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Original Article

Interventional thrombectomy efficacy in the treatment of acute ischemic cerebrovascular disease

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Abstract: Objective: The aim of the current study was to observe and analyze efficacy and prognosis levels of interventional thrombectomy procedures in the treatment of acute ischemic cerebrovascular disease (AICVD). Methods: A total of 100 patients with AICVD were enrolled. Fifty were treated with non-interventional therapy (control group), while 50 were treated with interventional thrombectomy procedures (intervention group). National Institute of Health Stroke Scale (NIHSS) scores, modified Rankin Scale (mRS) scores, vascular recanalization rates, effective rates of treatment, complications, and prognosis were retrospectively analyzed. Results: After treatment, NIHSS and mRS scores in intervention and control groups significantly decreased. Scores in the intervention group were significantly lower than those in the control group ($P<0.001$). After treatment, vascular recanalization rates in intervention and control groups were 98.00% and 72.00%, respectively ($P<0.05$). One month after treatment, the effective rate of treatment in the intervention group (92.00%) was significantly higher than that in the control group (74.00%) ($P<0.05$). Ninety days after treatment, mortality and prognosis rates in the intervention group were better than those in the control group ($P<0.05$). Conclusion: Interventional thrombectomy procedures can improve neurological function, greatly increase vascular recanalization rates, and reduce postoperative mortality rates of patients with AICVD.

Keywords: Acute ischemic cerebrovascular disease, interventional thrombectomy, efficacy, prognosis

Introduction

A sudden cerebrovascular disease, acute ischemic cerebrovascular disease (AICVD) leads to brain ischemia, cerebral infarction, and other disorders, seriously endangering the lives of patients [1, 2]. AICVD has shown incidence rate increases with the development of the social economy. It also produces high recurrence rates, disability rates, and mortality rates. After onset, the 1-year fatality rate is 11.4%-15.4%. Mortality and disability rates are 3.4%-44.6%, respectively [3, 4]. Treatment of AICVD is limited by its complex clinical symptoms, including the severity of vascular ischemia and damaged parts [5]. During treatment, vascular recanalization rates should increase and ischemia and hypoxia of local brain tissues should improve. The acute phase is the golden phase (within 3-4.5 hours after onset) of treatment. In this phase, drugs are commonly used [6-8]. However, most patients miss the ideal treatment time due to a lack of knowledge of the disease [9].

With the development of medical technology, AICVD is often treated by intravenous thrombolysis and intravascular interventional therapy (arterial thrombectomy, venous thrombectomy, angioplasty, and stenting). Interventional thrombectomy procedures provide the advantages of high vascular recanalization rates, no need for thrombolytic drugs, low incidence rates of complications, and a simple operation procedure. Thus, this method has been widely used in the treatment of ischemic vascular injuries, such as acute lower extremity arterial and venous occlusions and acute deep venous thrombosis [10, 11]. One study demonstrated that interventional thrombectomy procedures can decrease re-embolism rates, amputation rates, and mortality rates of patients with lower extremity arterial occlusion [12]. It also buys valuable time for treatment of AICVD because

of the simple operation procedure and short recanalization times after vascular occlusion. Thus, it has developed into an alternative therapeutic method for relevant diseases in clinical practice. However, compared with traditional treatment, efficacy levels remain unclear [13]. Therefore, the present study aimed to explore the therapeutic effects of interventional thrombectomy procedures.

Materials and methods

General information

A total of 100 patients with AICVD, admitted to Tengzhou Central People's Hospital, from January 2017 to June 2017, were enrolled. The current study retrospectively analyzed clinical data of these patients. There were 31 males and 19 females in the control group (treated with non-interventional therapy), with an average age of (62.91±4.77) years. There were 29 males and 21 females in the intervention group (treated with interventional thrombectomy), with an average age of (62.06±4.45) years. There were no statistically significant differences between the two groups in terms of gender, age, time of onset, and underlying diseases, suggesting the feasibility of this study. The present study was approved by the Ethics Committee of Tengzhou Central People's Hospital. All patients and families provided informed consent.

Inclusion and exclusion criteria

Inclusion criteria: Patients meeting the diagnostic criteria for ischemic cerebrovascular diseases from *Chinese Guidelines for Intravascular Interventional Diagnosis and Treatment of Ischemic Cerebrovascular Diseases,* formulated by the Society of Neurology, Chinese Medical Association in 2015 [14]; Patients examined with cerebral hemorrhaging via brain CT scans after admission; Patients suffering from the disease for the first time, with a time of onset of no more than 6 hours; Patients with blood pressure levels lower than 180/100 mmHg; Patients with no coagulation disorders; Patients not allergic to drugs.

Exclusion criteria: Patients with hemorrhagic tendencies or hemorrhaging; Patients with intracranial venous thrombosis and venous sinus thrombosis; Patients that had received surgery within 6 months; Patients with severe hepatic and renal dysfunction, severe infections, malignant tumors, or immune diseases; Patients with severe mental illness; Patients with poor compliance.

Therapeutic methods

Patients in the control group were treated according to China Guidelines for Cerebrovascular Disease Prevention and Treatment, formulated by the Chinese Committee for Cerebrovascular Diseases in 2010 [15]. They were orally administered clopidogrel (Sanofi Pharmaceutical Co., Ltd., Hangzhou), at 75 mg/time, once a day. They also received aspirin (JQC (Huayin) Pharmaceutical Co., Ltd.), at 100 mg/time, once a day.

Patients in the intervention group were treated with stent-retriever thrombectomy procedures. Specific steps were as follows: (1) A 6F catheter sheath was inserted through the femoral artery puncture; (2) Digital subtraction angiographies were performed to determine the site, degree of occlusion, and scope of thrombosis. A super selective microcatheter was used to embolize the distal end of the blood vessels under the guidance of a micro guidewire. Angiographies by the microcatheter showed the patency of distal vessels; (3) A Solitaire AB stent (EV3, USA) was placed on the thrombosis site through the micro guidewire, then released for 3-5 minutes. Afterward, the stent and the catheter were slowly withdrawn from the body; (4) The thrombus was taken out and checked. Thrombi could be taken out many times (generally no more than 5 times), according to surgical situations. Angiographies showed vascular recanalization. After surgery, the wound surface was cleaned. The local incision was then sutured. After the procedure, the patients were orally administered aspirin enteric-coated tablets (100 mg/d) and clopidogrel (75 mg/d) for 6 months. Next, they received aspirin enteric-coated tablets for a long time period.

Outcome measures

National Institute of Health Stroke Scale (NIHSS) scores were used to assess patient recoveries, including a scale of neurological examinations with 15 items. NIHSS scores were recorded to reflect actual patient situa-

Table 1. Comparison of demographic data ($\bar{x}$ ± sd)

Item	Control group (n=50)	Intervention group (n=50)	t/X^2	P
Gender (male/female)	31/19	29/21	0.167	0.683
Age (year)	62.91±4.77	62.06±4.45	-0.921	0.359
Body mass index (kg/m^2)	23.39±3.80	23.56±2.79	0.250	0.803
Time of onset	3.62±0.88	3.71±0.72	0.562	0.576
Underlying diseases			2.150	0.828
Hypertension	22	30		
Coronary heart disease	8	9		
Diabetes	15	10		
Smoking	28	31		
Drinking	32	35		
Atrial fibrillation	12	14		

Table 2. Comparison of NIHSS and mRS scores ($\bar{x}$ ± sd)

	Control group (n=50)	Intervention group (n=50)	t	P
NIHSS score	16.79±4.84	16.92±4.32	0.148	0.883
Before treatment	11.88±6.25$^{###}$	7.76±3.78$^{###}$	-3.984	<0.001
After treatment	4.32±0.97	4.52±1.00	1.033	0.304
mRS score	3.51±1.41$^{###}$	1.96±0.81$^{###}$	-6.710	<0.001
Before treatment	16.79±4.84	16.92±4.32	0.148	0.883
After treatment	11.88±6.25$^{###}$	7.76±3.78$^{###}$	-3.984	<0.001

Note: Compared with before treatment, $^{###}$P<0.001. NIHSS, National Institute of Health Stroke Scale; mRS, modified Rankin scale.

tions. Lower scores indicate better recoveries [16]. The modified Rankin Scale (mRS) was used to assess patient neurological function recoveries. Lower scores indicate better recoveries [17]. MRA-TICI (Siemens, Germany), which was divided into grades 0, I, II, and III, was used to assess hemodynamics. Grades 0-I indicate the failure of vascular recanalization. Grade II indicates partial recanalization and grade III indicates complete recanalization. Vascular recanalization rate = (the number of complete + partial recanalization cases)/total number of cases * 100%. Clinical efficacy levels of patients were observed and recorded, including cured, markedly effective, effective, and invalid. Total effective rate of treatment = (the number of cured + markedly effective + effective cases)/total number of cases * 100%. Postoperative complications were also observed. The patients were followed-up to account for deaths. Moreover, mRS scores were used to assess prognosis, with ≤2 points indicating good prognosis.

Statistical methods

SPSS 22.0 was used for statistical analysis. Measurement data are expressed by mean ± standard deviation ($\bar{x}$ ± sd) and were analyzed by independent samples t-tests, represented by t. Count data are expressed by the number of cases or percentages, analyzed by X^2 tests and represented by X^2. P<0.05 indicates that differences are statistically significant.

Results

Comparison of demographic data

There were no statistically significant differences between intervention and control groups in terms of gender, age, time of onset, and underlying diseases (all P> 0.05), suggesting the feasibility of this study. See **Table 1**.

Comparison of NIHSS and mRS scores

Before treatment, there were no statistically significant differences between intervention and control groups in NIHSS and mRS scores (both P>0.05). After treatment, NIHSS scores in the two groups significantly decreased. Scores in the intervention group were significantly lower than those in the control group (P<0.001). Similarly, after treatment, mRS scores in the two groups significantly decreased. Scores in the intervention group were significantly lower than those in the control group (P<0.001). See **Table 2** and **Figure 1**.

Comparison of vascular recanalization

After treatment, the vascular recanalization rate in the intervention group (98%) was significantly better than that in the control group (72%) (P<0.001). See **Table 3**. Recanalization after treatment is shown in **Figure 2**. One case was as follows: (Male, 60 years old, with under-

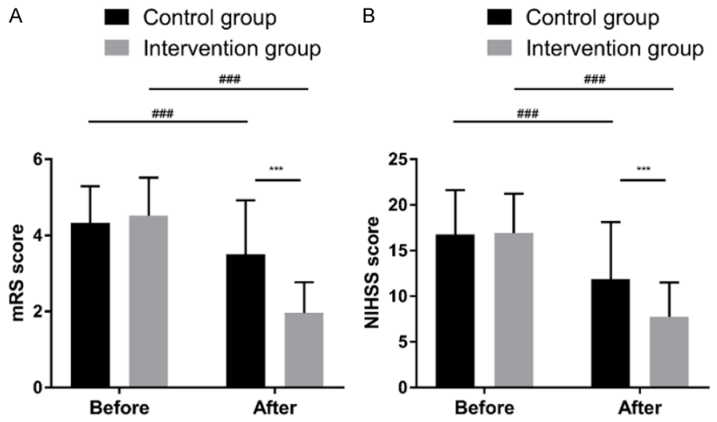

Figure 1. Comparison of NIHSS and mRS scores. A. NIHSS scores; B. mRS scores. Compared between the groups, ***P<0.001; compared within groups, ###P<0.001. NIHSS, National Institute of Health Stroke Scale; mRS, modified Rankin scale.

Table 3. Comparison of vascular recanalization (n, %)

	Control group (n=50)	Intervention group (n=50)
Complete recanalization	21 (42.0)	36 (72.0)
Partial recanalization	15 (30.0)	13 (26.0)
Failed recanalization	14 (28.0)	1 (2.0)
Recanalization rate (%)	72	98
X^2	13.255	
P	<0.001	

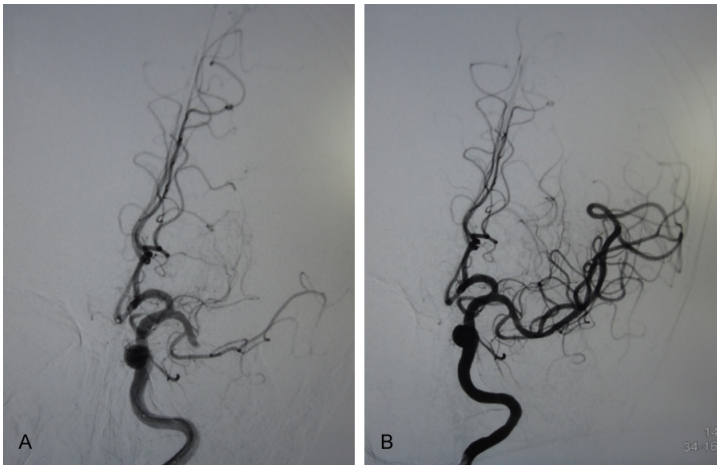

Figure 2. Image of basilar artery occlusion and recanalization of a patient in the intervention group. A. Before treatment. Digital subtraction angiography showed M1 segment occlusion of the left middle cerebral artery. B. After treatment. The left middle cerebral artery completely recovered to normal after opening. TICI was grade III.

lying diseases, including diabetes and coronary heart disease for 20 years) He came to the hospital for treatment 2.5 hours after distortion of commissure and right limb weakness. Before treatment, the digital subtraction angiography showed M1 segment occlusion of the left middle cerebral artery. After treatment, the left middle cerebral artery completely recovered to normal after opening. TICI was grade III.

Comparison of clinical efficacy after treatment

One month after treatment, the effective rate of treatment in the intervention group (92%) was significantly higher than that in the control group (74%) (P<0.05). See **Table 4**.

Comparison of complications, mortality, and prognosis after treatment

One day after treatment, the control group had 2 cases of symptomatic intracranial hemorrhaging, with a bleeding rate of 4.00%. The intervention group had 1 case of the disease, with a bleeding rate of 2.00% (both P>0.05). Ninety days after treatment, mortality (X^2=4.332, P=0.037) and prognosis (X^2=8.319, P=0.004) levels in the intervention group were better than those in the control group. See **Table 5**.

Discussion

AICVD, accounting for 70%-80% of cerebrovascular diseases, is a major disease that often leads to human death [18]. Hypoxia and ischemia of local brain tissues often lead to the depolarization of neurons, as well as the outflow of calcium ions and free radical generation. As a result, the cytoskeleton is damaged and brain cells die [19]. With high vascular recanalization rates, no need for thrombolytic drugs, low incidence rates of complications, and a simple operation procedure, interventional thrombectomies have been widely

Table 4. Comparison of clinical efficacy after treatment (n, %)

	Control group (n=50)	Intervention group (n=50)
Cured	10 (20.0)	19 (38.0)
Markedly effective	20 (40.0)	25 (50.0)
Effective	7 (14.0)	2 (4.0)
Ineffective	13 (26.0)	4 (8.0)
X^2	5.741	
P	0.016	

Table 5. Comparison of complications, mortality, and prognosis after treatment (n, %)

	Control group (n=50)	Intervention group (n=50)
Complication	2 (4.0)	1 (2.0)
Mortality	10 (20.0)	3 (6.0)*
Prognosis (mRS≤2)	12 (24.0)	26 (52.0)**

Note: Compared with the control group, *P<0.05, **P<0.01.

used in clinical practice [20, 21]. In this study, clinical efficacy levels of interventional thrombectomy procedures in the treatment of AICVD were analyzed.

NIHSS scores are an index for the early evaluation of neurological function recovery, while mRS scores are mainly used to assess patient outcomes and prognosis after treatment. One study showed that NIHSS and mRS scores of patients with AICVD significantly decreased after interventional thrombectomies [22]. Results of the present study showed that, after treatment, the two scores in intervention and control groups significantly decreased. The two scores in the intervention group were significantly lower than those in the control group, demonstrating that interventional thrombectomy procedures can recover patient neurological function, leading to a good prognosis.

Mortality of AICVD is affected by patient vascular recanalization. It is crucial for treatment and prognoses of patients. Previously, low vascular recanalization rates (12-18%) after intravenous thrombolysis have led to a poor prognosis [23]. However, with the application of interventional thrombectomies, rates have significantly increased.

Studies have shown that vascular recanalization rates of patients with AICVD have increased to 81%-91% after treatment with Solitaire AB stents [24, 25]. In a study retrospectively analyzing the clinical data of 38 patients with AICVD, the rate was 89% after thrombectomies with Solitaire AB stents [26]. In the present study, the rate in the intervention group (98%) was significantly better than that in the control group (72%), in accord with previous studies. Therefore, interventional thrombectomy procedures can increase vascular recanalization rates and improve prognosis.

Another study showed that 90-day prognostic rates (52%, mRS <2 points) and mortality rates (10.4%) of patients with AICVD, treated with Solitaire stent thrombectomies, were significantly better than those treated with drugs (prognostic rate was 29.3% and mortality rate was 19.0%) [24]. In Zong's study, analyzing 100 patients treated with Solitaire AB stent thrombectomies, 44 patients had good prognosis (44.0%) and low mortality (13.0%), according to postoperative follow-up records [27]. In the current study, compared with those in the control group, patients in the intervention group showed significantly higher effective rates of treatment, better prognosis, and lower mortality rates, in accord with findings of the above studies. Results indicate that interventional thrombectomy procedures have better efficacy and safety levels. There were no statistically significant differences in complications between intervention and control groups. However, the small sample size used in the current study may have led to outcome bias. Thus, the number of cases should be expanded in future research.

In summary, interventional thrombectomy procedures can improve the clinical situations and prognoses of patients with AICVD, as well as increase vascular recanalization rates.

Disclosure of conflict of interest

None.

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