

Research Paper: Trends of Poisoning Cases in Tertiary Care Teaching Hospitals in Western Indian Population



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ABSTRACT

Background: Any substance, which makes life better, if not used wisely and with proper care, would become dangerous to human life. These chemical substances can be termed poisons. A poison can be defined as a substance (solid, liquid, or gas), which if introduced into a living body or brought into contact with any part thereof would produce disease or even death by its constitutional or local effects or both. Pattern of poisoning in a particular region depends on various factors like availability and access to the poison, socioeconomic status of an individual, educational status, knowledge on pesticides, and their proper usage. In India, due to variations in geographical conditions and differences in religious and cultural practices, the incidence and pattern of poisoning vary from place to place, hence it is better to perform regional studies periodically to recognize the extent and evolution of the problem.

Methods: This is a cross-sectional and observational study, which was conducted in tertiary care teaching institutes in Western India. The study includes 318 deceased persons due to poison consumption brought for postmortem examination.

Results: Incidence of death due to poisoning was more in the third (31.7%) and second decade (22.6%) of life as compared to both extremes of age. The majority of victims were males (64.2%) as compared to females (35.8%). It was also observed that most victims belonged to lower socioeconomic class (58.8%) with educational status from illiteracy to primary education. Majority were farmers commonly due to insecticidal poisoning.

Conclusion: Pattern of poisoning in the present study corresponds with the pattern found in most other studies. Majority of victims were male and agricultural poisons were the most common type. Our study suggests that establishment of poison information centers, availability of antidotes in rural area, and creating awareness among people help effectively to resolve the problem.

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1. Introduction

All those substances which make life better, if not used wisely and with proper care would become dangerous to human life. These substances can be termed poisons. Poison can be defined as a substance (solid, liquid or gas), which if introduced in a living body or brought into contact with any part thereof would produce disease or even death by its constitutional or local effects or both [1, 2]. When mixed in blood or body fluids, it could destroy life or seriously impair one or more body functions [3]. For ages, poisons were known to human beings and had great impact on them. They have kept on changing their forms but still posed a great challenge to living creatures. With advancement of science and technology, these substances are being used in house holding works, paintings, grain preservatives, agriculture, industries, and so on. Despite the advanced medical treatment and awareness, the poisoning cases are increasing day by day.

According to WHO reports, about 3 million people around the world are inflicted by poison every year, out of them 220000 died. About 99% of these deaths occur in the developing countries. In India, 50000 deaths occur due to poisoning every year [4]. Pattern of poisoning in a particular region depends on various factors like availability and access to the poison, socioeconomic status of an individual, educational status, knowledge on pesticides, their proper usage, etc. Rapid industrialization and massive use of pesticides in agriculture have increased the incidence of poisoning. The commonest cause of poisoning in India and other developing countries is pesticides; the reasons are agriculture based economics, poverty unsafe practices, illiteracy, ignorance, lack of protective clothing, and easy availability of highly toxic pesticides. Organophosphates poisoning constitute the largest bulk of poisoning in India [5].

Poisoning is a major epidemic of non-communicable diseases in the present century. Among the unnatural deaths, deaths due to poisoning come next only to road traffic accident deaths. In earlier times, the poisoning deaths from pesticides were mainly accidental but easy availability, low cost, and unrestricted sale have led to an increase in suicidal and homicidal cases as well [6].

World Health Organization (WHO) estimated 3 million cases of poisoning every year worldwide, of which 99% of fatal poisoning cases occur in developing countries [7]. In India, due to variations in geographical conditions and differences in religious and cultural practices, the incidence and pattern of poisoning vary from one place to another,

hence it is desirable to perform regional studies periodically to recognize the extent and evolution of the problem.

2. Materials and Methods

The study consisted of 4506 medico-legal autopsy performed in the Department of Forensic Medicine, in tertiary care referral hospitals in Maharashtra, India. The study was conducted after due approval from institutional Ethics Committee. According to the Declaration of Helsinki, the consent to the use data of the deceased was obtained from legal heirs or relatives present to claim the mortal remains. During the period of 3 years from 2011 to 2013 of total 4506 medico-legal autopsies, 318 were victims of poisoning (7.05%).

Necessary information for the study was gathered from the Police, inquest report, and hospital treatment records. The routine viscera were preserved by using appropriate preservative according to nature of poison and sent to regional Forensic Science Laboratory, Pune (Maharashtra) for chemical examination. The cases were evaluated on the basis of hospital cases, police papers, available history from relatives or the police, and chemical analysis report. In few cases, adequate information could not be obtained and such cases were put under "undetermined group." A detailed format for recording history, epidemiological data and the details of poisoning etc. was prepared for filling the observation of the present study. Data were statistically analyzed by the Chi-square test using SPSS 20.

3. Results

During the period of 36 months from 2011 to 2013, a total of 318 cases of poisoning were reported out of total 4506 post-mortem cases. Incidence of death due to poisoning was more in the third (31.7%) and second decades (22.6%) as compared to both extremes of age. The majority of victims were men (64.2%) as compared to women (35.8%) (Table 1) and out of them, majority of victims were married (Figure 1). This study revealed that out of 318 cases, males outnumbered females with M:F ratio of 1.79:1. In 45.6% of cases, the victims were farmers (Table 2). It was also observed that most victims (males and females) belonged to lower socioeconomic class (58.8%) with educational status from illiteracy to primary level education (Table 3, Figures 2 and 3).

Significant difference was observed between rural and urban populations with $P < 0.01$ in various manners of poisoning cases. The victims of poisoning death cases were more in rural areas (63.21%) as compared to urban areas (36.79%) (Table 4). The manner of death was based on his-

Table 1. Age and sex wise distribution of poisoning cases

Age, y	Group	Male (%)	Female (%)	Total (%)
<10		11(3.46)	6(1.89)	17(5.35)
11-20		29(9.12)	43(13.52)	72(22.64)
21-30		72(22.64)	29(9.12)	101(31.76)
31-40		47(14.78)	18(5.66)	65(20.44)
41-50		24(7.55)	11(3.46)	35(11.01)
51-60		13(4.09)	5(1.57)	18(5.66)
>61		8(2.52)	2(0.63)	10(3.14)
Total		204(64.15)	114(35.85)	318(100)
	Total PM			4506

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Table 2. Distribution of poisoning cases according to the occupation

Occupation	Cases (%)
Farmer	145(45.60)
Worker	63(19.81)
Businessman	8(2.52)
Housewife	36(11.32)
Student	12(3.77)
Unemployed	54(16.98)
Total	318

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tory given by relatives and police papers. The large number of suicidal death cases (282[88.67%]) were followed by accidental death cases (34[13.33%]). Only two homicidal cases were found in urban area due to ingestion of poison mixed with food by parents (Table 4 and Figure 4).

Out of 318 cases of poisoning, 30 cases were of animal envenomation. Remaining 288 cases were studied by chemical analysis. Out of these, the highest cases (151[47.48%]) were of insecticides followed by rodenticide (49[15.41%]) and ethyl alcohol (25 cases). Among poisoning due to insecticides, organophosphorus com-

Table 3. Distribution of poisoning cases in terms of socioeconomic status

Socioeconomic Status	Cases (%)
Lower	187(58.81)
Middle	116(36.48)
High	15(4.72)
Total	318

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Table 4. Distribution of poisoning cases according to the manner of death

Manner	Cases	%	Rural	%	Urban	%	P (Rural vs. Urban)
Suicide	282	88.68	189	59.43	93	29.25	<0.01
Accidental	34	10.69	12	3.77	22	6.92	<0.01
Homicide	2	0.63	0	0.00	2	0.63	<0.01
Total	318	100.00	201	63.21	117	36.79	<0.01

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pounds were more in number than organochlorous compounds. Thimet was detected in 53 cases, Rogor (Dimethoate) in 38 cases, phosphide in 49 cases (Tables 5, 6). As per Table 6, most poisoning deaths occurred in rural territory. In rural areas, the most prevalent poisonous death occurred by monocrotophos followed by aluminum/zinc phosphide and methyl parathion. Animal envenomation could not be neglected in rural areas. In urban areas, the most prevalent poisonous death occurred

by aluminum/zinc phosphide followed by hydrochloric acid and monocrotophos (Table 6, Figures 5 and 6).

4. Discussion

In the present study, poisoning death cases were higher (64.15%) in males than females deaths (34.85%), which was also supported by previous studies like Bhagora et al., Gopal et al. and Panda et al. [9-11]. This may be due

Table 5. Distribution of poisoning cases according to poisonous compound based on chemical analysis report

Poison	2011	2012	2013	Total
Thimet (phorate) I	18	13	22	53
Endosulfan I	6	9	12	27
Chlorpyrifos I	5	1	4	10
Rogor (dimethoate) I	13	16	9	38
Nuvan (dichlorvos) I	5	1	3	9
Nuvacron (monocrotophos) I	1	0	2	3
Metacid–methyl parathion OP	1	0	0	1
Cypermethrin I	2	3	5	10
2, 4- Dichlorophenoxy acetic acid H	3	2	0	5
Gramoxone H	6	2	8	16
Glyphosate H	1	0	0	1
Drug amlodipine+Aten	1	2	0	3
Al/Zn phosphide	11	15	23	49
Ethyl alcohol	7	12	6	25
Kerosene	0	5	2	7
Acid	1	0	1	2
Animal envenomation	12	8	10	30
Not revealed	8	9	12	29
Total	101	98	114	318
Total PM	1496	1502	1518	4506

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Table 6. Distribution of poisoning cases according to type of poison, chemical examination, based on history and external examination

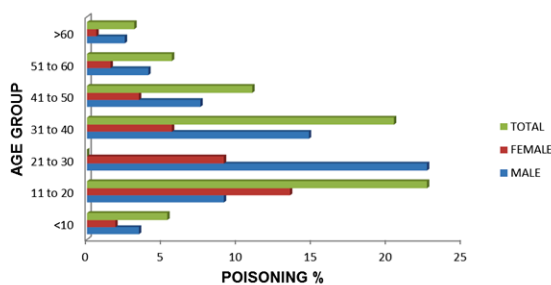
Poison	Cases	%
Insecticides	151	47.48
Rodenticide	49	15.41
Herbicide	22	6.92
Acid	2	0.63
Animal envenomation	30	9.43
Kerosene	7	2.20
Drug	3	0.94
Ethyl alcohol	25	7.86
No poison detected	29	9.12
Total	318	100.00

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to high M:F ratio and high exposure of men to poisons in this part of country. Men are also exposed to occupational hazards and they have easy access to the agrochemicals and often need to handle it in agricultural work. However two foreign studies; Tufekci et al. and Kavalci et al. [12, 13] reported female dominance in poi-

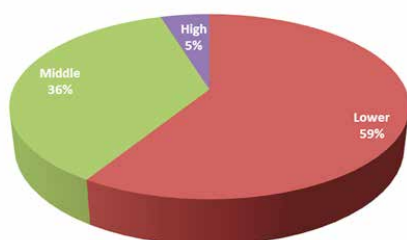
soning cases. This may be due to fact that females prefer toxic ingestion for inflicting self-harm.

Higher incidence of death due to poisoning in males was found in young age group between 21–30 years followed by 31–40 years and less in extremes of ages. Similar findings were observed in previous studies [4, 10, 14-



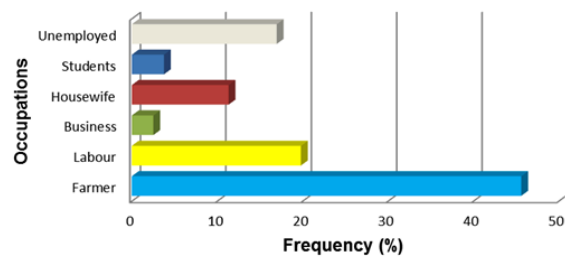
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Figure 1. Age and sex wise distribution of poisoning cases



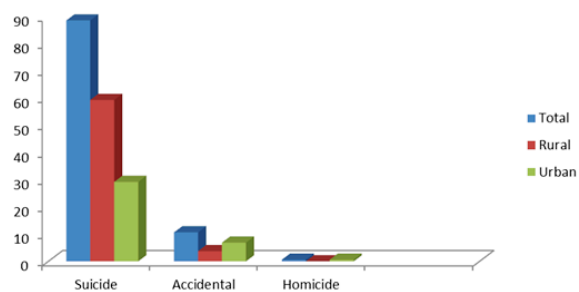
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Figure 3. Socioeconomic status of poisoning cases



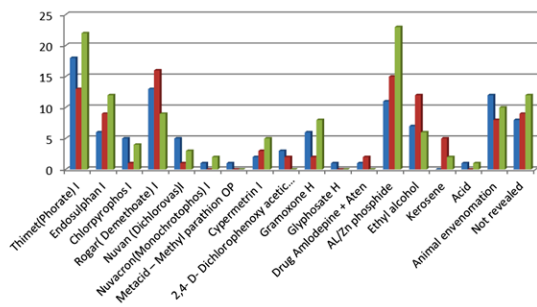
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Figure 2. Occupational distribution of suicide cases



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Figure 4. Distribution of poisoning cases according to the manner of death



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Figure 5. Distribution of poisoning cases according to poisonous compound based on chemical analysis report

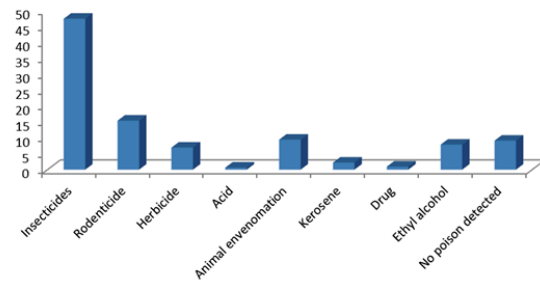
25]. It could be explained by the fact that young people suffer more from stress of the modern life style, family problems, financial problems, failure in the exams, unemployment, marital conflicts, failure in love, and so on. Maximum female deaths due to poisoning were found in the age group of 21-30 years followed by 11-20 years. As reported by Bhagora and Datir [9, 26], this may be due to early marriages, family stress, lack of education, dowry marital conflict, and failure in love.

Poisoning cases were observed more in rural areas as compared to urban areas due to people's illiteracy or less education, as well as shortage of immediate treatment of poisoning which was consistent with Varma et al. findings [8], while Chaudhary et al. [29] showed that 64.90% of poisoning cases were observed in urban areas as compared to rural areas (35.10%).

Regarding the manner of death, majority of deaths were suicidal (88.68%) followed by accidental (10.69%) that was consistent with results of studies like Sharma BR et al., Karamjitsingh et al., and Sanjeev Chaudhry et al. [27-29]. The suicidal cases were observed less in urban areas (29.25%) as compared to rural areas (77.85%). This might be due to increased awareness as well as immediate and better treatment of poisoning. The accidental poisoning cases were more (10.69%) in rural areas due to spraying of pesticides during farming activity and animal envenomation. Only two homicidal cases were noted which were in urban area.

Highest numbers of poisoning cases (58.81%) were seen in lower socioeconomic class followed by middle class and very few in high class. These findings were consistent with Kulshrestha et al. and Kailash UZ [30-31] studies. The reason for the above said findings may be due to economic instability, unemployment, and stress.

Death due to insecticides followed by rodenticides and next by animal envenomation were the prevalent



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Figure 6. Distribution of poisoning cases according to type of poison, chemical examination, based on history and external examination

forms of poisoning found in this study and is supported by other researchers [3, 14, 33, 34]. This study population were largely agriculture-based where the farmers apply pesticides to the crops, good crop attracts rodents, which inadvertently attracts snakes into the picture. Easy availability of pesticides, agricultural and outdoor habits probably are responsible for this common type of poisoning in this region. However, in some studies household agents dominates [7, 14] and in others medicinal drugs [12, 13].

5. Conclusion

Pattern of poisoning in the present study corresponds with the pattern found in most of the other related studies. Majority of victims were male and agricultural poisons were the most common poisons. Some of the effective measures to lower the rate of poisoning and improve the outcomes may be as follows: 1) Poison Information Centers, which are functional in few places should become operational in every district hospital and government medical colleges. This will act as a ready reckoner to treating physicians; 2) Drugs (antidotes) should be made available in the primary health centers and rural hospitals which contributes to the major bulk of the poisoning cases; 3) Proper care should be taken in storage of insecticide in farm or house; 4) Shopkeepers, farmers, and lay persons should be trained on how to handle and also dispose of poisonous substances. Knowledge and awareness about potential toxicity of common herbs in rural areas and household articles should be given to the lay persons.

Study Limitations are as follows: In some cases, mode of poisoning could not be reported correctly as these patients try to conceal the history or give false information; and in accidental animal bite cases, there was confusion between snake bite and other poisonous insect bite, thus such cases were included in the group of animal envenomation.

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Conflict of Interest

The authors declared no conflicts of interest.

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