



Injury Patterns and Emergency Department Mortality After Unsuccessful Suicide. A Descriptive Study of a Consecutive Case Series

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We hypothesized that trauma bay management and 24-hour emergency department (ED) mortality of patients that survived unsuccessful suicide attempts differ from other patients. Severely injured patients after an unsuccessful suicide attempt can be admitted to resuscitation rooms of any ED. To our knowledge, 24-hour mortality has not been investigated yet. We studied such patients admitted to the resuscitation room of a large ED. This consecutive case series included 64 patients who were evaluated in the resuscitation room because of an unsuccessful suicide attempt. Patient variables were recorded including method of suicide attempt, injuries, hemodynamic status, and treatment. Most patients were male [57 patients (89%)], and the most frequent methods were ingestion of harmful devices or substances [15 patients (23%); hanging [9 patients (14%); and strangulation [9 patients (14%)]. There were 2 patients who died in the ED: 1 from a self-inflicted gunshot to the head and the other from self-inflicted herbal poisoning. The frequency of emergency airway intervention was greater in patients after unsuccessful attempted suicide [18 patients, 28% (95% confidence interval [CI], 17.2%, 39%; endotracheal intubation, 17 patients; emergency tracheotomy, 1 patient] than all ED patients [1458 patients (16%); (95% CI, 14.9%, 16.4%; $P=0.005$)]. Following attempted survived suicide, 24-hour ED mortality was 3% and 4% within the control group; the difference is insignificant ($P = 0.9596$). However, ED mortality showed a trend toward earlier death within the suicidal group. Resuscitation room mortality of patients that survived unsuccessful suicide does not differ from the general population of an ED resuscitation room.

Key words: Psychiatry – Emergency care – Trauma – Intubation – Treatment – Mortality

In 2005, >320,000 patients were admitted to US hospitals with nonfatal self-inflicted injuries; and the frequency of this problem is increasing in the elderly.¹ Psychiatric disease, drug abuse, and opiate dependency may predispose to higher suicidal mortality.^{2,3} Some patients may use methods of suicidal behavior that may not cause death immediately, such as strangulation without full compression of cerebral perfusion, a jump from a height, or forearm vessel laceration.^{4,5} However, very little is known of the emergency medical management and immediate survival of patients that survive such an attempt. We hypothesized that management and emergency department (ED) mortality of patients who had unsuccessful suicide attempts differ from other patients in the trauma bay. Hence, the study evaluates outcomes, including injury spectrum, cardiorespiratory parameters, and ED mortality of patients who were admitted and treated for unsuccessful attempted suicide in the resuscitation room of a South African ED.

Methods

Study subjects

The descriptive study of this consecutive case series was performed from October 9, 2005, to October 15,

2008 (36 months) at the Chris Hani Baragwanath Academic Hospital, serving approximately 3.5 million people living in Soweto, Johannesburg, South Africa. There were 9315 ED patients identified that were admitted to and treated in the resuscitation room of the ED, including 64 patients after unsuccessful attempted suicide. The entire cohort of 9315 patients served as the control group. This study was part of a larger research project [Assessment of Physiological Fitness of Patients Who Underwent Operation for Penetrating Trauma to the Chest for Medical Evacuation (M-SAB1-5-A015)] funded by the German Federal Armed Forces (Deutsche Bundeswehr).

Evaluation

The ED resuscitation room of Chris Hani Baragwanath Academic Teaching Hospital is a 16-bed full monitoring and ventilation facility. Intubation, intercostal drainage, emergency diagnostics, and cardiopulmonary resuscitation are performed here. Patients with suspected, pending, or overt life-threatening surgical diseases; trauma with respiratory or cardiovascular compromise; or severe burns are admitted to the resuscitation room. The latter are transferred after initial resuscitation and pain therapy to the

Table 1 Methods/causes of self-harm in failed attempted suicides in 64 admitted patients

Method of self-harm	Patients, n (%)
Hanging	9 (14)
Strangulation	9 (14)
Stabbing	6 (9)
Fall from height	4 (6)
Gunshot	2 (3)
Ingestion	15 (23)
Burn	2 (3)
Unknown	17 (17)
All suicides	64 (100)

adult or pediatric burn unit. All diagnostics and therapy are executed using routine advanced trauma life support (ATLS) standards by the surgeons in charge. All patients admitted to the resuscitation room of the ED were evaluated immediately by a trauma surgeon and included in the study. There was no age restriction. Patients who had penetrating injuries and arrived in extremis were treated with an emergency thoracotomy and were included in the study, as were patients without witnessed signs of life within 10 minutes before arrival. Any secondary exclusion after inclusion to the study was not allowed. No patient included was inadequately included to this study. All patients were admitted and resuscitated in the trauma resuscitation room according to ATLS procedures. Patient variables recorded included time of admission; age; sex; injury mechanism; injury site; initial vital signs, including Glasgow coma scale (GCS) score; preoperative tests; initial treatment; intraoperative findings; procedures performed; and survival in the ED.

Data analysis

Data were entered into and analyzed with a spreadsheet (Excel, Microsoft Corp, Redmond, Washington) and graphing software (Prism GraphPad, GraphPad Software, Inc, La Jolla, California). Discrete variables were reported as numbers (%). Averages were reported as mean \pm standard deviation. Ratios were compared with proportionality testing and metric variables were compared with Wilcoxon rank sum test (R, version 3.1.0, The R Project for Statistical Computing, <http://www.r-project.org/>). Statistical significance was defined as $P \leq 0.05$.

Ethics

The study was approved by the Chris Hani Baragwanath Academic Hospital Ethics Committee.

The study did not apply or change any medications or treatment paths other than those approved and widely applied before.

Results

Within the 36-months period, 9315 patients were admitted to the resuscitation room of the ED. Of these, 64 were identified as patients who attempted suicide but failed to die at the scene. All arrived alive at the resuscitation room of the ED. No emergency thoracotomy was needed.

Most patients with failed suicide 39 (61%) were brought in between Friday and Sunday. Eight (13%) patients were brought in between 12 and 8 AM; 32 (50%) between 8 AM and 4 PM; and 24 (37%) patients between 4 PM and 12 AM. Seven (11%) of the patients were female, 57 (89%) were male. Average age was 27.82 ± 13.61 years.

The most common method of self-harm in the ED resuscitation room was hanging and strangulation ($n = 18$), followed by ingestion of sharp and harmful devices or corrosive and toxic substances ($n = 15$; Table 1). Two ingestions occurred in combination with head injuries. Self-inflicted stabbing was seen in 6 patients, which presented to the neck in 3 patients, to the abdomen in 1 patient, to both wrists in 1 patient, and covering multiple body areas in 1 patient. Two suicides were attempted by self-inflicted gunshot injuries: 1 was abdominal, while the other was through the head and neuro-cranium with oozing brain matter. Two self-inflicted burn patients were treated within the study period. Four patients who presented after jumps from tall buildings with suicidal intention were treated; 3 of them jumped from the 2nd- and 3rd-floor of buildings and 1 used a bridge. A total of 17 patients were brought in after suicide attempts with an unknown mechanism.

Mean oxygen saturation (SaO_2) in the suicide group was 96% and did not deviate significantly from the 9315 collective ($P = 0.1368$). However, indication for intubation according to the ATLS standard protocol was given and accordingly performed in 17 (27%) patients. Additionally, in 1 case emergency tracheotomy was indicated resulting in a total emergency airway intervention rate of 28% (Table 2). Five of the nine (56%) patients disturbed while hanging and 2 of 9 (22%) patients with strangulation needed an endotracheal tube, whereas 4 of 15 (27%) patients with ingestion or poisoning needed a definite airway (Table 2). Survived self-inflicted stabbings and falls from tall

Table 2 Airway intervention within specific suicide method and within the whole ED population

Method of self-harm	Intubation, n (%)	Tracheostomy, n (%)	Total airway intervention, n (%)*
Hanging	5 of 9 (56)	0 of 9 (0)	5 of 9 (56)
Strangulation	2 of 9 (22)	0 of 9 (0)	2 of 9 (22)
Stabbing	0 of 6 (0)	1 of 6 (17)	1 of 6 (17)
Fall from height	0 of 4 (0)	0 of 4 (0)	0 of 4 (0)
Gunshot	0 of 2 (0)	0 of 2 (0)	0 of 2 (0)
Ingestion	4 of 15 (27)	0 of 15 (0)	4 of 15 (27)
Burn	1 of 2 (50)	0 of 2 (0)	1 of 2 (50)
Unknown	5 of 17 (29)	0 of 17 (29)	5 of 17 (29)
All suicides	17 of 64 (27)	1 of 64 (2)	18 of 64 (28)
Total ED patients	1420 (15.2)	38 of 9315 (0.4)	1420 of 9315 (15.7)
95% CI	14.5%–16.0%	0.3%–0.6%	14.9%–16.4%

*Total Airway Interventions as the percentage of ED interventions calculated for each horizontal group (P values computed with proportionality test, confidence intervals follow from binominal distribution).

heights did not require emergency airway intervention in our consecutive case series, in contrast to those with self-inflicted gunshot wounds. One of the two (50%) patients of survived suicide attempts after self-inflicted burns required intubation (as shown in Table 2).

The rate of resuscitation room airway intervention in the suicide cases was significantly higher ($P = 0.0052$, proportionality test) when compared with the overall resuscitation room population.

Three patients with chest involvement were seen: 2 from the jump group and 1 with a self-inflicted abdominal gunshot wound, which was classified as a thoracoabdominal injury. All 3 received an intercostal drain.

Mean values of systolic and mean blood pressure were found to be within physiologic range with no statistical difference when compared with the whole collective. However, average heart rates were at 99 beats/min, 10% above the average 90 beats/min of the entire ER collective ($P = 0.002$; Table 3).

A total of 34 patients arrived awake, whereas 13 were drowsy and 17 arrived unconscious (GCS < 9). Of the 17 patients, 8 became conscious again, while 9 had to be intubated. Four drowsy patients and 4 patients from the conscious group had to be intubated during the treatment in the ED resuscitation room.

Radiologic diagnostics (as soon as the patient was hemodynamically stable) revealed only 1 patient from the hanging/strangulation group had a C1 fracture with subluxation of C2 and C3, although without any symptoms or signs of paraplegia. He was taken over by the neurosurgeons for open reduction and internal fixation. One woman (unknown suicidal mechanism) had a thoracic spinal injury. No other spinal or bony neck injuries were seen.

Eight patients went to the operating room (OR) including 2 jump patients; 2 self-inflicted stabbings (neck plus abdominal injury); 3 patients with acute abdomen after ingestion of acid or herbal poison; and 1 patient with a self-inflicted neck injury of

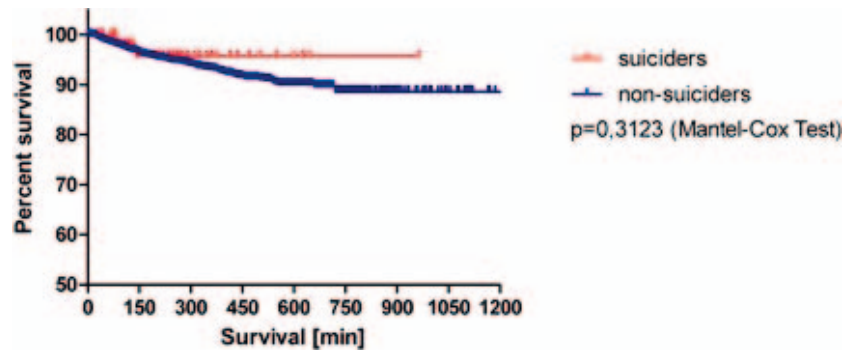
Table 3 Hemodynamic parameters within patients after specific suicide methods

Method	Systolic blood pressure, mmHg	Mean arterial pressure, mmHg	Heart rate, beats/min	SO ₂ , %± SD
Hanging	120 ± 18	85 ± 14	94 ± 13	98 ± 0.4
Strangulation	101 ± 28	74 ± 21	92 ± 12	97 ± 0.9
Stabbing	131 ± 44	88 ± 27	95 ± 12	NR
Fall from height	116 ± 38	81 ± 38	112 ± 13	NR
Gunshot	101 ± 25	73 ± 20	111 ± 13	95 ± 1.8
Ingestion	121 ± 35	84 ± 20	99 ± 18	NR
Burn	171 ± 28	98 ± 10	127 ± 33	NR
Unknown	128 ± 15	93 ± 9	91 ± 8	96 ± 2.0
All suicides	118 ± 10	83 ± 7	99 ± 5	96 ± 1.0
Total ED patients (n = 9315)	121 ± 1	86 ± 1	90 ± 1	96 ± 0.4
Significance, P	0.4237	0.4992	0.0021	0.1368

NR, data not recorded or number too small.

Significance testing was done with Wilcoxon test, assuming metric, but not normally distributed data.

Fig. 1 Kaplan-Meier analysis of 24-hour mortality after admission to the ED. The difference between suicide survivors and the entire cohort is not significant ($P = 0.31$). However, a trend suggests earlier deaths in the suicidal group.



undocumented mechanism. In sum, 4 laparotomies were done, 2 neck explorations, 2 external fixations, and 1 major soft tissue debridement (following a jump). One emergency tracheotomy was converted into a formal surgical airway in the OR.

Following attempted survived suicide, 24-hour ED mortality was 3% (1 self-inflicted gunshot to the head, 1 herbal self-poisoning) in study patients and 4% within the control group. Expectedly due to the minimal number of only 2 suicidal deaths, this difference does not carry significance ($P = 0.9596$). However, ED mortality showed a trend toward earlier death within the suicidal groups: 50% deaths occurred within 2 hours in the suicidal group versus 50% of deaths occurring 6 hours after admission in the nonsuicidal ED group (Fig. 1).

Discussion

We identified typical weekdays and times of day for patients admitted after unsuccessful suicide attempts as well as different injury patterns. We found that airway intervention rate is significantly higher in these patients when compared with the overall ED resuscitation room patient population, with higher rates especially in patients suffering from ingestions, hanging, and strangulation injuries, as to be expected. Astonishingly though, 24-hour mortality was not significantly different in the cases and showed a trend toward stabilization after 150 minutes.

Patients who survive after attempted suicide are a very small percentage (0.68%) of all admissions to this South African ED resuscitation room. Suicidal intention may go unnoticed during treatment of injuries in a busy ED resuscitation room; therefore, it is important to communicate with next of kin. A questionable medical history of severely injured patients might induce suspicions among ED surgeons and physicians, especially when treating

patients during the daytime on weekends. Either the suicide methods are more efficient, suicides go unnoticed, or more realistically, the prevalence of suicides is lower than in other cultures and countries. The percentage of patients that were male, 89%, is comparable with other places. An American study reported that 83% of patients were male (median age, 35 years) and the 3 most common injury mechanisms were stabbing (39%), jump from a height (26%), and gunshot injury (21%).⁶ A Turkish investigation on 22 patients after unsuccessful suicides by self-inflicted burning described a mean age of 35 years (range, 13–85 years) and a mean body surface burn of 53% (9%–100%).⁷ In urban South Africa, suicide by hanging was attributed to Asians and self-inflicted gunshot wounds to whites.⁸ Our entirely black cohort admitted to the hospital predominantly failed to die by hanging and strangulation; gunshot wounds were less frequent in our cases—or more efficient for suicide, thus impeding an admission to the ED resuscitation room. In our cases, operative management and 24-hour mortality after the most-often seen survived method, hanging, was 0%. However, a trauma registry review of patients who presented after near-hanging in attempted suicide reported a 19% prevalence of injuries in these patients. Risk factors associated with poor outcome included GCS ≤ 8 , systolic blood pressure (RRsys) < 90 mmHg, anoxic brain injury noted on computed tomography scan, and injury severity score > 15 . Favorable survival occurred in 90% patients, and 3.5% were discharged with severe or permanent disability.⁹

A previous study reported 15 (23%) of 66 patients who fell from a height > 6 m died, and 8 patients died after admission to the hospital.¹⁰ Univariate analysis showed that risk factors related to mortality included GCS ≤ 14 , injury severity score ≥ 16 , head/neck abbreviated injury scale score ≥ 4 , chest abbreviated injury scale score ≥ 4 , heart rate ≥ 100

beats/min or ≤ 50 beats/min, mean arterial pressure (MAP) ≤ 60 mmHg, serum glucose ≥ 140 mg/dL, and severe head injury.¹⁰ We do not know the number of suicide patients that die preclinically; but within our cohort arriving alive at the hospital, this history did not lead to an increased mortality. This is true as swift airway protection is provided as needed, which is more prevalent in the attempted suicide cohort.

According to ATLS principles, emergency endotracheal intubation is mandated with GCS ≤ 8 or any apparent airway problem that can be solved by intubation. Other airway injuries have been described from foam instillation into the trachea, but these injuries are rare and may be fatal.¹¹ If it is impossible to establish a definite endotracheal airway because of upper airway obstruction that cannot be relieved, lower emergency airway access (cricothyroidotomy) is necessary.¹² When neck trauma (hanging/strangulation) or the pharynx and esophagus (ingestions) are involved, the surgeons on duty should be especially alert of a pending airway intervention. ATLS guidelines prove to be reliable in these cases too.

Surgical airway management is seldom needed. The only tracheotomy was done in a psychiatric patient who had multiple self-inflicted stab injuries to the neck and abdomen. The small number of patients in the present study does not enable us to estimate the incidence or prevalence of emergency surgical airways needed.

Independent of a suicidal background, hemodynamic instability has to be expected after high-velocity trauma, such as jump from heights and other injuries harming major vessels. Systolic and mean arterial blood pressure can be treated according to established ATLS protocols. However, blood pressure was not of any significance in our cases. Contrary, the significant higher heart rate can be explained with the psychological circumstances and might be of essence when dealing with elderly patients at increased cardiac risk.

Not all admissions require immediate operative interventions, but indication for laparotomy might be given not only for established indications like abdominal stab wounds, but also for ingestions of harmful devices or substances.

It has been reported that self-injury may be associated with increased risk of mortality during subsequent treatment. Self-injured patients who required admission to an intensive care unit had higher mortality than patients who had uninten-

tional injuries.¹³ Our findings could not prove this, at least for the first 24 hours.

Due to the nature of the database, anatomic (ISS) and physiologic (RTS) severity of the injuries could not be analyzed and our findings represent a very distinct cohort of black patients in urban South Africa. In other sociocultural backgrounds, findings might differ and treatment priorities may accordingly have to be adjusted. Some patients may not have been identified as having attempted suicide. The comparison group of the entire cohort admitted to the resuscitation room is not a true control group, as it is not matched on any characteristics other than patients seen in the same unit. A multivariate analysis adjusting for major predictive characteristics could enable true comparisons in a future study.

These results may be useful in guiding surgeons who treat patients after unsuccessful attempted suicide. Emergency airway intervention may be required in patients who survive hanging or strangulation as well as ingestions of toxic substances. Having survived the initial 150 minutes, patients are not at increased risk to die within the next 24 hours in the ED.

Conclusion

As to be expected, patients that survived a suicide can successfully be managed according to the ATLS principles. Injury patterns vary widely and some cases require surgical interventions. Emergency surgeons, physicians, and anesthesiologists should be aware of a significant increase in airway interventions in the ED resuscitation room after ingestions, hanging, and strangulation. If these life-threatening airway management demands are met adequately, the mortality of patients that survived unsuccessful suicide attempts does not differ from the general population in an ED resuscitation room.

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