Journal of Chitwan Medical College 2023;13(45):3-8
Available online at: www.jcmc.com.np

ORIGINAL RESEARCH ARTICLE

ACUTE POISONING AND ENVENOMATION IN CHILDREN: CLINICO-EPIDEMIOLOGICAL PROFILE AND OUTCOME IN CENTRAL NEPAL

Biraj Parajuli[1,*], Aakash Kumar Pandit[1], Ritesh Ranjan Sah[1], Prakash Kumar Soni[1], Sonu Adhikari[1]
[1]Department of Pediatrics, Chitwan Medical College and teaching hospital, Bharatpur, Nepal

Received: 7 Aug, 2023
Accepted: 16 Sept, 2023
Published: 30 Sept, 2023

Key words: Children; Envenomation; Organophosphorus; Poisoning; Unintentional.

***Correspondence to:** Biraj Parajuli, Department of Pediatrics, Chitwan medical college and teaching hospital, Bharatpur, Nepal.*
Email: birajpgi@gmail.com
*DOI:*https://doi.org/10.54530/jcmc.1390

Citation

Parajuli B, Pandit AK, Sah RR, Soni PK, Adhikari S. Acute poisoning and envenomation in children: clinico-epidemiological profile and outcome in central Nepal. Journal of Chitwan Medical College.2023;13(45):3-8.

Peer Reviewed

ABSTRACT

Background: Acute poisoning and envenomation are significant concerns among children, demanding specialized approaches. This study aimed to assess the current scenario, clinico-etiological profile and outcome of acute poisoning and envenomation in children within Bagmati province, excluding the valley area.

Methods: A retrospective observational analysis was conducted involving children aged 28 days and above to 18 years admitted to Chitwan Medical College's Pediatric department between July 2020 to January 2023. Cases involving poison exposure or envenomation regardless of signs and symptoms, were included. Demographics, triage, interventions and outcomes were collected in predesigned data proforma and descriptive analysis was performed using SPSS 20.

Results: Results revealed, 179 admissions (3.49% of total) with most cases being accidental (87.3%), frequently among boys (64.8%) and age group 1-5 years old (53.1%) and median (IQR) age of 3 (2-8) years. Common presenting symptoms included vomiting (48%) and altered sensorium (21.2%). The median (IQR) time to hospital presentation post exposure was 3.75(2-7) hours. Organophosphorus (17.3%) and kerosene poisoning (8.4%) were the commonest poison, along with 11 cases of envenomation. Treatment included supportive care with antidote used in 17.9%. A majority (58.88%) only required 24- hour observation. There were a total of 5 deaths (2.79%) and 6 (3.35%) left against medical advice.

Conclusions: Our results align with previous similar studies conducted in Nepal and across Asia. Accidental cases predominated, particularly among young children. Organophosphorus remained a significant poison, while cypermethrin and alcohol poisoning were new observations. Basic supportive care saves more lives than all the antidotes put together.

INTRODUCTION

Any substance causing harm to living being are deemed poisons, making acute poisoning, particularly among children, a significant global health concern. It contributes substantially to mortality and morbidity, with around 45,000 annual child fatalities globally and an incidence rate of 1.8 per 100000 individuals.[1,2] Disparities exists in poisoning patterns and mortality between low- and middle-income countries (LMICs) to high-income counterparts.[3–5]

Recent studies report varying prevalence rates of acute poisoning in children, ranging from 0.38% to 3.93%.[3,6,7] This variability is influenced by factors like demographics, educational and socio-economic status, culture, and healthcare accessibility. Clinical manifestations differ based on factors like poison type, dosage, route of exposure, age, nutrition and gender. Male children are more frequently affected, attributed to their inherent inquisitiveness and exploratory behaviors.[1]

Accidental poisoning prevails among children aged 1-5 years, while suicidal poisoning becomes more prevalent during adolescence.[8] Snake bites, particularly from the Indian cobra and common krait, are concerning, primarily in tropical and subtropical regions of LMICs.[9] In Nepal's Terai Region, children constitute a quarter of reported snakebite cases.[10] Krait bites' lethality is associated with indoor bites occurring between midnight and early morning, initial consultations with traditional healers, delayed transportation, and inadequate access conveyance.[11] However, most snakebite cases necessitate observations, often without anti snake venom.

Given these circumstances, tailored epidemiological surveillance is crucial to comprehend the problems extend and attributes, enabling targeted prevention. To address this, we conducted a retrospective analysis to illuminate clinical and epidemiological aspects of acute poisoning and envenomation in children across central Nepal, beyond the confines of the Kathmandu valley, thus contributing to existing data.

METHODS

This retrospective study was conducted at the Pediatric Department of Chitwan Medical College, over a period of 2

and a half years, from July 2020 to January 2023. The study was approved by the institutional Review Committee (CMC-IRC/079/080-153). This study encompassed all children aged 28 days and above to 18 years who were admitted due to acute poisoning and envenomation during this period. All demographic information, clinical features, physiological derangements during emergency triage, treatment methods, and any complications were gathered from hospital's electronic records and entered in predesigned proforma. A descriptive analysis was done using statistical software (SPSS v 20.0). Median and interquartile range (IQR) were calculated for continuous variables and percentage were derived for categorical variables.

RESULTS

Out of a total of 5125 admitted cases we analyzed 179 cases of acute poisoning and envenomation in children during the study period. The majority of cases, involved children from Chitwan and the neighbouring districts. The distributions of these cases are shown in figure 1.

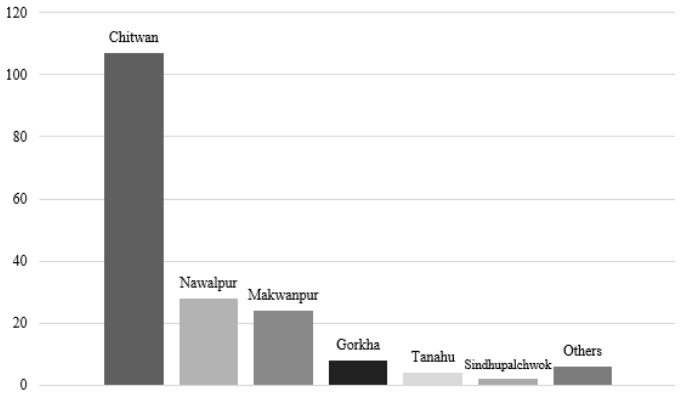

Figure 1: Geographical distribution of the admitted cases

This constituted about 3.49% of all total admissions. Among these cases, there was a higher number of boys, accounting for 116 cases (64.8%). The most common age group affected was 1-5 years old, making up 53.1% of the cases, with a median (IQR) age of 3(2-8) years. The distribution of cases according to age group and gender are shown in Table 1.

Table 1: Distribution of cases according to age group and gender

Age group	Gender distribution		
	Male (%)	Female (%)	Total (%)
<1 year	15(8.4%)	6(3.4%)	21 (11.7%)
1-5 years	63(35.2%)	32(17.9%)	95(53.1%)
5-10 years	21(11.7%)	9(5%)	30(16.8%)
>10 years	17(9.5%)	16(8.9%)	33(18.4%)
Total	116(64.8%)	63(35.2%)	179(100%)

Regarding the nature of the poisoning, accidental cases were the most frequent with 156 (87.2%) cases, followed by suicidal (17 cases, 9.5%), homicidal cases (4 cases,2.2%) and 2(1.1%) were in unknown circumstances. Notably, the instances of homicides involved the use of organophosphorus and paraquat, where the substance was administered to the children by the mother due to family disputes and depressive illness. The distribution of cases according to the nature of poisoning and age group is shown in table 2.

Table 2: Distribution of cases according to the nature of poisoning and age group

Age group	Accidental	Suicidal	Homicidal	Unknown
≤ 1 year	20(11.2%)	0	1(0.6%)	0
1-5 years	95(53.1%)	0	0	0
5-10 years	27(15.1%)	0	2(1.1%)	1(0.6%)
>10 years	14(7.8%)	17(9.5%)	1(0.6%)	1(0.6%)
Total (%)	156(87.2%)	17(9.5%)	4(2.2%)	2(1.1%)

Upon arrival at the emergency unit, 125 cases (69.8%) exhibited symptoms, with vomiting being the most common (48%) followed by altered sensorium (21.2%). Clinical features of the admitted cases are shown in table 3.

Table 3: Clinical features of the admitted cases

Symptoms	Number of cases (%)
Vomiting	86(48%)
Altered sensorium	38(21.2%)
Breathing difficulty	27(15.4%)
Abdominal Pain	20(11.2%)
Fever	19(10.6%)
Cough	15(8.4%)
Seizure	8(4.5%)
Loose stool	3(1.7%)
Gastrointestinal bleeding	3(1.7%)
Rash	3(1.7%)

The median (IQR) time interval between intoxication or envenomation and hospital presentation was approximately 3.75 (2-7) hours, and only 34 cases (18.99%) reached the hospital within the first hour. The most common group of poison encountered was pesticides/insecticides (n=78, 43.5%), hydrocarbons (n=26,14.5%), drugs (n=25,13.9%), chemicals (n=22,12.2%), and plants(n=10,5.5%). Envenomation was noted in 11cases (6.1%) including 10 snake bites and 1 scorpion sting. Different group of poisons and their outcome has been shown in Table 4.

Organophosphorus poisoning was the most prevalent (n=31,17.3%), followed by kerosene (n=15,8.4%), cypermethrin (n=10,5.6%), datura(n=6,3.4%) and alcohol(n=6,3.4%). Paracetamol poisoning (n=7, 25.92%) was most common drug-related poisoning. Among envenomation cases(n=11), 9 cases of neuroparalytic snake envenomation, 1 scorpion sting required intubation and mechanical ventilation. Antidote was administered in only 32 cases (17.9%), and gastric lavage was performed in 27 cases (15.1%). One hundred and six (58.88%) cases needed 24-hour observation only, and 142 cases (79.32%) were stable at emergency triage without requiring organ support. Among the critical cases, 12 (6.7%) had respiratory distress, and respiratory failure due to pulmonary cause was

Table 4: Distribution of poison cases according to the outcome

	Discharge	Death	LAMA	Total
Envenomation				
Hematotoxic snake venom	0	0	1	1
Neuroparalytic snake venom	6	3	0	9
Scorpion sting	0	1	0	1
Plants				
Camphor seeds	0	0	1	1
Datura	6	0	0	6
Diffenbachia seguina	1	0	0	1
Mushroom	2	0	0	2
Drugs				
Ambroxol	2	0	0	2
Amitraz	2	0	0	2
Benzodiazepine	2	0	0	2
Carbamazepine	3	0	0	3
Clonidine	1	0	0	1
Clozapine	1	0	0	1
Dapsone	0	0	1	1
Donepezil	1	0	0	1
Iron tablets	1	0	0	1
Olanzapine	3	0	0	3
Paracetamol	7	0	0	7
Risperidone	1	0	0	1
Chemicals				
Acid	1	0	0	1
Alcohol	5	0	1	6
Caustic soda	1	0	0	1
Corrosive	4	0	0	4
Detergent	1	0	0	1
Handwash	2	0	0	2
Hydrochloric acid	2	0	0	2
Phenol	2	0	0	2
Sanitizer	1	0	0	1
Soap water	1	0	0	1
Sulfuric acid	1	0	0	1
Hydrocarbon				
Diesel	4	0	1	5
Kerosene	15	0	0	15
Other hydrocarbon	1	0	0	1
Petrol	1	0	0	1
Turpentine oil	4	0	0	4
Insecticides/pesticides				
Alkali urea fertilizer	1	0	0	1
All out	1	0	0	1
Alphamethrin	1	0	0	1
Bromodiolone	1	0	0	1
Calcium carbide	1	0	0	1
Cyhalothrin	1	0	0	1
Cypermethrin	10	0	0	10
Delfin	1	0	0	1
Deltamethrin	2	0	0	2
Emamectin benzoate	1	0	0	1
Gamma benzene hexachloride	3	0	0	3

Glycel	1	0	0	1
Insecticide	1	0	0	1
Mosquito repellant	2	0	0	2
Organophosphorus	31	0	0	31
Paraquate dichloride	1	1	0	2
Poultry multivitamin	1	0	0	1
Prallethrin	3	0	0	3
Rat poison	5	0	0	5
Transfluthrin	6	0	0	6
Zinc phosphide	2	0	1	3
Zinc carbon battery	1	0	0	1
Carbon mono-oxide	1	0	0	1
Arsenic	1	0	0	1
Mercury	1	0	0	1
Unknown substance	3	0	0	3
Total	168	5	6	179

Table 5: Outcome of patients based on final physiological categorization

Final physiological categorization	Discharged	Death	LAMA	Total %
Stable	140	0	2	142 (79.3%)
Respiratory distress	11	1	0	12 (6.7%)
Respiratory failure (Pulmonary cause)	5	0	1	6 (3.4%)
Hypotensive shock	0	0	2	2 ((1.1%)
Primary brain dysfunction	7	0	0	7 (3.9%)
Cardiorespiratory failure	2	1	0	3(1.7%)
Cardiorespiratory arrest	0	1	0	1(0.6%)
Respiratory failure with brain dysfunction	3	2	1	6 (3.4%)
Total	168(93.85%)	5(2.8%)	6(3.4%)	179(100%)

seen in 6 cases (3.4%). Brain dysfunction with altered sensorium was observed in 13 (7.26%) cases while two cases presented with shock, 3 had cardiorespiratory failure while one had cardiopulmonary arrest on arrival. The final physiological categorization and their outcome had been shown in figure 2 and table 5.

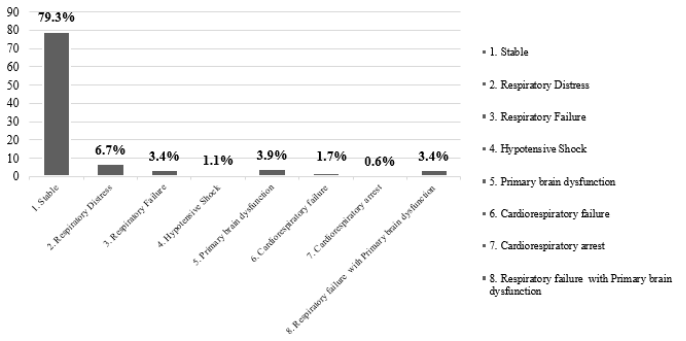

Figure 2: Final physiological categorization of the total admitted cases

Regarding interventions, mechanical ventilation was needed for 15 cases. Among these, 8 were due to neuroparalytic snake envenomation, 3 were related to alcohol poisoning, and 1 each resulted from a scorpion sting, carbamazepine ingestion, organophosphorus poisoning and caustic soda ingestion. Continuous positive airway pressure (CPAP) was required for 10 cases, high flow nasal canula for 1, and vasoactive support for 8 cases. Acute liver failure was seen in 2 cases of paracetamol poisoning and camphor poisoning. Non-oliguric acute kidney injury occurred in 3 cases: Scorpion sting, paraquat poisoning, and zinc phosphide poisoning. The occurrence of organ dysfunction among the cases was relatively low, underscoring the point that poisoning incidents in children often lead to minor consequences and necessitate careful observation only. Our study recorded 5 deaths (2.79%), and 6 cases (3.35%) left against medical advice while still in critical condition.

DISCUSSION

World Health Organization (WHO) reports acute poisoning as the fourth most common cause of childhood mortality and morbidity.[1,2] However, its occurrence varies globally, and there's a lack of substantial data from low-and middle-income countries.[4] Early recognition and prompt treatment, and implementing preventive measures are crucial in reducing harm caused by poisoning. During our study, we observed168 cases of acute poisoning and 11 cases of envenomation, comprising 3.49% of the total cases. This aligns with similar studies conducted in hospitals of Nepal.[7,12]

In our study the predominant involvement of children was from Chitwan and the neighbouring districts. This also underscores

the importance of establishing a localized epidemiological profile to address poisoning effectively within the region.

We also observed an extended time lapse between the poisoning and arrival of patients at our pediatric emergency department. This delay could potentially be attributed to rural patients having to cover greater distances and referral centre status. Most patients initially visited nearby healtcare facilities, where essential primary care for poisoned children, like gastric lavage, activated charcoal, was often unavailable. Notably, snake bite cases often sought anti-snake venom but required urgent ventilation, leading to a hypoxic state. These findings emphasize the necessary for improved local data, accessible medical care, and enhanced healthcare provider training to effectively address childhood poisoning and envenomation incidents.

The age group most affected was 1-5 years old (53.1%), likely due to their exploratory nature, curiosity, inability to distinguish harmful substances, frequent hand-to-mouth contact. Similar results have been noticed in multiple studies worldwide.[13–15] Boys had a higher incidence of poisoning at 64.8% compared to girls, which is consistent with findings from other Asian studies.[16–19] The male-to-female ratio was twofold up to the age of 10 years, after which the ratio equalized beyond this age threshold.

Most cases of poisoning were unintentional, although as age increases, there is a noticeable rise in the occurrence of suicidal cases (9.5%). Numerous studies conducted in Nepal and across South Asia have found that the majority of childhood poisoning cases stem from accidental circumstances. This can also be attributed to inadequate parental supervision and children's inquisitive nature.[16,20,21] Unfortunately, four cases of homicide were recorded, involving the use of organophosphorus and paraquat. These incidents revolved around mothers administrating these toxic agents to their children, likely due to family conflicts and struggles with depressive illness.

Organophosphorus pesticide poisoning was the most prevalent, consistent with other Nepalese studies, reflecting our agricultural economy and unrestricted use of pesticides with insufficient safety measures.[7,22,23] They are commonly kept in empty-colored bottles, increasing the risk of accidental ingestion by young children. The second most common case was kerosene poisoning, often stored in soft drink bottles within children's reach in rural areas. Fortunately, these incidents didn't lead to significant morbidity or mortality possibly due to the unappealing taste deterring substantial consumption. Cypermethrin, a synthetic pyrethroids, used as insecticides whose symptoms ranges from local to neurological, was a novel finding in our study. Another new observation was 6 cases of accidental alcohol poisoning which were linked to locally made alcohol stored in soft drink container. Out of these, three cases needed careful observation. However, one case had super refractory seizure requiring mechanical ventilation for 8 days while other had encephalopathy requiring ventilation for 3 days. One presented with aspiration pneumonia with acute respiratory distress syndrome who left against medical advice after 2 days in critical condition. In more affluent countries, the primary cause of childhood poisoning tends to be attributed to medication ingestion.[3,14,15] In our study, around 14% of cases involved medications, and the most frequent was paracetamol. This was due to miscalculation of dose by the parents due to confusion in the drug concentration between suspension and drops form.

Out of the 9 cases of neuroparalytic snake envenomation, all were referred to our centre for requirement of ventilation, which was delayed in the search for anti-snake venom (ASV). This highlights the importance of providing symptomatic treatment not just relying on ASV.

Most cases (79.3%) were stable upon arrival, with vomiting as the most main symptom likely due to the unpleasant taste of the poison. Gastric lavage was performed in 27 cases and activated charcoal was administered for 1 case only due delayed presentation. Around 60% required just 24-hour observation. The median (IQR) hospital stays was1(1-3) days, as only 20% had physiological derangements.

Mechanical ventilation was needed for all cases of neuroparalytic snake envenomation, and only a small number exhibited other organ dysfunction. Antidote was used in 32 cases, emphasizing its availability in 10-20% of poisons and the importance of prioritizing supportive care.

Our study recorded a 2.79%(n=5) mortality rate, with 6 cases leaving against medical advice while still requiring support. Death was attributed to neuroparalytic snake envenomation(n=3), scorpion sting and paraquat poisoning. A study conducted in Nepal a decade ago reported a mortality rate as high as 12.6%.[24] However, our study recorded a lower mortality rate compared to these earlier findings. This discrepancy could be attributed to the progress made in medical science and the emergence of improved treatment protocols.

CONCLUSION

This study provides current insights into childhood acute poisoning and envenomation in low- middle-income country. A significant portion of these cases were accidental and affected children under five years old. Organophosphorus still remains the leading poison, however, cypermethrin and alcohol poisoning were our new observations. It is a common error to search for a specific antidote to a poison as it is available for only about 5-10% of all poisons, and basic supportive care saves more lives than all the antidotes put together. There is a requirement to enhance public awareness about safety measures concerning the handling of pesticides, insecticides, and medications. Collaborative efforts among families, society, educational institutions, and medical facilities are essential to curbing the occurrence of acute poisoning and envenomation in children.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

REFERENCES:

1. Peden M, World Health Organization. World report on child injury prevention. 2008;211.
2. Peden M, Oyegbite K, Ozanne-Smith J, Hyder AA, Branche C, Rahman AF, et al.World Report on Child Injury Prevention. In:World Health Organization; 2008. p. 123-42.
3. Berta GN, Di Scipio F, Bosetti FM, Mognetti B, Romano F, Carere ME, et al. Childhood acute poisoning in the Italian North-West area: a six-year retrospective study. Ital J Pediatr. 2020; 46:83. [DOI]
4. Mintegi S, Azkunaga B, Prego J, Qureshi N, Dalziel SR, Arana-Arri E, et al. International Epidemiological Differences in Acute Poisonings in Pediatric Emergency Departments: Pediatr Emer Care. 2019; 35:50-7. [DOI]
5. Yadav S, Yadav S, Agrawal J, Shah G. Pattern of acute poisoning in children in a tertiary care hospital in eastern Nepal. Int J Contemp Pediatr. 2016;1001-5. [DOI]
6. K SH, Singi Y, V C, Dabhi D. A Study on the Profile of Poisoning in the Paediatric Population in a Tertiary Care Teaching Hospital of Chitradurga Region. Cureus 14(12): e32369. [DOI]
7. Giri A, Sah V, Yadav S, Yadav N. Clinico-Epidemiological Profile and Outcome of Poisoning in Children Presenting at a Tertiary Care Hospital of Eastern Nepal. Journal of Nobel Medical College. 2023; 12:27-32. [DOI]
8. Azab SMS, Hirshon JM, Hayes BD, El-Setouhy M, Smith GS, Sakr ML, et al. Epidemiology of acute poisoning in children presenting to the poisoning treatment center at Ain Shams University in Cairo, Egypt, 2009-2013. Clinical Toxicology. 2016 ;54(1):20-6. [DOI]
9. Minghui R, Malecela MN, Cooke E, Abela-Ridder B. WHO's Snakebite Envenoming Strategy for prevention and control. The Lancet Global Health. 2019;7(7):e837-8. [DOI]
10. Joshi DD. An Epidemiological Study of Snake Bite Cases in Children of Nepal. J. Nepal Paediatr Soc. 2010;30(3):135-40. [DOI]
11. Sharma SK, Chappuis F, Jha N, Bovier PA, Loutan L, Koirala S. Impact of snake bites and determinants of fatal outcomes in Southeastern Nepal. The American Journal of Tropical Medicine and Hygiene. 2004 ;71(2):234-8. [DOI]
12. Yadav S, Yadav S, Agrawal J, Shah G. Pattern of acute poisoning in children in a tertiary care hospital in eastern Nepal. Int J Contemp Pediatr. 2016;1001-5. [DOI]
13. Dhakal AK, Shrestha D, Shakya A, Shah S, Shakya H. Clinical Profile of Acute Poisoning in Children at a Teaching Hospital in Lalitpur. J Nepal Paedtr Soc. 2014;34(2):100-3. [DOI]
14. Lamireau T, Llanas B, Kennedy A, Fayon M, Penouil F, Favarell-Garrigues JC, et al. Epidemiology of poisoning in children: a 7-year survey in a paediatric emergency care unit: Eur. J. Emerg. Med. 2002 ;9(1):9-14. [DOI]
15. Ahmed A, AlJamal AN, Mohamed Ibrahim MI, Salameh K, AlYafei K, Zaineh SA, et al. Poisoning emergency visits among children: a 3-year retrospective study in Qatar. BMC Pediatr. 2015;15(1):104. [DOI]
16. Saikia D, Sharma R, Janardhan K. Clinical profile of poisoning due to various poisons in children of age 0-12 years. J Family Med Prim Care. 2020;9(5):2291. [DOI]
17. Malla T, Malla KK, Rao K, Gauchan E, Basnet S, Koirala D. A Scenario of Poisoning in Children in Manipal Teaching Hospital. J Nepal Paedtr Soc. 2011;31(2):83-8. [DOI]
18. Dayasiri MBKC, Jayamanne SF, Jayasinghe CY. Patterns and outcome of acute poisoning among children in rural Sri Lanka. BMC Pediatr. 2018 ;18(1):274. [DOI]
19. Lee J, Fan NC, Yao TC, Hsia SH, Lee EP, Huang JL, et al. Clinical spectrum of acute poisoning in children admitted to the pediatric emergency department. Pediatrics & Neonatology. 2019 ;60(1):59-67. [DOI]
20. Chaudhary N, Gupta BK, Poudel A, Chhetri P. Clinicoepidemiological Pattern and Outcome of Poisoning in Children in a Tertiary Care Hospital of Western Nepal. J Univ Coll Med Sci. 2022 ;10(01):28-32. [DOI]
21. Alwan IA, Brhaish AS, Awadh AI, Misnan A, Rahim NAA, Tangiisuran B, et al. Poisoning among children in Malaysia: A 10-years retrospective study. Sharma S, editor. PLoS ONE. 2022;17(4):e0266767. [DOI]
22. Rwimal HS, Tiwari U, Ghimire K, Thapa M. Hospital Based Study of Poisoning Among Children, 1 to 18 Years of Age in Eastern Nepal. Birat J Health Sci. 2017; 2:138-41. [DOI]
23. Thapa S, Dawadi BR, Upreti AR. Acute Poisoning among Patients Presenting to the Emergency Department of a Tertiary Care Center: A Descriptive Cross-sectional Study. J Nepal Med Assoc. 2020;58(227):470-3. [DOI]
24. Budhathoki S, Poudel P, Shah D, Bhatta N, Dutta A, Shah G, et al. Clinical profile and outcome of children presenting with poisoning or intoxication: a hospital based study. Nepal Med Coll J. 2009;11(3):170-175. [PMID]