

An Analysis of the Impact of Pre-hospital Emergency Care on Treatment Outcomes and Prognosis in Patients with Hypertensive Intracerebral Hemorrhage

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Abstract: *Objective:* To investigate the impact of pre-hospital emergency care, involving relevant emergency interventions, on patient prognosis following hypertensive intracerebral hemorrhage. *Methods:* The study included 54 patients with hypertensive intracerebral hemorrhage, all of whom received emergency treatment between May 2024 and December 2025. The 54 patients were randomized using a random number table to form two groups of equal size. Patients in the control group did not receive pre-hospital emergency care, whilst those in the observation group received pre-hospital emergency interventions prior to admission. The response times, treatment outcomes, and prognosis of the two groups were compared to evaluate the impact and role of pre-hospital emergency care on patients with hypertensive intracerebral hemorrhage. *Results:* A comparison of emergency response times between the two groups revealed that the observation group had significantly shorter transport times and initial treatment times than the control group ($p < 0.05$). The NIHSS scores in the observation group were lower than those in the control group at 1 month and 3 months post-intervention ($p < 0.05$). The observation group also achieved higher ADL scores than the control group at 1 month and 3 months post-intervention ($p < 0.05$). The comparison of treatment efficacy between the two groups (88.89% vs 62.96%) was statistically significant ($p < 0.05$). Following surgical treatment, the incidence of complications such as rebleeding in the observation group was 33.33%, which was higher than that in the control group ($p < 0.05$). *Conclusion:* Pre-hospital emergency care has a positive impact on the treatment outcomes and prognosis of patients with hypertensive intracerebral hemorrhage and is worthy of clinical promotion and application.

Keywords: Hypertensive intracerebral hemorrhage; Pre-hospital emergency care; Prognosis

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1. Introduction

In modern times, hypertension has become a relatively common condition. Patients experience elevated systemic arterial pressure, and as the disease progresses, it may affect multiple tissues and organs throughout the body, including the heart and brain, leading to a variety of complications. Hypertensive intracerebral hemorrhage is one of the most serious complications of hypertension; in addition to its sudden onset and rapid progression, it is associated with extremely high

mortality and disability rates, posing a serious threat to patients' lives and health ^[1]. As an acute cerebrovascular disease, hypertensive intracerebral hemorrhage requires emergency resuscitation to minimize the duration of cerebral ischemia and hypoxia, thereby reducing damage to brain tissue, mitigating neurological deficits, and improving patient prognosis ^[2]. In the emergency management of patients, pre-hospital care constitutes a critical phase. Emergency interventions at the scene of onset and during transport are essential to stabilize vital signs and control disease progression, thereby securing more time for in-hospital resuscitation and treatment ^[3]. However, in the past, the emergency management of some patients with hypertensive intracerebral hemorrhage has often lacked a standardized pre-hospital care component. This has led to the progression and worsening of the patient's condition during transport, thereby adversely affecting treatment outcomes and prognosis ^[4]. In response, this study investigated the impact of pre-hospital emergency care on treatment outcomes and patient prognosis in patients experiencing hypertensive intracerebral hemorrhage, with the aim of guiding the management of similar cases. The findings are reported below.

2. Materials and methods

2.1. General information

This study was conducted between May 2024 and December 2025, with 54 patients with hypertensive intracerebral hemorrhage selected as the study subjects for a comparative study. The control group comprised 15 men and 12 women; the patients' ages ranged from 57 to 78 years, with a mean age of (65.49 ± 3.58) years; and the duration of hypertension ranged from 3 to 12 years (7.26 ± 1.03 years). In the observation group, the male-to-female ratio was 16:11; the age range was 55–79 years, with a mean age of (65.62 ± 3.54) years; the duration of hypertension was 3–13 (7.30 ± 1.05) years. There were no statistically significant differences in the general characteristics between the two groups ($p > 0.05$), indicating that they were comparable.

2.1.1. Inclusion criteria

- (1) A clinical diagnosis of intracerebral hemorrhage;
- (2) A history of hypertension.

2.1.2. Exclusion criteria

- (1) Concurrent cerebral herniation or severe intracranial infection;
- (2) Non-hypertensive intracerebral hemorrhage;
- (3) A history of stroke with residual severe neurological deficits.

2.2. Methods

2.2.1. Control group

Patients did not receive pre-hospital emergency care; doctors administered medications such as nicardipine based on blood pressure readings to maintain blood pressure within a reasonable range; diuretics such as mannitol were administered to reduce intracranial pressure; hemostatic agents such as tranexamic acid and neuroprotective agents such as edaravone were administered; in addition to anti-infective treatment, measures to maintain fluid and electrolyte balance were implemented, alongside rehabilitation exercises.

2.2.2. Observation group

Upon receiving an emergency call from the patient's family, the emergency center swiftly coordinated the dispatch of an emergency team to the scene to provide pre-hospital care, as detailed below.

- (1) Upon arrival at the scene, the emergency personnel immediately assessed the patient, rapidly evaluating vital signs such as level of consciousness, pupil response, respiration and blood pressure. They used the Glasgow Coma Scale to

assess the severity of the patient's impaired consciousness, whilst simultaneously enquiring about the time of onset, symptoms and history of hypertension to make a preliminary assessment of the patient's condition.

- (2) Emergency management was initiated. Patients exhibiting impaired consciousness or respiratory distress were administered oxygen therapy; their airways were kept clear, and secretions from the mouth and nose were cleared; tracheal intubation was performed where necessary. Patients with a sudden rise in blood pressure were given oral captopril to control blood pressure. An intravenous line was established, and normal saline was infused to maintain blood volume.
- (3) Conduct an initial assessment and diagnosis. If cerebral hemorrhage is confirmed, administer tranexamic acid by intravenous push. For patients exhibiting signs of increased intracranial pressure or cerebral edema, administer mannitol intravenously to reduce intracranial pressure.
- (4) Following initial management, emergency personnel shall assist in the patient's transfer, using a stretcher to move the patient as smoothly as possible to avoid secondary brain injury caused by violent head movement. During transport, continuously monitor the patient's level of consciousness, blood pressure, heart rate and other vital signs, and remain vigilant for changes in their condition. Should respiratory arrest or a rise in blood pressure occur, administer appropriate symptomatic treatment immediately. Contact the A&E department to explain the patient's condition and the pre-hospital emergency measures taken, ensuring that preparations for admission are in place so that treatment can be initiated rapidly upon the patient's arrival.

2.3. Observation indicators

2.3.1. Initial steps

Record the emergency response times for both groups of patients, including transport time, initial assessment time, pre-treatment preparation time, and the time taken to receive treatment, and compare the relevant durations between the two groups.

2.3.2. The efficacy of emergency treatment was assessed in both groups of patients

A 'marked improvement' was defined as the patient's vital signs stabilizing following treatment, symptoms disappearing completely, imaging studies showing the hematoma had largely resolved, and a marked improvement in neurological deficits. A 'good response' was defined as the patient's vital signs stabilizing following treatment, symptoms improving significantly, the hematoma partially resolving, and some improvement in neurological deficits. Cases that did not meet the above criteria were classified as 'ineffective'. The overall treatment response rate was calculated as the sum of the rates of 'marked improvement' and 'good response'.

2.3.3. Assessments of neurological deficits

Assessments of the extent of neurological deficits and activities of daily living were conducted and compared at three time points: prior to intervention, one month after treatment, and three months after treatment. The assessment tool used for the first time point was the National Institutes of Health Stroke Scale (NIHSS), which evaluates patients' consciousness, sensation and limb movement, with a total score ranging from 0 to 42; the score is directly proportional to the degree of functional impairment; The latter assessment tool is the Barthel Index, which evaluates patients' ability to eat, dress and walk, with a total score ranging from 0 to 100, where the score is directly proportional to the level of functional ability.

2.3.4. Monitoring

Closely monitor changes in the patient's condition, record any instances of rebleeding, intracranial infection, pulmonary infection and stress ulcers, and calculate and compare the incidence rates of complications.

2.4. Statistical analysis

The data were analyzed using SPSS 28.0 software to classify and summarize the results. Quantitative data are presented in ($\bar{x} \pm s$) to compare emergency response times, and were subjected to a *t*-test; categorical data are presented as (n, %) to compare efficacy rates and complication rates, with the chi-square test used as the statistical test. A *p*-value of < 0.05 indicates a statistically significant difference.

3. Results

3.1. Comparison of response times between the two groups

The observation group recorded significantly shorter times for all emergency response-related procedures compared with the other group ($p < 0.05$). See **Table 1**.

Table 1. Comparison of emergency response times between the two groups of patients (min)

Category	Number of examples	Transit time	Initial processing time	Pre-treatment preparation time	Time taken to receive treatment
Observation group	27	78.34 $\pm$ 10.05	13.47 $\pm$ 2.09	28.76 $\pm$ 5.38	92.35 $\pm$ 11.27
Control group	27	105.62 $\pm$ 10.36	19.85 $\pm$ 2.24	41.87 $\pm$ 5.61	131.80 $\pm$ 11.85
<i>t</i>	-	9.821	10.821	8.764	12.535
<i>p</i>	-	0.000	0.000	0.000	0.000

3.2. Comparison of treatment outcomes between the two groups

Compared with the 62.96% treatment response rate in the control group, that of the observation group was higher ($p < 0.05$). See **Table 2**.

Table 2. Comparison of treatment outcomes between the two groups (n, %)

Category	Number of examples	Take effect	Valid	Invalid	Overall efficiency
Observation group	27	11 (40.74)	13 (48.15)	3 (11.11)	24 (88.89)
Control group	27	5 (18.52)	12 (44.44)	10 (37.04)	17 (62.96)
χ^2	-	-	-	-	4.964
<i>p</i>	-	-	-	-	0.026

3.3. Comparison of outcomes between the two groups of patients

Following treatment, there were differences between the two groups in terms of prognosis-related scores: the observation group had higher ADL scores, whilst the control group had higher NIHSS scores ($p < 0.05$). See **Table 3**.

Table 3. Comparison of NIHSS and ADL scores between the two groups at different time points (, points)

Group	Number of cases	NIHSS score			ADL score		
		Before intervention	1 month after treatment	3 months after treatment	Before intervention	1 month after treatment	3 months after treatment
Observation group	27	22.64 $\pm$ 4.58	11.27 $\pm$ 3.35	6.94 $\pm$ 1.88	40.03 $\pm$ 4.51	70.26 $\pm$ 5.82	81.35 $\pm$ 5.67
Control group	27	22.55 $\pm$ 4.70	15.02 $\pm$ 3.61	8.75 $\pm$ 2.23	39.66 $\pm$ 4.54	58.54 $\pm$ 4.86	75.11 $\pm$ 5.49
<i>t</i>	-	0.071	3.957	3.225	0.300	8.032	4.108
<i>p</i>	-	0.944	0.000	0.002	0.765	0.000	0.000

3.4. Comparison of complication rates between the two groups

A comparison of the incidence of complications between the two groups (the observation group and the control group) yielded the following results: 7.41% versus 33.33%. The incidence in the observation group was lower than that in the control group ($p < 0.05$). See **Table 4**.

Table 4. Comparison of complication rates between the two groups (n, %)

Group	Number of cases	Rebleeding	Intracranial infection	Pulmonary infection	Stress ulcer	Total incidence
Observation group	27	0 (0.00)	0 (0.00)	1 (3.70)	1 (3.70)	2 (7.41)
Control group	27	3 (11.11)	1 (3.70)	2 (7.41)	3 (11.11)	9 (33.33)
χ^2	-	-	-	-	-	5.594
p	-	-	-	-	-	0.018

4. Discussion

In recent years, the prevalence of hypertension among the Chinese population has been rising year on year, whilst the number of cases of cerebral hemorrhage caused by hypertension has also been on the increase. Hypertensive intracerebral hemorrhage is characterized by rapid disease progression and a high mortality rate. According to surveys, the mortality rate within one month of onset can reach 30% to 50%. The success rate of resuscitation is closely linked to the time taken to receive emergency treatment after onset. Timely and standardized treatment can reduce the extent of brain tissue damage, mitigate neurological deficits, improve treatment outcomes, and enhance patient prognosis^[5]. With the continuous development of emergency medicine and the ongoing refinement of emergency care systems, the importance of pre-hospital emergency care has significantly increased. The implementation of pre-hospital emergency interventions for patients with acute cerebrovascular diseases, such as hypertensive intracerebral hemorrhage, has yielded remarkable clinical outcomes.

The results of the study showed that patients in the observation group who received pre-hospital emergency care had shorter response times and achieved better treatment outcomes than those in the control group ($p < 0.05$). This indicates that pre-hospital emergency care can shorten the emergency response time and improve treatment outcomes. An analysis of the reasons suggests that, upon arrival at the scene, pre-hospital emergency personnel conduct a rapid assessment of the patient, make an initial judgment of their condition, and promptly brief the emergency department resuscitation team. This facilitates the timely formulation of a resuscitation plan and preparation for treatment, thereby shortening the emergency response time^[6]. Compared with the control group, pre-hospital emergency care provides emergency life support at the scene of the incident, monitors the patient's vital signs during transport, and administers interventions such as blood pressure control. This prevents fluctuations in the patient's condition from exacerbating brain tissue damage, buys more time for treatment, and consequently improves treatment outcomes^[7]. There was a significant difference in post-treatment NIHSS and ADL scores between the two groups, with the observation group showing superior outcomes ($p < 0.05$). Pre-hospital emergency care involves initial management prior to hospital admission to control disease progression and reduce brain tissue damage; simultaneously, enhanced nursing care during transport prevents secondary brain injury whilst ensuring patients receive emergency treatment in the shortest possible time, thereby mitigating the severity of brain injury^[8]. The more severe the brain injury, the poorer the recovery of brain function and the more pronounced the impact on activities of daily living; pre-hospital emergency care reduces brain injury and promotes neurological recovery, thereby improving patients' functional capacity^[9]. The incidence of complications was lower in the observation group than in the control group ($p < 0.05$). In pre-hospital emergency care interventions, administering oxygen to patients and maintaining airway patency can reduce the risk of pulmonary infection; administering antihypertensive drugs pre-hospital to control blood pressure helps prevent rebleeding caused by blood pressure fluctuations; implementing interventions such as fluid

restriction and hemostasis to control cerebral oedema thereby reduces the risk of intracranial infection; and enhanced monitoring of the patient's condition during transport helps reduce the incidence of stress ulcers and other complications ^[10].

In summary, pre-hospital emergency interventions for patients with hypertensive intracerebral hemorrhage have significantly reduced response times and improved treatment outcomes, whilst also preventing and reducing the risk of related complications. Patients demonstrate better neurological function and activities of daily living, highlighting the high clinical value of this approach.

Disclosure statement

The author declares no conflict of interest.

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