ORIGINAL ARTICLE

Clinical Profile, Corticosteroid Usage and Predictors of Mortality in Near-hanging Patients: A Five-year, Single-center Retrospective Study

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Abstract

Background: Hanging is the most common method of suicide in India. When near-hanging patients reach the hospital for treatment, their neurological outcome ranges from full recovery to severe neurological impairment or death. This study looked at the clinical profile, usage of corticosteroids and predictors of mortality in near-hanging patients.

Materials and methods: This retrospective study was conducted from May 2017 to April 2022. Demographic, clinical, and treatment details were collected from case records. Neurological outcome at discharge was assessed using the Glasgow Outcome Scale (GOS).

Results: The study involved 323 patients, 60% of men with a median (interquartile range) age of 30 (20–39). At the time of admission, the Glasgow Coma Scale (GCS) ≤8 in 110 (34%) patients, hypotension was present in 43 (13.3%) of patients, and 21 (6.5%) had hanging-induced cardiac arrest. About 101 patients required intensive care unit care. Corticosteroid therapy was given to 219 patients (67.8%) as part of anti-cerebral edema measures. Good neurological recovery was found (GOS-5) in 84.2% of patients, and the death rate (GOS-1) was 9.3%. Univariate logistic regression showed that usage of corticosteroids is significantly associated with poor survival ($p < 0.02$, odds ratio 4.7). In the multivariable logistic regression analysis, GCS ≤8, hypotension, need for intensive care, hanging-induced cardiac arrest, aspiration pneumonia, and severe cerebral edema were found to be significantly associated with mortality.

Conclusion: The majority of near-hanging patients had a good neurological recovery. Corticosteroids were used in two-thirds of the study population. There were multiple variables associated with mortality.

Keywords: Dexamethasone, Glasgow outcome score, Hanging-induced cardiac arrest, India, Intensive care, Near hanging, Steroids.

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Highlights

- The majority of near-hanging patients had a good neurological recovery.
- Corticosteroids were commonly used to manage near-hanging patients without any direct evidence of benefit.
- Early resuscitation measures can improve the outcome of near-hanging patients who are very sick at presentation.

Introduction

Suicide is a significant global public health issue. In 2019, over 7 lakh people worldwide died by suicide, with 1.7 lakh cases occurring in India alone.[1] The suicide rate in our country was 11.3 cases/lakh population. Hanging was the most common method of suicide in India, accounting for 57.8% of all suicides, followed by poison consumption, chosen by 25% of victims.[2]

Hanging is a form of strangulation in which a ligature material such as a rope or clothing is used to apply fatal pressure to the neck. The weight of the whole or part of the body creates a gravitational drag, exacerbating the pressure and leading to death. Hanging can result in immediate death, known as "fatal hanging," or unsuccessful attempts, known as "near hanging."[3] Patients who survive and reach the hospital are typically stable and can be treated in the ward, while unstable patients may require intensive care unit (ICU) admission for airway management, treatment of cerebral edema, hypoxic brain damage, and neck injuries.[4] Conservative management of complications plays a vital role. Corticosteroids are commonly used to manage cerebral edema or suspected spinal cord injury in near-hanging patients, despite limited evidence.[5] The patient's outcome after hospital treatment varies, from complete recovery to severe neurological deficits or death.[6] Low Glasgow Coma Scale (GCS), hypotension, hypoxic brain injury, pulmonary edema, high Acute Physiology and Chronic Health Evaluation - II (APACHE-II) scores, the requirement of vasopressor therapy, hanging-induced cardiac arrest, and hyperglycemia at admission were the factors associated with the poor prognosis of near-hanging patients.[6,7] There are very few Indian studies on near-hanging patients and the literature on steroid therapy in near-hanging is scarce. Hence, this study was designed to evaluate the clinical profile, treatment details, and predictors of mortality in near-hanging patients.

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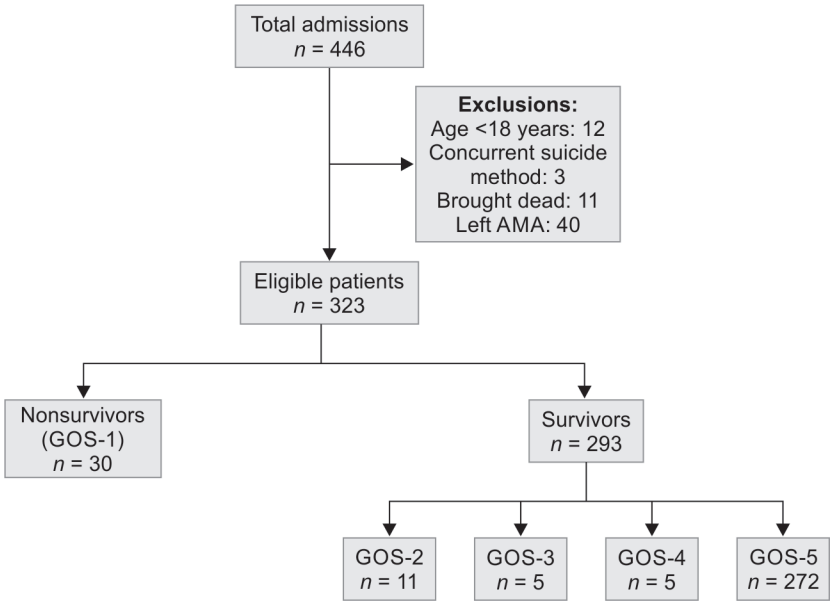
Flowchart 1: Flowchart showing the study design



Materials and Methods

This retrospective study analyzed deidentified data of patients admitted to a south Indian tertiary care hospital between May 2017 and April 2022 with a diagnosis of "hanging." Patients aged 18 years or above with "near-hanging" diagnoses were included, while those who adopted alternate suicide methods, brought dead, or discharged against medical advice were excluded. The case records with inadequate data were also excluded. The study was approved by the Institute's Ethics Committee. A flow diagram in Flowchart 1 shows the study plan.

Measurements and Outcomes

A total of 323 eligible case records were studied in detail. Demographic details, information about the type of hanging (complete or incomplete), the reason for hanging, previous suicidal attempts, the material used for hanging, and the history of comorbidities/psychiatric ailments were collected.

Physical examination findings were noted, including the GCS, vital signs (pulse rate, blood pressure), and ligature mark at the neck. Details of cardiac arrest, cardiopulmonary resuscitation (CPR), and seizures were noted. Radiological investigations of chest X-ray and computed tomography (CT) of brain were analyzed from the picture archiving and communication system to look for pulmonary edema and cerebral edema, respectively. Information about intubation, mechanical ventilation, the duration of the ICU stay, tracheostomy, complications during the ICU stay, and the total length of the hospital stay was collected. The treatment details, including anti-cerebral edema measures and corticosteroid therapy, were noted. When corticosteroids were used, data on the specific steroid, duration, dose, and their total dose equivalent to dexamethasone were collected. The patient's neurological outcomes were determined on the Glasgow Outcome Scale (GOS) using the information provided in the discharge summary.

Definitions

- If the patient's body is freely suspended in the air, it is considered a "complete" type of hanging. If part of the body is supported and has contact with the ground, it is considered as "partial or incomplete hanging."[8]
- Hypotension was defined as a systolic blood pressure of ≤90 mm Hg.
- If patients received anti-cerebral edema agents like mannitol, hypertonic saline, or both, it was considered as "severe cerebral edema."
- The GOS scale is as follows: (1) death; (2) persistent vegetative state; (3) severe disability (conscious but disabled); (4) moderate disability (disabled but independent); (5) good recovery.[9]

Statistical Analysis

Categorical and ordinal variables were mentioned in percentages. Continuous variables were mentioned as median with interquartile range (IQR) in the nonparametric dataset or mean with standard deviation in the parametric dataset. Univariate logistic regression was done for categorical outcomes to determine the significance. Following that, a multivariable logistic regression analysis was performed to find independent mortality predictors. We analyzed the data using the Statistical Package for the Social Sciences software for Windows (version 19; IBM, Chicago, IL, USA). A *p*-value of less than 0.05 was considered statistically significant.

Results

The total number of eligible near-hanging cases included was 323. Baseline characteristics are shown in Table 1. Among the 323 patients studied, 60% were men. The median age was 30 years (IQR: 20–39). Most of the patients were Hindus (96.9%) and belonged to rural areas (60%). The material predominantly used for hanging was soft clothes like sarees or shawls (77.4%). Family dispute (55.7%) was the leading reason reported for hanging. From the available records, 100 patients (31.2%) reported an intake of alcohol. Only 10% of the cases had comorbid conditions, with hypertension (3.4%), followed by diabetes mellitus (2.8%), and neurological diseases (2.8%). Nearly, 6% of the study population reported having an underlying psychiatric illness, and 60 patients (18.6%) reported previous suicide attempts.

Table 1: Baseline characteristics

Variable	*Sub-groups*	*n (%)*
Gender	Male	194 (60)
	Female	129 (40)
Age, years	18–30	175 (54.2)
	31–60	137 (42.4)
	>60	11 (3.4)
Religion	Hindu	313 (96.9)
	Muslim	6 (1.9)
	Christian	4 (1.2)
Residence	Rural	192 (59.4)
	Urban	131 (40.6)
Presentation to hospital	Direct	78 (24)
	Referral	245 (76)
Marital status	Married	254 (78.6)
	Single	65 (20.2)
	Widow	4 (1.2)
Timing of hanging	Morning (5 am–12 pm)	94 (29.1)
	Afternoon (12 pm–6 pm)	101 (31.3)
	Evening (6 pm–9 pm)	66 (20.4)
	Night (9 pm–5 am)	62 (19.2)
Season of hanging	Summer (March–June)	121 (37.4)
	Monsoon (July–October)	117 (36.2)
	Winter (November–February)	85 (26.3)
Material used	Soft clothes	250 (77.4)
	Rope	49 (15.2)
	Wire	5 (1.5)
	Belt	1 (0.3)
	Others	18 (5.6)
Reason for hanging	Family disputes	180 (55.7)
	Financial issue	27 (8.5)
	Illness	19 (5.9)
	Personal relationship issue	15 (4.6)
	Academic failure	3 (0.9)
	Unemployment	2 (0.6)
	Unknown	77 (23.8)
Addiction history	Teetotaler	183 (56.5)
	Alcohol intake	100 (31.2)
	Smoking and alcohol intake	38 (11.7)
	Smoking	2 (0.6)
Comorbidities	None	291 (90.1)
	Hypertension	11 (3.4)
	Diabetes mellitus	9 (2.8)
	Neurological disease	9 (2.8)
	Cardiac disease	4 (1.2)
	Endocrine disease	2 (0.6)
	Hematological disease	2 (0.6)
	Renal disease	1 (0.3)
	Liver disease	1 (0.3)
Psychiatric illness		19 (5.9)
Previous suicidal attempts		60 (18.6)

Table 2: Clinical characteristics of survivors and nonsurvivors

Sl. no.	*Patient characteristics*	*Survivors (n = 293)*	*Nonsurvivors (n = 30)*	*p-value*	*Odds ratio (95% CI)*
1	Age, years, median (IQR)	30 (24–39.5)	27 (22–37.8)	0.33	0.98 (0.95–1)
2	Gender, male, *n* (%)	180 (61.4)	14 (46.4)	0.12	0.5 (0.2–1.2)
3	Type of hanging-complete, *n* (%)	79 (27)	16 (53.3)	**0.004**	3.1 (1.4–6.6)
4	Seizures, *n* (%)	16 (5.5)	6 (20)	**0.005**	4.3 (1.5–12.1)
5	GCS ≤8, *n* (%)	81 (27.6)	29 (96.7)	**<0.001**	75.9 (10–566)
6	Pulse rate, median (IQR)	96 (86–109)	98 (85.5–125)	0.68	0.99 (0.98–1)
7	Systolic blood pressure, median (IQR)	110 (100–124)	105 (80–129)	**0.001**	0.97 (0.95–0.98)
8	Hypotension, *n* (%)	30 (10.2)	13 (43.3)	**<0.001**	6.7 (2.9–15)
9	Ligature mark, *n* (%)	225 (76.8)	26 (86.7)	0.22	1.9 (0.6–5.8)
10	Cardiac arrest, *n* (%)	5 (1.7)	16 (53.3)	**<0.001**	65.8 (21–205)
11	Pulmonary edema, *n* (%)	24 (8.2)	11 (36.7)	**<0.001**	6.5 (2.8–15)
12	Aspiration pneumonia, *n* (%)	27 (9.2)	13 (43.3)	**<0.001**	6.6 (2.9–15)
13	Cerebral edema in CT, *n* (%)	139 (47.4)	26 (86.7)	**<0.001**	7.2 (2.4–21)
14	ICU admission, *n* (%)	71 (24.2)	30 (100)	**<0.001**	90.6 (12–677)
15	Mechanical ventilation, *n* (%)	67 (22.9)	30 (100)	**<0.001**	97.4 (13–728)
16	Steroid therapy, *n* (%)	192 (65.5)	27 (90)	**0.02**	4.7 (1.4–15.9)
17	Dexamethasone equivalent cumulative steroid dose, median (IQR)	32 (16–48)	24 (8–72)	**0.01**	1.01 (1–1.02)
18	Severe cerebral edema, *n* (%)	213 (72.7)	29 (96.7)	**0.02**	10.9 (1.5–81)
19	Duration of hospital stay, days, median (IQR)	3 (2–5)	5.5 (3–11.5)	**0.03**	1.04 (1–1.1)
20	GOS at discharge, *n*				
	Death (1)	NA	30	NA	NA
	Persistent vegetative state (2)	11	NA		
	Severe disability (3)	5	NA		
	Moderate disability (4)	5	NA		
	Good recovery (5)	272	NA		

Bold values indicates the statistical significant *p*-values. CT, computed tomography; GCS, Glasgow Coma Scale; GOS, Glasgow Outcome Scale; ICU, intensive care unit; IQR, inter-quartile range

The differences in clinical characteristics, investigations, and treatment details between survivors and nonsurvivors are shown in Table 2. The median (IQR) GCS at presentation was 11 (6–15). The GCS score was 8 or below in 110 (34%) patients. The median GCS of survivors and nonsurvivors was 12 and 3, respectively. Hypotension was present in 43 patients (13.3%). Twenty-one patients had a hanging-induced cardiac arrest and were revived after the resuscitation, and five of them were discharged in an alive state. One of those five patients had a complete neurological recovery. Pulmonary edema was present clinically in 35 patients and radiologically in 40 patients. Aspiration pneumonitis was seen in 40 patients (12.4%). A cervical spine fracture was noted in only two patients. More than half (51.2%) had cerebral edema in the CT brain. The overall mortality rate was 9.35%. The median (IQR) hospital stay was 5.5 days (3–11.5).

One hundred and one patients received ICU care, and 97 of them were intubated and mechanically ventilated. Vasopressor therapy was required for 25 patients. Complications noted during an ICU stay were ventilator-associated pneumonia ($n = 28$), catheter-related bloodstream infection ($n = 5$), catheter-associated urinary tract infections ($n = 2$), and thromboembolism ($n = 3$). A tracheostomy was done for 14 patients. Mean ventilator days and ICU days were 4.3 and 4.9 days, respectively. Seventy percent of patients requiring ICU admission survived.

The differences in clinical characteristics, investigations, and treatment details between steroid receivers and nonsteroid receivers are shown in Table 3. Steroid therapy was given to 219 patients (67.8%). Dexamethasone was used for 200 patients, followed by hydrocortisone (15 patients) and methylprednisolone (four patients). The most commonly used steroid regimen was dexamethasone 6 mg once/twice daily for 2–5 days. After the cumulative steroid dose was converted uniformly equivalent to the dose of dexamethasone, the median (IQR) dose was 24 mg (12–48 mg). The duration of corticosteroid therapy varied, with 107 patients receiving it for less than 24 hours, 52 patients receiving it for 24–48 hours, and 60 patients receiving it for more than 48 hours. In addition to steroid therapy, other anti-cerebral edema agents, such as hypertonic saline ($n = 158$), mannitol ($n = 68$), or both ($n = 16$), were used for severe cerebral edema patients. The difference in steroid usage between various groups of neurological outcomes (based on GOS score) is shown in Figure 1.

Univariate logistic regression analysis revealed that the complete type of hanging, GCS ≤8, presence of seizures, presence of hypotension, cardiac arrest at presentation, pulmonary edema, cerebral edema in CT of brain, a requirement of ICU care, the need for mechanical ventilator support, steroid therapy, severe cerebral edema, and aspiration pneumonia were the predictors of mortality (Table 2). In the multivariable logistic regression, GCS ≤ 8, the

Table 3: Clinical characteristics of steroid receivers and steroid nonreceivers

Sl. no.	*Patient characteristics*	*Steroid receivers (n = 219)*	*Steroid nonreceivers (n = 104)*	*p-value*
1	Age, years, median (IQR)	29 (23–38)	31.5 (25–40)	0.25
2	Gender, male, *n* (%)	129 (59)	65 (62.5)	0.54
3	Type of hanging-complete, *n* (%)	74 (33.8)	21 (20.2)	**0.01**
4	Seizures, *n* (%)	17 (7.8)	7 (4.8)	0.33
5	GCS ≤ 8, *n* (%)	93 (42.5)	17 (16.3)	**<0.001**
6	Hypotension, *n* (%)	35 (16)	8 (7.7)	**0.04**
7	Ligature mark, *n* (%)	180 (82.2)	71 (68.3)	**0.006**
8	Cardiac arrest, *n* (%)	21 (9.6)	0	**0.001**
9	Pulmonary edema, *n* (%)	32 (14.6)	3 (2.9)	**0.004**
10	Aspiration pneumonia, *n* (%)	31 (14.1)	9 (8.7)	0.197
11	Cerebral edema in CT, *n* (%)	121 (55.3)	44 (42.3)	**0.03**
12	ICU admission, *n* (%)	89 (40.6)	12 (11.5)	**<0.001**
13	Mechanical ventilation, *n* (%)	85 (39)	12 (11.5)	**<0.001**
14	Severe cerebral edema, *n* (%)	179 (81.7)	63 (60.6)	**<0.001**
15	Hospital stay, days, median (IQR)	4 (3–6)	2 (2–3)	**0.008**
16	GOS at discharge, *n* (%)			
	Death (1)	27 (12.3)	3 (2.9)	**0.001**
	Persistent vegetative state (2)	10 (4.6)	1 (1)	
	Severe disability (3)	4 (1.8)	1 (1)	
	Moderate disability (4)	5 (2.3)	0	
	Good recovery (5)	173 (79)	99 (95.2)	

Bold values indicate statistically significant *p*-values. CT, computed tomography; GCS, Glasgow Coma Scale; GOS, Glasgow Outcome Scale; ICU, intensive care unit; IQR, inter-quartile range

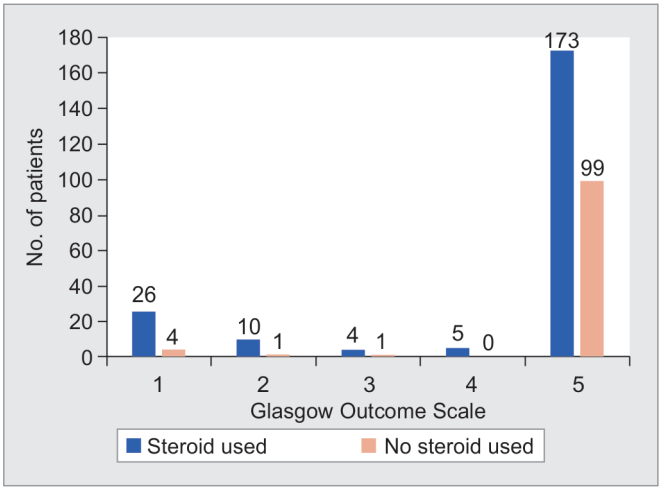


Fig. 1: Steroid usage among different outcome groups based on the Glasgow Outcome Scale

presence of hypotension, the requirement of ICU care, hanging-induced cardiac arrest, aspiration pneumonia, and severe cerebral edema were found to be significant independent predictors after adjusting the confounders (Table 4).

Discussion

The study analyzed the demographic, clinical, and treatment profiles of near-hanging patients and identified predictors of mortality. Mostly young or middle-aged men were the victims of near-hanging. Family dispute was the chief reason for the suicide attempt. Intensive care unit care was needed for one-third of them. Corticosteroids were commonly used for treatment. Most patients had a good neurological recovery, assessed based on GOS. Overall and ICU mortality rates were 9.3 and 29.7%, respectively.

Table 4: Result of multivariable logistic regression analysis for predicting mortality

Variables	*p-value*	*Odds ratio*	*95% CI*
GCS ≤ 8	0.04	15.9	1.1–229
Hypotension	0.003	15.7	2.6–94.6
Cardiac arrest at presentation	<0.001	26.9	4.8–150
ICU admission	0.004	57.9	3.6–930
Severe cerebral edema	0.015	46	2.1–1,032
Aspiration pneumonia	0.003	8.4	2.1–34

GCS, Glasgow Coma Scale; ICU, intensive care unit

In this study, the ratio of men to women was 1.5, with 90% of the patients between the ages of 18 and 50 years. These findings were similar to another south Indian study.[4] The primary reason for suicide was a family dispute (55.7%), while financial issues (8.5%), ill health (5.9%), and personal relationship issues (4.6%) were cited as other reasons. Rupani et al.[10] from north India also found that family dispute was the primary reason for hanging in their cohort. Around 78% of our patients were married. Nearly, 43% of patients had a history of alcohol intake. Substance abuse, including alcohol intake, cigarette smoking, or both, was more common among men than women (68.5% vs 5.4%). Studies from other countries reported alcohol abuse in 22 and 26% of the study population.[7,11] Our study suggests that substance abuse and family disputes may

contribute to suicide among young and middle-aged individuals. The potential impact of alcohol addiction on family dynamics and the risk of domestic violence should be recognized as significant risk factors for suicide.

The median (IQR) GCS at presentation was 11 (6–15). One hundred and ten patients (34%) had a low GCS of ≤8. Ganesan et al.[4] and Salim et al.[12] reported that 54.5 and 27% of their patients had a GCS ≤8, respectively. About 26.4% of our patients having poor GCS (≤8) died. The outcomes of 33 patients with the worst GCS score of 3 were interesting. Of those 33 patients, 48.5% died, 39.3% had complete neurological recovery, and 12% had a severe disability or a persistent vegetative state. This suggests that aggressive resuscitation at presentation may improve outcomes, despite a poor GCS score at presentation.

Hanging-induced cardiac arrest, a serious complication of hanging, was present in 6.5% of patients. However, they all received ICU care, and 23.8% survived, including one patient who was discharged with a complete neurological recovery. A large retrospective ICU study found a higher incidence of hanging-induced cardiac arrest (50.8% of 886 patients) and a lower overall survival rate (15.9% of cardiac arrest patients).[7] This can be due to several factors, such as the severity of the cardiac arrest, the delay in starting CPR, the duration of CPR, and the availability of advanced life support measures.

A significant proportion of our patients required intensive care (34%), with a high percentage of them having a GCS score of 8 or less (81.8%), experiencing seizures (11%), receiving vasopressors (24.8%), or developing pulmonary edema (27.7%). Around 97% of ICU patients were intubated and mechanically ventilated, with an average of 4.3 ventilator days and 4.9 ICU days. The ICU mortality rate was 30%. Compared to a similar ICU-based study in which the mortality rate was 10.3%, our patients had a significantly higher incidence of poor GCS (81% vs 65%) and a higher requirement for mechanical ventilation (97% vs 85%), which may have contributed to the higher mortality rate.[6]

The presumed indication of corticosteroid use in near-hanging is either cerebral edema or spinal cord injury secondary to cervical spine fracture. Dexamethasone is the steroid commonly used in patients with cerebral edema related to near-hanging because of its property of crossing the blood–brain barrier. It may not always effectively treat cerebral edema resulting from hanging cases. This is because near-hanging can lead to hypoxic brain injury and cytotoxic edema, which differ from vasogenic edema where dexamethasone may be effective.[13] However, dexamethasone has been found to be effective in high-altitude cerebral edema (HACE),[14] which has both cytotoxic and vasogenic edema changes.[15] Despite the unclear pathophysiology of hanging-induced cerebral edema, corticosteroids are used in such cases based on the assumption of similarities to HACE. About 67.8% of our patients received steroid therapy, with dexamethasone being the most commonly used agent (200 of 219). No study was found describing steroid therapy in near-hanging patients. A report on three hanging cases by Gandhi et al. described managing hanging patients in their center. Of those three patients, one received methylprednisolone, another received hydrocortisone, and the remainder received none of the steroid agents.[5] Cerebral edema in the CT brain was found in 51% of our patients. Other than corticosteroids, patients received other anti-cerebral edema therapies, considered it for severe cerebral edema, like mannitol, hypertonic saline, or both, amounting to 75%.

A cervical spine fracture is a rare complication of near-hanging. In the injured spinal cord due to cervical spine injury, steroid therapy is administered to reduce oxidative stress, calcium influx-related excitotoxicity, and immune-mediated neuro-phagocytosis.[16] Methylprednisolone is the recommended agent for acute spinal injury.[17] However, updated guidelines recommend against using corticosteroids even in cord injury because the risks outweigh the benefits.[18] Two of our patients (0.6%) had cervical spine fractures without spinal cord injury; one received 120 mg of dexamethasone over 5 days, and another was not given corticosteroids. Both of them were managed conservatively and discharged with a complete neurological recovery. In other studies, cervical spine injury was reported in 0–3% of patients.[19,20]

Pulmonary edema was found in 10.8% of our patients. Studies reported pulmonary edema in hanging, ranging from 11 to 28.5%.[4,21] Proposed mechanisms for pulmonary edema are increased pulmonary blood flow due to hanging-induced excessive negative intrathoracic pressure, and hypoxia-induced and high sympathetic output-related pulmonary vasoconstriction.[5,21] Forty patients (12.4%) developed the complication of aspiration pneumonia. The same was reported in 9% of patients by Boots et al.[11] Poor GCS leading to poor airway protection would be the main reason for the aspiration of salivary secretion.

While comparing the variables between survivors and nonsurvivors, though statistically insignificant, the nonsurvivors tended to be younger than the survivors. There were more female nonsurvivors than male nonsurvivors. The high number of patients with cardiac arrests in the nonsurvivor group suggests that these patients might have experienced severe physiological stress and organ damage, leading to poor outcomes. The higher incidence of complications such as seizures, hypotension, pulmonary edema, and cerebral edema in nonsurvivors may indicate that these patients developed more damage in vital organs, leading to worse outcomes. The need for ICU care and mechanical ventilator support were also important predictors of mortality, as these treatments are often used to support patients with severe physiological stress. The higher use of corticosteroids and treatment for cerebral edema in nonsurvivors may suggest that these patients had more severe neurological damage and that aggressive treatment might have been given to improve outcomes. Hospital stay was also significantly longer in nonsurvivors than survivors (5.5 days vs 3 days), which matches the expectation of sick patients requiring hospital care for longer. The overall mortality of our patients was 9.7%. The mortality rate for hanging varied from 2.6 to 41.5%.[4,19] About 84.2% of patients were assigned GOS scores of 5, and 1.5% of patients had GOS scores of 4. A retrospective study on 409 hanging patients reported good outcomes (both GOS 4 and 5) in 82.2%, which is closely similar to our results.[22] Other rare cardiac and neurological complications from hanging were also reported in the literature.[23,24]

GCS of ≤ 8, hypotension, ICU care, cardiac arrest at presentation, aspiration pneumonia, and severe cerebral edema were significant predictors of mortality in our study. In other studies also, hypotension, GCS ≤ 8, and hanging-induced cardiac arrest were reported as mortality predictors.[6,7,25] In contrast, Salim et al.[12] did not find an association between mortality and poor GCS. An interventional study on hanging patients with hypotension (mean arterial pressure <65 mm Hg), oxygen saturation < 94% and poor GCS <9 was done by Tharmarajah et al.,[26] in which early targeted therapy, including early tracheal intubation, aggressive therapy for hypotension and targeted therapeutic management were used. It showed a significant improvement in mortality and neurological outcomes. Our study also confirmed that poor GCS and hypotension

predicted mortality; if this aggressive therapy had been followed, it might have helped improve the poor outcome.

When compared to steroid nonreceivers, the neurological outcome was found to be worse in those who received steroids. This may be attributed to the fact that steroids were predominantly given to patients with poor general conditions. But it is evident that steroids have not improved the neurological outcome. It is also unclear whether using steroids caused additional worsening in those patients. Being an immunosuppressant, steroids may also increase the risk of infection, which may affect the neurological outcome. Hence, more studies are needed to ascertain the usefulness of steroids in near-hanging patients.

To the best of our knowledge, this is the first study that discusses the steroid therapy used in near-hanging patients. It is a composite study that describes the demographic details, clinical features, and management of the near-hanging patients at the tertiary care center. It is one of the largest studies on near-hanging patients from India.

Our study has a few limitations. As it is a record-based retrospective study, all necessary data were unavailable in the files. Also, as it is a single-center study, these results cannot be generalized. The neurological outcome was assessed once at the time of discharge. But patients with neurological deficits were not followed up to assess their recovery or worsening.

Conclusion

The majority of near-hanging patients had a good neurological recovery. Hanging-induced cardiac arrest, a low GCS score, hypotension, aspiration pneumonia, the requirement for ICU care, and severe cerebral edema were the predictors of mortality. Early resuscitation measures can improve the outcome of near-hanging patients who are very sick at presentation. Corticosteroids were commonly used to manage near-hanging patients without direct evidence of benefit. A randomized controlled study is reasonable to determine the role of corticosteroids in near-hanging patients.

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References

1. World Health Organization. Suicide Worldwide in 2019: Global Health Estimates. Geneva: World Health Organization; 2021. https://www.who.int/publications/i/item/9789240026643. Accessed on: 5 March 2023).
2. Suicides in India. Accidental Deaths and Suicides in India 2020. https://ncrb.gov.in/sites/default/files/adsi2020_Chapter-2-Suicides.pdf (accessed 5 March 2023).
3. Adams N. Near hanging. Emerg Med 1999;11(1):17–21. DOI: 10.1046/j.1442-2026.1999.00314.x.
4. Ganesan P, Jegaraj MK, Kumar S, Yadav B, Selva B, Tharmaraj RG. Profile and outcome of near-hanging patients presenting to emergency department in a tertiary care hospital in South India – A retrospective descriptive study. Indian J Psychol Med 2018;40(3):205–209. DOI: 10.4103/IJPSYM.IJPSYM_282_17.
5. Gandhi R, Taneja N, Mazumder P. Near hanging: Early intervention can save lives. Indian J Anaesth 2011;55(4):388–391. DOI: 10.4103/0019-5049.84863.
6. Renuka MK, Kalaiselvan MS, Arunkumar AS. An analysis of the predictors of mortality and morbidity in patients admitted after suicidal hanging to an Indian multidisciplinary Intensive Care Unit. Indian J Anaesth 2017;61(7):538–542. DOI: 10.4103/ija.IJA_170_17.
7. De Charentenay L, Schnell G, Pichon N, Schenk M, Cronier P, Perbet S, et al. Outcomes in 886 critically ill patients after near-hanging injury. Chest 2020;158(6):2404–2413. DOI: 10.1016/j.chest.2020.07.064.
8. Sauvageau A. About strangulation and hanging: Language matters. J Emerg Trauma Shock 2011;4(2):320. DOI: 10.4103/0974-2700.82238.
9. Jennett B, Bond M. Assessment of outcome after severe brain damage. Lancet 1975;1(7905):480–484. DOI: 10.1016/s0140-6736(75)92830-5.
10. Rupani R, Rathore S, Singh M, Kumari S, Singh R, Verma AK, et al. Demographic profile and outcome of near hanging cases presenting in tertiary care hospital in Northern part of India: An observational study. J Indian Acad Forensic Med 2020;42(2):120–122. DOI: 10.5958/0974-0848.2020.00031.7.
11. Boots RJ, Joyce C, Mullany DV, Anstey C, Blackwell N, Garrett PM, et al. Near-hanging as presenting to hospitals in Queensland: Recommendations for practice. Anaesth Intensive Care 2006;34(6):736–745. DOI: 10.1177/0310057X0603400610.
12. Salim A, Martin M, Sangthong B, Brown C, Rhee P, Demetriades D. Near-hanging injuries: A 10-year experience. Injury 2006;37(5):435–439. DOI: 10.1016/j.injury.2005.12.013.
13. Nehring SM, Tadi P, Tenny S. Cerebral Edema [Updated 2022 Jul 31]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022. Available from: https://www.ncbi.nlm.nih.gov/books/NBK537272/ (accessed 5 March 2023).
14. Luks AM, Auerbach PS, Freer L, Grissom CK, Keyes LE, McIntosh SE, et al. Wilderness Medical Society clinical practice guidelines for the prevention and treatment of acute altitude illness: 2019 update. Wilderness Environ Med 2019;30(4S):S3–S18. DOI: 10.1016/j.wem.2019.04.006.
15. Hackett PH, Yarnell PR, Weiland DA, Reynard KB. Acute and evolving MRI of high-altitude cerebral edema: Microbleeds, edema, and pathophysiology. AJNR Am J Neuroradiol 2019;40(3):464–469. DOI: 10.3174/ajnr.A5897.
16. Anwar MA, Al Shehabi TS, Eid AH. Inflammogenesis of secondary spinal cord injury. Front Cell Neurosci 2016;10:98. DOI: 10.3389/fncel.2016.00098.
17. Bracken MB. Corticosteroids for acute spinal cord injury. Cochrane Database Syst Rev 2012;1(1):CD001046. DOI: 10.1002/14651858.CD001046.pub2.
18. Walters BC, Hadley MN, Hurlbert RJ, Aarabi B, Dhall SS, Gelb DE, et al. Guidelines for the management of acute cervical spine and spinal cord injuries: 2013 update. Neurosurgery 2013;60(CN_suppl_1):82–91. DOI: 10.1227/01.neu.0000430319.32247.7f.
19. Krol LV, Wolfe R. The emergency department management of near-hanging victims. J Emerg Med 1994;12(3):285–292. DOI: 10.1016/0736-4679(94)90268-2.
20. Jawaid MT, Amalnath SD, Subrahmanyam D. Neurological outcomes following suicidal hanging: A prospective study of 101 patients. Ann Indian Acad Neurol 2017;20(2):106–109. DOI: 10.4103/0972-2327.205773.
21. Nair S, Jacob J, Aaron S, Thomas M, Joseph M, Alexander M. Pulmonary distress following attempted suicidal hanging. Indian J Med Sci 2009;63(2):53–57. DOI: 10.4103/0019-5359.49227.
22. D'sa SR, Nair S, Joe Philip V, Reji KK, Karuppusamy R, Joseph M. Study of the factors at admission predicting the outcome in

patients with attempted suicidal hanging. Trop Doct 2018;48(1):3–6. DOI: 10.1177/0049475517729065.
23. Brar G, Chacko J, Moorthy R. Apical ballooning syndrome after attempted suicidal hanging. Indian J Crit Care Med 2011;15 (1):43–45. DOI: 10.4103/0972-5229.78225.
24. Subramanian M, Velayudham S, Jeyaraj M, Arunan S, Perumal S, Mohan K. A case of Lance Adams syndrome in a patient with attempted hanging. Indian J Crit Care Med 2022;26(9):1052–1053. DOI: 10.5005/jp-journals-10071-24299.
25. Karanth S, Nayyar V. What influences outcome of patients with suicidal hanging. J Assoc Phys India 2005;53:853–856. PMID: 16459527.
26. Tharmarajah M, Ijaz H, Vallabhai M, Jena NN, LeSaux M, Smith JP, et al. Reducing mortality in near-hanging patients with a novel early management protocol. Am J Emerg Med 2018;36(11):2050–2053. DOI: 10.1016/j.ajem.2018.08.003.