Section: Pediatrics

Original Research Article

A TOXICO-EPIDEMIOLOGICAL STUDY OF PEDIATRIC POISONING CASES: A RETROSPECTIVE ANALYSIS

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Received : 20/12/2025
Received in revised form : 06/02/2026
Accepted : 23/02/2026

Keywords:
Pediatric poisoning, Hydrocarbon ingestion, Retrospective study, Toxico-epidemiology, Accidental poisoning, King George Hospital.

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DOI: 10.47009/jamp.2026.8.2.52

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (2); 277-282

ABSTRACT

Background: Childhood poisoning remains a significant cause of pediatric emergency admissions in India. Understanding local epidemiological patterns is essential for designing effective preventive strategies. The objective is to analyze the epidemiological patterns, clinical profiles, and outcomes of pediatric poisoning cases admitted to a tertiary care center in Visakhapatnam. **Materials and Methods:** A retrospective record-based study was conducted at the Department of Pediatrics, King George Hospital, Visakhapatnam, covering all children below 12 years admitted with poisoning from January 2022 to December 2024. Data were collected from hospital records and analysed using descriptive statistics. **Result:** A total of 55 pediatric poisoning cases were recorded. Children aged 0–3 years were most affected (41.8%). Gender distribution was nearly equal (male 50.9%, female 49.1%). Urban children constituted 65.5% of cases. Accidental ingestion was the predominant mode (89.1%). Hydrocarbon poisoning was the most common agent (47.3%), followed by pesticides/insecticides (21.8%), corrosive/household chemicals (14.5%), and pharmaceuticals (14.5%). Gastrointestinal symptoms predominated (76.3%). Chemical pneumonitis was the most frequent complication (12.7%). There was no mortality. The majority (81.8%) were discharged without complications. **Conclusion:** Pediatric poisoning in this region is predominantly accidental, involving hydrocarbons from unsafe household storage. Early hospital presentation and prompt supportive care resulted in zero mortality. Enhanced parental education, child-proof storage, and multidepartmental collaboration are urgently needed.

INTRODUCTION

Poisoning constitutes a global pediatric emergency and is recognised as the fourth leading cause of unintentional injury following road traffic accidents, burns, and drowning. The global death rate from poisoning in persons below 20 years of age is estimated at 1.8 per 100,000 population. In India, pediatric poisoning accounts for 0.33%–7.6% of total hospital admissions with mortality ranging from 0.64% to 11.6%.[1-3]

Children are inherently vulnerable to poisoning due to their exploratory developmental phase. Toddlers and preschool-age children have a particular propensity to ingest harmful substances owing to curiosity, inability to distinguish hazardous from safe items, and the attractive visual appearance of many toxic agents. With increasing age, incidence of accidental poisoning declines as children develop better judgement. In India, childhood poisoning is predominantly accidental rather than suicidal, a pattern distinct from adult poisoning.[4-6]

The epidemiological patterns of childhood poisoning in India show significant regional variation influenced by geographical, socioeconomic, and cultural factors, as well as accessibility to hazardous substances. Children from lower socioeconomic backgrounds are particularly vulnerable, as household chemicals and agricultural agents are often stored openly and within reach.[7-9]

Our institute, a tertiary care centre at King George Hospital, Visakhapatnam, serves a large and diverse catchment area. This study was undertaken to characterize the epidemiological patterns, clinical profiles, and outcomes of pediatric poisoning cases presenting to this centre over a three-year period (2022–2024), with the aim of informing preventive strategies and clinical management protocols.[10-12]

Aim and objectives

Aim: To analyze epidemiological patterns, clinical profiles, and outcomes of pediatric poisoning cases

ISSN (O): 2687-5365; ISSN (P): 2753-6556

admitted to King George Hospital, Visakhapatnam from January 2022 to December 2024.

Objectives

- To study the demographic profile of pediatric poisoning cases.
- To identify the most common toxic substances and sources of poisoning.
- To analyze the clinical presentations and outcomes.
- To suggest preventive measures and raise awareness regarding dangers of pediatric poisoning.

MATERIALS AND METHODS

Study Design: This was a retrospective, record-based descriptive study.

Study Setting and Period: The study was conducted at the Department of Pediatrics, King George Hospital, Andhra Medical College, Visakhapatnam — a tertiary care teaching hospital serving a broad regional catchment area. Data were collected during October–November 2025 for cases admitted between January 2022 and December 2024.

Inclusion Criteria

- All children less than 12 years of age admitted with poisoning.
- Pediatric poisoning cases with complete medical records.

Exclusion Criteria

- Incomplete medical records.
- Uncertain or doubtful diagnosis of poisoning.

Data Collection: Data were collected from hospital records including case sheets, discharge summaries, and emergency department registers using a pre-designed, pre-tested proforma. Variables recorded included: demographic details (age, gender, locality, parental education); incident details (date, time, mode of exposure, intent); source and type of poison; pre-hospital care; clinical presentation; psychiatric history; treatment, complications, ICU requirement, duration of hospital stay, and outcome.

Data Analysis: Data were entered in Microsoft Excel and analyzed using SPSS software. Descriptive statistics (means, percentages, and frequencies) were used to summarize demographic and clinical data. A p-value <0.05 was considered statistically significant.

Ethical Considerations: Institutional Ethics Committee approval was obtained prior to the study (Serial No.: 268/IEC AMC/NOV 2025). No direct patient interaction was involved. All data were anonymized and stored with strict confidentiality.

RESULTS

Demographic Profile: A total of 55 children were admitted with poisoning over the three-year study period. The gender distribution was nearly equal, with males constituting 50.9% (n=28) and females 49.1% (n=27). The majority of cases (41.8%) occurred in the 0–3 year age group, reflecting the high vulnerability of toddlers. Urban children accounted for 65.5% of cases — an unexpected finding compared to most earlier studies in India.

Table 1: Distribution by Gender

Gender	Frequency	Percentage (%)
Male	28	50.9
Female	27	49.1
Total	55	100

Table 2: Age Distribution of Poisoning Cases

Age Group (years)	Frequency	Percentage (%)
0–3	23	41.8
3–6	15	27.3
6–9	7	12.7
9–12	10	18.2

Table 3: Distribution by Residence

Residence	Frequency	Percentage (%)
Urban	36	65.5
Rural	19	34.5

Circumstances of Poisoning: The majority of poisoning events occurred indoors (89.1%), with the home being the primary risk environment. All cases involved oral ingestion as the route of exposure. Poisoning events peaked during afternoon hours (40.0%), followed by the evening (30.9%) and morning (23.6%). A significant proportion of patients (69.1%) reached the hospital within 1–6 hours of exposure.

Table 4: Place of Poisoning Event

Place of Poisoning	Frequency	Percentage (%)
Indoor (at home)	49	89.1
Outdoor	6	10.9

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Table 5: Time of Poisoning Presentation

Time	Frequency	Percentage (%)
Morning (5am–12pm)	13	23.6
Afternoon (12pm–5pm)	22	40.0
Evening (5pm–9pm)	17	30.9
Night (9pm–5am)	3	5.5

Table 6: Duration Between Poisoning and Hospital Presentation

Time (hours)	Frequency	Percentage (%)
Less than 1 hour	2	3.6
1–6	38	69.1
6–12	10	18.2
12–24	4	7.3
More than 24	1	1.8

Mode and Manner of Poisoning: Accidental ingestion was the most common mode, accounting for 89.1% of cases. Homicidal poisoning was observed in 3 cases (5.5%). Notably, suicidal (1.8%) and impulsive (3.6%) ingestions were recorded exclusively among children in the 9–12 year age group, representing a significant psychosocial concern.

Table 7: Mode and Manner of Poisoning

Mode of Poisoning	Frequency	Percentage (%)
Accidental	49	89.1
Homicidal	3	5.5
Suicidal	1	1.8
Impulsive Act	2	3.6

Mental Health History: Of the 55 children, 8 (14.5%) had a documented pre-existing neurodevelopmental or psychiatric condition: 4 with Global Developmental Delay (GDD), 2 with Intellectual Disability, 1 with Autism Spectrum Disorder, and 1 with Psychogenic Non-Epileptic Syndrome. This subgroup represents a high-risk population requiring intensified supervision and customized safety strategies.

Table 8: Mental Health History

Mental Health Status	Frequency	Percentage (%)
Normal	47	85.5
Abnormal	8	14.5

Types of Poisoning Agents: Hydrocarbon poisoning was the most prevalent category (47.3%, n=26), with thinner oil accounting for the largest share (53.8% of hydrocarbons). Pesticides and insecticides constituted 21.8% (n=12), with zinc phosphide (rat poison) being the most common agent in this category (33.3%). Corrosive and household chemicals accounted for 14.5% (n=8), followed by pharmaceutical poisoning (14.5%, n=8). One case of toxic alcohol poisoning was recorded.

Table 9: Types of Poisoning Agents

Type of Poison	Frequency	Percentage (%)
Hydrocarbon Poisoning (Total)	26	47.3
— Thinner oil	14	25.5
— Diesel	5	9.1
— Mosquito repellents	4	7.3
— Camphor	2	3.6
— Naphthalene ball	1	1.8
Pesticides and Insecticides (Total)	12	21.8
— Rat poison (Zinc phosphide)	4	7.3
— Organophosphate	2	3.6
— Organochlorine	2	3.6
— Plant derived toxin	2	3.6
— Pyrethroid	1	1.8
— General group	1	1.8
Corrosive and Household Chemicals (Total)	8	14.5
— Phenolic and cresol compounds	4	7.3
— Acids	2	3.6
— Detergents / Fabric conditioners	1	1.8
— Mechanical / Irritant powders	1	1.8
Pharmaceutical Poisoning (Total)	8	14.5
— Iron overload	2	3.6
— Clonidine	1	1.8

ISSN (O): 2687-5365; ISSN (P): 2753-6556

— Olanzapine	1	1.8
— Risperidone	1	1.8
— Labetalol	1	1.8
— Thyroxine	1	1.8
— Paracetamol	1	1.8
Toxic Alcohols	1	1.8
TOTAL	55	100

Clinical Presentations: The gastrointestinal system was the most commonly involved organ system at presentation (76.3%, n=42), with vomiting as the predominant symptom. Respiratory symptoms were present in 27% (n=15), and CNS symptoms — including convulsions, altered sensorium, and drowsiness — in 16.3% (n=9). Fever was noted in 7.3% of cases. Notably, 27.3% (n=15) of children were asymptomatic at presentation. One case of acid ingestion presented with whitish layer formation on the lips.

Clinical examination at admission was normal in 78.2% (n=43) of cases. Abnormal findings included respiratory signs (tachypnea, subcostal and intercostal retraction, wheeze, crepitations, consolidation), cardiovascular signs (tachycardia), and neurological signs (pinpoint pupils, absent reflexes, altered consciousness).

Complications and Outcomes: Chemical pneumonitis was the most common complication, observed in 7 cases (12.7%), predominantly following hydrocarbon ingestion — particularly thinner oil (n=3) and diesel (n=1). One case had chemical pneumonitis with consolidation and effusion, one had bilateral lower lobe pneumonia, and one had a gastric ulcer secondary to corrosive ingestion.

One case of organophosphate poisoning required PICU admission with mechanical ventilation. Supportive care (oxygen therapy, nebulization, antibiotics, antipyretics) was the mainstay of treatment. Specific antidotes — atropine and pralidoxime for organophosphate poisoning, and desferrioxamine for iron overload — were employed selectively. There was no mortality; all 55 patients were successfully treated and discharged.

Table 10: Association Between Complications and Type of Poison

Complication	Type of Poison	Frequency	Percentage (%)
Chemical Pneumonitis	Thinner oil	3	5.4
	Diesel	1	1.8
	Mosquito repellent	1	1.8
	Acid	1	1.8
	Phenolic/Cresol compound	1	1.8
Bilateral Lower Lobe Pneumonia	Diesel	1	1.8
Chemical Pneumonitis with Consolidation and Effusion	Diesel	1	1.8
Gastric Ulcer	Phenolic/Cresol compound	1	1.8

Duration of Hospital Stay

Table 11: Duration of Hospital Stay

Duration (days)	Frequency	Percentage (%)
0–2	3	5.5
2–4	27	49.1
4–6	16	29.1
7 and above	9	16.4

The majority of patients (49.1%) were discharged within 2–4 days. 16.4% required hospitalization for 7 or more days. The three patients discharged within 0–2 days were largely asymptomatic cases with early hospital presentation.

DISCUSSION

The present study provides a comprehensive overview of the epidemiological patterns, causative agents, clinical features, and outcomes of pediatric poisoning cases at a tertiary care centre in Andhra Pradesh, spanning a three-year period from 2022 to 2024.[13-15]

The highest proportion of cases (41.8%) occurred in children aged 0–3 years, consistent with the developmental phase characterised by exploratory behaviour, oral curiosity, and inability to distinguish hazardous substances. This finding aligns with multiple published studies, including Manjunath Vaddambal et al. and Nowneet Kumar Bhat et al., who similarly reported children below five years as the predominant age group. In contrast, Shreekrishna H.K et al. observed a higher incidence in early adolescents, attributable to behavioural experimentation. The observation that impulsive and suicidal ingestions were confined exclusively to the 9–12 year age group in this study underscores a distinct psychosocial risk in pre-adolescent children.[16-19]

The nearly equal male-to-female ratio in this study differs from the male preponderance reported in most earlier Indian studies (Pattanayak et al., Caroline D. Shira et al., Mallanagouda K.P et al.). This may

ISSN (O): 2687-5365; ISSN (P): 2753-6556

reflect changing household exposure patterns in urban settings, where gender-neutral access to hazardous agents is increasingly common.[20-22]

An unexpected finding was the higher proportion of urban children (65.5%) compared to rural children — contrasting with the rural predominance reported in earlier literature (Vaddambal et al., Shreekrishna H.K et al.). This may be attributable to the greater availability of diverse household chemicals, cosmetics, liquid repellents, and stored medications in urban homes, combined with increasing nuclear family structures and reduced supervision.

Accidental ingestion comprised 89.1% of cases, consistent with the global literature on pediatric poisoning. Intentional cases were rare but present, reaffirming the need for psychiatric evaluation alongside routine clinical care for older children.

Hydrocarbons emerged as the dominant category of poison (47.3%), with thinner oil being the single most common agent. This pattern differs from studies where organophosphates or pharmaceuticals predominated (Ambika Sood et al., Shreekrishna H.K et al.), but aligns with findings from Vaddambal et al. and Shira et al., who reported hydrocarbons and kerosene as the leading agents in young children. The prevalence of hydrocarbon poisoning highlights the continued practice of unsafe storage of industrial and domestic solvents within the reach of children in both urban and peri-urban households.

Pesticides and insecticides (21.8%) ranked second, reflecting access to agricultural chemicals. The presence of pharmaceutical poisoning (14.5%) — involving drugs such as clonidine, labetalol, thyroxine, and antipsychotics — underscores the importance of safe medication storage.

Gastrointestinal symptoms predominated (76.3%), consistent with the primarily ingestion-based route of all poisoning events. A significant proportion of children (27.3%) were asymptomatic at arrival, emphasising the importance of careful observation even in clinically stable cases. Aspiration pneumonitis from hydrocarbon ingestion represents the primary complication risk and was the most frequently observed adverse outcome in this series.

The zero mortality rate in this study stands in contrast to the 0.95%–9.9% mortality rates reported in other Indian series. This favourable outcome may be attributed to early hospital presentation (69.1% within 1–6 hours), the predominance of hydrocarbon poisoning (which has a generally benign course with supportive care), and the ready availability of critical care including PICU services at a tertiary centre.

CONCLUSION

This three-year retrospective study at King George Hospital, Visakhapatnam, reveals that pediatric poisoning remains a significant cause of hospital admissions in children below 12 years. Toddlers (0–3 years) are most vulnerable, and accidental ingestion at home — predominantly involving hydrocarbon compounds — is the predominant mechanism. The near-equal gender distribution and unexpectedly high urban preponderance highlight evolving epidemiological trends linked to modern urban household exposures. Critically, zero mortality was achieved through prompt presentation and effective supportive care.

Children with pre-existing neurodevelopmental conditions represent a high-risk subgroup requiring intensified safety measures. The occurrence of impulsive and suicidal ingestions in the 9–12 year age group necessitates routine mental health screening.

Prevention remains the cornerstone of management. Strategies must encompass: child-proof storage of all household chemicals and medications; mandatory childproof packaging by manufacturers; community-level parental education programs; poison information centres; and active collaboration between health, social welfare, and educational sectors. Clinicians should remain vigilant for respiratory complications even in initially asymptomatic hydrocarbon ingestion cases, and specific antidotes should be promptly deployed for organophosphate and iron toxicity.

7. Limitations

This study is a single-centre retrospective analysis; findings may not be generalizable to the broader population. Toxicological confirmation of specific agents was not performed in any case; diagnoses were based on clinical history and the treating physician's judgement. Systematic documentation of parental education, household storage practices, and caregiver supervision at the time of poisoning was absent from case records, limiting causal analysis. Future prospective multi-centre studies with toxicological verification and structured caregiver interviews are recommended.

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ISSN (O): 2687-5365; ISSN (P): 2753-6556

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ISSN (O): 2687-5365; ISSN (P): 2753-6556