

An analysis of the predictors of mortality and morbidity in patients admitted after suicidal hanging to an Indian multidisciplinary Intensive Care Unit

Address for correspondence:

Dr. MK Renuka,
C4 ICU, Department
of Anaesthesiology Sri
Ramachandra University,
Porur, Chennai - 600 116,
Tamil Nadu, India.
E-mail: renuramanujam@gmail.
com

MK Renuka, MS Kalaiselvan¹, AS Arunkumar¹

Departments of Anaesthesiology and ¹Critical Care Medicine, Sri Ramachandra University, Chennai, Tamil Nadu, India

ABSTRACT

Background and Aims: Hanging is a frequently used method to attempt suicide in India. There is a lack of data in the Indian population regarding clinical features and outcomes of suicidal hanging. The purpose of this study was to evaluate the factors affecting mortality and morbidity in patients admitted with suicidal hanging to the Intensive Care Unit (ICU). **Methods:** A 6-year retrospective study of adult patients admitted to the ICU with suicidal hanging was analysed for demographics, mode of hanging, lead time to emergency room (ER) admission, clinical presentation, Acute Physiology and Chronic Health Evaluation II (APACHE II) and Sequential Organ Failure Assessment (SOFA) scores, admission Glasgow coma scale (GCS) and neurological outcomes. The primary outcome was in-hospital mortality rate. Secondary outcomes were hospital length of stay (LOS), ICU-LOS, time for neurological recovery, organ support and duration of mechanical ventilation. Statistical analysis was performed using the Student's *t*-test for continuous variables and Chi-square test for categorical variables. **Results:** We analysed data of 106 patients. The median age was 27 years [Interquartile Range (IQR) (22–34)]. The median lead time to ER admission was 1 h [IQR (0.5–1.4)] with median ICU stay of 3 days [IQR (2–4)]. Vasopressors were administered to 27.4% patients. GCS was ≤ 7 in 65% patients, and 84.9% patients received mechanical ventilation. Mortality rate was 10.3%. Survivors recovered with normal organ function. **Conclusion:** Suicidal hanging is associated with significant mortality. Admission GCS, APACHE II and 48 h SOFA score were predictors of poor outcome.

Key words: Complications, intensive care management, mortality, neurological injuries, suicidal hanging

Access this article online

Website: www.ijaweb.org

DOI: 10.4103/ija.IJA_170_17

Quick response code



INTRODUCTION

Hanging is a frequently used method to attempt suicide in India and is also a prominent cause of suicidal deaths worldwide.^[1] These victims present to the emergency room (ER) of hospitals and need specialised care in Intensive Care Units (ICUs). There is a dearth of published data in the Indian population regarding clinical features and outcomes of suicidal hanging. Whereas a number of reports describe post-mortem findings in near-hanging, data on clinical presentation and neurological imaging as a means of prognostication are scanty. Manual, postural and ligature strangulation are known, but hanging is the most common form of strangulation injury.^[2,3]

Hanging occurs when pressure is exerted on the neck by an external mechanism, further increased by the suspended weight of the victim's body. Typical hanging refers to the situation where the point of suspension (knot) is placed over occiput. 'Complete' hanging occurs when a victim is fully suspended and the term 'incomplete' or 'partial' hanging is used for

This is an open access article distributed under the terms of the Creative Commons Attribution-NonCommercial-ShareAlike 3.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as the author is credited and the new creations are licensed under the identical terms.

For reprints contact: reprints@medknow.com

How to cite this article: 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;61:538-42.

other positions. The incidence and severity of initial injuries depend mainly on the height of fall, type and position of neck ligature, and whether it is complete or partial.^[4] Suicidal hanging typically involves a drop from a lower height when compared to judicial hanging, thereby resulting in lower incidence of hangman's fracture and arterial occlusion.^[5]

Death is usually due to direct neurological injury, asphyxiation, bradycardia and cardiac arrest. Skull and vertebral body fractures, cord compression, airway trauma and carotid artery occlusion or dissection are other serious injuries.^[5,6] Common clinical presentations include seizures, cerebral oedema, pulmonary oedema, acute respiratory distress syndrome and multi-organ failure. The aim of this study was to evaluate clinical presentation and outcomes of patients presenting with suicidal hanging in a multidisciplinary ICU.

METHODS

This was a study done on all adult patients admitted to a multidisciplinary ICU, from August 2009 to July 2015, with a history of suicidal hanging. Approval from the Institutional Ethics Committee was obtained for collection of data. Data were collected from chart retrospectively. All patients who presented to ER following hanging with the intent of suicide were admitted to the ICU as per our hospital protocol. Suicidal intent for hanging was confirmed from the history obtained from relatives and bystanders.

Primary outcome analysed was in-hospital mortality rate. Secondary outcomes were hospital length of stay (LOS), ICU-LOS, ICU-free days, time for neurological recovery, organ support, ventilator days and ventilator-free days. Data were collected on demographics, mode of hanging and clinical presentation. Lead time to ER admission was defined as the time taken from detection of the suicidal hanging victim to ER admission, and could be calculated approximately by the history obtained from the person accompanying the victim. The severity of illness scores such as admission Acute Physiology and Chronic Health Evaluation II (APACHE II),^[7] Sequential Organ Failure Assessment (SOFA)^[8] and 48 h SOFA score was calculated using the worst parameters obtained. Admission Glasgow coma scale (GCS) was recorded. The 'time for neurological recovery', defined as the time taken in days to regain a GCS of 15/15 was documented. Neurological outcome score,

the Glasgow outcome scale (GOS)^[9] was captured at the time of discharge or death, whichever was applicable. Computerised tomography (CT) imaging of brain, cervical spine and X-ray of the chest were recorded in all patients.

Data were entered into a computerised spreadsheet and analysed using IBM SPSS Statistics software (Version 12; IBM, Chicago, IL USA). Statistical analysis was performed using the Student's *t*-test or Mann-Whitney rank sum test for continuous variables and Chi-square test for categorical variables. Variables that were significant were selected for logistic regression to identify independent risk factors for poor outcome.

RESULTS

One hundred and six patients were admitted following suicidal hanging during the study period. The median age of patients was 27 years (interquartile range [IQR] 22–34). Patients' minimum age was 18 years and maximum was 71 years. Fifty-one percent of patients were male. The mode of hanging was partial in 80 patients (75.4%) and complete in 26 (24.5%). 42.4% patients were referred to us from other facilities. Most patients attempted suicide at home and were discovered at the scene by one of the relatives or bystanders. The lead time to ER admission was 1.0 h [IQR (0.5–1.4)].

Ninety (84.9%) patients presented with loss of consciousness; of these patients, 65.1% presented with GCS <7. Survivors regained consciousness (GCS - 15/15) within 24 h (median 1 day [IQR (1–1)]). Other common clinical presentations on admission were seizures (19.8%) and restlessness (34%). Patients had high severity of illness scores as indicated by high APACHE II and SOFA scores on admission [Table 1]. About 85% of patients required endotracheal intubation and mechanical ventilation for airway protection (low GCS) or hypoxia. On admission, 27.4% ($n = 29$) of patients required vasopressors for haemodynamic stability. Eleven patients (10.3%) had echocardiographic features of stress cardiomyopathy. Pulmonary oedema was the presenting feature in 27.4% ($n = 29$) of patients.

CT scan imaging of brain and cervical spine were done on all patients. 12.3% ($n = 13$) of patients exhibited an abnormality in their CT brain. None of the patients had an abnormality in their CT of the cervical spine [Figure 1].

Table 1: Clinical characteristics of survivors versus non-survivors of suicidal hanging patients

Patient characteristics	All patients	Survivors	Non-survivors	P
<i>n</i>	106	95	11	
Lead time to ER admission, median (IQR)	1 (0.5-1.37)	1 (0.5-1.3)	1.15 (0.75-2.5)	0.48
Loss of consciousness, <i>n</i> (%)	90 (84.9)	79 (87.8)	11 (12.2)	0.51
GCS ≤7, <i>n</i> (%)	69 (65.1)	58 (84.1)	11 (15.9)	0.01
Seizures, <i>n</i> (%)	21 (19.8)	17 (80.9)	4 (19.04)	0.17
Restlessness on admission, <i>n</i> (%)	36 (34)	36 (100)	0	0.02
Pulmonary oedema, <i>n</i> (%)	29 (27.35)	25 (26.3)	4 (36.3)	0.67
PaO ₂ /FiO ₂ ratio, median (IQR)	237 (168-341)	235 (177-344)	270 (123-318)	0.44
Scoring system at admission, median (IQR)				
Admission APACHE II	21 (17-24)	21 (17-23)	29 (24-30)	0.01
Admission SOFA	5 (4-7)	4 (3.5-7)	7 (6-8)	0.11
48 h SOFA	1 (0-2)	1 (0-2)	6 (4.25-8)	0.002
Laboratory parameters, mean±SD				
Haematocrit	37.39±7.89	36.89±7.83	41.73±7.45	0.054
Serum lactate (mmol/L)	2.16±2.32	2.07±2.38	2.93±1.66	0.043
Organ support, <i>n</i> (%)				
Mechanical Ventilation	90 (84.9)	79 (87.77)	11 (12.22)	0.2
Vasopressors at 24 h	42 (39.6)	31 (73.8)	11 (26.1)	0.04
Outcome, median (IQR)				
GOS at discharge	1 (1-1)	1 (1-1)	5 (5-5)	0.01
Hospital days	5 (3-7)	5 (3.5-6)	7 (2-11)	0.68
ICU ALOS (days)	3 (2-4)	3 (2-4)	7 (2-11)	0.02
ICU free days	2 (1-3)	2 (1-3)	0	0
Ventilator days	2 (1-3)	2 (1-2)	7 (2-11)	0.003
Ventilator-free days	2 (1-3)	2 (1-3)	0	0

ER – Emergency room; IQR – Interquartile range; GCS – Glasgow coma scale; APACHE II – Acute Physiology and Chronic Health Evaluation II; SOFA – Sequential organ failure assessment score; GOS – Glasgow outcome scale; SD – Standard deviation; ICU ALOS – Intensive Care Unit average length of stay

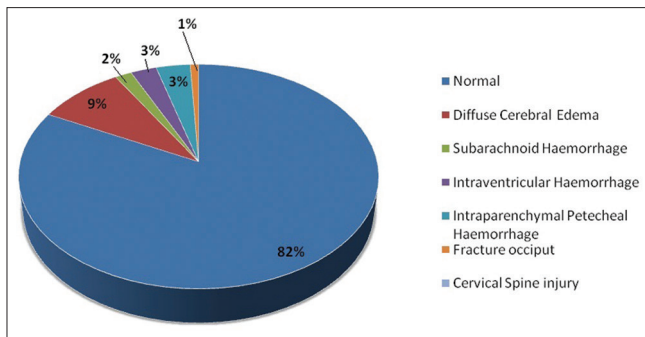


Figure 1: Incidence of neuroradiological abnormalities in patients with suicidal hanging

Mortality was 10.3% (*n* = 11). The median LOS in hospital was 5 days [IQR (3–7)]. The median ICU-LOS was 3 days [IQR (2–4)], and of these, 2 days [IQR (2–4)] were ventilator-free days. Forty-eight hour SOFA score was low in survivors, with a median 1 [IQR (0–2)] when compared to non-survivors who had a median SOFA score of 6 [IQR (4.25–8)], in line with the rapid improvement that survivors exhibited on aggressive treatment (*P* = 0.002).

The median GOS at discharge was one [range (1–5)]. Three patients (2.8%) suffered intraventricular

haemorrhage, but they exhibited complete neurological recovery. One patient developed the right-sided hemiplegia which recovered over a few weeks. Another patient developed right upper limb monoparesis which suggested C5, C6, C7 sensory-motor root lesion on clinical examination and nerve conduction studies. However, magnetic resonance imaging of the cervical spine was normal. Multivariate analysis showed that admission GCS >7, high APACHE II and 48 h SOFA score were higher among non-survivors [Table 2].

DISCUSSION

In this retrospective study of 106 patients admitted to the ICU after suicidal hanging, we found a mortality of 10.3%. Patients who died had lower GCS and higher severity of illness scores at admission, and higher organ failure scores at 48 hours than survivors.

Hanging is one of the most common forms of successful suicide, with a high case fatality rate (70%).^{10]} Patients who reach the hospital alive have a good survival rate with aggressive management in the ICU.

Parameters	Non-survivors (n=11)	Survivors (n=95)	OR (95%CI)	P
GCS				
≤7	11	58	14.74 (0.84-257.70)	0.0653
>7	0	37		
Admission APACHE II, median (IQR)	29 (24-30)	21 (17-23)	12.1 (1.12-96.3)	0.001
SOFA at 48hrs	6 (4.25-8)	1 (0-2)	7.3 (1.09-49.4)	0.002

GCS – Glasgow Coma Scale; APACHE II – Acute Physiology and Chronic Health Evaluation II; IQR – Interquartile range; SOFA – Sequential organ failure assessment score; OR – Odds ratio; CI – Confidence interval

The median age of our study population was 27 years with a male predominance (51%) which was consistent with other studies.^[11,12] The lead time to ER admission, in this study (1 h), did not influence the final outcome, which is unlike other studies in which delay in presentation has been associated with higher odds of a poor outcome.^[13]

The incidence of seizures in this study was higher (19.8%) when compared to that observed in another study (14%).^[13] Loss of consciousness was present in 84.9% ($n = 90$) of patients; however, 87.8% ($n = 79$) of these patients survived. None of these features had any correlation with mortality in this study.

Unlike in one of the studies,^[13] more patients in this study (39.4% vs. 30%) were haemodynamically unstable and on vasopressors, pointing toward a more depressed physical state on admission.

Mortality in various studies ranged from 8% to 12%,^[13-15] which was similar to this study, where the overall mortality was 10.3%. Mortality in hanging varies widely depending on patients presenting condition.^[10,16] However, in contrast to this study, another study^[10] demonstrated 77% mortality. This increased mortality was attributed to a higher incidence of cardiopulmonary arrest (91.5%) at the scene. In a study of the pattern of injury and functional outcome after hanging,^[6] the overall mortality (33%) was high with 14% of patients being dead on arrival or dying immediately on admission to the hospital. The occurrence of permanent neurological damage or delayed neuropsychiatric sequelae among survivors remains the most feared outcome.^[10]

This work confirms the findings of previously published studies, namely that a lower admission GCS is predictive of a worse outcome.^[13-15] We are unable to benchmark the presenting severity of illness of this study as there are no published data looking at admission severity in these groups of patients. Both SOFA and APACHE II are affected by GCS and as

the other physiological parameters were similar in both groups, it suggests that it is the lower GCS that is responsible for the elevation in the admission physiological scores. However, most patients showed rapid improvement in GCS following intensive care management and regained a GCS of 15/15 within 1 day of mechanical ventilation.

Several studies have shown that the sensorium at presentation was prognostically significant.^[13-15] In one study,^[17] admission GCS was an independent predictor of mortality similar to this study; however, another study^[5] observed that prognosis is not related to the initial state at presentation.

Although autopsy studies mention fracture and injury to cervical spine from hanging, none of the patients in this study had any cervical spine abnormality on CT imaging. One patient had fracture occiput, probably due to injury while being extracted. In one review,^[5] cervical spine injury was identified in only 4 out of 689 patients (0.6%) with near hanging. Cervical spine injury may be more prominent in patients who do not reach ER alive. However, in several other studies,^[6,15] the incidence of cervical spine injury was low (5% and 7%).

Injuries to soft tissue structures of the neck, fracture of laryngeal cartilages and hyoid bone, cricotracheal separation have been reported.^[17,18] This study neither came across any such injuries nor any difficulty in intubation. Carotid artery dissection or occlusion causing stroke has been reported following suicidal hanging though this study did not demonstrate any.^[19] Pulmonary involvement following hanging is usually neurogenic or due to stress cardiomyopathy.^[20] The incidence of pulmonary oedema associated with airway obstruction has been estimated at 11% in adults requiring active airway interventions, but we had none.^[21-23]

Most patients required short duration of mechanical ventilation and ICU stay which was consistent with

another study.^[13] However, failure to improve rapidly, as suggested by the 48-h SOFA, was a marker of poor prognosis and this correlated with mortality.

This study represents one of the largest Indian data on suicidal hanging from an ICU. This study has few inherent limitations. Although it demonstrated that as a whole, the patients did well in terms of survival, long-term outcome data are of more relevance, but due to the retrospective nature of the study, we did not have a follow-up after hospital discharge and were also unable to assess any possible long-term cognitive dysfunction.

CONCLUSION

Suicidal hanging is associated with significant mortality. Predictors of poor outcome in our study were admission GCS, APACHE II and SOFA at 48 h. This study has helped in highlighting the fact that based on these predictors, patients who come to the hospital alive following suicidal hanging can have a good outcome if treated with appropriate, timely and aggressive care. Further studies focusing on long-term outcomes will help identify patients with neurological sequelae.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

- Mohanty S, Sahu G, Mohanty MK, Patnaik M. Suicide in India: A four year retrospective study. *J Forensic Leg Med* 2008;15:346-7.
- Gunnell D, Bennewith O, Hawton K, Simkin S, Kapur N. The epidemiology and prevention of suicide by hanging: A systematic review. *Int J Epidemiol* 2005;34:433-42.
- Hawton K, Bergen H, Casey D, Simkin S. General hospital presentations of non-fatal hanging over a 28-year period: Case-control study. *Br J Psychiatry* 2008;193:503-4.
- James R, Silcocks P. Suicidal hanging in Cardiff – A 15-year retrospective study. *Forensic Sci Int* 1992;56:167-75.
- Adams N. Near hanging. *Emerg Med (Fremantle, WA)* 1999;11:17-21.
- Martin MJ, Weng J, Demetriades D, Salim A. Patterns of injury and functional outcome after hanging: Analysis of the National Trauma Data Bank. *Am J Surg* 2005;190:836-40.
- Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: A severity of disease classification system. *Crit Care Med* 1985;13:818-29.
- Vincent JL, Moreno R, Takala J, Willatts S, De Mendonça A, Bruining H, *et al.* The SOFA (Sepsis-related Organ Failure Assessment) score to describe organ dysfunction/failure. On behalf of the Working Group on Sepsis-Related Problems of the European Society of Intensive Care Medicine. *Intensive Care Med* 1996;22:707-10.
- Jennett B, Bond M. Assessment of outcome after severe brain damage: A practical scale. *The Lancet* 1975;305:480-4.
- Matsuyama T, Okuchi K, Seki T, Murao Y. Prognostic factors in hanging injuries. *Am J Emerg Med* 2004;22:207-10.
- Wilkinson D, Gunnell D. Comparison of trends in method-specific suicide rates in Australia and England and Wales, 1968-97. *Aust N Z J Public Health* 2000;24:153-7.
- Beautrais AL. Methods of youth suicide in New Zealand: Trends and implications for prevention. *Aust N Z J Psychiatry* 2000;34:413-9.
- Karanth S, Nayyar V. What influences outcome of patients with suicidal hanging. *J Assoc Physicians India* 2005;53:853-6.
- Penney DJ, Stewart AH, Parr MJ. Prognostic outcome indicators following hanging injuries. *Resuscitation* 2002;54:27-9.
- Salim A, Martin M, Sangthong B, Brown C, Rhee P, Demetriades D. Near-hanging injuries: A 10-year experience. *Injury* 2006;37:435-9.
- Hanna SJ. A study of 13 cases of near-hanging presenting to an Accident and Emergency Department. *Injury* 2004;35:253-6.
- 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;34:736-45.
- Linnau KF, Cohen WA. Radiological evaluation of attempted suicide by hanging: Cricotracheal separation and common carotid artery dissection. *Am J Roentgenol* 2002;178:214.
- Maier W, Fradis M, Malatskey S, Krebs A. Diagnostic and therapeutic management of bilateral carotid artery occlusion caused by near-suicidal hanging. *Ann Otol Rhinol Laryngol* 1999;108:189-92.
- Gnanavelu G, Sathiakumar DB. Reversible left ventricular dysfunction in suicidal hanging. *J Assoc Physicians India* 2008;56:545-6.
- Park JH, Kang SJ, Song JK, Kim HK, Lim CM, Kang DH, *et al.* Left ventricular apical ballooning due to severe physical stress in patients admitted to the medical ICU. *Chest* 2005;128:296-302.
- Brotman DJ, Golden SH, Wittstein IS. The cardiovascular toll of stress. *Lancet* 2007;370:1089-100.
- Kumar M, Mandhyan R, Shukla U, Kumar A, Rautela RS. Delayed pulmonary oedema following attempted suicidal hanging – A case report. *Indian J Anaesth* 2009;53:355-7.

Announcement

Northern Journal of ISA

Now! Opportunity for our members to submit their articles to the Northern Journal of ISA (NJISA)! The NJISA, launched by ISA covering the northern zone of ISA, solicits articles in Anaesthesiology, Critical care, Pain and Palliative Medicine. Visit <http://www.njisa.org> for details.

Dr. Sukhminder Jit Singh Bajwa, Patiala
Editor In Chief

Dr. Zulfiqar Ali, Srinagar
Co-Editor