

## Original Research Article

# Can clinical variables at admission influence the outcome in patients with suicidal hanging: a prospective study

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## ABSTRACT

**Background:** Hanging is considered one of the commonest ways of committing suicide, next only to poisoning in India. Very little information is only available in medical literature about prognosticating factors in suicidal hanging. Analysis of various parameters at the time of admission and their association with outcome can help in risk stratification as well as prognostication.

**Methods:** Four variables namely GCS, Mean arterial pressure, Oxygen saturation and capillary blood sugar were recorded at the time of admission. All patients received standard intensive care throughout the stay in ICU as demanded. Outcome was divided in to two groups, Good and poor. Good outcome was defined as complete neurological recovery at the time of discharge and poor outcome was defined as either death during hospital stay or persistent neurological deficit which did not improve even after a period of three months follow up.

**Results:** Total of forty patients was included in the study. Male patients outnumbered the number of female patients admitted with suicidal hanging. Irrespective of the gender more patients belonged to the third decade of. Out of forty, thirty patients showed complete neurological recovery, five patients had persistent neurological deficit even after three months and five patients died during the course of the treatment.

**Conclusions:** The present study confirms the age and sex distribution of suicidal hanging which is more common amongst male gender and 3rd followed by 4th decade of life in both sex. Admission parameters like  $GCS \leq 8$ ,  $MAP < 60$  mmHg and  $CBG > 180$ mg % can be considered as risk factors for poor outcome.

**Keywords:** Outcome, Risk factors, Suicidal hanging

## INTRODUCTION

There is worldwide concern over an observed rise in the rate of suicide, especially among young adults.<sup>1-3</sup> Hanging is considered one of the commonest way of committing suicide next only to poisoning in India.<sup>4</sup>

Hanging victims present to emergency department of hospitals and most of them need specialized care in

intensive care units. Unfortunately, suicidal hanging is one medical emergency about which there is very little information available in medical literature. Though numbers of reports about post-mortem findings in near-hanging are available, published data on clinical aspects of the problem and means of prognostication to guide the clinician are scanty. Also there are only very few studies available relating the risk factors with the outcome of suicidal-hanging patients.

On studying various risk factors and their association with outcome, there is a possibility that risk stratification as well as prognostication can be done more precisely. This might also be helpful in deriving various strategies in improving the outcome.

Aim of the present study was to find out the influence of admission clinical variables on outcome of patients admitted to emergency room (ER) with suicidal-hanging.

## METHODS

This prospective study has been carried out after obtaining institute ethical committee approval at a tertiary hospital at Puducherry, India involving 40 suicidal-hanging patients admitted in Emergency department in the hospital during the year January 2009 to December 2015

All patients, with alleged history of suicidal - hanging, irrespective of age and sex, brought to emergency department of our hospital within five hours were included in the study. Patients who were brought to the emergency medicine department after five hours of the incident were excluded. Four clinical variables that were assumed to have prognostic implications were recorded on admission.

### Variables studied

- Glasgow coma scale (GCS) on admission
- Mean arterial pressure (MAP) on admission
- Oxygen saturation on admission (SpO<sub>2</sub>)
- Capillary blood glucose (CBG) level on admission.

On arrival to ER all patients were paid immediate attention to airway, breathing and circulation. Oxygen was given at once by none rebreathing mask. An 18 gauge cannula was secured and Ringer lactate solution was started at a rate depending on the vitals and presence or absence of signs of pulmonary edema. Necessity of intubation was decided on any of the following clinical features, 1. Stridor, 2. Severe hypoxia, 3. Pulmonary edema, 4. GCS<8 and also if doubt exists regarding the maintenance of patent airway. Hemodynamically stable patients who were in need of intubation were pre medicated with intravenous propofol 1 to 2 mg/kg along with intravenous midazolam 0.04 to 0.05 mg/kg. In all unstable patients premedication was done with intravenous fentanyl 1.5 µ/kg with intravenous midazolam 0.02 mg/kg.

All patients on ventilator support received Intravenous infusion of midazolam at 0.01 mg/kg/hour for sedation and reassessed once in every 6 hours. If the patients were hemodynamically unstable they were given CVP guided fluids, if needed dopamine and Nor adrenaline infusion were started and optimized. Ventilatory support was discontinued and patients were extubated when they were conscious, and responding to commands, with no signs of

respiratory distress following a trial of T piece. All patients received standard ICU care including DVT prophylaxis, stress ulcer prophylaxis, nutrition, back and eye care. In all patients, post estuation psychiatry consultation was taken and recommendations followed.

Outcome was classified in to two groups as good and poor. Good outcome was defined as complete neurological recovery without any deficit at the time of discharge and poor or adverse outcome was defined as either death during hospital stay or discharged with neurological deficit which did not improve even after a period of three months follow up.

With the help of earlier studies and conventional definitions, a cut off value was chosen for all four variables that were considered in our study. Risk actors were standardized as GCS ≤ 8/15. MAP ≤ 60 mmHg, SpO<sub>2</sub> < 85%, CBG ≥ 180 mg/dl.

## RESULTS

During the study period, there were 40 patients admitted after attempted suicide by hanging.

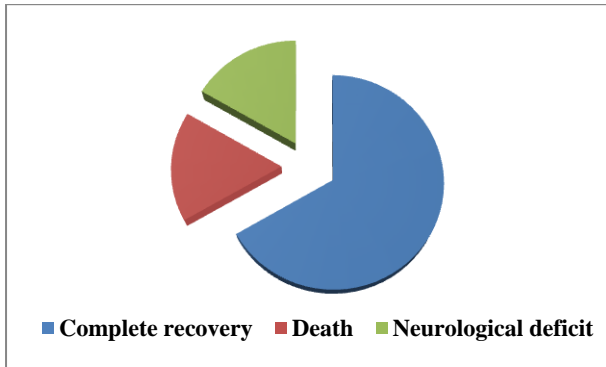
**Table 1: The admission demographics for the study group.**

Admission findings	
<b>Sex : N (40)</b>	
Male	27 (67.5%)
Female	13 (32.5%)
<b>Age: N (40)</b>	
<20	5 (12.5%)
21-30	20 (50%)
31-40	11 (27.5%)
41-50	3 (7.5%)
51-60	1 (2.5%)
<b>GCS</b>	
9-15	20 (50%)
≤8	20 (50%)
<b>MAP (mmHg) N (40)</b>	
>60	34 (85%)
<60	6 (15%)
<b>SpO<sub>2</sub>: N(40)</b>	
>85%	21 (52.5%)
<85%	19 (47.5%)
<b>CBG (mg%): N (40)</b>	
<180	23 (57.5%)
>180	17 (42.5%)

Table 1 summarises the admission demographics for the study group. Male patients constituted the majority (67.3%). Though the presentation age ranged from 18 to 55, maximum numbers of patients were belonging to middle age (i.e. 3<sup>rd</sup> decade of life).

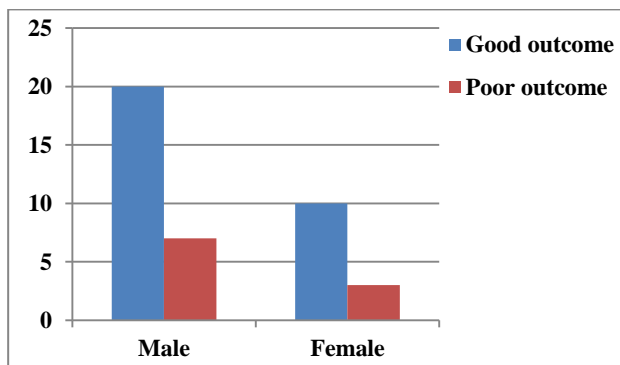
### Statistical analysis

Data was analysed using professional statistics package Epi info7.0 version for windows. Descriptive statistics was represented as mean $\pm$ SD for numeric variables and percentages for qualitative variables. Appropriate test of significance were used depending on nature and distribution of variables like independent T test for numerical variables, Fisher's exact test for categorical variables. Values of  $p < 0.05$  was considered statistically significant\*.

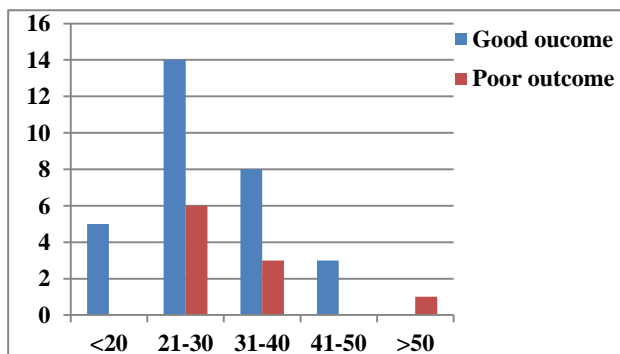


**Figure 1: Outcome analysis.**

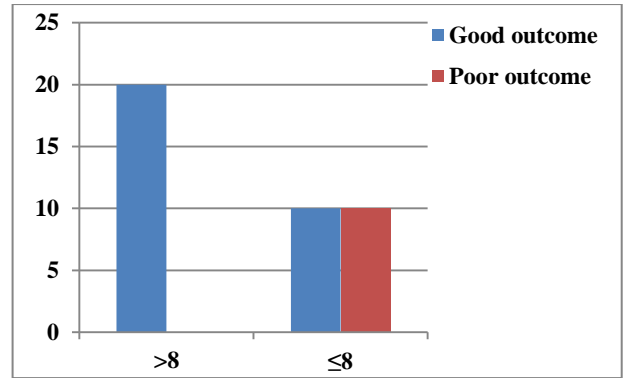
Out of 40 patients, thirty patients recovered completely and 10 patients had poor outcome. While 5 patients died, 5 patients had severe neurological deficit which did not show any signs of recovery even after 3 months.



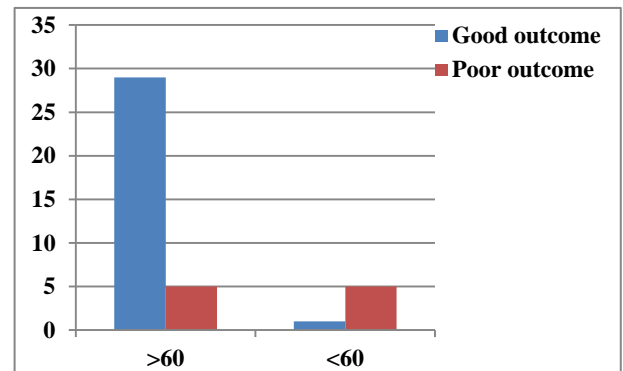
**Figure 2: Outcome based on sex distribution.**



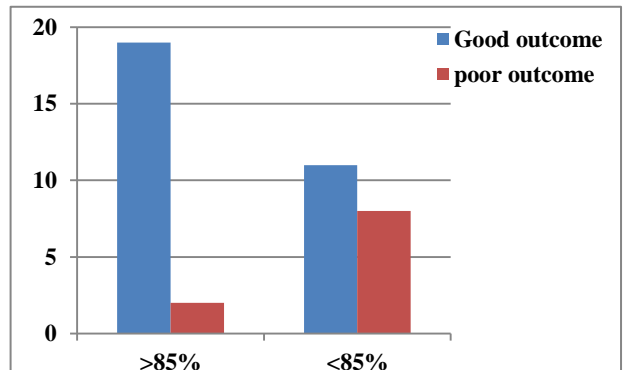
**Figure 3: Outcome in various age groups.**



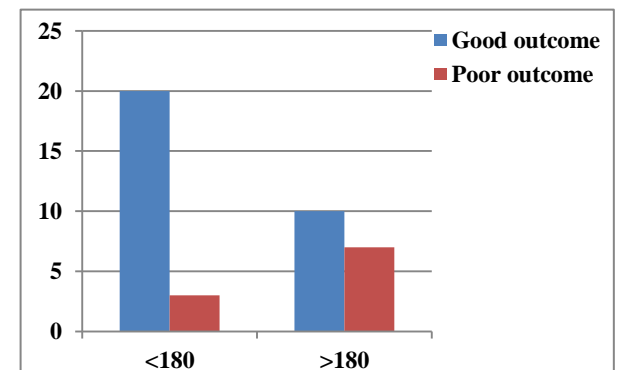
**Figure 4: GCS and outcome.**



**Figure 5: MAP and outcome.**



**Figure 6: SpO<sub>2</sub> and outcome.**



**Figure 7: CBG and outcome.**

Figure 2 to 7 shows the outcome pattern based on demographic distribution as well as admission risk factors. Statistical analysis of risk factors.

Table 3 summarizes the statistical significance of each risk factor when they are further categorized to good and bad outcome.

**Table 2: Frequency distribution.**

	Age	GCS	MAP	SpO2	CBG
N	40	40	40	40	40
Range (mean)	18-55 (29.6)	3-14 (7)	23-110 (75)	60-99 (83)	63-322 (171)
Std. deviation	8.66706	2.704	19.695	10.956	63.225
Minimum	18.00	3	23	60	63
Maximum	55	14	110	99	322

**Table 3: The statistical significance of each risk factor when they are further categorized to good and bad outcome.**

	GCS ≤8/15	MAP <60 mmHg	SpO2 <85%	CBG>18 0mg%
Good outcome	10 (50%)	1 (16.7%)	11 (57.9%)	10 (58.8%)
Poor outcome	10 (50%)	5 (83.3%)	8 (42.1%)	7 (41.2%)
P value	0.043*	0.02*	0.28	0.06*

## DISCUSSION

Hanging is defined as death due to external pressure on the neck when a ligature is applied to the neck of a wholly or partly suspended individual.<sup>5</sup> The term near hanging is reserved for victims who have survived the hanging injury and reaches the hospital.<sup>6,7</sup> Death in suicidal hanging usually results from asphyxial cerebral injury which is different from judicial hanging where death occurs due to cervical spine injury.<sup>8</sup> Mechanism of asphyxia is considered to be because of stagnant hypoxia resulting from jugular venous obstruction due to compression of the soft tissues of the neck.<sup>5,9</sup> As this is further worsened by carotid arterial obstruction due to further tightening of the ligature around the neck, with or without airway closure, leads to cerebral hypoxia and death.<sup>9</sup> Delayed death is usually due to respiratory complications.<sup>5</sup> Cervical spine injury usually is not found to be associated with suicidal hanging as opposed to judicial hanging where body falls from height more than the actual height of the victim.<sup>10</sup>

The pathophysiological basis of adverse outcome in hanging has been attributed to various factors like cerebral hypoxia, laryngeal oedema, airway obstruction, high vagal tone secondary to carotid sinus stimulation injuries secondary to local structures like thyroid cartilage/hyoid bone fracture/laryngeal rupture, secondary pulmonary complications (aspiration pneumonia, development of adult respiratory distress, negative

pressure, pulmonary oedema or secondary cerebral injury due to cerebral oedema etc.<sup>6,7</sup>

As in every other study, majority of patients who attempt suicidal hanging are invariably male and young, the same pattern continues in our study also. Out of forty patients, 27 (67.5%) patients belonged to male gender and twenty patients (50%) belong to age group (in both sexes) of twenty one to thirty years. This is followed by eleven patients (27.5%) in the age group of thirty one to forty years, confirming that middle aged persons of both male and female are more vulnerable to attempt suicide. The preponderance of suicidal hanging of this age group may be attributed to the social, familial and financial demands which will be maximum during this period of life.

Though the overall survival rate is between 70-100%-in our study 75%- the factors that can predict the outcome are not well studied and reports are also inconsistent.<sup>7</sup>

Out of probable factors that can predict the outcome, the well-studied and nearly confirmed predictor is duration of hanging time. Though the exact duration of hanging can never be mentioned accurately- for obvious reasons, it has been shown to be closely related to mortality. In our series, maximum hanging time was found to be five minutes which was informed by the relatives. We did not take hanging time as one of the clinical variable in influencing the outcome for two reasons. First, there are many literatures available which looked into hanging time and outcome. Secondly, we assumed no one can be very sure about the precise duration of hanging in minutes as nobody would have witnessed the act of hanging.

Hypoxic encephalopathy is the immediate sequel of patients who have survived hanging which will directly affect the outcome if not properly addressed. Identifying predictors of poor outcome is difficult because of the paucity of studies in the literature.<sup>9</sup> Hence this study was planned to identify the relationship of risk factors which are conventionally considered as factors that can worsen cerebral insult.

Of the various factors, admission GCS has been assessed by various studies in relation to mortality and morbidity and found to be associated with different outcome in different studies. In a review of 42 patients, the admission GCS was found to be a poor prognostic indicator but the presence of cardiac arrest influenced the outcome.<sup>11</sup> Where as in a review of 47 patients, Matsuyama et al found hanging time, admission GCS, and presence of cardiopulmonary arrest to be the better prognostic factors influencing outcome.<sup>12</sup> In our study 20 patients were admitted with GCS of 8 or less and 10 of them (50%) showed statistically significant poor outcome. All the patients who were admitted with GCS of more than 8 survived. This clearly shows as the GCS decreases below 8 the outcome of patients also will be affected.

Hypotension, hypoxemia, and hyperglycemia are other well-known factors that can worsen the outcome in traumatic brain injury in virtue of either disturbing the oxygen delivery or by producing cerebral edema. Few studies considered systolic blood pressure less than 90 mmHg as one of the variable that can influence the outcome in hanging.<sup>9,13</sup> However we decided to study the impact of mean arterial pressure on outcome as MAP is the direct determinant of cerebral perfusion pressure. Out of forty patients, six patients were admitted with severe hypotension (MAP <60 mmHg). In spite of active resuscitation, poor outcome was noticed in five patients (83.3%) who are also statistically significant. But out of thirty four patients admitted with MAP above 60mmHg, only 5 (14.7%) had poor outcome. Presence of hypotension in our study is only 15% (6/40) when compared to the earlier study by Karanth et al in the year 2005 where they found hypotension in 12 out of 37 (~33%).<sup>13</sup> But the adverse outcome noted in their study is much lower than ours (83.3% versus 12%). This very high incidence of poor outcome in hypotensive group in our study might be due to the difference in defining the hypotension. We defined hypotension as MAP <60 mmHg whereas the other study took systolic blood pressure less than 90 mmHg as cut off. Whether mean arterial pressure can predict poor outcome more precisely than systolic blood pressure is unanswerable now and need to be studied further.

Out of forty patients, 19 patients were admitted with hypoxemia (SpO<sub>2</sub> <85%). Out of this eight patients (42.1%) had poor outcome. Even though the patients with SpO<sub>2</sub> of less than 85% on admission had higher poor outcome incidence than other group, this is not turned out to be statistically significant. This could be because of the fact that these patients were immediately received oxygen supplementation either in the form of simple face mask or artificial ventilation and hypoxemia was addressed immediately thus avoiding the delayed effects of hypoxemia.

Hyperglycemia has been shown as one of the best independent predictor of mortality in head injury patients.<sup>14</sup> Though it is well established in traumatic brain

injury, no study has looked into its effect in suicidal hanging. In our study, out of seventeen patients admitted with CBG >180mg%, ten patients recovered completely thus making poor outcome in hyperglycaemic group as 41.1% which is also statistically significant.

In overall, out of forty patients admitted with suicidal hanging, five patients died making mortality as 12.5%. Out of thirty five patients recovered, only thirty had complete neurological recovery and five patients had very poor neurological deficit which was persisting even after three months thus making morbidity as 14.2%. The overall poor outcome defined as either death or poor neurological status was seen in 25% of the patients. The overall survival rate without any neurological deficit in our study is 75% which is well within the range quoted in earlier studies.<sup>7</sup>

As in any studies involving hanging, the less number of patients in this study is the major limitation.

## CONCLUSION

The present study confirms the age and sex distribution of suicidal hanging which is more common amongst male gender and 2nd and 3rd decade of life in both sexes. Admission parameters like GCS≤8, MAP < 60 mmHg and CBG >180mg % can be considered as risk factors for poor outcome. Adverse outcome arising out of hypoxemia at admission can be reduced if oxygenation is taken care immediately.

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