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Original Article

Clinical outcomes and associated factors of acute poisoning among patients admitted to the emergency department of Hawassa University Comprehensive Specialized Hospital, Sidama Regional State, Ethiopia

Kindalem Worku[1], Samrawit Fantaw[2], Kebede Tefera Betru[2*]

[1]School of Medical Sciences, College of Medicine and Health Science, Hawassa University, Hawassa, Ethiopia; [2] Public Health Academic and Service Directorate, College of Medicine and Health Sciences, Hawassa University, Hawassa, Ethiopia

*Correspondence: Kebede Tefera Betru; kebedetefera@hu.edu.et

Abstract

Background: Acute poisoning is a global public health issue and a medical emergency that occurs when someone is exposed to a harmful substance, often within a short time. It is a frequent cause of emergency room visits and can result in serious illness or death. In Ethiopia, the absence of a dedicated toxicology center makes it harder to treat such cases effectively. This study aimed to assess the clinical outcomes and key factors associated with acute poisoning among patients admitted to the Emergency Department of Hawassa University Comprehensive Specialized Hospital (HUCSH), Hawassa, Ethiopia.

Methods: We conducted a cross-sectional study using Hospital records. Data were collected using a structured questionnaire and processed using SPSS version 25. Descriptive statistics were run, and the data were presented using frequency tables and figures. The bi-variable and multivariable logistic regression was used to identify the possible factors of clinical outcome, acute poisoning (recovery or death from poisoning). Finally, Adjusted Odds ratios and 95% Confidence Intervals were used to declare statistical significance.

Results: A total of 212 cases of acute poisoning were analyzed. Men made up slightly more than half of the cases (110, 51.9%), with a mean age of 22 years (standard deviation 8.2). The overall death rate was 9.4% (20 deaths) (95% CI: 6.15%–14.20%). Organophosphate chemicals were the most common and most deadly agents, responsible for 31.1% of cases. Logistic regression revealed that the presence of medical complications [AOR = 49.2, 95% CI: 18.78–128.48], age greater than 26 years [AOR = 15.46, 95% CI: 1.02–23.27.

Conclusion: Acute poisoning poses a significant risk of death. The most common causes were intentional ingestion of toxic substances, particularly organophosphates, often linked to family disputes or suicidal behavior. Factors associated with poor outcomes included longer hospital stay, presence of

complications, and age over 26 years. Improving access to timely treatment, controlling the availability of toxic substances, and addressing mental health issues could significantly reduce deaths from poisoning.

Keywords: acute poisoning, clinical outcome, causes, prevention, southern Ethiopia

Introduction

Any substance that, when taken by any route, causes harm or death is considered as a poison. Acute poisoning occurs when exposure to such substances happens within a short time—usually less than 24 hours—and is considered a medical emergency. It is one of the most common reasons for emergency hospital visits worldwide and contributes significantly to illness and death (1,2). In East Africa, including Ethiopia, acute poisoning is on the rise due to changes in social behavior, increased availability of chemicals, and shifts in lifestyle patterns (3). The type of poison people is exposed to can vary by location. In many low- and middle-income countries, including Ethiopia, pesticides, and household cleaners like bleach are commonly involved in poisoning cases (4).

Studies from various parts of Ethiopia show similar trends. For example, organophosphates were reported as the main agents in Addis Ababa (27.5%) and Gondar (20.69%) (4), while household cleaning agents like bleach were prominent in Jimma (41.7%) and food poisoning (20.9%) (5), Ambo Organophosphate (53%) and in a study at Jimma showed cleansing agents accounting for (41.7%) and organophosphates (27.2%) (6, 7). These substances are often easily accessible in homes, especially in rural areas where agricultural chemicals are commonly used.

Acute poisoning is a major public health challenge, particularly in low-income countries like Ethiopia. Globally, over 1 million people are affected by poisoning each year (8), and the true number may be even higher due to underreporting (9). Many of these incidents result from deliberate ingestion—often as a response to social stress or mental health challenges—or from accidental exposure due to poor storage and handling of toxic substances. Pesticides, especially organophosphates and aluminum phosphide, are leading causes of poisoning deaths globally, accounting for more than 300,000 deaths each year (10). These chemicals are widely used in agriculture but are often poorly regulated or stored, increasing the risk of accidental or intentional misuse.

Understanding poisoning patterns is essential for public health planning. In Ethiopia, where agriculture is a primary occupation, the heavy use of insecticides poses a serious risk. According to the World Health Organization, 20% of global suicides are caused by pesticide ingestion, particularly in rural and agricultural regions, a trend reflected in Ethiopian data (11, 12).

This study was conducted to examine the clinical outcomes and factors linked to acute poisoning in patients admitted to Hawassa University Comprehensive Specialized Hospital. The findings can inform strategies to reduce poisoning-related illness and death in the region.

Understanding what causes poisoning, who is most at risk, and what outcomes to expect allows hospitals and public health officials to respond more effectively. The results may help shape public health campaigns focused on safe chemical storage, mental health support, and community education, particularly for vulnerable groups like young adults.

Although a few studies have been done in other parts of Ethiopia, there is limited data specific to southern Ethiopia. This study fills that gap and

offers insight into both the clinical and social dimensions of acute poisoning in the region. By identifying the key causes and contributing factors, we can recommend targeted prevention efforts, such as better regulation of toxic substances, improved mental health services, and timely access to treatment.

Methods and materials

Study Area

This study was conducted at Hawassa University Comprehensive Specialized Hospital (HUCSH), located in the Sidama Region, approximately 275 km from Ethiopia's capital, Addis Ababa. HUCSH serves a population of over 20 million people from Sidama and surrounding areas, including parts of the Oromia Region. The hospital has a capacity of 400 beds and provides both specialized and subspecialized healthcare services. The Emergency Department (ED) is staffed by five emergency medicine specialists, 15 residents, 38 nurses, and 25 interns, and annually attends to between 10,000 and 13,000 patients. This study focused on patients admitted to the ED with a diagnosis of acute poisoning between December 2018 and December 2023.

Study Design and Period

An institution-based cross-sectional study was conducted from February to March 2024.

Source and Study population

The source population comprised all patients with acute poisoning admitted to the Adult Emergency Department of Hawassa University Comprehensive Specialized Hospital, while the study population included those who met the inclusion criteria between December 2018 and December 2023.

Eligibility criteria

Patients were eligible if they were admitted for acute poisoning during the study period, excluding those with incomplete medical records, those referred elsewhere, or those who left against medical advice.

Sample Size Determination and Sampling Procedures

The sample size for the first objective was calculated to be 242 based on a 17.6% mortality rate from a prior study, using a 95% confidence level, 5% margin of error, and a 10% non-response rate. For the second objective, the largest calculated sample size was 234, so the original sample size of 242 was retained. Ultimately, 227 cases were identified, but 6 patients left against medical advice and 9 had missing records, resulting in a final sample of 212 patients. As this was a retrospective study, all eligible cases over the five years were included without random sampling.

Variables:

Dependent variables

Poisoning outcome: recovery or death

Independent Variables

- Socio-demographic factors: age, sex, place of residence
- Medical conditions: comorbid illness, psychiatric history, previous suicide attempt
- Medical complications on admission: pneumonia, shock, respiratory failure
- Treatments given: antidotes, oxygen, mechanical ventilation, intravenous fluids, antibiotics, and other emergency interventions
- Type and cause of poisoning,
- Time of exposure,
- Clinical features

Operational Definitions:

- **Acute poisoning**: Harmful exposure to a substance, usually within a few hours
- **Recovery**: Discharge from the hospital with improvement
- **Death**: Declared by a physician with a supporting death certificate
- **Time lapse**: Time between exposure and arrival at the hospital
- **Delayed presentation**: More than two hours
- after poisoning exposure

Data collection tools and procedures

Patient medical record numbers were identified from the hospital logbook. Data were reviewed using a structured questionnaire adapted from previous studies (3,5,6) and reviewed by medical experts for relevance. Trained first-year resident doctors extracted information using a printed data form. Information included: Patient demographics, Type and cause of poisoning, medical conditions, medical complications, Time of exposure, Clinical features, Treatments given, and Outcomes

Data Quality Control

To ensure data quality and accuracy, comprehensive training was provided to all data collectors involved in the project. Furthermore, supervisors conducted daily reviews of the collected data to verify its completeness. Before the main data collection phase, pre-testing of the instruments was carried out at two nearby hospitals to assess the clarity and understanding of the questions.

Data entry and Analysis

The data were systematically entered using the Kobo Toolbox software. Cleaned data were exported to SPSS version 25. Descriptive analysis was used to describe the data. Bivariate analysis identified variables with $p < 0.25$, which were then included in multivariable logistic regression to identify independent risk factors for clinical outcome (recovery or death). A p-value < 0.05 was considered statistically significant.

Results

Socio-Demographic Characteristics of Patients

A total of 212 cases of acute poisoning were analyzed, with 110 (51.9%) being male. The mean age was 22 years (standard deviation 8.2), and ages ranged from 15 to 75 years. The largest age group affected was 20 to 25 years, comprising 102 patients (48.1%), indicating that young adults were the most vulnerable population. Around two-thirds of the patients, 136 (64.2%), lived in urban areas. In terms of hospital access, most 131 patients (61.8%) arrived at the hospital by self-referral, rather than through formal referral systems (Table 1).

Table 1: Socio-demographic characteristics of patients with acute poisoning at HUCMHS_ Comprehensive Specialized Hospital, 2024 (n = 212).

Variable	Category	Frequency	percent
Sex	Female	102	48.1
	Male	110	51.9
Age in years	15-19 years	53	25.0
	20-25 years	102	48.1
	>26	57	26.9
Residency area	Rural	76	35.8
	Urban	136	64.2
Mode of presentation	Referral	81	38.2
	Self-referred	131	61.8

Intent and Route of Exposure

Most poisoning cases were intentional, with 176 patients (83%) deliberately exposed to toxic substances, often due to family conflicts or suicide attempts. In contrast, only 36 cases (17%) were the result of accidents. The oral route was the most frequent method of exposure, reported in 183 cases (86.3%), and followed by snake bites (24 cases, 11.3%) and carbon monoxide inhalation (5 cases, 2.4%). Among intentional poisonings, family quarrels accounted for 60.2%, while suicide attempts contributed to 31.8%. These findings show the urgent need for mental health support and social protection systems to help prevent deliberate self-harm through poisoning. And the overall contribution is described in Figure 1.

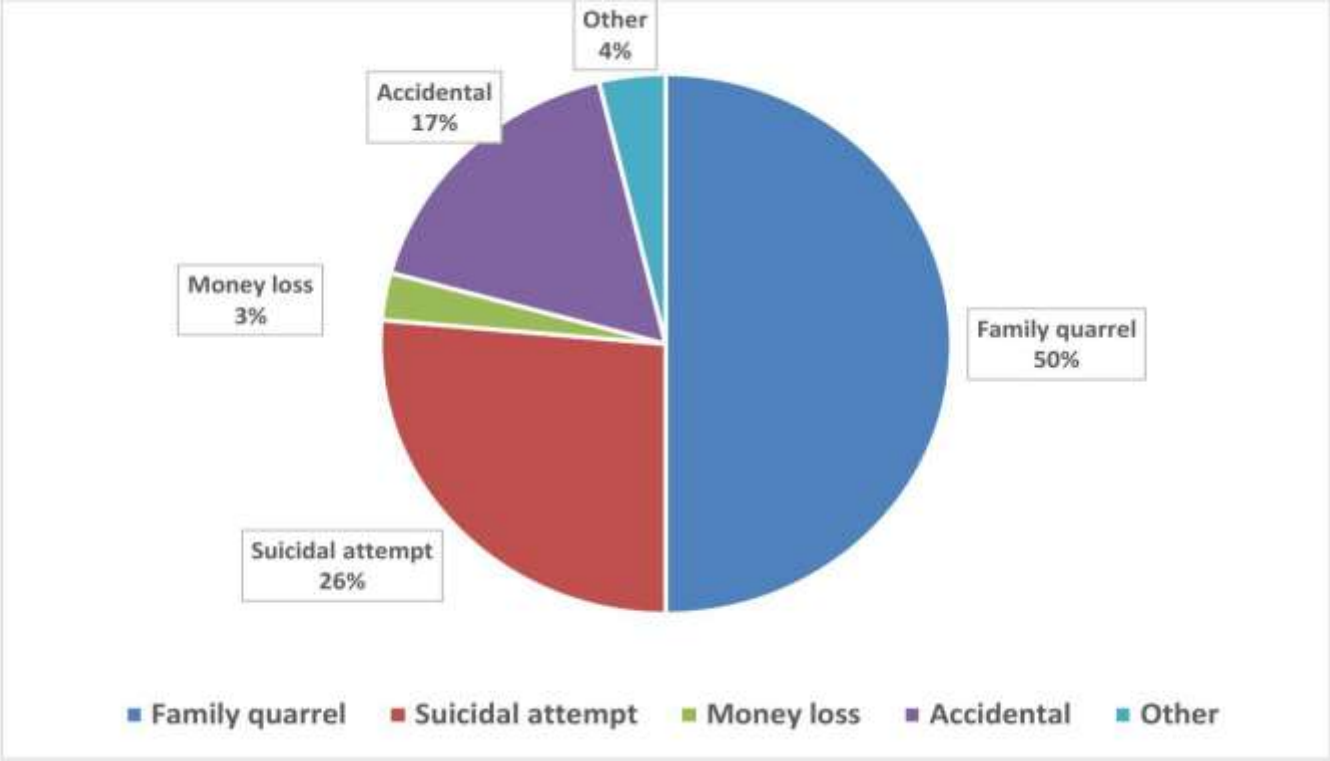

Figure 1: Causes of acute poisoning at HUCSH, 2024 (n=212)

Poisoning Agents and Exposure Circumstances

The most frequently identified toxic agent was organophosphate pesticides, accounting for 31.1% (66 cases), and also responsible for the highest number of deaths, particularly in suicide-related incidents and family disputes. This was followed by bleach and detergents (24.4%), rodenticides and snake bites (each 11.3%), and various pharmaceutical drugs (9.4%). Less common agents included carbon monoxide (2.4%), amitriptyline (1.4%), and other substances (5.1%). Notably, all accidental cases of poisoning were due to snake bites, underscoring the need for better prevention measures and access to anti-venom, especially in rural communities (Table 2).

Clinical Features and Treatments Given

Only 30 patients (14.2%) had pre-existing conditions, with mental illness accounting for the majority (25 cases, 11.8%), followed by

cardiovascular disease and diabetes (2 cases, 1%) and hypertension with kidney disease (3 cases, 1.4%). Additionally, 13 patients (6.1%) had a known history of previous suicide attempts. Most patients, 120 (56.6%), arrived at the hospital more than two hours after poisoning, which delayed treatment, while 129(60.8%) were hospitalized for 24 hours or less. All patients received intravenous fluids, and the majorities were treated with antacids (173, 81.6%). Access to specific antidotes, especially for organophosphate poisoning, was limited and may have contributed to the higher mortality rate observed (Table 3).

Table 2: Causative agents and circumstances of poisoning exposure at HUCSH, 2024 n=212

Variable /Poisoning agent	Circumstance of poisoning	Frequency	Percent
Organophosphate (n=66)	Family quarrel	35	53
	Suicide attempt	21	31.8
	Money/ property loss	7	10.6
	Other(low score in exam)	3	4..6
Bleach and detergents(n=52)	Family quarrel	41	78.8
	Suicide attempt	7	13.5
	Money/ property loss	1	1.9
	Other(low score in exam)	3	5.8
Rodenticides(n=24)	Family quarrel	15	62.5
	Suicide attempt	9	37.5
Snake bite(n=24)	Accident	24	100
Different Pharmacological agents(n=20)	Family quarrel	7	35
	Suicide attempt	6	30
	Accident	7	35
Anticonvulsants(n=7)	Family quarrel	3	42.9
	Suicide attempt	4	57.1
CO poisoning(n=5)	Accident	5	100
Amitriptyline(n=3)	Suicide attempt	3	100
Unknown(n=11)	Family quarrel	8	72.7
	Suicide attempt	3	28.3

Table 3: Treatment given during hospitalization for acute poisoning patients at HUCSH, 2024(n = 212).

Treatment type/Variable	Category	Frequency	Percent
IV fluid	Yes	212	100
	No	-	-
Antidote	Yes	71	33.5
	No	141	66.5
Antacid	Yes	173	81.6
	No	39	18.4
Antiemetic	Yes	83	39.2
	No	129	60.8
Antibiotics	Yes	47	22.2
	No	165	77.8
Inotropes	Yes	13	6.1
	No	199	93.9
Mechanical ventilator support	Yes	8	3.8
	No	204	96.2

Medical Complications

During hospitalization, 50 patients (23.6%) developed complications. The most common was pneumonia, seen in 42 patients (84%), likely due to aspiration following oral ingestion of poison. Other complications included respiratory failure (10 cases, 20%), hypotension (16 cases, 32%), and, less frequently, cellulitis, abscesses, coagulopathy, and multi-organ failure. These findings show the importance of early medical intervention and airway protection in managing acute poisoning cases (Table 4).

Table 4: Complications and complication types among patients treated for acute poisoning cases at HUCSH, 2024 (n=212)

Complications and the type of complications	Category	Frequency	Percent
Complications(n=50)	Yes	50	23.6
	No	162	76.4
Pneumonia(n=50)	Yes	42	84
	No	8	16
Respiratory failure (n=50)	Yes	10	20
	No	40	80
Hypotension(n=50)	Yes	16	32
	No	34	68
Abscess (n=50)	Yes	1	2
	No	49	98
Cellulitis(n=50)	Yes	1	2
	No	49	98
Multiple organ failure, including Acute Kidney Injury (n=50)	Yes	2	4
	No	48	96
Coagulopathy(n=50)	Yes	2	4
	No	48	96

Magnitude of Clinical Outcomes

From a total of 212 poisoning cases, 192 (90.6%) patients recovered and were discharged home and the remaining 20(9.4%) of patients at (95% CI: 6.2%, 14.2%). Among the 20 deaths reported, organophosphate represents the highest percentage, 17 (85%), and the other deaths were due to CO poisoning, rodenticide, and snakebite, 1(5%) each.

Factors associated with clinical outcomes

In the binary logistic regression analysis, variables including age, sex, residence, presence of comorbidities, duration before hospital presentation, presence of medical complications, and total length of hospital stay were found to have a p-value of 0.25 or less and were thus included in the multivariable logistic regression model. The final multivariable analysis identified three independent predictors of death: the presence of medical complications [AOR = 49.2, 95% CI: 18.78–128.48], age greater than 26 years [AOR = 15.46, 95% CI: 1.02–23.27] (see Table 5).

Table 5: Multivariable logistic regression analysis of factors associated with negative outcome of acute poisoning cases at Hawassa University Comprehensive Specialized Hospital (n=212).

Variables	Categories	Outcome		COR (95% CI)	AOR (95% CI)	P value
		Death	Recovered			
Sex	Male	14	96	2.33(.86,6.32)	1.95(.43,8.87)	.39
	Female	6	96	1	1	
Age in years	15-19	1	52	1	1	
	20-25	9	93	5.03(.62,40.83)	6.51(.40,105.75)	.18
	>26	10	47	11.06(1.36,89.73)	15.46(1.02,23.27)	**.048**
Area of residency	Rural	12	64	3.00(1.16,7.70)	1.35(.05,2.47)	.295
	Urban	8	128	1	1	
Presence of comorbidities	Yes	1	30	.29(.04,2.30)	.94(.01,1.55)	.098
	No	19	163	1	1	
Presence of complications	Yes	14	36	10.11(3.63,28.11)	49.2(18.78,128.48)	**.001**
	No	6	156	1	1	
Duration of presentation	< 2 hours	5	88	1	1	
	> 2 hours	15	104	2.53(.89,7.26)	3.50(.68,17.89)	.13
Length of stay in the hospital	< 2 days	13	135	1	1	
	> 2 days	7	57	1.27(.48,3.36)	1.009(1.007,18)	.02
Circumstances of poisoning	Intentional	18	158	1.94(0.43,8.74)	2.30(.34,15.75)	.40
	Unintentional	2	34	1	1	

Discussion

In this cross-sectional study, we reported the clinical outcomes and key factors associated with acute poisoning among patients admitted to the Emergency Department of Hawassa University Comprehensive Specialized Hospital (HUCSH). The findings showed an overall mortality rate of 9.4% (20 deaths; 95% CI: 6.15%–14.20%). Organophosphate compounds were the most common and most fatal agents, accounting for 31.1% of cases. The presence of medical complications and age over 26 years were significantly associated with adverse clinical outcomes.

In this study, the majority of patients affected by acute poisoning were young adults aged 20–25 years, which aligns with findings from studies - conducted in Ethiopia (3,13), Kenya (14), and India (15,16). This trend may reflect the greater vulnerability of young adults to stressors such as unemployment, relationship issues, exam pressures, and emotional immaturity. These factors can contribute to suicidal thoughts and intentional poisoning, as also observed in our data.

There was a slight male predominance, consistent with other Ethiopian and international studies (11, 17). This may be due to men's greater exposure to chemicals through farming and outdoor occupations, particularly in cash crop areas like Hawassa, where chemicals like pesticides are widely used.

Organophosphates were the most common poisoning agent, responsible for 31.1% of all cases and 85% of deaths. These substances are widely used as insecticides, and their easy availability and lack of regulation make them a common choice for intentional poisoning. Similar trends were seen in studies from Gondar (3), Metu (18), and Harar (17), as well as in Kenya (14). Although some studies report rodenticides or household chemicals as the most common agents (13), organophosphates consistently rank among the top causes in agricultural settings.

In contrast, studies from urban centres like Addis Ababa (4) and countries such as Nigeria and India (20, 21, 22) found pharmaceutical drugs and household cleaning products to be more common. This shows the influence of occupation, environment, and chemical accessibility on poisoning patterns.

The oral route was the most frequent means of exposure, accounting for 86.3% of cases, followed by snake bites (11.3%) and carbon monoxide inhalation (2.4%). These findings are consistent with other Ethiopian studies (5,7) and international ones (19,22). Oral ingestion is especially dangerous in suicide attempts, where people intentionally consume toxic substances kept in their homes or farms. There should be a need for safe storage and restriction of hazardous substances.

The mortality rate in our study was 9.4%, which is comparable to studies from Debre Tabor (18.6%), Gondar (17.6%)(5), and South India (13.6%)(19). It is notably higher than in Ambo (1.5%)(6) but lower than in Metu (27.6%)(18). Differences in access to medical care, type of poison, and the availability of antidotes likely explain these variations.

In our setting, organophosphate poisoning was the leading cause of death, likely due to the limited availability of antidotes like pralidoxime, delayed arrival at the hospital, and the fast and irreversible effects of the toxin if not treated promptly. In contrast, aluminium phosphide, which is nearly always fatal, was fortunately rare in this study. The median hospital stay was 2.44 days, similar to findings from Iran and India, and longer stays were linked to worse outcomes, which may reflect more severe illness or delays in care (15,16). Patients with complications like pneumonia or respiratory failure also faced a higher risk of death. Overall, the study shows that young adults are particularly vulnerable, mainly due to intentional poisoning linked to emotional distress and social pressures, and that organophosphates remain the most dangerous and accessible toxic agents. Key contributors to poor outcomes included late presentation, absence of effective antidotes, and serious medical complications. Prevention efforts should prioritize mental health support, safe chemical storage, community awareness, and stronger emergency care systems.

Conclusion

This study found that acute poisoning is a serious public health concern in southern Ethiopia, with a relatively high death rate of 9.4%. Young adults were most affected, and organophosphates were the leading cause of death. Risk factors for mortality included delayed hospital arrival, complications, and age over 26. Most poisonings were intentional, linked to family conflicts or suicide attempts. To reduce deaths, urgent measures are needed: strengthen mental health services, regulate toxic chemical sales, ensure hospital access to antidotes, train healthcare providers, and establish poison control centers. Public education and ongoing research are also essential to prevent poisoning and improve clinical outcomes. Further research and surveillance are needed to track poisoning patterns and assess the impact of public health interventions.

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Ethical considerations

Ethical clearance was obtained from the Institutional Review Board of Hawassa University, College of Medicine, and Health Sciences (Ref. No: IRB/090/16, dated 12/03/2024). A permission letter to collect the data was also secured from the College. Ethical guidelines regarding data ownership and use were strictly followed, ensuring that the data were used solely for research purposes. To maintain patient confidentiality, all personal identifiers were removed and replaced with coded identifiers.

Data availability statement

The data of the study is available and can be provided whenever requested

Conflicts of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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