ORIGINAL ARTICLE

SPECTRUM OF POISONING IN CHILDREN: STUDY FROM TERTIARY CARE HOSPITAL IN SOUTH INDIA
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ABSTRACT: PURPOSE: To understand pattern of poisoning in different age group in tertiary child care center and quantify burden of poisoning in pediatric admissions and mortality.
DESIGN: Retrospective observation study. SETTING: Tertiary care center for children. METHODS: All the children admitted with diagnosis of acute poisoning between January 2013 and June 2015 was studied. RESULTS: There were 332 admissions due to poisoning during the study period (5.4% of total admissions). Mortality due to poisoning was 7, i.e., 1.97% of all-cause mortality. 2.1% of poisonings died during the study period where as overall mortality from all causes was 5.71%. House hold Products topped the list with 112 cases, followed by agricultural products (88 cases), animal bites and stings (69 cases), drugs (48 cases) and industrial compounds (7 cases). Majority of admissions were in summer seasons 31% of all poisoning followed by rainy season. CONCLUSIONS: Incidence of acute poisoning in childhood has not changed significantly over time. Organophosphorus compounds, phosphides and drugs poisoning peak during adolescence and is particularly alarming. Conditions such as free availability of these compounds, co morbidity conditions of adolescents, adolescent stressors have to be addressed.
KEYWORDS: Poisoning trend in children, Childhood poisoning, Pattern of poisoning, Childhood poisoning.

INTRODUCTION: Poisoning can be defined as taking, or being otherwise exposed to, a substance or substances which are injurious to a person’s health.1 Childhood poisoning in accounts for nearly 20% of all poisoning in south India.2 It is a major cause of morbidity in both the developing and the developed world. In spite of the success of some intervention strategies to prevent accidental poisoning in the pediatric population, toxic ingestions continue to be a common occurrence.3 It is responsible for 13% of all fatal accidental poisonings worldwide, in under 20 years of age and is the fourth biggest cause of unintentional injury in 16 high and middle income countries.4

In low and middle income countries, poisoning accounts for 10% of the total burden of unintentional injuries, and 6% of disability adjusted life years.4 Drugs, household products, pesticides, poisonous plants and bites from insects and animals top the list in high-income countries where as Paraffin and kerosene, drugs and cleaning agents come, in order, in low income countries.3 18.5% of acute poisoning in less than 5 years of age has been reported with a...
male predominance of 62.5% in South Asian country. Kerosene alone was implicated in 24.3% of all cases in pediatric poisonings.\(^5\)

In one study of South Indian tertiary care center, under 18 years were only 189 of 1045 poisoning admissions. Accidental poisoning was seen more in children in the age group of 1-3 years. Boys were outnumbered girls in pediatric age group in that study. Females (71.4%) dominated the males (28.6%) in adolescent age group. Incidence of poisoning was decreased with the increasing age.\(^6\) Hence, this study was undertaken to know pattern of poisoning among children in south Indian setting.

**MATERIALS AND METHODS:** Retrospective study of all the children below the age of 18 years admitted with diagnosis of acute poisonings, to Vanivilas women and children’s hospital, tertiary health care center, under Bangalore Medical College and Research Institute, Bengaluru. Data was collected for the period from 1.1.2013 to 30.6.2015 from medico legal registry, in patient records, daily duty reports. Specially designed data collection proforma was used for getting information on demographic profile, name, quantity nature of poison, route of exposure, information regarding first aid received else, signs and symptoms, investigations done, treatment given, complications, treatment outcomes and events of mortality and the reasons for the mortality.

**RESULTS:** Total of 332 children were admitted with diagnosis of acute poisoning in pediatric emergency (Flow chart-1). Poisoning contributed for 5.3% of total admissions (332 of 6199 admission) during the period of January 2013 to June 2015. House hold Products topped the list with 112 cases, followed, agricultural products (88 cases), by animal bites and stings (69 cases) drugs (48 cases), industrial compounds (7 cases), miscellaneous-6, plant poisonings-2 (Table 1 & diagram 1). Among house products poisoning Kerosene contributed to maximum number of cases (95), phenyl and corrosive for 6 each.

There was one Potassium Permanganate poisoning. Snake bites, kerosene poisoning, organophosphorus compounds, phosphides and drugs combined contributed for 283 patients (85%). Most of agricultural poisonings were by Organophosphorus compounds (48 cases), followed by Phosphides (33 cases). Pyrethroids were encountered in 6 cases while carbamates in only one case. Industrial compounds and plant poisoning accounted for least number of cases (seven and two respectively). Interestingly, drug over dose and poisoning was seen in 48 patients.

Among the drugs, anticonvulsants, benzodiazepines and iron topped the list (table-1).

Majority of admissions were in summer seasons with 31% of all poisoning followed by rainy season. Least number of admissions was observed during spring season with 17% of total admissions (Diagram 2 and 3).

Males were affected in 42 of 59 bites (71%), 26 of 48 organophosphorus poisonings (54%), 12 of 48 drug poisoning (25%), 45 out of 95 (47.3%) in kerosene poisoning, 10 out of 33(33%) in rat poisoning. 76 of 95(80%) Kerosene poisoning occurred maximally in 1- 4 year age group. 90% of organophosphorus poisoning was observed in more than 10 years of age. 64% of all drug poisoning was seen after 10 years of age (Diagram 4).
Total of seven deaths occurred out of 332 poisonings. Three were due to organophosphorus compounds ingestion, 3 due to snake bites and one due to phosphides ingestion.

There were no deaths due to other poisonings. Mortality due to poisoning was 7, that is 1.97% of all-cause mortality. 2.1% of poisonings died during the study period where ad overall mortality from all causes was 5.71% (Diagram 5).

**DISCUSSION:** Acute poisoning in children is common and in many cases it is preventable. The very nature of a young child predisposes the child to explore the surrounding environment is one of the major factors in below 5 years. Quantum of contribution of childhood poisoning to total admission is variably reported from institute to institute with location, region, time of study acting as compounding factors.

In our case, poisonings accounted for 5.3% of all admissions to Paediatrics. This is far higher than reported less than 1.0% of all paediatric admissions below 12 years of age. Some studies mention admission rate of poisoning at 3.4% of all poisonings.

Children under 5 years are at high risk. Child self-exposure was responsible for 95% of visits. Child self-exposure to prescription products dominated the health care impact visits (55% of visits, 76% of admissions, 71% of significant injuries. Most morbidity followed self-ingestion of prescription products.

Prevention efforts have proved to be inadequate in the face of rising availability of prescription medications. The poisoning in children under 15 years of age is nearly 3.4% among total admissions in paediatric ward and PICU. These are largely preventable and treatable.

Outcome of our study was that house hold products topped the list with 112 cases, followed by agricultural products (88 cases), by animal bites and stings (69 cases), drugs (48 cases), industrial compounds (7 cases), miscellaneous-6, plant poisonings-2.

Our observation revolves around 5 years in consistent with different studies (3.12 year-6.8 years). Less than 5 years are worst affected age group in different observational studies with report of 55%-64% of all poisoning occurring in this age group.

Under five years of age is most susceptible for house hold stored products poisoning. Our observations are almost concurrent with observations made on the trend in childhood in one study done in north Indian tertiary care center was not different from those reported decade earlier, despite the rapid socioeconomic development in our country.

Maximum poisoning occurred in less than 6 years (64.75% of all childhood poisonings), followed by 12-16 years age group (14.3% of all poisonings) according one report on acute poisonings of 81 patients in less than 15 years, mean age was 6.8 years 74.2% of poisoning has been reported to occur with in 5 years of age, 35% with in three years, and 25.7% after five years.

More poisonings were observed due to cleaning agents than earlier studies and drugs continued to hunt in the same study. The most susceptible age was less than 5 years. This higher occurrence of unintentional poisoning has been explained by exploratory behaviors of the toddler...
and preschool children. As children grow and learn to become independent, they are compelled to investigate new and interesting items, places and objects.12

**Gender Difference:** Sex ratio varied in different age group. In our study, male: female ratio was 1:1.3 in contrast to reported ratio of 1.4:1.8 Males outnumbered females in different studies by a factor of two,9 1.02,10 1.5,12 Boys outnumbered girls in age less than 10 years of age (88 boys and 69 girls). After the age of 10 years girls outnumbered boys (55 boys, 110 girls). Contrast was more in 14 years of age where girls were 4.25 X more affected than boys (85 v/s 20). Although ratio is less, girls: boys of 2.4:1 was observed in another south Indian study.6 However, male predominance in younger age group, while a female predominance in more than 10 age group has been concurrent with other studies.10

Mean age of girls was higher than that of boys as been observed with other studies.10 This significant increase of poisoning in females during adolescents is responsible for this altered ratio in our study. This is very alarming given the declining number of female: male ratio in the country. There is an urgent necessity of interventions to stop devastating effects in the sex ratio.

We observed maximum number of admissions during summer seasons with 31% of all poisoning followed by rainy season. Least number of admissions was observed during spring seasons (17% of total admissions). Peak incidence of poisoning in our study is in consistent with observations of contemporary south Indian study.6

However second largest number of poisonings in our study was observed during rainy season in contrast to winter season observed by same study.6 What similarity exists between ours and one by J. Jesslin, R. et al is peak has been observed consistently for two years during winter seasons in both studies. Summer months peaks in poisoning has also other studies.12 About 25% were intentional We observed all approximately all poisonings through oral routes where as oral route was used in 96.8%, followed by dermal route-3.2% as reported in one of the studies.8 97% were accidental in nature with 2.9% being suicidal. All suicidal poising occurred in more than 10 years of age.

**Type of Poisoning:** The cause of paediatric poisonings varies in different age groups and hence, preventive strategies should be planned accordingly.10 Reports agrochemicals and hydrocarbons to be the most commonly implicated agents in paediatric poisoning.3 Non-medical compounds were the largest contributors (69.2%).13

In our study, kerosene poisoning topped the list with maximum number of cases, i.e. 95 out of 332 poisonings admissions (28.6%).Our observations are in consistent with observation of other studies at 27.9%,9 28.4%.10 Kerosene poisoning contribution varied significantly from 9.8% to 47% in different studies.8,13 80% of all kerosene poisonings in our study population occurred in less than 5 years of age.

In our study, drugs are among top 4 categories of poisonings with 14% contribution to all causes of poisonings. Our observation is slightly less than reported 19.8%.9 Organophosphate compounds in our study accounted for 17.8% of all poisoning case, observations consisted with reported incidence of 19.8%.3 Higher incidence (45.1%) of Organophosphorus poisoning along with organochlorine poisoning (8.2%) has been documented from one study conducted in Nepal.8
Pesticides contributed for 52.2% followed by house cleaning products (27.9%), food (5.8%). Poisoning occurred mostly in spring and the peak May, January was the month of lowest rate of poisoning. Snake bites and scorpion stings accounted for 69 of 332 cases in our study population (20.7%), figure higher than observed 9.2%. \(^\text{13}\) Very high incidence of scorpion stings are reported from centers whose catchment area is rural population.

**Adolescent Poisoning:** There was no gender difference in poisoning in the age of 10-14 years. However, increase in females after 14 years is very alarming and disturbing. We observed organophosphate poisoning in 43 cases, drug poisoning in 31 cases, rat poisoning in 25, snake bite in 38, kerosene in 8 cases. All suicidal poising occurred in more than 10 years of age.

Pesticides contributed for 52.2% followed by house cleaning products (27.9%), food (5.8%). Our figures are correlating with observations made in other studies.\(^\text{6}\) Social, emotional and professional stress have increased intentional poisoning during adolescents who frequently use pesticides or medicines.\(^\text{6}\)

**Mortality:** Prognosis depends time elapsed between exposure and treatment given, also has been linked to Glasgow Coma Scale with poor survival in those with late arrivals and having Glasgow coma scale of less than 8.\(^\text{8}\) Childhood poisoning constituted for 2.1% of the total paediatric admissions and 1.2% of total deaths in our study. Mortality observed in our study is much lower than reported mortality of 7.4%.\(^\text{3}\) More poisonings due to cleaning agents were observed than earlier studies and drugs continue to hunt.

**Preventive Strategy:** There is very need for aggressive strategy in educating people in visual and print media, school, as well as consultation cells for poisoning. Although that report of consultation with the poison cell resulted in improved patient management, our study suggest that no much change in poisoning pattern and incidence.\(^\text{9}\) Educating people, particularly rural folks could be particularly useful.

**Summary:** Poisoning contributed for 5.3% of total admissions. House hold Products topped the list, followed by, agricultural products, animal bites and stings, drugs. Majority of admissions were in summer seasons i.e., in summer season with 31% of all poisoning and least number in spring seasons with 17% of total admissions.

80% of kerosene poisoning occurred in 1-4 year age group and 90% of organophosphorus poisoning was observed in more than 10 years of age.

Very alarming observation was sharp increase in acute poisoning in females compared to males during adolescence given continuously deceasing female to male ratio in the country. All the deaths were due to organophosphorus compounds ingestion, snake bites and phosphides. Mortality due to poisoning was 1.97% of all-cause mortality. 2.1% of poisonings died during the study period where ad overall mortality from all causes was 5.71 %.

**Limitations of the Study:** This is single center retrospective study in tertiary care centre. Randomised control trials to know significance of each variable and meta-analysis of
contemporary literature involving different regions of the country is needed to help take effective steps in reducing the incidence of childhood poisoning.

CONCLUSIONS: Incidence of acute poisoning in childhood has not changed significantly over time despite improvement in educational and economic conditions. The fact that incidence of kerosene poisoning has not changed much suggests awareness, education, economic improvement have not been converted in to action. Peak incidence of Organophosphorus compounds, phosphides and drugs poisoning after age of 10 years is particularly worrying.

There is need of effective strategy in place for holistic care of adolescents and adolescent females, in particular. Conditions such as free availability of these compounds, co morbid conditions of adolescents and adolescent stressors have to be addressed. Strict law enforcement for over the counter prescription can reduce acute poisoning in children. Multicentric, randomized control trials are needed to assess significance of each variable contributing for acute poisoning in age less than 18 years.
Type of poisoning | Number | Type of poisoning | Number
--- | --- | --- | ---
1. House hold products: | | 4. Drugs. | |
Kerosene | 95 | Analgesics | 3 |
Detergents and corrosives | 6 | Anticonvulsants | 15 |
Phenyl | 6 | Antihistaminics | 2 |
Antiseptics | 4 | Benzodiazepines | 7 |
Potassium permanganate | 1 | Antitubercular drugs | 3 |
2. Agricultural products | | | |
Organophosphates | 48 | Iron | 7 |
Organochlorines | 0 | Thyroid hormones | 2 |
Aluminium phosphide | 15 | Tricyclic antidepressnats | 4 |
Zinc phosphide | 18 | Antipsychotics | 2 |
Pyrethroids | 6 | Mixed drugs | 3 |
Carbamates | 1 | | |
3. Industrial compounds | | | |
Thinner | 1 | Snake bites | 59 |
Terpentine | 2 | Scorpion stings | 10 |
Petrol | 3 | | |
Hydrogen peroxide | 1 | | |
miscellaneous | 0 | | |
4. Drugs. | | | |
Analgesics | 3 | | |
Anticonvulsants | 15 | | |
Antihistaminics | 2 | | |
Benzodiazepines | 7 | | |
Antitubercular drugs | 3 | | |
Iron | 7 | | |
Thyroid hormones | 2 | | |
Tricyclic antidepressnats | 4 | | |
Antipsychotics | 2 | | |
Mixed drugs | 3 | | |
5. Animal bites and stings | | | |
Snake bites | 59 | | |
Scorpion stings | 10 | | |
6. Plant poisoning | | | |
Yellow Oleander | 1 | | |
Dhatura | 1 | | |
7. Miscellaneous/others | | | |
(Yellow Phosphorus-2) | 6 | | |

**Table 1:** Summary of major types of poisoning in children

**Diagram 1:** Pie Chart Depicting Contribution of Type of Poisoning.
**Figure 2:** Depicting Month Wise Poisoning Admissions (Blue Line-2013, Red Line - 2014)

**Diagram 3:** Season Wise Distribution of Poisoning.
Figure 4: Age wise Distribution of Poisoning.

Diagram 5: Depicting Proportionality of Admissions and Mortality of Poisoning and All Cause Admissions and Mortality.
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