

Original Article

Effects of fast track emergency care on efficiency and risk prevention of emergency treatment in patients with acute cerebral infarction

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Abstract: Objective: The aim of the current study was to explore the effects of fast track emergency care on efficiency levels and risk prevention of emergency treatment in patients with acute cerebral infarction (ACI). Methods: One hundred and twenty-seven patients with ACI were included in this retrospective study. Sixty-three patients, receiving traditional emergency care, were assigned to the control group. Sixty-four patients, receiving fast track emergency care, were assigned to the research group. The two groups were compared in terms of efficiency of emergency treatment and clinical treatment effects, as well National Institutes of Health Stroke Scale (NIHSS), Barthel Index for Activities of Daily Living (ADL), and adenylyl cyclase (AC) expression (AC/GPR-DH) scores. Quality of survival and care satisfaction were also compared between the two groups. Results: Admission and treatment times, door-to-needle times, and rescue times in the research group were significantly shorter than those in the control group ($P < 0.001$). Lengths of stay, as well as rates of cerebral infarction recurrence (14.06%), disability (3.12%), and mortality (0.00%), in the research group were significantly lower than those in the control group (33.33%, 14.29%, 7.94%, respectively) ($P < 0.001$). The research group showed significantly higher AC/GPR-DH values, ADL scores, and quality of survival, but lower NIHSS scores ($P < 0.001$). Compared with the control group, the research group was significantly higher in all aspects of care satisfaction, including healthcare education, treatment and psychological care, and service attitude ($P < 0.001$). Conclusion: Fast track emergency care delivers better effects, improving efficiency levels and effects of emergency treatment in ACI patients. Thus, these patients enjoy a significantly higher quality of survival and are more likely to express satisfaction. Furthermore, ensuring safety during emergency treatment is a major key in improving treatment effects of emergency care.

Keywords: Acute cerebral infarction, fast track emergency care, efficiency of emergency treatment, risk prevention

Introduction

Acute cerebral infarction (ACI) is a common neurological disease. Pathological mechanisms include brain tissue necrosis, due to a sudden stop of blood supply to the brain. ACI often manifests as atherosclerosis or thrombosis of cerebral arteries. ACI is commonly seen in elderly males. It is characterized by acute onset and rapid progression, with mortality rates increasing on an annual basis. In 2018, mortality rates of ACI reached 90%, raising considerable clinical concerns [1]. Focal neurologic deficits are features of cerebral infarction. A key for treatment of cerebral infarction is the restoration of blood supply to the infarction area in the shortest time, aiming to reduce the infarct size to a minimum. In clinical settings, the time of

rescue of ACI determines the success of treatment. Patients need to be diagnosed and admitted within 0-45 minutes. They should receive intravenous thrombolysis within 0-4.5 hours and possible medication for intra-arterial thrombolysis, as well as thrombectomy procedures, de-fibrinogen therapy, and other non-pharmacological treatments, within 8 hours. If not promptly treated within a certain time period, ACI will cause irreversible nerve injuries or death [2]. With modern technologies for diagnosis and treatment, mortality rates have been effectively controlled. However, more than 80% of the patients still suffer limb dysfunction after successful treatment. Therefore, minimizing the disability rate is an important goal of ACI treatment [3]. Fast and effective emergency care is an important clinical factor, ensuring the

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success of emergency treatment. It is an important approach in protecting patient neurological function. Effective nursing processes can directly reduce time wasted in all aspects of treatment. This will ensure the maximum time of treatment for patients. For this reason, the standardization of emergency care is of great significance in improving the prognosis of ACI patients [4].

At present, conventional nursing care is generally applied to patients. However, it contributes limited effects to the efficiency of emergency treatment, only reducing mortality rates and rescue times by a small fraction [5]. Studies have shown that patients receiving intravenous thrombolysis within 4.5 hours (time window) is the key to ensuring rescue effects. Some factors, including prehospital times and door-to-needle time (DNT), will not only determine whether they can successfully receive treatment within the time window, but also affect the recovery of neurological function at the early stages of onset, as well as prognosis at 3 months after the rescue [6]. Therefore, the entire rescue process of ACI emphasizes time. Scientific and effective nursing care is crucial to rescue effects. Studies have shown that fast track emergency care is the best clinical approach, directly cutting down the time wasted in various aspects of care [7]. This approach improves treatment efficiency for ACI patients, reduces poor prognosis, and promotes the success of treatment. In recent years, researchers have improved the rescue efficiency of ACI patients, optimized the mode and process of emergency care, and adopted fast track emergency care. The current study investigated fast track emergency care, aiming to provide reference for clinical nursing care.

Materials and methods

General information

Of the 127 ACI patients included in this retrospective study, 63 patients received traditional emergency care and were assigned to the control group. A total of 64 patients received fast track emergency care and were assigned to the research group. This study was approved by the Medical Ethics Committee of Beijing Huaxin Hospital, the First Affiliated Hospital of Tsinghua University. All participants and their relatives provided informed consent before entry into the study.

Inclusion criteria: Patients meeting the diagnostic criteria of *Chinese Guidelines of Diagnosis and Treatment for Acute Ischemic Stroke (2014)*; Patients definitely diagnosed by magnetic resonance imaging (MRI) or head computed tomography (CT) scans [8]; Patients that experienced the first onset of ACI and received thrombolysis/anticoagulation therapy in Beijing Huaxin Hospital, the First Affiliated Hospital of Tsinghua University; Patients with consciousness within 4.5 hours of the onset. Exclusion criteria: Patients with coagulopathy or vascular dementia; Patients complicated with malignant tumors; Patients with severe diseases in vital organs or systemic diseases; Patients with mental disorders or poor treatment compliance.

Methods

For the control group, conventional emergency care procedures were performed, including admission, registration, and referral to specialist nurses. First, vital signs and clinical symptoms were evaluated, establishing reliable venous access. Symptoms, including hypoxia and productive coughing, were observed. Emergency treatments, including oxygen supply and sputum suctioning, were carried out as needed. When the vital signs were stable, the patient received specific examinations. After results were confirmed, patients were referred to the corresponding department by the specialist nurse for further treatment.

For the research group, fast track emergency care was performed. First, preparations were made prior to emergency treatment. Emergency kits and equipment were prepared in advance. Drugs and surgical instruments were kept in order. Second, the Emergency Department was readily available to receive patients at any time. Once the ambulance arrived at the hospital, the Emergency Department was promptly notified. Patients were assessed for vital signs in the shortest time. Emergency treatments, such as sputum suctioning and oxygen supply, were given. Check-in procedures were carried out later with the family members. During emergency treatment, relevant departments were notified to make preparations. After the patients were referred to the relevant departments, professional physicians immediately established venous access. They collected blood for examinations and performed MRIs, as well as head CT scans. The procedure shortened times

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to reception and treatment. As a result, this method reduced DNT. If patient conditions deteriorated under escort or examination, emergency treatment was performed on the spot.

Real-time monitoring was performed during treatment. During thrombolytic therapy, the same medical staff observed and recorded the vital signs of the patients. They paid attention to whether there were any abnormalities in blood pressure, oral cavities, and skin mucous membranes. If patients had high blood pressure, they were treated by a specialist physician, aiming to avoid the extension of DNT due to delayed treatment of abnormalities. In addition, thrombolysis might have a negative impact on patient emotions. Therefore, the nursing staff conducted psychological counseling, aiming to stabilize patient moods, relieve stress, and reduce poor treatment efficacy due to depression. Early discovery and improvement of patient emotions reduced the time of poor treatment efficacy.

The treatment scheme was developed pre-treatment. Prior to treatment, a variety of treatment plans were made as options to shorten the time of planning formulation. After admission, physicians of the relevant department were informed of patient conditions in advance, choosing a suitable treatment plan. Patients immediately underwent skin preparation and skin tests, preparing to receive treatment. The treatment should present no additional risks to the life and safety of patients. During treatment, the plan should be adjusted accordingly. An integrated and specific treatment plan should be formed.

Outcome measures and evaluation criteria

Primary outcome measures included emergency treatment effects, clinical nursing effects, expression of adenylate cyclase (AC) (AC/GPR-DH), degree of neurological deficit, and activities of daily living before and after nursing.

Evaluation of emergency treatment effects included admission times (time from entry to admission), treatment times (time from admission to treatment), DNT (time from treatment to intravenous thrombolysis), and rescue times (time from treatment to life saved). Evaluation of clinical nursing effects included lengths of stay, risk of recurrent strokes (the proportion of

patients diagnosed with cerebral infarction within one year after discharge in the total number of patients of the group), disability rates, and mortality rates. The degree of neurological deficit was assessed by National Institutes of Health Stroke Scale (NIHSS) scores. NIHSS scores range from 0 to 42, with higher scores indicating more severe neurological injuries (15-20: moderate-severe stroke, 5-15: moderate stroke) [9]. Barthel Index of Activities of Daily Living scores were used to evaluate the activities of daily living [10]. With scores totaling 100, the Barthel index (BI) evaluates variable incontinence, dressing, walking, bathing, grooming, and feeding. Scores ≥ 90 represent independence in daily activities. Scores of 60-90 represent mild dependence. Scores of 41-59 represent moderate dependence. Scores ≤ 40 represent severe dependence. AC/GPR-DH was determined by RT-PCR.

Secondary outcome measures included quality of survival and nursing satisfaction. Quality of survival was evaluated using the WHO Quality of Life Instrument and Short Form (WHOQOL-BREF), including mental states, personal beliefs, physical health, social relations, surrounding environment, and independence [11]. Nursing satisfaction was evaluated using a self-constructed questionnaire. The questionnaire had a maximum score of 40, including health knowledge education, nursing interventions, mental health care, and service attitude. Each dimension contained 10 points.

Statistical analysis

All statistical data were processed using SPSS 21.0 software. Measurement data were examined by Kolmogorov-Smirnov normality tests for normality. Normally distributed data are expressed as mean \pm standard deviation ($\bar{x} \pm SD$) and were compared based on t-test. Enumeration data are expressed as cases/percentage (n/%) and were compared based on Chi-square tests. $P < 0.05$ indicates statistical significance.

Results

Comparison of baseline characteristics

Comparison of baseline characteristics between the two groups showed no significant differences (all $P > 0.05$). See **Table 1**.

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Table 1. Comparison of baseline characteristics

	The control group (n=63)	The research group (n=64)	χ^2	P
Gender (male/female)	40/23	38/26	0.227	0.634
Mean age (year)	61.6 ± 11.4	62.0 ± 12.4	0.189	0.850
Mean time from onset to emergency treatment (h)	2.85 ± 1.62	2.89 ± 1.03	0.166	0.869
Glasgow Coma Scale	7.84 ± 2.65	7.91 ± 2.36	0.157	0.875
Acro-paralysis (n, %)	33 (52.38)	34 (53.12)	0.007	0.935
Aphasia (n, %)	11 (17.46)	10 (15.62)	0.077	0.781
Deviation of labial commissure (n, %)	15 (23.81)	16 (25.00)	0.024	0.876
Disturbance of consciousness (n, %)	5 (7.94)	5 (7.81)	0.001	0.979
Emesis (n, %)	4 (6.35)	4 (6.25)	0.001	0.982
Arrhythmia (n, %)	3 (4.76)	2 (3.12)	0.225	0.635
Abnormal respiration pattern (n, %)	3 (4.76)	3 (4.69)	0.000	0.984
Airway obstruction (n, %)	2 (3.17)	2 (3.12)	0.000	0.987

Table 2. Comparison of emergency treatment effects ($\bar{x} \pm sd$)

Groups	Admission time (min)	Treatment time (min)	DNT (min)	Rescue time (min)
The control group (n=63)	7.96 ± 1.46	27.83 ± 5.64	59.50 ± 12.47	48.35 ± 15.36
The research group (n=64)	3.34 ± 0.95	16.95 ± 2.32	39.05 ± 9.71	34.32 ± 10.68
χ^2	21.101	14.176	10.301	5.968
P	< 0.001	< 0.001	< 0.001	< 0.001

Note: DNT, door-to-needle time.

Comparison of emergency treatment effects

The research group was significantly lower than the control group in admission times, treatment times, DNT, and rescue times (all $P < 0.001$). See **Table 2** and **Figure 1**.

Comparison of clinical nursing effects

Compared with the control group, the research group was significantly shorter in lengths of stay, as well as lower in risks of recurrent strokes, disability rates, and mortality rates (all $P < 0.05$). See **Table 3** and **Figure 2**.

Comparison of AC/GPR-DH ratios, NIHSS scores, and BI scores before and after nursing care

Before nursing care, ratios and scores were not significantly different between the two groups (all $P > 0.05$). After nursing care, the two groups were significantly higher in AC/GPR-DH ratios and BI scores, as well as lower in NIHSS scores, compared to post-nursing levels. Changes in the research group were greater than those

in the control group (all $P < 0.001$). See **Table 4** and **Figure 3**.

Comparison of quality of survival

After nursing, compared to the control group, the research group had higher scores in mental states, personal beliefs, physical health, social relations, surrounding environment, and independence (all $P < 0.001$). See **Table 5**.

Comparison of nursing satisfaction

After nursing, compared to the control group, the research group had higher scores in health knowledge education, nursing interventions, mental health care, and service attitude (all $P < 0.001$). See **Table 6**.

Discussion

ACI has received widespread clinical attention due to high disability rates and mortality rates. Early diagnosis and treatment are keys to saving the lives of ACI patients. At present, the only effective treatment method for ACI is thrombolytic therapy. The timeliness of thrombolysis

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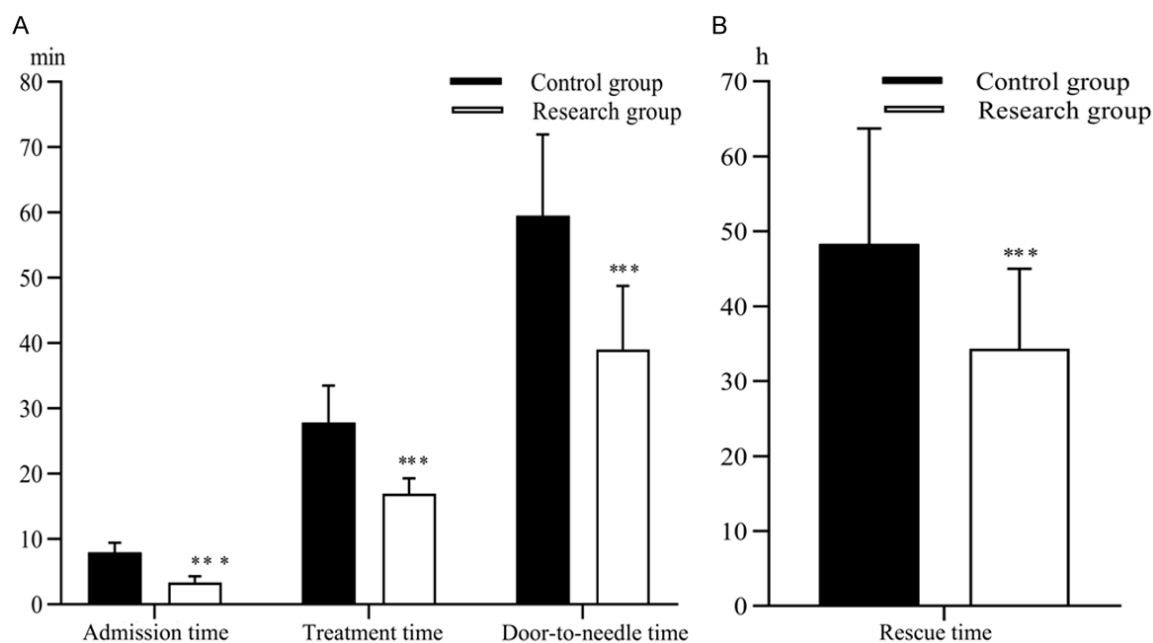


Figure 1. Comparison of emergency treatment effects. A. Comparison of admission times, treatment times, and DNT between the two groups; B. Comparison of rescue times between the two groups. Compared with the control group, ***P < 0.001. DNT, door-to-needle time.

Table 3. Comparison of clinical nursing effects ($\bar{x} \pm sd$, n, %)

Groups	Length of stay (d)	Risk of recurrent stroke (%)	Disability rate (%)	Mortality rate (%)
The control group (n=63)	32.56 ± 6.35	21 (33.33)	9 (14.29)	5 (7.94)
The research group (n=64)	12.23 ± 3.14	9 (14.06)	2 (3.12)	0 (0.00)
t	22.814	6.535	4.999	5.288
P	< 0.001	0.010	0.025	0.021

determines the quality of prognosis for ACI. Previous studies have shown that the time window for treatment of ACI is 4.5 hours. Thrombolytic therapy during this time could help to significantly reduce the risk of large hemorrhagic infarct [12]. Therefore, thrombolytic therapy needs to be combined with effective and standardized nursing care, ensuring the fastest times of thrombolytic therapy and quickest treatment times [13].

With the rising healthcare demand, clinicians not only focus on safety and effectiveness of nursing care in the Emergency Department, but also on improvement of work efficiency. In a study on the perception of efficiency and design in emergency nurses, Fay L et al. suggested that efficient and high-quality medical services would be affected by interactions among the Emergency Department's physical structure, processes, and outcomes. Examination of

the interrelationship between these three components is critical for evaluating quality of care in the Emergency Department [14]. In the case of conventional nursing care, registration, examination, and referrals can delay treatment. Thus, patients may miss the optimal time for thrombolytic therapy. Studies have shown that efficient emergency care workflow can shorten the time from treatment to thrombolysis for ACI patients, ensuring proper therapeutic efficacy of thrombolytic therapy [15]. At present, the optimization of emergency care procedures in a host of hospitals has resulted in a variety of nursing models, of which fast track emergency care is preferred by many hospitals. The purpose of fast track emergency care is to reduce the time wasted in admission, diagnosis, pre-treatment preparations, and treatment planning. This approach basically eliminates the time for the preparation of the facility prior to treatment. Thus, it saves the maximum rescue

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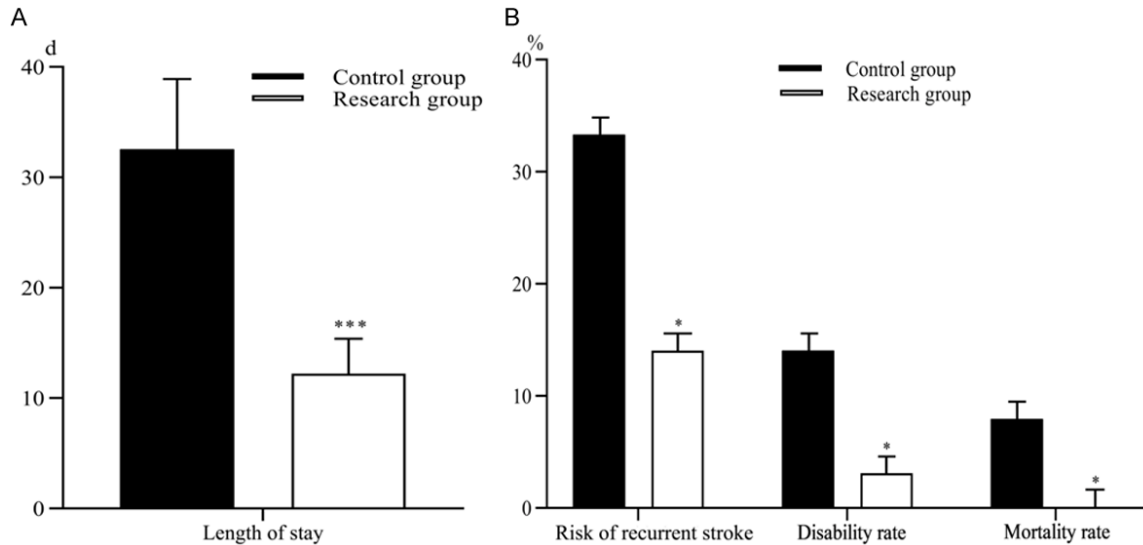


Figure 2. Comparison of clinical nursing effects. A. Comparison of lengths of stay between the two groups; B. Comparison of risks of recurrent strokes, disability rates, and mortality rates between the two groups. Compared with the control group, * $P < 0.05$, *** $P < 0.001$.

Table 4. Comparison of AC/GPR-DH ratios, NIHSS scores, and BI scores before and after nursing care ($\bar{x} \pm sd$)

	The control group (n=63)	The research group (n=64)	t	P
AC/GPR-DH ratio				
Before nursing	0.013 \pm 0.004	0.013 \pm 0.002	0.000	1.000
After nursing	0.453 \pm 0.012*	0.876 \pm 0.035*	91.383	< 0.001
NIHSS scores				
Before nursing	18.65 \pm 5.67	19.94 \pm 5.74	1.274	0.205
After nursing	14.82 \pm 3.02*	9.06 \pm 4.47*	8.521	< 0.001
BI scores				
Before nursing	38.35 \pm 9.17	39.23 \pm 10.21	0.511	0.610
After nursing	76.35 \pm 10.21*	85.62 \pm 9.72*	5.241	< 0.001

Note: Compared with before nursing, * $P < 0.001$. AC/GPR-DH, the expression of adenylyate cyclase; NIHSS, National Institutes of Health Stroke Scale; BI, Barthel Index.

time for the nurses and patients [16]. Compared with conventional nursing care, the standardization of emergency care streamlines the process of fast track emergency care, allowing more efficiency [17]. Wolf LA et al. applied fast track emergency care in emergency treatment, achieving remarkable results [18].

The current study used fast track emergency care to maximize rescue times, mainly from the preparations for emergency treatment, pre-treatment planning, and real-time monitoring during treatment. First, before emergency treatment, the job responsibilities of each medical staff member were clarified. The work of exami-

nation, treatment, and triage was assigned to specific medical personnel. Staffs prepared for the pre-treatment procedures in advance, aiming to reduce admission times and treatment times. These arrangements avoided time wasted by medical staffs due to unfamiliarity with nursing care and rescue. After receiving emergency calls, the medical staff promptly completed all preparations and performed prioritized diagnosis and treatment for the patients. This

was conducive to rescue work and saved time for emergency treatment. Second, by formulating rescue, treatment, nursing care plans (including accurate time windows for treatment), and professional procedures for various emergency diseases in advance, patients can receive treatment faster, avoiding unnecessary time consumption. They have enough time for thrombolytic therapy. In addition, precautions were made for potential accidents. Therefore, wasted time caused by making decisions during treatment was avoided and safety levels were increased. Moreover, the medical staff monitored vital signs of the patients throughout treatment. Once an accident occurred,

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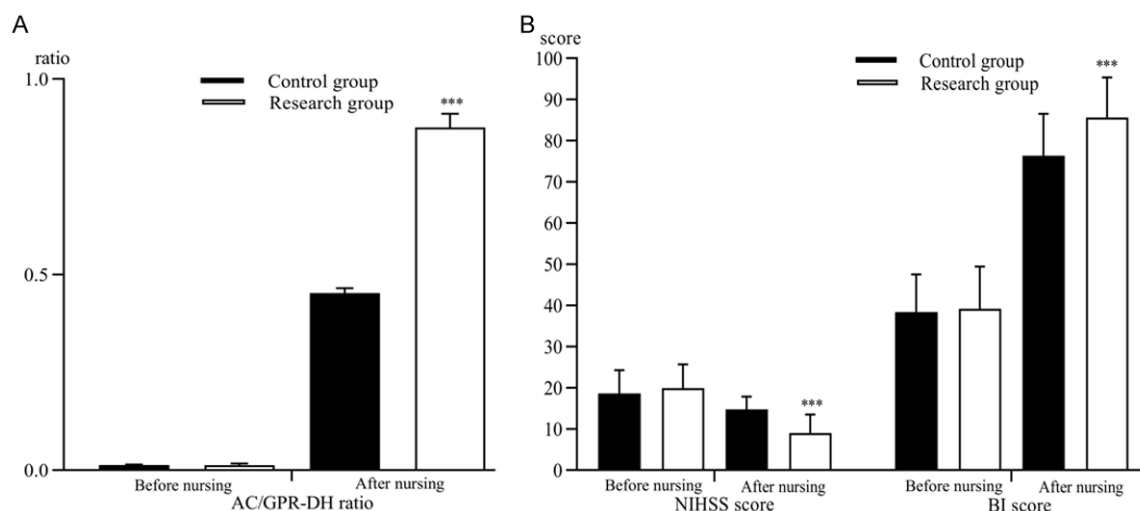


Figure 3. Comparison of AC/GPR-DH ratios, NIHSS scores, and BI scores before and after nursing care. A. Comparison of AC/GPR-DH ratios before and after nursing in two groups; B. Comparison of NIHSS and BI scores between two groups before and after nursing. Compared with the control group, *** $P < 0.001$. AC/GPR-DH, the expression of adenylate cyclase; NIHSS, National Institutes of Health Stroke Scale; BI, Barthel Index.

Table 5. Comparison of quality of survival

Groups	Mental state	Personal belief	Physical health	Social relations	Surrounding environment	Independence
The control group (n=63)	15.81 ± 2.34	2.33 ± 0.20	7.42 ± 1.24	6.97 ± 2.52	28.27 ± 1.46	13.28 ± 1.08
The research group (n=64)	18.78 ± 1.17	3.82 ± 0.14	10.61 ± 0.38	10.87 ± 0.25	30.81 ± 1.10	15.09 ± 0.15
t	9.025	48.568	19.536	12.225	11.060	13.178
P	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Table 6. Comparison of nursing satisfaction

Groups	Health knowledge education	Nursing interventions	Mental health care	Service attitude
The control group (n=63)	9.31 ± 0.15	9.33 ± 0.14	9.34 ± 0.31	9.44 ± 0.32
The research group (n=64)	9.85 ± 0.06	9.86 ± 0.10	9.85 ± 0.04	9.76 ± 0.08
t	26.559	24.516	12.952	7.704
P	< 0.001	< 0.001	< 0.001	< 0.001

treatment was delivered immediately. Thus, the difficulty of treatment and the time of rescue would not be increased due to delayed discovery [19].

Results of this study showed that admission times, treatment times, DNT, and rescue times were all shorter in the research group than the control group. Results were consistent with previous studies. This may be related to the prior knowledge of the medical staff about patient conditions, allowing them to notably improve the treatment effects by formulating and implementing emergency treatment continuously. This will save more time for the rescue [20]. In

this study, compared with the control group, the research group was shorter in lengths of stay and lower in risks of recurrent strokes, disability rates, and mortality rates. These improvements may be related to reduced waiting and treatment times, which ensure the best time for thrombolytic therapy. Moreover, receiving treatment from specialists as soon as possible also secures treatment effects. This reduces disability and mortality rates. After nursing, AC/GPR-DH ratios, BI scores, and scores on the quality of survival in the research group were significantly higher than those in the control group. However, NIHSS scores were significantly lower in the research group than the control

group. In terms of health knowledge education, nursing intervention, mental health care, and service attitude, scores in the research group were significantly higher than those of the control group. Improvements in patient satisfaction may be related to the fact that fast track emergency care improves the prognosis quality of patients, ensures the quality of care, and is more satisfactory to patients and their families. These factors are conducive to improved quality of life [21].

The Emergency Department is the most important frontline in the medical service system. The nursing process involves complicated and critical steps. Severe medical emergencies often occupy the department around the clock. In conventional emergency care, examinations are performed first. These are followed by initial diagnosis based on results and symptoms. Triage is then performed based on the severity of the patient. This is the overall process of the entire nursing care [22]. Compared with other departments, the Emergency Department has to deal with emergencies in most cases, such as traumatic accidents and public health events. Moreover, this department receives far more patients than other departments, which imposes greater burden, physically and mentally, on nursing staffs. In this context, medical disputes and complaints are more likely to occur [23]. Overcrowding in the Emergency Department has long been a major challenge for both patients and medical staff. McHugh C et al. reported on the first emergency-based telemedicine services developed by a multi-disciplinary emergency team [24]. Based on China's conditions, the ultimate goals of improving the efficiency of the Emergency Department, especially the Intensive Care Unit, are to improve treatment success rates, shorten the lengths of stays, and satisfy patients and their families. It is necessary to promote the development of high-quality medical services in China [25]. There were several limitations to the current study, however. It was a single-center study with a small sample size.

In conclusion, fast track emergency care demonstrated significant advantages in improving rescue efficiency and treatment effects in ACI patients. The quality of survival of the patients was considerably improved, resulting in greater satisfaction for the patients and families. Furthermore, ensuring the safety of emergency

treatment is the key to improving treatment success rates.

Disclosure of conflict of interest

None.

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