

Original Article

Effect of standardized nursing cooperation on intravenous thrombolysis with recombinant tissue plasminogen activator in acute ischemic stroke

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Received January 29, 2021; Accepted August 16, 2021; Epub October 15, 2021; Published October 30, 2021

Abstract: Objective: This study explored the impact of standardized nursing cooperation on intravenous thrombolysis with recombinant tissue plasminogen activator (rt-PA) in acute ischemic stroke (AIS). Methods: From June 2019 to June 2020, a total of 235 AIS patients that received rt-PA intravenous thrombolysis were enrolled as the research subjects. Among them, there were 101 patients who were admitted between June 2019 and December 2019 and were placed into control-group and received traditional routine nursing collaboration procedures; and the remaining 134 subjects admitted between January 2020 to June 2020 were classified into the observation-group and received standardized care collaboration procedures. The time spent (from admission to CT examination, from completion of CT to medication and from admission to medication), the thrombolysis within 1 h, 1-2 h, 2-3 h and 3-4.5 h, the degree of damage of neurological function before and after nursing intervention, the occurrence of complications and satisfaction with nursing care were compared between the two groups. Results: The time spent in each procedure of thrombolytic therapy in the observation group was remarkably less than that in control group ($P<0.05$). The distribution of thrombolysis in the observation group was superior to that in control group ($P<0.05$). NIHSS score of subjects in observation group after intervention was obviously lower than that in the control group, with statistically significant difference [(3.34±0.87) points, (4.82±0.93) points, $t=12.5318$, $P=0.0000$]. The incidence of complications in the observation group was 5.97%, and that in the control group was 24.75%, with a statistically significant difference ($X^2=16.8317$, $P=0.0000$). The nursing satisfaction of the observation group was 91.04%, which was significantly higher than 73.27% in the control group, and the difference was statistically significant ($X^2=13.1496$, $P=0.0003$). Conclusion: The standardized nursing cooperation for AIS patients with rt-PA intravenous thrombolysis is beneficial for effectively reducing the treatment delay and the incidence of complications, and improving the neurological function and satisfaction of nursing care, and as such it which is worthy of clinical promotion.

Keywords: Standardized nursing cooperation, acute ischemic stroke, rt-PA intravenous thrombolysis

Introduction

Acute ischemic stroke (AIS), also known as cerebral infarction, is a severe acute disease of the nervous system that accounts for over 65% of stroke cases [1]. The pathogenesis of AIS is cerebral infarction which is caused by the occlusion of cerebral arteries due to various reasons, and is accompanied by damage of various nerve cells and neurons in body. The clinical characteristics of the disease are high rate in incidence, mortality, disability and recurrence. The disease incidence has been increas-

ing annually and it imposes great stress and economic burden to patients, families and society [2, 3]. Therefore, it is of great significance to effectively treat AIS patients in a short period of time to reduce the mortality and disability rates. Currently, recombinant tissue plasminogen activator (rt-PA) intravenous thrombolysis is the go to treatment of AIS clinically. Rt-PA intravenous thrombolysis can effectively dredge blood vessels, improve cerebral blood supply, thus greatly increasing the survival rate and improving patients' quality of life [4, 5]. As the patients' condition changes rap-

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idly, the thrombolytic time should be strictly controlled during the treatment. According to the data, the optimal time for rt-PA intravenous thrombolysis is within 1 hour after the disease onset, and each 1 min delay in rt-PA intravenous thrombolysis will cause the death of 2 million neurons, and increase the risk of bleeding [6-8]. In view of the limited treatment time, nursing intervention is often adopted in the clinical therapeutic process to improve the treatment effect. Although the conventional nursing measures can remarkably help to reduce patients' suffering, the lack of coordination and management between hospital departments often results in inferior treatment effects. Therefore, it is of great significance to form a standardized nursing collaboration during emergency treatment of patients and improve the nursing coordination for patients to get rapid treatment in the hospital and reduce the delay of medication time. Based on the above background, we enrolled these 235 AIS subjects with rt-PA intravenous thrombolysis in our hospital from June 2019 to June 2020 for study, aiming to explore the effect of standardized nursing cooperation on patents. The research details are as follows.

Materials and methods

Research subjects

From June 2019 to June 2020, a total of 235 AIS patients that received rt-PA intravenous thrombolysis were enrolled in this study. Among them, 101 who were admitted between June 2019 and December 2019 were placed into the control-group and received traditional routine nursing collaboration procedures; and the remaining 134 subjects admitted between January 2020 to June 2020 were classified into the observation-group and received standardized nursing cooperation. This research received approval from the ethics committee of the hospital.

Inclusion and exclusion criteria

Inclusion criteria: (1) The subjects enrolled met the diagnostic criteria in Guidelines for Diagnosis and Treatment of Stroke in China in 2018 [9], and were diagnosed by craniocerebral CT examination; (2) The duration of brain injury was over 30 min and the onset time was within 4.5 h; (3) The patients' score of National Institute of Health Stroke Scale (NIHSS) [10]

was 4-25 points; and (4) The patients or their families gave informed consent to receive rt-PA intravenous thrombolysis and signed the corresponding documents.

Exclusion criteria: (1) Patients with intracranial hemorrhage and imaging changes of early large-scale infarction by craniocerebral CT examination; (2) Patients with severe heart, liver or kidney dysfunction; (3) Patients with coagulation dysfunction or bleeding experiences; (4) Patients with contraindications to thrombolysis; or (5) Patients who self-treated with anti-coagulants.

Methods

Both groups were treated with rt-PA intravenous thrombolysis with recombinant Human TNK Tissue-type Plasminogen Activator for Injection (rhTNK-tPA), Guangzhou Mingkang Biological Engineering Co., Ltd. S20150001.

The control group received a traditional routine nursing cooperation process, and the methods were as follows: Emergency department nurses conducted pre-examination and arrangement based on the patient's general clinical symptoms such as hemiplegia and dizziness, and transferred the patient to the emergency room. The emergency stroke experts conducted a NIHSS evaluation on patients. The green channel was opened at the same time for emergency nurses to perform blood tests, electrocardiogram, CT and other necessary examinations on the patient. After excluding cerebral hemorrhage, the patients were transferred to the neurology ward for rt-PA intravenous thrombolysis with prepared nurses.

The observation-group was given standardized nursing cooperation care with methods as follows: (1) Construction of a professional nursing team. The nursing staff who engaged in nursing care of strokes for over 5 years and had good communication skills, coordination ability and strong problem-solving ability were chosen as professional nursing staff. All professional nursing staff clearly mastered the standards of FAST rapid identification [11], which quickly identify strokes from the aspects of face (Face), limb (Arm), speech (Speech) and time (Time), and they received practical study of emergency thrombolysis and passed the assessment. (2) Provision of emergency thrombolysis kit. The emergency thrombolysis kit was managed by

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Table 1. Comparison of general data between the two groups of patients

Item	Control group (n=101)	Observation group (n=134)	X ² /t	P
Gender (M/F, cases)	60/41	85/49	0.3952	0.5296
Age ($\bar{x}\pm s$, yd)	69.23 \pm 6.87	70.71 \pm 6.36	1.7060	0.0893
Diabetes mellitus (Y/N, cases)	71/30	92/42	0.0729	0.7872
Hyperlipidemia (Y/N, cases)	64/37	81/53	0.2076	0.6487
Hypertension (Y/N, cases)	62/39	77/57	0.3669	0.5447
Coronary heart disease (Y/N, cases)	69/42	85/49	0.0420	0.8376

specialized staff, and the fixed quantity and variety were checked regularly and replenished in time. The thrombolysis kit was placed in a designated location and regularly disinfected, inspected and maintained. The thrombolysis kit contained: drug instructions that were posted outside of the kit; 2 boxes of rt-PA (Alteplase for injection, injection powder, 50 mg/ml, and 50 ml menstruum); 2 venous blood collection needles, and venous blood collection tubes in green, blue and yellow with each color of 2 units; 5 ml and 20 ml disposable syringes (2 for each spec), 22 G and 24 G intravenous indwelling needles (2 for each spec); 2 bottles of 100 ml normal saline for injection; 2 infusion sets and 1 thrombolytic recording book. (3) Implementation of standardized nursing cooperation. The specialized nurses conducted pre-examination and arrangement based on FAST standards and the patient's general clinical symptoms, and transferred the patient to the emergency room. The emergency stroke experts conducted a NIHSS evaluation of patients. After the patient was confirmed with a diagnosis, the specialized nursing staff would open the green channel to perform blood tests, electrocardiogram, CT and other related examinations. After excluding cerebral hemorrhage, the patients would receive rt-PA intravenous thrombolysis rapidly by professional nursing staff with the equipped thrombolysis kit. The implementation of the entire standardized nursing collaboration process was completed within the stroke center. The patient was kept in observation for 2 h, and transferred to the neurology ward for further treatment after the patient's condition stabilized.

Observation of indexes

(1) The time spent in each procedure of thrombolytic therapy (from admission to CT examination, from completion of CT to medication and from admission to medication) were compared between the two groups; (2) Thrombolysis with

in 1 h, 1-2 h, 2-3 h and 3-4.5 h were compared between the two groups; (3) Degree of neurological impairment before and after nursing intervention was evaluated by NIHSS and compared between the two groups; (4) The occurrence of complications in the two sets of subjects were recorded; (5) The nursing satisfaction questionnaire compiled by our hospital was sent to patients in the form of anonymity before their discharge, and the two groups' satisfaction of the nursing care was evaluated and compared. A score below 59 was referred to as dissatisfied, 60-79 points was basically satisfied, and a score over 80 represented satisfied. Total satisfaction = (satisfied + basically satisfied)/total number of cases \times 100.

Statistical analysis

The statistical analysis of data was handled by SPSS 25.0. The measurement data were expressed by ($\bar{x}\pm s$), the comparison between groups was conducted by independent-sample t-test, the count data were expressed by percentage, and chi-squared was used for testing of results. A statistically significant difference was set by $P<0.05$. The graphic software was by Graphpad prism 8.0.

Results

Clinical data

The difference of the two groups of general information was statistical insignificant and comparable, as shown in **Table 1**.

The CT images of typical patients before and after thrombolysis are shown in **Figure 1**.

Comparison of the time spent in each procedure of thrombolytic therapy between the two groups

The time spent in each procedure of thrombolytic therapy in the observation group was

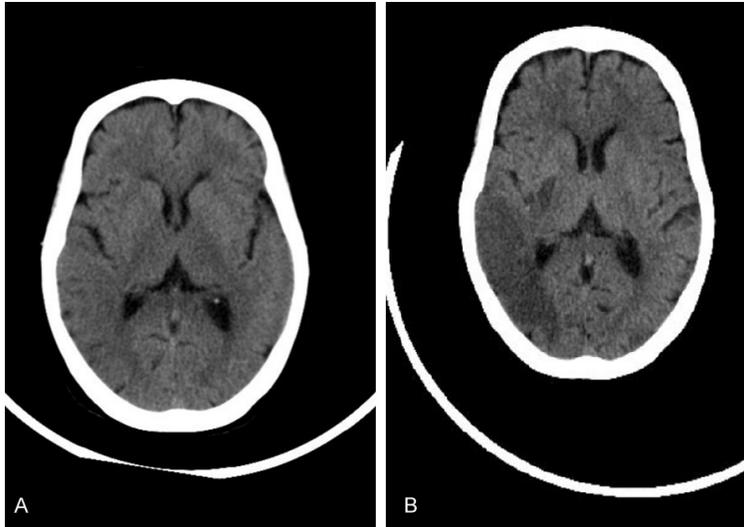


Figure 1. The CT images of a typical patient before and after thrombolysis. Note: (A) The midline structure is in the middle, multiple punctate low-density foci can be seen in the bilateral basal ganglia, no obvious expansion of the ventricular system, and part of the sulcus fissure widens and deepens. No obvious lesions were observed on the lateral cistern level of patient before thrombolysis. (B) The midline structure is in the center. Large low-density shadows can be seen in the right temporo-occipital lobe. Multiple punctate and small low-density lesions can be seen in the bilateral basal ganglia and the radial coronal area. There is no obvious expansion of the ventricular system, and some sulci fissures are widened and deepened. In the re-examination of the brain CT, the lateral cistern level was not found, and the infarcts were seen in the right temporal lobe and the posterior limb of the right internal capsule.

remarkably less than that in the control group, and the difference had statistical significance ($P < 0.05$) (Table 2).

Comparison of thrombolysis in the two groups of patients at different time periods

The distribution of thrombolysis in the observation group was superior to that in control group and the difference was statistically significant ($P < 0.05$) (Table 3).

Comparison of NIHSS scores before and after nursing intervention between the two groups

NIHSS score of subjects in the observation group after intervention was obviously lower than that in the control group, and the difference was statistically significant [(3.34±0.87) points, (4.82±0.93) points, $t=12.5318$, $P=0.0000$] (Table 4 and Figure 2).

Comparison of complications between the two groups

The incidence of complications in the observation group was 5.97%, which was evidently

lower than 24.75% in the control group, and the difference was statistically significant ($X^2=16.8317$, $P=0.0000$) (Table 5).

Comparison of nursing satisfaction between the two groups

The nursing satisfaction of the observation group was 91.04%, significantly higher than 73.27% in the control group, and the difference was statistically significant ($X^2=13.1496$, $P=0.0003$) (Table 6).

Discussion

Acute ischemic stroke is a common critical illness seen in the emergency department and the third leading cause of death [12]. The incidence of AIS has been increasing with the change of people's lifestyle and dietary habits. According to statistics, 1.5-2 million stroke cases are diagnosed every year in China, and 1.2 million people die of stroke [13, 14]. rt-PA intravenous thrombolytic is the first therapeutic option for the clinical treatment of AIS. It can quickly restore the blocked blood vessels, improve patient's ischemic state, reduce the damage of ischemic nerves, and prevent the continuous deterioration of disease [15-17]. However, the time point of thrombolytic therapy has a direct impact on the treatment effect and prognosis quality of patients. According to studies of the Association of Stroke Patients, the best time of treatment is within 4 h after onset, and the earlier patients get thrombolytic therapy after the onset, the better the effect will be [18, 19]. According to some experts' opinion, thrombolytic therapy 6 h after onset will lose its therapeutic significance [20, 21]. Therefore, it has become a crucial subject of clinical research at present stage to shorten the time required from admission to receiving rt-PA intravenous thrombolysis in AIS patients. Although the delay of the optimal treatment time during out-of-hospital delivery cannot be avoided, the time during in-hospital diagnosis and treatment can be improved. It has been reported that in the medical system of developed countries, the time

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Table 2. Comparison of the time spent in each procedure of thrombolytic therapy between the two groups ($\bar{x} \pm s$, min)

Group	Time from admission to CT	Time from completion of CT examination to medication	Time from admission to medication
Control group (n=101)	36.72±4.37	57.28±3.83	103.17±4.62
Observation group (n=134)	15.24±3.63	33.45±2.12	58.17±3.19
t	41.1168	60.7517	88.2653
P	0.0000	0.0000	0.0000

Table 3. Comparison of thrombolysis in the two groups of patients at different time periods [cases, (%)]

Group	Within 1 h	1-2 h	2-3 h	3-4.5 h
Control group (n=101)	17 (15.84)	50 (49.50)	34 (33.66)	12 (11.88)
Observation group (n=134)	108 (80.59)	21 (15.67)	5 (3.73)	0 (0)
t	94.0504	25.4504	37.2774	16.7775
P	0.0000	0.0000	0.0000	0.0000

Table 4. Comparison of NIHSS scores before and after nursing intervention between the two groups ($\bar{x} \pm s$, points)

Group	Before intervention	After intervention	T	P
Control group (n=101)	10.28±2.12	4.82±0.93	23.7028	0.0000
Observation group (n=134)	10.35±2.27	3.34±0.87	33.3798	0.0000
t	0.2407	12.5318		
P	0.8100	0.0000		

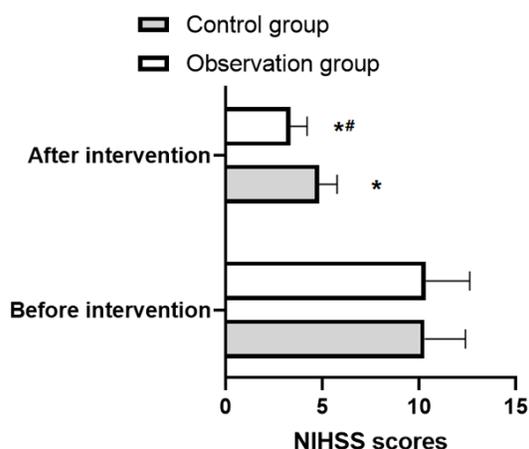


Figure 2. Comparison of NIHSS scores before and after nursing intervention between the two groups. Note: compare with before intervention, * $P < 0.05$; compare with control group, # $P < 0.05$.

from admission to medication thrombolysis for patients with AIS can be reduced by 20 min and controlled within 60 min [22, 23]. The reduction of the time from patient's admission to medication requires the coordination of emergency

department nurses, stroke nurses, laboratory staff, imaging staff, neurologists, neurology nurses and the related personnel in multiple departments. Specifically, nursing staff play an important role in coordination and management [24, 25]. In order to coordinate and manage the nursing

staff, it is necessary to establish a standardized nursing collaboration process.

The establishment of standardized nursing cooperation can organically combine departments into a whole unit. Under this process, the division of labor in each department is clear, and the workflow of each procedure of medical staff is standardized. The specialized nurses are on duty for 24 h and timely contact and they check in with the doctors of each department. This helps to resolve communication barriers between departments, and fundamentally avoids the time delay caused by waiting during the process of patients from admission to thrombolytic therapy, as well as effectively shortens the time required for therapy of patients. This study found that the time spent on each aspect of thrombolytic therapy (time from admission to CT, from completion of CT to medication and from admission to medication) in the observation group was remarkably shorter than that in the control group. The reasons are as follows: The coordination and cooperation between specialized nurses and different

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Table 5. Comparison of complications between the two groups [cases, (%)]

Group	Gingival bleeding	Cerebral hemorrhage	Thrombus	Total incidence
Control group (n=101)	11 (10.89)	5 (4.95)	9 (8.91)	25 (24.75)
Observation group (n=134)	5 (3.73)	0 (0)	3 (2.24)	8 (5.97)
χ^2	-	-	-	16.8317
<i>P</i>	-	-	-	0.0000

Table 6. Comparison of the satisfaction of the two groups of patients with nursing [cases, (%)]

Group	Satisfied	Basically satisfied	Dissatisfied	Satisfaction rate
Control group (n=101)	42 (41.59)	32 (31.68)	27 (26.73)	74 (73.27)
Observation group (n=134)	63 (47.01)	59 (44.03)	12 (8.96)	122 (91.04)
χ^2	-	-	-	13.1496
<i>P</i>	-	-	-	0.0003

departments settled the communication barriers; the thrombolysis kit prepared in advance provides a convenient and feasible infrastructure for the clinical implementation of thrombolysis; the entire diagnosis and treatment process was completed in the emergency/stroke room, effectively reducing the time wasted in pre-examination and arrangement, inspection/examination, diagnosis and medication, and transfer to the ward. The thrombolysis of patients in the observation group was concentrated within 1 h and between 1-2 h, and the NIHSS score and incidence of complications after nursing intervention were obviously lower than those in the control group. This indicated that the percentage of patients with thrombolysis treatment within 1 h and between 1-2 h can be increased through the implementation of standardized process, thus reducing nerve damage and incidence of complications. The results of this study revealed that the observation group's satisfaction with nursing care was evidently higher than that of the control group, demonstrating that the standardized nursing cooperation imposed a high nursing satisfaction in treating AIS patients with rt-PA intravenous thrombolysis.

However, the sample size of the study was limited, and there were still possible irregularities in nursing work. Therefore, in the follow-up clinical application, it is necessary to further observe the impact of a larger sample of patients, and meanwhile further strictly standardize the nursing measures to obtain more reliable clinical research conclusions.

To conclude, the standardized nursing cooperation for AIS patients with rt-PA intravenous thrombolysis can effectively reduce the treatment delay and the incidence of complications, and improve the neurological function and satisfaction of nursing care, which is worthy of clinical promotion.

Disclosure of conflict of interest

None.

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