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Original Article

Acute Poisoning Emergencies at Gulu University Teaching Hospitals in Northern Uganda: Prevalence, Outcomes and Clinical Challenges

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ABSTRACT

Acute poisonings, including envenomation as well as toxicological emergencies stemming from accidental or intentional ingestion of poisonous substances or drug overdose, are significant worldwide causes of morbidity and mortality. The study aimed to characterise acute poisoning emergencies admitted to two major hospitals in Northern Uganda. We conducted a retrospective review of charts of all patients admitted with acute poisoning emergencies between January and December 2021, as well as a structured interview of hospital staff working in these hospitals on challenges faced while managing these emergencies. Of the total 40,653 patient admissions, 416 (1%) were due to acute poisonings. The majority were admitted to SMHL (71.4%), 43.3% were between 20 and 40 years of age, and 59.9% were males. The average length of hospital stay was 1 (0-3). The most frequent diagnoses were acute alcohol intoxications (27.2%, n=113), snake bites (26.0%, n=108), and organophosphate poisonings (21.2%, n=88). Only 29.6% (n=123) of patients received antidotes. Peak admissions were observed in February, May, and July. The majority of poisonings were intentional (61.3%), resulting in a Case Fatality Rate of 6.3%. In the qualitative findings, participants highlighted key challenges in managing these conditions, including the lack of antidotes, patients presenting late at the hospital, economic barriers, staff shortages, and limited community awareness. Acute poisoning, especially acute alcoholic intoxication, snake bites and organophosphate poisoning, are common in northern Uganda, with significant numbers dying from it. The lack of antidotes remains a problem in these hospitals. Restriction of alcohol consumption use of agricultural organophosphates, and training of healthcare workers in managing these emergencies are recommended.

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INTRODUCTION

Globally, at least 421,000 envenomation and approximately 20,000 deaths occur every year following snakebite and 300,000 deaths from pesticide poisonings, the the majority of which are from low- and middle-income countries (1,2). Acute envenomation (injection of poisonous substances by stings, bites, or other similar means) and toxicological emergencies resulting from accidental or intentional ingestion of poisonous substances or drug overdose are significant causes of morbidity and mortality worldwide (3).

Both envenomation and toxicological emergencies are important concerns for both public health and emergency care systems (4). The most common poison used in deliberate self-harm in the developing world is pesticides (5). In Kampala, Uganda, pesticides and paracetamol overdose are among the commonest poisonings, while snake bites lead to acute envenomation emergencies (6–8). Most of these emergencies are common in developing countries. Snake has been termed the "disease of poverty" because of its prevalence and high mortality in poor countries (9). Children are the the majority of unintentional poisoning culprits (10,11). These poisonings vary from place to place, with some reports estimating up to over 17% of ward admission among children in rural areas of South Africa (12,13). In central Uganda, deliberate self-harm using poisonous substances such as pesticides was found to be common, especially among the young ones 20-24 years, those with higher educational status, loneliness, disturbed interpersonal relationships, and poor housing (8, 14). Over 75% of people who died from deliberate self-harm were from developing countries, according to earlier studies (15).

Acute poisoning is also common in other continents. In Sri Lanka, several districts had pesticides as the major cause of deaths in government hospitals, preceding all other causes (16). In one reference teaching hospital centre in Tehran, Iran, over 24,000 cases were recorded within a period of one year, and the commonest agent was drug poisoning, followed by organophosphates with a mortality rate of 1.3% (17).

Emergency care in resource-limited settings has long been regarded as unaffordable and not cost-effective given the competing demands from primary healthcare interventions with public health impact (18). Most attention and donor funding are directed towards research and care in HIV(19–22) and maternal child health (23–26). This is not to say these public health burdens are not of great concern. Although communicable diseases such as Malaria, HIV, TB, and respiratory, diarrhoeal, epidemic-prone, and vaccine-preventable diseases are the leading causes of illness and death - over 50% of all mortality in all age groups and sexes in Uganda (27–29), it should as well be noted that acute poisoning is significant and need for prevention

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and preparedness for management of these emergencies is of paramount importance (7).

Mortality from poisoning varies generally depending on the substance taken but is prevalent among those with intentional poisoning (suicide). For example, 0.74% case fatality among children with paraffin poisoning to about 20% among adults with Acute Organophosphate poisoning (AOPP) (30,31). However, it should be noted that morbidity and costs on hospital resources are often overlooked while tackling poisoning. Antivenom, as well as antidotes, are scarce in Africa, especially sub-Saharan Africa, due to their costs (32).

Northern Uganda has an especially higher risk of intentional self-poisoning due to its history of civil war with a higher level of poverty at a 67.4% index compared to other regions of Uganda (33–35). The poverty-stricken region also faces challenges when it comes to treatment with antivenom, such as snake bite, which is expensive for the ordinary peasant farmer. Whereas few studies have been done in Uganda, for example, in Kampala (7), no study yet has described these emergencies in the context of northern Uganda, the region at higher risk due to high levels of post-traumatic stress disorders following the civil war (36,37) and poverty especially the challenges faced by this hospital in managing these poor population with such emergencies.

Having estimates of the burden, challenges faced by hospitals and outcomes of these emergencies can help guide health system preparedness in managing them (38). Hence, this study aimed to describe the prevalence, outcomes, and challenges faced by these university teaching hospitals in managing these conditions.

MATERIALS AND METHODS

Study Design

In this study, we retrospectively reviewed patients' admission database from January to December 2021 in the two Gulu University teaching hospitals in northern Uganda.

Study Settings

St. Mary's Hospital Lacor and GRRH are located in Gulu City, in the Acholi sub-region. Gulu City has two divisions: Bardege-Layibi (where LH is located) and Pece-Laroo (where GRRH is located) Divisions. St. Mary's Hospital is a Private Not for Profit (PNFP) hospital, one of the largest in Uganda, funded by the Catholic Church. It has over 500 bed capacities, an average annual emergency department attendance of approximately 11,000 and average annual admissions of approximately 33,000 (personal communication with hospital management and records department). GRRH is the only government regional referral hospital in the Acholi sub-region with a total bed capacity of 250, average annual admissions of about 13,000 and emergency unit annual attendance of over 10,000. Both these hospitals are Gulu University Medical School teaching hospitals. These two hospitals were chosen because: Firstly, they are the biggest hospitals in northern Uganda in terms of bed capacity, number of patients seen at emergency centres, and number of health workers. Secondly, they are the referral centres for all emergencies in the sub-region and serve as Gulu University Medical School teaching hospitals.

Data Collection

Two research assistants, one for each hospital, were trained and employed to collect the data. Data on all recorded cases admitted to these hospitals from January to December 2021 were included. Two methods of data collection were employed: Retrospective survey of records of patients admitted with acute toxicological and envenomation emergencies and a structured interview of hospital leaders, head of the Emergency Department (ED) and intensive care unit (ICU), and ward nursing in-charges on challenges facing these hospitals in managing these conditions.

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Data Analysis

Data collected were entered into Microsoft Excel for Windows and kept in a protected computer only accessible to the study team. Data was exported and analysed using STATA version 17. Both quantitative and qualitative statistics were obtained.

Ethical Considerations

This study was reviewed and approved by the Lacor Hospital Research Ethic Committee (LHIREC: Approval number XXX), one of the ethical review committees seconded by Uganda National Council of Science and Technology (UNCST), with study approval number 005/04/2022. Individual hospital administrative permission was also obtained from each of the two hospitals before commencing data collection. For the retrospective surveys of patient records, no consent was required, and only demographics and medical data records were obtained without any identifying information such as names. For the interviews of hospital managers, heads of units and nursing ward in-charges, they signed informed consent, and they were free to decline to participate in the study and to withdraw at any time with no consequences.

RESULTS

Socio-Demographic Characteristics

Of the 40,653 total hospital admissions in the two hospitals from January to December 2021, there were 416 cases of toxicological emergencies, contributing 1.0% of the total hospital admissions. The majority of the cases were from SMHL (n=297), and most were males 59.9% (n=249), with the highest number within the age between 20 and 40 years 43.3% (n=180), followed by those who were less than 20 years old 33.9% (n=149). Median length of hospitalisation was 1(1-0).

Table 1: Characteristics of the patients admitted with acute toxicological emergencies

Variable		Frequency (%)
Hospital	GRRH	119(28.6)
	SMHL	297(71.4)
Age in years	</= 20	149(33.9)
	21-40	180(43.3)
	41-60	73(17.5)
	>60	22(5.3)
Sex	Female	167(40.1)
	Male	249(59.9)
Type of organic poisoning	Alcohol intoxication	113(27.2)
	Carbon-mono-oxide	7(1.7)
	Drugs	29(7.0)
	Food poisoning	18(4.3)
	Organophosphate	88(21.2)
	Snake bites	108(26.0)
	Others	53(12.7)
Antidote given?	No	275(66.1)
	Yes	123(29.6)
	N/A	18(4.3)
Intentional?	No	161(38.7)
	Yes	255(61.3)
Length of hospitalisation, median (IQR), days		1(0-3)
Outcome	Alive	390(93.8)
	Dead	26(6.2)

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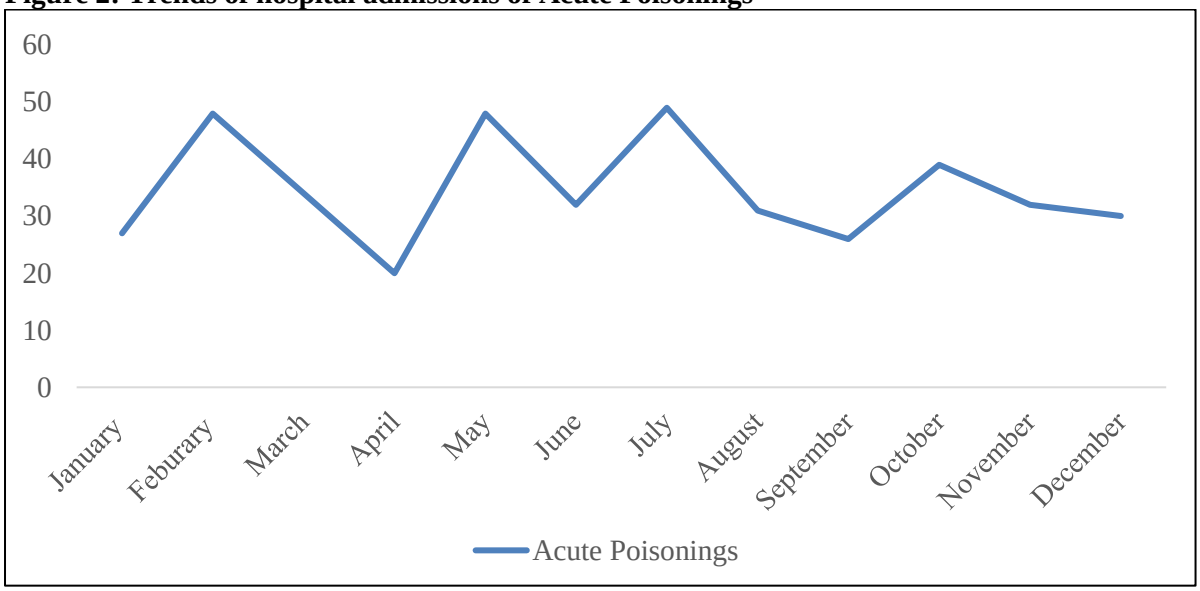
Acute Poisoning

Overall, 416 (1%) cases of toxicological emergencies were admitted. Alcohol intoxications contributed the highest to the hospital admissions of these emergencies 27.2% (n=113), followed by snake bites 26.0% (n=108) and organophosphates 21.2% (n=88), while carbon monoxide poisoning was the least 1.7% (n=7). Case Fatality Rate (CFR) was 6.3% (n=26. Of those who needed specific antidotes (n=398), only 30.1% received them (n=123). Sixty-one percent (61.3%) of the cases were intentional ingestion of poisonous substances. *Table 1*.

The peak number of admission cases was in the months of February, May and July, *Figure 1*.

Figure 2: Trends of hospital admissions of Acute Poisonings



Factors independently associated with mortality were only being admitted to SMHL (aOR: 7.2, 95%CI: 1.64-31.69, p=0.009) (*Table 2*).

Table 2: Multivariate analysis of factors independently associated with mortality among cases of acute toxicologic emergencies.

Variable	Adjusted Odds ratio	95% CI	P value
Hospital			
GRRH	1.0		
SMHL	7.2	1.64-31.69	0.009

Clinical Challenges

The majority of the staff interviewed from these two hospitals on challenges faced in managing these emergencies were Medical Officers, n=9 and nurses n=8, with the most mentioned challenges being lack of antidote, lack of finance among patients and late presentation at hospitals (*Table 3*).

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Table 3: Challenges faced by hospitals in managing these emergencies and possible measures to address these challenges

		Frequency (n=21)
Hospital	GRRH	12
	LH	8
Position in the hospital	Medical Director	0
	Nursing Officer-in-charge	2
	Nurse/Midwife	8
	Clinical Officers	1
	Intern Doctor	1
	Medical Officer	9
	Specialist Doctor	
Challenges	Inadequate medical equipment and space	3
	Lack of antidotes/antivenom (drugs)	11
	Inadequate human resources	3
	Lack of knowledge in community first aid	1
	Lack of clinical knowledge to manage	2
	Poor government policies	
	Late presentation and/or referral to hospital	4
	Lack of transport	2
	Lack of finance from patient to cost share	5
	Limited investigations that can be done	1
Possible ways to address the challenges	Coordination with partners for health to increase funding	10
	Training of staff in managing these emergencies	2
	Negotiation with the ministry of Health to increase the budget for health	1
	Ensure medical supplies are timely and adequate	2
	Recruitment to boost human resources	1
	Community Awareness on prevention and first aid	10
	Improve emergency preparedness	2
	Improve the ambulance system for transportation	1
	Waiver for cost share for antivenom in LH	2
External assistants are required to manage and prevent these emergencies	Seek more implementing partners and donors in health	10
	Improve emergency Department	2
	Community awareness on prevention and first aid	8
	Support supervision	1
	Training of staff in managing these emergencies and quick referral	4
	Creation of a Toxicological centre	3

DISCUSSIONS

This study assessed prevalence, outcomes, and associated factors as well as challenges faced by hospitals in managing acute toxicologic and envenomation emergencies in the two University teaching hospitals in northern Uganda. Acute poisoning emergencies accounted for 1.0% of total hospital admissions in these two hospitals, with acute alcohol intoxications and snake bites contributing highest, with the highest contributor being acute alcohol intoxications. This is in contrast to findings in Kampala, a survey done in Tygerberg information centre in South Africa, a systematic review of 9 studies done in Ethiopia, a correctional study in Lusaka Zambia, and a study done in Sri Lanka where the highest contributor to the cases were AOPP (7,8,16,39–41), but consistent with study conducted in an urban Emergency Department (ED) of a tertiary hospital in Tanzania whereby the leading admission case diagnosis was alcohol (7,39,42,43). Alcohol consumption is very high in Uganda, just as in other sub-Saharan countries in Africa, with the possibility of excessive consumption and

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subsequent toxicities possibly explaining the many cases of intoxication (44,45).

The majority of the cases (61.3%) in our study were intentional ingestion of the poisonous substances. This is similar to findings in studies done in Uganda and the rest of Africa (8, 39, 40, 42, 43) and other developing countries (16).

Our study found the case fatality rate to be 6.3%. This is five times higher than the one found in a study in two hospitals in Kampala, Uganda, which was 1.4% (7). This could possibly be due to the fact that our study hospitals serve rural settings with multitudes of challenges, including distance and delays to reach the hospital whereas these hospitals in Kampala serve city populations with relatively good road networks and quick access to the hospitals. Our study found that the case fatality rate was one and a half times higher than a national survey of trends of organophosphate poisoning in Uganda using the District Health Information System for data between 2017 and 2022, where the case fatality rate was 4.2% (4). This difference could be because the national survey only looked at AOPP compared to our study, which looked at various poisonings. Our study found case fatality rate two to three times higher than some studies done in South Africa and Botswana (46,47) and five times higher than the rate found in a study done in Iran (17). In Morocco, a study of snake bite cases reported to poison control centres showed a case fatality rate of 3.9% (48). On the contrary, one observational prospective study of 61 patients admitted with APP in Mbarara Regional Referral Hospital found a case fatality rate of 18% (49). This study included few participants and focussed only on APP compared to our study, hence possibly accounting for the huge difference. Earlier studies showed that over 75% of people who died from deliberate self-harm, such as intentional self-poisoning, came from developing countries like Uganda (15). Being admitted in SMHL was independently associated with seven times the risk of mortality compared to those admitted in GRRH. This could be possible because SMHL is a private not-for-profit (PNFP), relatively well-funded, more equipped ED and Intensive Care Unit (ICU) and relatively well stocked with antidotes and antivenoms compared to government health facilities, including GRRH. Quite often, severe cases are even referred from GRRH to SMHL (interactions with staff at ED), and this could explain more deaths in SMHL since cases referred from GRRH are more likely to be severe with a higher likelihood of fatality than those that remained or admitted at GRRH. One observational prospective longitudinal study done in Kampala assessing predictors of motility among patients admitted with APP, though with a small sample size (n=61), found poor triage vital signs on admission, male gender, and time of admission to be significantly associated with mortality (49).

Lack of antidotes followed by poverty and late presentation and/or referral were the most commonly mentioned points as the major challenges facing these hospitals in managing acute poisonings. Only 29.9% of patients received antidotes in our study compared to the finding in one study done in Kampala, where 52.3% of patients with pesticides received atropine (43). Lack of antidotes and poverty have been demonstrated before as being associated with poor outcomes from snake bites due to the inability of hospitals in poor countries to deal with it, terming it as a “Disease of the poor” (9,32). A qualitative survey of healthcare workers’ (HCWs) perspective, knowledge, and health facility’s capacity to manage snake bites in Uganda, Kenya and Zambia found only 12% of HCWs had formal training and availability of antidotes in health facilities ranging from 0 – 34% (50). Late presentation being one of the major challenges is consistent with the finding of a survey done in Kampala, where the median time of presentation was 4 hours, and in Tanzania, where 12.3% of the patients presented at ED within 2 hours of exposure to poisons (42,49). This could be from various well-studied factors that delay health seeking among people, such as delays in making decisions, delays in reaching hospitals and delays in getting services (51). Delays in health seeking could be addressed through community

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awareness, which was mentioned by our respondents as one of the ways to address these challenges. Other factors mentioned, such as shortage of staff, lack of equipment and space, deficient clinical knowledge, and lack of training among staff on management of these cases, limited investigations, costs and lack of community awareness, have also been found in other studies. Assessment of the effects of training healthcare workers on diagnosis and treatment of pesticide poisoning found improved knowledge on pesticide toxicities and handling of poisoning cases (52). Similarly, a study done in Kenya found that higher qualifications and training enhanced knowledge, attitudes, and practice of initial management of acute poisoning patients among nurses at ED at a tertiary hospital (53). Assessment of healthcare workers' knowledge and training in managing snake bites in Uganda found that, although 87.1% of staff were confident in managing snake bites, only 22.8% had high knowledge of the management of snake bites and were mainly those who had previous training on the topic suggesting need for specific staff training in managing these emergencies as mentioned by staff during our oral interviews (54). Other ways suggested by hospital staff to mitigate these challenges include seeking more implementing donor partners, community awareness, which includes the need for early presentation in the hospital and first aid that can be given at prehospital by lay personnel and creating a toxicologic centre.

Acute poisoning is still a burden in northern Uganda, especially acute alcohol intoxications and organophosphate poisoning, with higher fatality rates than other studies have shown before in other parts of Uganda and Africa. Hospitals and staff are faced with a multitude of challenges, some of which can be addressed locally through training, while others need policymakers and community engagements.

Study strengths and limitations

This study was a retrospective study based on recorded data, so it is not subject to lose to follow-up; it is also not subject to subjective response except for a small component of interviews. However, interviews of hospital managers/heads of units may be subjected to bias such as desirability bias. This was dealt with by having pre-set questions designed in such a way as to eliminate this bias, and the questionnaire was piloted.

CONCLUSIONS

Acute poisoning, especially acute alcoholic intoxication, snake bites and organophosphate poisoning, are common in northern Uganda, with significant numbers dying from it. Hospitals are faced with multitudes of challenges, including lack of antidotes, lack of additional staff training on managing these emergencies and late presentation of poisoning patients in hospitals. Community awareness, restriction of alcohol consumption use of agricultural organophosphates and training of healthcare workers in managing these emergencies are recommended.

LIST OF ABBREVIATION

SMHL – St. Mary's Hospital Lacor

GRRH – Gulu Regional Referral Hospital

ED – Emergency Department

ICU – Intensive Care Unit

PNFP – Private Not for Profit

HCWs – Healthcare Workers

AOPP – Acute Organophosphate Poisonings

APP – Acute Pesticide Poisoning

Ethical Approval

The study protocol was approved by Lacor Hospital Internal Review Ethical Committee (LHIREC), review number LHIREC Admin. 005/04/2022. It is one of the research ethical review committees approved by the Uganda National Council of Sciences and Technology. Administrative clearances were also obtained from the administrators of both hospitals. For the interview part, participation in the study was

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voluntary from participants and informed written consent was mandatory before participating in the study. Participants were free to withdraw from the study at any point, even during or after the interview.

Consent For Publication

Not applicable to participants as no individual person's data in any form, including any individual details, images or videos, have been included in this manuscript.

Availability of Data and materials

The datasets used and/or analysed in this study are available from the corresponding author on request.

Conflict Of Interests

The authors declare that they have no conflict of interest to declare

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Authors Contribution

Keneth OPIRO, Concept and proposal development, Data collection and analysis, and writing of manuscript. *Amone Derick,* Proposal development, data collection and analysis, and writing of manuscript. *Amos Wokorach,* Proposal development, data collection and analysis, and writing of the manuscript. *Margret Sikoti,* Proposal development, data collection and analysis, and writing of manuscript. *Bongomin Felix,* Data analysis and writing of the manuscript

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