Predictors of Mortality in Critically Ill Patients with Poisoning: A Single Center Experience

Kritik Zehirlenme Olgularında Mortalite Belirteçleri: Tek Merkez Deneyimi

Ramazan COŞKUN,[a]
Kürşat GÜNDOĞAN,[a]
Elif ATAĞ,[b]
İsmail Hakkı AKBUDAK,[c]
Ahmet ÖZTÜRK,[d]
Muhammet GÜVEN,[a]
Murat SUNGUR[a]

Departments of
[a]Internal Medicine Intensive Care Unit,
[b]Internal Medicine,
[d]Biostatistics and Medical Informatics,
Erciyes University Faculty of Medicine, Kayseri
[c]Department of Internal Medicine,
Pamukkale University Faculty of Medicine, Denizli

Geliş Tarihi/*Received:* 12.12.2012
Kabul Tarihi/*Accepted:* 11.03.2013

Yazışma Adresi/*Correspondence:*
Ramazan COŞKUN
Erciyes University Faculty of Medicine, Internal Medicine Intensive Care Unit, Kayseri,
TÜRKİYE/TURKEY
drramazancoskun@gmail.com

ABSTRACT Objective: Poisoning is among the common health care problems which may be fatal and 3-5% of the acutely poisoned patients need intensive care admission. The aim of this study was to examine the acutely poisoned patients admitted to intensive care unit (ICU) in terms of individual, etiological and demographical characteristics and also to determine the factors affecting mortality. **Material and Methods:** This study was retrospectively conducted on the patients admitted to medical ICU of a university hospital due to acute poisoning over a six year period. The patients' age, gender, comorbid disease status, sociocultural characteristics, cause of the poisoning, transfer time to hospital and to the ICU, signs and symptoms, laboratory data, Glasgow coma score, Acute Physiology and Chronic Health Evaluation II (APACHE II) score, Sequential Organ Failure Assessment score, length of stay in ICU, the treatments employed and their results were analyzed. **Results:** The total number of the patients included in the study was 190. The median age of the patients was 28.5 (16-72) years and 97 (51%) patients were females. The mean length of stay in ICU was 4.2±3.6 days. The overall mortality rate was 8.4%. Independent risk factors for mortality were presence of concomitant physical disorders, time to ICU admission, and higher APACHE II scores. **Conclusion:** Individual characteristics, cause of poisoning and type of toxic agent should be clearly determined since they are predictors for mortality. Early intervention is life saving. ICU scoring systems in predicting mortality are very valuable and should be used.

Key Words: Intensive care; mortality; poisoning

ÖZET Amaç: Zehirlenme ölümcül olabilen ve akut zehirlenmiş hastaların %3-5'inin yoğun bakıma yatışını gerekebilen yaygın bir sağlık problemidir. Bu çalışmanın amacı mortaliteyi etkileyen faktörleri belirlemek amacıyla yoğun bakım ünitesine (YBÜ) kabul edilen akut zehirlenmiş hastaların bireysel, etyolojik ve demografik özelliklerini incelemektir. **Gereç ve Yöntemler:** Bu çalışma retrospektif olarak altı yıl içinde akut zehirlenme nedeniyle bir üniversite hastanesi medikal yoğun bakımına yatan hastalar üzerinde yapıldı. Hastaların yaş, cinsiyet, eşlik eden hastalık durumu ve sosyokültürel özellikleri, zehirlenme nedeni, hastane ve yoğun bakıma transfer süresi, belirti ve bulguları, laboratuvar verileri, Glasgow koma skoru, Akut Fizyoloji ve Kronik Sağlık Değerlendirmesi II (APACHE II) skoru, Ardışık Organ Yetersizliğinin Değerlendirilmesi skoru, YBÜ yatış süresi, tedavileri ve sonuçları analiz edildi. **Bulgular:** Çalışmaya dahil edilen hastaların toplam sayısı 190 idi. Hastaların ortanca yaşı 28,5 (16-72) yıldı ve 97 (%51) hasta kadın idi. Yoğun bakımda kalış süresi ortalama 4,2±3,6 gün idi. Mortalite oranı % 8,4 idi. Mortalite için bağımsız risk faktörleri fiziksel alt hastalığın bulunması, yoğun bakıma kabule kadar geçen süre ve yüksek APACHE II skorları idi. **Sonuç:** Hastaların bireysel özellikleri, zehirlenme nedeni ve toksik maddenin türü mortalite belirteçleri olmalarından dolayı açıkça belirlenmelidir. Erken müdahale hayat kurtarıcı olmaktadır. Mortalitenin öngörülmesinde YBÜ skorlama sistemleri çok değerlidir ve kullanılmalıdır.

Anahtar Kelimeler: Yoğun bakım; ölüm oranı; zehirlenme

doi: 10.5336/medsci.2012-33098

Turkiye Klinikleri J Med Sci 2013;33(5):1274-82

It has been reported that over 13 million natural or synthetic chemical substances exist worldwide. Approximately 3000 of these chemicals are involved in 95% of the accidental or intentional poisonings. Technological advances and social improvements have facilitated to access several drugs and chemicals.[1]

Cases with poisoning are integral part of intensive care practice. The most common reason for non-traumatic coma below 35 years of age is poisoning.[2] There has been an increase in the number of reported cases and mortality rates by years.[3-5] Thus, poisoned patients should be cautiously managed in order to prevent morbidity and mortality.

Although early diagnosis and treatment is life saving in poisoning, it is likely that factors such as causative agent, age and time to intensive care admission affect mortality and morbidity. Morbidity and mortality related to poisoning have regional variations. Thus, the information about general poisoning pattern in certain regions may be helpful in early diagnosis and in the management of poisoning.[6] Previous studies suggested that age, Acute Physiology and Chronic Health Evaluation II (APACHE II) score, Glasgow coma score (GCS) at admission, type of the agent, reason for poisoning, respiratory failure, renal failure, hypotension, cardiac rhythm abnormalities and abnormal body temperature might be predictors of mortality in patients admitted to intensive care unit (ICU).[7,8] In our country, intensive care mortality related to poisoning was found to vary between 0.21 and 15.7%. However, these studies have usually focused on etiological agents and mortality of poisoning, and there are limited number of studies on factors which influence mortality and morbidity.[4,9]

The aim of this study was to determine the etiological and demographic characteristics of the patients admitted to our ICU due to poisoning and to evaluate the factors which affect mortality.

MATERIAL AND METHODS

This study was retrospectively conducted on the patients admitted to medical ICU of a university hospital due to acute poisoning between January 2005 and September 2011. This study was performed in accordance with the principles of the Helsinki Declaration of 2008 and approved by Institutional Ethics Committee (Consent #: 2012/17; Date 03.01.2012). Cases more than 16 years of age who were followed in ICU longer than 24 hours were included in this study. The following characteristics were recorded in 190 patients included in this study: age, gender, rural or urban residence of the patient, educational status, marital and employment status.

The presence of underlying chronic disease, history of psychiatric diseases, history of previous suicide attempt and the reason for poisoning (suicidal or accidental) were determined. The type of the agent was recorded.

The route of poisoning was recorded as follows: ingestion, inhalation and multiple routes. The time from exposure to a toxic agent to arrival at the emergency department was recorded as reference time. The time interval for the first intervention was evaluated. Its time was recorded if there were more than 4 hours.

GCS score at the admission to the emergency department, and GCS, Sequential Organ Failure Assessment (SOFA) and APACHE II scores at the admission to ICU were recorded. Furthermore, the length of ICU stay, mechanical ventilation status, the duration of mechanical ventilation, invasive monitorization status, vasopressor need, infection during ICU stay and the type of infection were recorded. Patients were stratified into 2 groups as survivors or non survivors at the end of ICU stay. These two groups were compared for the factors affecting mortality. If the patient was dead, the cause of the death was classified as death related to poisoning or death related to other causes.

STATISTICAL ANALYSIS

Continuous variables with normal distribution were presented as mean±SD. Median (min-max) value was used where normal distribution was absent. The statistical analysis for the parametric variables was performed using the Student's t-test

between the two groups. The Mann-Whitney U test was used to compare the nonparametric variables between the two groups. Qualitative variables were expressed as percent and the association between the categorical variables was investigated using the Chi-square tests (Proportions were statistically compared by using the Pearson Chi-square test, Fisher exact test for 2x2 tables, or Fisher-Freeman-Halton exact test for Rxc tables, depending on the expected frequencies). Multiple binary logistic regression analysis (Forward Stepwise) was used to assess the risk factors influencing mortality. SPSS for Windows version 15.0 was used in the statistical analysis. Odds ratios and 95% confidence intervals were calculated. $p<0.05$ was considered as significant.

RESULTS

One hundred and ninety patients who had been followed in ICU over a six year period were included in the study. Of the patients, 97 (51%) were females and 93 (49%) were males. Their median age was 28.5 (range: 16-72) years. The reason for poisoning was suicide in 137 (72.1%) patients, but it was accidental in 53 (27.9%) patients.

General demographic characteristics and variations between the female and male patients were presented in Table 1.

The median reference time was 1.5 (range: 0.5-75) hours. The mean GCS score at presentation was 11.5±3.9, while the mean GCS score, the mean APACHE II score and the median SOFA scores at admission to ICU were 12.1±3.9, 10.9±8.4 and 2.0 (range: 0-13), respectively.

The causative agents were drugs in 83 (43.7%) patients, pesticides in 81 (42.6%) patients, mushroom-plant in 8 (4.2%) patients, alcohol in 8 (4.2%) patients, carbon monoxide (CO) in 5 (2.6%) patients, and other causes in 5 (2.6%) patients. The types of the pesticides were insecticides or rodenticides in 10 (12.3%) patients, organophosphate-containing pesticides in 56 (69.2%) patients and non-organophosphate pesticides in 15 (18.5%) patients.

There was multidrug ingestion in 31 (37.3%) patients and tricyclic antidepressant ingestion in 23 (27.7%) patients. Of 31 patients with multidrug ingestion, drugs were psychiatric drugs in 26 (83.9%) patients.

The median length of the ICU stay was 3 (range: 1-24) days, whereas the median length of the hospital stay was 3.75 (1-120) days. Mechanical ventilation was needed in 48 (25.3%) patients. Invasive hemodynamic monitoring was used in 25 (13.2%) patients and vasopressors were needed in 16 (8.4%) patients.

The mortality rate was 8.4% (16 patients). The cause of the death was poisoning in 14 (87.5%) patients, while death occurred in 2 (12.5%) patients due to other reasons (severe sepsis).

The mean age was 31.9±13.7 years in survivors, whereas 46.7±17.1 years in non-survivors. Non-survivors were significantly older than survivors ($p<0.001$). Age, gender, marital status and presence of comorbidities were found to have significant relation with mortality (Table 2).

The reason for poisoning was suicide attempt in 130 (74.7%) patients and accidental poisoning in 44 (25.3%) patients for survivors. The reason was suicide in 7 (43.8%) patients and accidental poisoning in 9 (56.2%) patients for non-survivors. The mortality rate was significantly higher in accidental poisonings compared to suicidal poisonings ($p=0.012$).

When the relationship between the causative agent and the mortality was considered, the mortality rate was found to be 2.4% in drug poisoning, 6.2% in pesticide poisoning, 25% in mushroom-plant poisoning, 60% in alcohol intoxication and 25% in CO intoxication. The association between the clinical characteristics and the mortality was presented in Table 2.

In the multiple binary logistic regression analysis, independent risk factors for mortality were the presence of concomitant physical disorder, time to ICU admission and higher APACHE II scores (Table 3).

TABLE 1: Individual and demographic characteristics of the patients according to gender.

Variables	Total n= 190	Female n= 97	Male n= 93	p
Age (median) (range) years	28.5 (16-72)	25 (16-68)	37 (16-72)	<0.001
Marital status (n, %)				
Married	110 (58)	56 (57.7)	54 (58.1)	0.963
Single	80 (42)	41 (42.3)	39 (41.9)	
Employment (n,%)				
Employee	73 (38.4)	12 (12.4)	61 (65.6)	<0.001
Retired/unemployed	40 (21.1)	15 (15.5)	25 (26.9)	
Student	19 (10)	12 (12.4)	7 (7.5)	
Housewife	58 (30.5)	58 (59.8)	—	
Education level (n,%)				
Illiterate	7 (3.7)	4 (4.1)	3 (3.2)	0.644
Literate	5 (2.6)	3 (3.1)	2 (2.2)	
Primary school graduates	106 (55.8)	55 (56.7)	51 (54.8)	
Middle/high school graduates	51 (26.8)	22 (22.7)	29 (31.2)	
University graduates	21 (11.1)	13 (13.4)	8 (8.6)	
Admitted from (n,%)				
Rural	75 (39.5)	39 (40.2)	36 (38.7)	0.833
Urban	115 (60.5)	58 (59.8)	57 (61.3)	
Psychiatric disease (n, %)	60 (31.6)	28 (28.9)	32 (34.4)	0.411
Prior the suicide attempt (n, %)	25 (13.2)	17 (17.5)	8 (8.6)	0.109
Physical disease (n, %)	41 (21.6)	13 (13.4)	28 (30.1)	0.009
Intent of poisoning (n, %)				
Suicide	137 (72.1)	80 (82.5)	57 (61.3)	0.002
Accidental	53 (27.9)	17 (17.5)	36 (38.7)	
Initial vital signs (mean±SD)				
SAP (mmHg)	118±29.6	113±24.7	123.5±33.4	0.015
DAP (mmHg)	73.6±18.6	71.2±15.6	76.2±21.2	0.064
Heart Rate /minute	96±25.9	96.8±27.9	95.4±23.8	0.700
Respiratory Rate/minute	22.4±4.45	22.1±3.7	22.7±5.1	0.400
Temparature (°C)	36±1.7	36±2.0	36.1±1.1	0.570
Vital signs in ICU (mean±SD)				
SAP (mmHg)	123.8±26.3	122.2±21.8	125.5±30.3	0.380
DAP (mmHg)	72.4±16.5	72.9±14.8	71.9±18.1	0.650
Heart Rate beats/minute	96.35±23	97.5±21.5	95.2±24.6	0.490
Respiratory Rate breaths/ minute	23.1±5.1	22.7±4.4	23.5±5.8	0.260
Temparature (°C)	36.2±0.8	36.2±0.79	36.2±0.8	0.630

SD: Standart deviation; SAP: Systolic arterial pressure; DAP: Diastolic arterial pressure; ICU: Intensive Care Unit.

DISCUSSION

Poisoning is an important health issue worldwide with an increasing rate.[3,5] Despite its low mortality, acute poisoning comprises a significant proportion of intensive care unit admissions, and there is considerable use of ICU sources for poisoning.[10,11] As mortality caused by poisoning is a concern in young adults, identification of the factors influencing mortality and morbidity becomes more important. Reasons for poisoning vary among countries and by time. Thus, it is rather essential to identify regional epidemiological data for the prevention of poisoning and more realistic use of sources.[7,12]

TABLE 2: Individual, demographic and clinical features in relation to mortality.

Variables		Survivors n=174	Non Survivors n=16	p
Age (median) (range) (year)		28 (16-72)	47.5 (18-70)	<0.001
Gender n (%)	Female	94 (54)	3 (18.8)	0.015
	Male	80 (46)	13 (81.3)	
Marital status n (%)	Married	96 (55.2)	14 (87.5)	0.025
	Single	78 (44.8)	2 (12.5)	
Admitted from n (%)	Rural	69 (39.7)	6 (37.5)	1.000
	Urban	105 (60.3)	10 (62.5)	
Physical disease		32 (18.4)	9 (56.3)	0.002
Psychiatric disease		56 (32.2)	4 (25)	0.756
Poisoning route n (%)	Oral	165 (94.8)	13 (81.3)	0.143
	Inhalational	6 (3.4)	2 (12.5)	
	Skin	1 (0.6)	0 (0)	
	Multiple routes	2 (1.1)	1 (6.3)	
Initial vital signs (mean±SD)				
SAP (mmHg)		117.8± 27	122.2 ±51.8	0.560
DAP (mmHg)		73.6 ±16.7	73.4 ±34.4	0.950
Heart Rate beats/min		95.5± 26	102.6 ±24.1	0.290
Respiratory Rate breaths/min		22.4 ±3.9	22.3 ±8.3	0.940
Temparature (°C)		36 ±1.7	35.7 ±1.1	0.410
Vital signs in ICU (mean±SD)				
SAP (mmHg)		124.5 ±23.3	115.9 ±48.9	0.200
DAP (mmHg)		73.3 ±14.9	63.3± 27.9	0.020
Heart Rate beats/min		95.5± 23	105.8 ±21.9	0.880
Respiratory Rate breaths/min		23.2± 4.4	22± 10.1	0.370
Temparature (°C)		36.2± 0.7	36.2 ±1.7	0.990
Time to first intervention > 4 h, n (%)		24 (13.8)	6 (37.5)	0.024
GCS (Admission)		13.5 (3-15)	6 (3-15)	<0.001
GCS (in ICU)		14 (3-15)	3 (3-15)	<0.001
SOFA Score		1 (0-13)	9.5 (3-12)	<0.001
APACHE II Score		8 (0-38)	25.5 (9-42)	<0.001
Gastric lavage/active charcoal, n (%)		140 (80.5)	8 (50)	0.010
MV, n (%)		33 (19)	15 (93.8)	<0.001
Invazive hemodynamic monitorization, n (%)		12 (6.9)	13 (% 81.3)	<0.001
Vasopressor, n (%)		2 (1.1)	14 (% 87.5)	<0.001
Infection, n (%)		49 (28.2)	9 (56.3)	0.043
HD, n (%)		3 (1.79)	5 (31.3)	<0.001
Length of ICU stay (day)		3.25 (1-24)	2.5 (1-24)	0.146
Length of hospital stay (day)		4.5 (1-120)	3.75 (0.6-25)	0.033

SD: Standart deviation; SAP: Systolic arterial pressure; DAP: Diastolic arterial pressure; GCS: Glasgow come score; ICU: Intensive Care Unit; SOFA: Sequential Organ Failure Assessment; APACHE: Acute Physiology and Chronic Health Evaluation; MV: Mechanical ventilation; HD: Hemodialysis.

In a study by Seydaoglu et al. performed on 2229 patients presented with poisoning to emergency department, women (mean age 24 years) were significantly younger than men (mean age 29 years).[9] Another study by Satar et al. confirmed the same gender distribution data.[13] Our age groups are similar to these studies.

In our study, the most common reason for poisoning was suicide attempts. The suicide rate in women was higher than men, whereas accidental

TABLE 3: Multiple binary logistic regression analysis for mortality

Variables	0R 95% CI	p
Physical disease : No* Yes	8.131 (1.307-50.563)	<0.05
Time to ICU admission (hour)	1.075 (1.033-1.119)	<0.001
APACHE II score	1.393 (1.189-1.631)	<0.001

APACHE: Acute Physiology and Chronic Health Evaluation; ICU: Intensive Care Unit.
*Referance value, Hosmer-Lemesow test: chi-square= 1.586, p=0.991.

exposure and drug abuses in men were more common than women. In the study by Islambulchilar et al., suicide attempts were more frequent in women compared to men.[14] Another study from Turkey reported that poisoning more commonly occurred due to suicide attempts in women, whereas accidental poisoning was more common in men.[15] Studies conducted in Spain and France reported that successful suicidal poisoning attempts were more frequent among men, whereas women primarily used less severe methods for suicide attempts.[16,17] The higher incidence of accidental poisoning in men may be due to the fact that men work more in agriculture and industry. In addition, alcohol and narcotic abuse are more common in Turkish male population.[18] Thus, it could be reasonable to think that intoxication related to these agents can be observed more frequently in Turkish male population.

Higher mortality rates have been reported among men in the literature.[7,8,16] In the above-mentioned study by Chien et al., mortality among men was 2.3 fold higher than women. In that study, when reason for poisoning was considered in relation to gender, it was seen that mortality rate due to unintentional poisoning was higher in men compared to women, whereas mortality related to intentional poisoning was higher in women compared to men.[5]

Agents of poisoning may vary among countries and localization. In 2010 Annual Report of American Association of Poison Control Centers, the most common 5 causative agents were detected as analgesics (11.5%), cosmetic or personal care products (7.7%), household cleaning substances (7.3%), sedatives/hypnotics/antipsychotics (6.0%) and foreign body/toys (4.2%), when all intentional and unintentional exposures were considered.[19] Yildiztepe et al. found causative agents as drugs in 73.4%, pesticides in 4.6%, cleaning substances in 3.2%, alcohol in 6.3%, mushroom in 2.5%, CO in 2.7%, and corrosive agents in 3.1% in cases older than 18 years of age.[20] In our study, the most commonly detected causative agent was drugs (43.7%), followed by pesticides (42.6%), mushroom-plant (4.2%), alcohol (4.2%), and carbon monoxide (2.6%). This might be due to easier access to medical drugs and pesticides. Exposures to pesticides are more common in our study compared to Yildiztepe et al.'s study. Our hospital is a reference hospital for severe poisonings and all poisonings from rural areas are referred to us. The main reason for the difference between our and Yildiztepe et al.'s study may be because of this. Although similar results have been reported in some studies from Western and Eastern countries, alcohol and narcotic intoxications are stand in the forefront in some Western countries.[7,12,14,21-23] Pesticide poisonings are more common in developing countries and regions where agriculture is the main activity.[24,25]

Intensive care mortality varies from 0.24% to 27% for poisoning in literature.[4,7,10,25-27] Poisoning-related mortality rate was found as 8.4%. The mean age was 31.9±13.7 years in survivors, whereas 46.7±17.1 years in non-survivors in our study. In a study at toxicology ICU by Mühlberg et al., the overall mortality was 0.24% in 3740 patients who had been followed for drug intoxication, age-specific mortality was 2.17% in 184 patients over 65 years.[25] In our study, the positive correlation between the age and the mortality was in agreement with literature.[7,8,27] Increasing mortality by age may be linked with comorbid health issues. In Taiwan, Chien et al. evaluated 20,260 deaths related to poisoning and reported that age over 65 years was found as a high-risk factor for poisoning-related mortality.[5] On the contrary, there are studies conducted at Sri Lanka and USA suggesting that mortality related to poisoning is higher in young adolescents between 15 and 19 years age.[18,28] This may be due to cultural diversity and frequent oc-

currence of intoxication with high mortality such as narcotics and alcohol among young individuals.

In our study, the mortality rate related to accidental poisoning was significantly higher compared to the mortality related to suicide. This might have been caused by the fact that eventual intention might have been to draw attention rather than death in some cases. In such cases, lower mortality rate may be due to low doses of ingested toxic agent, vomiting after ingestion and immediate referral to a hospital. In a public health report by Bohnert et al., it was reported that mortality rate of unintentional poisoning was increased by 108.5% during 1996-2006, although mortality rate of intentional poisoning remained stable at the same period.[3] In a study by Lee et al., it was found that suicide attempts had a higher mortality rate compared to accidental poisoning.[7] In a study by Pedroso and Silva, it was found that mortality of poisoning was significantly higher in individuals attempting to suicide compared to those with accidental poisoning.[27]

As in all medical emergencies, early intervention is life saving in acute poisoning. As majority of patients with poisoning are unconscious or confused and no reliable information can be gathered in case of suicide, delays occur in diagnosis and interventions despite early presentation to hospital. Therefore, we distinctly assessed the time to the first intervention and the time to the ICU admission in our study. In conclusion, the time to the first intervention more than 4 hours and the time to the admission to ICU were found as risk factors for mortality.

In a study by Lee and Tai, APACHE II score higher than 26 was shown to be a good predictor for mortality.[29] Similarly, in a study by Sungurtekin et al. in which several scoring systems were compared in organophosphate intoxication, it was found that APACHE II and GCS scores were good indicators in predicting the severity and the prognosis of intoxication.[30] Eizadi-Mood et al. evaluated patients in coma due to multidrug intoxication and found that the mean GCS score at 24 hours after the presentation in survivors was higher compared to non -survivors.[31] In the same study, APACHE II score at the presentation and 24 hours after the presentation were lower in survivors.[31] In our study, GCS score at the presentation and at the admission to the ICU were lower in survivors, APACHE II and SOFA scores at the admission to the ICU were higher in survivors compared to non survivors.

In a study by Lee et al., it was detected that dependent risk factors for mortality included respiratory failure, hypotension, abnormal cardiac rhythm, abnormal body temperature, GCS score <10 and advanced age.[7]

Liisanantti et al. evaluated organ system failures in patients treated in ICU due to multidrug intoxication, and dependent risk factors identified were respiratory failure, cardiovascular dysfunction, cardiovascular failure, central nervous system (CNS) dysfunction, CNS failure, renal dysfunction, renal failure, tachycardia, bradycardia, hyperthermia, hypothermia, hypotension, hyperphosphatemia, acidosis, leukocytosis and thrombocytopenia.[8] In the same study, age, thrombocytopenia, leukocytosis, hypotension, renal dysfunction and failure and respiratory failure was identified as independent risk factors.[8] According to our study, risk factors for mortality included male gender, age, marital status, accidental poisoning, delay in time to the first intervention as well as low GCS score at the presentation and at the admission to the ICU, high SOFA score at the admission to the ICU, the presence of an infection and the requirement of mechanical ventilation, hemodialysis, invasive monitoring and vasopressor agents.

In our study, APACHE II score, time to admission to ICU, and the presence of a concomitant physical disorder were independent risk factors. These results are in agreement with the literature.

These patients should be meticulously questioned and assessed at admission as individual characteristics as well as reason and causative agent of poisoning are determinants of mortality in poisoning. Early intervention might be life saving. ICU scoring systems are valuable in the prediction of mortality and should be used. It is important to

identify factors influencing mortality and morbidity, since poisoning is an important health care problem pertaining to young, socially and economically active population, in which mortality can be prevented by appropriate and timely intervention.

CONCLUSION

In our study, APACHE II score, the time to the admission to the ICU, and the presence of concomitant physical disorder were identified as independent risk factors.

Acknowledgements

All authors have made substantial contributions to the work from the outset. RC and EA collected the data. All authors analyzed and criticized all data. Ahmet Ozturk contributed to the analysis of the statistics in the paper. RC, EA and MS wrote large portions of the final text, approval of the conceptions and final version.

REFERENCES

1. Robertson WO, Lawrence RA. Poisoning. In: Beers MH, Berkow R, eds. The Merk Manuel of Diagnosis and Therapy. 17th ed. New Jersey: Merk Research Laboratories; 1999. p.2619-56.
2. Hawton K, Fagg J, Simkin S, Mills J. The epidemiology of attempted suicide in the Oxford area, England (1989-1992). Crisis 1994;15(3): 123-35.
3. Bohnert AS, Fudalej S, Ilgen MA. Increasing poisoning mortality rates in the United States, 1999-2006. Public Health Rep 2010;125(4): 542-7.
4. Cengiz M, Baysal Z, Ganidagli S, Altindag A. Characteristics of poisoning cases in adult intensive care unit in Sanliurfa, Turkey. Saudi Med J 2006;27(4):497-502.
5. Chien WC, Lin JD, Lai CH, Chung CH, Hung YC. Trends in poisoning hospitalization and mortality in Taiwan, 1999-2008: a retrospective analysis. BMC Public Health 2011;11:703. doi: 10.1186/1471-2458-11-703.
6. Singh B, Unnikrishnan B. A profile of acute poisoning at Mangalore (South India). J Clin Forensic Med 2006;13(3):112-6.
7. Lee HL, Lin HJ, Yeh ST, Chi CH, Guo HR. Presentations of patients of poisoning and predictors of poisoning-related fatality: findings from a hospital-based prospective study. BMC Public Health 2008;8:7. doi: 10.1186/1471-2458-8-7.
8. Liisanantti JH, Ohtonen P, Kiviniemi O, Laurila JJ, Ala-Kokko TI. Risk factors for prolonged intensive care unit stay and hospital mortality in acute drug-poisoned patients: an evaluation of the physiologic and laboratory parameters on admission. J Crit Care 2011;26(2):160-5.
9. Seydaoglu G, Satar S, Alparslan N. Frequency and mortality risk factors of acute adult poisoning in Adana, Turkey, 1997-2002. Mt Sinai J Med 2005;72(6):393-401.
10. Singh O, Javeri Y, Juneja D, Gupta M, Singh G, Dang R. Profile and outcome of patients with acute toxicity admitted in intensive care unit: Experiences from a major corporate hospital in urban India. Indian J Anaesth 2011; 55(4):370-4.
11. Henderson A, Wright M, Pond SM. Experience with 732 acute overdose patients admitted to an intensive care unit over six years. Med J Aust 1993;158(1):28-30.
12. Watson WA, Litovitz TL, Rodgers GC Jr, Klein-Schwartz W, Reid N, Youniss J, et al. 2004 Annual report of the American Association of Poison Control Centers Toxic Exposure Surveillance System. Am J Emerg Med 2005; 23(5):589-666.
13. Satar S, Seydaoglu G, Akpinar A, Sebe A, Karakoc E, Gumusay U, et al. Trends in acute adult poisoning in a ten-year period in Turkey: factors affecting the hazardous outcome. Bratisl Lek Listy 2009;110(7):404-11.
14. Islambulchilar M, Islambulchilar Z, Kargar-Maher MH. Acute adult poisoning cases admitted to a university hospital in Tabriz, Iran. Hum Exp Toxicol 2009;28(4):185-90.
15. Güloğlu C, Kara İH. [Cases of acute poisoning in Southeast Anatolia of Turkey]. Dicle Medical Journal 2004:31(2):37-45.
16. Burillo-Putze G, Munne P, Dueñas A, Pinillos MA, Naveiro JM, Cobo J, et al.; Clinical Toxicology Working Group, Spanish Society of Emergency Medicine (SEMESTOX). National multicentre study of acute intoxication in emergency departments of Spain. Eur J Emerg Med 2003;10(2):101-4.
17. Lapatto-Reiniluoto O, Kivistö KT, Pohjola-Sintonen S, Luomanmäki K, Neuvonen PJ. A prospective study of acute poisonings in Finnish hospital patients. Hum Exp Toxicol 1998; 17(6):307-11.
18. Ulus B, Öztürk MO. [Mental disorders due to psychoactive substance]. Öztürk MO, Uluşahin A, editörler. Ruh Sağlığı ve Hastalıkları, II. Cilt. 11.Baskı. Ankara: Nobel Kitabevi; 2008. p.687-735.
19. Bronstein AC, Spyker DA, Cantilena LR Jr, Green JL, Rumack BH, Dart RC. 2010 Annual Report of the American Association of Poison Control Centers' National Poison Data System (NPDS): 28th Annual Report. Clin Toxicol (Phila) 2011;49(10):910-41.
20. Yıldıztepe E, Aksay NH, Demir O, Arıcı A, Oransay K, Evcim S, et al. Analysis of the year 2007 data of Dokuz Eylül University Drug and Poison Information Center, Turkey. Turkiye Klinikleri J Med Sci 2010;30(5):1622-30.
21. Thomas SH, Bevan L, Bhattacharyya S, Bramble MG, Chew K, Connolly J, et al. Presentation of poisoned patients to accident and emergency departments in the north of England. Hum Exp Toxicol 1996;15(6):466-70.
22. Dorado Pombo S, Martín Fernández J, Sabugal Rodelgo G, Caballero Vallés PJ. [Epidemiology of acute poisoning: study of 613 cases in the Community of Madrid in 1994]. Rev Clin Esp 1996;196(3):150-6.
23. Poplas-Susic T, Komericki-Grzinic M, Klemenc-Ketis Z, Tusek-Bunc K, Zelko E, Kersnik J. Aetiological and demographical characteristics of acute poisoning in the Celje region, Slovenia. Eur J Emerg Med 2009;16(3):127-30.
24. Recena MC, Pires DX, Caldas ED. Acute poisoning with pesticides in the state of Mato Grosso do Sul, Brazil. Sci Total Environ 2006; 357(1-3):88-95.
25. Mühlberg W, Becher K, Heppner HJ, Wicklein S, Sieber C. Acute poisoning in old and very old patients: a longitudinal retrospective study of 5883 patients in a toxicological intensive care unit. Z Gerontol Geriatr 2005;38(3): 182-9.

26. Juárez-Aragón G, Castañón-González JA, Pérez-Morales AJ, Montoya Cabrera MA. [Clinical and epidemiological characteristics of severe poisoning in an adult population admitted to an intensive care unit]. Gac Med Mex 1999;135(6):669-75.

27. Pedroso JA, Silva CA. The nephrologist as a consultant for acute poisoning: epidemiology of severe poisonings in the State of Rio Grande do Sul and techniques to enhance renal elimination. J Bras Nefrol 2010;32(4): 340-8.

28. Eddleston M, Udayakumara N, Adhikari S, de Silva D, Sheriff MH, Waidyaratne DL. The importance of poisoning vs. road traffic injuries as a cause of death in rural Sri Lanka. PLoS One 2007;2(7):e599.

29. Lee P, Tai DY. Clinical features of patients with acute organophosphate poisoning requiring intensive care. Intensive Care Med 2001; 27(4):694-9.

30. Sungurtekin H, Gürses E, Balci C. Evaluation of several clinical scoring tools in organophosphate poisoned patients. Clin Toxicol (Phila) 2006;44(2):121-6.

31. Eizadi Mood N, Sabzghabaee AM, Khalili-Dehkordi Z. Applicability of different scoring systems in outcome prediction of patients with mixed drug poisoning-induced coma. Indian J Anaesth 2011;55(6):599-604.