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Original research

MECHANICAL THROMBECTOMY AND INTRACRANIAL STENTING FOR ACUTE ISCHEMIC STROKE IN THE POSTERIOR CIRCULATION: ASSESSMENT OF EFFICACY AND OUTCOME

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ABSTRACT

Introduction: *Acute ischemic stroke due to large vessel occlusion in the posterior circulation is a critical emergency with a high mortality and disability rate. Endovascular thrombectomy has been shown to improve prognosis compared to standard medical treatment. However, in many cases where thrombectomy alone does not achieve recanalization, acute intracranial stenting is performed. The prognosis and outcomes in such cases remain unclear, prompting us to conduct this study.*

Methods: *This is a descriptive, cross-sectional study with longitudinal follow-up and no control group, conducted on patients with ischemic stroke due to large vessel occlusion in the posterior circulation who underwent recanalization through thrombectomy and intracranial stenting.*

Results: *In the 14 cases studied, the average age was 66 years, with 64% being male. The door-to-groin puncture time was 68 minutes, with an average puncture-to-stenting time of 60 minutes. The rate of good reperfusion (mTICI 2b or higher) was 100%. The rate of stent occlusion during the intervention, with a 15-minute waiting time after stent deployment, was 0%. The rate of good functional recovery after 3 months, with a mRS score of 0-2, was 43%, while the rate of favorable outcome (mRS 0-3) was 64%.*

Conclusion: *Treatment of ischemic stroke in the posterior circulation with thrombectomy and intracranial stenting increases the good recanalization rate, does not increase peri-procedural severe complications, and improves 3-month functional outcomes.*

Keywords: *Ischemic stroke, Posterior circulation, Large vessel occlusion, Thrombectomy, Intracranial stenting.*

I. INTRODUCTION

Acute ischemic stroke due to large vessel occlusion in the posterior circulation, including basilar artery occlusion and dominant vertebral artery occlusion, represents a severe medical emergency [1]. Results from two recent trials, ATTENTION and BAOCHE, demonstrate that endovascular therapy is superior to standard medical treatment in improving functional outcomes and reducing mortality. However, findings from these trials also show that even with aggressive treatment using all available reperfusion therapies, recovery rates at 3 months remain limited, with only 46.0 - 46.4% achieving a modified Rankin Scale (mRS) score of 0 - 3, while mortality remains very high at 30.9 - 36.7% [2, 3]. Clinical experience shows that mechanical thrombectomy alone often fails without stenting in cases of severe underlying atherosclerotic stenosis. This scenario is particularly common in posterior circulation large vessel occlusions, especially involving the vertebral V4 segment or proximal/mid basilar artery. Outcomes for this subgroup likely differ from those treated with thrombectomy alone [4]. Therefore, we conducted this study with two objectives:

- Evaluate characteristics related to endovascular intervention with mechanical thrombectomy and intracranial stenting.

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- Assess clinical and imaging features before and after intervention, as well as functional outcomes at 3 months.

II. MATERRIALS AND METHOS

Study Population: Conducted at the Stroke Center of Hue Central Hospital from May 2022 to May 2024.

Inclusion criteria: Acute ischemic stroke due to posterior circulation large vessel occlusion; symptom onset/worsening within 24 hours; NIHSS score ≥ 6 at intervention; unsuccessful mechanical thrombectomy (mTICI < 2b or severe stenosis ≥ 70% of culprit artery with limited distal perfusion); underwent intracranial stenting at culprit site.

Exclusion criteria: Cardioembolic stroke; thrombectomy without intracranial stenting; Non-consent.

Study Design: Cross-sectional descriptive study with longitudinal follow-up.

Intervention Protocol: Femoral artery access with 8F sheath; cerebral angiography to assess occlusion characteristics; approach via larger vertebral artery for basilar occlusion, ipsilateral for vertebral occlusion.

Thrombectomy procedure: Use aspiration catheter when possible. If 8F guiding catheter cannot be placed in vertebral artery: a) Use 6F guiding catheter in vertebral artery b) Place 8F guiding catheter in subclavian artery.

Stent retrieval options: Deploy stent retriever and assess occlusion characteristics; retrieve after 3 - 5 minutes; replace microcatheter with aspiration catheter if using 8F guiding catheter; perform combined retrieval-aspiration.

Post-thrombectomy: If severe stenosis (≥ 70%) remains, proceed with intracranial stenting. For self-expanding stents, perform balloon angioplasty before placement. Balloon-expandable stents do not require mandatory pre-stenting angioplasty.

Medication protocol: Non-thrombolysis patients: Early antiplatelet loading (Plavix 450mg, Aspirin 324mg). Post-thrombolysis patients: Consider stenting only after failed balloon angioplasty; avoid balloon-expandable stents; delayed antiplatelet loading (Plavix 300mg, Aspirin 324mg); deploy stent retriever to maintain perfusion; wait 60 minutes before permanent stenting. Consider detachable stent retriever. Anticoagulation during procedure: antiplatelet loading < 120 minutes before stenting: heparin bolus 70 IU/kg. If thrombolysis given: heparin 50 IU/kg.

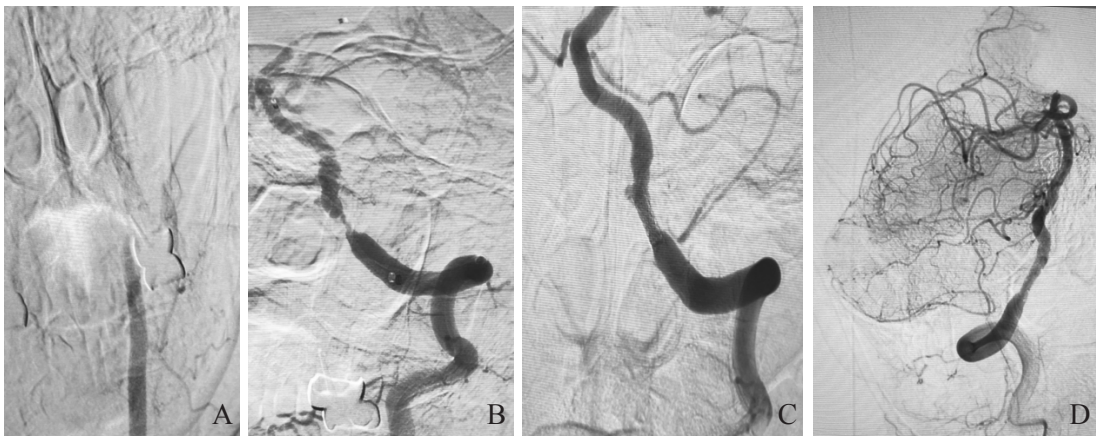

Figure 1: Intracranial stenting after mechanical thrombectomy.
A. The occlusion of the V4 segment of the left vertebral artery.
B. Severe stenosis appeared after thrombectomy with stent retriever.
C. Well-expanded stenosis segment after stenting.
D. Good reperfusion of the brainstem after stenting.

III. RESULTS

3.1. Clinical and Imaging Characteristics Before and After Intervention.

The average time from symptom onset to hospital admission was 263 ± 97 minutes, with 2 cases (14.3%) receiving intravenous thrombolysis prior to intervention. The door-to-puncture time was 68 ± 24 minutes. The mean NIHSS score on admission was 15.5 ± 4.7, decreasing to 10.9 ± 5.5 after 24 hours. On admission, pc-ASPECTS scores were predominantly ≥ 8 (71.4%) and 6 - 7 (28.6%); after 24 hours, 2 patients had scores below 6 (Table 1).

Table 1: Clinical and imaging characteristics before and after intervention

Characteristics	Value (N=14)
Age	65.8 ± 9.4
Gender	
Male	64.3%
Female	35.7%
Hypertension	78.6%
Diabetes	42.9%
Smoking	35.7%
Time from onset to hospital admission	263 ± 97 minutes
Intravenous thrombolysis prior to intervention	14.3%
Time from admission to intervention	68 ± 24 minutes
NIHSS at admission	15.5 ± 4.7
NIHSS after 24 hours	10.9 ± 5.5
pc-ASPECTS at admission	
≥ 8	71.4%
6 - 7	28.6%
< 6	0%
pc-ASPECTS after 24 hours	
8-10	57.1%
6-7	28.6%
< 6	14.3%
Mild intracranial hemorrhage after intervention and/or hemorrhagic transformation	28.6%
New territory ischemic stroke unrelated to the culprit artery	21.4%

3.2. Endovascular Intervention Characteristics

The mean procedure time was 60 ± 16 minutes, with 71.4% of patients undergoing combined retrieval-aspiration thrombectomy. Stents were placed in all patients, with 50% using balloon-expandable stents. After stenting, 35.7% of patients had <30% residual stenosis, with no cases of stent occlusion during the 15-minute post-deployment observation period. Successful reperfusion (mTICI 2b or better) was achieved in 100% of cases, with complete reperfusion in 35.7% and near-complete reperfusion (mTICI 2c) in 57.1% of patients (Table 2).

Table 2: Characteristics of endovascular intervention

Characteristics	Value (N=14)
Intervention time	60 ± 16 minutes
Thrombus removal method	
Initial aspiration	7.1%
Stent retriever only	21.4%
Combined stent retriever and aspiration	71.4%
Initial guiding catheter position	
Vertebral artery	64.3%
Subclavian artery	35.7%
Number of thrombectomy attempts	
1	64.3%
2	28.6%
3	7.1%

Characteristics	Value (N=14)
Degree of stenosis after thrombectomy	
≥ 70%	100%
≥ 90%	64.3%
Balloon angioplasty after thrombectomy	57.1%
Stent placement	
Stent type	
Self-expanding	21.4%
Balloon-expandable	50%
Detachable stent retriever	28.6%
Balloon angioplasty after stenting	21.4%
Degree of stenosis after stenting	
≥ 30%	0
< 30%	35.7%
Thrombus formation in stent after placement (within 15 minutes)	7.1%
Stent occlusion after placement (within 15 minutes after stent deployment)	0
Procedural complications	
Visible bleeding during intervention	0%
Distal embolization	
Small branch	28.6%
Large branch	7.1%
Vasospasm	28.6%
Mild vertebral artery dissection	21.4%
Final reperfusion grade	
Complete reperfusion (mTICI 3)	35.7%
mTICI 2c	57.1%
mTICI 2b	7.1%
mTICI < 2b	0

3.3. Clinical Outcomes at 3 Months

At 3-month follow-up, 42.9% of patients had good functional recovery (mRS 0-2), while 28.6% had severe disability (mRS 4-5) and mortality rate is 7.1%. Recurrent ischemic stroke within 3 months occurred in 1 patient (7.1%) and was related to the stented artery. (Table 3)

Table 3: Functional outcomes at 3 months and recurrent stroke rates

Characteristic	Percentage (N=14)
mRS Score	
0 - 2	42.9%
3	21.4%
4 - 5	28.6%
6	7.1%
Recurrent ischemic stroke within 3 months	7.1%
Related to stented artery	7.1%
Unrelated	0

IV. DISCUSSION

4.1. Clinical and Imaging Characteristics Before and After Intervention

Our study population shares several similarities with related studies in terms of age, gender, and underlying conditions such as hypertension and diabetes [5, 6]. The mean age was 65.8 years, aligning with the mean ages of 62-67 years reported for the intervention groups in the BASICS, BEST, ATTENTION, and BAOCHE trials [2, 3, 7, 8].

The rate of intravenous thrombolysis prior to intervention was relatively low in our study at 14.3%, comparable to the BAOCHE trial (14%) but considerably lower than BASICS (79.1%), BEST (27%), and ATTENTION (30.5%). For cases that received intravenous thrombolysis, the indication for stenting presents challenges due to increased risk of intracranial hemorrhage [2, 3, 7, 8].

No patients had a pc-ASPECTS score < 6 pre-intervention, consistent with other studies on posterior circulation thrombectomy. Post-intervention pc-ASPECTS scores tended to be lower, with 2 cases (14.3%) scoring < 6 at 24 hours.

The rate of post-intervention intracranial hemorrhage was relatively high, although there were no cases of severe hemorrhage. This contrasts with the 3.9% to 8% rate of severe, symptomatic hemorrhage reported in the literature [2, 3].

The mean NIHSS score on admission was 15.5, significantly lower than reported in other studies such as BASICS (21), BEST (32), ATTENTION (24), and BAOCHE (20) [2, 3, 7, 8]. The mean NIHSS score after 24 hours decreased to 10.9, indicating significant early clinical improvement following intervention.

4.2. Endovascular intervention characteristics

The mean time from femoral artery puncture to recanalization was 60 minutes, comparable to previously published reports. This duration is longer than for anterior circulation interventions due to the more challenging nature of posterior circulation procedures.

In our study, 92.8% of cases underwent stent retriever thrombectomy (21.4% stent retriever alone and 71.4% combined stent retriever and aspiration). This rate is similar to the BAOCHE trial (93.6%) and higher than BASICS (50.8%), BEST (83%), and ATTENTION (54.6%) trials [2, 3, 7, 8].

In 35.7% of cases, the guiding catheter was placed in the subclavian artery, facilitating a smooth procedure. This approach can reduce procedure time and limit brainstem ischemia caused by guiding catheter placement.

Nearly two-thirds of cases required only one thrombectomy attempt before proceeding to stenting, reducing procedure time and limiting complications associated with multiple attempts.

Balloon-expandable stents were most commonly used (50%), followed by detachable stent retrievers (28.6%) and self-expanding stents (21.4%). Balloon-expandable stents offer the advantage of rapid deployment for quick cerebral reperfusion and do not require pre-dilation [9].

Post-stenting, all cases achieved good reperfusion (13/14 cases reached mTICI 2c-3, 1 case mTICI 2b), with no cases of residual stenosis ≥ 30%. Residual stenosis < 30% was observed in 35.7% of cases.

No cases of in-stent thrombosis, hemorrhage, or vessel perforation were observed during the procedure, demonstrating the efficacy and safety of our dual antiplatelet and anticoagulation protocol.

Distal embolization occurred in 5 cases, with 4 to small branches and 1 to a large branch. Vasospasm was a common complication but responded to intra-arterial nimodipine administration. Vertebral artery dissection occurred in 21.4% of cases, though none were severe.

Post-intervention recanalization rates were excellent, with 100% achieving mTICI 2b-3, and 92.8% achieving >90% recanalization (mTICI 2c-3). These results are superior to those reported in major trials: BASICS (72% mTICI 2b-3), BEST (71%), ATTENTION (93.3%), and BAOCHE (88.1%) [2, 3, 7, 8].

4.3. Clinical outcomes at 3 months

Our study demonstrated remarkably favorable functional outcomes at 3 months post-intervention. We observed that 64.3% of patients achieved a modified Rankin Scale (mRS) score of 0-3, significantly surpassing results reported in previous major trials: BASICS (44%), BEST (42%), ATTENTION (46%), and BAOCHE (46.4%) [2, 3, 7, 8].

Several factors contributed to this improved outcome: High rate of near-complete recanalization (> 90% in most cases); lower initial stroke severity (NIHSS) compared to other studies; limited pre-intervention ischemic area (71.4% with pc-ASPECTS ≥ 8); excellent technical success (100% mTICI ≥ 2b, 92.8% mTICI 2c-3); short average procedure time (60 minutes); absence of severe complications during interventions.

The mortality rate in our study group was strikingly low at 7.1% after 3 months, contrasting with significantly higher rates in the ATTENTION (36.7% intervention group, 55.3% control group) and BAOCHE (30.9% intervention group, 42.1% control group) trials [2, 3].

V. CONCLUSION

Advanced thrombectomy with selective stenting shows promise for posterior circulation stroke. High recanalization rates, shorter procedures, and fewer severe complications are key. Patient selection remains crucial. While outcomes match those of anterior circulation thrombectomy, large-scale trials are needed to confirm safety and effectiveness of this treatment modality.

Disclosure

The authors report no other conflicts of interest in this work.

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