A Study of Epidemiology and Outcome of Poisoning in children up to the age of 14 years

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Abstract
Background: Poisoning is the 3rd most common injury treated in emergency rooms for children less than 16 years of age. The cases range from accidental ingestion in toddlers to intentional overdoses in adolescents. The reported incidence of childhood poisoning in various studies varies as the causes of poisoning depend on many factors. Continuing morbidity and mortality due to poisoning is a serious challenge to the paediatricians and public health officials.

Material and Methods: This was a prospective cohort study conducted at Hi-Tech Medical College And Hospital over the period of two years. All children below 14 years presenting to the Emergency department and Inpatient department of Paediatrics were included in the study. A detailed history taking and examination were done and their clinical profile and outcome were noted.

Results and Conclusion: Kerosene poisoning was found to be the most common type of poisoning in the study followed by animal bites and household products. Majority of the poisonings were reported from the middle class socioeconomic group and predominantly males.

Keywords: Poisoning, hydrocarbon, epidemiology.

Introduction
Poisoning in children is one of the commonest emergencies encountered in paediatric practice. Children below the age of five years constitute about 15% of unintentional poisoning related deaths. A survey of 16 middle-income and high-income countries revealed that, of the different external causes of unintentional injury death among children aged between 1 and 14 years, poisonings ranked fourth in 2000–01, after road traffic crashes, fires and drowning. Poisonings occur when substances are ingested, inhaled, injected or absorbed through the skin in quantities that are harmful to the body. The various reasons of poisoning depend on many factors such as education, socio-economic status, local beliefs, disregarding behaviour of parents, customs and type of population, whether urban or rural. Effective preventive and therapeutic approaches in childhood poisoning should be based on appropriate knowledge of general epidemiologic data to assist emergency
department personnel on the proper management of poisoning cases.\textsuperscript{7,8}

The factors determining the severity of poisoning and its outcome in a child are interrelated. They are the type of poison, the dose, the formulation, the route of exposure, the age of the child, the presence of other poisons, the state of nutrition of the child and the presence of other diseases or injuries. The window between the time of ingestion and time of presentation plays a vital role in determining the outcome of the child. Most children are immediately bought to the emergency department but in some cases the child could be out playing and the realization that he/she had ingested some substance only sets in after some time. The prolongation in these windows of opportunity leads to increased morbidity and mortality.

In India, the reports for fatality in poisonings ranged between 0.6\% and 11.6\%.\textsuperscript{9}

According to the WHO world report child injury prevention, the common agents in childhood poisoning are Table.1

Table.1 The most common agents involved in childhood poisoning according to WHO report

| Over-the-counter preparations | Prescription medications | Household products | Pesticides |
|------------------------------|--------------------------|--------------------|------------|
| • Paracetamol                | • Antidepressants        | • Personal care products |
| • Cough/ cold remedies       | • Narcotics              | • Bleach           |
| • Vitamins and iron tablets  | • Analgesics             | • Disinfectants    |
| • Antihistamines             | • Illicit drugs.         | • Detergents       |
| • Anti-inflammatory drugs.   |                          | • Cleaning agents  |
| Paraffin/kerosene.           |                          | • Cosmetics        |
| Poisonous plants.            |                          | • Vinegar          |
| Animal or insect bites       |                          |                    |

Identification of an ingested substance in most cases can be done through proper history taking and identifying the proper signs and symptoms Table 2. Estimating the amount of ingested toxin can be challenging but can be obtained by methods such as estimation of the amount of items/tablets missing from a package and the amount of liquid remaining in the bottle from which the child has ingested etc.

Table 2 Symptoms observed in poisoning according to severity

| Mild Symptoms                 | Moderate symptoms                  | Severe symptoms                      |
|-------------------------------|-----------------------------------|--------------------------------------|
| Restlessness                  | Vomiting                          | Convulsions                          |
| Irritability                  | Trembling                         | Coma                                 |
| Headache                      | Temperature                       | Tachycardia                          |
| Loss of appetite              | Disorientation                    | Tachynea                             |
| Nausea                        | Diaphoresis                       | Hypotension                          |
| Drowsiness                    | Tachycardia                       | Respiratory distress                 |
| Loose stools                  | Blurring of vision                | Cardiopulmonary arrest               |
| Stiffness in the joints       | Difficulty breathing              | Hyperthermia                         |
| Thirst                        | Incontinence                      | Loss of consciousness                |
| Fatigue                       | Confusion                         | Severe Muscle twitching              |
| Passing cough                 | Cramps                            | Status epilepticus                   |
| Weakness                      | Drooling                          |                                      |
|                               | Decreased bowel sounds            |                                      |
|                               | Abnormalities in blood pressure   |                                      |
|                               | Loss of muscle control /muscle twitching |                                 |
|                               | Persistent cough                  |                                      |
### Table 3: Signs and symptoms, diagnosis and treatment of different poisons in the study population

| Hydrocarbon poisoning | Lung irritation | History of contact | Decontamination |
|-----------------------|----------------|--------------------|-----------------|
| Ingestion of Petroleum products, Oils like paraffin and turpentine | Coughing | Examination for residue on clothes or on person | Prevention of aspiration |
| Intentional breathing, huffing, bagging, sniffing of the fumes of glues, paint/thinners, solvents, cleaning sprays, gasoline, or fluorocarbons used as refrigerants or propellants in aerosols | Dyspnoea | Full Blood Examination | O2 Supplementation & Bronchodilators for pneumonitis |
| | Cyanosis | Urea Electrolytes and Creatinine | Intubation, Mechanical ventilation |
| | Choking | Arrhythmia | 12 lead ECG & cardiac monitoring for 4 hours |
| | Chemical pneumonitis | Ventricular fibrillation (sudden sniffing death syndrome) | Electrolyte correction |
| | Arrhythmia | Nausea | Benzodiazepines for seizures |
| | Ventricular fibrillation (sudden sniffing death syndrome) | Vomiting | Antibiotics in diagnosed infection |
| | | Pruritus | |
| | | Diarrhoea | |
| | | Melena | |
| | | Hematemesis | |
| | | Headache | |
| | | Lethargy | |
| | | Drowsiness | |
| | | Poor coordination | |
| | | Stupor or coma | |
| | | Seizures | |

| OTC medication poisoning | Flushing of skin | History | Decontamination |
|--------------------------|------------------|---------|-----------------|
| Dryness of mouth | Coughing | Blood tests | Prevention of aspiration |
| Pain in abdomen nausea | Dyspnoea | Urine tests | O2 Supplementation & Bronchodilators for pneumonitis |
| vomiting | Cyanosis | | Intubation, Mechanical ventilation |
| Auditory problems (ringing) | Choking | | 12 lead ECG & cardiac monitoring for 4 hours |
| Tachycardia | Chemical pneumonitis | | Electrolyte correction |
| Vomiting | Arrhythmia | | Benzodiazepines for seizures |
| Hematemesis | Ventricular fibrillation (sudden sniffing death syndrome) | | Antibiotics in diagnosed infection |
| Constipation | Nausea | | |
| Hallucinations | Vomiting | | |
| Mydriasis | Pruritus | | |
| Hyperactivity seizures | Diarrhoea | | |
| Dizziness | Melena | | |
| Sleepiness | Hematemesis | | |
| Dyspnoea | Headache | | |
| confusion unconsciousness | Lethargy | | |
| | Drowsiness | | |
| | Poor coordination | | |
| | Stupor or coma | | |
| | Seizures | | |

| Prescription medication overdose | Antidepressants | History | Decontamination |
|---------------------------------|-----------------|---------|-----------------|
| Anticholinergic effects | Xerostomia | Complete blood cell count (CBC) | Activated charcoal |
| | Blurred vision, mydriasis | Electrolyte levels (with determination of anion gap) | |
| | Urinary retention | Urinalysis (UA) | |
| | Hypoactive or absent bowel sounds | Blood gases | |
| | Pyrexia | Chest radiography | |
| | Myoclonic twitching | Serum cyclic antidepressant levels | |
| Cardiovascular effects | Sinus tachycardia | Electrocardiogram (ECG) | |
| | Prolonged QRS and QT intervals | | |
| | Heart block | | |
| | Peripheral vasodilatation | | |
| | Hypotension | | |
| | Cardiogenic shock | | |
| | Ventricular dysrhythmias | | |
| | Asystole | | |
| CNS effects | Drowsiness | | |
| | Restlessness | | |

| | | Decontamination | |
| | | Activated charcoal | |
| | | Sodium bicarbonate therapy | |
| | | (Alkalizing agent and Management of Cardiovascular Toxicity) | |
| | | Vasopressors(non responsive persistent hypotension) | |
| | | Phenytoine | |
| | | Norepinephrine | |
| | | Inotropic agents (heart failure) | |
| | | Dopamine | |
| | | Dobutamine | |
| | | Antiarrhythmic agents (arythmias) | |
| | | Lidocaine | |
| | | Magnesium sulphate | |
| | | Benzodiazepines (seizures) | |
| Extrapyramidal signs | Cardiotoxicity (maprotiline) |
|----------------------|----------------------------|
| Rigidity             | Opioid overdose triad       |
| Ophthalmoplegia      | a. pinpoint pupils          |
| Respiratory depression| b. unconsciousness         |
| Delirium             | c. respiratory depression. |
| Seizure (amoxapine)  |                           |
| Coma                 |                           |

**Opioid overdose triad**
- a. pinpoint pupils
- b. unconsciousness
- c. respiratory depression.

- Anxiety
- Emotional lability
- Restlessness
- Confusion
- Ataxia
- Tremors
- Seizures
- Coma
- Apnea
- Impaired memory
- Confusion
- Irritability
- Lethargy
- Psychosis
- Chronic organophosphate-induced neuropsychiatric disorders
- Respiratory: Muscarinic, nicotinic, and central effects contribute to respiratory distress in acute and delayed organophosphate toxicity
- Muscarinic effects: Bronchorrhea, bronchospasm, and laryngeal spasm, respiratory failure is the most life-threatening effect
- Nicotinic effects: weakness and paralysis of respiratory oropharyngeal muscles
- Central effects: respiratory paralysis
- Cardiac abnormalities: Sinus tachycardia, sinus bradycardia, extrasystoles, atrial fibrillation, ventricular tachycardia, ventricular fibrillation
- Hypotension, hypertension, and noncardiogenic pulmonary edema
- Gastrointestinal

- Lorazepam
- Diazepam
- Phenobarbital
- IV fluids (hypotension)

Gastric lavage within one hour of ingestion has to be weighed against adverse effects like vomiting, aspiration, and esophageal perforation. Cardiac monitoring for dysrhythmias Ventilatory support

**Decontamination**
- Cleanse with soap and water to hydrolyse organophosphate solutions.
- Oxygenation, intubation (in most cases necessary)
- Atropine
- Pralidoxime

Irrigation of eyes in case of eye exposure

**Pesticide poisoning**
From air because of spraying, unhygienic handling of food, Accidental, voluntary ingestion
Organophosphates and carbamates

- Anxiety
- Emotional lability
- Restlessness
- Confusion
- Ataxia
- Tremors
- Seizures
- Coma
- Apnea
- Impaired memory
- Confusion
- Irritability
- Lethargy
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- Gastrointestinal

atropine therapeutic trial
plasma cholinesterase
RBC cholinesterase
CXR
ECG
blood gases

IV fluids (hypotension)
manifestations: Nausea, vomiting, diarrhea, and abdominal pain
- Genitourinary and/or endocrine effects: Urinary incontinence, hypoglycemia, or hyperglycemia is possible

| Animal bites | Autonomic nervous system | History of scorpion sting |
|--------------|--------------------------|--------------------------|
| Snake bites  | Profuse perspiration     | Clinical features         |
| Scorpion stings | Tachypnoea               | Lab investigations        |
|               | Excessive salivation     | Urine analysis            |
|               | Vomiting                 | Blood glucose             |
|               | Lacrimation              | Estimation of ALT         |
|               | Mydriasis                | Blood gas analysis        |
|               | Frequent passage of stools and urine | ECG |
|               | Priapism and ejaculation |                         |
|               | CNS                      |                          |
|               | Encephalopathy           |                          |
|               | Convulsions (Focal or generalised) |                      |
|               | Hemiplegia and other focal neurological deficits |          |
|               | Transient blindness      |                          |
|               | CVS                      |                          |
|               | Hypertension/Hypotension |                          |
|               | Arrhythmias              |                          |
|               | Gallop rhythm            |                          |
|               | Varying degrees of conduction block |                    |
|               | Apical systolic murmur   |                          |
|               | Focal myocardial infarction |                       |
|               | Myocarditis              |                          |
|               | Congestive heart failure |                          |
|               | Shock                    |                          |
|               | Respiratory              |                          |
|               | Dyspnœa                  |                          |
|               | Cyanosis                 |                          |
|               | Haemoptysis              |                          |
|               | Pulmonaryedema           |                          |
|               | Gastrointestinal         |                          |
|               | Abdominalpain            |                          |
|               | Hematemesis              |                          |
|               | Malena                   |                          |
|               | Pancreatitis             |                          |
|               | Pseudo pancreatic cyst   |                          |
|               | Rised serum amylase      |                          |
|               | Other                    |                          |
|               | Hetmaturia               |                          |
|               | Oliguria                 |                          |
|               | Renal failure            |                          |
|               | Intravascular thrombosis |                          |
|               | Muscle fasciculations    |                          |

Airway, breathing, and circulation (ABC) and early intubation for patients with significant signs and central nervous system (CNS) depression is mandatory in all case of poisoning.

Materials and Methods
This was a prospective cohort study conducted over in the inpatient department and Paediatric intensive care unit (PICU) of Hi-Tech medical college and hospital, Bhubaneswar over a period of two years.

Inclusion criteria
A total number of 126 children up to 14 years of age were admitted in the Paediatric department during the study period were taken as the study population.
Exclusion criteria
Children presenting with other chronic diseases with similar clinical features were excluded. Children whose appropriate authorities did not consent for the study were excluded. All children up to 14 years of age were included in the study and by using a predesigned proforma. Prior informed proper consent was taken from all the study participants and respective parents/guardians.

Statistical Analysis was done using IBM SPSS software. Pearson's chi-squared test was used to determine the significant difference between the expected frequencies and the observed frequencies in both groups. P values <0.01 were taken as significant findings.

Results and Discussion
The Total number of patients admitted in our inpatient ward during the study period was 2338. Number of cases admitted in paediatric intensive care unit (PICU) was 630. Among these cases admitted with complaints of poisoning were 126 cases which accounted for 5.39% of total admissions and 20% of PICU admissions.

A total of 79 cases (62.7%) were male and 47 (37.3%) were female. P value was 0.23. It was found to be non significant.

The median time to hospital visit from the time of poisoning was 5.4 hours. Twenty-one (16.67%) children were induced vomiting. A few children were given milk and others water. The mean duration of hospitalization for the children was 13.5 days

Table 4 Incidence of Poisoning in Relation with Age Group

| Age Group | No. of cases | Incidence |
|-----------|--------------|-----------|
| < 1 year  | 18           | 14.29%    |
| 1-5 years | 43           | 34.13%    |
| 5-10 years| 38           | 30.16%    |
| >10 years | 27           | 21.43%    |
| Total     | 126          | 100%      |

The age distribution of the study population was between 1-14 years. Most cases of poisoning occurred in the age group of 1-5 years (14.29%). 43(34.13%) cases were between age group between 1-5 years. 38 (30.16%) were between 5-10 years and 27 (21.43%) were above 10 years of age. In the present study, 93 (73.81%) cases were from Urban areas and 33 (26.19%) cases were reported from the surrounding rural areas.

Table 5 Distribution of study population according to socioeconomic status

| Grade | No. of Cases | Percentage |
|-------|--------------|------------|
| I     | 5            | 3.97%      |
| II    | 34           | 26.98%     |
| III   | 59           | 46.83%     |
| IV    | 28           | 22.22%     |
| Total | 126          | 100%       |

The cases were divided into four socioeconomic groups based on modified kuppuswamy scale. Most cases 59(46.83) were reported from Lower middle class (Grade III) followed by Upper middle class (Grade II), 28 (22.22%) upper lower (Grade IV) and 5(3.97%) Upper lower socioeconomic groups.

Table 6 Type of poisoning in the study population

| Type of Poisons    | No. of Cases | Percentage |
|--------------------|--------------|------------|
| Over the counter medications | 10 | 7.94%      |
| Prescription medications | 2 | 1.59%      |
| Household products | 18 | 14.29%     |
| Pesticides | 2 | 1.59%      |
| Kerosene/Paraffin oil | 66 | 52.38%     |
| Animal bites | 19 | 15.08%     |
| Poisonous plants | 1 | 0.79%      |
| Miscellaneous | 9 | 6.35%      |
| Total | 126 | 100%       |

In the present study, Kerosene/Paraffin oil poisoning was the most common type of poisoning accounting to 66(52.38%) of the total poisonings. Animal bites were the second most common with 19 (15.08%) cases closely followed by household product poisoning 18(14.29%). The causative substances for household poisonings were liquid fabric conditioners, Dettol and venigar in the study population. In animal bites, Scorpion bites 71.9% were more common followed by snake bites 28.1%. Different types of medications leading to poisoning in the study population were Paracetamol, chlorpromazine, haloperidol, benzene hexachloride, and some ayurvedic products. Poisonous plant poisoning included a case of mushroom poisoning. Miscellaneous cases included poisoning from eating days old food, mosquito repellent liquid ingestion etc.
A total number of 99.21% cases were accidental ingestions and 0.79% was suicidal. One case of pesticide poisoning was voluntary ingestion. The child did not want to be sent to a hostel and following a quarrel with parents, she ingested a pesticide. The outcome in this particular case was death.

**Table 7** System wise symptoms noted due to poisoning in the study population

| System                    | No. of Cases | Percentage |
|---------------------------|--------------|------------|
| Respiratory System        | 72           | 57.14%     |
| Gastrointestinal System   | 58           | 46.03%     |
| Central nervous system    | 36           | 28.57%     |
| Cardiovascular System     | 17           | 13.49%     |
| Other                     | 41           | 32.54%     |

Respiratory problems like respiratory distress, cough were found the most commonly occurring 72(57.14%) in the study followed by gastrointestinal problems 58(46.03%) and other symptoms 41(32.54%) like hyperhidrosis etc.

**Table 8** Outcome of poisoning in the study population

| Outcome   | No. of Cases | Percentage |
|-----------|--------------|------------|
| No. Sequelae | 119         | 96.44%     |
| With Sequelae | 6           | 4.76%      |
| Death      | 1           | 0.79%      |

In this study, 119(96.44%) cases recovered without any sequelae. 6(4.76%) cases of poisoning recovered but had sequelae over a period of time like severe oesophagitis and gastritis. They were followed up regularly and treated symptomatically. Only one poisoning resulted in death and that was a case of organophosphate poisoning.

**Conclusion**

Out of all cases poisonings accounted for 5.39% of total admissions and 20% of PICU admissions signifying that the burden of poisonings in paediatric health practice is ever so significant. The children between 1-5 years were most affected and the most common poisoning was kerosene/ hydrocarbon poisoning. Many children were forced to vomit by induction which is actually contraindicated in poisonings such as hydrocarbons as they could lead to aspiration pneumonitis. With poisoning being such a prevalent problem understanding the presentations, epidemiology of the various poisons can help ease the burden of the problem.

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