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# Analysis of Factors Influencing the Prognosis of Thrombolysis Patients with Acute Cerebral Infarction in Advanced Age

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## Abstract

**Objective:** To investigate the prognosis of patients with Acute Cerebral Infarction (ACI) thrombolysis in advanced age and its influencing factors.

**Methods:** Information about patients with Acute Cerebral Infarction (ACI) in the Department of Neurology of Jiangsu Province Subei People's Hospital from August 2018 to July 2023 was retrospectively analyzed and patients' baseline data were collected. They were grouped according to the 3-month mRS scores and divided into good prognosis (n=67) and poor prognosis groups (n=98). Logistic regression was used to analyze the factors affecting patients with acute cerebral infarction at advanced age. The advanced age thrombolysis group was divided into good prognosis (n=41) and poor prognosis group (n=44). Logistic regression was used to analyze the influencing factors of the senior acute cerebral infarction thrombolysis patients. The patients with poor prognosis were divided into thrombolysis group (n=44) and non-thrombolysis group (n=54) to explore the differences between them.

**Results:** NIHSS score, age, urea nitrogen and diabetes mellitus were the influencing factors for the prognosis of patients with thrombolysis for cerebral infarction in advanced age.

**Conclusion:** More attention should be paid to NIHSS score, age, urea nitrogen level and the presence of diabetes mellitus in patients with acute cerebral infarction thrombolysis in the advanced age with a view to improving the patients' prognosis.

**Keywords:** Elderly stroke; Intravenous thrombolysis; Risk factors; Prognosis

## Introduction

Acute Cerebral Infarction (ACI) is an acute disease in which the blood vessels in the brain become diseased, leading to ischemia and hypoxic necrosis in the corresponding blood-supplying areas of the blood vessels, and is characterized by high morbidity, high mortality and high disability. The pathogenesis of acute cerebral infarction is mainly divided into cerebral thrombosis, cerebral embolism and cerebral infarction caused by hemodynamic mechanism. With the continuous progress of social production level and the development of population aging, the average age of acute cerebral infarction patients is rising and the

elderly cerebral infarction patients are mostly combined with more basic diseases, their own conditions are poor and they often have a poor prognosis, which seriously affects the daily life level of the patients and it also increases the economic pressure of the family and the whole society and it brings a heavy economic and mental pressure. In this study, through retrospective analysis, we searched for the influencing factors of the prognosis of elderly patients with acute cerebral infarction thrombolysis, focusing on patients with risk factors, which will help to improve the prognosis of patients.



## Materials and Methods

### Data collection

Information about patients with acute cerebral infarction in the Department of Neurology of Jiangsu Provincial Subei People's Hospital from August 2018 to July 2023 was retrospectively analyzed. Inclusion criteria: Patients with acute cerebral infarction aged 80 years and above, diagnosed with the first attack and confirmed by CT/MRI within 7 days; the study was approved by the Medical Ethics Committee. Exclusion criteria: Having previous ischemic or hemorrhagic stroke; serious infection or myocardial infarction within the last six months; autoimmune or blood diseases; craniocerebral trauma, intracranial lesions, history of surgery; presence of cerebral hemangiomas, malformations and vasculitis; serious cardiorespiratory, hepatic and renal insufficiency; pregnancy; known malignant tumors; and inability to cooperate with completing the various examinations.

### Methods

Basic information of the patients was collected, including age and gender, clinical indicators such as NIHSS score on admission and mRS score three months later and laboratory test results covering blood routine, blood lipids, coagulation function and so on. In addition, the patients' past medical history, including history of atrial fibrillation, coronary artery disease, hypertension, diabetes mellitus and stroke, as well as lifestyle habits such as whether they had a history of smoking, were also recorded.

### Statistical analysis

The data were statistically analyzed in this study using SPSS 27.0 software. Quantitative data were expressed as mean  $\pm$  standard deviation ( $\bar{x} \pm s$ ) if they were normally distributed and comparisons between different groups were realized by one-way ANOVA or independent samples t-test; qualitative data were presented as percentages (%) and differences between groups were determined by chi-square ( $\chi^2$ ) test, with  $P < 0.05$  indicating that the results were statistically significant.

## Results

The patients were grouped according to the 3-month mRS scores and divided into a good prognosis group ( $n=67$ ) and a poor prognosis group ( $n=98$ ). Whether thrombolysis, admission NIHSS score, hypertension, diabetes mellitus, age as independent variables and patients' prognosis as dependent

variables were included in the logistic regression analysis, which showed that the factors affecting the prognosis of patients with cerebral infarction in advanced age were whether thrombolysis, history of diabetes mellitus and admission NIHSS score.

Comparison of the senior thrombolysis group into a good prognosis ( $n=41$ ) and a poor prognosis group ( $n=44$ ): The factors that were statistically significant in the univariate analysis of admission NIHSS score, time to DNT, diabetes mellitus, age, urea nitrogen, HDL and atrial fibrillation were used as the independent variables and the prognosis of the patients was included in the Logistics regression analysis as the dependent variable and the results showed that NIHSS score, age, urea nitrogen and diabetes mellitus as prognostic factors. Doing ROC curve yielded the area under the curve of NIHSS score, age, urea nitrogen and diabetes mellitus as 0.837, 0.746, 0.629 and 0.621, respectively.

Patients with poor prognosis were categorized into thrombolytic group ( $n=44$ ) and non-thrombolytic group ( $n=54$ ) and univariate analysis showed that there was a difference between the two groups in admission NIHSS, urea nitrogen, triglycerides and high-density lipoprotein.

## Discussion

According to the data of the seventh national census in 2021, by the end of 2020, China's elderly population aged 60 years and above reached 18.70%, totaling 264 million people, while the elderly population aged 65 years and above accounted for 13.50%, or about 190 million people. The data reveal that China as a whole has entered a new period of deeply aging society [1]. According to the Global Burden of Disease Study, stroke is the leading cause of death and disability in the Chinese adult population and stands out for its high morbidity, disability, mortality, recurrence and high economic burden [2]. Cerebral infarction is a common neurological disease, which poses a great threat to the life safety and quality of life of patients. With the acceleration of the aging process in China, the incidence of cerebral infarction in the elderly is rising year by year, so it is particularly important to conduct an in-depth investigation of its influencing factors [3]. Thrombolysis is an important treatment modality for acute cerebral infarction, which can rapidly dissolve the thrombus blocking the cerebral blood vessels, restore blood flow, reduce the damage of brain tissue and improve the survival rate and quality of life of patients. As shown in **Tables 1,2** thrombolysis is now internationally recognized as important for improving the prognosis and quality of life of elderly patients [4].



**Table 1:** Univariate analysis of prognosis of elderly patients.

Sports event	Good prognosis group (n=67)	Poor prognosis group (n=98)	X <sup>2</sup> /t	P
(a person's) age	84.03±3.68	85.68±3.95	2.713	0.007
Admission NIHSS score	5.88±5.99	12.68±10.84	4.668	0.001
albumin	41.99±3.06	41.18±4.36	1.315	0.191
total protein	74.99±6.17	73.47±7.86	1.335	0.184
urea nitrogen	6.53±1.75	7.02±2.73	1.303	0.194
creatinine	79.41±24.87	80.71±36.21	0.256	0.799
triglyceride	1.29±0.75	1.36±0.72	0.58	0.563
high density lipoprotein (HDL)	1.15±0.31	1.24±0.34	1.829	0.069
low density lipoprotein (LDL)	2.38±0.86	2.41±0.77	0.244	0.808
glycemic	5.80±1.93	6.74±3.12	1.958	0.052
glycosylated hemoglobin	6.24±0.95	6.61±1.50	1.263	0.208
red blood cell	4.30±0.53	4.25±0.62	0.536	0.593
leucocyte	6.96±2.24	7.19±2.70	0.573	0.567
blood platelet	188.15±55.71	172.26±58.35	1.75	0.082
D-dimer	2.01±5.18	2.27±3.61	0.353	0.725
Distinguishing between the sexes				
male	35 (52.2)	47 (47.9)	0.292	0.589
daughter	32 (47.3)	51 (52.0)		
coronary heart disease	6 (8.9)	11 (11.2)	0.243	0.622
diabetes	9 (13.4)	30 (30.6)	6.507	0.011
cigarette smoking	18 (26.9)	34 (34.7)	1.13	0.288
atrial fibrillation	19 (28.4)	40 (40.8)	2.689	0.101
high blood pressure	41 (61.2)	76 (77.5)	5.161	0.023
Previous cerebral infarction	11 (16.4)	28 (28.5)	3.257	0.071
drinking wine	21 (31.3)	33 (33.6)	0.098	0.754
Is thrombolysis	41 (61.2)	44 (44.9)	4.231	0.04
Combined lung infection	28 (41.8)	46 (46.9)	0.426	0.514

**Table 2:** Logistics regression analysis of prognostic factors influencing the prognosis of elderly patients.

Sports event	B	S.E.	Wald	P	OR	95% CI
Thrombolysis or not(1)	-2.357	0.533	19.576	0.001	0.095	(0.033, 0.269)
(a person's) age	0.059	0.054	1.191	0.275	1.06	(0.954, 1.178)
Admission to NIHSS	0.187	0.04	22.133	0.001	1.205	(1.115, 1.302)
Hypertension (1)	0.505	0.427	1.397	0.237	1.657	(0.717, 3.828)
Diabetes (1)	1.35	0.503	7.215	0.007	3.859	(1.441, 10.339)

Through careful combing of previous medical records and selecting a certain number of cases of acute cerebral infarction in advanced age as research subjects (**Table 3,4**), we conclude that thrombolysis has a positive significance for the prognosis of advanced age

patients with cerebral infarction and although in the past there were doubts that advanced age patients might not be suitable for thrombolysis treatment, the latest research results have disproved this viewpoint and the conclusions that we have drawn are also in line



with this. The aim of this paper was to analyze the factors related to the prognostic influence of thrombolysis in elderly patients with acute cerebral infarction. Logistic regression analysis showed that the factors that have an impact on the prognosis of elderly patients with thrombolysis for cerebral infarction include: whether there is a history of diabetes, age, urea nitrogen level and NIHSS score at the time of admission. Diabetes mellitus: Studies have shown that failure to properly control blood glucose levels in patients with diabetes mellitus greatly increases the risk of cardiovascular and cerebrovascular disease and alone is a key factor in stroke. In addition, patients with diabetes who experience acute cerebral infarction tend to suffer more severe neurologic impairment, with subsequent higher rates of disability and poorer prognoses. [5] The chronic hyperglycemic state of diabetes mellitus damages blood vessels, reduces their function and tolerance, promotes atherosclerosis,

prevents the formation of new blood flow channels and increases brain damage after cerebral infarction. At the same time, the high-glycemic environment promotes anaerobic metabolism in brain cells, producing lactic acid and aggravating cerebral ischemic necrosis. In one study, researchers analyzed the relationship between the glycemic control status of diabetic patients and the prognosis of cerebral infarction. It was found that poor glycemic control in diabetic patients was a risk factor for the prognosis of cerebral infarction [6]. Another study pointed out that stress hyperglycemia occurring during the acute phase of cerebral infarction is an important influence on poor prognosis even in non-diabetic patients [7]. Therefore, for diabetic patients, good glycemic control is not only crucial for the prevention of cerebral infarction, but also has an important impact on improving the prognosis of cerebral infarction.

**Table 3:** Univariate analysis of prognosis in elderly thrombolysis patients.

Sports event	Good prognosis (n=41)	Poor prognosis (n=44)	X <sup>2</sup> /t	P
(a person's) age	82.78±2.56	84.52±3.521	2.592	0.011
DNT time	58.32±23.52	76.77±32.201	2.999	0.004
ONT time	159.88±49.94	160.18±47.77	0.292	0.977
total protein	74.69±5.83	72.66±7.58	1.382	0.171
urea nitrogen	6.67±1.69	7.73±2.72	2.152	0.034
creatinine	77.46±21.37	83.08±45.83	7.151	0.476
triglyceride	1.10±0.53	1.17±0.64	5.801	0.563
high Density Lipoprotein (HDL)	1.20±0.29	1.39±0.37	2.501	0.015
low Density Lipoprotein (LDL)	2.27±0.67	2.31±0.81	0.201	0.841
glycemic	5.98±2.19	7.19±3.73	1.563	0.123
glycosylated hemoglobin	6.09±0.84	6.43±1.33	1.388	0.169
red blood cell	4.36±0.52	4.18±0.59	1.488	0.141
leucocyte	6.78±2.23	7.25±2.99	0.813	0.418
blood platelet	184.19±54.73	169.91±51.06	1.245	0.217
Distinguishing between the sexes				
male	19 (46.3)	12 (27.3)	3.331	0.068
daughter	22 (53.7)	32 (72.7)		
coronary heart disease	5 (12.2)	8 (18.1)	0.659	0.417
diabetes	5 (12.2)	16 (36.4)	6.664	0.01
cigarette smoking	7 (17.1)	9 (20.5)	0.159	0.69
atrial fibrillation	16 (39.0)	30 (68.2)	7.267	0.007
high blood pressure	26 (63.4)	34 (77.3)	1.963	0.161
Previous cerebral infarction	7 (17.1)	11 (25)	1.2	0.273
drinking wine	13 (31.7)	20 (45.5)	1.689	0.194
Combined lung infection	20 (48.9)	23 (52.3)	0.104	0.748



**Table 4:** Logistics regression analysis of factors influencing the prognosis of patients presenting with thrombolysis in advanced age.

sports event	B	S.E.	Wald	P	OR	95% CI
Admission NIHSS score	0.155	0.062	6.366	0.012	1.168	1.035-1.318
DNT time	0.005	0.013	0.161	0.688	1.005	0.979-1.032
(a person's) age	0.27	0.13	4.331	0.037	1.31	1.016-1.689
urea nitrogen	0.363	0.181	4.036	0.045	1.437	1.009-2.048
high density lipoprotein (HDL)	2.118	1.155	3.362	0.067	8.312	0.864-79.955
diabetes	2.914	0.965	9.118	0.003	18.421	2.780-122.077
atrial fibrillation	0.103	0.764	0.018	0.892	0.902	0.202-4.031

**Age:** With increasing age, patients generally have more underlying diseases, decreased body functions, organ function decline, decreased resistance, poorer vascular conditions and a lower possibility of realizing recanalization after thrombolysis, which often results in a poor prognosis.

**Urea nitrogen:** Urea nitrogen is a commonly used biochemical indicator for assessing renal function and its value often suggests the prognosis of critically ill patients. [8] Elevated BUN usually implies reduced renal excretory function, which may lead to accumulation of toxins in the body, affecting multiple organ systems. After cerebral infarction, damaged brain cells release potassium ions and other substances, leading to disturbed fluid balance in the brain and the formation of cerebral edema. This edema may be exacerbated by renal excretory insufficiency. BUN is also associated with an inflammatory response in the body, which can exacerbate brain damage and interfere with the repair and regeneration of brain tissue. In addition, elevated levels of urea nitrogen may be associated with nutritional status, infections and other complications in patients with cerebral infarction. It adversely affects the prognosis of patients [9].

**NIHSS score:** NIHSS score is a kind of National Institutes of Health Stroke Scale, which is widely used to assess the degree of neurological deficit in patients with cerebral infarction. The higher the score, the more severe the patient's neurological deficit and the worse the prognosis may be. [10] In the prognostic assessment of patients with cerebral infarction, NIHSS score is an important index. Several studies have shown

that NIHSS score is closely related to the prognosis of patients with cerebral infarction. For example, one study found that as the NIHSS score increased, the mortality rate of patients increased and the NIHSS score of the death group was significantly higher than that of the survival group [11]. Another study noted the efficacy and safety of applying intravenous thrombolytic therapy in patients with acute cerebral infarction with an NIHSS score  $\geq 12$  and concluded that a high NIHSS score is a risk factor for poor prognosis after thrombolysis in this group of patients. Early implementation of thrombolytic therapy results in a more favorable prognosis high NIHSS scores usually reflect a greater extent of cerebral infarction, which may cause cerebral edema, increase intracranial pressure, compress cerebral blood vessels, damage vascular walls and exacerbate cerebral ischemia and subsequent reperfusion injury. Also, a high score may indicate that the patient has a thrombus in a large vessel and these patients may not do well on thrombolytic therapy and therefore have a poorer prognosis.

In this study, the grouping was further refined by dividing the elderly patients with poor prognosis into thrombolytic and non-thrombolytic groups and the results showed that the NIHSS scores and urea nitrogen levels in the thrombolytic group were higher than those in the non-thrombolytic group (**Table 5**), which suggests that high levels of urea nitrogen may be associated with worse prognosis and therefore close monitoring of urea nitrogen levels is needed in the course of treatment and appropriate therapeutic measures need to be taken to improve the prognosis of the patients [12].

**Table 5:** Prognostic univariate analysis of patients with poor prognosis in advanced age.

Sports event	Thrombolysis (n=44)	No thrombolysis (n=54)	X <sup>2</sup> /t	P
(a person's) age	85.52±3.41	85.81±4.37	0.362	0.718



Admission to NIHSS	19.59±9.57	7.05±8.29	6.939	0.001
total protein	72.65±7.57	74.13±8.09	0.921	0.361
urea nitrogen	7.73±2.71	6.43±2.61	2.392	0.019
creatinine	83.07±45.83	78.76±25.95	0.582	0.562
triglyceride	1.17±0.64	1.49±0.75	2.205	0.03
high density lipoprotein (HDL)	1.38±0.36	1.13±0.28	3.804	0.001
low density lipoprotein (LDL)	2.31±0.81	2.48±0.73	1.137	0.258
glycemic	7.18±3.72	6.47±2.70	0.98	0.33
glycosylated hemoglobin	6.43±1.32	6.56±1.63	0.395	0.694
red blood cell	4.17±0.58	4.30±0.65	0.97	0.334
leucocyte	7.25±2.99	7.13±2.47	0.201	0.841
blood platelet	169.90±51.05	174.16±64.09	0.358	0.721
Distinguishing between the sexes				
male	12 (27.3)	35 (64.8)		
daughter	32 (72.7)	19 (35.2)	13.691	0.001
coronary heart disease	8 (18.2)	3 (5.6)	4.054	0.044
diabetes	16 (36.4)	14 (25.9)	1.244	0.265
cigarette smoking	9 (20.5)	25 (46.3)	7.146	0.008
atrial fibrillation	30 (68.2)	10 (18.5)	24.755	0.001
high blood pressure	34 (77.3)	42 (77.8)	0.004	0.952
Previous cerebral infarction	11 (25)	17 (31.5)	0.499	0.48
drinking wine	20 (45.5)	13 (24.1)	4.962	0.026
Combined lung infection	23 (52.3)	23 (42.6)	0.912	0.34

## Conclusion

In summary, for patients with acute cerebral infarction thrombolysis whose age is greater than or equal to 80 years, older age may increase the complexity and risk of treatment. For patients with diabetes mellitus, high urea nitrogen levels, older age and patients with high NIHSS scores on admission should pay more attention to the changes in their conditions and timely symptomatic management should be carried out to maximize the prognosis and quality of life of patients with acute cerebral infarction thrombolysis in advanced age.

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