


Treatment outcome and associated factors among patients admitted with acute poisoning in a tertiary hospital in Eastern Ethiopia: A cross-sectional study

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Abstract

Introduction: Acute poisoning causes morbidity and mortality worldwide. There is scarce of information on acute poisoning in the study area.

Objective: To assess treatment outcome and the associated factors among patients admitted with acute poisoning at Hiwot Fana Comprehensive Specialized Hospital, Eastern Ethiopia.

Methods: A cross-sectional study was conducted. All acutely poisoned patients who had been admitted at the emergency department of Hiwot Fana Comprehensive Specialized Hospital from 1 January 2016 to 31 December 2020 who fulfilled the inclusion criteria of the study were included. Data were collected by review of medical records. Poor treatment outcome of acute poisoning was defined as the acutely poisoned patient was died, or survived with disability. Multivariate logistic regression analysis was used to determine factors associated with the outcome of acute poisoning.

Result: A total of 175 patient's medical records were reviewed. Of these, 150 patient's medical records had complete information and were included in the final analysis. The majority of participants 89 (59.3%) were in the age group of 19–37 years. More than half of the participants 86 (57.3%) were females. Organophosphate was the most poisoning agent encountered in 62 cases. Acetaminophen was the predominant drug poisoning agent encountered in 10 participants. Among 30 patients managed with antidote, 18 patients were treated with atropine for organophosphate poisoning. Of all the poisoning cases admitted during the study period, 16.7% died. Participants who were poisoned by themselves were 2.4 times more likely to have poor treatment outcomes than those who were poisoned accidentally: 2.44 (95% confidence interval: 1.10–5.42). The odd of having poor treatment outcome in participants who were poisoned by drugs was 2.13 more likely: 2.13 (95% confidence interval: 1.21–3.32).

Conclusion: Organophosphate was the predominant cause of acute poisoning encountered in 62 cases. The modes of poisoning and drug poisoning were significant risk factors associated with poor treatment outcomes of acute poisoning.

Keywords

Outcome, poisoning, treatment, Eastern Ethiopia

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Introduction

Acute poisoning is a common reason for visits to emergency departments and hospitalizations as well as a common cause of morbidity and mortality worldwide. World health organization (WHO) data of 2016 showed that, worldwide, approximately 106,683 people died due to unintentional poisoning.¹ There were an estimated 385 million unintentional acute pesticide poisoning (UAPP) cases worldwide including around 11,000 fatalities. The greatest estimated number of UAPP cases was in southern Asia, followed by southeastern Asia and east Africa with regards to nonfatal UAPP.² In Africa, there were an estimated 7800 deaths per year as a result of intentional self-poisoning with pesticides. In addition, snake bite causes between 1400 and 10,000 deaths in eastern sub-Saharan Africa.³ In Ethiopia, evidence from hospital-based studies revealed that acute poisoning is common and an important clinical emergency with a varying case fatality rate, ranging from 1.5% to 18.6%.^{4–11}

Even though acute poisoning is a significant cause of morbidity and mortality worldwide, the extent of the problem, the situations of exposure, and the types of poisoning differ from country to country.^{4,12,13} The impact of acute poisoning is well documented in most developed countries. The Toxic Exposure Surveillance System (TESS) data, gathered by the American Association of Poison Control Centers (AAPCC), for instance, offers evidence about poisonous contacts and subsequent health impacts all over the United States and is used to determine emerging hazards, to focus prevention and education programs and to guide clinical research.¹⁴ However, most of the developing countries have not yet entirely identified the risks and impacts posed by acute poisoning on human health. One of the justifications was the lack of comprehensive national epidemiological data on acute poisoning.^{15,16}

In Ethiopia, there is no well-organized poison control center, routine screening, and confirmatory tests.¹⁷ There is also a limitation of epidemiological data on acute poisoning, particularly on treatment outcomes of its clinical management in the emergency department at the hospital level. Some hospital-based retrospective cross-sectional studies have identified acute poisoning-related morbidity and mortality^{5,8} and listed suggested factors as determinants for poor treatment outcomes of acute poisoning. Some of these factors are variations in sex, age, residence, type of poisoning, season of poisoning, time of arrival to the hospital, duration of and hospital stay.^{6,7} However, the pieces of evidence are not as strong to show which of these determinant factors are directly associated with poor treatment outcomes of acute poisoning. This is because the previous studies were inconsistent and the associated factors influencing poor treatment outcome of acute poisoning differs across the country. Hence, this study is aimed to assess the treatment outcomes of acute poisoning and identify factors associated with treatment outcomes among patients who had been admitted to the emergency ward in the study area.

Methods and materials

Study area, design, and period

A cross-sectional study was conducted in Hiwot Fana Comprehensive Specialized Hospital (HFCSH), Eastern Ethiopia. HFCSH serves as a referral hospital for the entire Eastern part of Ethiopia, including Eastern Oromia, Dire Dawa City Administration, the Somali Regional State, and the Harari Regional State. The catchment population of the hospital is expected to be 5,800,000 of whom 2.85 million are females and 2.95 million are male.¹⁸ Currently, the hospital has about 238 beds with 294 functional rooms to offer different services for the community. There is one General Hospital and Federal Police hospital as well as eight public health centers in the catchment area. The study was carried out from 30 June to 31 July 2021 (data collection period).

Source and study population

All acutely poisoned patients who had been admitted to the emergency department of HFCSH were the source population for this study. All acutely poisoned patients who had been admitted to the emergency department of HFCSH from 1 January 2016 to 31 December 2020 (admission year of participants) were considered as the study population.

Inclusion and exclusion criteria

All acutely poisoned patients who were admitted to the emergency department were included. Acute poisoning cases with incomplete information on the medical record were excluded.

Sample size

There were a total of 175 registered poisoning cases listed in the registry of the emergency department from 1 January 2016 to 31 December 2020, of which 150 cases had complete data, and were included in the study.

Data collection procedure

A data abstraction format adapted from different literature,^{4,7,10,12,13} was used to record the necessary information from patients' medical records. The data abstraction format was prepared in English language and included variables like sex of patients, age of patients, residence, route of poisoning, type of poisoning, clinical presentations, the status of patients when coming to the hospital, reason of patients for taking the poison, time of arrival to the emergency of the hospital, source of poisoning agents, length of hospital stay, treatment given for the acute poisoning, and treatment outcome.

The medical records of acutely poisoned patients were captured by taking medical record numbers from the registration manual of the emergency department. After selecting the medical record numbers of poisoning cases, the medical

records were obtained from the medical record room. Then, the necessary information was extracted by using data abstraction format by three well-trained nurses.

Data quality control

To ensure the quality of data, the pretest was done on 5% of the total study population in Jugol hospital. The pretest was conducted on randomly selected medical records of acutely poisoned patients to ensure the agreement of the data abstraction format with the objective of the study. Any error found during the process of the pretest was corrected and modification was made into the final version of the data abstraction format. The data collectors were trained before the process of data collection. Supervision and checking were made by the well-trained supervisor to ensure the completeness and consistency of the data. All collected data were examined for completeness and consistency during data management, storage, and analysis.

Operational definitions

Acute poisoning: It is an injury in which the toxic effects occur almost immediately after taking the poisoning agents, usually within hours from the time of exposure.

Treatment outcome of acute poisoning: In this study, the treatment outcome of acute poisoning could be good or poor.

Poor treatment outcome: Death or survived with disability.

Good treatment outcome: Recovered without disability.

Survived: When the acutely poisoned patient was discharged with disability.

Recovered: When the acutely poisoned patient was discharged without disability.

Disability: Either a physical disability or physiological disability leading to new morbidity, dialysis, or respiratory or another organ failure following acute poisoning which was confirmed by laboratory investigation or suspected by clinicians, based on the clinical complaints of patients

Statistical analysis

The collected data were entered into Epi data statistical software version 3.1 and then exported to Statistical Packages for Social Sciences (SPSS) version 22 to code, edit, clean, and analyze. Continuous variables were presented as mean, standard deviation (SD), whereas categorical variables were presented as frequency and percentage. Multiple logistic regression model was used to control the effect of confounding variables. Multivariable logistic regression analysis was used to determine factors associated with the treatment outcome of acute poisoning. Multicollinearity among selected independent variables was checked through variance inflation factor (VIF) and none was found. The presence and

strength of statistically significant associations were declared at $p < 0.05$ and using adjusted odds ratio (AOR) with its 95% confidence intervals (CIs). Finally, data were presented using texts, tables, and figures.

Ethical consideration

An ethical clearance letter was obtained from Haramaya University, College of Health and Medical Sciences, Institutional Health Research Ethics Review Committee (IHRERC). An official letter of cooperation to conduct the study was sent to HFCSH. Informed, voluntary, written and signed consent was obtained from the Head of HFCSH before the start of data collection. The Head of HFCSH was also informed that the information obtained from medical records was kept with complete confidentiality. COVID-19 safety measures (wearing a mask, keeping social distance, and using alcohol-based hand rubs) were applied throughout the study to protect the data collectors as well as the supervisors from the deadly pandemic.

Results

Sociodemographic characteristics and mode, route, source, and reason of poisoning

A total of 175 patient's medical records were reviewed. Among these, 150 patient's medical records had complete information and were included in the final analysis. The majority of participants 89 (59.3%) were in the age group of 19–37 years. The mean age of participants was 24.2 years with an SD of 16.3. More than half of the participants 86 (57.3%) were females. Half of the participants 76 (50.7%) lived in rural areas. The mode of poisoning was suicidal in 77 (51.3%) participants. Oral ingestion was the most common route of poisoning which occurred in 111 participants (74%). More than half of the study participants 81 (54%) obtained poisoning agents from their home. The most common reason for accidental poisoning was mental disorder 41 (56.2%) (Table 1).

Type of poisoning agent, time to arrival, admission status, hospital stay, and treatment

Eighty-three patients were admitted with conscious status. Eighty percent of this study participants were hospitalized for 1 day at emergency departments. The majority of participants 107 (71.3%) arrived at the hospital 1 h after the intake of the poisoning agent. Histamine 2 receptor blocker particularly cimetidine was administered for 34% of the cases. Nearly 20% of cases were treated by antidote and normal saline. Of all the poisoning cases admitted during the study period, 56.7% were recovered and discharged while death was recorded in 25 (16.7%) cases. Pesticide poisoning was the commonest poisoning which accounted for 72 (48%)

Table 1. Sociodemographics characteristics and mode, route, source, and reason of poisoning for acutely poisoned patients who had been admitted at the emergency department of HFCSH.

| Characteristics | | Frequency (%) | Treatment outcome | | p value |
|---------------------------------|-----------------------|---------------|-------------------|-----------|---------------|
| | | | Good (%) | Poor (%) | |
| Sex | Female | 86 (57.3) | 40 (62.5) | 24 (37.5) | 0.21 |
| | Male | 64 (42.7) | 45 (52.3) | 41 (47.7) | |
| Age (years) | <18 | 45 (30) | 26 (57.8) | 19 (42.2) | 0.25 |
| | 19–37 | 89 (59.3) | 53 (59.6) | 36 (40.4) | |
| | >38 | 16 (10.7) | 6 (36.5) | 10 (62.5) | |
| Current residence | Urban | 74 (49.3) | 42 (56.8) | 32 (43.2) | 0.57 |
| | Rural | 76 (50.7) | 43 (56.6) | 33 (43.4) | |
| Mode of poisoning | Accidental | 73 (48.7) | 45 (61.6) | 28 (38.4) | 0.23 |
| | Suicidal | 77 (51.3) | 40 (51.9) | 37 (48.1) | |
| Reason for accidental poisoning | Mental disorder | 41 (56.2) | 31 (75.6) | 10 (24.4) | 0.004* |
| | Eating food | 32 (43.8) | 13 (41.9) | 18 (58.1) | |
| Reason for suicidal poisoning | Family disharmony | 31 (40.3) | 25 (80.6) | 6 (19.4) | ----- |
| | Marital disharmony | 10 (12.9) | 6 (60) | 4 (40) | |
| | Exam failure | 8 (10.4) | 4 (50) | 4 (50) | |
| | Unplanned pregnancy | 15 (19.5) | 5 (33.3) | 10 (66.7) | |
| Route of poisoning | Conflict in work area | 13 (16.9) | 9 (69.2) | 4 (30.8) | ----- |
| | Oral | 111 (74.0) | 65 (58.6) | 46 (41.4) | |
| | Inhalational | 38 (25.3) | 19 (50) | 19 (50) | |
| Source of poisoning | Bite | 1 (0.7) | 1 | 0 | 0.005* |
| | Home | 81 (54.0) | 52 (64.2) | 29 (35.8) | |
| | Hotel | 33 (22.0) | 21 (63.6) | 12 (36.4) | |
| | Workplace | 36 (24.0) | 12 (33.3) | 24 (66.7) | |

The p value was calculated by using the Pearson chi-square test, *there is an association between the reason for accidental poisoning and treatment outcome, and -----Not fulfilled chi-square test assumption.

cases and followed by household poisoning 54 (36%). Organophosphate was the most common poisoning agent from the overall poisoning agents as well from pesticide poisoning which was encountered in 62 cases. The most common household poisoning agent was food 21 (14%). Acetaminophen was the predominant drug poisoning agent encountered in 10 participants. Poisoning due to snakebite occurred only in one participant (Table 2).

Use of antidote in acutely poisoned patients

Among the 30 patients managed with antidote, 18 patients were treated with atropine for organophosphate poisoning (Table 3).

Factors associated with poor treatment outcome of acute poisoning

In bivariate logistic regression analysis, variables with p value less than or equal to 0.25 were entered to multivariable logistic regression analysis to control for potential confounding variables that affect the poor treatment outcome of acute poisoning. In bivariate analysis, variables such as sex, age, mode of poisoning, source of poisoning, drug poisoning, and time to

arrival had a p value of less than 0.25. These variables were used in multivariable model. In multivariable logistic regression analysis, mode of poisoning and drug poisoning were significantly associated with poor treatment outcomes of acute poisoning. Participants who were poisoned by themselves were 2.4 times more likely to have poor treatment outcomes than those who were poisoned accidentally: AOR=2.44; 95% CI: (1.101–5.421; $p=0.028$). The odd of having poor treatment outcome in participants who were poisoned by drugs was 2.13 times than non-drug poisoning: AOR=2.13; 95% CI: 1.21–3.32; $p=0.006$ (Table 4).

Discussion

Suicidal modes of poisoning and drug poisoning were significantly associated with poor treatment outcomes of acute poisoning. In addition, among the 150 cases admitted with acute poisoning, 56.7% recovered while 16.7% died.

In the current study, acute poisoning was found to be predominant within the age of 19–37 years. Other studies revealed similar results.^{4,19–22} This could be due to increased levels of stress on an individual with exposure to different social, economical, and occupational pressure.²³ The finding of the current study showed that acute poisoning was higher

Table 2. Type of poisoning agent, time to arrival, status, hospital stay, and treatment of acutely poisoned patients who had been admitted at the emergency department of HFSUH.

| Characteristics | | Frequency (%) | Treatment outcome | | p value |
|-------------------------------|------------------------------|---------------|-------------------|-----------|-------------|
| | | | Good (%) | Poor (%) | |
| Pesticide poisoning | Organophosphate | 62 (41.3) | 39 (62.9) | 23 (37.1) | ----- |
| | Zinc phosphide | 9 (6.0) | 4 (44.4) | 5 (55.6) | |
| | Benzene | 1 (0.7) | 1 | 0 | |
| Household poisoning | Kerosene oil | 2 (1.3) | 0 | 2 | ----- |
| | Food | 21 (14.0) | 18 (85.7) | 3 (14.3) | |
| | Carbon monoxide | 12 (8.0) | 8 (66.7) | 4 (33.3) | |
| | Alcohol | 3 (2.0) | 3 | 0 | |
| | Cleaning substance | 16 (10.7) | 10 (62.5) | 6 (37.5) | |
| Type of drug poisoning | Misoprostol | 1 (0.7) | 0 | 1 | ----- |
| | Chlorpromazine and diazepam | 6 (4.0) | 4 | 2 | |
| | Acetaminophen | 10 (6.7) | 8 (80) | 2 (20) | |
| | Aspirin | 1 (0.7) | 1 | 0 | |
| | Promethazine | 1 (0.7) | 1 | 0 | |
| | Haloperidol | 4 (2.7) | 0 | 4 | |
| Animal poisoning | Snake bite | 1 (0.7) | 0 | 1 | ---- |
| Time to arrival (h) | < 1 | 43 (28.7) | 24 (55.8) | 19 (44.2) | 0.89 |
| | ≥ 1 | 107 (71.3) | 61 (57) | 46 (43) | |
| Status at admission | Conscious | 83 (55.3) | 71 (85.5) | 12 (14.5) | 0.0* |
| | Unconscious | 67 (44.7) | 14 (20.9) | 53 (79.1) | |
| Length of hospital stay (day) | < 1 | 30 (20.0) | 21 (70) | 9 (30) | 0.09 |
| | > 1 | 120 (80.0) | 64 (53.3) | 56 (46.7) | |
| Treatment given | Gastric lavage | 16 (10.7) | 11 (68.8) | 5 (31.2) | ----- |
| | Antidotes | 30 (20.0) | 21 (70) | 9 (30) | |
| | Histamine 2 receptor blocker | 51 (34.0) | 24 (47.1) | 27 (52.9) | |
| | Antiemetics | 1 (0.7) | 1 | 0 | |
| | Normal saline | 31 (20.7) | 16 (51.6) | 15 (48.4) | |
| | Intranasal oxygen | 21 (14.0) | 12 (57.1) | 9 (42.9) | |

The p value was calculated by using the Pearson chi-square test, *there is association between the status at admission and treatment outcome, and ----- not fulfilled chi-square test assumption.

Table 3. Use of antidote in acutely poisoned patients who had been admitted at the emergency department of HFSUH.

| Poisoning (n) | Antidote(n) |
|----------------------|----------------------|
| Organophosphate (62) | Atropine (18) |
| Carbon monoxide (12) | Oxygen (7) |
| Acetaminophen (10) | N-acetylcysteine (4) |
| Diazepam (2) | Flumazenil (1) |

in females (57.3%) than males, which is comparable to other study results.^{8,10} Sociocultural characteristics of rural societies, low social status, and lack of economic freedom among women may lead to suicidal attempts.²⁴

In this study, the most common poisoning was due to Organophosphate similar to studies conducted in Eastern Nepal, Kenya, and Gondar.^{25–27} This may be due to the easy availability of this poisoning agent in the agricultural community and inadequate knowledge to support their safe residential use.²⁸ Unlikely the current study, studies done in

Debretabor General Hospital, Addis Ababa, South Africa, and Uganda reported that rat poisoning, drug poisoning, and household chemical poisoning were accounted for the highest numbers of cases, respectively.^{10,11,29} This discrepancy may due to variations in the availability of poisoning agents and the dominance of agricultural community.

This study showed that suicidal manner of poisoning was reported in more than half of cases, which is in agreement with the finding of other studies conducted in Karnataka, Jimma University Specialized Hospital, Nepal, and Ondukoz Mayis University Hospital.^{5,14,30,31}

In the current study, gastric lavage was done for 10.7% of poisoning cases which is lower than in other studies done in India (80%), Debre tabor (48.3%), and Jimma (81%).^{5,6,9} Lower utilization of gastric lavage in the present study may result from delayed arrival of poisoned patients in the hospital. In addition, 29.0% of organophosphate poisoned cases were treated with atropine which is not in line with the study conducted in India.⁹ This difference might be due to variation in the availability of atropine.

Table 4. Multivariable analysis of factors associated with poor treatment outcome of acute poisoning.

| Variables | Treatment outcome | | Crude odds ratio (95% CI) | AOR (95% CI) | p value | |
|---------------------|-------------------|-----------|---------------------------|------------------|------------------|---------------|
| | Good (%) | Poor (%) | | | | |
| Sex | Male | 40 (62.5) | 24 (37.5) | | | |
| | Female | 45 (52.3) | 41 (47.7) | 1.52 (0.79–2.9) | 1.31 (0.62–1.8) | 0.34 |
| Age (years) | <18 | 26 (57.8) | 19 (42.2) | | | |
| | 19–37 | 53 (59.6) | 36 (40.4) | 0.93 (0.4–1.9) | 0.81 (0.3–1.2) | 0.22 |
| | >38 | 6 (36.5) | 10 (62.5) | 2.28 (0.7–7.4) | 2.14 (0.4–6.3) | 0.31 |
| Mode of poisoning | Accidental | 45 (61.6) | 28 (38.4) | | | |
| | Suicidal | 40 (51.9) | 37 (48.1) | 1.49 (0.78–2.8) | 2.44 (1.1–5.4) | 0.028* |
| Source of poisoning | Home | 52 (64.2) | 29 (35.8) | | | |
| | Hotel | 21 (63.6) | 12 (36.4) | 1.02 (0.4–2.4) | 0.8 (0.24–1.8) | 0.45 |
| | Workplace | 12 (33.3) | 24 (66.7) | 3.58 (1.6–5.2) | 2.45 (0.94–4.3) | 0.08 |
| Drug poisoning | No | 76 (59.8) | 51 (40.2) | | | |
| | Yes | 9 (39.1) | 14 (60.9) | 2.32 (1.3–4.7) | 2.13 (1.21–3.32) | 0.006* |
| Time to arrival (h) | <1 | 24 (55.8) | 19 (44.2) | | | |
| | ≥1 | 61 (57) | 46 (43) | 0.95 (0.46–1.94) | 1.2 (0.82–1.96) | 0.092 |

AOR: adjusted odds ratio; CI: confidence interval.

*Statistically significant.

In the present study, 16.7% of the acutely poisoned patients were recorded to be dead. The proportion of death that occurred in this study was smaller than results reported in Birjand (19.5%), Debretabor General Hospital (18.6%), and Tehran (17.7%), and higher than a study done in Andhra Pradesh (8.47%), Bengal (15.03%), Maharashtra, Wellega (7.1%), and Tikur Anbessa Specialized Teaching Hospital (8.6%).^{7,10,11,32–35} This discrepancy may be due to the difference in availability of antidote, nature of poison, dose consumed, and the time interval between intake of poison and provision of medical help. In this study, there was no death report due to benzene, alcohol, aspirin, and promethazine poisoning which is similar to the study conducted in Desse Referral Hospital.⁶ This might be due to early presentation to the hospital and treated appropriately.

In this study, more than half of the cases (56.7%) were recovered and discharged. The result was in line with other studies done in Jimma, Adama, Nepal, and West Bengal.^{5,8,36,37} In the current study, a lower proportion of partially recovered cases were reported unlike a study conducted in Birjand city.³⁸ This difference might be due to variation in management practice of cases.

This study revealed that suicidal mode of poisoning is significantly associated with poor treatment outcomes of acute poisoning. The finding contradicts the studies conducted in Turkey, Ethiopia, and Eastern Nepal which reported no significant association between mode of poisoning and poor treatment outcome of acute poisoning.^{4,7,12,13,39} In the current study, the odds of having poor treatment outcome in participants who were poisoned by drugs was 2.13 times more likely than non-drugs poisoning. Improving rational use of drugs and counseling the patients in their drugs would decrease the number of severe acute poisoning cases.^{10,12}

This study had the following limitations: the data were collected retrospectively which was not possible to find

complete information in all patient medical charts; the sample size is small which may affect the representativeness of the results; factors associated with poor treatment outcome of acute poisoning were assessed using a cross-sectional design which might not show causal relationships with potential risk factors; and the study conducted a single study area which might limit generalizability of result at the national level.

Conclusion

Acute poisoning, among most cases in our study, was related to organophosphate taken orally and more common at home. Mode of poisoning and drug poisoning were significant risk factors associated with poor treatment outcomes of acute poisoning.

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Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

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Informed consent

Written informed consent was obtained from legally authorized representatives before the study.

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Supplemental material

Supplemental material for this article is available online.

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