

## Original Article

# Effect of High Dose Methylprednisolone in Near Hanging Patients: A Retrospective Observational Study in a Tertiary Level Private Hospital in Bangladesh

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## Abstract:

**Background:** In the context of Bangladesh, hanging stands out as a notable method of suicide. This study focuses on patients who presented with near hanging, assessing their clinical profile, response to early management protocol and their outcome.

**Method:** Spanning from January 1 to December 31, 2023, this retrospective study delves into the records of 10 Bangladeshi patients who engaged in near hanging. Demographic, clinical, and treatment particulars were collected along with initiation of early management protocol with an emphasis on the administration of high-dose methylprednisolone. The study evaluates the outcomes, including length of stay in the intensive care unit (ICU), and the need for intubation & mechanical ventilation, and in hospital mortality.

**Results:** Within the specified sample size of 10 patients, comprising 30% men with a median age of 18 (range: 14–40), admission data revealed that 20% of patients had a Glasgow Coma Scale of  $\leq 8$ , 10% exhibited hypotension, and no patient experienced hanging-induced cardiac arrest. All patients received high-dose methylprednisolone to reduce inflammation and oedema in injured spinal cord. Notably, a positive neurological outcome was observed in 90% of patients, with no reported mortality. The median length of stay in the ICU was 3 days, and only 10% of patients required intubation.

**Conclusion:** The administration of high-dose methylprednisolone resulted in favourable outcomes. The study showed a zero-mortality rate, a median ICU stay of 3 days, and a 10% requirement for intubation. These findings emphasize the potential efficacy of high-dose methylprednisolone in managing near hanging cases in the Bangladeshi population, offering insights for future interventions and research.

**Keywords:** Hanging, ICU, Methylprednisolone, Mortality, Suicide.

## Introduction:

Suicide constitutes a significant public health challenge globally. The suicide rate in Bangladesh stood at 11.3-17.9

cases per lakh population.<sup>1</sup> Hanging, a form of strangulation utilizing ligature materials such as ropes or clothing, applies fatal pressure to the neck. The gravitational drag, facilitated by the body's weight, intensifies the pressure, leading to death. Hanging can result in immediate fatality, termed "fatal hanging," or unsuccessful attempts known as "near hanging".<sup>2</sup>

Survivors reaching the hospital after a hanging incident may exhibit stability, allowing treatment in regular wards. However, unstable patients may necessitate admission to the intensive care unit (ICU) for airway management, cerebral oedema treatment, management of hypoxic brain damage, and addressing neck injuries. Conservative management of complications is crucial, and corticosteroids are commonly used to address cerebral oedema or suspected spinal cord injuries in near-hanging patients, despite limited evidence supporting their efficacy.<sup>2-4</sup>

Patient outcomes following hospital treatment range from complete recovery to severe neurological deficits or death. Factors associated with a poor prognosis in near-hanging patients include a low Glasgow Coma Scale (GCS), hypotension, hypoxic brain injury, pulmonary oedema, high Acute Physiology and Chronic Health Evaluation - II

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(APACHE-II) scores, the need for vasopressor therapy, hanging-induced cardiac arrest, and hyperglycaemia at admission.<sup>2,5-7</sup>

While there is limited research on near-hanging patients in the Bangladesh context, and the literature on steroid therapy in near-hanging scenarios is scarce, this study aims to bridge these gaps. The study is designed to assess the clinical profile, treatment details, and outcome of patients with partial hanging receiving a protocolized treatment with special attention to high dose methylprednisolone as early intervention measure.<sup>1,5,6,8,9</sup>

**Methodology:**

*Study Design:* In this retrospective study conducted at the ICU of Proactive Medical College & Hospital, a tertiary care facility in Bangladesh, data of patients admitted between January 1 and December 31, 2023, with a diagnosis of "hanging" were analysed. The sample size consisted of 10 patients.

*Participant Selection:* Inclusion criteria encompassed individuals aged 12 years or above with "near-hanging" diagnoses, while those who opted for alternative suicide methods, were brought in dead, or discharged against medical advice were excluded. Additionally, case records with insufficient data were also excluded from the analysis.

*Evaluation of parameters:* A detailed examination was conducted on a sample size of 10 eligible case records in this study. The collected data included demographic details, specifics regarding the type of hanging (complete or partial), the motive behind hanging, history of prior suicidal attempts, the material employed for hanging, and the presence of comorbidities or psychiatric ailments. Physical examination findings encompassed the GCS, vital signs such as pulse rate and blood pressure, and the identification of ligature marks at the neck.<sup>2,4,10</sup>

Additional details involved the documentation of cardiac arrest, cardiopulmonary resuscitation (CPR), and seizures. Radiological investigations, including cervical spine x-ray, chest X-rays and computed tomography (CT) scans of the brain, were analysed using the picture archiving and communication system to identify pulmonary oedema and cerebral oedema, respectively.<sup>7,11,12</sup> Information regarding intubation, mechanical ventilation, duration of ICU stay was collected.

The study also documented treatment details, focusing on anti-cerebral oedema measures and corticosteroid therapy.<sup>8,9</sup>

All patients received protocolized treatment. After initial Airway (A), Breathing (B), Circulation (C), and Disability (D) management most of the patients received high dose methylprednisolone who presented within 8 hours of suicidal attempt with hanging. Patients were treated with cervical collar for cervical spine stabilization. Need for vasopressor was assessed and early initiation of vasopressor was ensured in eligible cases. Patients with cerebral oedema received 3% NaCl until improvement of neurological status.<sup>6,9,12,13</sup>

Methylprednisolone was given intravenously at loading dose of 30 mg/Kg and 5.4 mg/kg /hour for next 23 hours who came with 8 hour of near hanging incident.<sup>3</sup> The neurological outcomes of the patients were evaluated using the Glasgow Outcome Scale (GOS) based on information provided in the discharge summary.<sup>5-7,14,15</sup>

*Some definitions:*

1. A hanging was classified as "complete" if the patient's body was freely suspended in the air. Alternatively, if part of the body was supported and had contact with the ground, it was deemed "partial or incomplete hanging."<sup>12</sup>
2. Hypotension was specifically defined as a systolic blood pressure of  $\leq 100$  mm Hg.<sup>15</sup>
3. Administration of anti-cerebral oedema agents such as mannitol, hypertonic saline, or both was designated as indicating "severe cerebral oedema."<sup>12</sup>
4. The GOS was employed for neurological outcomes, with the following scale: (1) death; (2) persistent vegetative state; (3) severe disability (conscious but disabled); (4) moderate disability (disabled but independent); (5) good recovery.<sup>15</sup>

**Statistical analysis:** In terms of statistical analysis, categorical and ordinal variables within the 10-patient sample were expressed as percentages. Continuous variables were presented as either median with interquartile range (IQR) in the nonparametric dataset or mean with standard deviation in the parametric dataset. The analysis was conducted using the Statistical Package for the Social Sciences software for Windows (version 25; IBM, Chicago, IL, USA).

**Results:**

In the analysis of a sample size of 10 near-hanging cases, the baseline characteristics are summarized in Table 1. Among the 10 patients studied, 30% were men, and the median age was 18 years (IQR: 12–40). The majority of the patients were Muslims (90%). Soft clothes like sarees or shawls were predominantly used for hanging in 60% of cases. Personal relationship issue (40%) was reported as the primary reason for hanging. From the available records, only 1 case (10%) had comorbid condition. Approximately 10% of the study population reported having an underlying psychiatric illness, and 3 patients reported previous suicide attempts.

**Table I:** General characteristics of near hanging patients (N=10)

		n (%)
Gender	Male	3 (30)
	Female	7 (70)
Age, years	<18	3(30)
	18–30	5 (50)
	30-60	2 (20)
	>60	0

Religion	Muslim	9 (90)	Addiction history	Unemployment	0		
	Hindu	1 (10)		Unknown	1 (10)		
	Christian	0		Alcohol intake	0		
Residence	Rural	5 (50)	Comorbidities	Smoking and alcohol intake	0		
	Urban	5 (50)		Smoking	1 (10)		
Presentation to hospital	Direct	5 (50)	Psychiatric illness	None	9 (90)		
	Referral	5 (50)		Cardiac disease	1 (10)		
Marital status			Psychiatric illness	Psychiatric illness	1 (10)		
				Married	5 (50)	Previous suicidal attempts	1 (10)
				Single	4 (40)		
Material used	Widow	1 (10)	Patients were assessed for hypotension (SBP <100 mm Hg), GCS score, cranial nerve function, motor function, sensory function, and pupillary response, which have been showed in table II. Patient 1 presented with hypotension and a GCS score of E1V2M3, with cranial nerve function, motor function, and sensory function being unable to be assessed, and pupillary response showing mid dilation with sluggish reaction to light. Patient 2 had similar feature despite the fact he/she had normal pupillary response with higher GCS score. Patients 3 to 10 either presented without hypotension, with varying GCS scores and intact cranial nerve, motor, sensory functions, and normal pupillary responses. No patient had an episode of cardiac arrest or received cardiopulmonary resuscitation.				
	Soft clothes	6 (60)					
	Rope	4 (40)					
Wire	0						
Belt	0						
Reason for hanging	Family disputes	2 (20)					
	Financial issue	0					
	Illness	1 (10)					
	Personal relationship issue	4 (40)					
	Academic failure	2 (20)					

**Table II: Key Clinical findings of individual patient during admission**

	Hypotension (SBP <100 mm Hg)	GCS	Cranial nerve	Motor	Sensory	Pupillary response
Patient 1	Present	E1V2M3	Could not be assessed	Could not be assessed	Could not be assessed	Mid dilated, Sluggishly Reacting to light
Patient 2	Present	E2V3M4	Could not be assessed	Could not be assessed	Could not be assessed	Normal
Patient 3	Absent	E3V4M4	Intact	Intact	Intact	Normal
Patient 4	Absent	E3V4M5	Intact	Intact	Intact	Normal
Patient 5	Absent	E3V5M6	Intact	Intact	Intact	Normal
Patient 6	Absent	E4V5M6	Intact	Intact	Intact	Normal
Patient 7	Absent	E2V3M4	Could not be assessed	Could not be assessed	Could not be assessed	Normal
Patient 8	Absent	E3V3M5	Intact	Intact	Intact	Normal
Patient 9	Absent	E2V5M5	Intact	Intact	Intact	Normal
Patient 10	Absent	E3V4M4	Intact	Intact	Intact	Normal

Table III illustrates imaging findings in near hanging patients. Patient 1 exhibited normal X-ray cervical spine, bilateral pulmonary opacity on X-ray chest, and cerebral enema on brain CT scan. Patient 2 had basal consolidation on X-ray chest. Patients 3 to 10 showed normal results across all imaging modalities, except for Patient 7, who displayed hyperinflation of lung and increased translucency with a tubular heart on X-ray chest, while brain CT scan was not performed for patients 6 and 7. MRI was not done in any patient as the hospital lacked MRI facility and transportation of the patient for MRI was troublesome.

**Table III: Imaging findings of study subjects**

	X ray cervical spine	X ray chest	CT scan of Brain
Patient 1	Normal	Bilateral pulmonary opacity	Cerebral oedema
Patient 2	Normal	Basal Consolidation	Normal
Patient 3	Normal	Normal	Normal
Patient 4	Normal	Normal	Normal
Patient 5	Normal	Normal	Normal
Patient 6	Normal	Normal	Not done
Patient 7	Normal	Hyperinflation of lung, Increased translucency Tubular heart	Not done
Patient 8	Normal	Normal	Normal
Patient 9	Normal	Normal	Normal
Patient 10	Normal	Normal	Normal

The median GCS of patients at presentation was 12 (table IV), with 2 patients having a GCS score of 8 or below. Hypotension occurred in 2 patients. Pulmonary oedema manifested clinically in only 1 (10%) patient. Aspiration pneumonia was observed in 1 patient (10%). Cervical spine fracture occurred in no patient. One patient exhibited cerebral oedema in the CT brain. The overall mortality rate within the sample was nil. The median (IQR) hospital stay was 3 days (2–8). Among the 10 patients, 6 received ICU care, and 1 (10%) of them required intubation and mechanical ventilation. Most of the patients (90%) received high dose methylprednisolone as early intervention. Vasopressor therapy was necessary for 1 patient. Complications during ICU stay included ventilator-associated pneumonia (n = 1). All the patients who required ICU admission, survived.

**Table IV: Clinical characteristics of near hanging patients**

Clinical characteristics	n (%)
Seizures, n (%)	1 (10)
GCS ≤8, n (%)	1 (10)
Pulse rate, median (IQR)	92 (78-108)
Systolic blood pressure, median (IQR)	110 (100-120)
Hypotension, n (%)	2 (20)
Ligature mark, n (%)	7 (70)
Cardiac arrest, n (%)	0
Pulmonary edema, n (%)	1 (10)
Aspiration pneumonia, n (%)	1 (10)
Cerebral edema in CT, n (%)	1 (10)
ICU admission, n (%)	6 (60)
Mechanical ventilation	1(10)
High dose methylprednisolone	9 (90)
Duration of hospital stay, days, median (IQR)	3 (2-8)

**Table V: Glasgow Outcome Scale at discharge**

GOS at discharge	n (%)
1. Death	0
2. Persistent vegetative state	0
3. Severe disability	0
4. Moderate disability	1(10)
5. Good recovery	9 (90)

GOS: Glasgow Outcome Scale

Most of the patients (90%) had good recovery with only one patient left with moderate disability (10%).

**Discussion:**

Following a near hanging, the spinal cord sustains secondary injuries alongside the primary mechanical damage. Identifying the most effective treatment for optimizing neurological recovery post-cervical spinal cord injury has been a topic of extensive debate. Interest in pharmacological interventions for acute spinal cord injuries traces back five decades. The NASCIS (National Acute Spinal Cord Injury Study), established in 1975, evaluated pharmacological therapies in the immediate aftermath of spinal cord injuries.<sup>17</sup>

Initially, NASCIS-I trial compared a high-dose infusion of methylprednisolone sodium succinate with a lower-dose bolus treatment. Subsequently, NASCIS-II trial explored higher doses of methylprednisolone and introduced a placebo arm alongside an opiate receptor blocker, Naloxone hydrochloride. Later, NASCIS-III trial compared methylprednisolone administration for different durations and included Tirilazad mesylate as an alternative therapy.<sup>18</sup>

Rasool T, et al (2004) described high dose methylprednisolone didn't show significant changes post-methylprednisolone administration while six-week assessments revealed improved scores in motor function, touch, and pinprick sensation compared to the control group.<sup>19</sup>

However, Cabrera-Aldana et al. (2017) challenged methylprednisolone's role in experimental models by investigating its impact on Aquaporin 4 (AQP4) expression and blood-spinal cord barrier permeability post-spinal cord injury (SCI) in rats. They discovered that SCI elevated AQP4 expression in spinal cord white matter, which methylprednisolone reduced back to baseline levels. Additionally, methylprednisolone increased plasma component leakage after SCI, exacerbating tissue swelling and edema. These findings go against use of methylprednisolone following SCI.<sup>17</sup>

In our study, subjects exhibited a median Glasgow Coma Scale (GCS) at presentation of 12 (IQR: 5–15), with 20% of patients displaying a GCS score of 8 or below, indicating a range of neurological impairments. Hypotension was observed in 20% of the cases, while pulmonary oedema and aspiration pneumonitis manifested clinically in 10% each. Notably, no patients experienced cervical spine fractures. Cerebral oedema was detected in 10% of the study participants through CT brain scans. Importantly, despite the varied complications, the overall mortality rate within the sample was nil.

The hospital stay median (IQR) was recorded as 3 days (2–8), reflecting the efficient management of the patients. Among the 10 individuals, 60% received intensive care unit (ICU) care, and 10% of them required intubation and mechanical ventilation, indicating the severity of their conditions. Remarkably, 90% of the patients received early intervention in the form of high-dose methylprednisolone, highlighting the positive role of this treatment in managing cerebral oedema improving perfusion, reducing oedema, modulating inflammatory cells, and inhibiting lipid peroxidation. Vasopressor therapy was necessary for only one patient, underscoring the overall effectiveness of the interventions.

Complications during ICU stay were limited, with only one case of ventilator-associated pneumonia reported. Encouragingly, all patients requiring ICU admission not only survived but thrived.

The efficacy of methylprednisolone, exceeding typical corticosteroid receptor activation doses, suggests additional mechanisms at play. High doses enhance blood flow in injured spinal cords, potentially by inhibiting lipid peroxidation, stabilizing membranes, and reducing vasoreactivity by-products of arachidonic acid metabolism.

In conclusion, methylprednisolone plays a crucial role in acute cervical cord injury due to near hanging by preventing secondary damage and neuronal degeneration. Immediate initiation of glucocorticoid treatment post-injury can profoundly impact patient functional outcomes.

#### Scopes and limitations:

The study is constrained by its retrospective design, potentially resulting in data incompleteness or absence. The limited sample size, consisting of only ten patients, restricts the generalize ability of the findings to a broader population. Moreover, the absence of a control group and the lack of a

comparative analysis with alternative treatment modalities may impede the study's capacity to formulate definitive conclusions.

#### Conclusion:

In conclusion, this study, focusing on near-hanging cases in Bangladesh, provides valuable insights into the clinical profile, treatment outcomes, and management approaches. The administration of high-dose methylprednisolone as early intervention emerged as a crucial element in achieving favourable outcomes, with a noteworthy zero-mortality rate. The study's limitations, including its retrospective design and small sample size, should be considered in interpreting the results, emphasizing the need for further research to validate these findings in a larger and more diverse population.

#### Conflict of Interest

The authors have no conflict of interest to declare.

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