

Poor clinical outcome despite successful basilar occlusion recanalization in the early time window: incidence and predictors

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ABSTRACT

Background Endovascular treatment (EVT) for basilar artery occlusions (BAO) is associated with a higher rate of futile recanalization compared with anterior circulation procedures. We aimed to identify the incidence and predictors of poor clinical outcome despite successful reperfusion in current clinical practice.

Methods We used data from the ETIS (Endovascular Treatment in Ischemic Stroke) registry, a prospective multicenter observational registry of stroke treated with EVT in France. Patients undergoing EVT for acute BAO from January 2014 to May 2019 successfully treated within 8 hours from onset were included. Predictors of 90-day poor outcome (modified Rankin Scale (mRS) 4–6) were researched within patients with successful (modified Thrombolysis In Cerebral Infarction (mTICI 2b–3)) and excellent (mTICI 2c–3) reperfusion.

Results Among 242 patients treated within 8 hours, successful reperfusion was achieved in 195 (80.5%) and excellent reperfusion in 120 (49.5%). Poor outcome was observed in 107 (54.8%) and 60 (50%) patients, respectively. In patients with successful early reperfusion, age, higher initial National Institutes of Health Stroke Scale (NIHSS) score, lower posterior circulation Alberta Stroke Programme Early CT Score (pc-ASPECTS), and absence of prior intravenous thrombolysis were independent predictors of poor outcome. The only treatment factor with an independent predictive value was first-pass mTICI 2b–3 reperfusion (adjusted OR 0.13, 95% CI 0.05 to 0.37, $p < 0.001$). In patients with excellent early reperfusion, independent predictors were age, initial NIHSS score, first-pass mTICI 2c–3 reperfusion, and hemorrhagic transformation on post-interventional imaging.

Conclusions Early successful reperfusion with EVT occurred in 80.5% of patients, and the only treatment-related factor predictive of clinical outcome was first pass

Key messages

What is already known on this topic

⇒ The proportion of patients with basilar artery occlusion who achieve favorable clinical outcome after endovascular therapy remains relatively low, despite high rates of arterial recanalisation within the early time window.

What this study adds

⇒ First pass reperfusion is a strong predictor of clinical outcome after endovascular treatment of basilar occlusions. In this study, it was the only treatment related factor with independent predictive value.

How this study might affect research, practice or policy

⇒ Further research is warranted to identify the optimal techniques and devices associated with first pass reperfusion in the posterior circulation.

mTICI 2b–3 reperfusion. Further research is warranted to identify the optimal techniques and devices associated with first pass reperfusion in the posterior circulation.

INTRODUCTION

Basilar artery occlusion (BAO) stroke is associated with high rates of functional dependency and mortality.^{1 2} Endovascular treatment (EVT) is the standard of care for large vessel occlusion in the anterior circulation; however, conclusive evidence of clinical benefit in posterior circulation strokes is still lacking because these patients were excluded from the pivotal thrombectomy trials.³



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Two randomized clinical trials^{4,5} failed to demonstrate a clinical benefit of EVT for BAO. In both of these trials—BASICS (Basilar Artery International Cooperation Study) and BEST (Basilar Artery Occlusion Endovascular Intervention Versus Standard Medical Treatment)—there was a relatively low proportion of good clinical outcome despite treatment in the early time window (up to 6 hours from symptom onset in BASICS, up to 8 hours in BEST) and relatively high reperfusion rates achieved in the EVT arms (Thrombolysis In Cerebral Infarction (TICI) 2b-3: 72% in BASICS, 71% in BEST). Good outcome, defined as 90-day modified Rankin Scale (mRS) score 0–3, was obtained in 44.2% and 44% of cases, respectively.

Similar clinical results have been observed in retrospective studies. Zi *et al*⁶ reported a large prospective multicentric cohort including 647 patients treated with EVT for BAO. Most patients were treated in the early time window (71.6% within 6 hours, 87.1% within 9 hours), and TICI 2b-3 reperfusion was obtained in 80.7% of patients; however, a good outcome was observed in only 32% of cases.

Moreover, when compared with anterior circulation procedures, EVT for BAO could be associated with a higher rate of futile recanalization.⁷ Therefore, a better understanding of baseline and procedural factors associated with futile recanalization could potentially improve patient selection for future clinical trials and provide guidance in current clinical practice.

The ETIS (Endovascular Treatment in Ischemic Stroke) registry is a prospective multicentric observational cohort of patients treated with EVT for acute stroke in French comprehensive stroke centers. We aimed to investigate the incidence and predictors of poor outcome despite successful reperfusion of BAO with EVT, with or without prior thrombolysis, in patients treated within 8 hours after onset.

METHODS

Data were extracted from the ETIS (NCT03776877) registry, a prospective, open, multicenter, observational registry for endovascular stroke interventions performed at 18 participating tertiary stroke centers in France. Patients were selected for EVT using local institutional protocols, without prespecified inclusion or exclusion criteria. Patients who underwent EVT for acute BAO from January 2014 to May 2019 were included in the study if: (1) BAO was angiographically proven; (2) femoral puncture was performed within 480 min from symptom onset; and (3) successful reperfusion was achieved at the end of EVT. Early treatment window was defined as the time from symptom onset to femoral puncture \leq 8 hours. Successful reperfusion and excellent reperfusion were defined as modified TICI (mTICI) scales of 2b-3 and 2c-3, respectively, at the end of the procedure. Procedures and follow-up were carried out using standard-of-care recommendations. Patients' baseline clinical and radiologic characteristics, procedure details, and outcomes were collected using standardized definitions.

Outcomes

The primary outcome was clinical status at 90 days. Poor outcome was defined as mRS 4–6. Hemorrhagic transformation at day 1 was quantified according to ECASS criteria (European Cooperative Acute Stroke Study). Functional outcome at 3 months was assessed by board-certified vascular neurologists during a routinely scheduled clinical visit or by a study nurse certified in administering the mRS during a standardized telephone interview if the patient was unable to attend a clinic visit. Imaging variables, including mTICI scores, were adjudicated by interventionists in the respective centers.

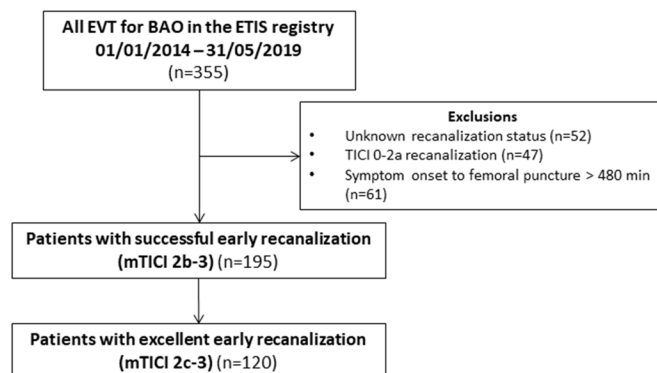


Figure 1 Patient selection flowchart. BAO, basilar artery occlusions; ETIS, Endovascular Treatment in Ischemic Stroke; EVT, endovascular treatment; mTICI, modified Thrombolysis In Cerebral Infarction.

Statistical analysis

Quantitative variables are expressed as mean (SD) in case of normal distribution or median (IQR) otherwise. Categorical variables are expressed as numbers (percentage). Patients with successful reperfusion at the end of the procedure were divided into two groups according to clinical outcome at 3 months (mRS 4–6 vs mRS 1–3). Baseline characteristics were compared between these study groups using the Student t-test for Gaussian continuous variables, the Mann-Whitney U test for non-Gaussian continuous variables, or the χ^2 test (or Fisher exact test when the expected cell frequency was <5) for categorical variables, as appropriate. For identification of outcome predictors, multiple regression models were fitted using the Akaike and Bayesian information criterion (AIC and BIC). All baseline characteristics and procedural metrics were included in the multivariable analyses.⁸ The same analyses were then performed in the group of patients with excellent reperfusion. Statistical testing was conducted at the two-tailed α level of 0.05. Data were analyzed using STATA software version 17 (StataCorp, TX).

RESULTS

Population

During the studied period, 355 patients who underwent EVT for BAO were identified in the ETIS registry. Figure 1 illustrates the flow chart of patient selection. Among patients with known reperfusion status, successful reperfusion was achieved in 84.4% (256/303). Successful reperfusion led to improved clinical outcomes: 45.1% of patients had favorable clinical outcome at 3 months compared with only 21% in case of failed (mTICI 0 to 2a) reperfusion ($p=0.006$). The rate of favorable clinical outcome was numerically lower in patients with mTICI 2b reperfusion compared with patients with excellent reperfusion (37.3% vs 50%); however, the difference did not reach statistical significance ($p=0.103$).

Contact aspiration was used as first line technique in the majority of cases (72.1%). Clinical outcome at 3 months was not significantly different according to the first line thrombectomy strategy: 44.1% favorable clinical outcome in the contact aspiration group versus 56.2% for stent retriever and 51.5% for combined technique ($p=0.538$).

EVT was initiated in the early time window (within 8 hours from symptom onset) and resulted in successful reperfusion in 80.5% (195/242) and excellent reperfusion in 49.5% (120/242). These two patient groups were included in the present study.

Baseline characteristics and procedural metrics according to clinical outcome are listed in table 1 for patients with successful

Table 1 Baseline characteristics and procedural metrics in patients with successful reperfusion (mTICI 2b-3)

	Good outcome (n=88)	Poor outcome (n=107)	All patients (n=195)	P value	Missing data/n (%)
Age, mean (SD)	62 (18)	68 (13)	65 (16)	0.013	0/195 (0.0)
Female sex, n (%)	39 (44.3)	38 (35.5)	77 (39.5)	0.211	0/195 (0.0)
Hypertension, n (%)	47 (53.4)	69 (65.7)	116 (60.1)	0.082	2/195 (1.0)
Hypercholesterolemia, n (%)	28 (31.8)	50 (48.1)	78 (40.6)	0.022	3/195 (1.5)
Diabetes mellitus, n (%)	13 (14.8)	28 (26.7)	41 (21.2)	0.044	2/195 (1.0)
Smoking, n (%)	21 (24.1)	26 (26.8)	47 (25.5)	0.679	11/195 (5.6)
Previous antiplatelet treatment, n (%)	14 (17.5)	23 (25.0)	37 (21.5)	0.232	23/195 (11.7)
Previous oral anticoagulants, n (%)	8 (10.0)	12 (13.0)	20 (11.6)	0.535	23/195 (11.7)
Baseline systolic BP, mean (SD)	149 (25)	152 (31)	150 (28)	0.529	58/195 (29.7)
Baseline diastolic BP, mean (SD)	84 (16)	81 (16)	82 (16)	0.256	59/195 (30.2)
Baseline glycemia (mmol/L), mean (SD)	8 (3)	8 (3)	8 (3)	0.892	67/195 (34.3)
Pre-stroke mRS ≤ 2 , n (%)	12 (13.6)	19 (17.8)	31 (15.9)	0.434	0/195 (0.0)
Initial NIHSS score, median (IQR)	11 (12)	25 (29)	17 (22)	0.000	8/195 (4.1)
Admission mode, n (%)					
Drip and ship	49 (61.3)	58 (63.0)	107 (62.2)	0.809	23/195 (11.7)
Mothership	31 (38.8)	34 (37.0)	65 (37.8)		
Initial imaging modality, n (%)					
CT	16 (20.0)	39 (42.4)	55 (32.0)	0.002	23/195 (11.7)
MRI	64 (80.0)	53 (57.6)	117 (68.0)		
pc-ASPECTS score, median (IQR)	8 (2)	7 (2)	7 (3)	0.001	23/195 (11.7)
Stroke etiology, n (%)					
TOAST 1 (atheroma)	28 (56.0)	37 (47.4)	65 (50.8)	0.647	67/195 (34.3)
TOAST 2 (cardioembolic)	1 (2.0)	3 (3.8)	4 (3.1)		
TOAST 4 (dissection)	3 (6.0)	3 (3.8)	6 (4.7)		
TOAST 5 (unknown)	18 (36.0)	35 (44.9)	53 (41.4)		
Positive FLAIR MRI, n (%)	25 (43.1)	32 (66.7)	57 (53.8)	0.015	89/195 (45.6)
Intravenous thrombolysis, n (%)	48 (54.5)	35 (32.7)	83 (42.6)	0.002	0/195 (0.0)
First-line thrombectomy strategy, n (%)					
Contact aspiration	56 (68.3)	71 (75.5)	127 (72.2)	0.538	19/195 (9.7)
Stent retriever	9 (11.0)	7 (7.4)	16 (9.1)		
Combined	17 (20.7)	16 (17.0)	33 (18.8)		
Adjunctive treatment, n (%)					
None	74 (86.0)	72 (71.3)	146 (78.1)	0.080	8/195 (4.1)
Balloon angioplasty	2 (2.3)	10 (9.9)	12 (6.4)		
Intraprocedural antiplatelet treatment	1 (1.2)	5 (5.0)	6 (3.2)		
Antiplatelets and balloon angioplasty	6 (7.0)	11 (10.9)	17 (9.1)		
Stenting	3 (3.5)	3 (3.0)	6 (3.2)		
Number of passes, median (IQR)	1 (0)	2 (2)	1 (2)	0.000	10/195 (5.1)
Anesthesia type, n (%)					
General anesthesia	36 (40.9)	36 (33.6)	72 (36.9)	0.573	0/195 (0.0)
Conscious sedation	48 (54.5)	66 (61.7)	114 (58.5)		
Local anesthesia	4 (4.5)	5 (4.7)	9 (4.6)		
Onset to puncture (min), median (IQR)	268 (118)	289 (166)	270 (145)	0.170	0/195 (0.0)
Onset to imaging (min), median (IQR)	127 (77)	145 (95)	133 (90)	0.397	24/195 (12.3)
Imaging to puncture (min), median (IQR)	125 (96)	146 (118)	138 (107)	0.163	23/195 (11.7)

Continued

Table 1 Continued

	Good outcome (n=88)	Poor outcome (n=107)	All patients (n=195)	P value	Missing data/n (%)
Puncture to reperfusion (min), median (IQR)	40 (37)	48 (52)	45 (46)	0.042	1/195 (0.5)
mTICI 2c-3, n (%)	60 (68.2)	60 (56.1)	120 (61.5)	0.084	0/195 (0.0)
mTICI 3, n (%)	54 (61.4)	51 (47.7)	105 (53.8)	0.056	0/195 (0.0)
First pass mTICI 2b-3, n (%)	65 (77.4)	44 (44.9)	109 (59.9)	0.000	13/195 (6.6)
First pass mTICI 3, n (%)	43 (50.6)	28 (26.4)	71 (37.2)	0.001	4/195 (2.0)
Procedural complications, n (%)	17 (19.3)	13 (12.1)	30 (15.4)	0.167	0/195 (0.0)
Early neurological improvement, n (%)	61 (69.3)	45 (42.1)	106 (54.4)	0.000	0/195 (0.0)
Any hemorrhagic transformation, n (%)	10 (12.3)	32 (34.8)	42 (24.3)	0.001	22/195 (11.2)
PH hemorrhagic transformation, n (%)	3 (3.8)	11 (12.5)	14 (8.3)	0.040	27/195 (13.8)
Mortality at 90 days, n (%)	0 (0.0)	73 (69.5)	73 (37.8)	0.000	2/195 (1.0)

BP, blood pressure; FLAIR, fluid attenuated inversion recovery; mRS, modified Rankin Scale; mTICI, modified Thrombolysis In Cerebral Infarction; NIHSS, National Institutes of Health Stroke Scale; pc-ASPECTS, posterior circulation Alberta Stroke Programme Early CT Score; PH, parenchymal hematoma.

reperfusion and in table 2 for patients with excellent reperfusion. Poor outcome was observed in 107 (54.8%) patients with successful early reperfusion and 60 (50%) patients with excellent early reperfusion. Mortality rates in the two groups were 73/195 (37.5%) and 42/120 (35%), respectively. Predictors of poor outcome in patients with successful and excellent reperfusion groups are detailed in table 3.

Predictors of poor outcome

In patients with successful early reperfusion, the following baseline characteristics were identified as independent predictors of poor clinical outcome: increasing age, higher initial NIHSS score, lower pc-ASPECTS score and absence of prior intravenous thrombolysis. The only treatment factor with independent predictive value was first pass mTICI 2b-3 reperfusion.

In patients with excellent early reperfusion, the following baseline characteristics were identified as independent predictors of poor clinical outcome: increasing age and higher initial NIHSS score. The only treatment factor with independent predictive value was first pass mTICI 2c-3 reperfusion. In addition, hemorrhagic transformation on post-interventional imaging was predictive of poor outcome in this group of patients.

DISCUSSION

In the present large cohort of patients treated with early EVT, first pass mTICI 2b-3 reperfusion was the only treatment-related factor identified as an independent predictor of clinical outcome, in addition to several unmodifiable baseline characteristics.

The ETIS collaboration recently explored the effect of first pass reperfusion in posterior circulation strokes. In a multicentric cohort of 280 patients, Aubertin *et al*⁹ showed that both first pass mTICI 2b-3 and mTICI 2c-3 reperfusion were associated with improved clinical outcome, compared with cases where the same degree of reperfusion was obtained after multiple passes or with the help of adjunctive treatments. Abdullayev *et al*¹⁰ studied a small retrospective cohort of 56 patients with complete (TICI 3) reperfusion and observed that first pass reperfusion was an independent predictor of favorable clinical outcome.

These previous studies were designed to specifically assess the effect of first pass reperfusion, whereas in the present study we employed a different approach. In order to identify predictors of poor clinical outcome despite successful reperfusion, all available baseline variables were included, without prespecified criteria. In

addition, the analysis was focused exclusively on patients treated within the early time window, in order to reduce the influence of time to treatment on clinical outcomes. By fitting multiple regression models, which included all baseline and procedural variables, we aimed to evaluate the relative importance of these factors and retain the ones with the best predictive value. The fact that first pass reperfusion emerged as the sole procedural factor with independent predictive value reinforces the role of this metric for EVT of BAO.

Of note, first pass complete (mTICI 3) reperfusion (also called true first pass effect) was included in our initial univariate analyses, but did not add additional predictive value compared with first pass mTICI 2b-3 and mTICI 2c-3 reperfusion, when the subsequent multivariable models were constructed.

One previous study⁷ researched predictors of futile recanalization (defined as mRS 3–6 at 3 months despite successful reperfusion) in a multicentric cohort of 165 patients treated with EVT for BAO. Age, baseline NIHSS score, and intracranial stenting were identified as independent predictors, whereas the number of device passes and pc-ASPECTS score did not remain significant in the multivariate analysis, possibly due to the smaller cohort size. Rates of first pass reperfusion were not reported and thus the predictive value of this variable was not explored.

The detrimental effect of repeated retrieval attempts on functional outcome has not yet been explained. Possible explanations include less distal emboli, intimal lesions, or the introduction of thrombus into perforator vessels.¹¹ Pending the results of the future pc-ASTER trial, to date, data in the literature are insufficient to support a technical recommendation for a specific thrombectomy technique which might improve first-pass reperfusion rates. For anterior circulation occlusions, a recent large multicentric study¹² found significantly higher first pass excellent reperfusion rates when combined stent retriever (SR)+contact aspiration (CA) technique was used as a frontline strategy, in conjunction with a balloon guide catheter, but this result was not replicated in other retrospective studies^{13 14} nor in the two ASTER (Contact Aspiration vs Stent Retriever for Successful Revascularization) randomized clinical trials (ASTER1¹⁵ and ASTER2¹⁶). For posterior circulation thrombectomies, a recently published multicentric cohort of 128 patients¹⁷ compared outcomes according to front-line technique (SR, CA, combined SR+CA). The highest numerical proportion of first pass complete reperfusion (mTICI 3) was observed in the combined SR+CA group;

Table 2 Baseline characteristics and procedural metrics in patients with excellent reperfusion (mTICI 2c-3)

	Good outcome (n=60)	Poor outcome (n=60)	All patients (n=120)	P value	Missing data/n (%)
Age, mean (SD)	64 (19)	69 (13)	67 (16)	0.141	0/120 (0.0)
Female sex, n (%)	24 (40.0)	17 (28.3)	41 (34.2)	0.178	0/120 (0.0)
Hypertension, n (%)	34 (56.7)	38 (65.5)	72 (61.0)	0.324	2/120 (1.6)
Hypercholesterolemia, n (%)	22 (36.7)	26 (44.8)	48 (40.7)	0.367	2/120 (1.6)
Diabetes mellitus, n (%)	11 (18.3)	11 (19.0)	22 (18.6)	0.930	2/120 (1.6)
Smoking, n (%)	14 (23.7)	13 (23.2)	27 (23.5)	0.948	5/120 (4.1)
Previous antiplatelet treatment, n (%)	10 (17.5)	15 (25.4)	25 (21.6)	0.302	4/120 (3.3)
Previous oral anticoagulants, n (%)	7 (12.3)	8 (13.6)	15 (12.9)	0.837	4/120 (3.3)
Baseline systolic BP, mean (SD)	151 (25)	149 (30)	150 (27)	0.764	29/120 (24.1)
Baseline diastolic BP, mean (SD)	85 (16)	81 (15)	83 (16)	0.289	30/120 (25.0)
Baseline glycemia (mmol/L), mean (SD)	8 (2)	7 (3)	7 (3)	0.482	34/120 (28.3)
Pre-stroke mRS ≤ 2 , n (%)	6 (10.0)	5 (8.3)	11 (9.2)	0.752	0/120 (0.0)
Initial NIHSS score, median (IQR)	11 (12)	23 (31)	14 (20)	0.000	5/120 (4.1)
Admission mode, n (%)					
Drip and ship	33 (57.9)	35 (59.3)	68 (58.6)	0.876	4/120 (3.3)
Mothership	24 (42.1)	24 (40.7)	48 (41.4)		
Initial imaging modality, n (%)					
CT	10 (17.5)	26 (44.1)	36 (31.0)	0.002	4/120 (3.3)
MRI	47 (82.5)	33 (55.9)	80 (69.0)		
pc-ASPECTS score, median (IQR)	8 (2)	7 (2)	7 (3)	0.013	16/120 (13.3)
Stroke etiology, n (%)					
TOAST 1 (atheroma)	18 (62.1)	13 (33.3)	31 (45.6)	0.043	52/120 (43.3)
TOAST 4 (dissection)	2 (6.9)	2 (5.1)	4 (5.9)		
TOAST 5 (unknown)	9 (31.0)	24 (61.5)	33 (48.5)		
Positive FLAIR MRI, n (%)	18 (42.9)	19 (61.3)	37 (50.7)	0.119	47/120 (39.1)
Intravenous thrombolysis, n (%)	30 (50.0)	15 (25.0)	45 (37.5)	0.005	0/120 (0.0)
First-line thrombectomy strategy, n (%)					
Contact aspiration	40 (70.2)	42 (71.2)	82 (70.7)	0.993	4/120 (3.3)
Stent retriever	4 (7.0)	4 (6.8)	8 (6.9)		
Combined	13 (22.8)	13 (22.0)	26 (22.4)		
Adjunctive treatment, n (%)					
None	51 (86.4)	50 (84.7)	101 (85.6)	0.835	2/120 (1.6)
Balloon angioplasty	2 (3.4)	2 (3.4)	4 (3.4)		
Intraprocedural antiplatelet treatment	1 (1.7)	2 (3.4)	3 (2.5)		
Antiplatelets and balloon angioplasty	4 (6.8)	5 (8.5)	9 (7.6)		
Stenting	1 (1.7)	0 (0.0)	1 (0.8)		
Number of passes, median (IQR)	1 (0)	1 (2)	1 (1)	0.003	4/120 (3.3)
Anesthesia type, n (%)					
General anesthesia	23 (38.3)	17 (28.3)	40 (33.3)	0.416	0/120 (0.0)
Conscious sedation	34 (56.7)	41 (68.3)	75 (62.5)		
Local anesthesia	3 (5.0)	2 (3.3)	5 (4.2)		
Onset to puncture (min), median (IQR)	272 (134)	284 (184)	277 (156)	0.215	0/120 (0.0)
Onset to imaging (min), median (IQR)	128 (84)	138 (76)	131 (79)	0.661	5/120 (4.1)
Imaging to puncture (min), median (IQR)	115 (112)	150 (126)	137 (111)	0.145	4/120 (3.3)
Puncture to reperfusion (min), median (IQR)	35 (29)	45 (46)	40 (37)	0.107	1/120 (0.8)

Continued

Table 2 Continued

	Good outcome (n=60)	Poor outcome (n=60)	All patients (n=120)	P value	Missing data/n (%)
mTICI 3, n (%)	54 (90.0)	51 (85.0)	105 (87.5)	0.408	0/120 (0.0)
First pass mTICI 2b-3, n (%)	47 (82.5)	37 (62.7)	84 (72.4)	0.017	4/120 (3.3)
First pass mTICI 3, n (%)	43 (75.4)	28 (47.5)	71 (61.2)	0.002	4/120 (3.3)
Procedural complications, n (%)	6 (10.0)	6 (10.0)	12 (10.0)	1.000	0/120 (0.0)
Early neurological improvement, n (%)	41 (68.3)	19 (31.7)	60 (50.0)	0.000	0/120 (0.0)
Any hemorrhagic transformation, n (%)	6 (10.9)	21 (41.2)	27 (25.5)	0.000	14/120 (11.6)
PH hemorrhagic transformation, n (%)	1 (1.8)	8 (15.7)	9 (8.5)	0.010	14/120 (11.6)
Mortality at 90 days, n (%)	0 (0.0)	42 (71.2)	42 (35.3)	0.000	1/120 (0.8)

BP, blood pressure; FLAIR, fluid attenuated inversion recovery; mRS, modified Rankin Scale; mTICI, modified Thrombolysis In Cerebral Infarction; NIHSS, National Institutes of Health Stroke Scale; pc-ASPECTS, posterior circulation Alberta Stroke Programme Early CT Score; PH, parenchymal hematoma.

Table 3 Predictors of poor outcome despite early reperfusion

Successful reperfusion (mTICI 2b-3)	aOR (95% CI)	P value
Age	1.05 (1.02 to 1.08)	<0.001
Initial NIHSS score	1.09 (1.05 to 1.14)	<0.001
pc-ASPECTS score	0.76 (0.59 to 0.97)	0.032
Intravenous thrombolysis	0.34 (0.14 to 0.84)	0.019
First pass mTICI 2b-3 reperfusion	0.13 (0.05 to 0.37)	<0.001
Excellent reperfusion (mTICI 2c-3)	aOR (95% CI)	P value
Age	1.04 (1.01 to 1.08)	0.011
Initial NIHSS score	1.11 (1.05 to 1.18)	<0.001
First pass mTICI 2c-3 reperfusion	0.25 (0.07 to 0.88)	0.032
Any hemorrhagic transformation	6.03 (1.57 to 23.08)	0.009

aOR, adjusted OR; mTICI, modified Thrombolysis In Cerebral Infarction; NIHSS, National Institutes of Health Stroke Scale; pc-ASPECTS, posterior circulation Alberta Stroke Programme Early CT Score.

however, the differences did not reach statistical significance. The rates of first pass successful or excellent reperfusion were not reported in this study.

In a large multicentric cohort of 345 patients with posterior circulation occlusions,¹⁸ the use of CA was associated with higher rates of functional independence (mRS 0–2) compared with SR or combined techniques; however, the rates of first pass reperfusion were not reported. In the present study we did not find a significant correlation between first line thrombectomy technique and clinical outcomes.

There were several differences in predictors of outcome between the groups of patients with successful versus excellent reperfusion. Intravenous thrombolysis and pc-ASPECTS score did not remain significant in the group of patients with excellent reperfusion. It is possible that the importance of these variables was reduced by the achievement of excellent reperfusion in the early time window in this specific subgroup of patients. Conversely, one post-procedural factor emerged as significant predictor—the presence of hemorrhagic transformation on post-interventional imaging. This is concordant with previous studies both for posterior¹⁹ and anterior²⁰ circulation thrombectomies.

The two main strengths of the present study are a dataset acquired through a multicentric registry of consecutive thrombectomy procedures, and the systematic independent 90-day follow-up with adjudication of clinical outcomes. There are, however, several limitations: the analysis was conducted retrospectively, treatment protocols and patient selection criteria

varied between participating centers, and imaging data (including mTICI scoring) were not adjudicated by an independent core laboratory.

CONCLUSION

In this large cohort of BAO successfully treated with early EVT, the sole treatment-related factor predictive of clinical outcome was first pass reperfusion. Further research is warranted to identify the optimal techniques and devices associated with first pass reperfusion in the posterior circulation.

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