

Neurological Outcome and Associated Injuries In Near-Hanging Patients: A 10-Year Songklanagarind Hospital Experience

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ABSTRACT

Objective: Death and injury from attempted hanging is common in Thailand. To date, few studies that have collected and analyzed treatment outcomes following near-hanging in this country. This study was conducted to examine factors associated with treatment outcomes in near-hanging injury patients.

Material and Methods: The records of all near-hanging injury patients who visited Songklanagarind Hospital between 2009 and 2018 were reviewed. Data collected and analyzed included patient characteristics, imaging, and neurological outcomes from their arrival at the emergency department to their last follow-up or death. The treatment outcomes were classified into favorable and unfavorable outcomes.

Results: Twenty-one cases were included in the study and the median age was 36 years. Of the 21 cases, 13 cases were categorized as incomplete hanging, seven were complete hanging and one had no recorded type of hanging. Six of the patients died, four at the emergency department and two after being hospitalized. Fourteen patients had favorable outcomes, the patients in this group had higher systolic blood pressure, oxygen saturation, and Glasgow Coma Scale Score on admission.

Conclusion: Near-hanging injury patients had a high mortality rate. The factors associated with unfavorable outcomes were history of cardiac arrest before hospitalization, initial Glasgow Coma Scale Score, systolic blood pressure, and oxygen saturation on admission.

Keywords: brain injury; near-hanging injury; outcomes

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doi: 10.31584/psumj.2022247338
<https://he01.tci-thaijo.org/index.php/PSUMJ/>

PSU Med J 2022;2(2):45–49
Received 2 February 2021
Revised 14 September 2021
Accepted 15 September 2021
Published online 19 May 2022

INTRODUCTION

Hanging is one of the oldest recorded judicial punishments spreading throughout Europe in the 15th century.¹ Hanging instigates death either by the fracturing the cervical spine or by strangulation. However, after judicial hanging were largely eliminated worldwide, it came to be one of the most common ways to commit suicide and it can also be accidental. In the United State of America (USA), hanging is the second most common suicidal method.² All cases who survive their hanging, intentional or accidental, until arrival at the hospital are classified as “near-hanging injury”.

Near-hanging injuries include not only strangulation, but also numerous other injuries such as abrasion wounds, anoxic brain injury, C-spine fractures, pharyngeal injuries, esophageal injuries and cervical vascular injuries.³ Previous studies have reported that a low initial Glasgow Coma Scale Score (GCS) score was associated with poorer outcomes.^{4,5}

Although near-hanging is a common injury, studies have never been conducted to report or describe the outcome of treatment in Thailand. Therefore this study was conducted using data from our center to examine any associations between near-hanging-related factors and outcomes.

MATERIAL AND METHODS

Population and setting

The medical records of near-hanging-injury patients who visited Songklanagarind Hospital between the years 2009 and 2018 were reviewed. After reviewing the data from the Trauma Registry, 21 patients were enrolled in this study. Patient characteristics and neurological outcomes were collected from the medical records. Additional information included consisted of type of hanging, duration of hanging, ligature material, initial vital signs upon arrival at the ER, history of cardiac arrest before hospitalization, time to return of spontaneous circulation, initial serum lactate level and associated injuries. The data were collected from the time of the patient's arrival at the emergency department to the

last follow-up or death. The study was approved by the Human Research Ethics Committee, Faculty of Medicine, Prince of Songkla University, Thailand. REC.62-104-10-4.

Definitions and outcome measurements

Two types of hanging were recognized, complete hanging and incomplete hanging. Complete hanging was defined as hanging with complete free suspension of the body and incomplete hanging was defined as hanging with incomplete suspension, with part of the body supporting the victim's weight.⁶ Complete hanging can result in more severe than incomplete hanging.

Imaging findings of associated injuries

At the ER, the victim's exterior wounds were assessed by physical examination. A chest x-ray could detect pulmonary edema but other associated injuries were assessed by computer tomography (CT). Both CT and chest film CT findings were recorded by radiologists.

Glasgow Outcome Score

The Glasgow Outcome Score (GOS) was the primary outcome of the study; this is the most widely used outcome measure after traumatic brain injury⁷, as it provides a quick and accurate evaluation of neurological status. The GOS divides the severity of disability into five levels, as shown in Table 1. These categories are sometimes grouped together as either favorable outcomes (4,5) or unfavorable outcomes (1,2 or 3).

Table 1 Glasgow Outcome Score (GOS)

Level	Functional status	
1	Dead	
2	Vegetative state	Sleep/awake, nonsentient
3	Severe disability	Conscious but dependent
4	Moderate disability	Independent but disabled
5	Good recovery	May have mild residual effects

Statistical analysis

Data are presented as means with ranges when they have normal distribution and medians with interquartile ranges otherwise. The patient characteristics and their hospitalized data, and outcomes were compared by Fisher's exact test. A P-value of less than 0.05 was considered statistically significant. All statistical analysis were carried out with R program version 3.6.1.

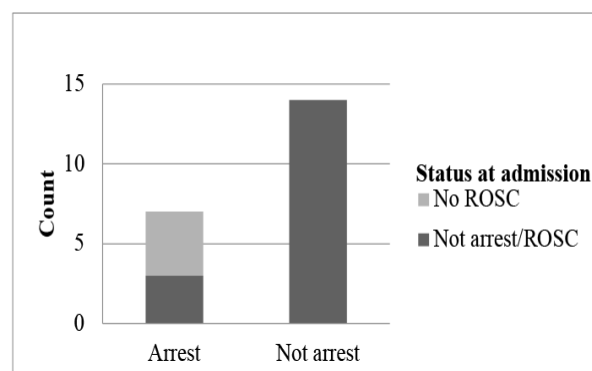
RESULTS

The twenty-one near-hanging-injury patients enrolled in this study were aged 11 to 70 years, with a median age at enrolment of 36 years (IQR 28 – 50 years). Eighty one percent were male, 66.7% were married, and 100% were a Buddhist. The most common occupation 38.1% was jobless. The most prevalent comorbidity was psychiatric disorder in 14.3%. Sixty five percent were classified as incomplete hanging and 35.0% as complete hanging, one patient did not have hanging type recorded. None of the near-hanging patients were referrals.

There was a variety of ligature materials; the most prevalent was rope at 44.4% followed by fabric 27.8%, wire 22.2% and belt 5.6%. Fifty-four percent had a positive result in serum alcohol testing and 25.0% had history of drug abuse.

Seven patients had gone into cardiac arrest prior to arriving at the ER, and 3 of these had return of spontaneous circulation (ROSC) at the ER (Figure 1), with a ROSC time of 1 – 17 minutes. Type of hanging was not related to incidence of cardiac arrest; 28.6% for complete hanging and 30.8% for incomplete hanging (p-value = 1) (Table 2).

Of the 15 patients who survived their hanging, 14 had GOS 5 at the last recorded follow up, and only one patient had permanent disability after treatment. This patient was an 18-year-old female with a history of cardiac arrest prior to arriving at the ER and who then underwent cardiopulmonary resuscitation for 10 minutes. She then had



*Results base on cross-tabulation.

Figure 1 Patient distribution base on status on arrival

Table 2 The relationship between type of hanging and history of cardiac arrest before hospitalization

	Complete (n=7)	Incomplete (n=13)	p-value*
Cardiac arrest before hospitalization, n (%)			>0.999
Cardiac Arrest	2 (28.6)	4 (30.8)	
Non-arrest	5 (71.4)	9 (69.2)	

Results base on Fisher's exact test. P-value significance level is defined at 0.050

10 days of ventilator time. She was the only patient that had abnormal findings from computer tomography of her brain (CT brain), which revealed several ill-defined hypodense areas involving cortical grey matter with subcortical white matter of both cerebral hemispheres, without intracranial hemorrhage or midline shift.

Seven patients needed ventilator support with a median ventilators time was of 1 day (IQR 1–6.5 days). Two of these seven died shortly after admission without experience of weaning, and these two were both young, had had cardiac arrested before hospitalization and pulmonary edema from chest film. All died from multi-organ failure.

There were only 2 concomitant injury types that were found with the hanging, anoxic brain injury and pulmonary edema. In this study, two patients had pulmonary edema on admission. They did not have any other associated injuries, but they died in the hospital. Their characteristics were similar; age, arrested before admission and low GCS score (3 point).

Regarding categorization of the patients in to favorable and unfavorable outcome groups, the favorable outcome group had higher systolic blood pressure, oxygen saturation, and GCS score on arrival. There was no difference between duration of hanging (Table 3).

DISCUSSION

Patients who had a history of cardiac arrest had a higher proportion of unfavorable outcomes, which could be explained by longer low perfusion time when compared with patients who did not have a cardiac arrest. In a previous study, patients who had out of hospital cardiac arrest (OHCA) had a survival rate with intact neurological outcome of 8.0%.⁸ In our study, no one with a previous OHCA had a favorable outcome.

From a previous study, hanging was the cause of multiple injuries; 41% had brain injury, 18.0% had

cervical spine injury and 1% had esophageal/laryngeal or cervical vascular injury.³ Interestingly, our study found few associated injuries which were only pulmonary edema and anoxic brain, though that may be due to the fact that the majority of our patients had been “incomplete hanging”, meaning that the part of the body weight was supported and thus there was less weight pulling on the neck where the rope was attached, causing less damage. Nineteen percent of our patients (four in twenty-one) also experienced cardiac arrest before hospitalization and then died before undergoing chest x-ray or CT scan.

As there was only a small population in this study, the results cannot be statistically significant. In future studies, if we can collect data from a multicenter population, statistical significance can be higher significance.

CONCLUSION

In summary, our study found initial GCS' score and history of cardiac arrest before hospitalization were predictors of survival rate in near-hanging injury.

FUNDING SOURCES

The trauma registry in Songklanagarind Hospital is funded by the Faculty of Medicine.

Table 3 Characteristics and outcomes of patients between favorable and unfavorable groups

	Favorable (n=14)	Unfavorable (n=7)	p-value
Age, years, median (IQR)	38.5 (17.0)	31 (42.0)	0.433
Male, n(%)	13 (92.9)	4 (57.1)	0.049
ISS, median(IQR)	1 (3.0)	9 (5.0)	0.012
Systolic blood pressure, mmHg, median (IQR)	146 (37.0)	0 (91.0)	< 0.001
Oxygen saturation, %, median (IQR)	99 (3.0)	0 (85.0)	0.005
Glasgow Coma Scale score, median (IQR)	15 (0)	3 (0)	<0.001
Injury severity score, median (IQR)	1 (0)	3 (0)	< 0.001
Cardiac arrest before hospitalization, n(%)	0 (0)	7 (100)	< 0.001

ISS = international staging system; IQR = Inter quartile range

CONFLICTS OF INTEREST

There were no conflicts of interest related to this study.

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