

Acute poisoning in the Rift Valley Provincial General Hospital, Nakuru, Kenya: January to June 2012

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Background: Information on the patterns of acute poisoning in Kenyan hospitals is limited, and yet such information is crucial for the appropriate management of poisoning. This study attempted to address this knowledge gap by examining admissions in a regional hospital in Kenya.

Method: This was a retrospective review of the hospital records of 96 acute poisoning patients in Rift Valley Provincial General Hospital, Nakuru, in the first six months of 2012. A pretested data collection form was used to obtain data on important variables.

Results: The prevalence of acute poisoning was 0.07% (96 of 141 769 cases). The average age of the patients was 22.6 years \pm 11.20 years, the majority of whom were males [odds ratio (OR) 2.06]. The most prevalent toxic agent was pesticide (50, 52.08%). The majority of cases were intentional poisoning (48.96%) versus unintentional poisoning (43.75%), and involved mainly males (OR 3.06). Conversely, females were the majority with respect to accidental poisoning (25%) versus males (17.7%). However, accidental poisoning was most prevalent in patients aged 12 years and younger (23, 23.96%). Overall, acute poisoning was most prevalent in the age category of 20–30 years (40, 41.66%), in which intentional poisoning was predominant (26, 27.08%). The majority of cases of acute poisoning were incorrectly diagnosed (OR 1.79). The three patients who died were males (3.13%).

Conclusion: This study showed that the majority of acute poisoning cases affected males and were intentional. The study also showed that the most prevalent acute toxic agent was pesticide and that acute toxic agents were often misclassified and hence misdiagnosed. These observations should be included when designing focused hospital poison management protocols.

Keywords: accidental poisoning, acute poisoning, intentional poisoning, misdiagnosis, toxic agents

Introduction

Morbidity and mortality from acute poisoning is a major public health issue in many countries. It is estimated that poisoning events are responsible for more than one million illnesses annually.^{1,2} Although acute poisoning is either intentional or accidental, most admissions are due to intentional self-poisoning with a highly toxic agent, such as pesticide.¹ The epidemiology of poisoning in Kenya, as in other African countries, is not well established.³ However, in countries like Kenya with few established poison information centres, hospital toxicovigilance is important in providing toxicoepidemiological information that can be used in the design of focused interventions.¹ In an attempt to generate this information, this study aimed to characterise acute poisoning in the Rift Valley Provincial General Hospital in Nakuru, Kenya.

Method

This was a retrospective study based on a review of hospital records of patients admitted to a regional referral hospital, Rift Valley Provincial General Hospital in Nakuru, Kenya; for acute poisoning in the first six months of 2012. Prior to commencement of the study, research approval was obtained from the hospital ethics committee. Relevant patient files were obtained from the hospital's records department. A pretested structured data collection form was used to collect data on age, residential area, gender, diagnosis, circumstances behind the poisoning (intentional or accidental), the toxic agents (the trade name or local name are indicated, where available), and the outcome of the treatment (whether or not the patients survived or died). Obtaining the patients' history was used to deduce the circumstance of poisoning in this study. In addition, cases of self-poisoning and homicide were classified as intentional

poisoning. The length of admission was computed from the difference between the date of admission and date of discharge, as shown in the discharge summary. The reported diagnosis was the one indicated in the discharge summary. Diagnoses were routinely made based on the generic name of the toxic agent, i.e. organophosphate compounds. The known generic name of the suspected toxic agent indicated in the patient history was used to categorise the diagnoses. In this study, a diagnosis was incorrect if the generic name used in the diagnosis was not the correct generic name of the suspected toxic agent. A diagnosis was categorised as unknown if no suspected toxic agent was reported in the patient history. The researchers recorded the trade or common names of the toxic agents in order to tabulate the respective generic names to aid health workers to make an appropriate acute poisoning diagnosis.

The data were analysed using descriptive statistics using Microsoft® Excel® 2007. The mean age was determined as mean \pm standard deviation. Odds ratios (OR) was hand calculated and used as the inferential statistic.

Results

The study sample was patients admitted to the regional referral hospital for acute poisoning treatment. Their mean age was 22.6 years \pm 11.20 years. Overall, the half-year prevalence of acute poisoning in the hospital was 0.07% (96 of 141 769 cases). However, in this study, the majority of cases could not be identified by residential area (12.50%). Of the patients whose residential area could be extracted, the highest proportion (7.29%) resided in Rongai, an area in which large-scale farming is practised. The second highest prevalence of cases was equally distributed, at 4.17% each between the Salgaa, Kaptembwo and

Table 1: The frequencies of the various categories of toxic agents

Toxic agents	Cases	Percentage of the total
Pesticides	50	52.08
Food poisoning	9	9.38
Petroleum distillates	9	9.38
Animal poison	8	8.33
Pharmaceutical drugs	5	5.21
Noxious gases	4	4.17
Poisonous plants	2	2.08
Corrosive agents	2	2.08
Other	7	7.29
Total	96	100.00

the Free Area which are the suburban areas of Nakuru town, a provincial headquarters. Salgaa, Kaptembwo and Free area at 4.17% each. It is notable that Rongai and Salgaa are neighbouring residential areas responsible for a combined case load of roughly 11.46%.

The most common category of toxic agents implicated in acute poisoning in the hospital (in descending order) were pesticides, food poisoning, petroleum distillates and animal poison (Table 1).

Overall, poisoning in the majority of the cases was intentional (Table 2). With regard to the circumstances of the poisoning per age category (Table 2), the highest number of acute poisoning cases and the most intentional poisoning occurred in the age category of 20–30 years. However, accidental poisoning was most frequently reported in the age group of 12 years and younger (Table 2).

With regard to the gender distribution of the cases (Table 3), acute poisoning was twofold more likely in male than in female patients (OR 2.06). In addition, a gender difference was applicable to the circumstances behind the poisoning. Intentional poisoning was threefold more likely in males than in females (OR 3.06).

Table 2: Circumstances of acute poisoning by age

Circumstances	Age category				0 ≥ 30 n (%)
	≤ 12 n (%)	13–19 n (%)	20–30 n (%)	> 30 n (%)	
Accidental	23 (23.96)	3 (3.13)	9 (9.38)	7 (7.29)	42 (43.75)
Intentional	1 (1.04)	8 (8.33)	26 (27.08)	12 (12.50)	47 (48.96)
Unknown	0 (0.00)	1 (1.04)	5 (5.21)	1 (1.04)	7 (7.29)
Total	24 (25.00)	12 (12.50)	40 (41.66)	20 (20.83)	96 (100.00)

Table 3: Circumstances of poisoning by gender

Circumstances of poisoning	Gender			0 ≥ 30 n (%)
	Females n (%)	Males n (%)	Not indicated n (%)	
Accidental	24 (25.00)	17 (17.71)	1 (1.04)	42 (43.75)
Intentional	14 (14.58)	33 (34.38)	0 (0.00)	47 (48.96)
Unknown	1 (1.04)	6 (6.25)	0 (0.00)	7 (7.29)
Total	39 (40.63)	56 (58.33)	1 (1.04)	96 (100.00)

On evaluating the distribution of the toxic agents by gender in the 20- to 30-year-old age category (Table 4), it was found that some toxicants showed gender bias. Agents like Triatix® (amitraz) were used by males exclusively, while Rat and Rat® (zinc phosphide), were predominantly used by females. The two patients who took a combination of pesticides in this group were males. With regard to appropriateness of diagnosis, the majority of the acute poisoning cases in the hospital, as shown in Table 5, were incorrectly diagnosed (OR 1.79), although approximately 4% of the diagnosis could not be ascertained owing to incomplete data entries.

The majority of the patients survived the poisoning (Figure 1). The fatalities were all males.

Discussion

The very low mortality of acute poisoning reported in this study was in contrast with the high mortality (1–17%) reported in southern Africa.³ This variation in mortality may be explained by the short study period and hence a smaller sample size evaluated. The average age of the patients seen in Rift Valley Provincial General Hospital in Nakuru, Kenya, over the first six months of 2012 was 22.6 years ± 11.20 years. This is consistent with the findings of other studies in which an average age of 23.3 years ± 6.3 years was reported.^{2,3}

The reasons for the relatively high number of cases from Rongai and Salgaa (cumulatively 11.46%) may relate to the agricultural activities in these areas that increase the exposure risk to pesticides, and even snake envenomation. It is also possible that the Salgaa trading centre, which is populated by long-distance truck drivers, may be attracting commercial sex workers that increases the risk of sexually transmitted diseases such as HIV-AIDS which curtails the socio-economic activities of the infected and their dependants. This may then elevate the risks for intentional poisoning not only in this area but also surrounding areas thus partly explaining the high number of acute poisoning cases in Salgaa and Rongai. However, further research in these areas to uncover the predisposing factors is strongly recommended.

Pesticides were the toxic agents most implicated in acute poisoning (52.08%). The high number of pesticide poisoning in this study may relate to the agricultural practices of the population

Table 4: The distribution of toxic agents by gender in the 20- to 30-year-old group

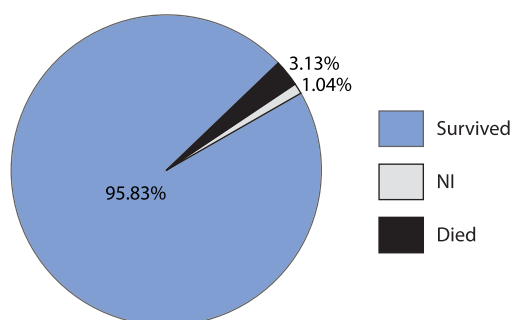
Toxic agent		Males	Females	Total	Percentage of the total
Trade name or common name	Generic names				
Antitermite	Unknown	1	0	1	2.50
Battery acid	Sulphuric acid	1	0	1	2.50
Carbon monoxide	Noxious gases	1	1	2	5.00
Cattle dip	Unknown	1	0	1	2.50
TM	Organophosphate	2	3	5	12.50
Duduthrin®	Organophosphate	1	0	1	2.50
Fruit juice	Food poisoning	1	0	1	2.50
Murphy®	Organophosphate	1	0	1	2.50
Mushrooms	Food poisoning	0	1	1	2.50
NI	Unknown	2	1	3	7.50
Rat and Rat®	Zinc phosphide	1	4	5	12.50
Savina Dudu Dust®	Organophosphate	1	0	1	2.50
Septrin®	Sulphur drugs		1	1	2.50
Snake poison	Snake poison	2	3	5	12.50
Triatix®	Amitraz	8	0	8	20.00
Triatix® and Rat and Rat®	Amitraz and zinc phosphide	2	0	2	5.00
Wild vegetable	Unknown	2	0	2	5.00

NI: not indicated in the patient file.

which entails the wide use of pesticides. Pesticide poisoning will inevitably be high because of its perceived high potency as a suicide agent, coupled with its wide accessibility.^{1,2,6,7,9,10} The relatively high number of cases of petroleum distillate poisoning reported in children (≤ 12 years) may be the result of widespread poverty in the catchment area, resulting in the extensive usage of kerosene as an energy source.^{3,6,9,11} Children are mostly exposed to petroleum products as a result of their inherent curiosity, coupled with the poor storage habits of users such as keeping kerosene in unlabeled containers within reach of children.³

The finding that snake poisoning was among the most frequent causes of acute poisoning was consistent with a study in Karnataka, India, in which the highest number of cases in early adulthood (20–30 years of age) was also reported.⁶ This age group was possibly most affected because it comprises the most active members of the population who eke out a living in the fields.

There was gender bias with regard to some toxic agents and the pattern of poisoning. For instance, amitraz poisoning was reported exclusively in males, whereas zinc phosphide poisoning was observed mainly in females. This bias may be explained by

**Figure 1:** A graphical presentation of the poison treatment outcome*

Notes: NI: not indicated in the patient file

*: The majority of cases survived the poisoning. The fatalities were all males

Table 5: Status of diagnosis of the acute poisoning cases

Status of diagnosis	Number of cases	Percentage
Correct	41	(42.71)
Incorrect	51	(53.13)
Unknown	4	(4.17)
Total	96	(100.00)

differences in the cultural roles of males and females. This might have influenced the probability of exposure. Culturally, the management of livestock diseases is often carried out by males. Therefore, they are more likely to be exposed to animal pesticides, such as acaricides (amitraz), than females. In contrast, females are often involved in household activities, including the control of household pests with pesticides such as zinc phosphide. This increases their exposure levels. It is also possible that there is a gender difference in the perception of potency between zinc phosphide and Amitraz that would influence their choice for intentional poisoning among males and females. This study also postulates that as a result of the cultural roles, people could easily purchase pesticides over-the-counter with suicidal intent without suspicion being elicited.

The majority of the poisoning cases were intentional, an observation that is in agreement with those made in other studies.^{2,5,6} The higher proportion of intentional poisoning (78%) reported elsewhere⁵ may be attributed to the exclusion of participants aged 12 years and younger in those studies. In addition, this study does not corroborate the one carried out in Botswana in which a majority of the poisoning cases were found to be accidental.³ This variation may be attributable to socio-economic differences in the populations in the two countries. The observation that acute poisoning was highest in the age category 20–30 years was inconsistent with the finding in a study in Botswana whereby most of the cases were found to be in the 0- to 12-year-old category.³ This observation might be explained by the predominance of accidental poisoning in the Botswana study, unlike the predominance of intentional poisoning experienced in this

study. Although this study didn't evaluate the specific reasons behind the poisoning, owing to its retrospective nature, the fact that intentional poisoning was highest in early adulthood (in the 20- to 30-year-old category) suggests that this group may have experienced socio-economic tension as the majority of patients were school and college leavers, under pressure to provide for their families. Other reasons could be alcohol and drug abuse, as well as emotional distress. The observation that accidental poisoning was highest in the age group ≤ 12 years was consistent with studies that have been carried out elsewhere.^{5,6} The mental immaturity of children may have contributed to their lack of caution when handling potentially toxic agents leading to accidental self poisoning. However, further research on specific reasons as to the vulnerability of early adulthood with respect to acute poisoning need to be explored, with the intention of developing focused preventive interventions.

In this study, the majority (twofold) of poisoning cases were males (58.33%) versus females (40.63%). The OR was 2.06. This is consistent with study findings that have been reported elsewhere.⁸ Furthermore, a gender difference was found with regard to the circumstances behind the poisoning. Males were threefold more likely to have been poisoned intentionally (OR 3.06). This disparity may be explained by the patriarchal nature of the population which lays most of the socio-economic burden on males. The high number of male cases could also be explained by the lack of adequate psycho-social support for males in the population, unlike that given to females who are often involved in informal socio-economic groups, such as "merry go rounds", -women groups involved in regular pooling of finances through table banking which are then given to members as unsecured loans. The meetings offer opportunities for individual challenges to be shared. However, this observation was in contrast with those made by other researches who found female cases of suicide to be significantly higher than males.^{2,3} This inconsistency may be attributed to the socio-economic and cultural differences in the populations studied. On further analysis of the cases, males were found to be a majority among the poisoning cases aged above 20 years (27(60.00%) against 13(35.00%) female cases) while females were marginally higher in the under 20 year group (19 (52.78%) versus 17(47.22%). This observation also reinforces the immense social pressure on males in the study population as a result of cultural expectations. A higher number of females aged under 20 were more likely to self poison unlike males, this may be explained by higher teenage peer pressure and pregnancies compared to their older counterparts.

The reported mortality of 3.13% was similar to that reported in some studies^{1,3,12} but was far lower than that reported in two others (13.18% and 15.4%, respectively).⁴⁻⁶ The apparently low mortality reported in this study, compared to that in the latter studies, may be attributed to the shorter study period and possibly the small sample size. However, it is also possible that the basic management of acute poisoning in the regional referral hospital was satisfactory, in spite of the many misdiagnoses.

The residential areas of the patients who were poisoned was a variable that was collected to identify an association between residential area and acute poisoning so that focused interventions could be initiated. This objective was impaired owing to incomplete patient records. The high number of missing data may be attributed to a lack of appreciation by data clerks of the importance of vital data in patient management. Since most of the patients (nine of the 12 cases) whose residential areas could not be established were children aged 12 years and younger, their immaturity may have impacted negatively on their ability to recall

their residential areas contributed to this situation. Therefore, it is prudent that health facilities train data clerks on the importance of quality data in the management of health conditions.

This study also showed that it was likely that cases were incorrectly diagnosed (OR 1.79). Misdiagnosis was mainly as a result of misclassification of the toxic agents because most clinicians were unfamiliar with the common toxic agents in the catchment area. However, some misdiagnoses were the result of similarities between the symptoms. For instance, the co-existence of bradycardia, miosis and the respiratory depression in amitraz (Triatix[®]) poisoning was incorrectly diagnosed as organophosphate poisoning. There was also a tendency by the clinicians to make a default diagnosis of organophosphate poisoning when faced with unfamiliar pesticide poisoning, leading to the inappropriate use of some drugs, such as atropine sulphate and pralidoxime (2-pyridine aldoxime methyl chloride), with consequent financial liability to both the patient and hospital.

Conclusion and recommendations

A major limitation of this study was its retrospective nature which culminated in missing patient data, coupled with the short study period, which may have affected the generalisation of this study. Nevertheless, it generated important findings on acute poisoning cases seen in the hospital. It showed that there were more male than female cases of acute poisoning. It also demonstrated that males were poisoned intentionally more often than females. Our study reported that the most affected age category was 20–30 years. In addition, it revealed that pesticides were the most commonly used toxic agent. Lastly, it showed that toxic agents were misclassified and hence misdiagnosed.

Recommendations include the following:

- Future studies should be prospective in nature to more accurately capture acute poisoning information, and thereby rectify the position of having to conduct analyses with missing data.
- Continuous medical education of medical personnel, including data clerks, is required on the importance of obtaining and filing a complete patient history.
- Further research is needed to establish the reasons behind the high proportion of poisoning cases in the Rongai and Salgaa area in order for appropriate preventive measures to be devised.
- Regulated access by the general population should be implemented with respect to amitraz, diazinone and zinc phosphide pesticides.
- Public health education should be provided on the safe storage of petroleum distillates.
- Finally, in order to facilitate the efficient management of poisoning, a hospital database of trade names, as well as local and generic names of commonly observed toxic agents and their standard treatment protocols, should be established.

Acknowledgements – The authors express their appreciation and gratitude to Catherine Kosgei for her immense assistance during the data entry process. Special thanks are given to the medical superintendent, Dr John Murima; and Dr Lydia Githurwa, the pharmacist in charge at Rift Valley Provincial General Hospital, for their support in this study being conducted with the hope of improving the high levels of poisoning and the management thereof within the hospital.

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Received: 14-06-2013 Accepted: 30-10-2013