

Predictors of Outcome of Hanging in Patients Presented to the Emergency Department ICU

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ABSTRACT

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Background: Hanging is a leading method of suicide in India, with rising incidence and high mortality. Identifying clinical and laboratory predictors of outcome is essential for early intervention.

Methods: This retrospective observational study was conducted in the Emergency Department ICU of a tertiary centre in Kerala from March 2024 to February 2025. Twenty-seven patients admitted following suicidal hanging without prior comorbidities were analysed. Demographics, lead time, GCS, hemodynamic status, renal function, cardiac evaluation (ECG, Troponin I, POCUS), ABG, and neuroimaging findings were assessed. Primary outcome was ICU mortality; secondary outcomes included cardiac and neurological abnormalities, and ICU stay.

Results: Median age was 29 years (IQR 22–45), with male predominance (59%). Mortality was 37% (10/27), with 81.8% deaths in patients presenting with out-of-hospital cardiac arrest (OHCA). Predictors of mortality included prolonged lead time >30 min ($p=0.002$), low GCS ($p<0.001$), elevated Troponin I ($p=0.013$), renal dysfunction ($p<0.001$), and abnormal neuroimaging ($p<0.001$). Myocardial injury, defined by Troponin I elevation and/or LV systolic dysfunction, was observed in 37% and correlated with poor outcomes. Psychosocial stressors identified included relationship conflicts, financial distress, academic pressure, and psychiatric illness.

Conclusion: Mortality in patients presented with hanging was strongly associated with OHCA, delayed presentation, low GCS, renal dysfunction, and myocardial or hypoxic brain injury. Early resuscitation, bystander CPR, and rapid ICU stabilization are vital to improve survival. Integrating psychosocial interventions alongside acute care may reduce recurrence and long-term morbidity.

Keywords: Hanging, Predictors of mortality, Myocardial injury, Out-of-hospital cardiac arrest

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INTRODUCTION

Hanging is a common method of suicide in India and worldwide. There is a rising incidence of hanging cases in different parts of the world, as many believe this is a simple, certain and painless method of self-destruction. According to the National Crime Records Bureau (NCRB) data, there is an alarming rise in suicide rates due to hanging. In 2022, suicide due to hanging accounted for 58.2% of total suicides in India, with 99,415 reported cases. Kerala alone reported 7,956 cases, reflecting a significant burden of hanging-related fatalities. These alarming statistics underscore the critical need for research into clinical outcomes, prognostic indicators, and psychosocial factors influencing patients.

The decision to commit suicide by hanging is influenced by a complex interplay of psychosocial factors. Several key determinants contribute to suicidal behaviour in these patients like mental Health Disorders (Depression, schizophrenia, bipolar disorder, and anxiety disorder), Substance Abuse- Alcohol and drug dependence are frequently associated with impulsive suicide attempts, Socioeconomic Stressors (Financial difficulties, unemployment, and poverty increase vulnerability to suicidal behaviour) Interpersonal Conflicts (Relationship problems, domestic violence, and family disputes act as acute triggers) Social Isolation (Lack of a strong support system and loneliness exacerbate mental health struggles), Previous Suicide Attempts (A history of self-harm or previous suicide attempts significantly increases the risk of recurrence), Cultural and

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Regional Factors (Societal pressure, stigma surrounding mental health, and accessibility to means of suicide) also play a role. Understanding these factors is crucial for developing effective prevention strategies, including early psychiatric intervention, community-based support systems, and crisis management programs to reduce suicide rates. Early psychiatric intervention and social support are essential components of post-ICU care and are also needed to prevent recurrent suicide attempts and to improve long-term outcomes.

In hanging cases, various mechanisms can lead to death. Known mechanisms include asphyxiation due to airway obstruction, cerebral ischemia due to arterial blockage, carotid sinus reflex, congestion due to venous blockage, and fractures with the spinal cord injury.

We conducted a record-based study on subjects admitted with hanging managed in the Emergency Department ICU (EDICU) of a tertiary care centre in Kerala over one year. Understanding the clinical presentations, laboratory abnormalities, and their impact on outcomes is crucial for early intervention and better prognosis. Hanging injuries have adverse effects on cardiac function. Several case reports and studies discuss cardiac impairment in patients admitted with hanging. However, hanging-associated cardiovascular damage has not been fully understood.

AIMS AND OBJECTIVES

- To analyse the clinical profile, laboratory and imaging parameters of patients presenting with hanging admitted to the ED ICU
- To identify parameters associated with clinical severity and outcomes.

METHODOLOGY

This was a single-centre observational record-based study from 1st March 2024 to 28th February 2025. Twenty-seven patients admitted following hanging, having no previous known co-morbidities and treated in the EDICU of the tertiary care centre were included in this study. The primary outcome studied was the mortality rate during ICU stay, and the secondary outcomes measured were cardiac abnormalities, neurological abnormalities in imaging, the length of ICU stay, and lead time to the emergency room (ER) admission (from the last well-known time to presentation to ED). The clinical parameters assessed were ligature mark, GCS, hypotension or on vasopressor/inotropic support (hypotension defined as systolic BP <90 mm Hg/MAP <65mm of Hg) at presentation. Continuous monitor-

ing was done to assess haemodynamic status, cardiac arrhythmias and GCS during the ICU stay. Investigations done were- renal function tests (was recorded as abnormal if there is an increase in serum creatinine level more than 1.5 times from baseline or $\geq 0.3\text{mg/dl}$ increase in creatinine), quantitative-Troponin I (normal level <0.01ng/ml), ABG, Neuroimaging (CT head with c-spine, MRI Brain if indicated), ECG and point of care ultrasound (done by emergency medicine physician). Cardiac involvement was considered if at least one of the following criteria is met namely ECG abnormalities recorded on arrival, serial elevated troponin I titer, POCUS showing LV systolic dysfunction (EPSS>0.7cm). Median ICU stay was noted in all the patients.

RESULTS

Twenty-seven patients presenting with hanging admitted to the ED ICU at Government Medical College, Kozhikode, Kerala, during the study period were included. Sixteen of them were males and 11 were females, with a male-to-female ratio of 1.45:1. The median age of patients was 29 years (IQR 22-45), with a minimum age of 15 years and a maximum of 78 years. Most patients were in the 20-40 years age group. The median time of presentation was 20 minutes (IQR 15-60), ranging from 5 to 120 minutes.

Median GCS of the patients was 6 (IQR 3-9), with a minimum of 3 and a maximum of 10. The median length of ICU stay was 3 days (IQR 3-5), ranging from 2 to 30 days. Twelve patients were received intubated from peripheral hospitals. Fifteen patients were intubated at our hospital due to low GCS and airway compromise. C-spine was stabilized with a hard cervical collar in all cases. Ligature marks were present in all patients, and in one case, subcutaneous emphysema was observed, which was diagnosed to have hyoid bone fracture on CT. Clinical features and investigations at presentation are shown in **tables 1&2**.

Median Time of presentation, Median GCS, and Median ICU stay were significantly higher in non-survivors (**Table 3**).

Table 1. Clinical characteristics at presentation

	Frequency	Percentage %
Breathlessness	6	22.2
Unresponsiveness	17	63
Seizures	4	14.8
OHCA	11	40.7
Hypotension	18	66.7

OHCA-Out of hospital cardiac arrest

Table 2. Investigations at presentation

Sl no	Investigations	Frequency (n = 27)	Percentage %
1	LV systolic dysfunction by Ultrasound	9	33.3
2	Elevated trop-I (ng/ml)	10	37
3	ABG abnormalities		
	HAGMA	10	37
	Respiratory acidosis(RA)	9	33.3
	HAGMA+RA	4	14.8
4	ECG abnormalities		
	Sinus tachycardia	9	33.3
	ST-T changes	5	18.5
	Atrial fibrillation	1	3.7
5	CT abnormalities	15	55.6

ST-T changes- ST depressions, T wave inversions
HAGMA-High anion gap metabolic acidosis

In the present study, age was not a statistically significant predictor of mortality (**Table 4**). Ten out of the 27 patients who were admitted with hanging succumbed to death, with a mortality of 37% in this study.

Assessment of Psychosocial factors among subjects

Various psychosocial stressors were noted in all subjects. Relationship and family conflicts were the most frequent precipitating factors, reported in eight patients. Financial distress was identified in six cases, all of whom were males. Academic pressure contributed to hanging in three younger individuals. Additionally, three patients had a history of previous suicide attempts, and six had pre-existing psychiatric conditions, of whom only 3 three were on regular medications.

DISCUSSION

This was a study conducted in 27 patients who came with hanging and was treated from emergency medicine ICU of a tertiary care centre in Kerala.

Among our 27 subjects enrolled as per the protocol, 10 succumbed to their injuries, 9 of them were post-cardiac arrest, and the remaining patient had a prolonged lead time (>30 min), resulting in a mortality rate of 37%. This is significantly higher than the 10.3% mortality reported in the six-year retrospective study, conducted by Renuka et al, potentially due to differences in patient selection criteria, as we have enrolled only those patients admitted to the ED ICU over a one-year duration whereas the other study included all patients presented to ED with alleged hanging.¹

Table 3. Comparison of parameters between survivors and non-survivors

Sl no	Investigations	Frequency (n = 27)	Percentage %
Lead time < 30mins	17(85)	3(15)	0.002
>30mins	0(0)	7(100)	
Echo			
Normal	13(72.2)	5(27.8)	0.219
LV systolic dysfunction	4(44.4)	5(55.6)	
Trop I			
Normal	14(82.4)	3(17.6)	0.013
Elevated	3(30)	7(70)	
RFT			
Normal	17(100)	0	<0.001
Deranged	0	10(100)	
CT/MRI			
Normal	11(100)	0	<0.001
Abnormal	5(33.3)	10(66.6)	
OHCA			
No	15(93.8)	1(6.3)	<0.001
Yes	2(18.2)	9(81.8)	

ST-T changes- ST depressions, T wave inversions
HAGMA-High anion gap metabolic acidosis

The median age in this study was 29 (IQR 22-45), which aligns with the ICU-based study reporting a median age of 27 years. However, one study from China reported a higher median age of 42 years, indicating possible regional or socioeconomic differences in the affected population. A male predominance was observed in all studies, consistent with global trends in suicidal hanging.^{1,2}

GCS on arrival was a crucial predictor of outcome, with lower scores associated with increased mortality. This is in agreement with both studies by Kao et al and by Renuka et al, where a GCS <3 is strongly correlated with poor prognosis. In our study, time to presentation was significantly different between survivors and non-survivors, highlighting the critical window for early intervention.^{1,2}

Table 4. Comparison of Parameters with mortality.

	Mortality	Median	IQR	P value
Age	Yes	25	21.75-46	0.58
	No	32	21.8-43.5	
Lead time	Yes	90	27.5-120	0.002
	No	15	10-20	
GCS	Yes	3	2-3	<0.001
	No	9	5.5-9	
Length of ICU stay	Yes	6	3-13.5	0.049
	No	3	2.5-4	

Mortality predictors across studies were consistent with OHCA and low GCS. Additionally, our study identified Troponin I positivity and LV dysfunction as significant factors contributing to mortality, which were not extensively studied in the previous studies, and point-of-care echo was not included in the assessment. The role of myocardial injury in post-hanging patients highlights the need for cardiac evaluation, especially in cases of unexplained hypoxia.

Echocardiographic abnormalities were noted in 9 patients (33.3%), but did not show a statistically significant association with mortality. Two of the patients had apical hypokinesia and ballooning with basal hyperkinesia suggestive of Takotsubo cardiomyopathy.³ This emphasises the importance of echocardiographic evaluation, as the treating clinicians may overlook cardiac dysfunction as a potential cause of respiratory distress. In survivors of this study, LV dysfunction resolved subsequently, reinforcing the need for timely recognition and management. Troponin I was positive in 10 patients (37%), with a significantly higher mortality rate ($p = 0.013$). However, seven of these patients presented with OHCA and had received CPR on arrival, which may have influenced the Troponin I elevation. The remaining three patients had LV systolic dysfunction and Troponin I positivity despite having no prior cardiac abnormalities, further supporting the association between myocardial dysfunction and hanging-related cardiac injury. ECG abnormalities were present in 55.6% of cases, though only higher-grade abnormalities correlated with poor outcomes.

ABG abnormalities were seen in 85.2% of patients, with high anion gap metabolic acidosis being the most common presentation. Acidosis ($\text{pH} < 7.2$) was a strong predictor of poor prognosis in Kao et al.'s study, aligning with our study.²

The presence of hypoxic-ischemic brain injury or haemorrhagic changes significantly increased mortality ($p < 0.001$). One case of subcutaneous emphysema had a hyoid bone fracture identified in CT. While uncommon in suicidal hanging, such findings highlight the variability in injury patterns and the potential for airway complications.⁴ One patient had cervical spine anterolisthesis and did not survive. Fifteen patients without prior neurological deficits showed changes on CT/MRI, likely due to hypoxic injury. Among those cases with hypoxic changes in CT/MRI, 12 were post-cardiac arrest, and only one survived among them. Four of the survivors with CT/MRI findings, such as haem-

orrhages and infarcts, had residual neurological deficits.

Among patients who had OHCA, 81.8% died ($p < 0.001$), reinforcing that cardiac arrest before primary medical contact is a strong predictor of poor survival. OHCA was highly correlated with poor outcomes, with Kao et al. reporting 100% poor outcomes in OHCA cases. In our study, only two OHCA patients survived, with one receiving bystander CPR before hospital arrival, emphasising the impact of early intervention. Prompt chest compressions and airway management can help maintain circulation and oxygenation until advanced medical care is available, reducing the extent of hypoxic brain injury and multi-organ dysfunction.^{2,5}

In addition to clinical and physiological factors, the psychosocial background of hanging patients plays a crucial role in understanding the risk factors, intent, and prevention strategies.

CONCLUSION

Hanging is now a predominant method of deliberate self-harm (DSH). This study highlights the critical role of early intervention in determining outcomes in patients with hanging. The Lead time, initial GCS, myocardial injury markers, renal dysfunction, and neuroimaging findings were key predictors of mortality. Strengthening prehospital emergency response, rapid airway management, and targeted neuroprotective strategies may improve survival in these patients.

Myocarditis, identified as elevated Troponin I levels, LV systolic dysfunction, and hypoxic brain injury, were common findings. Further clinical and autopsy studies are needed to understand the extent of myocarditis in hanging-related deaths to derive better treatment modalities.

Integrating mental health support, crisis intervention, and community-based preventive strategies alongside medical management is essential in reducing suicide rates and improving long-term outcomes.

Early initiation of resuscitation, Basic Life Support (BLS), including bystander-initiated CPR, plays a critical role in improving survival outcomes for patients with hanging injuries, particularly those experiencing OHCA. Public awareness and training programs in BLS, including hands-only CPR, could significantly enhance survival rates in cases of suicidal hanging, underscoring the need for widespread community education and accessibility to emergency response resources.

LIMITATIONS

This is a retrospective record-based single-centre study of patients with hanging admitted to an Emergency Department ICU of a tertiary care centre in Kerala.

The present study was approved by the Institute Ethical Committee of Government Medical College, Kozhikode, GMCKKD/RP2025/IEC/163 dated 19/07/2025.

END NOTE

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Conflict of Interest: None declared

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