depression and stress. Awareness and education safety from hazardous chemicals at household and occupational level is a strong indication to prevent accidental poisoning. Burden of poisoning and animal bite cases brought to casualty, demands strategies for identification and rational management providing optimal outcomes. Due to high incidence of snakebites, hospital stockpiles should be regularly checked for availability of ASV. Educational programs with emphasis on preventive measures for acute poisoning are necessary to create awareness among the general public.

CONCLUSION

Pattern and magnitude of poisoning are multidimensional and demand multi-sectoral approach for facing this problem. Due to high incidence of snakebites, hospital stockpiles should be regularly checked for availability of antivenom. There is a need for stringent pesticide regulation laws, counselling and training programs to reduce incidence of poisonings and deaths due to it.

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