

The Effective Factors on Survival in Near-Hanging

Abstract

Aim: Neck hanging is one of the most lethal suicide methods. The morbidity and mortality due to hanging is usually associated with neck's structure injury attached to a fall from height, venous obstruction and cerebral hypoxia time. Mortality is usually caused by respiratory failure in patients who recovered from hanging. In this study, we aimed to investigate effective factors on mortality in cases of neck hanging.

Materials and methods: Socio-demographic data of 43 out of 2006-2013 patients brought to our hospital because of neck hanging were analyzed retrospectively. The first arrival time of clinical signs of the patient, laboratory findings and complications due to hanging were recorded. The effects of these findings on mortality are examined.

Results: 35% of the 43 patients were included in the study were female gender. The mean age of the patients was 21.4±6.8 minutes. The estimated time was found to be 25±12 (minimum-maximum 3-60) minutes. 26 patients (68.4%) were lost their life. The Glasgow coma score of the majority of patients who died was less than 7. Among the most common complications associated with hanging, laryngeal edema (60%) was observed. Among the most common complications during the intensive care, pulmonary infection (18.5%) was developed.

Conclusion: The most important factor in terms of effectiveness over mortality for hanging were observed to be time increment of hanging and low Glasgow coma score. We recommended that the cases of near hanging should be aggressively resuscitated and treated regardless of their bad initial findings.

Keywords: Near hanging, Intensive care unit, Glasgow of coma score

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Introduction

Hanging is the most mortal suicide methods after the gunshot wounds in many countries.¹ In hanging the morbidity and mortality occur due to venous obstruction and cerebral hypoxia, laryngeal edema and delayed airway obstruction, increased vagal tone, injury of neck structures (thyroid cartilage/hyoid bone fracture/laryngeal rupture) pulmonary complications (aspiration pneumonia, development of adult respiratory distress syndrome, pulmonary oedema secondary to negative intrathoracic pressure due to attempted inspiration in upper airway obstruction or centrally mediated sympathetic discharge leading to generalized vasoconstriction), subarachnoid hemorrhage, hyperthermia, status epileptics.²

Despite hanging has high fatality rate, survival is possible even after prolonged periods of suspension, and the term near hanging refers to patients who initially survive the attempt.³ The most effective factors on survival are the compression of low body weight and neck structures in near hanging.⁴ Some factors such as Systolik blood pressure < 90, Glasgow koma skoru (GCS) < 8, anoxic brain injury on CT scan, and Injury Severity Scor > 15 were found to be significantly associated with mortality in near-hanging.⁵ In the present study we aimed to investigate the prognostic factors on the survival rate of the near hanging patients treated in intensive care unit (ICU).

Material and methods

In this study, patients diagnosed and treated between 2006 and 2013 at the university hospital, ICU were analyzed retrospectively. The all cases of patients such as age, gender, the hanging reason, whether he/she comes from the epicenter or not, the first admission time, physical examination findings, laboratory data and psychiatric status in their resume were recorded. In addition, the presence of intubation in the intensive care unit, duration of intubation, intensive care unit length

of stay, complications in the intensive care unit and discharge status were recorded. Patients were divided into two groups as survivors and deceased. SPSS 18 (Statistical Packages for Social Sciences) program was used for statistical analysis of the data obtained in the study. Data were presented as mean±standard deviation, minimum and maximum values. The analysis of the data between the two groups were evaluated by Mann-Whitney U test and effective factors on mortality were evaluated by chi-square test.

Results

The study included 43 patients. Of them 28 (65%) were male, and 15 (35%) were female. The mean age of the patients was 21.4±6.8 (range 4-38)years. The subjects were divided into two groups as died and survived. Twenty six of 43 patients (Group D) were died and 17 of them (group S) survived. Comparisons between groups showed no statistically significant difference with respect to age, gender and body weight ($p=0.77$, $p=0.48$ and $p=0.8$ respectively). 5 of the patients were intubated during the first responders, 8 of them were intubated at the ICU and 25 were intubated at emergency services. 26 (68.4%) out of 38 (88%) patients who were followed as intubated died, whereas the non-intubated patients survived. The estimated average duration of hanging was 25±12 (min-max:3-60)minute, and mortality was significantly increased as the hanging time increased ($p<0.001$). The demographics of the patients were summarized in Table 1.

The relationship between the initial clinical findings and survival cases are presented in Table 2. 17 (39.5%) out of 43 patients survived. All patients who had GCS>8 of evaluation made during first acceptance to the hospital were observed to survive. The relationship between recovery and first laboratory data of the patients are presented in Table 3. While laboratory data is dominated by acidosis in all patients, the patients who died had more severe acidosis. The relation between mortality and patients' growing pathologies associated with hanging

were examined (Table 4). Among the pathologies associated with hanging oneself, the most seen was laryngeal edema(60%). During monitoring in the intensive care, among the growing complications, the most developed one was pulmonary infection (18.5%).

Table 1 Demographic data

	Group S n=17	Group D n=26	P
Gender			
Male	10	18	0.48
Female	7	8	
Age	20.7±7.6	21.8±4.9	0.77
<18 years	4	3	
≥18 years	12	24	
Airway management			
Intubated	12	26	0.003
Non intubated	5	0	
Body weight*	65.1±13.5	66.7±7.3	0.8
Hanging time			
<10 min	8	0	<0.001
10-20 min	9	2	
>20 min	0	24	

*The 4 years old patient was not given

Table 2 The relationship of clinical parameters at the time of admission to hospital with survival

	Total patients, n	Group S, n (%)	Group D, n (%)	P
GCS				
3-7	30	4 (13.3)	26(86.7)	<0.001*
8-15	13	13 (100)	0	
MAP (mmHg)				
MAP<60	10	1 (10)	9(90)	0.04*
MAP≥60	33	15 (45.5)	18(54.5)	
Heart rate/min				
<60	8	0	8(100)	0.002*
≥60	35	18 (51.4)	17(48.6)	
Breath rate/min				
<10	19	1(5.2)	18(94.8)	<0.001*
11-20	10	3(33)	7(67)	
>21	14	13(92.8)	1(7.2)	
SpO2 (%)				
<85	30	6(20)	24(80)	<0.001*
≥85	13	12(92.3)	1(7.7)	

P<0,05

Table 3 The comparisons of the laboratory parameters between two groups at the admission to hospital

	Total (mean±SD)	Group S (mean±SD)	Group D (mean±SD)	P
pH	7.20 ±0.14	7.32±0.11	7.13±0.12	<0.001*
PO₂ (mmHg)	64±23	69±18	62±12	0.1
PCO₂ (mmHg)	43±9.6	37±7	46±10	0.05*
HCO₃ (mmol/L)	17±4.9	20±3	16±5	0.04*
WBC (10³/mm³)	16.1±4.7	15±5	17±5	0.2
Urea (mg/dL)	41±18	32±9	47±15	<0.001*
Creatinin (mg/dL)	1.22±0.4	0.7±0.3	1.5±0.2	0.002*
Aspartat transaminaz (U/L)	106±14	55±33	136±45	<0.001*
Alanin transaminaz (U/L)	79±11	37±15	100±55	<0.001*
Calcium (mmol/L)	8.1±0.5	8.2±0.2	8±0.4	0.4
Potasium (mmol/L)	4.1±0.6	4.1±0.1	4.1±0.8	0.3
Sodium (mmol/L)	139±5	135±5	141±7	<0.001*
Glucose (mg/dL)	191±64	155±26	208±58	<0.001*

P<0,05

Table 4 Effects of concomitant pathologies of patients on survival, Relationship between Complications and Mortality

	Total patient (n)	Group S n (%)	Group D n (%)	P
Cranial radiological imaging in the positive findings*	12	2(16,6)	10(83,4)	0,05*
Cervical spine injury	6	1(16,6)	5(83,4)	0,3
previous cardiac arrest	7	1(14,2)	6(85,8)	0,1
Neck injuries				
Laryngeal injury	8	1(12,5)	7(87,5)	
Tracheal injury	3	0(0)	3(100)	0,7
Laryngeal edema	26	10(38)	16(62)	
Pulmonary Complications				
Pneumothorax	3	2(66,6)	1(33,4)	
Pulmonary edema	3	2(66,6)	1(33,4)	0,09
Lung infections	8	5(62,5)	3(37,5)	
Convulsion	26	17(65,3)	9(34,7)	0,4

P<0,05* Brain edema, intracranial hemorrhage, hypoxic findings

Discussion

Hanging, a preferred type of suicide for especially men, is the most lethal suicide method after gunshot wounds. Death in hanging is caused by pressure-induced neck structures injuries or usually spinal cord trauma depending on body weight and falling from high.² When the methods of suicide attempts are analyzed, hanging's ratio is observed around 5%, but it rises to level of 30% in fatality attempts, and is located in the first row.⁶ The most of patients had attempted to hang themselves were constituted male gender and when the mean age was studied they were young population in many countries.^{5,7} It was observed that 72% of patients were male in the studies performed in our country and the average age of all patients was 37.⁴ Also, in our study, 65% of the patients were male and the mean age was found to be 21.4±6.8years. Having patients from the younger population may be caused by regional differences. Because, the younger population is relatively more dense in our region.⁸

Hang time is closely associated with mortality. The extension of the hanging period increases brain damage by increasing the duration and degree of anoxia. It also increases the likelihood of injury to the neck structures. It has been shown that there is less mortality if period of hanging is less than 5minute which is the critical threshold for hanging. However, mortality was increasing very significantly in cases hanging period was over 30min.⁷ In our study, the estimated mean hanging duration was 25±12min. All the patients who had less than 10minutes estimated hanging time survived. All the patients who had more than 20minutes hanging time died.

Initial GCS evaluation of patients were significantly assessed in terms of mortality and morbidity in the studies related hanging. However, even in cases like GCS was less than 7, mortality was found maximum 30%.^{5,7,9,10} Matsuyama et al.,¹¹ found that the presence of cardiopulmonary arrest, GCS arrival and hanging time was related to prognosis in 47 patients. However, 50% of the patients who had GCS>3 survived. In our study, mortality rate was found 90% which was a very high rate in patients with a GCS <7. The reason for so much less survival in our work was linked to much lower of GCS scores of the patients compared to other studies. Moreover, the complications and mortality rate has increased significantly due to too long arriving duration of our patients to hospital.

Penny et al.,¹⁰ found that GCS arrival was associated with poor prognosis, but they reported that the presence of cardiac arrest and low GCS were main determinant to survival of the patients. In our study, despite successful resuscitation of the 7 patients who had cardiac arrest, only one of them survived. Therefore, it may be said that

cardiac arrest adversely affected prognuz during initial application. When patients who had first systolic blood pressure of <90mmHg were defined as hypotensive in other studies done, it was found that there was a significant association between systolic blood pressure<90mm Hg and mortality.^{5,7} Also, in our study, higher mortality was observed in patients with hypotensive (mean arterial pressure <60 mm Hg) during the application. In addition, a significant relationship were observed between mortality and decline of heart rate and reduction in the number of respiratory. Therefore, the vital parameters during the first application may be instructive in determining the prognosis.

In patients hang themselves, hyoid bone fractures, laryngo tracheal injury, carotid injuries, and spinal injuries have been identified by result of the autopsy. Survivors of the hanging initiative and characteristic injuries are generally described in case reports. Very low rate of cervical spinal cord injury was observed, or it never seen in studies.^{5,12,13} In the literature, fracture was detected in the cervical spine of 4 (0.6%) out of 689 patients. In our study, the cervical spine fracture or dislocation of the cervical spine was observed in 6 (14%) out of 43 patients. This finding was a very high rate compared to other studies. This difference may depend on performing the preferred method of hanging act in a similar manner to the method of judicial hanging.

The most common observed injury was laryngeal dysfunction as 10.8% in neck structures associated with the hanging.⁷ Ali salim et al.,⁵ have identified laryngeal fracture in 3 (4.8%), tracheal fracture in 1 (1.6%), pharyngeal laceration in 1 (1.6%), and carotid artery injury 1 (1.6%) patient. Laryngeal injuries of the neck structure were found in 8 patients, tracheal injury was observed in 3 patients, and laryngeal edema was found in 26 patients in our study. Theoretically, this may reflect spontaneous rupture of vessels within a high-pressure venous system created by vascular obstruction. In other studies on cranial imaging, findings such as brain edema, cerebral hypoxia, and cerebral hemorrhage have been found between 13% and 30%.^{5,10,14} In our study, positive findings such as brain edema, intracranial hemorrhage and hypoxic had been revealed in cranial imaging of 23.3% of the patients.

As pulmonary complication the most seen cases were pulmonary edema and bronchopneumonia in the patients recovered from hanging and treated in hospital.¹⁵⁻¹⁷ The mechanism of pulmonary edema in near-hanging appears to be increasingly negative transpulmonary pressure during a forceful inspiration against a closed upper airway. Among our patients, 3 cases of pulmonary edema and 8 cases of pneumonia was observed. Those related to lung was the third most frequent in the entire complications. Effects of the lung findings on

mortality were not found. Epileptic seizure is a common finding in patients hang themselves and it was determined that 13.5% of patients had a seizure.^{7,18} In our study, it was found that 26(60.5%) of our patients had epileptic seizure during the first admission. The cause of cerebral hypoxia is the prevention of cerebral blood flow in hanging cases. Irreversible brain damage occurs as a result of interruption of cerebral blood flow with a 5-6 min period. Cerebral hypoxia with respiratory and/or metabolic acidosis is often an expected finding. It was found that mortality of the hanging patients with acidosis in their blood gas results was higher.¹⁹ In our study, by analysing blood gas, a significant relationship was observed between pH decrement, reduction of HCO₃, and SpO₂ decrement. However, a significant association was found between mortality and high K, Ca impairment, urea, creatinine, aspartate transaminase, alanine transaminase, high glucose. In conclusion, a hanging period greater than 20 minutes, a GCS less than 7 and a systolic blood pressure less than 60mm Hg increase significantly mortality in hanging patients in our study. We recommended that the cases of near hanging should be aggressively resuscitated and treated regardless of their bad initial findings.

Limitations

This study was carried out in our country, just based only on a specific geographical area and a specific time interval. Patients' findings, examinations and imaging's were reached retrospectively via patient files. It does not include the autopsy results.

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Conflicts of interest

Authors declare that there is no conflict of interest.

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