



# Demographic and clinical features of patients suffering acute intoxication with an emphasis on cardiovascular complications; an observational case series

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## ARTICLE INFO

**Article Type:**  
Original

### Article History:

Received: 7 March 2023

Accepted: 8 May 2023

Published online: 22 May 2023

### Keywords:

Acute intoxication  
Chronic renal insufficiency  
Medical emergency  
Cardiovascular symptoms  
Kidney damage  
Hyponatremia

## ABSTRACT

**Introduction:** Acute intoxication is an ongoing health issue worldwide and one of the most prevalent causes of hospital admission. Investigation of the features of acute intoxication occurrence allows for effectively planning preventive measures and required health resources.

**Objectives:** The current study investigated acute intoxication's demographic and clinical characteristics in an Iranian province.

**Patients and Methods:** An observational case-series study was designed to investigate patients suffering from acute intoxication and admitted to two referral tertiary teaching hospitals over six months. Demographic data, vital parameters comprising neurologic, respiratory, and hemodynamic status, clinical symptoms, and blood analysis data were prospectively recorded. Data analysis was conducted using SPSS version 21 software.

**Results:** In total, 447 patients were included in the study (3.5% of all emergency admission). The mean age of patients was  $33 \pm 16$  (4-88) years, and 190 (42.6%) patients were female. Seventy percent of patients were under 40 years. The male patients were significantly older than the female ones ( $P=0.001$ ). Hospital mortality was 2.7%. Circulatory shock and respiratory apnea occurred separately in 13 (2.9%) patients, and alteration in consciousness affected 30%. Reduced arterial blood saturation and visual acuity were observed in 14% and 3.6% of the patients. A cumulative prevalence of electrocardiogram anomalies of 38% was also observed. The most prevalent electrolyte disorder was hypocalcemia (12%), followed by hypokalemia (10%); 17 % of patients were affected by severe blood acidosis.

**Conclusion:** Acute intoxication is a medical emergency with a high risk of death. A multi-organ-based diagnosis and therapeutic approach should be implemented to manage the potentially lethal complications as soon as possible. Effective preventive planning for reducing acute intoxication should be performed concerning the socioeconomic status of the targeted population.

### Implication for health policy/practice/research/medical education:

Digging the knowledge upon epidemiologic, clinical features to the acute intoxication should lead to plan effective prevention and therapeutic clinical pathways, as well as upraising the clinical and social awareness.

**Please cite this paper as:** Ramezannezhad P, Raeisi E, Roostami-far A, Khaledi-far A. Demographic and clinical features of patients suffering acute intoxication with an emphasis on cardiovascular complications; an observational case series. J Nephroarmacol. 2023;12(2):e10597. DOI: 10.34172/npj.2023.10597.

## Introduction

The kidneys are a pair of fist-sized organs at the bottom of the chest. There is a kidney on each side of the spine. Kidneys may be damaged and unable to do their work. This damage, sometimes being acute, describes a sudden loss of kidney function that is determined based on increased serum creatinine levels (a marker of kidney

excretory function) and reduced urinary output (oliguria) (a quantitative feature of urine production) and is limited to a duration of 7 days (1). Kidney damage can also be caused by diabetes, high blood pressure, and other chronic (long-term) conditions. Kidney disease can lead to other health problems, including weak bones, nerve damage, and malnutrition. Kidneys are essential for a healthy body,

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and their main task is to filter waste materials, excess water, and other impurities in the blood. These toxins are stored in the bladder and then removed from the body during urination. Kidneys also regulate the body's pH, salt, and potassium levels. They produce hormones that regulate blood pressure and control the production of red blood cells. The kidneys even activate a form of vitamin D that helps the body absorb calcium. If the kidney disease worsens over time, there is a possibility that the kidneys will stop functioning totally. Among the disorders threatening kidneys, acute intoxication can be mentioned, to name just a few, and represents a major daily emergency medical challenge. Over 1 000 000 people suffer from acute intoxication, causing nearly 300 000 deaths annually (2,3). Acute intoxication mainly affects young men (4). Among children, acute intoxication represents the fifth cause of unintended death (5). Acute intoxication is the cause of one-third of the intended suicides and is more prevalent in developing countries, so it is the cause of 60% of all suicide-related deaths in Asian countries (4,6-8). Irregularities and inconsistencies in regulations related to drug and chemical substances distribution have led to their convenient access, contributing to acute intoxication (8,9).

Among the developing countries with a population of approximately 80 million (8,10), some developing countries have reached from the 91<sup>st</sup> rank in 1991 (111 cases) to 58<sup>th</sup> rank in 2003 (3967 patients) in terms of the annual rate of occurring acute intoxication (8,11-13). Therefore, establishing the epidemiological and clinical features is extremely important to consistently plan the local health resources to deal with ongoing and increasing acute intoxication.

## Objectives

The current study investigated the patients admitted to a tertiary health facility for acute intoxication for six months with a further focus on cardiovascular complications to determine the epidemiological and clinical features of patients admitted for acute intoxication in Chaharmahal and Bakhtiari province.

## Patients and Methods

### Study design

All patients diagnosed with acute intoxication referred to two tertiary teaching hospitals (Ayatollah Kashani and Hajar) from February to July 2022 were included in the study. Demographic data, medical history, clinical presentations, vital hemodynamic and respiratory parameters, clinical findings (respiratory, cardiovascular, and neurologic), electrocardiogram disorders, biochemical disturbances on the blood analysis, plasmatic liver enzymatic activities, blood troponin levels, and clinical complications were collected. Consciousness status was evaluated using the Glasgow Coma Scale.

## Statistical analysis

Categorical data were expressed as a percentage, and the non-categorical data were expressed as the means  $\pm$  standard deviation (SD). The comparison of the means was affected using the independent t-test. In the tests, the  $P < 0.05$  was considered significant.

## Results

Demographics data was presented in Table 1. A total of 447 patients were finally included in the study. The total number of admitted patients to the emergency departments during the studied period was 12806; consequently, acute intoxication accounted for 3.5% of all causes of emergency admissions. The percentage of emergency cardiovascular admissions was drawn to 25%. Regarding gender, 257 (57.4%) were male, and 190 (42.6%) of the patients were female ( $P < 0.05$ ). The mean age was  $33 \pm 16$  (range; 4-88) years; the mean age of patients in terms of gender was  $35 \pm 16$  and  $31 \pm 16$  years in men and women, respectively; the mean age of male patients was significantly higher compared to that of female patients ( $P = 0.001$ ). About 70% of the patients were aged under 40 years. The majority of the patients (47%) belonged to the age group of 20-40 years.

Patients' past medical history was illustrated in Table 2. The percentages of active smoking, opioid, and ethylic addiction were 13.6, 12.5, and 11.8%. Arterial hypertension was documented in 6.5% of the patients. One patient had a history of chronic obstructive pulmonary disease, one had a history of thromboembolism, and two suffered from chronic renal insufficiency.

Clinical presentations and symptoms was shown in Table 3.

## Neurologic status

Accordingly, 327 (73%) patients had an ordinary consciousness with a Glasgow Coma Scale of 15, 111 (25%) patients had a Glasgow Coma Scale of 10-14, and 5% had a Glasgow Coma Scale under 10. Visual acuity diminution was reported in 16 (3.6%) patients. Myosis was observed

Table 1. Patients' demographic data

Demographic data	P value
Gender, No. (%)	<0.05
Female	190 (42.6)
Male	257 (57.4)
Mean age, $33 \pm 16$ (range: 4-88) years	0.001
Female	$31 \pm 16$
Male	$35 \pm 16$
Age groups (y), No. (%)	
0-20	114 (25.4)
21-40	209 (44.6)
41-60	91 (20.3)
>60	34 (7.5)

**Table 2.** Patients' medical history

	No. of patients	Percent
Alcohol abuse	53	11.8
Opioid addiction	56	12.5
Active smoking	61	13.6
Systemic arterial hypertension	19	4.2
COPD	1	0.1
Renal insufficiency	1	0.1
DVT	1	0.1

COPD, Chronic obstructive pulmonary disease; DVT, deep venous thrombosis.

**Table 3.** Clinical vital data at admission

Vital system	Vital signs	No. of patients	Percent
Respiratory status	Apnea	13	2.9
	Tachypnea	1	0.22
	SaO <sub>2</sub> < 90%	84	19
Hemodynamic status	Circulatory shock	13	2.9
	Ventricular Fibrillation	1	0.22
	Systemic arterial hypotension	19	4.2
Neurologic status	Systemic arterial hypertension	29	6.5
	10 < GS < 15	111	25
	0 < GS < 10	22	5
	Seizure	17	3.4
	Mydriasis	12	2.7
Gastrointestinal symptoms	Myosis	43	9.6
	Alteration of visual acuity	16	3.6
		12	2.6
Corporeal temperature	Hypothermia	1	2.2
	Hyperthermia	5	1.1

GCS: Glasgow Coma Scale, SaO<sub>2</sub>: arterial blood oxygen saturation.

in 43 (9.6%) patients, while 12 (2.7%) patients exhibited a mydriasis state. Eighty patients complained of severe headaches (18%).

### Respiratory symptoms

Apnea was documented in 13 patients (2.9%), tachypnea in one (0.2%), and 96.6% of patients presented with normal respiratory rhythm. An arterial blood saturation below 90 % was observed in 84 (14%) patients.

### Hemodynamic symptoms

Thirteen (2.9%) patients were in non-cardiogenic shock at admission to the emergency department. Hypotension was found in 19 (4.2%) patients and 29 (6.5%) ones presented with hypertension. Cyanosis was detected in 5 (1.1%) patients.

**Table 4.** Cardiac symptoms and electrocardiography findings

	No. of patients	Percent
Rhythm disturbances		
Tachycardia	65	14.5
Bradycardia	32	7.1
AF	3	0.7
Conductive disturbances	9	2
Wide QRS	53	11.8
Long QT segment	7	1.6

AF, atrial fibrillation; ECG, electrocardiogram.

### Cardiovascular symptoms

Tachycardia was documented in 65 (14.5%), and 32 patients (7.1%) presented with bradycardia. Three (0.7%) patients had atrial fibrillation arrhythmia. Conductive disturbances were detected in 9 (2%) patients, and an enlarged QRS pattern in electrocardiography was reported in 53 (11.8%). A prolonged QT segment was observed in 7 (1.6%) patients. The blood troponin levels were reported to increase in 5 (1.3%) patients. The cumulative prevalence of recorded electrocardiography anomalies was 38% (Table 4).

### Laboratory findings

Hyponatremia affected 36 (8%) patients, while hypernatremia was observed in 33 (7%). Hypokalemia was reported in 47 (10%) patients, and only three (0.7%) patients exhibited hyperkalemia. Hypocalcemia was observed in 55 (12.2%) patients, and hypophosphatemia in 39 patients (9%). Blood acidosis was diagnosed in 77 (17%) patients and alkalosis in 15. A rise in plasmatic troponin enzymatic activity was detected in 6 (1.3%) patients (Table 5).

### Survival rate

Twelve (2.7%) patients were reported to die, resulting in a survival rate of 97.3% (n: 435).

### Discussion

Acute intoxication is one of the most prevalent medical emergencies worldwide. Diagnosing acute intoxication is challenging due to a wide range of possibly misleading clinical symptoms. The socioeconomic and cultural factors entailing a myriad of collective beliefs may contribute to increasing the prevalence of acute intoxication (14,15). According to the World Health Organization (WHO), nearly 7.5 deaths are caused by acute intoxication annually worldwide, 90% of which occur in developing countries (8,16). Therefore, we were encouraged to investigate the incidence, the predisposing factors, the symptoms, and the cardiovascular complications of acute intoxication among the patients referred to two tertiary referral teaching hospitals in Chaharmahal and Bakhtiari province.

**Table 5.** Blood analysis findings

	No. of patients	Percent	Mean	Normal values
Na <sup>+</sup>				
Hyponatremia	36	8		
Hypernatremia	33	7		
K <sup>+</sup>				
Hypokalemia	47	10		
Hyperkalemia	3	0.7		
Ca <sup>++</sup>				
Hypocalcemia	55	12.2		
Phosphorus				
Hypophosphatemia	39	9		
Positive qualitative troponin	6	1.3		
Acid-base disturbances				
Arterial blood gas acidosis	77	17		
Arterial blood gas alkalosis	15	3.3		
Plasma creatinine			1.013 ± 0	F: 0.6-1.1 mg/dL M: 0.5-1.1 mg/dL
BUN			28 ± 15	5-20 mg/dL
Plasmatic liver enzymatic activity				
AST			49 ± 164 UI (10-2600)	F: 7-30 IU, M: 10-50 IU
ALT			45 ± 241 UI (5-3600)	4-36 IU

BUN, Blood urea nitrogen; Ca<sup>++</sup>, Calcium; F, Female gender; K<sup>+</sup>, Potassium; M, Male gender; Na<sup>+</sup>, Sodium.

In the present study, 447 patients were admitted to the emergency department due to acute intoxication for six months. Among the patients, the male gender (57.4%) was significantly more prevalent compared to female ones ( $P < 0.001$ ). The male gender's higher prevalence among patients suffering from acute intoxication has already been reported by Mbarouk et al in Tanzania (17). Acute intoxication was more prevalent in the age group of 20 to 40 years, which agrees with a study in the southern Sahara (18). In the current series, 70% of the patients suffering from acute intoxication were in the first four decades of their life, which is enough incentive for health authorities and practitioners to anticipate preventive measures. In the current series, acute intoxication represented 3.5% of admitted patients through the two investigated medical emergency departments. Nevertheless, it is pretty practical to set up steps to prevent acute intoxication and save resources by locally investigating the factors predisposing to its occurrence.

Exogenous addiction, ethylic dependency, and even tobacco smoking were reported as the predisposing factors to acute intoxication. Wasserman et al reported ethylic intoxication as one of Russia's most prevalent types of acute intoxication (19). In the present study, opioid addiction, active smoking, and alcoholism were reported in 12.5%, 3.6%, and 11.8% of the patients, respectively. Overall, 30% of the included patients in the present study suffered from an exogenous substance dependency.

Regarding the symptoms recorded in the patients admitted with a diagnosis of acute intoxication, 97.1% were in a stable hemodynamic state. In comparison, 13

(2.9%) patients exhibited a circulatory shock at admission, and 19 (4.6%) patients presented with systemic arterial hypotension. Ventricular fibrillation occurred in three (0.7%) patients, and one patient with respiratory distress and apnea was reported. A long-QT segment was observed in 7 (1.7%) and 9 patients (2%) who displayed conductive disturbances on the admitted ECG examination. Critical bradycardia was observed in 32 patients (7.1%).

Nevertheless, the most prevalent rhythm disturbance was drawn as sinus tachycardia (14.5%). A hemodynamic shock circulatory state was reported in up to 13% of acute intoxication patients associated with organic phosphoric-based substances (20). Therefore, the cause of the shock state can be related to the occurrence of congestive heart failure.

Initially, 30% of patients presented an alteration in consciousness level, of whom 5% had a Glasgow Coma Scale lower than 10. The visual acuity was altered in 16 (4.6%) patients.

The current finding showed that more than 45% of patients admitted with a diagnosis of acute intoxication are prone to be affected by blood electrolyte disorders and life-threatening blood acid-base disturbances. The latter corroborates the data reported by the series of Thongprayoon et al, in which the overall prevalence of clinical symptoms and blood laboratory findings was approximately 25.4%, with the bulk of blood acidosis and alkalosis reaching 19.1% and 11.1%, respectively, in the setting of salicylates intoxication (21). The two most prevalent blood electrolyte disturbances were hypocalcemia (12%) and hypokalemia (10%), both

considered potentially lethal cardiovascular risks.

### Conclusion

Acute intoxication remains a daily clinical challenge in medical emergency departments. Acute intoxication is characterized by a wide range of clinical presentations reflecting diverse organ-damaging processes that are potentially life-threatening. Particular attention should be paid to early diagnosis and management of associated blood electrolytes and acid-base disturbances. Continuous monitoring of the acute intoxication epidemiology according to the local socio-environmental particularities seems necessary to plan effective prevention and therapeutic programs for escalating the incidence of acute intoxication, especially for people under 40 and living in urban areas.

### Limitations of the study

The acute intoxication features vary according to the underlying intention and the environmental events; hence, the different subsets to acute intoxication should be further investigated. Further, more extensive series with sufficient statistical power are needed to better shed light on social implications when assessing the cardiovascular complications sustaining the acute intoxication in each causative substance.

### Authors' contribution

Conceptualization: AK.

Methodology: PR, ER, AK.

Validation: PR, ER, AK.

Formal analysis: PR, AK, AR.

Investigation: PR, AK, AR, ER.

Resources: PR, AK, AR.

Data curation: PR, AK, AR, ER.

Writing—original draft preparation: AR.

Writing—review and editing: PR, AK, AR, ER.

Visualization: PR, AK, AR, ER.

Supervision: PR, AK, ER.

Project administration: PR, AK, ER.

### Conflicts of interest

The authors declare that they have no competing interests.

### Ethical issues

The research followed the tenets of the Declaration of Helsinki. The Ethics Committee of Shahrekord University of Medical Sciences approved this study (Ethical code#IR.SKUMS.REC.1399.177). Accordingly, written informed consent was taken from all participants before any intervention. This study was extracted from the M.D thesis of Ayat Roostami-far at this university (Thesis #1828). The authors have observed ethical issues (including plagiarism, data fabrication, and double publication).

### Funding/Support

This study was funded by the Research and Technology Deputy of Shahrekord University of Medical Sciences (Grant #5558).

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