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Paediatrics

STUDY OF POISONING IN CHILDREN IN A TERTIARY CARE CENTRE

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ABSTRACT **Background:** According to 2014 annual report of the U.S./ American Association of Poison Control Center (AAPCC), there were 28,90,909 accidental exposures to various poisons, 10,31,927 (48% of total exposure) exposures were in children younger than 6 years.(1). This article provides a systematic, critical evaluation of the current state of knowledge in this area. **Objective:** To study about accidental poisoning in children and to know commonest poison, clinical features, mortality and morbidity. **Materials and Methods:** This is an observational study done upon 72 children attending with history of poisoning to department of paediatrics, in a Teaching Hospital, in Telangana State, India. This study was done from Aug 2018 to Mar 2020. Children from the age 1 year to 15 years were included in the study. The relevant data was collected and statistical analysis was done. **Results:** In this study the commonest age group involved was 1 – 3 yrs (Toddlers) with 39 Cases. Out of 72 cases 59 cases belong to rural areas whereas 13 cases are from urban area. Most of the cases were of organophosphate poisoning (34 Cases) and snake bite (4 Cases) cases contributed the least. Symptoms of gastrointestinal system like vomiting abdominal pain were noted. Respiratory symptoms such as cough and breathlessness especially with kerosene poisoning were also noted. Mortality was 8.33%. **Conclusion:** The history of poison stretches from before 4500 BC to the present day. Poison has allowed much progress in branches, toxicology, and technology, among other sciences. Most poisonings in children occur at home and usually non fatal. The peak age for childhood poisoning is between 1-3 years. Most common poisoning was organophosphate poisoning followed by scorpion sting, kerosene poisoning, drug overdose and snake bite. Most of the cases were from rural areas.

KEYWORDS : Toddlers, Poisoning, Organophosphates, Scorpion Sting, Kerosene Poisoning Drug Overdose, Snake Bite, Rural Area.

Introduction

Poisoning is a global health problem. According to 2014 annual report of the U.S./ American Association of Poison Control Center (AAPCC), there were 28,90,909 accidental exposures to various poisons , 10,31,927 (48% of total exposure) exposures were in children younger than 6 years, 1,32,067 (6 % of total exposure) were note in the age group of 6- 12 years, 1,58,468 (7 % of total exposure) were noted in the teenage group, 8,25,009 (38 % of total exposure) and 17,671 exposures (1% exposure) in other age groups [(1)]. However the offending agent and the associated morbidity and mortality vary from place to place and change over a period of time. With the control of infectious diseases, the contribution of poisoning to childhood mortality and morbidity has been increasing in developed countries [(2-7)].

In India mortality varies between 18 - 30%, and is the 4th most common cause of mortality and 12th leading cause of admissions in the pediatric wards and accounts for 1% of the hospitalized patients (8). Childhood poisoning accounts for nearly 20% of all poisoning in South India. Poisoning represents one of the most common medical emergencies encountered in young children and accounts for a significant proportion of emergency room visits.

Poisoning is defined as an individual's medical or social unacceptable condition as a consequence of being under influence of an exogenous substance in a dose too high for the person concerned. Poison is any substance, that when ingested, inhaled, or absorbed, even in relatively small quantities, can cause damage to a structure or disturbance of body function by its chemical action[(9)] . There are some medications which are toxic to children even in small amounts. Administration of even a medicine, which is otherwise intended to cure a disease, may be referred to as poisoning, if the dose and manner of use is not medically justified. Hence goes a famous saying "The dose makes the poison"[(10)].

Poisoning in pediatric age group has a bimodal distribution with the highest peak in young children and a continuous increase in adolescence (12). The pattern of poisoning in India is different from that in western countries, where drugs especially, aspirin and barbiturates are the common offending agents, but in our country household substances (by far the commonest being kerosene, cleaning agents and pesticides) account for the majority of poisoning in young children (1-4yrs). Opium poisoning is common in North India. Organophosphate (OP) poisoning is common in rural areas.

The aim of this study is to know about accidental poisoning in children and to find out commonest poison, clinical features, mortality, and morbidity outcome of cases of accidental poisoning.

Review of the Literature

According to the general poisoning statistics of Cincinnati drug and poison information centre (DPIC) accidental poisonings are a leading public health problem. More than 2 million poisonings are reported each year to the 56 poison control centers across the country. According to WHO data, in 2012 an estimated 193,460 people died worldwide from unintentional poisoning. Of these deaths, 84% occurred in low- and middle-income countries.

1. A prospective study conducted by Rathore S et al [(42)], at King George Medical College and its associated Gandhi Smarak Hospitals, Lucknow in the year 2013 , a total of 100 pediatric patients of <15 years of age made the material of the following series. 62% were under 5 years of age and 70% male. Incidence was also more common in urban areas (55%) as compared to rural (45%) and rainy season was found to be the most vulnerable period for poisoning. Kerosene and snake bite were the most common offending agents, both accounting for 31% cases each. Mortality of 4% was reported. Mortality due to poisoning in children has remained high over the last five decades (2.9%-4.7%). Kerosene has remained the single largest contributor to childhood poisoning (51.5% in the 1960s vs. 52.8% in the 1990s).

2. In a retrospective record based study conducted by Nowneet Kumar Bhar et al [(43)], all children and adolescents aged less than 18 years with definite history of poisoning during the 3-years period from December 2008 to November 2011 were included. Total 117 patients presented with acute poisoning during the study period. Median age of our patients was 4 years (range 0.75- 17.75). The majority of our patients (60.68%) were in the 1 - 6 year age group. Male to female ratio was 1.4:1. The majority of our patients resided in rural areas. Insecticides (37.61%), drugs (25.64%), and Kerosene oil (18.8%) were the agents most frequently implicated. Almost all (97.2%) cases in 1 - 6 year age group were accidental in nature, whereas in the 12 - 18 year group, the

majorities (80.9%) were suicidal. Thirty-six patients (30.7%) remained asymptomatic; the rest developed symptoms related to toxic ingestion and required symptomatic or definitive treatment. Thirteen patients required ICU care and 7 required intubation and mechanical ventilation. Gastric lavage was done in 34% patients and specific antidote was given to 28 (23.9%) patients. Four patients (3 adolescents and 1 preschool child) died.

3. The one-year descriptive study was conducted by Syed Khasif Abbas et al [44] in the Paediatric Emergency Unit of the Liaquat National Hospital, Karachi, from April 1, 2006 to March 31, 2007, involving all patients under 12 years of age who visited the unit with a history of accidental exposure to toxic substances. Demographic data and all other relevant information were obtained mainly by retrieving hospital records and the admission register. During the study period, 43 cases of accidental poisoning were registered, constituting 0.58% of the total emergency visits. Most (46.5%) were less than 3 years of age. Pharmaceutical products (34.9%) were the leading cause of ingestion followed by kerosene oil (25.6%), organophosphorous (16.3%), alkali (9.3%) and acid (7%). Regarding the outcome of these cases, 29 were admitted, 7 were discharged and 7 patients left against medical advice. In this study, a small percentage of children presented with acute poisoning. Pharmacologic agents were a common source of poisoning in children. There is a need to further study and identify risk factors of acute poisoning in children.

4. In a retrospective analysis done by Suresh Kumar Gupta et al [45] of the poisoning calls received by the National Poisons Information Centre (NPIC) showed a total of 2,720 calls during a period of three years (April 1999– March 2002). Poisoning in children was reported in 995 calls (36.6%). The age ranged from less than 1 yr to 18 yr and the age groups involved were divided into four categories (0–6 yr, >6–12 yr, >12–16 yr, >16–18 yr). The most vulnerable age group included children from less than one year to 6 yr old. Males outnumbered females (M=628, F=367). Although the accidental mode was the commonest (79.7%), intentional attempts were also noticed (20.2%) in the >12–16 yr and >16– 18 yr age groups. In the majority of cases, the route was oral (96.8%) followed by dermal exposure (3.2%) comprising bites and stings. Various types of agents belonged to classes of household products (47.0%), drugs (21.8%), industrial chemicals (7.9%), agricultural pesticides (9.1%), bites and stings (3.2%), plants (1.5%), miscellaneous products (5.3%) and unknown products (4.0%). The incidence of poisoning was highest due to household products comprising mainly pyrethroids, parad/thermometer mercury, rodenticides, phenyl, detergents and corrosives, etc. Poisoning due to drugs mainly included anticonvulsants, thyroid hormones, benzodiazepines, analgesics and oral contraceptives. Among the agricultural pesticides aluminium phosphide was the most commonly consumed, followed by organochlorines and organophosphates, etc. Paint thinners were common among industrial chemicals. Bites and stings were mainly snake bites and scorpion stings. Poisoning due to plant material was low and among that datura was most commonly ingested.

5. A retrospective study was conducted in the pediatric intensive care unit (PICU) of an urban multispecialty teaching and referral hospital in North India from June 1993 - June2008 to determine the epidemiology, clinical profile, outcome and predictors of outcome in children with acute poisoning. Data of 225 children with acute poisoning was retrieved from case records. Acute poisoning constituted 3.9% of the total pediatric intensive care unit admission, almost 96.9% was accidental. The mean age of the study patients was 3.3 $\pm$ 3.1 (range 0.10-12) years with majority (61.3%) being toddlers (1-3years). The study concluded that acute poisoning in children over the past 15years has shown a changing trend with significant decrease in kerosene, iron and aluminum phosphate and an increase in organophosphate and prescription drugs(35,37,45).

6. A retrospective study from a tertiary care teaching hospital in Kolkata revealed 3.6% of the Pediatric admissions were due to poisoning. Oral poisoning was common in fewer than five children of urban areas than rural areas. Acute poisoning was more commonly noted in poor socio-economic group residing in urban slums than rural areas .The study points merely on trend of poisoning in community. So community surveys are required to find out causes and nature of acute poisoning in children and to design urgent appropriate health education programmer for prevention of this apparently preventable condition.

7. Bilal Ahmed, et al [46] conducted a matched case control study to determine the factors associated with unintentional poisoning among children under five years of age with 120 cases and 360 controls at tertiary care hospitals in Karachi, Pakistan. Accessibility to hazardous chemicals and medicines due to unsafe storage, aggressive behavior of the child, storage of kerosene oil and petrol in soft drink bottles, low socio-economic status and low level of mother's education were independently related to unintentional poisoning. The study concluded that health message focusing on safe storage of hazardous substances may play a key role in decreasing the burden of childhood poisoning.

8. Honnungar Ravindras, et al [47] conducted a study to analyze the cases of all childhood poisoning in District hospital, Belgaum, Karnataka in the 1-15 years age group. The study showed male predominance and most common age group involved was 1-3 years. Manner of poisoning in 92% cases was accidental in nature. The study concluded that access prevention and massive health education campaign should be instituted to reduce the incidence of accidental poisoning in children.

9. Utkarsh Kohli, et al [37] conducted a study to determine the profile and outcome of pediatric patients presenting with acute poisoning to a tertiary care centre in North India. Samples were 111 children presenting to the pediatric emergency during the study period (July 2004 - 2006). Majority of children (63.9%) were in 1-3 year age group, resided in urban areas. Kerosene (27.9%), drugs (19.8%) and insecticides (11.7%) were the agents most frequently implicated. The study concluded that the trends of pediatric poisoning are not very different from those observed more than a decade ago, despite of rapid socio-economic development in our country.

10. Thomas M, et al [48] conducted a study to determine the incidence of hospital admission following acute poisoning, nature of agents involved and the pattern of poisoning in a major teaching hospital in South India. The result shows that there were 52 deaths (3.3%) among the 1584 admissions and kerosene was the most common poison in children. The study concluded that the measures to increase public education and awareness could prevent a number of these admissions.

11. Shideh Assar, et al [49] conducted a retrospective, cross sectional study to find out the common causes of poisoning in infants and children, who were hospitalized due to acute poisoning in two Ahwaz university hospitals, Pakistan. 143 cases were evaluated between 2001 and 2004. 71% of poisoning occurred in the age range of 1-5 years. Causes were accidental ingestion (77.8%), given by others (16%) and suicide attempts (6.2%). The study concluded that parent s should be educated about the safe storage of medicines and household products.

12. Sunitha Tibdewal, et al [50] conducted a study to evaluate the mothers attitude and practices regarding the use of medications in the preschool children in Indira Gandhi Medical College & Hospital, Nagpur. The samples of the study were 916 mothers having at least one child less than 6 years, with history of illness in past 30 days. The results show that 575(58.9%) used medication on their own, most commonly for cough and cold (23.9%). The commonest nonprescription drugs used were analgesics - antipyretics (34.9%). The findings necessitate mothers education and enforcement of law against selling of non-prescription drugs.

13. Melissa Eckert et al [51] conducted a study to determine the difference in poison prevention knowledge and behaviors between the care givers receiving “Be poison smart education” via individual education and those care givers receiving group education in Ohio state university. The samples were 40 care givers of children less than 6 years of age recruited from women, infant and children clinics. The findings of the study suggests that poison prevention education can be taught either individually or in a small group and such education will positively impart the poison prevention knowledge and behavior of care givers .

Children younger than age 6 years account for 53% of all reported pediatric and adult poisoning exposures. Children younger than age 6 years account for 79% of all reported pediatric exposures; children of age 6–12 years, account for 10 %, and adolescents, 13–19 years old account for 11%. Approximately 11,000 exposures each year are classified as adverse drug reactions. These account for 0.3% of exposures in young children, and 2% of exposures in older children and adolescents.

Materials and Methods

This is an observational study carried out upon 72 children attending to our PICU in the department of paediatrics, in a Teaching Hospital, in Telangana State, India. This study was done from Aug 2018 to Mar 2020. Children from the age 1 year to 15 years were included in the study. Allergic reactions to plants, food, and idiosyncratic reactions to drugs food poisoning due to infective causes are excluded from the study.

Funding: Funds were offered by companies of drugs and commercial products, for investigations, drugs distribution, and transportation required for children included in this study throughout the study period.

Study procedure: Consent from the parents was taken. Institutional ethics and scientific committee approval was also taken for this study. The patient's symptoms and signs which were present were noted along with time of presentation, time of poisoning, place of poisoning, poison consumed, volume of poison consumed, route of poisoning, circumstances of poison consumption and analysis of consumed poison wherever feasible. The patient clinical examination was done. All relevant laboratory investigations were done according to the complaints and clinical features. All the relevant details of the patient were collected using a structured questionnaire. Appropriate treatment was initiated. The patient was followed up till discharge and the outcome of the patient was noted. The data was analyzed using various statistical methods.

Results

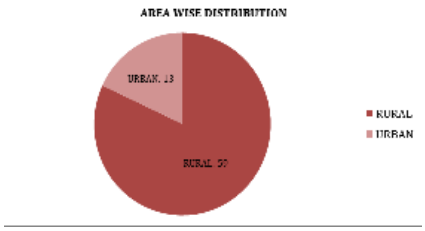
The commonest age involved 1 – 3 yrs age group (Toddlers) with 39 Cases followed by 4 – 5 yrs age group (Preschool) with 13 cases. The age group least involved was below one year (infant group) with 3 cases (Table 1).

Table 1: Age Wise Distribution of Cases

Age	Number Of Cases	Percentage
< 1year (Infant)	03	4.2
1-3 Yrs (Toddler)	39	54.2
4- 5 Yrs (Pre-School)	13	18
6-10 Yrs (School Age)	10	13.8
11 – 14 Yrs (Pre-Adolescence)	07	9.8
Total	72	100

In this study, out of 72 cases 59 cases belong to rural areas whereas 13 cases are from urban area (Chart 1).

Chart 1: Area Wise Distribution of Cases

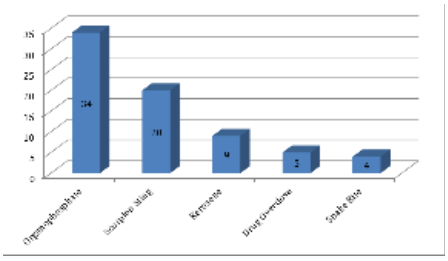


Out of 72 cases, most of the cases were of organophosphate poisoning (34 Cases) and snake bite (4 Cases) cases contributed the least (Table 2).

Table 2: Type of Poisoning

Name Of Poison	Number Of Cases	Percentage
Organophosphate	34	47.2
Scorpion Sting	20	27.8
Kerosene	09	12.5
Drug Overdose	05	6.95
Snake Bite	04	5.55
Total	72	100

Most of the cases in this study are from the rural and tribal areas and the commonest accidental poisoning was due to organophosphate (Pesticide) which is used as a treatment of agricultural remedy. (Chart .2)



The commonest gastrointestinal symptom was vomiting. One patient of kerosene poisoning had symptoms and signs of peritonitis namely abdominal tenderness and guarding. The commonest symptoms were cough and breathlessness whereas the commonest lung finding was a crepitations, increased respiratory rate. Tachycardia was the commonest cardiovascular finding which however cannot be taken as a specific sign because it could have been due to the patient's anxiety. [Table.3]

Table 3: Clinical Features

General Symptoms	Local Symptoms	GIT Symptoms	RS SYMPTOMS	CNS SYMPTOMS	CVS Symptoms
Fever	Bite Marks	Vomiting	Cough	Irritability	Palpitation
Sweating	Cellulitis	Abdominal Pain	Breathlessness	Seizures	
Abnormal Smell		Oral Ulcers	Groaning	Altered Sensorium	
		Hemateme sis/ Maleana	Chest Pain		
		Abdominal Distension			
		Diarrhoea/ Constipation			
Signs	Signs	Signs	Signs	Signs	Signs
Dehydration	Cellulitis	Abdomen Tenderness	Crepitations	Ptosis	Hypertension
Cyanosis	Parasthesia	Peritonitis	Retractions	Miosis/ Mydriasis	Tachycardia
			Tachypnea	Ataxia	

Among 72 children 4 children with organophosphorous poisoning and 2 with drug overdose were expired. (8.33% mortality)

Discussion

Childhood poisoning remains an important health issue in children globally. More than 2 million human poisoning exposures are reported annually to the toxic exposure surveillance system of American Association of poison control centers (AAPCC),more than 50% occur in children 5 years or younger (52). The causes and types of poisoning vary in different parts of the world depending on accessibility of poisons to children which depends upon factors such as demography, socioeconomic status, education, local beliefs and customs (53). Furthermore, introduction of a whole range of new and complex chemicals in the form of pesticides, household cleaners, medicines, etc has widened the spectrum of toxic products to which children may get exposed (45).

Age wise distribution – the children were divided according to the classification given (58) and according to this the maximum incidence of cases was in the 1-3 years (Toddler) age group- 39 cases. The next highest incidence was seen in the 4- 5 yrs age group-18 cases. In the < 1yr group, only 3 cases were seen. This agrees with the observations given in (58) that toddlers, being the most curious and mobile are most likely to ingest substances unknown to them. This finding is similar to other studies where two thirds (67.6%) were below 5 years.

Area wise distribution –In this study, most of the accidental poisoning cases were from rural areas than the urban population. 59 cases (82 %) were from rural area, 13 cases (18%) of the cases were from the urban population. Rural to urban ratio was 4.5:1. Our study correlates with one study conducted by Kumar .V. et al (56) that had patients from the

rural area than urban – rural to urban ratio of 5: 2. In this study, most common type was organophosphate poisoning which is in correlation with various studies conducted nationwide and worldwide. Correlation is tabulated in (Table 2).

Among the parenteral poisoning the commonest was scorpion sting. All snake bites and stings accounted for 5.55% and 27.8 % of the cases respectively which is in comparison with the study conducted by Kumar .V et al 11.2 % and 31 % (56).

Among hydrocarbons kerosene is the most common agent of poison in children according to the majority of authors as per their experience. Accidental ingestion of kerosene oil was the commonest poisoning encountered in this study. 84% of kerosene poisoning cases was below 3 years of age. Common symptoms included vomiting (61%), hurried respiration (42%), cough (30%), Fever (15%).

Various studies reported kerosene to be the commonest offending agent (32, 33, 35,37,45,54 & 64). Storage of kerosene in bottles used for drinking water and in cool drink bottles and easy accessibility as kerosene bottles are kept on the floor or in open cupboards in a majority of households without properly capping the bottles are some of the reasons for common occurrence of accidental ingestion of kerosene (64).

Table 4: Type of Poisoning (%)

Study	Organo-Phosphates	Scorpion Sting	Kerosene	Snake Bite	Drugs
Buch et al [55]	15.1	NA	13.1	NA	53
Singh et al [57]	23.5	NA	25.3	NA	22.1
Kumar et al [56]	11	12	17	19	5
Khadgawat et al[54]	NA	5.2	48.8	6	11.7
Narahari et al	6	6	44	5	8
Syed Khasif Abbas et al [44]	16.2	NA	25.5	NA	34.88
Nowneet et al [43]	37.6	NA	18.8	NA	25.64
Rathore S et al[42]	12	NA	31	31	26
Indu TH et al [61]	24.8	NA	NA	NA	6.8
Present Study	47.2	27.8	12.5	5.55	6.95

Symptom wise the commonest system involved was the gastrointestinal tract with commonest symptom being vomiting 40%. The commonest respiratory symptoms were cough 28%, Breathlessness 24%. The commonest symptom attributed the nervous system was altered sensorium ranging from drowsiness to deep coma. Only 2% presented with convulsions. The commonest lung finding was crepitations 27% followed by tachypnoea 26%. These finding were similar to another study (56) were also gastrointestinal symptoms predominated vomiting being the commonest symptom.

Merits and Demerits: This study was done under the guidance of senior intensivist and pediatrician. Before confirming diagnosis child is examined carefully and necessary investigations like CBP, CUE, ultra sound scanning abdomen including pelvis were done. Team approach was there even enquiry was done regarding family atmosphere, school environment and if necessary visiting of these areas was also taken place. This study concentrates mainly on common causes of childhood poisoning and clinical presentation.

However, this study was conducted in children, who were attending to our hospital. Thus our findings may not represent the exact picture in the population. These figures probably depend on the watershed area of the hospital from where it gets its patients.

Recommendations: The majority of non-fatal poisonings occur in children younger than 6 years old. More than 90 percent of these poisonings occur in the home.

1. All chemicals, drugs and potentially poisonous substances should be kept out of reach of children in child proof cupboards, in child resistant containers.
2. Edible and poisonous substances should not be stored together.
3. Poisonous substances should be stored in the original packing and not in other containers. Eg. Kerosene in cool drink bottles.
4. Avoid taking medicines in the presence of children, because they love to imitate our actions.
5. All medicines should be clearly labeled and those drugs whose names are illegible should not be taken.
6. All parents should be educated regarding the potential poisonous nature of common household substances.
7. All drugs should be given in the correct doses and at the right frequency.
8. The address and telephone number of the nearest hospital and doctor should be easily available. Doctors are the best source of medical information.
9. Legislation is required regarding establishment of poison information centres (28,29) which can provide information regarding any type of poison and its treatment over the phone and also store antidotes for the common poisons.
10. Over the counter drug sales should be harmed without an authorized doctor's prescription.
11. All non-authorized personnel like, pharmacy owners and non-allopathic medical practitioners should be banned from prescribing allopathic drugs.

Conclusion

This is an observational study carried out in the department of pediatrics, in a Teaching Hospital in Telangana State, India. Children from the age 1 year to 15 years were included in the study. A total of 72 cases of accidental poisoning were studied from Aug 2018 to Mar 2020.

The oral route of poisoning was more common than parenteral route. There was no seasonal variation among the number of poisoning cases. There was more number of males than females among the patients. The commonest age group involved was the toddlers. Most of the patients came from rural areas than urban. The most common poison was by organophosphates followed by scorpion sting, and the least common is snake bite. Among the parenteral types of poisoning, scorpion sting was the most prevalent.

Poisoning occurred throughout the day without any specific time preference. The average time taken for a case to come from the rural areas was more than twice that taken by patient to come from an urban area. The duration of stay in the hospital for most of the patients was between 1 to 2 days. The gastrointestinal tract was the most common system to be involved with vomiting as the most common symptom. The commonest respiratory symptoms were Cough followed by breathlessness. In Kerosene Poisoning the commonest symptoms in order were breathlessness, cough, vomiting and fever. The commonest lung finding was crackles. The mortality in this study was 8.33%.

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