

Toxicological Pattern of Poisoning in Urban Hospitals of Western India

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ABSTRACT

Background: Poisoning is a significant global public health problem which leads to nearly a million deaths each year. Incidence of poisoning in India is among the highest in the world. Despite the vast number, evidence on prevalence pattern in India is yet limited. **Objective:** The present study aimed to characterise acute poisoning cases with respect to the demographics, effect due to time lag and treatment outcomes. **Methods:** The cross sectional retrospective study was conducted from January 2013 to December 2015 in government and private teaching hospitals. **Results:** Of all reviewed cases male over female predominance was observed. Maximum poisoning was observed in the age group 20-35 years with an increased incidence of female cases in age category 13-19 years. Household and agricultural agents (56.4%) were associated with most poisoning. Intentional poisoning was more common (53.3%) and predominant in age category 20-35 years. Maximal exposure was observed between 6 pm – 12 am. Maximum patients (77.6%) responded to the therapy given while 12.6% absconded, took discharge against medical advice or were referred to another hospital. The mortality rate was 9.6 % with male predominance. **Conclusion:** The study concludes that the burden of poisoning demands

strategies for prevention, identification and rational management providing optimal treatment outcomes.

Key words: Poisoning pattern, Acute poisoning, Time lag, Treatment outcomes, Mortality.

Key message: Epidemiological study on prevalence of Poisoning and its outcomes in different regions of India are less documented. Such studies help in developing poison registries and development of hospital based poison information centres.

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INTRODUCTION

Poisoning is a significant global public health problem ranking 45th in total death worldwide. Nearly a million people die each year because of suicide, and it is estimated that deliberate ingestion of pesticides causes 3,70,000 deaths each year. According to WHO data, in 2012 an estimated 1,93,460 people died worldwide from unintentional poisoning. Of these deaths, 84% occurred in low- and middle-income countries. In the same year, unintentional poisoning caused the loss of over 10.7 million years of healthy life.¹

The incidence of poisoning in India is among the highest in the world. It is estimated that more than 50,000 people die every year from toxic exposure. According to the National Poisons Information Centre, New Delhi, analysis of poisoning calls showed that the highest incidence of poisoning was due to household agents (44.1%) followed by drugs (18.8%), agricultural pesticides (12.8%), industrial chemicals (8.9%), animals bites and stings (4.7%), plants (1.7%), unknown (2.9%) and miscellaneous groups (5.6%). The commonest cause of poisoning in developing countries is pesticides which includes organophosphates, carbamates, chlorinated hydrocarbons, pyrethroids and aluminium or zinc phosphide. The reason behind this upsurge is the agriculture based economics, poverty, unsafe practices, illiteracy, ignorance and easy availability of highly toxic pesticides. Majority of victims of poisoning are from lower socio economic status.²

Globally much is known and documented on poisoning. On the contrary, lack of updated information due to unavailability of published data

and accessible databases, a few established poison centres and national surveillance is faced in India. Similar challenges have been observed in other countries such as China, Botswana and South Africa. This paucity of information on risk population, circumstances and toxic substances is a hurdle to effective poisoning prevention and targeted intervention programs. Therefore, the need for a current review of poisoning patterns in India is imperative. This study sought to characterize poisoning with regard to demographic factors (i.e. age, sex and residence), common toxic agents used and their case fatality rates as well as the overall mortality rate of acute poisoning in Pune district.

Pune is a district in the state of Maharashtra in India. According to the most recent census in 2011, the total population was 9.4 million making it the 4th most populous district in India. The city accommodates many industrial areas which provides easy accessibility of large number of chemicals and pesticides which in turn results in tremendous use of these agents for poisoning. The agricultural diversity of Pune has resulted in increase of animal bites and stings and also use of pesticides for deliberate self harm and accidental exposures.

METHODOLOGY

Study Area

The study was conducted in Pune district of Maharashtra, which resides a total population of 9.4 million inhabitants with a male to female ratio

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of 1.1:1. It forms a part of the topical monsoon land and therefore shows a significant seasonal variation in temperature and rainfall.

The Pune city resides many multispecialty hospitals. The Government hospital, a 380 bedded multispecialty hospital, is located in Pimpri - Chinchwad which engulfs a wide area of surrounding suburban and industrial areas like Aundh, Bhosri, Nigdi and villages like Moshi, Chikli, Dehu, etc. The private teaching hospital is a 900 bedded hospital with hi-tech super specialties. It is located in inner suburbs of Pune which includes areas like Katraj, Ambegaon, Vadgaon, Parvati Hill, etc. These are the industrial and agricultural areas where high number of chemical or pesticide poisoning can be observed.

Population and Sampling

The study was cross-sectional and made use of retrospective extraction of data from records available at the government and private teaching hospitals respectively. All cases of poisoning available in the medical record departments were included in the study.

Data Collection and Extraction:

The records were collected from Medical Record Department of the respective hospitals. The data collection period was from January 2013 to December 2015. The cases were reviewed for gender, age, route and reason of poisoning, seasonal variation and agents. Poisonous agents were described and grouped in accordance with International Classification of Diseases [ICD-10].

Statistical Analysis: Data was collected in predefined forms. Chi Square test was used to determine the association between the variables. $P < 0.05$ was used to determine significance.

RESULTS

Demography of poisoning cases and toxic agents involved

A total of 1010 cases were reviewed over a span of 3 years. Marital status and occupational background were not included in the study due to inappropriateness and unavailability of data in many case files. The sex, age, reason of poisoning, route of poisoning, seasonal variation and agents involved in poisoning is according to the records available. Thirteen cases were reported dead on admission. The post mortem reports of these cases were reviewed for sex, reason and route of poisoning, and agents but age was unavailable. The age of patients ranged from 0 – 72 years with a median age of 27 years. Poisoning in males was predominant (56.24%) with a male to female ratio of 1.3:1. Maximum number of cases was observed in the age group of 20-35 years (55.5%) followed by 13-19 years (14.9%). Increased female cases were reported in age category 13-19 years (65.3%) (Table 2). Poisoning was more during summer season (35.1%). Household and agricultural agents (56.4%) followed by bites and stings (26.4%) were associated with most poisoning (Table 1). Organophosphates and carbamates were the most common causes. Drug poisoning was reported in 10.8% cases and maximum abuse was by NSAIDs and anti-pyretic agents. Drugs were widely used by children of 13-19 yrs as self-harm (Table 2).

Reason and Route of poisoning

Intentional poisoning was more common (53.3%) and maximum in 20-35 age category (65.2%) [$p < 0.05$]. Household and agricultural agents (79.4%) were used widely and drugs (16.7%) were the second most used agent for intentional poisoning [$p < 0.05$]. Most cases in age group 13-19 years were intentional (16.5%) [$p < 0.05$]. Accidental cases were maximum in 20-35 yrs (39.8%) followed by 24.4% in age group 0-12 years. 60.4% percent accidental poisoning was due to bites and stings (Table 3). Animal bites and stings were the most common cause of accidental poisoning. In people above 55 years, accidental were more compared to intentional, the reason being old age, mishandling and non adherence. Out of all

Table 1: Characteristics of Poisoning Cases Reviewed

Characteristics	Frequency	Proportion (%)
Sex		
Male	568	56.24
Female	442	43.76
Age		
0-12	108	10.7
13-19	150	14.9
20-35	560	55.5
36-55	140	13.9
>55	39	3.9
Reason for poisoning		
Intentional	539	53.3
Accidental	442	43.8
Unknown	29	2.9
Route of Poisoning		
Ingestion	702	69.5
Injection	1	0.1
Inhalational	39	3.9
Bite/Sting	267	26.4
Eye	1	0.1
Season of Poisoning		
Summer	355	35.1
Monsoon	322	31.9
Winter	333	33.0
Agent Involved		
Household and Agricultural products	570	56.4
Animal Bites and Stings	267	26.4
Drugs	109	10.8
Plants and Miscellaneous	36	3.6
Unspecified	28	2.8

- Marital status and occupational background were not included due to unavailability of data.
- 13 cases were reviewed from post mortem reports where age was not available.

cases reported, oral ingestion was the most common route of exposure (69.6%) followed by bites and stings (26.4%), inhalational (3.9%) and injection (0.1%). The reported 39 exposures by inhalational were accidental occupational exposure whereas one exposure by injection was accidental higher dose of Insulin in a 40 year old female.

Outcome of Poisoning with Time of exposure, Time of Hospitalization and Time lag

Maximum patients (77.6%) responded to the therapy given while 12.6% absconded, took Discharge against Medical Advice (DAMA) or were

Table 2: Patient Characteristics According to Age Category

Characteristics	Age in years [Numbers (%)]					P value
	0-12 [n=108]	13-19 [n=150]	20-35 [n=560]	36-55 [n=140]	>55 [n=39]	
Sex						<0.05
Male	67(62.0)	52(34.7)	324(57.9)	87(62.1)	30(76.9)	
Female	41(38.0)	98(65.3)	236(42.1)	53(37.9)	9(23.1)	
Reason for poisoning						<0.05
Intentional	0	89(59.3)	365(65.2)	62(44.3)	12(30.8)	
Accidental	108(100)	54(36.0)	176(31.4)	76(54.3)	26(66.7)	
Unknown	0(0)	7(4.7)	19(3.4)	2(1.4)	1(2.5)	
Route of Poisoning						<0.05
Ingestion	45(41.7)	135(90.0)	439(78.4)	49(35.0)	21(53.8)	
Inhalational	0	2(1.3)	3(0.5)	34(24.3)	0	
Injection	0	0	0	1(0.7)	0	
Bite/Sting	63(58.3)	13(8.7)	117(20.9)	56(40.0)	18(46.2)	
Eye	0	0	1(0.2)	0	0	
Agents Involved						<0.05
Household and Agricultural products	21(19.5)	115(76.7)	345(61.6)	61(43.6)	17(43.6)	
Animal Bites and Stings	63(58.3)	13(8.6)	116(20.7)	58(41.4)	15(38.5)	
Drugs	5(4.6)	16(10.7)	68(12.1)	16(11.4)	4(10.3)	
Plants and Miscellaneous	17(15.7)	3(2.0)	11(2.0)	3(2.1)	2(5.1)	
Unspecified	2(1.9)	3(2.0)	20(3.6)	2(1.4)	1(2.6)	

13 cases were reviewed from post mortem reports where age was not available.

- p value was calculated using Chi-square test.

Table 3: Factors Associated with Reason for Poisoning

Characteristics	Reason for poisoning [Numbers (%)]			P value
	Accidental [N=442]	Intentional [N=539]	Unknown [N=29]	
Sex				<0.05
Male	281(63.6)	270(50.1)	17(58.6)	
Female	161(36.4)	269(49.9)	12(41.4)	
Age				<0.05
0-12	108(24.4)	0	0	
13-19	54(12.2)	89(16.5)	7(24.1)	
20-35	176(39.8)	365(67.7)	19(65.5)	
36-55	76(17.2)	62(11.5)	2(6.9)	
>55	26(5.9)	12(2.2)	1(3.5)	
Route of Poisoning				<0.05
Ingestion	134(30.3)	539(100)	29(100)	
Inhalational	39(8.8)	0	0	
Bite/Sting	267(60.4)	0	0	
Injection	1(0.2)	0	0	
Eye	1 (0.2)	0	0	
Agent Involved				<0.05
Household and Agricultural products	117(26.5)	428(79.4)	25(86.2)	
Animal Bites and Stings	267(60.4)	0	0	
Drugs	16(3.6)	90(16.7)	3(10.3)	
Plants and Miscellaneous	36(8.1)	0	0	
Unspecified	6(1.4)	21(3.9)	1(3.5)	

P value was calculated using Chi-square test.

Table 4: Factors Associated with Outcome of Poisoning

Characteristics	Outcome for poisoning [Numbers (%)]			P value
	Recovered [N=784]	DAMA/Absconded/Referral [N=127]	Death [N=99]	
Sex				<0.05
Male	420 (53.6)	82 (64.6)	70 (70.7)	
Female	364 (46.4)	45 (35.4)	29 (29.3)	
Age				<0.05
0-12	89 (11.2)	7(5.5)	12 (12.1)	
13-19	122 (15.4)	25 (18.9)	3 (3.0)	
20-35	452 (57.9)	77 (63.8)	31 (44.4)	
36-55	101 (12.9)	13(8.7)	26 (26.3)	
>55	21 (2.6)	4 (3.1)	14 (14.2)	
Route of Poisoning				<0.05
Ingestion	513(65.4)	109 (85.8)	80 (80.8)	
Inhalational	35 (4.5)	0	4 (4.1)	
Bite/Sting	235 (30.0)	18 (14.2)	14 (14.1)	
Injection	0	0	1 (1.0)	
Eye	1(0.1)	0	0	
Agent Involved				<0.05
Household and Agricultural products	410 (52.3)	78 (61.4)	82 (82.8)	
Animal Bites and Stings	225 (28.7)	28 (22.1)	14 (14.2)	
Drugs	93 (11.9)	14 (11.0)	2 (2.0)	
Plants and Miscellaneous	34 (4.3)	2 (1.6)	0	
Unspecified	22 (2.8)	5 (3.9)	1 (1.0)	

- p value was calculated using Chi-Square Test

referred to another hospital [$p < 0.05$]. Symptoms improved in 74.5 % cases and did not improve in 9.8%. The mortality found in the present study was 9.8% with predominance of males to females in death cases. According to available data, most death was seen in adults (Table 4). Maximum death were reported due to exposure to household and agricultural agents (82.8%) followed by animal bites and stings (14.1%) and drug poisoning (2.0%) (Table 4). Mortality due to organophosphates was highest (55.6%) (Figure 1). An increased trend in consumption of alcohol along with toxic agent for self harm was observed, increasing the risk of aspiration, coma and respiratory failure leading to death. Exact Time of Exposure (TOE) was unavailable in majority of the cases. According to available data, TOE was maximum during 6 pm – 12 am followed by daytime between 6am – 12 pm (Figure 2). Time of Hospitalization (TOH) was available in majority cases and was found highest during afternoon 12 pm – 6 am and maximum death was also recorded during this time (Figure 3). The time lag between TOE and TOH was determined by the available data. Maximum time lag of 1-3 h was found in the study. One case with time lag more than 24 h died whereas cases with time lag less than 1 h showed better recovery (Figure 4).

DISCUSSION

A wide range of age groups of both genders were found exposed and victims to poisoning, with male predominance. A similar trend was

reported by studies conducted in Northern,^{3,4,6} Southern,^{8,9} Western^{12,13,15} and Eastern¹⁶ regions of India and countries like Sri Lanka¹⁷ and Uganda.¹⁸ This trend may be due to increased occupational hazard and exposure of men to stress as they are the only earning members of a large family.^{5,19} The high incidence of poisoning in age group 20-35 years may be due to domestic, educational and employment related stress. Also the easy availability of household agents thereby explains the preponderance. Domestic violence, emotional status of young girls and their vulnerability to stress during puberty is the reason for increased female cases in age category 13-19 yrs. Rapid increase of indebtedness by farmers and failure to reimburse due to natural calamities like draught is the reason behind the increase in poisoning during summer season.^{10,11} India being an agriculture nation, handling of pesticides is a routine practice by farmers and their family members. Household and agricultural agents (56.4%) were associated with most poisoning due to easy availability of these agents and inadequate knowledge to support their safe residential use.²⁰ Studies have shown that pesticide is the most common toxic agent involved in poisoning.^{21,22} Drug poisoning was reported in 10.8% cases and maximum abuse was by NSAIDs and antipyretic agents, which were also the case in United States according to Centres for Disease Control and Prevention²³ followed by anti psychotic drugs, anti parasites and anti infective agents, anti epileptics, these drugs were also abused by children of 13-19 yrs as self-harm. This may be due to availability of drugs consumed by elders at home.

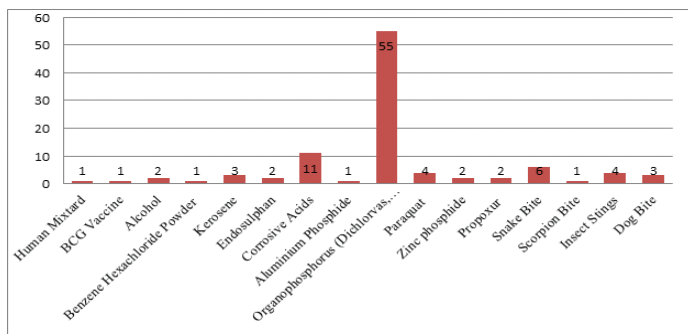


Figure 1: Agents Responsible for Mortality

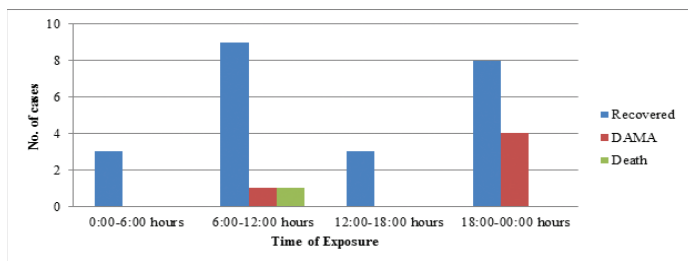


Figure 2: Outcome of Poisoning in accordance to Time of Exposure

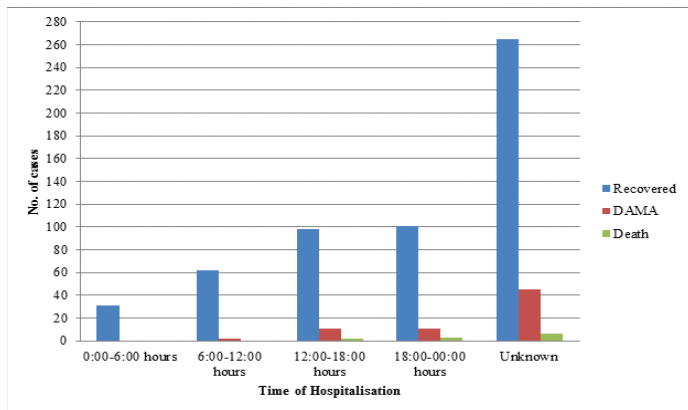


Figure 3: Outcome of Poisoning in accordance to Time of Hospitalisation

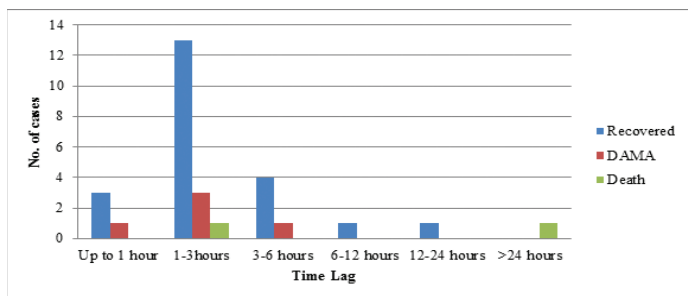


Figure 4: Outcome of Poisoning in accordance to Time Lag

Intentional poisoning was more common which was similar to other studies mentioned above. Maximum exposure in 20-35 age category is due to family dispute, domestic violence, and stress due to job/unemployment. Household and agricultural agents were used widely. The reason behind this is easy availability of these agents in common household and agricultural use. Intentional poisoning cases more prevalent in age group 13-19 yrs may be due to increasing suicidal tendencies in teens due to peer pressure, unwarranted expectations by parents to perform well in studies, and family issues. Animal bites and stings were the most common cause of accidental poisoning which was contrary to findings of the studies conducted in South India where most accidental poisoning was due to household poisons.^{24,25} This may be due to the difference in geography and occupation. Old age, mishandling and non adherence of medicinal drugs in people above 55 yrs is the possible cause for accidental poisoning. The most likely explanation behind absconding is due to low socio-economic status of the patient and to refrain from medico-legal proceedings. The reason behind referral to other hospitals is due to lack of specialty treatment in the hospital. DAMA may be due to lack of awareness and improper counselling to the patients. The mortality found in the present study 9.8%, is higher compared to Eastern and Southern regions where it was 3.84%¹⁶ and 7.5%⁷ respectively and lower than Northern regions²⁶ other Western regions.¹⁴ Predominance of males was found compared to females in death cases and similar pattern was observed in other study.²⁷ According to available data, most death was seen in adults which was similar to reports by Poison Statistics National Data 2014 that poisonings in Teens and Adults are more serious.²⁸

Mortality due to organophosphates was highest according to the present study which was similar to the study conducted in South India. Aluminium phosphide is observed as the leading cause of poisoning in South India. An increased trend in consumption of alcohol along with toxic agent for self harm was observed, increasing the risk of aspiration, coma and respiratory failure leading to death. Maximum exposure during 6 pm – 12 am might be that people tend to over think about their problems more in the evening. Unable to cope up with the stress, they tend to take extreme measures and harm themselves.

CONCLUSION

Increased intentional poisoning in teens and adults emphasize on importance of counseling and awareness about depression and stress affecting the major strata of the society which increases suicidal tendencies. Awareness and education among the population about safety from hazardous chemicals at household and occupational level is a strong indication to prevent accidental poisoning. Maximum cases reported with time lag of 1-3 h suggests the need for awareness about first aid in emergency situation at primary healthcare level. Burden of poisoning and animal bite cases brought to casualty demands strategies for identification and rational management providing optimal outcomes.

The study was conducted retrospectively by collecting the data from medical records, which missed out vital information about socio-economic details of the patients. Poor maintenance of records was frequently observed in the government setting. Cases referred from other hospitals lacked detailed patient history. The time of exposure and admission were not recorded in all the files.

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None.

CONFLICT OF INTEREST

None.

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