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Characteristics and Outcomes of Adult Patients Receiving Mechanical Ventilation Due to Acute Poisoning

Akut Zehirlenme Nedeniyle Mekanik Ventilasyon Uygulanan Hastaların Karakteristik Özellikleri ve Sonuçları

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SUMMARY Objective: Poisoning is an important cause of admission to intensive care units (ICUs) and prolongs the length of stay (LOS) in the ICU. The patients whose admitted to the ICU with poisoning may require mechanical ventilation (MV). The need of prolonged MV causes a significantly longer LOS and higher mortality in the ICU. The analysis of the characteristics and outcomes of patients receiving MV after poisoning may be useful in the clinical management of these patients, allowing for better counseling of the patients and their families. The objective of this retrospective study to evaluate the relationship between demographic and etiological characteristics with need of MV in patients admitted to ICU due to poisoning. **Material and Method:** 211 patients diagnosed with poisoning were analyzed from January 2010 to December 2011. Data regarding age, gender, the time between exposure and ICU admission, type of poisoning, exposure to toxic agents, the route of exposure, a history of previous toxicity, consciousness status on arrival, the length of the ICU stay, need of MV, complications associated with MV, the Glasgow coma scale and outcome were obtained. **Results:** Of the 211 patients, 143 (67.8%) were female. The most common cause of poisoning was suicide (87.7%), and the main route of exposure was oral (93.4%). The greatest number of agents which patients were exposed was drugs. (74.4%). The most common drugs causing poisoning were antidepressants (including tricyclic antidepressants) (38.3%). The need of MV was significantly related to both gender ($p=0.04$) and the route of exposure ($p<0.001$). The need of MV was also significantly related to type of poisoning ($p=0.01$) and the toxic agents ($p<0.001$). There were very strong relationships between the drug poisoning and gender ($p=0.002$) and between type of poisoning and gender ($p=0.006$). **Conclusion:** The present study demonstrated that there were significant relationships between the need of MV and gender, type of poisoning, the toxic agents, the route of exposure and the ICU LOS. The need of MV may lead to poor outcome as it is associated with higher incidence of ventilator related complications and longer ICU stay.

Key Words: Poisoning, Intensive care unit, Mechanical ventilation; Toxicology

ÖZET Amaç: Zehirlenme, yoğun bakım ünitelerine (YBÜ) kabulün önemli bir nedenidir ve yoğun bakımda kalış süresini uzatır. Zehirlenme nedeniyle YBÜ'ye kabul edilen hastalar mekanik ventilasyona (MV) ihtiyaç duyabilirler. Uzamış MV gereksinimi YBÜ'de kalış süresini ve mortaliteyi artırır. Zehirlenme nedeniyle MV uygulanan hastaların özellikleri ve sonuçlarının değerlendirilmesi, klinik yönetimde yararlı olabilir ve hastalar ile ailelerine daha iyi danışmanlık sağlayabilir. Bu geriye dönük çalışmanın amacı zehirlenme nedeniyle YBÜ'ye yatırılan hastaların demografik ve etiyolojik özellikleri ile MV ihtiyacı arasındaki ilişkiyi incelemektir. **Gereç ve Yöntem:** Ocak 2010 - Aralık 2011 tarihleri arasında YBÜ'ye kabul edilen 211 değerlendirildi. Yaş, cinsiyet, zehirlenme oluşumu ile YBÜ'ye kabulüne kadar geçen süre, zehirlenmenin tipi, maruz kalınan toksik ajanlar, alınma yolu, daha önceki zehirlenme öyküsü, başvurudaki bilinç durumu, YBÜ'de kalış süresi, MV ihtiyacı. MV ile ilişkili komplikasyonlar, Glasgow koma skoru ve sonuçları incelendi. **Bulgular:** Değerlendirilen 211 hastanın 143'ü (%67,8) kadındı. Zehirlenmenin en sık nedeni intihar (%87,7) idi ve oral yol ile (%93,4) gerçekleşmişti. Hastaların en çok maruz kaldığı ajanlar ilaçlardı (%74,4). İlaçlarla oluşan zehirlenmenin en sık nedeni antidepressanlar (trisiklik antidepressanlar dahil) (%38,3) idi. MV ihtiyacı hem cinsiyet ($p=0,04$), hem de alınma yolu ile anlamlı şekilde ilişkiliydi. MV ihtiyacı zehirlenmenin tipi ($p=0,01$) ve toksik ajanlar ($p<0,001$) ile de anlamlı şekilde ilişkiliydi. İlaçlarla zehirlenme ile cinsiyet ($p=0,002$) ve zehirlenme tipi ile cinsiyet ($p=0,006$) arasında oldukça güçlü bir ilişki vardı. **Sonuç:** Bu çalışmada MV ihtiyacı ile cinsiyet, zehirlenmenin tipi, toksik ajanlar, alınma yolu ve YBÜ'de kalış süresi arasında anlamlı bir ilişki olduğu gösterildi. MV ihtiyacı ventilatöre bağlı komplikasyonların sıklığı ve daha uzun süre YBÜ'de yatışı ile ilişkili olarak kötü prognoza öncülük edebilir. **Anahtar Kelimeler:** Zehirlenme, Yoğun bakım, Mekanik ventilasyon, Toksikoloji

Introduction

The mortality rate for acute poisoning is low. However, poisoning is an important cause of admission to intensive care units (ICUs) and prolongs the length of stay (LOS) in the ICU (1). The poisoning rate of patients admitted to the ICU ranges from 2% to 13.8%, and the in-hospital mortality rate ranges from 0.2% to 1.1% (2-4).

It has been demonstrated that at least one fourth of hospitalized poisoning patients are comatose (5). The appropriate management of poisoned patients should include airway protection and mechanical ventilation (MV), hemodynamic stabilization, and specific procedures that enhance the elimination of the toxin (1,4). The clinical course and outcome are related to the agent, the dose, pre-existing comorbidities, the time between exposure and ICU admission, and the availability of effective medical treatment (6).

Patients who comes with self-poison or overdose may require MV. The need of prolonged MV causes a significantly longer LOS and higher mortality in the ICU (7). The analysis of the characteristics and outcomes of patients receiving MV after poisoning may be useful in the clinical management of these patients, allowing for better counseling of the patients and their families.

The objective of this study was to evaluate the relationships between demographic and etiological characteristics and the need of MV.

Materials and Methods

This study was a retrospective review of the medical records of all adult poisoned patients admitted to the ICU of İnönü University School of Medicine Department of Anaesthesiology and Reanimation from January 2010 to December 2011, Malatya, Turkey. After approval of the Ethics Committee of Inonu University Turgut Ozal Medical Centre (Ethical Committee Nr. 2013/34, 11 April 2013) the following pertinent data were recorded: age, gender, the time between exposure and ICU admission, type of poisoning, toxic agents, the route of exposure, the owner of the poisoning agent (the patient or someone else), a history of previous toxicity, consciousness status on arrival, the length of the ICU stay, need of MV, complications of MV, the Glasgow coma scale (GCS) at admission, and outcome.

Toxic agents were classified into six categories: drugs, carbon monoxide (CO), pesticides, corrosives, alcohol, and food. The drugs were categorized into nine subgroups: tricyclic antidepressants, antipsychotics, analgesics, antiepileptics, antibiotics, antidiabetics, cardiovascular drugs, antidepressants and unknown. The results were also analyzed for four age groups: 17-25 years, 26-35 years, 36 – 45 years and over 46 years.

Statistical Analysis

The statistical analysis was performed with SPSS version 16.0 (SPSS Inc., Chicago, USA). The numerical results were expressed as the mean values with SDs. Categorical results were given as numbers (percentages). In relation to categorical variables, Pearson's chi-square test, Yates' corrected chi-square test, and Fisher's exact test were used for statistical analyses where appropriate. Pearson correlations were also calculated for numerical variables. P values <0.05 were considered statistically significant.

Results

A total of 211 patients diagnosed with poisoning from January 2010 to December 2011 were included in the analysis. The patient characteristics are presented in Table 1, and Table 2. Of the 211 patients, 143 (67.8%) were female and 68 (32.2%) were male.

The most common cause of poisoning (type of poisoning) was suicide 185 (87.7%). Also, the main route of exposure was oral 197 (93.4%), and thence ICU mortality was 3 (1.4%).

The agents causing the greatest number of poisonings among our patients were drugs (75.3%). The agents to which patients were exposed are listed in Table 3.

The most common drugs causing poisoning were antidepressants (including tricyclic antidepressants) (38.3%). The drugs involved in the poisonings are listed in Table 4.

There was a weak positive relationship between the time between exposure and ICU admission and the ICU LOS (PC=0.18, p=0.009, Pearson's correlation).

Characteristics of patients receiving MV are presented in Table 5. The need of MV was significantly related to both gender (p=0.04) (Yates' corrected chi-square test) and the route of exposure (p<0.001) (Pearson's chi-square test).

The need of MV was also significantly related to type of poisoning (p=0.01, Fisher's exact test) and the toxic agents (p<0.001, Pearson's chi-square test).

There were very strong relationships between the drug causing the poisoning (antipsychotics, cardiovascular drugs, unknown) and gender (p=0.002, Pearson's chi-square test) and between type of poisoning and gender (p=0.006, Yates' corrected chi-square test).

There was no significant relationship between the drug causing the poisoning and MV (p=0.12, Pearson's chi-square test).

Outcomes were that 208 (98.6%) patients discharged from the ICU without sequelae and 3 (1.4%) deaths.

Table 1. Demographic characteristics of poisoning patients by gender and ages (n=211)

Variable of interest	n %
Male	68 (32.2)
Female	143 (67.8)
17-25 years	112 (53.2)
26-35 years	52 (24.6)
36-45 years	26 (12.3)
More than 46 years	21 (9.9)

Discussion

The present study demonstrated that gender, type of poisoning, the toxic agents, the route of exposure and the ICU LOS were related to the need of MV based on the results of the current study. The need of MV was higher in female, oral route of exposure and suicide attempt and drugs poisoning.

In many studies carried out in Turkey, the most common cause of poisoning were suicide. The rates of suicidal reasons in poisoning were 63.5% (8), 78.5% (9), 87.0% (10). In the present study, the rate of suicidal reasons was 87.7%. Different from other developing countries in Turkey the great majority of patients used drugs and suicide rate were very high. The cause of this high rate may be the mild accidental poisonings by traditional methods (yoghurt, vomiting etc.) and these patients poisoned with mild accidental have not been applied to the hospital in these regions as noted by Akbaba (10).

Previous studies have shown that deliberate self-poisoning is more common in females and that the majority of patients are 21-30 years old (1,4,9). The present study confirms these past results; 143 (67.8%) of the patients were female, and 53.2% were 17-25 years old.

The predominant cause of poisoning (type of poisoning) differs from country to country. In developed countries, drugs are common poisoning agents taken by adults, but this varies in developing countries, where the use of drugs for suicide is rare. The most common agents for poisoning in developing countries (i.e., India) are pesticides (11). Singh et al. (6) reported that pesticides were the most common agents for acute poisoning in the Indian subcontinent due to their wide availability and that the drugs were more common in Western countries. The mortality rate for self-poisoning is far greater in the tropics than in the industrialized world because of the toxicity of the available poisons and the paucity of medical services (11). In previous reports from Turkey, drugs caused the great majority of all acute poisoning. The rates

Table 2. Demographic data of patients admitted the ICU (n=211)

Variable of interest	n (%)
The time between exposure and ICU admission	63 (29.9)
Less than 2 hours	110 (52.1)
2-6 hours	38 (18.0)
More than 6 hours	
The type of poisoning	
Suicidal	185 (87.7)
Accidental	26 (12.3)
The route of exposure	
Oral	197 (93.4)
Intravenous	3 (1.4)
Inhaler	11 (5.2)
The type of drug taken	
Single agent	129 (61.1)
Multiple agents	82 (38.9)
The owner of the poisoning agent	
The patient	99 (46.9)
Someone else	112 (53.1)
A history of previous toxicity	
Exist	37 (17.5)
No	174 (82.5)
Consciousness status on arrival	
Conscious	134 (63.5)
Confused	51 (24.2)
Unconscious	26 (12.3)
The length of the ICU stay	
0-1 day	111 (52.6)
2-3 day	89 (42.1)
3- more day	11 (5.3)
Use of MV	
Exist	13 (6.2)
No	198 (93.8)
The Glasgow coma score at admission	
GCS 15-11	152 (72.0)
GCS 10-8	46 (21.8)
GCS 7-3	13 (6.2)
Outcome	
Cured	208 (98.)
Died	3 (1.4)

Figures are numbers (percentages).

ICU, Intensive care unit; GCS, Glasgow coma score; MV, Mechanical ventilation

Table 3. The agents to which patients were exposed (n=211)

Agents	n (%)
Drugs	159 (75.3)
CO	10 (4.7)
Pesticides	27 (12.8)
Corrosives	3 (1.4)
Alcohol	2 (0.9)
Food	10 (4.7)

Figures are in numbers (percentages)
CO, Carbon monoxide.

Table 4. The drugs involved in the poisonings (n=159)

Drugs	n (%)
Tricyclic antidepressants	21 (13.2)
Antipsychotics	14 (8.8)
Analgesics	30 (18.9)
Antiepileptic	12 (7.5)
Antibiotics	9 (5.7)
Antidiabetics	3 (1.9)
Cardiovascular drugs	16 (10.1)
Antidepressants	40 (25.2)
Unknown	14 (8.8)

Figures are numbers (percentages)

were 71.1% (10) and 75.8% (9). In the present study, 75.3% of all poisonings was caused by drug intake. This situation is similar to many studies in Turkey and in the literature (12,13).

The most common drugs used in poisonings were antidepressants (including tricyclic antidepressants). Similarly, previous studies have found that psychotropic drugs, particularly benzodiazepines, are the most commonly used agents in poisonings (1,14).

It has been reported that the typical ICU LOS is 1 or 2 days and stays longer than 2 days can be defined as prolonged stays (1). The ICU LOS was less than 3 days and 1.5 days in the studies of Lamminpaa et al. (15) and Thomas et al. (16), respectively. Several studies have evaluated the risk factors for prolonged LOS in the ICU at the time of admission. Liisanantti et al. (1) reported that respiratory failure, renal failure, and a low platelet count were risk factors for a prolonged ICU LOS while Thomas et al. (16) reported that the mean hospital stay was longer for the elderly. Geoffrey et al. (17) have shown that overdose patients are at risk for aspiration pneumonitis and reported that these patients had a significantly longer LOS, an increased ICU

Table 5. Characteristics of Patients Receiving MV. (n=13)

Age/Gender	The type of poisoning	The toxic agents	The route of exposure	The time exposure and admission (hours)	Consciousness status on arrival	The GCS score	Duration of MV(days)	ICU stay (days)	Complication	Outcome
1 39/ M	Suicide	Antipsychotics	Oral	3	Unconscious	5	3	4	Hypertension	Cured
2 21/ M	Suicide	Analgesics	Oral	12	Unconscious	5	2	4		Cured
3 21/ F	Suicide	Antidepressants	Oral	6	Unconscious	5	5	5	Ventilator-associated pneumonia	Cured Died
4 19/ F	Accidental	CO	Inhaler	10	Unconscious	6	4	6	Ventilator-associated pneumonia	Cured
5 24/ F	Suicide	Antiepileptic, Analgesics	Oral	6	Unconscious	5	12	15	Aspiration pneumonia	Cured
6 39/ M	Suicide	Pesticides	Oral	8	Unconscious	6	3	4		Cured
7 23/ F	Suicide	Antipsychotics	Oral	6	Unconscious	7	3	4		Cured
8 31/ F	Suicide	Antidepressants	Oral	3	Unconscious	6	3	5		Cured
9 28/ M	Accidental	CO	Inhaler	5	Unconscious	5	5	5	Ventilator-associated pneumonia	Cured Died
10 63/ M	Suicide	Pesticides	Oral	4	Unconscious	4	11	11	Ventilator-associated pneumonia	Died
11 27/ M	Accidental	CO	Inhaler	10	Unconscious	6	1	3	Sleep disturbance and agitation	Cured
12 51/ M	Accidental	CO	Inhaler	6	Unconscious	5	1	3		Cured
13 32/ M	Accidental	CO	Inhaler	7	Unconscious	5	3	4	Sleep disturbance and agitation	Cured

ICU, Intensive care unit; GCS, Glasgow coma scale; MV, Mechanical ventilation; M, Male; F, Female; CO, carbon monoxide

admission rate, and an increased rate of MV. In the present study, 200 (94.7%) patients had ICU stays less than 3 days, in accordance with the results from previous studies performed in developed countries. A longer ICU LOS was also observed for patients who received MV.

Prkacin et al. (18) indicated that the rates of a history of previous suicide attempts were 14%. Thirty-three patients (17.5%) had a history of previous toxicity in the present study. This result is consistent with the report of Prkacin et al. (18). However, no relationship was observed between a history of previous toxicity and receiving MV or mortality.

It was reported that the mortality rate were 1.5 % (1), 2.6 % (4), 1.2 % (9) in previous studies. In the present study, the mortality rate was 1.4% and similar to previous studies (1,4,9).

More than 300,000 patients are estimated to receive MV in the ICU in the United States each year. Depending on the risk factors for respiratory failure, the in-hospital mortality rate is nearly 50%. One common indication of MV is acute respiratory failure, and this indication is similar in all countries (19). For patients receiving MV, the outcomes depend on the severity of the illness, the in-hospital MV volume, and the case mix. (20) Estaban et al. (21) reported that survival among MV patients depends not only on the factors present at the start of MV but also on the development of complications and on patient management in the ICU.

A review of the literature has indicated that no studies have investigated the relationship between poisoning and the use of MV. In the present study, 13 patients (6.2%) received MV; 8 (61%) were male, 6 (46.2%) were poisoned with drugs, 4 (30.8) were poisoned with CO, and 3 (23.1) were poisoned with pesticides. These patients had much longer ICU LOS than the patients who did not receive MV.

Carbon monoxide (CO) poisoning is a serious matter during winter season in Turkey, because coal stove are being used for heating in some regions. We observed that the need of MV was more common accidental poisonings (especially CO) than suicidal poisonings. Of 26 patients with

accidental poisonings, 5 (19.2%) patients needed MV and of 185 patients with suicidal poisonings, 8 (4,3%) patients needed MV.

Liisanantti et al. (1) reported that lowered consciousness and GCS are important reason for requiring MV and the ICU admission of intoxicated patients. Similarly all our patients who need of MV were unconscious and GCS was low. The main reason for the need of MV was central nervous system and respiratory depression, and in eight patients were seen respiratory depression.

Mechanical ventilation is a life-saving intervention, however the weaning process (discontinuation MV) may be difficult in the poisoning patients associated with important complications, such as nosocomial pneumonia, prolonged ICU stay, and even mortality, especially in those with persistent weaning failure (22). Five of thirteen patients receiving MV showed signs of pneumonia. Sleep disturbance and agitation were seen in two patients receiving MV and, hypertension was observed in one patients receiving MV.

Limitation

This retrospective study was performed at a single medical center and was based on medical records. Although the necessary precautions taken in order to avoid bias, medical records could contain errors that can bias retrospective studies.

Conclusion

This retrospective study demonstrated that there were significant relationships between the need of MV and gender, type of poisoning, the toxic agents, the route of exposure and the ICU LOS. The need of MV may lead to poor outcome as it is associated with higher incidence of ventilator related complications and longer ICU stay.

Conflict of Interest

Authors reported no conflicts of interest.

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