Submitted: 23 November, 2022 Accepted: 04 January, 2023 Published: 08 July,2023 DOI:10.22514/sv.2023.055

Open Access
Signa Vitae

ORIGINAL RESEARCH

Comparison of clinical efficacy and safety between intravenous thrombolysis and endovascular therapy in patients with acute large vessel occlusion stroke of the posterior circulation

Jianmei Cai[1], Guangjun Xi[1], Zheng Dai[1,*]

[1]Department of Neurology, the Affiliated Wuxi People's Hospital of Nanjing Medical University, Wuxi People's Hospital, Wuxi Medical Center, Nanjing Medical University, 214023 Wuxi, Jiangsu, China

***Correspondence**
zheng_d1121@163.com
(Zheng Dai)

Abstract

To investigate the efficacy and safety of intravenous thrombolytic (IVT) therapy and endovascular (EV) therapy in patients with acute posterior large vessel occlusion stroke (PLVOS). A total of fifty patients with acute PLVOS were randomly divided into the IVT group and EV group. The general baseline data, post-treatment vascular recanalization rate, National Institute of Health Stroke Scale (NIHSS) score before and after intervention, prognosis, and perioperative complications were compared between the two groups. There were no significant differences in the overall baseline data between the two groups ($p > 0.05$). The post-treatment recanalization rate was significantly higher in the EV group (88.00%) than in the IVT group (64.00%, $p < 0.05$). The NIHSS score at 24 h post-admission was significantly lower and prognosis was significantly better in the EV group than in the IVT group (both $p < 0.05$). The EV group had significantly lower overall complication rate (16.00%) than the IVT group (48.00%, $p < 0.05$). Compared with IVT therapy, EV therapy can effectively improve neurological damage, vascular recanalization rate and prognosis as well as reduce the incidence of perioperative complications in patients with acute PLVOS.

Keywords

Acute posterior large vessel occlusion stroke; Intravenous thrombolytic therapy; Endovascular therapy; Recanalization rate; Safety evaluation

1. Introduction

Stroke is the most commonly diagnosed disorder in secondary and tertiary hospitals in China, and its disability and mortality rates have exceeded that of malignant tumors and ischemic heart diseases. Ischemic stroke is the most common type of stroke, accounting for more than 80% of all stroke cases [1, 2]. According to incomplete statistics, ischemic stroke of the posterior circulation accounts for 20% of all stroke cases, and the mortality rate of acute posterior basilar artery occlusion has reached more than 80% [3]. Untimely treatment of acute ischemic stroke of the posterior circulation caused by large vessel occlusion often leads to severe disability or even death in patients [4]. Previous studies have showed that the recanalization of occluded vessels and the restoration of blood perfusion to brain tissue are key in the treatment of this disorder. Intravenous thrombolysis (IVT; performed within 4.5 h of onset) and mechanical thrombectomy are currently the mainstay of clinical treatments for this disorder [5, 6]. It was reported that IVT has limited usage and benefit in patients due to its strict time window, indications and contraindications [7, 8]. In recent years, endovascular (EV) therapy has been a hot topic in research. A growing body of study shows that EV therapy can effectively improve the 90-day prognosis for patients with anterior large vessel occlusion, which not only makes it the first-line treatment for acute ischemic stroke caused by large vessel occlusion, but also leads to the revision of national and international guidelines for the treatment of acute ischemic stroke [9, 10]. The efficacy of EV therapy in patients with anterior circulation occlusion has been demonstrated by several studies. However, its efficacy and safety in acute large vessel occlusion stroke of the posterior circulation have rarely been reported. In the present study, the clinical efficacy and safety of EV therapy versus IVT therapy in the treatment of acute ischemic stroke caused by posterior large vessel occlusion were evaluated.

2. Data and methods

2.1 Subjects

Fifty eligible patients with acute PLVOS admitted to our hospital between June 2019 and July 2021 were selected for this study. Screening criteria: (1) Inclusion criteria: ① 18 years

older or above within 4.5 hours after onset; ② Acute PLVOS; ③ Absence of early-stage extensive cerebral infarction in head Computed Tomography (CT). (2) Exclusion criteria: ① Hemorrhagic disorder or bleeding tendency, such as a history of cerebral hemorrhage; ② Surgery in past 2 weeks or history of severe trauma; ③ Digestive tract ulcer or malignant tumor with severe organ dysfunction; ④ Have surgical contraindications and the life expectancy is less than 90 days.

2.2 Methods

Fifty subjects were randomly divided (sealed envelope method) into the IVT therapy group and EV therapy groups (n = 25 in each group). Patients in the IVT therapy group were given 0.9 mg/kg alteplase (strength: 20 mg/vial; Boehringer Ingelheim Pharma GmbH & Co. KG, Ingelheim, RP, Germany; approval license no. S20160054), the maximum dose is <90 mg/dose. Patients were intravenously infused with 10% of the total dose of alteplase for 1 min, followed by continuous intravenous pumping of the remaining dose within 1 hour. Blood pressure (BP), pulse, respiratory and neurological changes in the patients were closely monitored throughout treatment. If severe headache, acute hypertension, nausea and vomiting occur, IVT therapy should be immediately discontinued and CT examination should be performed in time. Treatments in the EV therapy group included Solitaire Blood flow reconstruction device (FR) stents, mechanical thrombectomy with large-diameter aspiration catheter under local or general anesthesia, or thrombus aspiration using the a direct aspiration first pass technique (ADAPT)/Solitaire retriever stentcombing With Intracranial support catheter aspiration for Mechanical thrombectomy (SWIM) method. Rescue therapy such as emergency angioplasty or arterial thrombolysis was performed when necessary. The choice of anesthesia method is based on the cooperation of the patient. After anesthesia, a femoral artery sheath was inserted for diagnostic angiography to determine pathological changes in arterial and bilateral vertebral artery access. Once the occlusion site has been identified, the tip of the 6F guide catheter was placed distal to the ascending segment of the internal carotid artery under the guidance of an ultra-smooth loach guidewire. The posterior circulation was placed distal to the V2 segment of the vertebral artery without passing through the V3 segment. A Rebar 18 microcatheter (Medtronic, Santa Rosa, Calif, USA) was used to deliver the micro guidewire to the occluded segment of the basilar artery. Microcatheter angiography was performed to determine the patency of the distal blood vessels at the occlusion site to assess the length and location of the occluded segment. The Solitaire thrombectomy stent (Medtronic) was delivered through a microcatheter. Place the sent on the thrombus as much as possible and let stand for 5 min to ensure complete contact with the thrombus. The thrombus was removed by gently retracting the stent and microcatheter into the guidewire. Thrombectomy can be repeated no more than 5 times during the surgery. Angiography was performed once every 5 min for 15–20 min after thrombectomy to assess changes in residual stenosis and maintenance of forward blood flow. If angiography confirms severe residual stenosis after recanalization or poor blood flow maintenance, rescue therapies such as tirofiban hydrochloride (Guoyao Zhunzi H20070072, Kangchen Pharmaceutical (Inner Mongolia) Co., Ltd, Tongliao, China) (platelet glycoprotein IIb/IIIa receptor inhibitor), balloon dilation (Tianjin Cinorch Pharmaceutical Co., Ltd., Tianjin, China) or stent implantation (ENTERPRISE, Johnson & Johnson Codman, Miami, FL, USA) may be offered. Once arterial patency was confirmed by angiography, the microcatheter and guidewire were withdrawn and the femoral artery was sutured.

2.3 Assessments

The recanalization rate, National Institute of Health Stroke Scale (NIHSS) score at 24 h post-admission, and 90-day prognosis were compared between the IVT therapy group and EV therapy groups. Recanalization was assessed using the modified thrombolysis for cerebral infarction (mTICI) scale, with grade 2b or 3 indicating successful recanalization. Prognosis was assessed using the modified Rankin scale (MRS), with a score of $\leq$2 indicating a good prognosis. Complications associated with perioperative endovascular thrombectomy were also assessed and recorded in detail.

2.4 Statistical analysis

Data were summarized in tables and analyzed using Statistical Product and Service Solutions (SPSS) 23.0 (IBM SPSS Inc., Chicago, IL, USA). The measured data ($\bar{x} \pm s$) and count data (n (%)) were compared using the independent *t*-test and chi-square test, respectively. A $p < 0.05$ was considered statistically significant.

3. Results

3.1 Comparison of baseline data of 50 patients with acute PLVOS received IVT therapy and EV therapy

The baseline data of patients with acute PLVOS were shown in Table 1. There were no significant differences in the mean age, gender ratio, history of smoking and drinking, complications (hypertension and diabetes) and types of cerebral infarction (large artery atherosclerosis, cardioembolic stroke and other or unknown type) between acute PLVOS patients with IVT therapy and EV therapy ($p > 0.05$).

3.2 Comparison of vascular recanalization rate in acute PLVOS patients with IVT therapy and EV therapy

The vascular recanalization rate (Postoperative mTICI grade 2b-3) was significantly higher in the EV therapy group (22, 88.00%) than that in the IVT therapy group (19, 64.00%) (p = 0.047; Table 2).

TABLE 1. Baseline data of 50 patients.

Group	IVT therapy (n = 25)	EV therapy (n = 25)	t/χ^2 value	*p* value
Age	60.55 ± 10.77	64.89 ± 8.40	1.558	0.119
Gender ratio (male/female)	17/8	15/10	0.347	0.556
History of smoking	11 (44.00)	14 (56.00)	0.720	0.396
History of drinking	9 (36.00)	8 (32.00)	0.089	0.765
Hypertension	7 (28.00)	8 (32.00)	0.095	0.758
Diabetes	11 (44.00)	10 (40.00)	0.082	0.774
Hyperlipidemia	6 (24.00)	4 (16.00)	0.500	0.480
Fibrillation	9 (36.00)	11 (44.00)	0.333	0.564
Type of cerebral infarction				
Large artery atherosclerosis	14 (56.00)	17 (68.00)	0.776	0.678
Cardioembolic stroke	8 (32.00)	6 (24.00)		
Other or unknown type	3 (12.00)	2 (8.00)		
PC-ASPECTS (Early CT score of posterior circulation ALberta stroke)	6.26 ± 1.31	6.56 ± 1.16	0.853	0.398

IVT: intravenous thrombolytic; EV: endovascular; CT: Computed Tomography.

TABLE 2. Comparison of vascular recanalization rate in acute PLVOS patients with IVT therapy and EV therapy.

Postoperative mTICI grade	IVT therapy group (n = 25)	EV therapy group (n = 25)	Vascular recanalization rate (*p*)
Grade 0	2 (8.00)	0 (0.00)	0.047
Grade 1	3 (12.00)	1 (4.00)	
Grade 2a	4 (16.00)	2 (8.00)	
Grade 2b	7 (28.00)	9 (36.00)	
Grade 3	9 (36.00)	13 (52.00)	

mTICI: modified thrombolysis for cerebral infarction; IVT: intravenous thrombolytic; EV: endovascular.

TABLE 3. Comparison of prognosis in acute PLVOS patients with IVT therapy and EV therapy.

Prognosis	IVT therapy group	EV therapy group	χ^2 value	*p* value
Good	14	21	4.667	0.031
Poor	11	4		

IVT: intravenous thrombolytic; EV: endovascular.

TABLE 4. Comparison of perioperative complications in acute PLVOS patients with IVT therapy and EV therapy.

Complication	IVT therapy group	EV therapy group	χ^2 value	*p* value
Intracranial hemorrhage	4	2	5.882	0.015
Pulmonary infection	8	2		
Overall incidence of complication	48.00	16.00		

IVT: intravenous thrombolytic; EV: endovascular.

3.3 Comparison of NIHSS score at 24 h post-admission in acute PLVOS patients with IVT therapy and EV therapy

There was no significant difference in NIHSS score between acute PLVOS patients received IVT therapy (15.43 ± 3.26) and EV therapy (14.47 ± 2.12) before treatment (t = 1.240, p = 0.221). However, NIHSS score at 24 h post-admission was significantly lower in the EV therapy group (9.31 ± 1.95) than that in the IVT therapy group (13.69 ± 1.94) (t = 7.971, p = 0.000).

3.4 Comparison of prognosis in acute PLVOS patients with IVT therapy and EV therapy

Acute PLVOS patients with EV therapy had significantly better prognosis than that with IVT therapy ($p < 0.05$, Table 3).

3.5 Comparison of perioperative complication in acute PLVOS patients with IVT therapy and EV therapy

The perioperative complications were observed in 4 patients received EV therapy, including 2 cases of intracranial hemorrhage and 2 cases of pulmonary infection. The perioperative complications were observed in 12 patients received IVT therapy, including 4 cases of intracranial hemorrhage and 8 cases of pulmonary infection. However, the overall incidence of complication was significantly lower in the EV therapy group (16.00%) than that in the IVT therapy group (48.00%) ($p <$ 0.05, Table 4).

4. Discussion

Large vessel occlusion is a common cause of acute ischemic stroke, characterized by acute onset, rapid progression, high disability rate and poor prognosis, posing a serious threat to the physical and mental health of patients [11–13]. National and international guidelines have recommended IVT as the preferred treatment for acute stroke. However, studies have shown that a very small number of patients are within the treatment window and indications for treatment, and the rate of post-IVT recanalization is relatively low [14–16]. Nevertheless, several studies have demonstrated that this treatment regimen is safe and feasible within a treatment window of 3–4.5 hours and can effectively improve prognosis [17, 18]. Mechanical endovascular thrombectomy is another important treatment recommended by guidelines for acute ischemic stroke. This treatment provides the most rapid and direct recanalization and effectively improves the 90-day prognosis of patients. Furthermore, this approach extends the treatment time for acute ischemic stroke caused by large vessel occlusion to 24 hours, demonstrating superior therapeutic advantages [19–21].

Most of the existing literature suggests that EV therapy is effective in patients with anterior circulation occlusion [22–25]. However, the efficacy of EV therapy in acute PLVOS remains controversial. A randomized-controlled trial (RCT) published by Liu *et al.* [26], comparing standard medical therapy with EV therapy for posterior ischemic stroke, which showed that the two treatments had comparable outcomes. In contrast, the study by Zi *et al.* [27] revealed that direct thrombectomy within 24 hours of acute posterior ischemic stroke due to large vessel occlusion improved patient prognosis and reduced mortality rate. Therefore, the current opinion on the efficacy of EV therapy for posterior ischemic stroke is that more research is still needed. In this study, the efficacy and safety of EV therapy and IVT therapy were compared in acute ischemic stroke patients with posterior large vessel occlusion who were within 4.5 hour of onset, with clinical indications for IVT therapy and EV therapy and admitted to our hospital between June 2021 and July 2022. To our knowledge, this is the first RCT in Wuxi for vascular treatments for posterior circulation stroke.

Comparing the postoperative mTICI grades between the two groups, it was found that 25 patients in the intravascular therapy group without grade 0, 1 patient in grade 1, and 22 patients (2 patients in grade 2a, 9 patients in grade 2b and 13 patients in grade 3) with vascular recanalization. The vascular recanalization rate was 88.00%, which was significantly higher than that of 19 patients in the intravenous thrombolytic therapy group (4 patients in grade 2a, 7 patients in grade 2b and 9 patients in grade 3), and the recanalization rate was 64.00%. These investigations were consistent with previously published contents, further confirming the significant effect of intravascular therapy on vascular recanalization rate [28]. NIHSS is the most commonly used scale to evaluate the degree of neurological impairment in stroke. Previous studies have showed that the internal consistency of the scale is as high as 0.93, and the consistency between assessors is up to 0.95, making the scale suitable for stroke evaluation and rehabilitation assessment by medical staff [29, 30]. This study demonstrated that while both IVT therapy and EV therapy effectively improved the NIHSS scores of patients, EV therapy resulted in significantly greater score improvement than IVT therapy. This indicated that EV therapy can effectively improve and repair the neurological functions of patients within 24 hour post-admission, which may be attributed to its ability to increase recanalization rate, attenuate nerve cell damage, improve cerebral tissue perfusion, and reduce hypoxia and ischemia. Acute PLVOS is common in middle-aged and elderly individuals. This disorder not only affects physical functions and consciousness, but its untimely treatment can also lead to serious consequences, which are the main reason for the poor prognosis and low quality of life of patients. Comparison of MRS score at 90-day post-surgery showed the significantly higher number of patients with good prognosis in the EV therapy group than that in the IVT therapy group. In addition, the incidences of perioperative complications, namely intracranial hemorrhage and pulmonary infection, between the two groups were also compared, and the results found that the overall incidence of these complications was significantly lower in the EV therapy group than that in the IVT therapy group. This result demonstrates that EV therapy is a safe and effective treatment for acute posterior stroke. Although the efficacy between EV therapy and IVT therapy through recanalization rate, NIHSS score improvement, prognosis and incidence of complication have been compared, there are still several limitations in this study. First, this was a single-center study with a small sample size and limited duration. Second, there is lack of evaluation on the

impact of the treatments on serological markers of neurological impairment. Therefore, it is necessary to conduct large cohort studies of longer duration.

5. Conclusions

In summary, EV therapy can increase the recanalization rate, improve neurological impairment, and improve prognosis in patients with acute PLVOS. EV therapy is therefore a safe and more effective regimen than IVT therapy.

AVAILABILITY OF DATA AND MATERIALS

The authors declare that all data supporting the findings of this study are available within the paper and any raw data can be obtained from the corresponding author upon request.

AUTHOR CONTRIBUTIONS

JMC, GJX and ZD—designed the research study; performed the research; analyzed the data; wrote the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Ethical approval was obtained from the Research Ethics Committee of Wuxi People's Hospital (Approval No. KY21088). Written informed consent was obtained from a legally authorized representative(s) for anonymized patient information to be published in this article.

ACKNOWLEDGMENT

Not applicable.

FUNDING

This research was funded by Foundation of Wuxi Municipal Health Commission, grant number M202142.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Rabinstein AA. Update on treatment of acute ischemic stroke. Continuum. 2020; 26: 268–286.

[2] Maida CD, Norrito RL, Daidone M, Tuttolomondo A, Pinto A. Neuroinflammatory mechanisms in ischemic stroke: focus on cardioembolic stroke, background, and therapeutic approaches. International Journal of Molecular Sciences. 2020; 21: 6454.

[3] Silva GS, Nogueira RG. Endovascular treatment of acute ischemic stroke. Continuum. 2020; 26: 310–331.

[4] Jolugbo P, Ariëns RAS. Thrombus composition and efficacy of thrombolysis and thrombectomy in acute ischemic stroke. Stroke. 2021; 52: 1131–1142.

[5] Ajoolabady A, Wang S, Kroemer G, Penninger JM, Uversky VN, Pratico D, *et al*. Targeting autophagy in ischemic stroke: from molecular mechanisms to clinical therapeutics. Pharmacology & Therapeutics. 2021; 225: 107848.

[6] Datta A, Sarmah D, Mounica L, Kaur H, Kesharwani R, Verma G, *et al*. Cell death pathways in ischemic stroke and targeted pharmacotherapy. Translational Stroke Research. 2020; 11: 1185–1202.

[7] Mendelson SJ, Prabhakaran S. Diagnosis and management of transient ischemic attack and acute ischemic stroke: a review. JAMA. 2021; 325: 1088–1098.

[8] Warach SJ, Dula AN, Milling TJ Jr. Tenecteplase thrombolysis for acute ischemic stroke. Stroke. 2020; 51: 3440–3451.

[9] Li L, Cheng P, Zhang J, Wang G, Hu T, Sun F. Clinical effect and prognostic factors of mechanical thrombectomy in the treatment of acute ischemic stroke. Pakistan Journal of Medical Sciences. 2022; 38: 1107–1112.

[10] Pan L, Jin J, Huang R, Wang W, Chen Q. Application of transcranial Doppler in prognosis assessment of nerve function in patients with acute cerebral infarction after intracranial mechanical thrombectomy. Chinese Critical Care Medicine. 2020; 32: 835–839.

[11] Sinha D, Nag P, Nanayakkara D, Duijf PHG, Burgess A, Raninga P, *et al*. Cep55 overexpression promotes genomic instability and tumorigenesis in mice. Communications Biology. 2020; 3: 593.

[12] Pirson FAVA, Boodt N, Brouwer J, Bruggeman AAE, Hinsenveld WH, Staals J, *et al*. Etiology of large vessel occlusion posterior circulation stroke: results of the MR CLEAN registry. Stroke. 2022; 53: 2468–2477.

[13] Sweid A, Hammoud B, Ramesh S, Wong D, Alexander TD, Weinberg JH, *et al*. Acute ischaemic stroke interventions: large vessel occlusion and beyond. Stroke and Vascular Neurology. 2020; 5: 80–85.

[14] Roaldsen MB, Lindekleiv H, Mathiesen EB. Intravenous thrombolytic treatment and endovascular thrombectomy for ischaemic wake-up stroke. Cochrane Database of Systematic Reviews. 2021; 12: CD010995.

[15] Turc G, Tsivgoulis G, Audebert HJ, Boogaarts H, Bhogal P, De Marchis GM, *et al*. European stroke organisation (ESO)—European society for minimally invasive neurological therapy (ESMINT) expedited recommendation on indication for intravenous thrombolysis before mechanical thrombectomy in patients with acute ischemic stroke and anterior circulation large vessel occlusion. Journal of NeuroInterventional Surgery. 2022; 14: 209–227.

[16] Lattanzi S, Coccia M, Pulcini A, Cagnetti C, Galli FL, Villani L, *et al*. Endovascular treatment and cognitive outcome after anterior circulation ischemic stroke. Scientific Reports. 2020; 10: 18524.

[17] Jovin TG, Nogueira RG, Lansberg MG, Demchuk AM, Martins SO, Mocco J, *et al*. Thrombectomy for anterior circulation stroke beyond 6 h from time last known well (AURORA): a systematic review and individual patient data meta-analysis. The Lancet. 2022; 399: 249–258.

[18] Mullen MT, Pisapia JM, Tilwa S, Messé SR, Stein SC. Systematic review of outcome after ischemic stroke due to anterior circulation occlusion treated with intravenous, intra-arterial, or combined intravenous + intra-arterial thrombolysis. Stroke. 2012; 43: 2350–2355.

[19] Jadhav AP, Desai SM, Jovin TG. Indications for mechanical thrombectomy for acute ischemic stroke: current guidelines and beyond. Neurology. 2021; 97: S126–S136.

[20] Zhang Y, Shi M, Wang Z, Li C, Sun M, Zhou J, *et al*. Factors associated with poor outcomes in patients undergoing endovascular therapy for acute ischemic stroke due to large-vessel occlusion in acute anterior circulation: a retrospective study. World Neurosurgery. 2021; 149: e128–e134.

[21] Ganesh A, Ospel JM, Menon BK, Demchuk AM, McTaggart RA, Nogueira RG, *et al*.; ESCAPE-NA1 trial investigators. assessment of discrepancies between follow-up infarct volume and 90-day outcomes among patients with ischemic stroke who received endovascular therapy. JAMA Network Open. 2021; 4: e2132376.

[22] Zi W, Qiu Z, Li F, Sang H, Wu D, Luo W, *et al*. Effect of endovascular treatment alone vs intravenous alteplase plus endovascular treatment on functional independence in patients with acute ischemic stroke: the DEVT randomized clinical trial. JAMA. 2021; 325: 234–243.

[23] Hasan TF, Hasan H, Kelley RE. Overview of acute ischemic stroke evaluation and management. Biomedicines. 2021; 9: 1486.

[24] Treurniet KM, LeCouffe NE, Kappelhof M, Emmer BJ, van Es ACGM, Boiten J, *et al*.; MR CLEAN-NO IV Investigators. MR CLEAN-NO IV: intravenous treatment followed by endovascular treatment versus direct endovascular treatment for acute ischemic stroke caused by a

proximal intracranial occlusion-study protocol for a randomized clinical trial. Trials. 2021; 22: 141.

[25] Hartmann C, Winzer S, Pallesen L, Prakapenia A, Siepmann T, Moustafa H, *et al*. Inadvertent hypothermia after endovascular therapy is not associated with improved outcome in stroke due to anterior circulation large vessel occlusion. European Journal of Neurology. 2021; 28: 2479–2487.

[26] Liu X, Dai Q, Ye R, Zi W, Liu Y, Wang H, *et al*.; BEST Trial Investigators. Endovascular treatment versus standard medical treatment for vertebrobasilar artery occlusion (BEST): an open-label, randomised controlled trial. The Lancet Neurology. 2020; 19: 115–122.

[27] Writing Group for the BASILAR Group; Zi W, Qiu Z, Wu D, Li F, Liu H, Liu W, *et al*. Assessment of endovascular treatment for acute basilar artery occlusion *via* a nationwide prospective registry. JAMA Neurology. 2020; 77: 561–573.

[28] Alexandre AM, Valente I, Consoli A, Piano M, Renieri L, Gabrieli JD, *et al*. Posterior circulation endovascular thrombectomy for large-vessel occlusion: predictors of favorable clinical outcome and analysis of first-pass effect. American Journal of Neuroradiology. 2021; 42: 896–903.

[29] Chalos V, van der Ende NAM, Lingsma HF, Mulder MJHL, Venema E, Dijkland SA, *et al*.; MR CLEAN Investigators. National institutes of health stroke scale: an alternative primary outcome measure for trials of acute treatment for ischemic stroke. Stroke. 2020; 51: 282–290.

[30] Yamal JM, Grotta JC. National institutes of health stroke scale as an outcome measure for acute stroke trials. Stroke. 2021; 52: 142–143.

How to cite this article: Jianmei Cai, Guangjun Xi, Zheng Dai. Comparison of clinical efficacy and safety between intravenous thrombolysis and endovascular therapy in patients with acute large vessel occlusion stroke of the posterior circulation. Signa Vitae. 2023; 19(4): 129-134. doi: 10.22514/sv.2023.055.