



Evaluation of poisoning cases admitted to the emergency department in terms of life-threatening criteria: A retrospective study

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Abstract

This study aimed to retrospectively analyze forensic cases admitted to the Emergency Department of Balıkesir University Faculty of Medicine with intoxication. Forensic cases evaluated as poisoning cases in the Emergency Department of Balıkesir University Faculty of Medicine were evaluated within the scope of the guideline for forensic evaluation of injury crimes defined in the Turkish Penal Code. Between the dates of the study, 2048 forensic reports were issued. It was determined that 6.54% (n=134) of these reports were poisoning cases. It was determined that 65 (48.5%) of the poisoning cases were men and 69 (51.5%) were women. The mean age of poisoning cases was 40.2 years. The most common age range was 18-44 years (67.9%; n=91). It was found that the most common substance (31.3%) was antidepressant-antipsychotic group drugs. It was determined that 99 cases (73.9%) were at the toxic level and 29 cases (21.6%) were at the lethal level. It was determined that the blood calcium value was lower than 8.8 in 29 cases (21.6%) and the blood calcium value was higher than 10.6 in 2 cases (1.5%). In cases of poisoning, when the clinical conditions of the cases are evaluated in the light of life-threatening criteria, unnecessary 112 referrals of patients to higher centers will be reduced, the density of the upper centers will not increase, and the occupancy of the emergency department bed for 24 or 48 hours will be prevented. In addition, errors in forensic reports will be prevented.

Keywords: Emergency department, forensic case, poisoning

Introduction

In forensic cases, physicians are required to notify the judicial authorities in accordance with Article 280 of the Turkish Penal Code (TPC). In such situations frequently encountered in daily clinical practice—physicians prepare forensic reports and serve as both medical and forensic expert witnesses for judicial authorities [1].

The discipline of Emergency Medicine not only provides urgent medical care in hospital emergency departments but also plays a critical role in the initial assessment and management of forensic cases. These include incidents such as falls, assaults, poisonings, traffic accidents, occupational injuries, abuse, burns, and gunshot wounds, all of which commonly present to emergency

departments. In Türkiye, forensic reports are typically prepared by the first physician to assess the patient at the initial healthcare facility following the incident [2,3]. Therefore, emergency physicians hold essential responsibilities in terms of identifying forensic cases, documenting potential lesions, and managing the medico-legal process.

Epidemiological studies indicate that poisoning cases account for approximately 0.7% to 5% of all emergency department admissions in Türkiye [4,5]. Numerous studies in the literature focus on the epidemiology and clinical aspects of poisoning cases [6,7]. However, there is a lack of studies assessing life-threatening criteria in poisoning cases from the joint perspective of Emergency Medicine and Forensic Medicine. The current study seeks to address this gap.

CITATION

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Recent international studies highlight that acute poisoning agents vary significantly across regions depending on socioeconomic and cultural factors [8]. Therapeutic drug overdoses, especially involving antidepressants, antipsychotics, and analgesics, are frequently reported as the leading causes of intentional poisonings in countries like China and Turkey [9]. In agricultural regions, pesticide-related poisoning remains a major concern. For instance, organophosphates account for a significant portion of poisoning cases in rural settings [10]. Carbon monoxide poisoning and corrosive substance ingestion (e.g., bleach, acids) also rank high in household or occupational exposure scenarios [11]. These global patterns are largely consistent with our findings, where psychiatric drugs, psychoactive substances, and corrosives were the top three agents identified.

In addition to substance type, dose level is a critical factor in evaluating the severity of poisoning. In our cohort, the majority of patients ingested toxic or potentially lethal doses. Literature suggests that while higher doses are generally associated with more severe clinical outcomes, inter-individual variability (due to drug interactions, tolerance, or metabolism) can lead to significant differences in presentation. Quetiapine, for example, may cause seizures even at near-therapeutic levels in some patients [12]. This reinforces the need to evaluate both dosage and clinical presentation together.

Finally, clinical parameters such as Glasgow Coma Scale (GCS), arterial blood gas (ABG) analysis, and electrolyte disturbances, particularly hypocalcemia, serve as crucial indicators in determining life-threatening conditions. $GCS \leq 8$, presence of Anion Gap High Metabolic Acidosis (AGHMA), and elevated or depressed partial Pressure of Carbon Dioxide (pCO_2) levels are strongly associated with poor outcomes and often require intensive care. These indicators, supported by international data, underscore the necessity of incorporating objective clinical criteria when classifying poisoning cases as life-threatening in both emergency and forensic settings [9].

In this retrospective study, cases of intoxication evaluated as forensic incidents were reviewed. These cases were analyzed based on the Guideline for the Evaluation of Injury Crimes as outlined in the TPC. The study aimed to contribute to the literature by identifying clinical and laboratory parameters that may indicate life-threatening conditions, thereby supporting both forensic and emergency medical assessments.

Material and Methods

Ethics Committee Approval

The study was approved by the Non-Invasive Research Ethics Committee of Balıkesir University (Date: 22/11/2023; Decision no: 2023/169). The data used in the research were collected following legislation and institutional requirements.

Research Model and Cases

The research model is a retrospective, cross-sectional, and

descriptive research model. The universe of the study consists of 2048 forensic cases that applied to the Emergency Department of Balıkesir University Faculty of Medicine between 01.01.2019-01.01.2024. The sample consists of poisoning cases that were evaluated as poisoning cases, which constitute 6.54% ($n=134$) of 2048 forensic cases. All cases were obtained from hospital records. The data collection method was a retrospective review of registered patient data. The collected data included detailed demographic information (age, sex), clinical presentation (type of substance ingested, route of exposure), and vital signs (systolic blood pressure, respiratory rate, heart rate, body temperature). In addition, key laboratory parameters were recorded: serum calcium levels, potassium levels, arterial blood gases, and GCS scores at admission. Each case was also assessed for the presence of convulsions, need for intubation or cardiopulmonary resuscitation, and length of stay in the emergency department. Dose classification (therapeutic, toxic, or lethal) was conducted based on clinical documentation and toxicological reference values where available. The examined values of all poisoning cases were evaluated within the scope of the guideline for the evaluation of injury crimes defined in the TCK in terms of forensic medicine.

Statistical Analysis

SPSS 25 was used in the analysis of the obtained data. Mean, percentage, and frequency were used as descriptive statistics in determining the poisoning cases.

Results

Over a period of approximately four years, 65 (48.5%) of the poisoning cases were male and 69 (51.5%) were female (Table 1).

When age distribution was examined, 67.9% of patients were adults aged 18–44 years, 21.6% were aged 45–65 years, and 10.4% were over 65 years old (Table 1).

Regarding the substances involved in poisoning, the most frequently encountered agents were antidepressant-antipsychotic drugs (31.3%), psychotropic substances (17.9%), and corrosive materials (13.4%) (Table 1).

According to the ingested dose levels, 99 cases (73.9%) were classified as toxic, 29 cases (21.6%) as lethal, and 6 cases (4.5%) as therapeutic (Table 1).

Assessment of GCS values revealed that 4 patients (3%) had scores ≤ 8 , while 130 patients (97%) had scores ≥ 9 (Table 1).

In terms of AGHMA findings on arterial blood gas analysis, AGHMA was detected in 9 cases (6.7%), absent in 47 cases (35.1%), and unavailable in 78 cases (58.2%) (Table 1).

Regarding of pCO_2 levels, values >45 mmHg were observed in 9 cases (6.7%), values <45 mmHg in 47 cases (35.1%), and data were missing for 78 cases (58.2%) (Table 1).

Analysis of serum calcium levels showed hypocalcemia (<8.8 mg/dL) in 29 cases (21.6%), hypercalcemia (>10.6 mg/dL) in 2

cases (1.5%), and normal levels (8.8–10.6 mg/dL) in 103 cases (76.9%) (Table 1).

Convulsions were present in 21 patients (15.7%), while 113 patients (84.3%) had no seizures (Table 1).

Systolic blood pressure (SBP) was below 80 mmHg in 18 cases

(13.4%), above 180 mmHg in 3 cases (2.2%), and within normal limits (80–180 mmHg) in 113 cases (84.3%) (Table 1).

Regarding respiratory rate, one case (0.7%) had <10 breaths/min, two cases (1.5%) had >30 breaths/min, and 131 cases (97.8%) had normal respiratory rates (10–30 breaths/min) (Table 1).

Table 1. Physical examination and laboratory findings of poisoning cases

Variables	Groups	Frequency	Percentage
Gender	Women	69	51.5
	Men	65	48.5
Age (year)	18-44	91	67.9
	45-65	29	21.6
	>65	14	10.4
Distribution of cases according to the substance used	Antidepressants-Antipsychotics	42	31.2
	Psychotics	24	17.9
	Antibiotics	3	2.2
	Corrosive Substance	18	13.4
	Fungus	8	6.0
	Alcohol	4	2.9
	Carbon Monoxide	7	5.2
	Agrochemicals	9	6.7
	Drug-Stimulant Substance	8	6.0
	Mouse Poison	2	1.5
	Volatile Substance-Thinner	3	2.2
	Unknown	6	4.5
Dosage	Toxic	99	73.9
	Lethal	29	21.6
	Therapeutic	6	4.5
GCS	8 and below	4	3.0
	9 and above	130	97.0
AGHMA	Yes	9	6.7
	No	47	35.1
	Unreachable	78	58.2
pCO2 (mmHg)	High	9	6.7
	Low	47	35.1
	Unreachable	78	58.2
Calcium (mg/dl)	Less than 8.8	29	21,6
	Normal Range (8.8-10.6)	103	76,9
	More than 10.6	2	1,5
Convulsion	Yes	21	15,7
	No	113	84,3
Blood Pressure (mmHg)	Below 80	18	13,4
	Normal Range (80-180)	113	84,3
	Above 180	3	2,2
Respiratory Rate	Under 10	1	0,7
	Normal Range (10-30)	131	97,8
	Over 30	2	1,5

GCS: Glasgow Coma Scale; AGHMA: Anion Gap High Metabolic Acidosis; pCO2: Partial Pressure of Carbon Dioxide

Discussion

Poisoning cases constitute a significant portion of emergency department (ED) admissions. These patients may present at any hour, with a wide spectrum of clinical symptoms, and typically require prompt and serious medical attention due to their potentially critical nature [13].

Consistent with previous studies conducted in Türkiye, our findings showed that women were slightly more affected than men (51.5% vs. 48.5%) [6,14]. This supports the notion that the female population may be more prone to poisoning. Additionally, the mean age of patients in our study was 40 years, and a substantial majority (67%) were between the ages of 18 and 44, aligning with other reports suggesting that poisoning is more common in younger age groups [14,15].

Our study findings are broadly consistent with international literature published over the last five years across various continents. The predominance of young adult populations, a slightly higher frequency of female cases especially those involving suicide attempts and the leading role of therapeutic drugs and pesticides as causative agents are recurring patterns in global data. Similarly, the majority of patients in our series were classified as having moderate-to-severe intoxication, a finding echoed by reports from several regional studies. These comparisons strengthen the generalizability and relevance of our findings [16].

In contrast to many studies where analgesics were the most frequently involved substances [11,12], our results indicated that antidepressant-antipsychotic medications were the leading agents (31.3%). This shift may reflect both increased use of these drugs in the community and possible attempts by patients to obtain secondary gain. The identification of this pattern highlights the need for stricter prescription control and follow-up for psychiatric medications to prevent misuse and associated poisonings.

When evaluating the severity of poisoning based on the ingested dose, the majority of cases (73.9%) were classified as toxic, with 21.6% considered lethal, and only 4.5% falling within therapeutic ranges. The predominance of toxic or lethal cases may be attributed to the hospital's status as a referral center, where more severe cases are directed for further management, while milder cases are handled in district hospitals.

Prior studies also emphasize the variability of clinical presentations due to overdose, particularly highlighting the influence of individual factors such as drug combinations, metabolism, or tolerance. For example, some reports document seizures or cardiac arrhythmias in quetiapine overdoses, even at near-therapeutic doses, underscoring the complexity of dose-response relationships [12].

GCS assessment revealed that 97% of patients had a score ≥ 9 , and only 3% had a score ≤ 8 . While another study reported that 88.4% of cases had a perfect GCS score of 15, the variation

in our study may stem from the selection bias of referred cases and delayed transportation from peripheral areas [17]. Additionally, only 2.2% of cases required intubation and one patient underwent cardiopulmonary resuscitation (CPR), indicating that most cases were clinically stable and managed with observation.

When analyzed in terms of metabolic and biochemical parameters, our data—such as a GCS ≤ 8 in 3% of cases and AGHMA detected in approximately 7% are in line with the expected low incidence of severe poisonings. Life-threatening presentations such as coma or severe metabolic acidosis remain relatively rare but are associated with high morbidity and mortality [9].

Metabolic evaluation showed that 6% of patients exhibited anion gap metabolic acidosis (AGMA); no patients required dialysis, and pH levels dropped below 7.2 in only three cases. Convulsions occurred in 15% of patients, and normal sinus rhythm was noted in 90.3%, indicating a relatively stable cardiac status overall.

Among electrolyte disturbances, hypocalcemia (serum calcium < 8.8 mg/dL) was detected in 21.6% of patients, while potassium levels remained largely within normal limits.

Despite the relatively stable clinical profiles of most patients, a considerable number were classified as life-threatening in forensic reports. This discrepancy may reflect hesitation on the part of emergency physicians to assume responsibility in forensic cases, leading to over-referral and extended observation periods, sometimes due to medicolegal concerns rather than true clinical necessity. In many instances, referrals were justified by stating that the case was life-threatening, although objective findings did not support this classification.

A more accurate application of life-threatening criteria in poisoning cases would help reduce unnecessary referrals to tertiary centers, alleviate ED overcrowding, and minimize inappropriate forensic classifications. To achieve this, it is crucial to implement regular training programs both during undergraduate education and in clinical practice focusing on forensic reporting standards and objective criteria for determining life-threatening conditions.

Conclusion

Considering the significant impact of forensic reports on legal proceedings, the accuracy and reliability of these documents are crucial [18,19]. The current Guideline for the Evaluation of Injury Crimes, as defined in the TPC, serves as a fundamental reference for physicians in determining life-threatening conditions in forensic cases. However, based on our study findings, we propose that certain additional clinical parameters such as blood calcium levels, respiratory rate, and SBP could further aid in assessing life-threatening conditions in poisoning cases.

We believe that incorporating the following objective criteria into

forensic evaluations may assist emergency physicians in making more consistent and accurate determinations when preparing reports for poisoning cases:

- Metabolic disturbances, particularly hypocalcemia or hypercalcemia, should be considered potentially life-threatening in forensic assessments.
- An arterial SBP exceeding 200 mmHg may also indicate a life-threatening state and warrant special attention in medico-legal documentation.
- Implementation of forensic toxicology training at both undergraduate and postgraduate levels may improve physician competence in assessing life-threatening conditions and documenting them accurately.
- Future research should prioritize multi-center study designs to overcome the limitations of single-center experiences and improve generalizability.

One limitation of our study is that it was conducted at a single center, which may restrict the broader applicability of our findings. Therefore, further multi-center studies with larger sample sizes are recommended to validate and expand upon these results.

Conflict of Interests

The authors declare that there is no conflict of interest in the study.

Financial Disclosure

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Ethical Approval

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