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Stent-retriever alone vs. combined technique with balloon guide catheter in large vessel occlusion stroke: A single center experience

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Abstract

Background: Today, balloon guide catheters are widely used in thrombectomies. This study aimed to compare the demographic, angiographic, and clinical outcome parameters of thrombectomy for anterior circulation large vessel occlusion strokes (LVOS) using a first-line stent retriever (SR) alone with those of a thrombectomy using a technique combining a balloon guide catheter (BGC) with a distal access catheter (DAC) and an SR. *Methods:* We retrospectively analyzed the data of patients who had experienced anterior circulation LVOS and underwent mechanical thrombectomy with a BGC at our stroke center between January 2015 and December 2022. The patients were divided into two groups based on the techniques used in the thrombectomy: a stent retriever alone (BGC+SR) and a combined approach (BGC+DAC+SR). Baseline characteristics, procedure details, angiographic results, and clinical outcomes were assessed. The primary clinical outcome in this study was the rate of functional independence (mRS score ≤2) at 90 days. The primary technical outcome was the rate of first pass effect (FPE), defined as achieving near complete/complete revascularization (modified thrombolysis in cerebral infarction [mTICI] 2c-3) after a single treatment pass. Secondary outcomes included mortality at 90 days, procedural complications, embolic complications, and symptomatic intracranial hemorrhage. *Results:* Out of 234 patients, 137 (58.6%) were in the BGC +SR group, while 97 (41.4%) were in the BGC+SR+DAC group. Patients treated with BGC and SR alone were younger (median age 58 vs. 61 years, p=0.005) and had a higher prevalence of middle cerebral artery occlusions (M1 segment: 64.9% vs. 37.5%; M2 segment: 14.9% vs. 5.2%, p<0.001) compared to those in the combined group. The BCG+SR group had a greater incidence of cardioembolism and embolic stroke of undetermined source (49.3% vs. 41.1%, 26.5% vs. 12.6%, respectively, p=0.007). The median NIHSS of the entire population was 15 (IQR, 11–18), and 108 (46%) patients received intravenous thrombolytics before thrombectomy. The patients treated with the combined technique tended to have higher rates of FPE compared to those in the BGC+SR (47.4% vs. 35.8%, p=0.074) and higher rates of successful (≥mTICI 2b) and excellent (≥mTICI 2c) recanalization overall (93.8% vs. 90.5% p=0.504; 78.4% vs. 71.5%, p=0.306, respectively). The groups had similar rates of good clinical outcome (mRS 0-2) and mortality at 90 days (61.7% vs. 53.3%, p=0.21;14.3% vs. 18.7%, p=0.495, respectively) with comparable rates of complications. Multivariate analyses identified higher baseline Alberta Stroke Program Early CT scores (OR=1.19; 95% CI, 1.09–1.28) and middle cerebral artery M1 occlusion locations (OR=1.90; 95% CI, 1.45–2.42) as independent predictors of first-pass success. *Conclusion:* In this study, treating acute ischemic strokes with an anterior system large vessel occlusion using a thrombectomy technique employing a BGC with an SR resulted in similar recanalization and FPE rates as using a technique employing a BGC in combination with an SR and a DAC. Both first-line strategy techniques had similar rates of good clinical outcome (mRS score ≤2) and mortality at 90 days.

Keywords: Acute thrombectomy, stent retriever, combined technique, balloon guide catheter

INTRODUCTION

Evolving endovascular techniques for acute large vessel occlusion stroke (LVOS) include stent retrievers (SR), aspiration with distal access catheter (DAC), and balloon guide catheter (BGC). Stent retriever-mediated mechanical

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thrombectomy has recently been considered the standard of care for selected patients with acute LVOS in the anterior circulation due to the positive results of five recent randomized clinical trials.[1,2]

In recent years, there has been increasing interest in utilizing BGC flow arrest to improve both angiographic and clinical outcomes.[3] During the evolution of thrombectomy, the versatile uses of 8 F or 9 F BGCs have been recognized in different clinical setups. BGCs can be used with only SR or combined (SR+DAC) with other adjunctive thrombectomy procedures.[4] The SR technique approach integrates stent retrievers (SRs) with the support and guidance of balloon guide catheters (BGCs), elevating the precision and efficacy of clot removal procedures. On the other hand, combined techniques using BGC with a stent retriever and distal access catheter (BGC+DAC+SR) have gained increasing acceptance and have largely replaced the more traditional approaches based on BGC+SR alone.[5,6] Although various techniques and devices are used for mechanical thrombectomy to achieve successful reperfusion and FPE, it remains to be seen which method is optimal for treating acute ischemic stroke.[7,8] We require evidence to establish the most effective strategy among commonly utilized techniques. This retrospective study evaluated whether combining BGC+DAC+SR thrombectomy techniques could improve angiographic and clinical outcomes compared to the BGC+SR approach in treating anterior circulation stroke.

METHODS

The records of 590 patients with anterior circulation ischemic stroke and acute large vessel occlusion (LVO) who underwent endovascular treatment at Eskisehir Osmangazi University Stroke Center were retrospectively reviewed between January 2016 and December 2022. The ethics committee approved this study. Patients were included if they had anterior circulation large vessel occlusion due to intracranial internal carotid artery (ICA) or middle cerebral artery (MCA) M1/M2 segments and underwent mechanical thrombectomy with isolated SR with BGC or combined (SR+DAC) with BGC as first-line technique. Patients excluded from the analysis had no direct contact between their aspiration catheter and the clot and did not use stent retriever devices during the first-line technique (Figure 1).

Patients were categorized according to isolated SR (BGC+SR) versus combined techniques (BGC+SR+DAC). Baseline demographic characteristics, risk factors, time metrics, initial NIHS scores, intravenous tissue plasminogen activator (tPA) administration, and stroke subtypes were recorded from the database. The primary clinical outcome was the rate of functional independence (mRS score ≤2) at 90 days. The primary technical outcome was the rate of first pass effect (FPE), defined as achieving near complete /complete revascularization (modified Thrombolysis in Cerebral Infarction, mTICI 2c-3) after a single treatment pass. Secondary outcomes were mortality at 90 days, procedural complications, embolic complications, and symptomatic intracranial hemorrhage (SICH).[10] Two endovascular neurologists blind to previous clinical information and treatment reviewed all images and three months' outcomes. After the procedure, they assessed the images, which included baseline brain computed tomography (CT), brain CT angiography, and digital subtraction angiography (DSA). Large vessel occlusion (LVO) is defined as occlusions in middle cerebral artery M1- M2 segments, distal internal carotid artery (İCA terminus), and proximal ICA occlusion together with MCA M1 segment occlusion is defined as tandem occlusion. Early ischemia findings were evaluated by calculating the Alberta Stroke Program Early CT (ASPECT)[9] scores and collateral circulation by calculating the modified TAN score. The modified Tan scoring system is used for collateral assessments on Computed Tomography Angiography (CTA), in which flow< 50% refers to poor, and flow≥ 50% refers to good collateral status.[10] Bovine arch, aortic arch, and internal carotid artery dolichoarteriopathy were categorized for each patient, resulting in a B.A.D. score that predicts the time to revascularization and patient outcome after mechanical thrombectomy.[11]

Experienced neurointerventionalists performed the procedures under conscious sedation or general anesthesia. Our institute's endovascular procedures are performed with a Siemens Artis Zee monoplane system in a specific neuro-angiography room. The choice of devices and techniques for recanalization therapy was left to the discretion of the operator. The procedural first techniques evaluated were isolated stent retrievers and combined. The stent retriever alone technique combines a balloon guide catheter and retrieval with the stent retrieval device (BGC+SR) underflow arrest. Combine techniques[12] involving using DAC, applied at the clot in conjunction with proximal flow control and a stent retriever (BGC+SR+DAC) (Figure 2). We recorded the

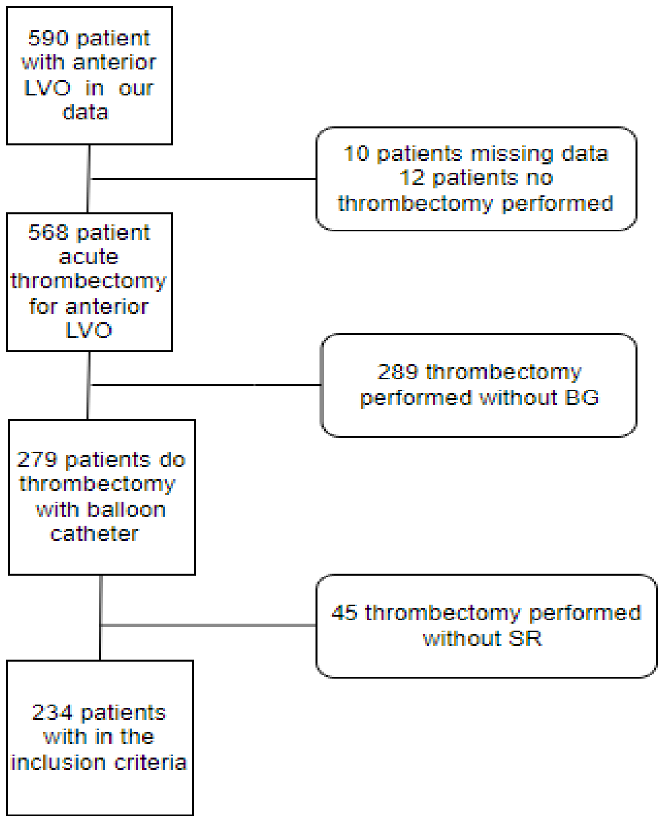

Figure 1. Flow chart showing the patient inclusion algorithm from our database.

rescue treatment (different techniques, intra-arterial selective thrombolytic therapy, intracranial balloon angioplasty, or/and stenting) rate, defined as a change in treatment modality after up to two failed thrombectomy passes with the first technique. The outer diameters of BGC and DAC catheters used during thrombectomy were recorded.

Statistical analysis

Data were analyzed using the Statistics Package for Social Science (SPSS 23.0-IBM, New York,

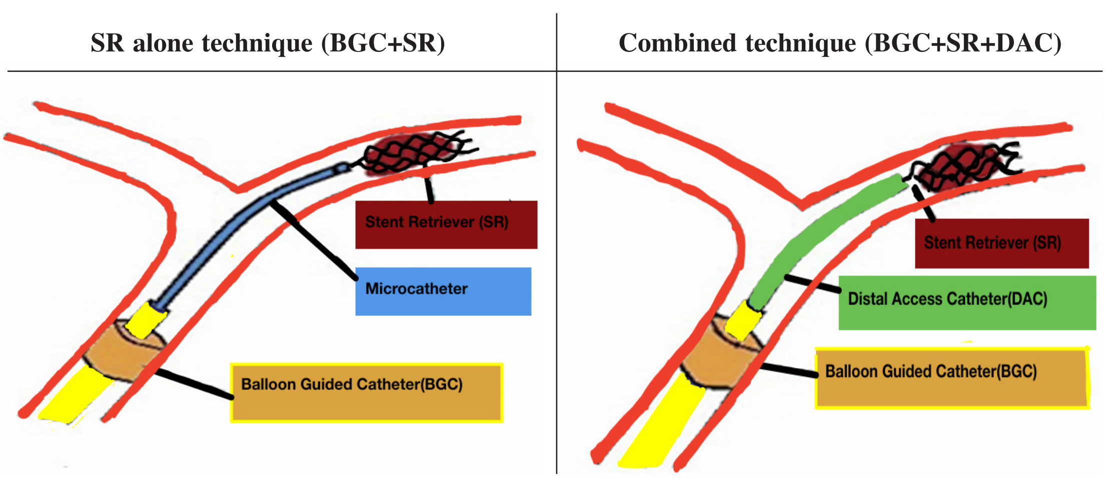

Figure 2. shows a schematic drawing that illustrates the techniques for SR alone (BGC+SR) and combined (BGC+SR+DAC).

USA). Chi-squared test or Fisher's exact test was used for categorical variables, and the Mann–Whitney U test was used to compare baseline, procedural, and outcome parameters between the two groups. A backward model was used to develop univariate logistic regression models to identify factors associated with the first-pass effect (FPE). Significance was set at p<0.05, and all p values were two-sided.

RESULTS

From our central database, 590 patients with acute stroke due to anterior large vessel occlusion between 2015 and 2023 were screened. A total of 234 patients were eligible for the analysis.

Table 1 shows the study groups' demographic, imaging, and stroke characteristics. A total of 234 patients were included in the study: 137 (58.6%) patients in the SR alone (BGC+SR) group and 97 patients (41.4%) in the combined

Table 1: Demographics, imaging, and stroke characteristics at baseline

Characteristics	Overall (N=234)	BGC+SR (n=137)	BGC+SR+DAC (n=97)	p-value
Age, median (IQR)	59 (50-67)	58 (49-66)	61 (54-71)	**0.005**[a]
Women, n (%)	94 (40.2)	58 (42.3)	36 (37.1)	0.422 [b]
Medical history, n (%)				
Atrial fibrillation	59 (25.8)	30 (22.2)	29 (30.9)	0.142[b]
Hypertension	94 (40.2)	54 (39.4)	40 (41.2)	0.780[b]
Current Smoking	78 (33.8)	44 (32.8)	34 (35.1)	0.725[b]
Diabetes	50 (21.4)	30 (21.9)	20 (20.6)	0.814[b]
Coronary artery disease	58 (24.8)	33 (24.1)	25 (25.8)	0.769[b]
Previous stroke	31 (13.2)	18 (13.1)	13 (13.4)	1.000[b]
Systolic pressure, median, IQR	140 (120-165)	140 (120-165)	142 (130-167)	0.320[a]
Glucose, median (IQR)	122 (106-150)	121 (106-150)	125 (109-143)	0.502[a]
NIHSS, median (IQR)	15 (11-18)	14 (11-18)	16 (12-19)	0.159[a]
Cause of stroke, n (%)				**0.007**[b]
Cardioembolic	106 (45.9)	67 (49.3)	39 (41.1)	
Large artery atherosclerosis	53 (22.9)	23 (16.9)	30 (31.6)	
İCAD	10 (4.3)	4 (2.9)	6 (6.3)	
Dissection	14 (6.1)	6 (4.4)	8 (8.4)	
ESUS	48 (20.8)	36 (26.5)	12 (12.6)	0.017[c]
Site of occlusion, n (%)				**<0.001**[b]
MCA-M1	123 (53)	87 (64.9)	36 (37.5)	
MCA-M2	25 (10.9)	20 (14.9)	5 (5.2)	
İCA terminus	38 (16.5)	15 (11.2)	23 (24)	
MCA/ICA tandem occlusion	44 (19.1)	12 (9)	32 (33.3)	
İV tPA, n (%)	108 (46.2)	63 (46)	45 (46.4)	0.951[b]
ASPECT, median (IQR)	9 (8-10)	9 (8-10)	9 (8-10)	0.479[a]
mTAN score n (%)				0.801[b]
Bad Collateral (≤ 0-50%)	99 (43.2)	57 (42.5)	42 (44.2)	
Good Collateral (>50%)	130 (56.8)	77 (57.5)	53 (55.8)	
B.A.D score, median (IQR)	1 (1-2)	1 (1-2)	1 (1-2)	0.070[a]

a: Mann-Whitney U test, b: Pearson Chi-square or Fisher's Exact test. IQR, Interquartile range. NIHSS, National Institutes of Health Stroke Scale; İCAD, intracranial atherosclerosis disease; ESUS, Embolic Stroke Undetermined Source; ASPECT, Alberta Stroke Program Early CT Score; B.A.D, Bovine arch, Aortic arch and Dolichoarteriopathy.

group (BGC+SR+DAC). The median age of the entire population was 59 (IQR, 50-67), the median NIHSS was 15 (IQR 11-18), and 108 (%46) patients received intravenous thrombolytics before thrombectomy. Patients treated with isolated SR and combined techniques had a median age of 58 (IQR, 49-66) years and 61 (IQR, 54-71), respectively. There was a statistically significant difference in median age between the groups (p=0.005). (p=0.007). Median (IQR) presenting Alberta Stroke Program Early CT scores and B.A.D scores were 9 (IQR 8-10) and 1 (IQR 1-2), respectively. Among the patients in the SR alone group, 67 (49.3%) had cardioembolism, and 36 (26.5%) had an embolic stroke of undetermined source (ESUS). In contrast, in the combined group, 30 (31.6%) had large artery atherosclerosis, and six (6.3%) had intracranial atherosclerosis disease (ICAD) stroke subtypes. There was a statistically significant difference in the distribution of stroke etiologies between the groups (p = 0.007). In the SR alone group, 87 patients (64.9%) had MCA-M1 occlusion, and 20 patients (14.9%) had MCA-M2 occlusion. Conversely, in the combined group, 23 patients (24%) presented with ICA terminus occlusion, while 32 (33.3%) showed MCA/ICA tandem occlusion. A statistically significant difference in occlusion site between the two groups was observed (p=0.005). For the overall cohort, the SR alone group was younger and more likely to have MCA M1-M2 occlusion, cardioembolism, and embolic stroke of undetermined source (ESUS) stroke subtypes.

The time from symptom onset to hospital admission was slightly longer in the SR alone group than in the combined group. Onset to hospital admission was 96 minutes in the SR alone group and 91 minutes in the combined group (p=0.585). The combined group showed a trend towards prolonged procedure time, although the difference was not statistically significant (42 min vs. 37.5 min, p=0.164). In both groups, a high proportion of angiographic procedures were performed under conscious anesthesia (97.9 % vs 98.5 %). In the SR alone group, the median of the total pass number and the rate of rescue therapy were comparatively higher (median: 2 IQR (1-9) vs 2 IQR (1-6); 52 (38%) vs 27 (27.8%), but these differences were not statistically significant (p=0.301; p=0.107). Patients treated with larger bore balloon guides and aspiration catheter use were more common in both groups (9F BGC vs. 8F BGC, %57.7 vs. 42.3%; 6F DAC vs. 5F DAC, 71.8% vs. 28.2 %). Table 2 shows the periprocedural details of endovascular treatment.

Table 3 summarizes both groups' angiographic and clinical outcomes and adverse events. There was no difference between the groups regarding technical and clinical primary outcomes. Patients treated with the combined technique had a higher rate of mTICI 2c or 3 after the first pass compared with SR alone (47.4 % vs 35.8%, p=0.074).

Table 2: Angiographic characteristics and endovascular procedure

Characteristics	Overall (N=234)	BGC+SR (n=137)	BGC+SR+DAC (n=97)	p-value
Median duration (IQR), min				
Onset to door	95 (45-175)	96 (49-179)	91 (45-174)	0.585 [a]
Door to puncture	94 (40.2)	58 (42.3)	36 (37.1)	0.422 [a]
Procedure time	40 (26-62)	37.5 (25-60)	42 (29-65)	0.164 [a]
Onset to recanalization	245 (185-310)	247 (185-310)	244 (187-335)	0.841 [a]
Conscious sedation, n (%)	230 (98)	135 (98.5)	95 (97.9)	1.000 [b]
No. of passes, median (IQR)	2 (1-7)	2 (1-9)	2 (1-6)	0.301 [a]
Rescue therapy n (%)	79 (33.8)	52 (38)	27 (27.8)	0.769 [b]
BG size, n (%)				0.495 [b]
8 F	99 (43.2)	61 (44.5)	38 (39.2)	
9 F	135 (57.7)	76 (55.5)	59 (60.8)	
DAC size, n (%)				0.278 [b]
5 F	42 (28.2)	18 (34.6)*	24 (27.7)	
6 F	107 (71.8)	34 (57.5)*	53 (55.8)	

a: Mann-Whitney U test, b: Pearson Chi-square or Fisher's Exact test, IQR: Interquartile range.
BG size: Baloon guide catheter outer diameter; DAC size: Distal access catheter outer diameter
* Number of DACs used when the BGC+SR technique fails

Table 3: Clinical outcomes and adverse events

Characteristics	Overall (N=234)	BGC+SR (n=137)	BGC+SR+DAC (n=97)	p-value
Successful recanalization≥mTICI 2b	215 (91.9)	124 (90.5)	91 (93.8)	0.504[b]
Excellent recanalization≥mTICI 2c	174 (74.4)	98 (71.5)	76 (78.4)	0.306[b]
FPE (mTICI2c-3) n (%)	95 (40.6)	49 (35.8)	46 (47.4)	0.074[b]
mRS 0-2 after 90 days, n (%)	128 (58.2)	79 (61.7)	49 (53.3)	0.210[b]
Mortality after 90 days, n (%)	35 (16.1)	18 (14.3)	17 (18.7)	0.495[b]
Embolization to distal or a new territory	9 (3.8)	3 (2.2)	6 (6.2)	0.168[a]
Vasospasm n (%)	99 (42.5)	64 (46.7)	35 (36.5)	0.119[a]
Arterial dissection or perforation	15 (6.4)	11 (8)	4 (4.1)	0.352[a]
Re-occlusion n (%)	10 (4.3)	3 (2.2)	7 (7.2)	0.097[a]
İntracranial hemorrhage at 24 h	64 (27.4)	41 (29.9)	23 (23.7)	0.293[a]
Hemorrhagic infarction n (%)				
Type 1	19 (29.7)	12 (29.3)	7 (30.4)	
Type 2	10 (15.6)	8 (19.5)	2 (8.7)	
Subarachnoid hemorrhage n (%)	10 (15.6)	7 (17.1)	3 (13)	
Parenchymal hematoma n (%)				
Type 1	17 (26.6)	9 (22)	8 (34.8)	
Type 2	8 (12.5)	5 (12.2)	3 (13)	
Decompressive hemicraniectomy	31 (13.2)	16 (11.7)	15 (15.5)	0.518[a]

a: Mann-Whitney U test, b: Pearson Chi-square or Fisher's Exact test, IQR: Interquartile range.
mTICI modified Thrombolysis in Cerebral Infarction; FPE, first-pass effect; mRS modified Rankin Scale; Type 1 hemorrhagic infarction indicates scattered small petechia with no mass effect; Type 2, confluent petechia with no mass effect; Type 1 parenchymal hematoma indicates hematoma within infarcted tissue occupying less than 30% with no substantive mass effect; Type 2 hematoma occupying 30% or more of the infarcted tissue with mass effect.

Similarly successful (≥mTICI 2b) and excellent (≥mTICI 2c) recanalization rates were higher in the combined group (93.8% vs. 90.5% p=0.504; 78.4% vs. 71.5%, p=0.306). Although FPE and reperfusion rates were higher in the combined technique than in the SR alone group, there was no statistically significant difference. Both groups had similar good clinical outcomes (mRS score of 0-2 at 90 days) and mortality rates (53.3% vs 61.7%, p=0.21; 18.7% vs 14.3%, p=0.49). The number of hemorrhagic and procedural complications observed were also comparable. Vasospasm was the most common procedure related adverse event (42.5 %).

Table 4 analyzes the identified predictors of first-pass mTICI 2c or 3 recanalization. Univariate tests and multivariate logistic regression analysis revealed that the higher baseline ASPECT score (OR=1.19; 95 %CI, 1.09-1.28) and middle cerebral artery M1 occlusion location (OR=1.90; 95 %CI, 1.45-2.42) were independent predictors of the first-pass effect.

DISCUSSION

The following key findings were observed in our study: (1) The number of patients who underwent stent retrieval alone was larger than those who underwent the combined technique, and the patients were younger. (2) The combined technique was used predominantly in cases of tandem and distal internal carotid artery (ICA) occlusions, while stent retrieval alone was favored for middle cerebral artery (MCA) occlusions. (3) Both techniques yielded comparable rates of successful or excellent recanalization, first-pass effects (FPEs), 90-day modified Rankin scale (mRS) scores of 0–2, mortality, procedural complications, and symptomatic intracranial hemorrhages (SICHs). (4) Higher baseline ASPECT scores and MCA M1 occlusions were independent predictors of the FPE.

In a matched analysis of stent retrievers (SRs) alone and the combined technique, the mean patient age was 64.4 years. The ASTER-2 study's

Table 4: Regression analysis with mTICI 2c or 3 on the first pass as an outcome

Variables set	Univariate OR (95% CI)	p-value
First-line MT strategy		
BGC+SR+DAC	1.62 (0.95-2.75)	0.074
Age	1.00 (0.98-1.02)	0.661
Systolic Blood Pressure	1.00 (0.99-1.01)	0.931
Baseline NIHSS	1.07 (1.00-1.06)	0.187
Baseline ASPECT score	1.20 (1.12-1.29)	**<0.001**
Clot location		
MCA-M1	2.04 (1.54-2.70)	**<0.001**
MCA-M2	1.62 (1.17-2.25)	0.005
IV tPA	1.02 (0.52-1.48)	0.622
Good collateral	1.54 (0.90-2.64)	0.117
Onset to recanalization	1.00 (0.99-1.01)	0.722
	Multivariate*	
Baseline ASPECT score	1.19 (1.09-1.28)	**<0.001**
Clot location		
MCA-M1	1.90 (1.45-2.42)	**<0.001**
MCA-M2	1.25 (0.91-1.78)	0.15

*Backward: Wald method

mean age was 73 years.[7,13] The current study revealed a younger population; the average age was 59 years (IQR, 50–67). The NASA (North American Solitaire Stent Retriever Acute Stroke) and TRACK (TREVO Stent- Retriever Acute Stroke) registries provide valuable data on patients treated with SRs alone for MCA occlusions. Using a balloon guide catheter with the SR device improves revascularization and results in faster procedure times and reduced adjunctive therapy use, according to both registries.[6,14] Furthermore, TRACK and NASA included a wide range of patients, but outcomes were generally better in those with less complex vascular anatomy. Our study evaluated the patients' anatomy by considering the presence of a Bovine arch, the type of aortic arch, and the internal carotid artery dolichoarteriopathy (B.A.D) score.[11] The mean B.A.D score was determined to be 1 (IQR 1-2), suggesting that our patient population generally did not present with anatomically challenging vascular structures. Factors such as ICA tortuosity, pre-existing plaques, or carotid bulb stenosis require a comprehensive patient assessment when considering DAC use. These factors may complicate catheter navigation, increasing the risk of procedural complications such as vessel injury, dissection, plaque disruption, or embolic events. In addition, SR+DAC combination procedures were more complex than SR alone, and there was less experience with SR+DAC combination. Operators during the study period preferred using the first-line approach SR alone over the combined technique in younger patients and patients with MCA occlusion for the above reasons, which may contribute to these results.

The ASTER-2 trial found that the combined thrombectomy technique did not significantly improve the rate of excellent recanalization compared to SRs alone (eTICI 2c/3; 64.5% vs. 57.9%, $p = 0.17$). Similarly, the FPE rate was not significantly different between the two groups (40.9% vs. 33.7%, $p = 0.12$).[7] A matched analysis study showed that the combined technique did not increase first-pass reperfusion or good clinical outcome rates.[13] Our findings showed similar excellent recanalization (≥m TICI 2c/3) rates and first pass effect (FPE) between the two techniques. (78.4% vs. 71.5%, p=0.306; 47.4 % vs 35.8 % p=0.074). FPE and recanalization rates were higher in our study. However, as in ASTER-2, the two groups had no statistically significant differences.

The combination of contact aspiration and SR thrombectomy has been suggested as a potentially more effective approach for achieving higher reperfusion rates.[15,16] Theoretically, the DAC optimizes retrieval forces and enhances clot engagement, but the potential synergistic effect of these devices in initial mechanical thrombectomy remains uncertain.[17] Otherwise, it is plausible that the need for BGCs functionally diluted the effect of the aspiration catheter in studies comparing BGC+SR+DAC and BGC+SR, given the overlapping mechanism of a BGC and distal aspiration.[18] In the ASTER-2 study published this year, a post-subgroup analysis of 362 patients showed that using the first-line combine technique resulted in higher reperfusion grades for patients with ICA terminus±M1-MCA at the end of the procedure.[19] Our study found that operators preferred the combined technique over the isolated SR technique in the ICA terminal and ICA/MCA tandem occlusion (20.2% versus 57.3%). The effect of the aspiration catheter, which is used to stabilize the stent retriever and increase aspiration power in cases of high thrombus burden and challenging anatomy, may have yet to be demonstrated compared to the isolated stent retriever technique in our study.

Previous studies have emphasized the relationship between the FPE and better clinical outcomes.[20] A multicenter prospective study shows that MCA-M1occlusion and a higher DWI ASPECTS score were independent predictors of an increased likelihood of FPE.[15] Similarly, multivariate logistic regression analysis revealed that the higher baseline ASPECT score (OR=1.19; 95 %CI, 1.09-1.28) and middle cerebral artery M1 occlusion location (OR=1.90; 95 %CI, 1.45-2.42) were independent predictors of first-pass effect in our study.

Our study had some limitations. These include the retrospective design of the data collection, a relatively small sample size, and self-assessed angiographic evaluation without core laboratory review. The study's single-center design also restricts our ability to control for external factors that may have influenced the study outcomes. Variations in practice patterns, patient demographics, and local policies could all potentially impact the internal validity of our findings. Additionally, using techniques and devices was left to the operator's discretion, which may have introduced bias into the results. Finally, it's worth noting that newer techniques and devices for mechanical thrombectomy were developed during the study period, and we were unable to analyze and compare the optimal treatment for large vessel occlusion. Newer technologies, such as balloon guides and distal aspiration catheters with significantly larger bores, are now accessible, which may make aspiration a more efficient process.

In conclusion, our retrospective study compares the first-line use of two thrombectomy techniques: SR alone and combined. The study revealed that in patients with anterior circulation stroke who underwent thrombectomy with BGC as a proximal flow arrest strategy, using the SR alone technique as a first-line treatment resulted in similar rates of recanalization, first-pass effect, and mRS 0-2 after 90 days as using combined techniques as a first-line treatment.

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