ORIGINAL ARTICLE

Drug Utilization Study on Acute Poisoning Cases Treated at a Tertiary Care Hospital in Western Part of India

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Abstract

Background: Acute poisoning is a common medical emergency. This study was designed to investigate the pattern of drug utilization, poisoning agents, and outcome in patients with acute poisoning treated at a tertiary care teaching hospital in Vadodara, west of India.
Methods: This prospective cross sectional drug utilization study was carried out on patients with diagnosis of acute poisoning admitted to emergency department of Sir Shree Sayajirao General Hospital during October, 2013 to March, 2014.
Results: During 6 months, 340 acute poisoning cases were enrolled, out of which 216 cases (63.5%) were men. Mean age of the patients was 31.9 ± 12.7 years. Commonest mode of poisoning was intentional (suicidal), which was observed in 62.1% of cases. Pesticides were the most common cause of poisoning (40%), followed by venomous animal exposures (25.9%). Fifty-six patients (16.5%) died. A significantly higher number of deaths was seen in intentional poisonings compared to accidental poisonings (24.2% vs. 3.9%; $P < 0.001$). The most common symptomatic treatments given to the patients were antiemetics (97.9%), H_2 blockers (89.1%) and antimicrobials (75%s). Atropine (47.7%), pralidoxime (42.4%) and anti-snake venom (15%) were the most commonly prescribed specific antidotes. Median number of drugs per encounter was 8 [range: 1 to 23]. Over half of drugs were prescribed by generic and nearly one-thirds of drugs were prescribed by brand name.
Conclusion: Use of antimicrobial medicines for poisoned patients was too high and irrational. Due to high incidence of snakebites, hospital stockpiles should be regularly checked for availability of antivenom. Educational programs with emphasis on preventive measures for toxic exposures are necessary to create awareness among the general public.

Keywords: Drug Utilization; Epidemiology; India; Poisoning

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INTRODUCTION

Acute poisoning due to accidental or deliberate exposure to drugs, chemicals and natural toxins is a common medical emergency. Poisoning is a major public health problem of the developing world resulting in health threats and hospitalization leading to great financial burden on victims and an immense strain on hospital services (1). According to a national annual report, 110,688 people died due to poisoning in India in 2012 (2). Data from National Crime Bureau of India show accidental poisoning accounted for 7.8% of all causes of un-natural deaths in the year 2012. Poison ingestion for committing suicide was observed in 29.5% of suicidal deaths during 2012 (2).

The management of acute poisonings depends upon institutional protocols, availability of healthcare facilities and life-saving drugs. 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 (3). There is also a need to evaluate annual epidemiologic data on acute poisonings treated at each medical setting to better handle and manage drug and antidote stockpiles (4). Hence, this study was designed to investigate the pattern of drug utilization, poisoning agents, and outcome in patients with acute poisoning treated at a tertiary care teaching hospital in Vadodara, west of India.

METHODS

This prospective cross sectional drug utilization study was conducted at Sir Shree Sayajirao General (SSG) Hospital, a 1500-bed tertiary care teaching hospital affiliated to Medical College, Baroda , for a period of 6 months from October 1st, 2013 to March 31st, 2014. SSG hospital provides medical services to the patients of Vadodara, central Gujarat, as well as nearby districts to Vadodara including Madhya Pradesh and Maharastra state. This tertiary care teaching hospital admits poisoned patients initially and also admits referrals (severe poisoned patients) from secondary care hospitals and private hospitals in the region.

All patients with diagnosis of acute poisoning admitted to emergency department were included in this study. Diagnosis was made by the treating clinicians on the basis of history and clinical findings and in some cases through routine laboratory

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investigations, as well. Patients with uncertain diagnosis as well as those with 12 years of age and under were excluded from the study. Approval of the institutional ethics committee for human research was taken before initiating the study. The confidentiality of patients' personal information was maintained.

Data of subjects including age, duration of hospital stay, clinical findings, final diagnosis, treatments delivered and final outcomes were taken from the case papers during their admission in the hospital. For patients who were hospitalized for less than 24 hours, hospital stay was counted as 1 day. For drugs prescribed for patients by brand names and for fixed dose combinations, the information about generic name of the drugs and contents of formulations were obtained from the 2013 edition of Indian Drug Review and the 2013 edition of Current Index of Medical Specialties. The 2011 edition of National List of Essential Medicines of India (NLEM) was also used for measuring the percentage of drugs with reasonable costs prescribed for the patients. NLEM is written in regards to consider the health care needs of India at large view, where focus is on many factors out of which cost: benefit ratio is one of the important factors. There may be some drugs which are not included in NLEM, perhaps because of high cost, although clinicians may find them more efficacious and may prefer to prescribe them.

Data were analyzed using Statistical Package for the Social Sciences (SPSS Inc., Chicago, USA). Results are expressed with frequency and percentage for qualitative variables and with mean ± standard deviation (SD) for normally distributed quantitative variables, and with median and range for non-normally distributed quantitative variable. The difference of frequency between two groups was analyzed using the chi-squared test. P values less than 0.05 were considered statistically significant.

RESULTS

Poisoning pattern

During the study period 340 acute poisoning cases were treated at SSG hospital, out of which 216 cases (63.5%) were men. Mean (± SD) age of the patients was 31.9 ± 12.7 years. Majority of cases belonged to the age group of 13-40 years (77.6%).

Ingestion was the most common route of exposure to poisons (71.5%) followed by dermal exposure (in cases of venomous animal exposures) (25.9%) and inhalation (2.6%). Commonest mode of poisoning was intentional (suicidal), which was observed in 62.1% of cases while accidental poisoning accounted for 37.9% of cases.

Different causative poisoning agents observed during this study are shown in table 1. Pesticides were the most common cause of poisoning (40%), followed by venomous animal exposures which accounted for approximately a quarter of cases (25.9%). Venomous animal exposures included snake bites (66 cases), honey bee stings (4 cases), scorpion stings (2 cases), and unknown bites and stings (19 cases). In 19.4% of cases, the poisoning agents could not be identified.

Most frequently observed symptoms in the patients were vomiting (57.9%), local puncture and bite marks in venomous animal exposures (22.9%), altered sensorium (18.2%), dizziness (13.5%), difficulty in breathing (7.1%) and abdominal pain (4.4%).

Table 1. Poisoning agents of acute poisoning cases

Poisoning agents	N (%)
Pesticides	136 (40.0)
Organophosphates	66 (19.4)
Rodenticides	30 (8.8)
Variable insecticides	29 (8.5)
Pyrethroids	4 (1.2)
Herbicides[1]	4 (1.2)
Organophosphate + pyrethroid	2 (0.6)
Aluminum phosphide	1 (0.3)
Venomous animal exposures	88 (25.9)
Household agents	28 (8.2)
Hydrocarbons[2]	17 (5.0)
Corrosive agents[3]	9 (2.6)
Cosmetic	2 (0.6)
Drugs[4]	11 (3.2)
Recreational substances	7 (2.1)
Ethanol	5 (1.5)
Bhang	2 (0.6)
Mercury	1 (0.3)
Dhatura leaf	1 (0.3)
Insecticide + Kerosene	1 (0.3)
Food poisoning	1 (0.3)
Unknown compounds	66 (19.4)

[1] Including unidentified herbicides, carbamate and urea
[2] Including phenyl compounds, kerosene, hit liquid
[3] Including different acids, harpic toilet cleaner and dettol
[4] Paracetamol, valproate sodium, diazepam, haloperidol, ibuprofen, anti-retroviral tablets, and unknown medicines

Mean duration of hospital stay was 5.4 ± 3.8 days with a median of 4 [range: 1-38] days. Maximum length of hospital stay was observed in a case of acid ingestion. Figure 1 illustrates outcome of patients. Complete recovery was seen in 66.5% of cases and mortality rate was 16.5%. Out of 56 death cases, 51 were due to suicidal poisoning and 5 were due to accidental poisoning which shows a statistically significant difference (24.2% vs. 3.9%; $P < 0.001$). Deaths recorded were due to unknown compounds (23 cases), OP agents (19 cases), snakebites (4 cases), unclassified insecticides (4 cases), corrosive agents (2 cases), pyrethroid (1 case), aluminum phosphide (1 case), ethanol (1 case) and rodenticide (1 case).

Drug utilization pattern

The most common symptomatic treatments given to the patients were antiemetics (97.9% of cases), H_2 blockers (89.1% of cases) and antimicrobials (75% of cases) (Table 2). Atropine (47.7% of cases), pralidoxime (42.4% of cases) and anti-snake venom (ASV) (15% of cases) were the most commonly prescribed specific antidotes. As nutritional supplements, different vitamin preparations and enzyme

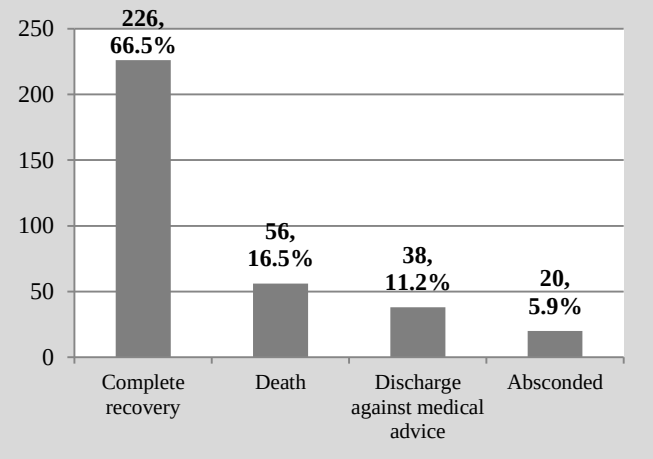

Figure 1. Outcome of acute poisoning cases

preparations (serratiopeptidase, trypsin and chymotrypsin, bromalein and rutoside trihydrate) were also prescribed for 214 and 75 patients, respectively.

Parenteral route was the most common route used for drug administration (98.5%). Only 5 patients (1.5%) received drugs orally. In total, 103 different drugs were prescribed including 56 drugs (54.4%) which were prescribed by generic name and 31 drugs (30.1%) which were prescribed by brand name. There were also 15.5% of drugs which were prescribed by generic name for some patients and by brand name for others. Only 66% of drugs were prescribed from the NLEM-2011.

DISCUSSION

Poisoning as an emergency is more common in India than western countries owing to the easy availability of poisons, increasing use of chemicals for industrial and domestic purpose, quack remedies containing poisonous substances and high frequency of venomous animal exposures (5). The occurrence of 340 cases of acute poisoning in a single hospital over a period of six months highlights the seriousness of the problem in this area. In this study, the majority of patients were men. The similar pattern was observed by Ramanath et al in a study carried out in Karnataka and another study by Maharani et al in Tamil Nadu (6,7) In many other studies also, male predominance was observed in acute poisonings (8-13). This could be due to the fact that men are more often exposed to the strain and stress in a day to day life, as well as to the occupational threats compared to women. In this study, most of the cases were between 13-40 years of age. In two Indian studies by Srivastava et al and Vaidya and Hulke, highest arte of acute poisoning was similarly observed in this age group (14,15). It is a known fact that adolescents and young adults are more prone to poisoning due to work pressure, marriage, emotional problems, quarrel with family, economical stress and other life settlement factors (2,16).
The most common reason behind poisoning was suicidal intent which was observed in 62% of cases. Jesslin et al reported similar rate in reviewing 1045 poisoning cases in southern India (17). The higher incidence of intentional poisonings compared to accidental ones is a usual observation in poisoning epidemiologic research especially if children are excluded from the study (18).

Table 2. Medicines prescribed for acute poisoning cases

Medicines	N (%)
As Symptomatic Treatment	
Antiemetic	333 (97.9)
H_2 blockers*	303 (89.1)
Antimicrobials	275 (75.0)
Proton pump inhibitors*	115 (33.8)
Inotropic agents	54 (15.9)
Vasopressor agents	53 (15.6)
Tetanus toxoid	46 (13.5)
Analgesics	38 (11.2)
Anticonvulsants	28 (8.2)
Glucocorticoids	27 (7.9)
Benzodiazepines	25 (7.4)
Antihistamines	21 (6.2)
Calcium	16 (4.7)
Bronchodilators	12 (3.5)
Diuretics	6 (1.8)
As Specific Antidote	
Atropine	162 (47.7)
Pralidoxime	144 (42.4)
Anti-snake venom	51 (15.0)
Neostigmine**	10 (2.9)
Glycopyrrolate	9 (2.7)
Physostigmine***	1 (0.3)

* For some cases, both H_2 blockers and PPIs were prescribed. In such cases, treatment was started with PPIs and switched to H_2 blockers after few days
** Given for neurotoxic snakebite envenomation
*** Given for datura poisoning

In this study, the most common poisoning agents were pesticides. Maharani et al similarly reported pesticides as the most common poisoning agent in Tamil Nadu, southern India (7). Studies conducted in Bangladesh and Nepal likewise ascertained pesticides as the commonest toxic agent used for poisoning (16,19). The fact is that the pesticide poisoning is a common health problem in Indian subcontinent, mainly due to easy availability of such chemicals (20,21). Following pesticide poisoning, venomous bites and stings were the second most frequent toxic exposure, responsible for over a quarter of cases. Similar results were seen in a study conducted by Banerjee et al, in which venomous bites were responsible for nearly 30% of cases (22). The high incidence of this type of toxic exposure in the present study could be explained either by the fact that the hospital is located in the central Gujarat where vast tropical forests occur and that the study was carried out in the harvesting season in this agriculture-based region when farm workers were majorly affected by venomous creatures (23).

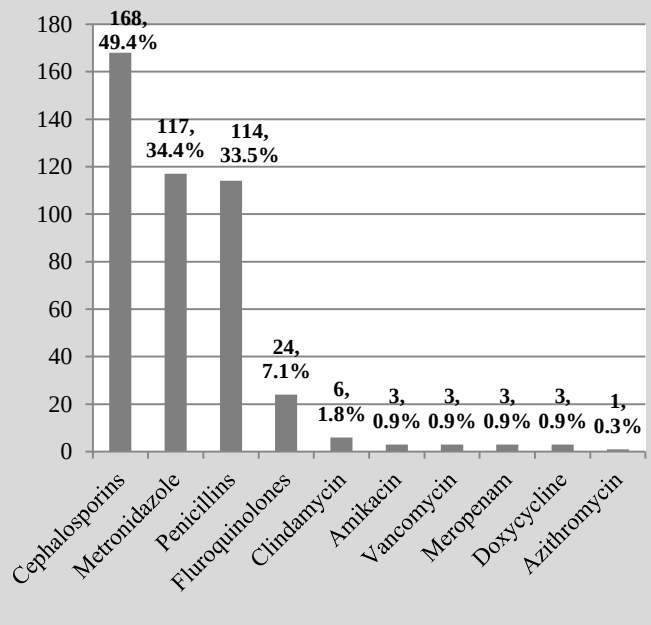

Figure 2. Antimicrobials prescribed for acute poisoning cases

Various treatments including symptomatic care and specific antidote were used depending on the poisoning agents in this study. Symptomatic and supportive care was the mainstay of management in the majority of poisoning cases in the present study. In our setting, treatment modality for acute poisoning was found to be almost similar for various cases during the study period and included prevention of further absorption and increase in poison elimination. In this respect, it can be said that except for patients with venomous animal exposures, ethanol overdose, corrosive agent ingestion and food poisoning, activated charcoal was given to all the other patients except for those patients arriving to hospital later than 1 hour after toxic exposure. In addition, for symptomatic treatment, gastro-protective drugs like H_2 blockers and proton pump inhibitors, antiemetics and antibiotics were given. Atropine, pralidoxime and ASV were the most frequently used antidotes. In a similar study by Aravind et al, gastro-protective drugs constituted the majority of prescribed medicines, among which proton pump inhibitors were preferred over H_2 blockers, and atropine and pralidoxime followed by N-acetyl cysteine were the most commonly given antidotes (1). Our hospital is a tertiary care teaching hospital run by state government. Hence, purchasing of different drugs is done centrally at state level. Therefore, sometimes a particular medicine/antidote might be out of stock. In this study, 15 snakebite victims did not receive ASV because of unavailability of the antidote in the hospital stockpile. The shortage of essential medicines in public medical facilities, although being uncommon, is a frustrating problem both in high income and low income countries (24).

In this study, for some patients with organophosphate poisoning, glycopyrrolate was given along with atropine. There are some data which suggest that addition of glycopyrrolate to atropine reduces the dose of atropine required and may also reduce the toxic effects on the central nervous system and the duration of ventilatory support (25,26).

Antimicrobials were given to three fourth of the patients in this study. The most frequently prescribed antimicrobials in the present study were third generation cephalosporins followed by metronidazole and penicillins. Similar antimicrobial usage was reported by Aravind et al in Karnataka, southwest India (1). Irrational use of medicines is a major global problem. World Health Organization estimates that more than half of all medicines are prescribed, dispensed or sold inappropriately (27). Antimicrobials are common irrationally used medicines in low and middle income countries (28). Antibiotic resistance poses a serious threat to humans and undermines global economy. It is inexplicable that this high usage of antibiotics exists in a poisoning ward like ours. Various clinical trials did not prove any benefit of antibiotic therapy for acute poisonings especially in snakebites and organophosphate poisoning (29,30).

In this study, 54.3% of drugs were prescribed by generic and 30.1% were prescribed by brand name. Drugs prescribed by brand names impose more costs to the patients. In the Aravind et al's study, audits showed 60% of the prescriptions comprised generic drugs (1). Paying attention to generic prescribing would rationalize the drug use and reduce the healthcare costs. Moreover, we found that 34% of drugs were given although they were not included in the NLEM. Prescription of drugs not present in NLEM might be due to clinicians' preference, a fact that should not be neglected by the health authorities.

The morbidity and mortality in any case of acute poisoning depends on the number of factors such as nature of poison, dose consumed, level of available medical facilities and time interval between intake of poison and provision of medical help. In the present study, mortality was recorded in 16.5% of patients. In a study conducted by Vaidya and Hulke, overall mortality due to poisoning was 20% (15). In another study by Ramesha et al, overall mortality was found to be 15.4% (9). Nonetheless, in some other Indian studies, death rate is much lower, even lower than 5% (2,17). 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 envenomations, 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 (31).

LIMITATIONS

As this study was conducted for a short duration and at a single hospital, results cannot be generalized. The poor documentation of patients' information in medical records due to lack of well-trained staff can be another limitation of the study. Poisonous agents abused by some of the patients were not clearly identifiable in many cases. This is partly due the fact that SSG hospital does not have a toxicology laboratory and no specific toxicological investigation is performed in SSG. Medicines used

for treatment of poisoned cases were documented by recording the clinicians' orders out of case papers into our checklists. We did not make comment on the treatments given. Moreover, for many cases, there were no clear-cut therapeutic guidelines and the treatment was mainly based on clinicians' experience and preference. Hence, as pharmacologists, we feel that this high use of antimicrobials was irrational.

CONCLUSION

Use of antimicrobial medicines for poisoned patients was too high and irrational. Due to high incidence of snakebites, hospital stockpiles should be regularly checked for availability of ASV. Educational programs with emphasis on preventive measures for toxic exposures are necessary to create awareness among the general public.

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