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Toxicological Emergencies and Their Management at Different Health Care Levels in Northern India-An Overview*

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Abstract: The aim of this retrospective comparative study was to analyze the characteristics of toxicological emergencies reporting at three different levels - primary, secondary and tertiary-in order to find out the problems faced at each level and to highlight the need to examine and redress the different problem areas to prevent the ever-increasing deaths due to poisoning, particularly in the developing countries. Detailed scrutiny of the departmental records was carried out to ascertain information pertaining to the poisoning patients reporting to the primary, secondary and tertiary health-care hospitals in and around Chandigarh, India. The 7815 of the total 114036 (7%) cases reporting to Emergency Department (ED) of different health care levels during the period of study were due to poisoning. Of these, 63% were males. The 21-25 year age group accounted for the maximum number of cases (28%). Agrochemicals were the most commonly used (34%); of which Aluminum Phosphide (ALP) was the most preferred (44%). Ingestion was the most common route of intake (90%); home- the most common venue (73%) and night-the most preferred time (35%). Time lag between intake of poison and reporting at the ED was less than 2hrs in 53% cases. Most of the admissions were direct (85%). Of the referred cases, 51% were from Primary Health Care center (PHC) and 41% from private hospitals. Gastric lavage was performed in 75% of the patients in the Tertiary Health Care center (THC) against 73% in Secondary Health Care center (SHC) and 67% in Primary Health Care centers (PHC). 20% of the patients in THC received antidotes as against 18% in SHC and 14% in PHC. Life saving measures were employed in 13% cases in THC, 3% in SHC and 1% in PHC. ICU care was resorted to 7% cases in THC and 1% in SHC. 2% of the poisonings were fatal. ALP was responsible for the maximum deaths, 54%; while agrochemicals as a whole accounted for 85% of the total deaths.

Key words: Poisoning, agrochemicals, medical toxicology, toxicological emergencies, health-care levels

Introduction

Deliberate self-poisoning is a major problem encountered worldwide (Eddleston, 2000). However, there are marked differences in Case Fatality Proportions (CFP) when comparing developed and developing countries (Singh, 1999; Singh, 1997; van der Hoek, 1998; Eddleston, 1998). These differences have been attributed to the nature of the agents involved, given that self-harm is the primary intention and the choice of method is often secondary (Hettiarachchi, 1989a, 1989b; Nandi, 1979).

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Rodenticides like Aluminium phosphide and Pesticides such as Organophosphorus compounds (Ops) are a common means of self-harm in the developing world (Eddleston, 2000), in comparison to pharmaceuticals in the developed world (Repetto, 1997). Pesticides, used extensively in agriculture since the 1950s, have been promoted as a tool without which developing countries could not develop and become self-sufficient. However, intentional and occupational poisoning from pesticides has emerged as a major problem in these countries, with millions of cases and hundreds of thousands of deaths occurring each year (Bull, 1982; Dinham, 1993; Murray, 1994; Karalliedde, 2001; Eddleston, 2002; Kishi, 2001). Management is difficult-there are few effective antidotes and many patients require intensive care, which is a rare resource in much of the developing world (Eddleston, 2000).

This situation has caused health authorities and legislators to consider regulating the use and availability of pesticides in an attempt to control their harmful effects. The main impetus to these activities was the publication in 1985 of a Code of Conduct on the Distribution and Use of Pesticides by the Food and Agriculture Organization (FAO, 1990) of the United Nations. Several other strategies have also been implemented. The pesticide industry itself has established "safe-use" initiatives in which people are educated in the safer use of pesticides (Ellis, 1998; Murray, 2000). Governments and Nongovernmental Organizations (NGOs) have taken other approaches, such as introducing stricter regulations and encouraging the use of fewer pesticide applications within FAO's (1996) integrated Pest Management (IPM) system. WHO and FAO have also encouraged countries to introduce legislation to restrict the availability of problem pesticides (FAO, 1990; WHO, 1998; 2001). Although this approach appears to have been successful in reducing pesticide-related death rates in some countries, such strategies have not always been found to reduce the overall mortality.

Medical Toxicology became a specific subject in the early 1950s in the developed countries in response to the proliferation and use of chemicals in every day life. In India, a Toxicology Laboratory was setup at the Medicolegal Institute, Bhopal, in 1984, following the Bhopal Gas Tragedy. In 1994, a National Poison Information Center was setup at All India Institute of Medical Sciences, New Delhi and few others followed in the succeeding years. However, a handful of such centers do not serve the purpose in a vast country like India, particularly when majority of population living in rural areas has access mainly to primary level of Health Care. Lack of specially trained medical and para-medical staff, specific antidotes, life-saving drugs; associated with wrong/ improper history given by the patients and/or their attendants and unavailability of prompt analytical facilities have further added to the problem (Harish, 2002).

Furthermore, acute poisoning invariably presents as a medical emergency that poses a major health problem because its type, associated morbidity and mortality varies from place to place and changes over a period of time. Poisoning in pediatric age group usually occurs due to accidental ingestion of commercial and household poisonous products, but in adolescents and adults, intentional-poisoning is more common (Sharma, 2003). Knowledge of general pattern of poisoning in a particular region can help in early diagnosis and treatment of such cases, thus contributing to a decrease in mortality and morbidity. The present study examines the pattern and management of acute poisoning cases reporting at different health care levels and attempts to point out the problem areas of health care systems in India. However, the limitations of such a retrospective study do exist because of data collection from different health-care centers functioning under different departments and/or individuals.

Materials and Methods

This retrospective study was conducted by the Department of Forensic Medicine and Toxicology, Government Medical College and Hospital, Chandigarh, India, in the three important categories of health care systems prevalent in the country:

1. Primary Health Care (PHC) level comprising of primary health centers, dispensaries, private clinics, general practitioners etc, having a staff of 1 to 3 general duty medical officers assisted by paramedical staff who can handle common ailments, antenatal checkups, immunization programs etc. and some facility for symptomatic treatment of minor to moderate effect poisoning cases, having mini-labs for routine examination of blood for TLC, DLC or HB and occasionally, X-ray machines in the name of diagnostic facility and ambulance for transportation of the patient to SHC or a referral center.
2. Secondary Health Care (SHC) level comprising of the district-level hospitals, with services of specialist health care workers and the facilities for support of vital functions, diagnosis, treatment and monitoring of moderate to major effect poisoning cases.
3. Tertiary Health Care (THC) level comprising of medical college hospitals or others especially meant for a specific service.

All the cases of suspected poisoning reporting to the emergency departments of five PHC, one SHC and one THC institutions during the period from January 2004 to December 2004 were included in the study. Detailed scrutiny of the records was carried out to ascertain information pertaining to the patient like age, sex, socioeconomic background, poison suspected to have been consumed or contacted, time, place, route and quantity of intake; time of admission, treatment given and the outcome, etc. Medical outcome categories were classified as:

Minor Effect

Where the patient developed some signs or symptoms as a result of the exposure, but they were minimally bothersome and generally resolved rapidly with no residual disability.

Moderate Effect

Where the patient exhibited signs or symptoms as a result of the exposure that were more pronounced, more prolonged, or more systemic in nature than minor symptoms. Usually some form of treatment was indicated. Symptoms were not life threatening and the patient had no residual disability (e.g., corneal abrasion, acid-base disturbance, high fever, disorientation, hypotension that is rapidly responsive to treatment and isolated brief seizures that respond readily to treatment).

Major Effect

Where the patient exhibited signs or symptoms as a result of the exposure that were life-threatening or resulted in significant residual disability (e.g., repeated seizures or status epilepticus, respiratory compromise requiring intubation, ventricular tachycardia with hypotension, cardiac or respiratory arrest, esophageal stricture and disseminated intravascular coagulation).

Fatal Effect

Where the patient died as a result of the exposure or as a direct complication of the exposure. Only those fatal outcome cases, whose autopsy report and the toxicological/ chemical examination of the viscera by the Central Forensic Science laboratory/chemical examiner confirmed the presence of poison as the cause of death were included in the study (the autopsy rate being approximately 100% in unnatural deaths including those due to poisoning) except six cases whose report of chemical analysis was negative but prolonged treatment records strongly supported poisoning and its complications.

Results

During the period under study, a total of 114306 cases reported to the ED of the three different levels of health care centers, the maximum being in the SHC (43%) and the minimum in the PHC (11%). Like-wise, the maximum cases of poisoning reported at the SHC (48%) and the minimum at the PHC (21%). However the percentage of the poisoning cases in relation to the total cases reporting to each center was maximum at the PHC (13%) and minimum at the THC (5%), while the overall percentage of the poisoning cases was 7% (Fig. 1).

Of the total 7815 cases included in the study, 63% were males, the male: female ratio being 1.7: 1. The age group 21-25 years accounted for the maximum cases (28%), followed by the age-group 26-30 years (20%) and 31-35 yrs (11%). Least number of the cases were from the >60 years age group (1%). In all the age groups, males accounted for more than 60% cases. (Table 1).

A wide range of products including agro-chemicals, insect repellents, drugs, disinfectants and cleaning fluids, etc constituted the allegedly consumed poisons. The commonest was Aluminium Phosphide (15%), followed by Organo-choloro compounds (9%) and sedatives (7%). Agro-chemicals, as a whole, were consumed by about 34% patients, followed by drugs (27%) and cleaning fluids (12%).

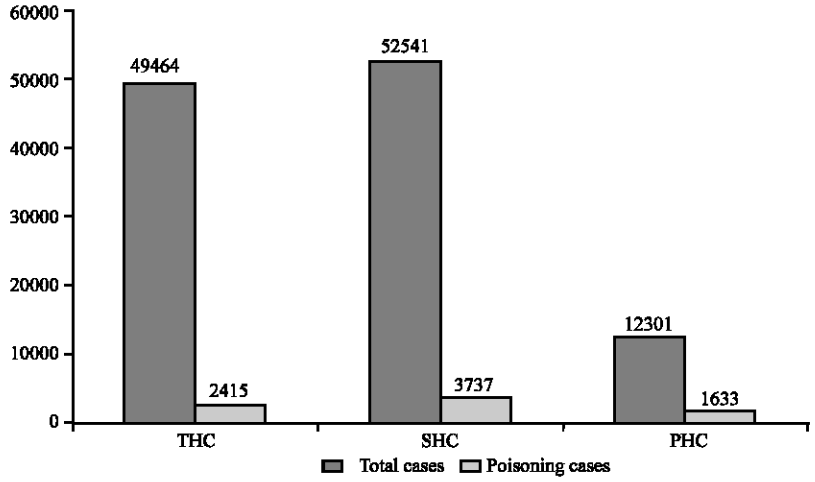

Fig. 1: Cases reporting to difffrent health care levels

Table 1: Age and gender distribution of cases

	Male		Female		Total	
Age (Years)	No.	%	No.	%	No.	%
<10	280	75.68	90	24.32	370	04.74
10-15	321	62.81	190	37.18	511	06.54
16-20	794	61.93	488	38.06	1282	16.41
21-25	1383	64.21	771	35.79	2154	27.56
26-30	932	60.40	611	39.60	1543	19.74
31-35	491	59.81	330	40.19	821	10.51
36-40	300	61.10	191	38.90	491	06.28
41-50	271	67.58	130	32.42	401	05.13
51-60	90	64.29	50	35.71	140	01.79
>60	71	69.61	31	30.39	102	01.31
Total	4930	63.08	2885	36.92	7815	100

Table 2: Different poisonings reporting at the various health care levels

	Cases							
	THC		SHC		PHC		Total	
Name of poison	No.	%	No.	%	No.	%	No.	%
Agrochemicals	650	26.91	1290	34.25	712	43.60	2652	33.93
Al. Phosphide (Rodenticide)	249	10.31	531	14.10	388	23.76	1168	14.95
Zn. Phosphide (Rat poison)	80	03.31	140	03.72	80	04.90	300	03.84
Organo-chloro comp.	211	08.73	388	10.30	128	07.83	727	09.30
Organo-phos. comp.	110	04.56	231	06.13	116	07.10	457	05.85
Cleaning fluids	338	14.00	442	11.73	152	9.30	932	11.93
Toilet cleaner	80	03.31	155	04.11	54	03.30	289	03.70
Floor cleaner (Phenol)	226	09.36	241	06.40	89	05.45	556	07.11
Savlon	18	00.74	27	00.72	00	00	45	00.58
Dettol	14	00.58	19	00.50	09	00.55	42	00.53
Drugs	563	23.31	1075	28.54	449	27.50	2087	26.71
Pharmaceuticals	300	12.42	566	15.03	116	07.10	982	12.57
Opioids	57	02.36	211	05.60	166	10.17	434	05.55
Alcohol	110	04.56	196	05.20	141	08.63	447	05.72
Alcohol+Pharmaceuticals	96	03.98	102	02.71	26	01.59	224	02.86
Miscellaneous	864	35.78	960	25.48	320	19.60	2144	27.43
Insect repellents	199	08.24	193	05.12	65	03.98	457	05.85
Plant poison	48	01.99	39	01.04	70	04.29	157	02.01
Kerosene	108	04.47	99	02.62	38	02.33	245	03.14
Mercury	09	00.37	14	00.37	00	00	23	00.29
Hydrogen peroxide	14	00.58	11	00.29	00	00	25	00.32
Naphthalene balls	36	01.49	24	00.64	00	00	60	00.77
Petrol/other fumes	121	05.00	166	04.41	21	01.29	308	03.94
Unknown	329	13.62	414	10.99	126	07.72	869	11.12
Total	2415	30.90	3767	48.20	1633	20.90	7815	100

Table 3: Particulars of poison consumption

	Cases							
	THC (n = 2415)		SHC (n = 3767)		PHC (n = 1633)		Total (n = 7815)	
Poison consumption								
Route of intake	No.	%	No.	%	No.	%	No.	%
Ingestion	2144	88.77	3416	90.68	1463	89.59	7023	89.87
Inhalation	108	04.47	116	03.08	47	02.88	271	03.47
Parenteral	163	06.75	235	06.24	123	07.53	521	06.67
Time of intake								
Morning	491	20.33	861	22.86	372	22.78	1724	22.06
Afternoon	468	19.38	542	14.39	310	18.98	1320	16.89
Evening	551	22.82	1044	27.71	436	26.70	2031	25.99
Night	905	37.47	1320	35.04	515	31.54	2740	35.06
Place of intake								
Home	1754	72.63	2905	77.12	1042	63.81	5701	72.95
Work place	239	09.90	351	09.32	241	14.76	831	10.63
Party	172	07.12	119	03.16	77	04.72	368	04.71
Others	250	10.35	392	10.41	273	16.72	915	11.71

However, health-care level-wise, agrochemicals accounted for 44% of the total cases at PHC, 34% at SHC and 27% at THC. It was not possible to identify 11% of the allegedly consumed substances on account of the patient leaving against medical advice and/or minor effect of poison (Table 2).

The most common route of intake was ingestion (90%), while inhalation (4%) was the least common. Night was the most preferred time (35%), followed by evening (26%). Home was the most preferred venue (73%) while community gatherings/parties were the least (5%) (Table 3).

The time lag between intake of a poisonous substance and admission to the Emergency wing of a hospital was less than 2 h in majority of the cases (53%). However, in about 8% of the cases, the time lag was more than 12 h. Predictably, most of the admissions occurred in the evening and the night,

Table 4: Cases reporting at the various health care levels

	Cases							
	THC (n = 2415)		SHC (n = 3767)		PHC (n = 1633)		Total (n = 7815)	
Time lag (h) (Admission)	No.	%	No.	%	No.	%	No.	%
<2	1273	52.71	2084	55.32	813	49.79	4170	53.36
2-4	551	22.82	791	21.00	411	25.17	1753	22.43
4-6	138	05.71	262	06.96	156	09.55	556	07.12
6-12	171	07.08	370	09.82	143	08.76	684	08.75
>12	282	11.68	260	06.90	110	06.74	652	08.34
Time of admission								
7 AM-11 AM								
270 11.18	452	12.00	180	11.02	902	11.54		
11 AM-3 PM	358	14.82	411	10.91	331	20.27	1100	14.06
3 PM-7 PM	341	14.12	519	13.78	167	10.23	1027	13.14
7 PM-11PM	809	33.50	1226	32.55	473	28.97	2508	32.09
11 PM-3 AM	566	23.44	811	21.53	339	20.76	1716	21.96
3 AM-7 AM	71	02.94	348	09.24	143	08.76	562	07.19
Type of admission								
Direct	1893	78.38	3216	85.37	1556	95.28	6665	85.28
Referred (from)	522	21.62	551	14.63	77	04.72	1150	14.72
a) PHC	272	52.11	314	56.99	00	00	586	50.96
b) Private hosp	161	30.84	237	43.01	77	100	475	41.30
c) SHC	89	17.05	00	00	00	00	89	07.74

Table 5: Management particulars at different health care levels

	No. of Cases							
	THC (n = 2415)		SHC (n = 3767)		PHC (n = 1633)		Total (n = 7815)	
Treatment given	No.	%	No.	%	No.	%	No.	%
Gastric lavage	1813	75.07	2736	72.63	1094	66.99	5643	72.21
Antidotes	492	20.37	673	17.87	228	13.96	1393	17.82
Life saving measures	311	12.88	117	03.18	16	00.98	444	05.68
ICU Care	166	06.87	41	01.09	00	00	207	02.65
Intra-venous fluids	1683	69.69	2692	71.47	1257	76.98	5632	72.06
Symptomatic	2415	100	3767	100	1633	100	7815	100

Table 6: Poisoning mortality at various health care levels

	Deaths							
	THC		SHC		PHC		Total	
Poison	No.	%	No.	%	No.	%	No.	%
Aluminium phosphide	25	53.19	40	52.63	09	64.29	74	54.02
Organo-chloro comp.	08	17.02	13	17.11	03	21.43	24	17.52
Organo-phos. Comp	07	14.89	11	14.47	01	07.14	19	13.87
Kerosene	02	04.26	03	03.95	00	00	05	03.65
Phenol	01	02.13	04	05.26	00	00	05	03.65
Mineral acids	02	04.26	02	02.63	00	00	04	02.92
No poison detected	02	04.26	03	03.95	01	07.14	06	04.38
Total	47	34.31	76	55.48	14	10.22	137	100

the 7PM- 3AM time slot accounting for about 54% admissions. Maximum admissions (85%) were direct to a particular level of health care. Health-care level-wise, the PHC recorded 95% direct admissions, while THC recorded 78%. Of the referred cases, 51% were from the PHC level followed by 41% from general practitioners/private clinics (Table 4).

Gastric lavage was performed in 72% patients on the whole; while health-care level-wise, it was performed in 75% patients at THC, 73% at SHC and 67% at PHC. Antidotes were administered to a total of 18% patients, Intra-Venous fluids to 72%; life-saving measures were employed in a total of 6%, ICU care was resorted to in about 3%, while 100% received symptomatic treatment. (Table 5)

Eighty one percent of the patients were discharged following recovery. Of these, 94% were from the THC, 82% from the SHC and 61% were from the PHC level. Seven percent of the total patients were recorded as those who Left Against Medical Advice (LAMA), of which maximum were from the PHC level (90%). Fatal outcome was found in 2% of the patients, of which, PHC level recorded 1% and the SHC level 2%. Overall, 81% of the poisoning cases were found to be in the 'Minor Effect to Moderate Effect' category, 10% in the 'Major Effect' category and 2% in the 'Fatal Effect' category.

Of the deaths due to poisoning, 54% were due to Aluminium Phosphide followed by Organo-Chloro Compounds (18%) and Organo-phosphorous compounds (14%). All in all, agro-chemicals accounted for 85% of the deaths. 'No poison detected' was reported in 4% of the cases admitted and treated as suspected cases of poisoning (Table 6).

Discussion

Management of toxicological emergencies is a challenge at every level of health-care system. The difficulties faced in the diagnosis and treatment of the various cases of poisoning coming to the primary health care hospitals are usually attributed to lack of specially trained medical and para-medical staff, specific anti-dotes and life-saving drugs etc. However, the picture is no different at the secondary or even tertiary care levels of the existing health care system in India where the treating physicians identify wrong/improper history given by the patient/relatives and unavailability of prompt analytical facilities as the main problem areas. On the other hand, many studies have reported that the incidence of poisoning, is persistently increasing despite many legislations and strict punishments that have been brought into force (Sharma, 2002a;b; 2003; 1996; Singh, 2004). The in-hospital mortality rate following poisoning has been reported to be high in developing countries as compared to the United Kingdom (Eddleston, 1998). Several factors have been identified to affect the outcome of acute poisoning, including the nature of the poison, dose consumed, quality of medical facilities available and the time between exposure and medical care (Siwach, 1995).

The overall percentage of poisoning cases in our study was 7% whereas Tüfekci *et al*. (2004) found this to be 2.4%, while Özköse (1999) stated that this percentage was 0.7% of all the ED admissions. Though apparently, more poisoning cases reported to the SHC in relation to the other levels of health care centers, the percentage of poisoning cases with respect to total cases reporting to the ED was maximum in PHC (13%) followed by the SHC (7%). This could be attributed to the fact that the PHCs, catering to a rural population as opposed to the SHCs and the THCs, do not witness many cases of vehicular and other industrial accidents (Sharma, 2001), drug abuse, assaults, etc.

Males outnumbered females in our study, the male: female ratio being 1.7:1. This corresponds with the findings of other Indian studies in the field (van der Hoek, 1998; Sharma, 2002; 2003; Singh, 2004). However, most of the studies in the west found that females far outnumbered males, being more than even three times the number of male victims (Özköse, 1999; Sharma, 2001; Bentur, 2004; Dorado, 1996; Prkacin, 2001; Ghaznaw, 1998).

Adolescents and young adults in the age group of 16-30 years (64%) have been reported to be the most vulnerable category to poisoning deaths by many studies and our findings are in conformity with those of others from the Indian subcontinent (Harish, 2002; Singh, 2004). The present study reveals that the age group of 21-30 years was the most prone to poisoning, 47%. Yedida Bentur *et al*. (2004)

observed that in case of females, the peak age was 15-20years, while in males, it was older. Özköse (1999) found that 64% of patients in his study were below the age of 25 years. In our earlier studies we have reported that this particular age group is also the most involved in vehicular accidents, suicides, dowry deaths, etc. (Sharma, 2003; 2001; 2004; 2005). Teenagers between 15-20 years of age, also formed a significant group, 16%. Failure in exams or love affairs, scolding/ humiliation by peers and parents, inability to live up to the expectations of others, etc. are some of the main reasons forcing a growing number of adolescents to attract attention by these methods or to attempt to "take the easy way out". Hawton *et al.* (1996; 1997) and Taylor (1984) found that the most common problems faced by the teenagers were those related to relationships, the difficulties of adjustment with their parents being the most common followed by relation with friends, including social isolation. Many other studies have reported similar trends (Lapatto- Reiniluoto, 1998; McClure, 1994; Bialas, 1996).

Most poisonings are reported to be the acts of self-harm (Jeyaratnam, 1997). Many cases of self-poisoning in India are without a history of previous attempts or extensive pre-meditation; rather, they represent an impulsive response to difficult, or even relatively trivial, situations. Because a high proportion of the Indian population is involved in agriculture, there is ready access to highly toxic pesticides at the moments of stress. A similar situation exists in the neighboring countries like Sri Lanka and China (Maracek, 1998; Phillips, 2002).

The route and time of intake suggest that the consumption of poison is convenience dependent, as the majority of poisons were consumed by ingestion (90%) followed by the paranteral route (7%) and the late evening or night hours were chosen for consumption in 61% cases and home was the most preferred venue (73%). Studies from other countries have reported inhalation to be the second most favored route, after ingestion (Alsen, 1994; Buckley, 1995). Over 60% cases reporting after working hours, between 7pm to 7am, when only emergency staff is on duty further increases the difficulties and may be an important cause of delay in treatment and increase in referral.

Though the majority (54%), received treatment within two hours, a delay of 6 to 12 h and more was recorded in 7.5 and 9%, respectively. The vast rural population with lack of transportation facilities could be responsible for the greater time lag as it was recorded among the cases referred from Primary Health Care to Tertiary Health Care Levels. This could be a significant contributing factor to delays in diagnosis and initiation of treatment and possibly to mortality at secondary (2.02%) and tertiary care levels (1.95%).

Aluminium Phosphide (15%), Organo-chloro compounds (9%) and Organo-phosphorus compounds (6%) have emerged as the "Poison of choice" for intentional /self-poisoning. This may be attributed to the easy availability of these compounds to the agriculture dependant population in this area (Sharma, 2002; Thomas, 1996). According to a report from Sri Lanka (WHO, 2003), the total national number of admissions due to poisoning doubled and admissions due to pesticide poisoning increased by more than 50% between 1986 and 2000. At the same time, the Case Fatality Proportion (CFP) fell for total poisonings and for poisonings due to pesticides. During 1991-92, 72% of pesticide-induced deaths were reportedly caused by Organophosphorus (OP) and carbamate pesticides-in particular, the WHO class I OPs monocrotophos and methamidophos and by the WHO class II organochlorine endosulfan, from one in 1994 to 50 in 1998. Although these drugs are less toxic than class I OPs, the management of class II OPs remains difficult because they are, nevertheless, still highly toxic and their toxicity is exacerbated by the paucity of available facilities.

According to the annual report of the American Association of Poison Control Centers 2003, of the 2, 395,582 human exposures reported, 92.6% occurred at a residence, a male predominance was found, 58% of poisoning fatalities occurred in 20-49 year age group, 49% of fatal cases involved two

or more drugs or products, 88% of adolescent deaths and 81% of adult deaths (older than 19 years of age) were intentional, ingestion being the route of exposure in 76.9% of cases, followed in frequency by inhalation and parenteral routes. Of the cases managed in a health care facility, 52.9% were treated and released without admission, 14.3% were admitted for critical care and 7.7% were admitted for noncritical care. Where treatment was provided in a health care facility, 32.3% of the patients were referred in by the poison center and 67.7% were already in or en route to the health care facility when the poison center was contacted. Health care facilities included acute care hospitals (83.3%), physician offices or clinics (8.9%) and freestanding emergency centers (3.2%). The most common classes of substances involved in fatalities were analgesics, stimulants and street drugs, antidepressants, cardiovascular agents and sedative/hypnotics/antipsychotics. Of the 375 fatalities reported by the study, an analgesic was found to be the primary responsible agent, 62 were associated with acetaminophen as a single agent, 52 with acetaminophen and at least one other substance and 100 with acetaminophen in a combination product, usually containing an opioid. There were 23 fatalities where aspirin alone was considered responsible (Watson, 2004). The findings of our study are in conformity with those of this report except for the drugs/products that are subject to availability on regional basis.

A high rate of referral of poisoning patients from the Primary Health Care Centers (50%) and privately run hospitals (43%) can be attributed to a lack of infrastructural facilities. However, it reflects an underlying problem of registration of the patient at more than one center, thus artificially raising the number of presentations and reducing the death rate, resulting in underestimation of the true CFP from poisoning.

Commonly faced problems by the doctors working in the Casualties and Emergency Departments of various health care level hospitals as well as the patients noticed during the study can be summarized as follows:

1. The patient, who has intentionally consumed some poisonous substance, or his relatives, may not provide proper history regarding the poisonous substance to avoid the harassment at the hands of Investigating Agencies at a later stage. They may also try to disguise it as an episode of illness/gastroenteritis, etc. This deliberate uncooperative attitude by the patients and/or their relatives causes great difficulty to the treating doctor.
2. Most of the time, primary health care level hospitals are in acute shortage of specific antidotes and life saving drugs. Infrastructural facilities like emergency care or life support are also lacking in most of these hospitals. Furthermore, there is scarcity of ambulances to transport the patient to a secondary or tertiary health-care level
3. The absence of a specialized toxicology wing, even in a tertiary care hospital, is very much felt, when the life of victim is compromised on account of the lack of infrastructural facilities. On reporting to a govt. dispensary/hospital, the patient first comes in contact with Emergency medical officer or a general duty medical officer, who usually has little knowledge of the various manifestations of particular poisons and the means to diagnose and treat them. Furthermore, the patient or his attendants may report the trade name of the substance consumed to the doctor on duty who may not be aware of the exact chemical constituents of the alleged poison.
4. There is no database at a national level that may help to estimate the frequency and pattern of poisoning for policy planning in such cases. In the available data on regional basis, there are problems with interpreting it on national and district admissions and CFP, as for example:

- Double counting: national/district data are pooled from peripheral and secondary hospitals and are based on events rather than on individual patients. Most patients are referred for specialized care to a secondary hospital, producing a second registration; some are again transferred for tertiary care, which produces a third registration. Also, patients may be discharged alive but then

readmitted with delayed but fatal complications, such as paraquat-induced pulmonary fibrosis. Overall, it is likely that each poisoning death may be associated with at least one live discharge for the same event. This artificially raises the number of presentations and reduces the death rate, underestimating the true CFP from poisoning and minimizing the magnitude of problem (Watson, 2004).

- Miscoding of medical records is an established problem when they are used for epidemiological studies (Blanc, 1993).
- Changes in referral thresholds from smaller hospitals owing to changes in practice or experience of the referring doctor are a well-documented fact. Increased referral rates may reduce the CFP at referring hospitals, while increasing the number of admissions to the receiving hospital.

What Can Be Done?

1. Specialized toxicology centers equipped with the latest diagnostic and analytical laboratories, as also all the necessary and important medical facilities need to be established on the pattern of trauma care systems.
2. Regular refresher courses should be conducted by the medical colleges for the medical officers working in the primary and secondary health care centers as a part of the Continuing Medical Education (CME) program to update their knowledge regarding the toxicological emergencies. Presently ongoing CME programs (rightly) focused on AIDS control, Population control, Medical negligence, etc, need to divert some energy towards functioning of different health-care levels also.
3. Ways must be devised to generate adequate funds by the health-care centers, so that any short falls in the stock of the various antidotes and life saving drugs at different health care levels can be replenished immediately.
4. Various health-care centers need to organize mass education programs to create awareness and stress the significance of a proper history to minimize the mortality due to poisoning.
5. Toxic Exposure Surveillance System (TESS) data as compiled by the American Association of Poison Control Centers (AAPCC) on behalf of US poison centers and used to identify hazards early, focus prevention education, guide clinical research, direct training and detect chem/bioterrorism incidents have prompted product reformulations, repackaging, recalls and bans; are used to support regulatory actions; and form the basis of postmarketing surveillance of newly released drugs and products need to be established globally in general and those parts of the world with high incidence of poisoning in particular.

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