



## A STUDY ON NEUROLOGICAL OUTCOME FOLLOWING SUICIDAL HANGING IN TERTIARY CARE CENTRE

### General Medicine

**Dr. Velagala S Sai Lakshmi**

M.D., Associate Professor, Department of General Medicine, Government Siddhartha Medical College, Vijayawada

**Dr. Kunnerla Bhargav Sai Srinivas\***

Post Graduate, Department of General Medicine, Government Siddhartha Medical College, Vijayawada\*Corresponding Author

**Dr. Kudurupaka Prasad**

M.D., General Medicine, Department of General Medicine, Government Siddhartha Medical College, Vijayawada

### ABSTRACT

**Background:** Suicidal hanging may cause hypoxic-ischaemic brain injury, airway compromise and systemic complications. Early predictors of outcome are clinically important. **Objective:** To describe the clinical, respiratory, neurological and radiological profile of patients admitted after suicidal hanging and identify factors associated with mortality. **Methods:** This prospective observational study included 50 patients aged >18 years admitted to the ICU of New Government General Hospital, Vijayawada, from August 2023 to July 2024. Demographic, clinical, neurological and radiological findings were recorded. Outcome was assessed at hospital discharge. **Results:** Most patients were young adults; 32% were aged 18–30 years and 72% were male. Partial hanging was recorded in 60% and complete hanging in 40%. Pulmonary edema occurred in 42%, oxygen saturation <92% in 30%, retrograde amnesia in 34%, and seizures in 4%. Mechanical ventilation was required in 16%. GCS was <8 in 50%, 9–12 in 28% and 13–15 in 22%. Cerebral edema was present in 30%, hypoxic-ischaemic encephalopathy in 8%, PRES in 2%, and cervical spine injury in 6%. At discharge, 86% were alive without major neurological deficit, 8% died, 4% remained in a persistent vegetative state and 2% had hemiparesis. GCS <8 and pulmonary edema were significantly associated with mortality ( $p=0.0001$ ). **Conclusion:** Suicidal hanging can cause serious respiratory and neurological complications. Low GCS and pulmonary edema were associated with higher mortality. Early treatment and psychiatric follow-up are important for better outcomes.

### KEYWORDS

Suicidal hanging; near hanging; Glasgow Coma Scale.

### INTRODUCTION

The mechanism of injury is predominantly related to interruption of cerebral blood flow and oxygenation following compression of cervical structures. Survivors may therefore present with a spectrum of neurological and respiratory abnormalities, and the initial clinical assessment must rapidly identify hypoxia, depressed consciousness, airway compromise and potentially reversible complications. Although major cervical spine injury is uncommon in suicidal hanging, it remains clinically relevant in selected patients. The prognostic value of early bedside findings is particularly important in resource-limited settings where advanced neuroimaging may not be immediately available.

Suicidal hanging is an important cause of potentially preventable morbidity and mortality. Survivors who reach hospital alive are commonly described as near-hanging cases.[1,2] Compression of cervical structures can produce cerebral hypoxia, venous congestion, airway compromise and, less frequently, vascular or cervical spine injury.[3–5] Neurological consequences range from transient loss of consciousness and amnesia to hypoxic-ischaemic encephalopathy, seizures, focal deficits, coma and death.[6–9]. Previous studies have identified admission GCS, pulmonary edema, hypoxia and cerebral imaging abnormalities as important indicators of severity and outcome. [10–12]. The present study describes the clinical, respiratory, neurological and radiological profile of patients following suicidal hanging and evaluates factors associated with short-term mortality.

### AIM AND OBJECTIVES

1. To study the neurological outcomes following suicidal hanging.
2. To study neurological and other systemic manifestations and their prognosis.
3. To study the clinical profile of patients presenting after suicidal hanging.

### MATERIALS AND METHODS

The study population represented patients who survived the hanging event sufficiently to reach the ICU and undergo hospital evaluation. Clinical information was obtained from the patient and/or attendants when available. The assessment included the circumstances of the attempt, estimated duration of suspension, ligature material and previous suicidal attempts. Neurological assessment focused on level of consciousness, GCS, retrograde amnesia and seizures, while respiratory assessment included oxygen saturation, pulmonary edema and need for ventilatory support. Radiological abnormalities were docu-

mented from CT/MRI brain and cervical imaging performed during evaluation. The principal outcome measure was neurological status at hospital discharge.

This hospital-based prospective observational study was conducted from August 2023 to July 2024 at New Government General Hospital, Vijayawada. Fifty patients aged >18 years admitted to the ICU following suicidal hanging were included. Patients <18 years and those for whom the patient or attendant declined participation were excluded. Demographic details, type and duration of hanging, precipitating factors, ligature material, previous suicidal attempts, respiratory complications, neurological findings, GCS and requirement for mechanical ventilation were recorded. CT brain, CT cervical spine, X-ray cervical spine, arterial blood gas analysis and serum electrolytes were performed as clinically indicated. Hospital discharge outcome was classified as death, persistent vegetative state, hemiparesis or alive without major neurological deficit.

### RESULTS

The most frequently reported precipitating factor was failure in examinations (28%), followed by alcohol influence (26%) and domestic quarrel (24%). Saree or cloth was the commonest ligature material (70%), and 38% of participants reported a previous suicidal attempt. Among neurological manifestations, retrograde amnesia was more frequent than seizures. These findings demonstrate that survivors can have clinically important cognitive and respiratory abnormalities even when ultimate hospital survival is favourable.

Among 50 patients, the largest age group was 18–30 years (32%), followed by 31–40 years (30%) and 41–50 years (26%). Males constituted 72% of the cohort. Complete hanging accounted for 30 (60%) patients and partial hanging for 20 (40%).

**Table 1. Demographic Characteristics of the Study Population**

| Variable        | n  | %  |
|-----------------|----|----|
| Age 18–30 years | 16 | 32 |
| Age 31–40 years | 15 | 30 |
| Age 41–50 years | 13 | 26 |
| Age 51–60 years | 4  | 8  |
| Age 61–70 years | 2  | 4  |
| Male            | 36 | 72 |
| Female          | 14 | 28 |

**Table 2. Circumstances and Characteristics of the Hanging Attempt**

| Characteristic            | n  | %  |
|---------------------------|----|----|
| Duration <2 min           | 21 | 42 |
| Duration 2–5 min          | 29 | 58 |
| Failure in examinations   | 14 | 28 |
| Alcohol influence         | 13 | 26 |
| Domestic quarrel          | 12 | 24 |
| Love-related issues       | 8  | 16 |
| Chronic illness           | 3  | 6  |
| Saree/cloth ligature      | 35 | 70 |
| Rope ligature             | 15 | 30 |
| Previous suicidal attempt | 19 | 38 |
| No previous attempt       | 31 | 62 |

**Table 3. Distribution According to Type of Hanging**

| Type of hanging  | Frequency | Percentage (%) |
|------------------|-----------|----------------|
| Complete hanging | 30        | 60             |
| Partial hanging  | 20        | 40             |
| Total            | 50        | 100            |

**Table 4. Clinical, Respiratory and Neurological Findings**

| Finding                         | n  | %  |
|---------------------------------|----|----|
| Pulmonary edema                 | 21 | 42 |
| Oxygen saturation <92%          | 15 | 30 |
| Retrograde amnesia              | 17 | 34 |
| Seizures                        | 2  | 4  |
| Mechanical ventilation required | 8  | 16 |
| GCS <8                          | 25 | 50 |
| GCS 9–12                        | 14 | 28 |
| GCS 13–15                       | 11 | 22 |

**Table 5. Radiological Findings and Discharge Outcome**

| Finding/outcome                                     | n  | %  |
|-----------------------------------------------------|----|----|
| Cerebral edema                                      | 15 | 30 |
| Hypoxic-ischaemic encephalopathy                    | 4  | 8  |
| PRES                                                | 1  | 2  |
| C1–C2 injury                                        | 2  | 4  |
| C4–C5 dislocation                                   | 1  | 2  |
| Died                                                | 4  | 8  |
| Persistent vegetative state                         | 2  | 4  |
| Hemiparesis                                         | 1  | 2  |
| Alive/discharged without major neurological deficit | 43 | 86 |

**Table 6. Association of Admission Gcs and Pulmonary Edema With Mortality**

| Variable                | Alive n | Dead n | Total | p value |
|-------------------------|---------|--------|-------|---------|
| GCS <8                  | 21      | 4      | 25    | 0.0001  |
| GCS 9–12                | 14      | 0      | 14    |         |
| GCS 13–15               | 11      | 0      | 11    |         |
| Pulmonary edema present | 17      | 4      | 21    | 0.0001  |
| Pulmonary edema absent  | 29      | 0      | 29    |         |

Twenty-one patients (42%) had pulmonary edema and 15 (30%) had oxygen saturation <92%. Retrograde amnesia occurred in 17 (34%) and seizures in 2 (4%). Mechanical ventilation was required in 8 (16%). At admission, 25 (50%) had GCS <8, 14 (28%) had GCS 9–12 and 11 (22%) had GCS 13–15. Cerebral edema was present in 15 (30%), hypoxic-ischaemic encephalopathy in 4 (8%), PRES in 1 (2%), C1–C2 injury in 2 (4%) and C4–C5 dislocation in 1 (2%). At discharge, 43 (86%) were alive without the specified major neurological complications, 4 (8%) died, 2 (4%) remained in a persistent vegetative state and 1 (2%) had hemiparesis.

## DISCUSSION

Radiological abnormalities were dominated by cerebral edema, while HIE was identified in 8%. PRES was uncommon. Cervical spine abnormalities were detected in three patients, representing 6% of the cohort. The low frequency of cervical injury is consistent with previous reports of suicidal hanging without a long drop, but the presence of such injuries supports targeted cervical imaging when the clinical context warrants it.[13,16] The difference between CT-based assessment in the present study and MRI-focused studies is relevant because MRI may detect subtle hypoxic, vascular or soft-tissue abnormalities that are not evident on CT.[15]

The neurological profile also demonstrates the importance of post-resuscitation assessment. Retrograde amnesia was documented in 34% of patients, a finding comparable with the substantial prevalence

reported by Jawaaid et al.[10] Persistent memory disturbance has also been described despite apparently normal neurological examination and imaging, indicating that hospital discharge without a major motor deficit does not necessarily represent complete neurological recovery. [8,9] Long-term cognitive and psychiatric outcomes were not assessed in the present study.

The respiratory findings were clinically important. Pulmonary edema was present in 21 patients and oxygen saturation was <92% in 15. Jawaaid et al. reported a similar frequency of pulmonary edema and hypoxia, while Renuka et al. described a substantially greater requirement for mechanical ventilation in their ICU cohort.[10,11] The lower ventilation requirement in the present study may reflect differences in case mix, severity, admission practices and indications for intubation.

The distribution of admission severity was notable: half of the cohort had GCS <8, yet most of these severely impaired patients survived. This emphasizes that a low initial GCS should be interpreted as a marker of acute severity rather than an absolute determinant of irreversible neurological injury. Nevertheless, all four deaths occurred in the GCS <8 group, making admission GCS a particularly useful early prognostic variable in this cohort.

The cohort was predominantly young and male, with 62% aged 18–40 years and 72% male. This pattern is broadly comparable with published near-hanging cohorts, in which young adults and males form a substantial proportion.[10–14] In the present study, complete hanging accounted for 60% and partial hanging for 40%. This distribution is close to the 2024 Indian MRI study cited in the thesis, which reported complete hanging in 59.45% and incomplete hanging in 40.54%.[15]

Respiratory compromise was common. Pulmonary edema occurred in 42% and oxygen saturation <92% in 30%, closely resembling the 42.6% and 31.7% reported by Jawaaid et al.[10] Pulmonary edema may reflect airway obstruction, aspiration and negative-pressure pulmonary edema following resuscitation. Its association with mortality in this cohort supports early recognition and aggressive respiratory support when indicated.

Retrograde amnesia occurred in 34%, consistent with the substantial memory disturbance described in survivors of hanging.[8,10] Half of the patients presented with GCS <8. Four of these patients died, whereas all patients with GCS ≥9 survived; the association was statistically significant ( $p=0.0001$ ). This agrees with studies identifying low admission GCS as an important predictor of poor outcome.[10,11]

Cerebral edema was the commonest radiological abnormality, followed by hypoxic-ischaemic encephalopathy. Cervical spine injury was uncommon (6%), consistent with reports that major cervical injury is relatively infrequent in short-drop suicidal hanging.[4,13,16] The presence of neurological abnormalities despite initial survival highlights the importance of appropriate neuroimaging and serial neurological assessment.

The overall short-term outcome was favourable in most patients, with 86% discharged alive without major neurological deficit. Nevertheless, 8% died and 6% had major persistent neurological disability at discharge. Pulmonary edema was strongly associated with mortality: 4 of 21 patients with edema died, while all 29 without edema survived ( $p=0.0001$ ). Psychiatric assessment and suicide-prevention planning remain essential after medical stabilization, particularly because 38% of participants reported a previous suicidal attempt.

## Clinical Implications

The association of both GCS <8 and pulmonary edema with mortality in this study suggests that these variables can be used for early bedside risk stratification. However, the small sample size and single-centre design mean that these associations should be interpreted as prognostic signals rather than independent causal predictors.

The findings support a structured early assessment of survivors of suicidal hanging. Particular attention should be given to airway and oxygenation, GCS at admission, pulmonary edema, neurological examination and appropriate neuroimaging. Patients with marked impairment of consciousness or respiratory compromise require close monitoring and timely supportive treatment. After medical stabilization, assessment of memory, cognition and psychosocial factors is important because neurological or psychiatric sequelae may persist beyond hospital discharge.

## LIMITATIONS

The study did not include systematic follow-up neuropsychological testing or standardized long-term functional outcome scales. Consequently, subtle memory, executive, behavioural or psychiatric sequelae may have been missed. The sample was also limited to patients admitted to a single tertiary-care ICU, and estimated duration of hanging may have been dependent on collateral history.

The study was single-centre with a small sample size of 50, limiting generalizability. Outcome assessment ended at hospital discharge, so delayed cognitive, memory and neuropsychiatric sequelae were not evaluated. The observational design limits causal inference. The exact timing of rescue and some history variables depended on available collateral information.

## CONCLUSION

Most patients had favourable short-term neurological outcomes after suicidal hanging. Lower admission GCS and pulmonary edema were significantly associated with mortality. Early airway and respiratory management, neurological assessment, appropriate imaging and structured psychiatric follow-up are important components of care.

## REFERENCES

1. Hellier C, Connolly R. Cause of death in judicial hanging: a review and case study. *Med Sci Law*. 2009;49(1):18–26.
2. Gandhi R, Taneja N, Mazumder P. Near hanging: early intervention can save lives. *Indian J Anaesth*. 2011;55(4):388–91.
3. Kodikara S. Uneventful recovery from suicidal hanging: a case report. *Med Sci Law*. 2006;46(1):89–91.
4. McHugh TP, Stout M. Near-hanging injury. *Ann Emerg Med*. 1983;12(12):774–6.
5. Kenaga T, Kajikawa M, Kajikawa H, Yamamura K, Wakabayashi C, Sumioka S, et al. Unilateral dissection of the cervical portion of the internal carotid artery and ipsilateral multiple cerebral infarctions caused by suicidal hanging: a case report. *No Shinkei Geka*. 1996;24(9):853–8.
6. Takeuchi S, Takasato Y, Homma M. Reversible posterior leukoencephalopathy syndrome caused by hanging. *J Neurol Neurosurg Psychiatry*. 2009;80(8):908–9.
7. Calvanese JC, Spohr MH. Hyperthermia from a near hanging. *Ann Emerg Med*. 1982;11(3):152–5.
8. Medalia AA, Merriam AE, Ehrenreich JH. The neuropsychological sequelae of attempted hanging. *J Neurol Neurosurg Psychiatry*. 1991;54(6):546–8.
9. Markowitsch HJ. The neuropsychology of hanging: an historical perspective. *J Neurol Neurosurg Psychiatry*. 1992;55:507.
10. Jawaid MT, Amalath SD, Subrahmanyam DK. Neurological outcomes following suicidal hanging: a prospective study of 101 patients. *Ann Indian Acad Neurol*. 2017;20(2):106–8.
11. 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):538–42.
12. Gantois G, Parmentier-Decrucq E, Duburcq T, Favory R, Mathieu D, Poissy J. Prognosis at 6 and 12 months after self-attempted hanging. *Am J Emerg Med*. 2017;35(11):1672–6.
13. Atreya A, Kanchan T. Clinico-epidemiological study of near-hanging cases—an investigation from Nepal. *J Forensic Leg Med*. 2015;33:35–8.
14. Solhi H, Pazoki S, Mehrpour O, Alfred S. Epidemiology and prognostic factors in cases of near hanging presenting to a referral hospital in Arak, Iran. *J Emerg Med*. 2012;43(4):599–604.
15. Das U, Jonmenjoy, Biswas N, Pandit N, Bhadra T. Magnetic resonance imaging neurological findings in Indian patients who survived suicidal hanging: a retrospective study. *Ain Shams J Forensic Med Clin Toxicol*. 2024;43(2):7–13. doi:10.21608/ajfm.2024.365476.
16. Nikolić S, Živković V. Cervical spine injuries in suicidal hanging without a long-drop—patterns and possible underlying mechanisms of injury: an autopsy study. *Forensic Sci Med Pathol*. 2014;10:193–7.
17. Choi DW, Lee SW, Jeong SH, Park JS, Kim H. Early diffusion-weighted imaging and outcome prediction of comatose survivors after suicidal hanging. *Am J Emerg Med*. 2019;37(1):5–11.
18. Kim MJ, Yoon YS, Park JM, Cho J, Lim H, Kang H, Kim HJ, Kim SW, Lee KR, Kim GB, Park JS. Neurologic outcome of comatose survivors after hanging: a retrospective multicenter study. *Am J Emerg Med*. 2016;34(8):1467–72.
19. Aneja J, Jangli S, Kulhara P, Bathla M. Neuropsychiatric sequelae of attempted hanging and diagnostic dilemmas. *Ind Psychiatry J*. 2017;26(2):239–42.
20. Prasad DM, Manjula S. A state of reversed hypoxic encephalopathy following attempted suicidal hanging: a boon. *Med Sci Law*. 2012;52(1):44–6.