

Analysis of suicidal patients admitted to the emergency rooms and their intensive care requirements: A double-center study in Turkey

Betül Kocamer Şimşek^{1*}, Şengül Kocamer Şahin²

Abstract

Objective: In the present study, the clinical and socio-demographic data of the patients who admitted to the emergency department due to suicide attempt, the duration at the emergency department, and hospitalizations are examined. Requirement of intensive care and duration of hospitalization are investigated in the patients with suicide attempt.

Materials and Methods: Patients who were admitted to the emergency department of the hospitals after suicide attempts between 2015 and 2017 and per 2018 were included in the retrospective study. Reason for suicide, suicide modality, duration between the suicide attempt and arrival to the emergency department, suicide time, first treatment at the emergency department, hospitalization, mortality, and the levels at the intensive care unit (ICU) were retrospectively reviewed and analyzed. Data obtained from the archives of the hospitals. SPSS 25.0 (IBM Corporation, Armonk, New York, United States) program was used to analyze the variables.

Results: In the present study, 428 patients were included. Ratio of the female to male patients was 319/109. The mean age of the patients was 29.18±10.48. 205 patients were single. 136 patients were unemployed. Ninety-four (22.87%) patients were diagnosed with a psychiatric disorder. Four hundred twenty-two (98.59%) of the patients were attempted suicide with drugs/toxics. One hundred ninety-seven patients (49.75%) reported domestic violence and family issues reasons for suicide. Mean duration between the time of suicide and the time to arrive to the emergency department was 100.53±91.82 minutes. One hundred thirty (30.5%) patients were transferred to ICU, and 45 (10.5%) patients were followed in clinical departments. One hundred twenty (92.3%) patients hospitalized in the first-level ICU, 4 (3%) in the second-level ICU, and 6 (4.6%) in the third-level ICU. The mean ICU stay was 2.37±1.48 days.

Conclusion: The suicide attempts were prominent in acute poisoning cases. Majority of the patients stated domestic violence and family issues as a reason of suicide. They were discharged mostly from the emergency department and 10.5% of the patients were kept under surveillance in the departments. When the suicide attempts were evaluated in terms of their time, they were observed during day time at a higher rate.

Keywords: Suicide; Intensive care; Emergency

Introduction

Suicide is a public health problem that concerns communities, provinces and all the countries. More than 800.000 people die each year due to suicide. Suicide is the second most important cause of death between 15- and 29-years old patients worldwide (1). Methods of suicide attempt vary according to the countries. The most frequent suicide methods are over dosage, hanging themselves, asphyxiation, jumping out, pesticide poisoning, and use of firearms (2). Pesticide intake is one of the most common methods of suicide attempt globally (1). Most frequently used two methods of suicide leading to death in Turkey are hanging oneself and the use of firearms (3). The patient with suicide attempt can be discharged or hospitalized

based on the examination. The need for medical attention and interventions after a suicide attempt varies from 22% to 88% (4). Treatment settings include the department, intensive care unit, and the outpatient treatments. Severe suicide attempts, refusal of treatment, or mental state changes with metabolic, toxic, infectious situations or any other etiology generally require hospitalization (5). In Nordic countries, the rate of the patients requiring intensive care only after overdose varies between 3% and 15.7% (6).

There are limited numbers of studies in which suicidal attempts and the follow-up of the treatment at the intensive care unit are considered and there are no large-scale studies



including the interventions at the emergency department and the follow-ups at the intensive care unit in Turkey.

There is a rapidly increasing trend in suicide attempts in Turkey especially in respect of elderly suicides (7,8) and suicidal patients who are required intensive care, poses a significant cost to the health care system in Turkey (9). Current studies in this area are mostly investigated patients who were admitted ICU due to suicide (10). In other perspective, this study investigates the rate of the patients who were in need of intensive care or followed up under clinical conditions after suicide attempt. In this exploratory study, the clinical and socio-demographic data of the patients with suicide attempt who admitted to the emergency department, duration of admission to the emergency department, and hospitalizations are examined. Requirement of intensive care and duration of hospitalization are investigated in the patients with suicide attempt.

Material and Methods

Data collection: The present study was retrospectively conducted at Adana State Hospital and Sanko University Hospital of Faculty of Medical. Approval for the study was granted by the Institutional Ethics Committee of Sanko University, Gaziantep, Turkey (No: 2017/01-4 date: 25.01.2017). Patients who were admitted to emergency departments of the hospitals after suicide attempts between 2015 and 2017 and per 2018 were included in the study. The file numbers, and hospitalization process of the patients were retrospectively reviewed from central electronic file system of the two hospitals. This system includes all data of procedures applied to patients in hospital. Suicide time, arrival time, suicide pattern and reasons were reviewed from the paper charts which had been applied to patients by a nurse and a psychologist when the patient had admitted to emergency due to suicide. Age, gender, relationship status, employment status, alcohol or substance abuse, history of psychiatric disorders, history of chronic illnesses, reason for suicide, suicide modality, previous suicide attempts, history of suicide in family members, duration between the suicide attempt and arrival to the emergency department, suicide time, initial treatment at the emergency department, hospitalization, mortality, and intensive care unit (ICU) levels were retrospectively reviewed and analyzed. If the answers for the said elements were not present in the hospital registries, they were recorded as missing data. Patients' information were received as anonymized.

Statistical analysis: SPSS 25.0 (IBM Corporation, Armonk, New York, United States) program was used to analyze the variables. Chi-Square and Binominal tests are used for the homogeneity of categorical variables, Fisher-Freeman-Holton tests are used for the comparison with each other and they are tested by using the Monte Carlo Simulation technique. The ratios of the columns are compared with each other and expressed according to the Bonferroni corrected p value results. Quantitative variables were shown as mean \pm SD (Standard Deviation) and median (Minimum/maximum) and categorical variables as n (%) in the tables. The variables were examined at

confidence level of 95% and p value less than 0.05 was accepted as significant.

Results

Totally 458 patients were detected in this review of inpatients records. Patients who have missing data (suicide time, reason etc.) were excluded from the study. Rest of the patients (428) were included the study. Ratio of the female to male patients was 319/109. The mean age of the patients was 29.18 \pm 10.48. Most of the patients were married (n=189) and single (n=205) and others were widow (n=20) or divorced (n=14). The patients were mostly unemployed. One hundred nine patients were housewives (n=109), 103 were working in a job, 58 were students and 3 were retired. Table 1 shows the sociodemographic data of the patients.

Table 1. Demographic data of the cases

	n (%)
Gender	
Female	319 (74.53)*
Male	109 (25.47)
Relationship status	
Single	205 (47.90)*
Married	189 (44.16)*
Widow	20 (4.67)
Divorced	14 (3.27)
Occupying	
Unemployed	136 (33.25)*
Working in a job	103 (25.18)
Housewife	109 (26.65)
Student	58 (14.18)
Retired	3 (0.73)
Age (n: 428)	
Mean \pm SD.	29.18 \pm 10.48
Median (Min./Max.)	26 (14 / 67)

Ninety-four patients were diagnosed with a psychiatric disorder, and ninety of them were receiving treatment. Sixteen patients were diagnosed with chronic illnesses as diabetes mellitus, hypertension, cardiac problems and cancer, and 3 of these patients were diagnosed with neurological disorders. Fifteen patients had substance abuse and 31 patients had alcohol abuse. Eighty-five patients had attempted suicide previously, 23 of these patients had a history of suicide attempt in the family members and 21 of them had a history of psychiatric disorders in the family members. Medical history of the patients was analyzed, and they are shown in table 2. **Other comorbidities are diabetes mellitus, hypertension, cardiac problems and cancers. Four hundred twenty-two of the patients were attempted suicide with drugs/toxic substances. Of these patients, 3 attempted suicide with cutting tools, 2 by jumping over (1=4th floor, 1=2nd floor), and 1 by gunshot (died within 12 hours).

The reasons for attempting suicide were analyzed, and 396 patients specified the reason, but 32 patients did not want to give information. In the said 396 patients, majority stated the reason as domestic violence and family issues (n=197) followed by chronic illnesses, (n=64) and others specified the reason as communication problems (n=46), sexual

problems (n=28), economic problems (n=18), loneliness (n=12), alcohol/substance abuse (n=9), parental conflicts (n=8), exams (n=8), Death/lost (n=6), juvenile problems (3), and school (n=2). Table 3 shows the suicide modality of the patients.

Table 2. Medical history of patients

History	n (%)
Alcohol abuse	
Yes	31 (7.29)
No	394 (92.71)*
Substance abuse	
No	408 (96.45)*
Yes	15 (3.55)
Comorbidities	
None	409 (96.23)*
Other **	13 (3.06)
Neurological	3 (0.71)
Psychiatric disorder	
None	317 (77.13)*
Yes	94 (22.87)
Psychiatric treatment	
None	293 (76.50)*
Yes	90 (23.50)
History of suicide attempt before	
No	335 (79.76)*
Yes	85 (20.24)
History of suicide attempt in family members	
No	353 (93.88)*
Yes	23 (6.12)
Psychiatric disorder in family members	
No	341 (94.20)*
Yes	21 (5.80)

Table 3. Suicide descriptive.

Suicide modality	Numbers (%)
Drugs/toxics	422 (98.59)*
Cutting tools	3 (0.70)
High jump	2 (0.47)
Gun	1 (0.24)
Reason for suicide attempt	
Domestic violence and family issues	197 (49.75)*
Chronic illnesses	64 (16.16)
Communication problems	46 (11.62)
Sexual problems	23 (5.81)
Economic problems	18 (4.54)
Loneliness	12 (3.03)
Alcohol/substance abuse	9 (2.27)
Parental conflict	8 (2.02)
Exams	8 (2.02)
Death/lost	6 (1.52)
Juvenile problems	3 (0.76)
School	2 (0.51)
Suicide time	
[24:00-06:00]	75 (18.9)*
[06:00-18:00]	174 (43.9)
[18:00-24:00]	147 (37.1)

The times of suicide attempts were examined in three different periods: evening period (18:00-23:59), night period (00:00-05:59), and day time period (06:00-17:59). The records of the times of suicide attempts were available in 396 patients. Most of the patients attempted suicide

during the day time period (n=174), secondly in the evening period (n=147), and finally in the night period (n=75) (table 3). Table 4 shows the descriptive characteristics of ICU and the emergency department. Four hundred twenty patients were treated with gastric lavage and activated charcoal in the emergency department, 3 patients with tracheal intubation and transferred to ICU, and 3 patients with tracheal intubation and then immediately transferred to the operating room. One hundred twenty (92.3%) patients hospitalized in first-level ICU, 4 (3%) in second-level ICU, and 6 (4.6%) in third-level ICU.

Table 4. ICU and emergency room descriptives.

Steps in ICU	n (%)
1.Step	120 (92.3) *
2. Step	4 (3)
3. Step	6 (4.6)
Stay in hospital	
Discharge from emergency room	251 (58.9)*
ICU	130 (30.5)
Clinical Services	45 (10.5)
Treatment in emergency room	
Gastric lavage and activated charcoal	420 (98.5)*
Tracheal intubation and transfer to ICU	3 (0.7)
Tracheal intubation and transfer to operating room	3 (0.7)
Treatment in ICU	
Monitored Care	120 (92.3) *
Hemodialysis	4 (3)
Mechanical ventilation and Hemodialysis	3 (2.3)
Mechanical ventilation and operation	3 (2.3)
Discharge from ICU	
Discharged	129 (99.24)*
Death	1 (0.76)

Two hundred fifty one patients were discharged from the emergency department, 130 patients were transferred to ICU, and 45 patients were followed in clinical departments. Mean duration between the time of suicide attempt and the time to arrive to the emergency department was 100.53±91.82 minutes (n=416) (table 5). Sixty-three female and 40 male patients were working in a job, and 92 female patients and 44 male patients were unemployed. The reasons for suicide attempts were mostly domestic violence and family issues (52.7%) in female patients and were mostly the economic problems (13.5%) and illnesses (13.5%) in male patients. The most common cause in all relationship status when the relationship status and the reason of suicide are compared is domestic violence and domestic problems. Similarly, the most common causes in employment conditions when the employment status and the reason of suicide are compared, are domestic violence and domestic problems. Table 6 shows the relationship status, and the occupational status.

Table 5. Time to reach to the emergency room and Stay in ICU.

	Mean±SD.	Median (Min/Max)
Time to reach to the emergency room (min)	100.5±91.8	60 (6 / 540)
Stay in ICU (day)	2.37±1.48	2 (1 / 12)

Table 6. Relationship between suicide reasons and gender, relationship status, occupying. *p<0.001

	Gender			Relationship status					Occupying				
	Female n (%)	Male n (%)	Single n (%)	Divorced n (%)	Widow n (%)	Married n (%)	Working in a job n (%)	Unemployed n (%)	Retired n (%)	Housewife n (%)	Student n (%)		
Domestic violence and family issues	158 (52.7)*	39 (40.6)	69 (37.3)*	9 (64.3)*	7 (41.2)*	112 (62.2)*	51 (52)	51 (40.8)	1 (50)	64 (61)*	20 (39.2)		
Alcohol/substance abuse	1 (0.3)	8 (8.3)	9 (4.9)	0 (0)	0 (0)	0 (0)	3 (3.1)	4 (3.2)	0 (0)	0 (0)	2 (3.9)		
Sexual problems	15 (5)	8 (8.3)	16 (8.6)	0 (0)	1 (5.9)	6 (3.3)	5 (5.1)	6 (4.8)	0 (0)	5 (4.8)	5 (9.8)		
Parental conflict	7 (2.3)	1 (1)	7 (3.8)	0 (0)	0 (0)	1 (0.6)	0 (0)	7 (5.6)	0 (0)	0 (0)	1 (2)		
Economical problems	5 (1.7)	13 (13.5)*	7 (3.8)	0 (0)	0 (0)	11 (6.1)	6 (6.1)	9 (7.2)	0 (0)	1 (1)	1 (2)		
Juvenile problems	2 (0.7)	1 (1)	3 (1.6)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (5.9)		
Chronic illnesses	51 (17)	13 (13.5)*	29 (15.7)	3 (21.4)	5 (29.4)	27 (15)	22 (22.4)	19 (15.2)	1 (50)	18 (17.1)	4 (7.8)		
Communication problems	35 (11.7)	11 (11.5)	26 (14.1)	1 (7.1)	1 (5.9)	18 (10)	11 (11.2)	15 (12)	0 (0)	12 (11.4)	7 (13.7)		
School	2 (0.7)	0 (0)	1 (0.5)	0 (0)	0 (0)	1 (0.6)	0 (0)	0 (0)	0 (0)	0 (0)	2 (3.9)		
Death/lost	6 (2)	0 (0)	2 (1.1)	0 (0)	2 (11.8)	2 (1.1)	0 (0)	2 (1.6)	0 (0)	4 (3.8)	0 (0)		
Exams	6 (2)	2 (2.1)	8 (4.3)	0 (0)	0 (0)	0 (0)	0 (0)	5 (4)	0 (0)	0 (0)	3 (5.9)		
Loneliness	12 (4)	0 (0)	8 (4.3)	1 (7.1)	1 (5.9)	2 (1.1)	0 (0)	7 (5.6)	0 (0)	1 (1)	3 (5.9)		

Discussion

As reported from Turkish Statistical Institute, the number of suicides that resulted in death was 3 thousand 169 in the revised 2014, while it increased by 1.3% in 2015 and became 3 thousand 211, also 72.7% of the suicides were men and 27.3% were women.

The time of suicide per hundred thousand population, and in 2015, it remained unchanged at 4,11 per hundred thousand. In other words, four of every hundred thousand people committed suicide in 2015 (11).

It is critical to understand the extent of suicide attempts in order to develop the protection and intervention programs. The present study contributes to the literature regarding the suicide modalities, duration between the suicide attempt and arrival to the emergency department, time of the suicide attempt, first treatment at the emergency department, hospitalization, and the intensive care unit (ICU) stages in order to monitor suicide-related treatment level.

Previous studies found that suicide attempts are higher in females and males are more likely to have completed suicide (12,13). Similarly, in the present study, the number of suicide attempts were higher in women than in men and 1 person who died due to a suicide attempt was male. Also, being single acts as a risk factor for a suicide attempt (14). Consistently, it was found that suicide attempts were higher in singles.

In the present study, the predominant method for suicide attempt was drug intoxication, and the second reason was slitting his/her wrists. Only 3 patients attempted suicide by slitting their wrists. Drug overdose was found the most common way of attempting suicide in also adolescents like adults (15). This frequency is compatible with the previous studies regarding suicide attempt (13).

Psychiatric disorders, history of suicidal behaviors, and substance abuse are important risk factors for suicide attempt (16,17). In the current study, 94 patients were diagnosed with a psychiatric disorder, 15 had substance abuse, 31 had alcohol abuse, and 85 had a previous suicide attempt. The approaches to interpersonal/relationship problems, psychiatric morbidity may be complementary for the doctors at the emergency department as well as the psychiatrists.

There is a significant correlation between domestic violence and suicide attempt tendency in developing countries (18,19). In the current study including 396 patients, most of the patient stated domestic violence and family issues (n=197) as the reason for a suicide attempt followed by chronic illnesses.

The results of the studies regarding the times of suicide attempt are not consistent. In the present study, the highest incidence rate for suicide attempt was the day time period (06:00-17:59). Times of suicide attempts are analyzed in different time intervals (ex. Most frequent time intervals according to the studies are 15.00-18.00, 06.00-16.00, 12.00-16.00, 8.30-12.30) (20-21), it may be considered that

the suicide attempts are more frequent when the patient is awake in the day time.

One of the distinctive results of the present study is how long the patients reach the emergency department after suicide attempt. In a study conducted in Turkey, the median time from the exposure to substance intake to the ED was 2 hours (22,23). It took 100.53 ± 91.82 minutes to arrive to the emergency department after any suicide attempt in the current study. 130 (30.5%) patients were transferred to ICU, and 45 (10.5%) patients were followed in the clinical departments. The mean ICU stay was 2.37 ± 1.48 days.

The patients who needed intensive care due to suicide attempts were also examined. In a previous study, it was determined that 12.8% of the patients, who applied due to suicide attempt, were admitted to ICU (22). In the present study, 130 (30.5%) patients were transferred to ICU. According to the classification of the ICU levels, 120 patients with suicide attempts, who took drugs, were kept in ICU at first level, 4 patients at the second level (one needed CPAP ventilation, two needed hemodiafiltration, 1 had a Glasgow coma scale of 10). Mechanical ventilation was required for 6 patients, so they were accepted as the ICU level 3. Two of these patients jumped from a high place, 1 attempted suicide with a gun, and 3 had a respiratory failure due to the use of drugs. All the patients in the 1st level were accepted to ICU due to the possible adverse events like arrhythmia, loss of consciousness and respiratory, cardiac, renal or hepatic failures and they were monitored according to the said adverse events as mentioned in the previous studies (6).

In a study in Turkey, it was determined that the rate of deaths caused by the suicide attempts by using drugs is 6%. In another study, this rate was found to be 0.1% (24, 25). According to the findings of World Health Organization, mortality rate after a suicide attempt is 11,4 per 100.000 (1,25,26). In the current study, it was found that 1 patient died by blowing his/her brains out in a suicide attempt. No patient died due to the suicide attempts by using drugs. The result supports the low mortality rate in the suicide attempts in Turkey.

A major limitation of this study is the retrospective design. There are no detailed psychiatric examination findings in the emergency departments.

Conclusion

The suicide attempts were prominent in acute poisoning. Majority of the patients stated domestic violence and family issues as a reason of suicide. They were discharged mostly from the emergency department and 10.5% of the patients were kept under surveillance in the departments. When the suicide attempts were evaluated in terms of their time, they were observed during day time at a higher rate.

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References

1. World Health Organization. 2014. Preventing Suicide: A Global Imperative.
2. Bachmann S. Epidemiology of Suicide and the Psychiatric Perspective. *Int J Environ Res Public Health*. 2018; 15(7): 1425. doi: 10.3390/ijerph15071425
3. Enginyurt Ö, Özer E, Gümüş B, Demir EY, Çankaya S. Evaluation of suicide cases in Turkey, 2007–2012. *Med Sci Monit*. 2014; 20:614–62. doi: 10.12659/MSM.890689
4. Bertolote JM, Fleischmann A, De Leo D, Bolhari J, Botega N, De Silva D et al. Suicide attempts, plans, and ideation in culturally diverse sites: the WHO SUPRE-MISS community survey. *Psychol Med*. 2005; 35(10):1457-65.
5. American Psychiatric Association (APA). 2010. Practice guideline for the assessment and treatment of patients with suicidal behaviors.
6. Clark D, Murray DB, Ray D. Epidemiology and outcomes of patients admitted to critical care after self poisoning. 2011; 12
7. Yakar M, Temurçin K, Kervankıran I. Suicide in Turkey: its changes and regional differences. *Bulletin of Geography. Socio-economic Series*. 2017; 35(35): 123-144.
8. Koo Y W, Kölves K, De Leo D. Profiles by suicide methods: an analysis of older adults. *Aging & mental health*, 2017; 1-7.
9. Sut N, Memis D. Intensive care costs of acute poisoning cases. *Clinical Toxicology*, 2008; 46(5): 457–460. doi:10.1080/15563650701644295
10. Wolk-Wasserman D. The intensive care unit and the suicide attempt patient. *Acta Psychiatrica Scandinavica*, 1985; 71(6): 581-595.
11. http://www.tuik.gov.tr/PreHaberBultenleri.do?id=21516&utm_term=istatistik,nufus,enflasyon,sanayi,gsyih,demografi&utm_source=twitter&utm_medium=twitter
12. Canetto SS, Sakinofsky. The gender paradox in suicide. *Suicide Life Threat Behav*. 1998; 28(1):1-23.
13. Zeppego P, Gramaglia C, Castello LM, Bert F, Gualano MR, Ressler F, Coppola I, Avanzi GC, Siliquini R, Torre E. Suicide attempts and emergency room psychiatric consultation. *BMC Psychiatry*. 2015 ; 15: 13.
14. Davis AT, Schrueder. The prediction of suicide. *C Med J*. 1990; 5; 153(9): 552-4.
15. Doğan M , Öztürk S , Esen F , Demirci E , Öztürk MA " Evaluation of Child and Adolescents who Attempted Suicide." *Bozok Tıp Dergisi* 8.3: 30-34.
16. Moscicki EK. Epidemiology of completed and attempted suicide: toward a framework for prevention. *Clin Neurosci Res*. 2001; 1:310–23.
17. Yılmaz EB. "Psikiyatri Hastalarında Özkıyım Riskini Değerlendirme ve Yönetme." *Psikiyatride Guncel Yaklaşımlar-Current Approaches in Psychiatry* 2019; 11: 1-1.
18. Geneva, Switzerland: The World Health Organization; 2001. World Health Report; 42.
19. Yılmaz, N, Kugu, N, Kavakci, O, Dogan, O. "Psychopathology and sociodemographic characteristics in suicide attempters: a single center study." *Cumhuriyet Medical Journal* 40.3 (2018): 215-225.

20. Vollen KH, Watson CG. Suicide in relation to time of day and day of week. *Am J Nurs*. 1975; 75(2): 263
21. Williams P, Tansella M. The time for suicide. *Acta Psychiatr Scand*. 1987; 75(5): 532–5.
22. Altamura C, Van Gastel A, Pioli R, Mannu P, Maes M. Seasonal and circadian rhythms in suicide in Cagliari, Italy. *J Affect Disord*. 1999; 53(1): 77–85
23. Walker X, Lee J, Koval L, Kirkwood A, Taylor J, Gibbs J et al. Predicting ICU admissions from attempted suicide presentations at an Emergency Department in Central Queensland.. *Australas Med J*. 2013; 6(11): 536–541.doi: [10.4066/AMJ.2013.1730]
24. Kara H, Bayir A, Degirmenci S, Kayis SA, Akinci M, Ak A et al. Causes of poisoning in patients evaluated in a hospital emergency department in Konya, Turkey. *J Pak Med Assoc*. 2014; 64(9): 1042-8.
25. Taktak S, Uzun I, Balcioglu I. Gender differences in completed suicides in Istanbul, Turkey. *J Affect Disord*. 2013; 145: 394-9.
26. Junior DFM, Felzemburgh RM, Dias AB, Caribé AC, Bezerra-Filho S, Miranda-Scippa A.. Suicide attempts in Brazil, 1998–2014: an ecological study. *BMC Public Health*. 2016; 16: 990.

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