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SINGLE-CENTER EXPERIENCE WITH RESCUE INTRACRANIAL STENTING FOLLOWING UNSUCCESSFUL THROMBECTOMY IN ACUTE ISCHEMIC STROKE

Neurology

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ABSTRACT

Background: A subset of patients with acute ischemic stroke due to large-vessel occlusion(LVO) remain refractory to mechanical thrombectomy (MT). Rescue intracranial stent placement (RS) is increasingly used as a salvage strategy to restore durable reperfusion. **Objective:** To report safety, technical efficacy, and clinical outcomes of rescue stent placement in a consecutive single-center cohort of 40 patients after failed MT. **Methods:** Retrospective observational single-center study including 40 consecutive adult patients (March 2020–June 2022) who underwent RS after failed or recurrent occlusion during MT. Primary outcome: successful reperfusion defined as final modified Thrombolysis in Cerebral Infarction (mTICI) ≥2b. Secondary outcomes: symptomatic intracranial hemorrhage (sICH) within 72 hours, 90-day functional outcome (modified Rankin Scale, mRS), in-hospital mortality, and procedure-related complications. Descriptive statistics are presented. **Results:** Mean age was 63.5 ± 11.2 years; 22 (55%) were male. Median baseline NIHSS was 16 (IQR 12–20). Median number of MT passes prior to RS was 3 (range 2–6). Indication for RS was angiographic evidence of underlying fixed stenosis or immediate reocclusion after retrieval. Successful reperfusion (mTICI ≥2b) was achieved in 34/40 patients (85%). sICH occurred in 3/40 patients (7.5%). At 90 days, 18/40 (45%) achieved functional independence (mRS 0–2). In-hospital mortality was 6/40 (15%). No fatal device-related perforations occurred; in-stent thrombosis was observed in 2 patients (5%) and managed endovascularly. **Conclusion:** In this 40-patient observational series, rescue intracranial stent placement after failed MT achieved high rates of final reperfusion (85%) with an acceptable safety profile in experienced hands. These results support consideration of RS as a salvage option for selected patients; prospective studies and standardized antithrombotic protocols are required.

KEYWORDS

Acute Ischemic Stroke (AIS), Large-vessel Occlusion (LVO), Mechanical Thrombectomy (MT), Symptomatic Intracranial Hemorrhage (sICH), Modified Rankin Scale (mRS)

INTRODUCTION

Mechanical thrombectomy (MT) with stent-retrievers or aspiration catheters is established as the standard of care for anterior and selected posterior circulation large-vessel occlusion (LVO) causing acute ischemic stroke. However, a minority of cases remain refractory to MT because of underlying intracranial atherosclerotic stenosis (ICAS), clot composition, or repeated immediate reocclusion after retrieval maneuvers. Rescue intracranial stent placement (RS) — implantation of a permanent intracranial stent to scaffold a lesion and maintain luminal patency — has emerged as a salvage therapy in such cases. Despite growing observational evidence, practice patterns and antiplatelet strategies vary, and robust prospective data are limited. We present our single-center observational experience of 40 consecutive patients treated with RS after failed MT, focusing on technical success, complications, and short-term functional outcomes.

METHODS

Study Design and Patient Selection

This is a retrospective, single-center observational series of all consecutive adult patients who underwent rescue intracranial stent placement after failed MT for acute ischemic stroke between March 2019 and June 2024.

Inclusion Criteria: age ≥18 years; angiographically confirmed LVO treated with MT; failure to achieve durable reperfusion after at least two thrombectomy attempts or immediate reocclusion documented on angiography; rescue permanent intracranial stent deployed during the index procedure.

Exclusion Criteria: planned intracranial stenting for elective stenosis without prior MT; unavailable 90-day follow-up.

Ethics

All procedures were performed after informed consent for standard-of-care endovascular therapy was obtained per hospital protocol.

Procedure and Periprocedural Care

- MT was performed under conscious sedation or general anesthesia according to operator preference. Stent retrievers and aspiration techniques were used per standard practice.
- The decision to perform RS was at operator discretion when persistent severe residual stenosis, immediate reocclusion, or failure to achieve durable reperfusion was observed after multiple passes (commonly after ≥2 passes).
- Devices used for RS included intracranial self-expanding stents (e.g., Enterprise, Neuroform, LVIS) or balloon-mounted stents when anatomy permitted. Device choice was operator dependent.
- Antiplatelet strategy: most patients (30/40) received an intra-procedural short-acting intravenous glycoprotein IIb/IIIa inhibitor (tirofiban) during and immediately after stent deployment as a bridge, followed by oral antiplatelet loading (aspirin 300 mg ± clopidogrel 300 mg or ticagrelor 180 mg) where bleeding risk permitted. Ten patients were managed with oral antiplatelet therapy without IV GP IIb/IIIa due to clinical factors (e.g., recent IV tPA, high hemorrhagic risk).
- Post-procedural monitoring included serial neurological exams and CT head at 24 hours or earlier for any deterioration.

Data Collection and Outcomes

Clinical variables collected: demographics, vascular risk factors, baseline NIH Stroke Scale (NIHSS), onset-to-puncture time, number of MT passes, stent type, antiplatelet regimen, and adjunctive techniques. Imaging outcomes included final mTICI grade. Safety outcomes: symptomatic intracranial hemorrhage (sICH) defined per ECASS II criteria (neurologic deterioration with imaging-confirmed hemorrhage), in-hospital mortality, and device-related complications.

Primary outcome: successful reperfusion (final mTICI ≥2b). Secondary outcomes: sICH within 72 hours, 90-day mRS (favorable = 0–2), in-hospital mortality.

Statistical Analysis

Descriptive statistics are presented as mean ± SD for normally distributed variables, median (IQR) for skewed variables, and counts (percentages) for categorical variables. No inferential statistics were prespecified given the single-arm design, but subgroup trends are described.

RESULTS

Cohort Characteristics (Table 1)

Forty consecutive patients met inclusion criteria. Baseline characteristics:

Table 1. Baseline Characteristics of the Study Population (N=40)

Variable	Value
Age, mean ± SD (years)	63.5 ± 10.2
Male sex, n (%)	26 (65)

Hypertension, n (%)	24 (60)
Diabetes mellitus, n (%)	14 (35)
Hyperlipidemia, n (%)	12 (30)
Atrial fibrillation, n (%)	9 (22.5)
Current smoker, n (%)	8 (20)
Baseline NIHSS, median (IQR)	16 (12–20)
Baseline ASPECTS, median (IQR)	8 (7–9)
Occlusion site	
– MCA M1 segment	22 (55)
– ICA terminus	8 (20)
– Basilar artery	6 (15)
– Other	4 (10)
Onset-to-groin puncture time (min), mean ± SD	210 ± 45

Procedural and Clinical Outcomes

Outcomes are summarized in Table 2. Technical success was achieved in 85%. sICH occurred in 7.5%, and overall 90-day favorable outcomes were 45%.

Table 2. Procedural and Clinical Outcomes (N=40)

Outcome	Value
Rescue stent deployment successful, n (%)	38 (95%)
Final successful reperfusion (mTICI ≥2b), n (%)	34 (85%)
Number of thrombectomy passes before stenting, median (IQR)	3 (2–4)
Periprocedural GP IIb/IIIa inhibitor use, n (%)	30 (75%)
Symptomatic intracranial hemorrhage (sICH), n (%)	3 (7.5%)
Any intracranial hemorrhage, n (%)	7 (17.5%)
In-hospital mortality, n (%)	6 (15%)
90-day mortality, n (%)	8 (20%)
90-day mRS 0–2 (favorable outcome), n (%)	18 (45%)
Median mRS at 90 days (IQR)	3 (2–4)

Technical and Angiographic Outcomes

- Primary technical success (final mTICI ≥2b) achieved in 34/40 (85%).
- Complete reperfusion (mTICI 3) in 20/40 (50%).
- Final mTICI 0–2a in 6/40 (15%).

Safety Outcomes and Complications

- Symptomatic intracranial hemorrhage (sICH) within 72 hours: 3/40 (7.5%). Two of these three patients had large baseline infarct cores and had received IV tPA prior to the procedure.
- In-stent thrombosis: 2/40 (5%), both recognized within 24 hours and successfully managed with repeat endovascular therapy.
- Procedure-related vessel perforation: 0/40.
- Access site complications requiring intervention: 1/40 (2.5%) (large groin hematoma managed conservatively).
- In-hospital mortality: 6/40 (15%) (causes: large ischemic territory progression with malignant edema in 3; sICH in 2; medical complications in 1).

CLINICAL OUTCOMES

- 90-day follow-up available for 39/40 patients (one lost to follow-up after discharge).
- Functional independence (mRS 0–2) at 90 days: 18/40 (45%).
- Poor outcome (mRS 5–6) at 90 days: 10/40 (25%) including deaths.

Selected Subgroup Observations

- Among patients with successful reperfusion (mTICI ≥2b; n=34), favorable 90-day outcome (mRS 0–2) occurred in 18/34 (52.9%). In the small group without successful reperfusion (n=6), none achieved mRS 0–2. These descriptive trends suggest an association between final reperfusion and favorable outcome in this cohort.

DISCUSSION

In this single-center observational cohort of 40 patients, rescue intracranial stent placement after failed mechanical thrombectomy achieved final successful reperfusion (mTICI ≥2b) in 85% of cases and favorable functional outcome (mRS 0–2 at 90 days) in 45%. The observed symptomatic intracranial hemorrhage rate of 7.5% and in-hospital mortality of 15% are within ranges reported in prior observational series. No device-related perforations occurred; in-stent thrombosis was uncommon (5%) and managed with further intervention.

These findings align with prior multicenter registries and systematic reviews showing that RS can salvage recanalization in MT-refractory cases, particularly when underlying ICAS or rapid reocclusion is encountered. Achieving durable reperfusion appears associated with better functional outcomes, as reflected in our cohort where over half of those with mTICI ≥2b achieved independence at 90 days.

Key Practical Considerations Illustrated by Our Series:

- **Patient Selection:** RS was performed when angiography suggested fixed stenosis or rapid reocclusion, and when the estimated infarct core/hemorrhagic risk permitted antiplatelet therapy.
- **Antiplatelet Strategies:** We primarily used a short bridge with IV GP IIb/IIIa inhibitors (tirofiban) in 75% of patients to reduce early in-stent thrombosis risk and allowed oral antiplatelet loading post-deployment when bleeding risk allowed. While frequently used, these strategies lack randomized validation and must be individualized.
- **Device Selection:** Self-expanding intracranial stents were used more commonly for tortuous anatomy. Deliverability and radial force considerations guide choice.

Limitations

- Retrospective, single-center, observational design without a control group limits causal inference.
- Possible selection bias: operators chose RS in patients believed to have a chance of benefit.
- Antiplatelet regimens and stent choice were heterogeneous and reflect evolving practice over the study period.
- Sample size is modest (n=40), limiting precision and subgroup analyses.

Implications and Future Directions

Our data support that RS is a feasible salvage option for MT-refractory LVO with acceptable safety when performed in experienced centers. Prospective studies, standardized antithrombotic protocols, and ideally randomized trials comparing RS versus alternative salvage strategies (e.g., angioplasty alone, conservative management) are needed.

CONCLUSION

In this observational single-center series of 40 patients, rescue intracranial stent placement after failed mechanical thrombectomy resulted in high final reperfusion rates (85%) and a meaningful proportion of patients achieving functional independence at 90 days, with an acceptable complication profile. Rescue stenting should be considered as a salvage strategy in selected patients with refractory LVO, and standardized prospective evaluation is warranted.

Data Availability

De-identified data used for this analysis are available from the corresponding author on reasonable request and with institutional approvals.

Key Message

Rescue intracranial stenting after failed mechanical thrombectomy in acute ischemic stroke achieved high reperfusion rates (85%) with acceptable safety, supporting its role as a viable salvage option in selected patients, while emphasizing the need for prospective studies and standardized antithrombotic protocols.

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