



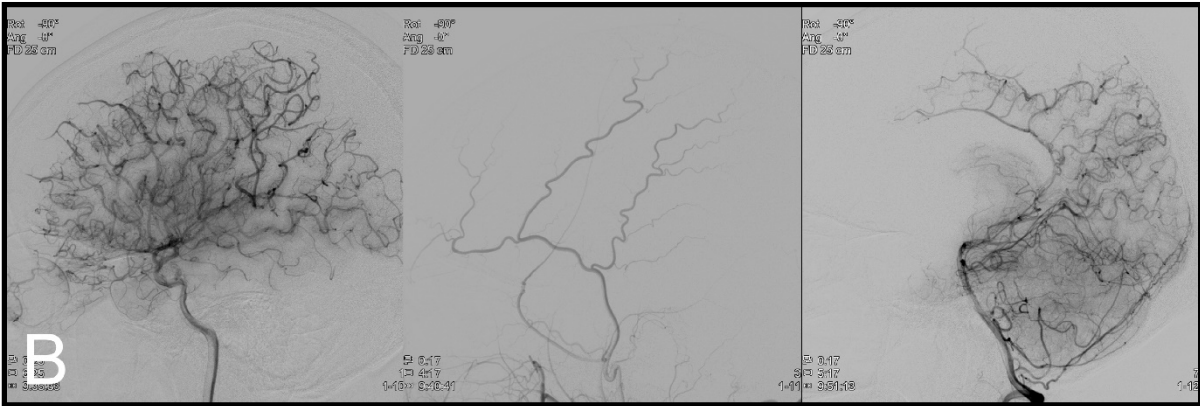
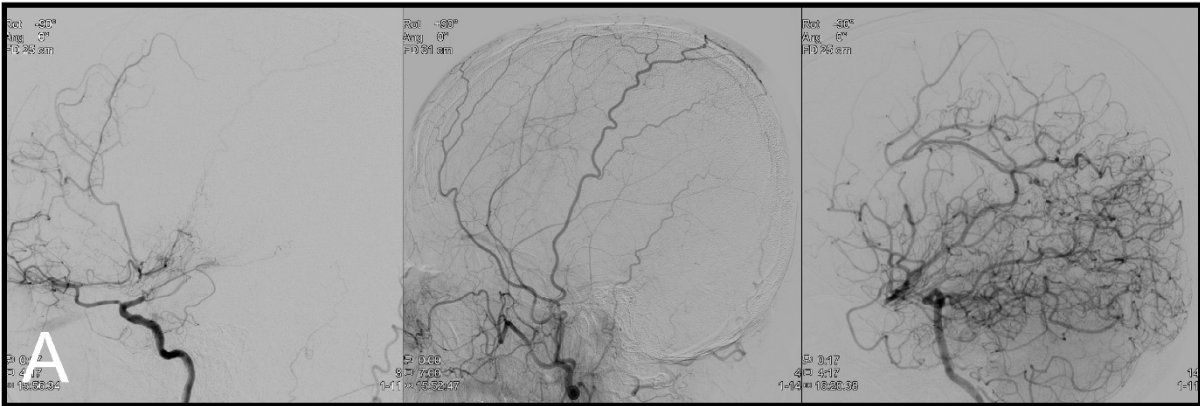
Supplementary Material

Supplementary Figures and Tables

Supplementary Figure 1

1A: Example of “Impaired” vascularity on lateral DSA view.

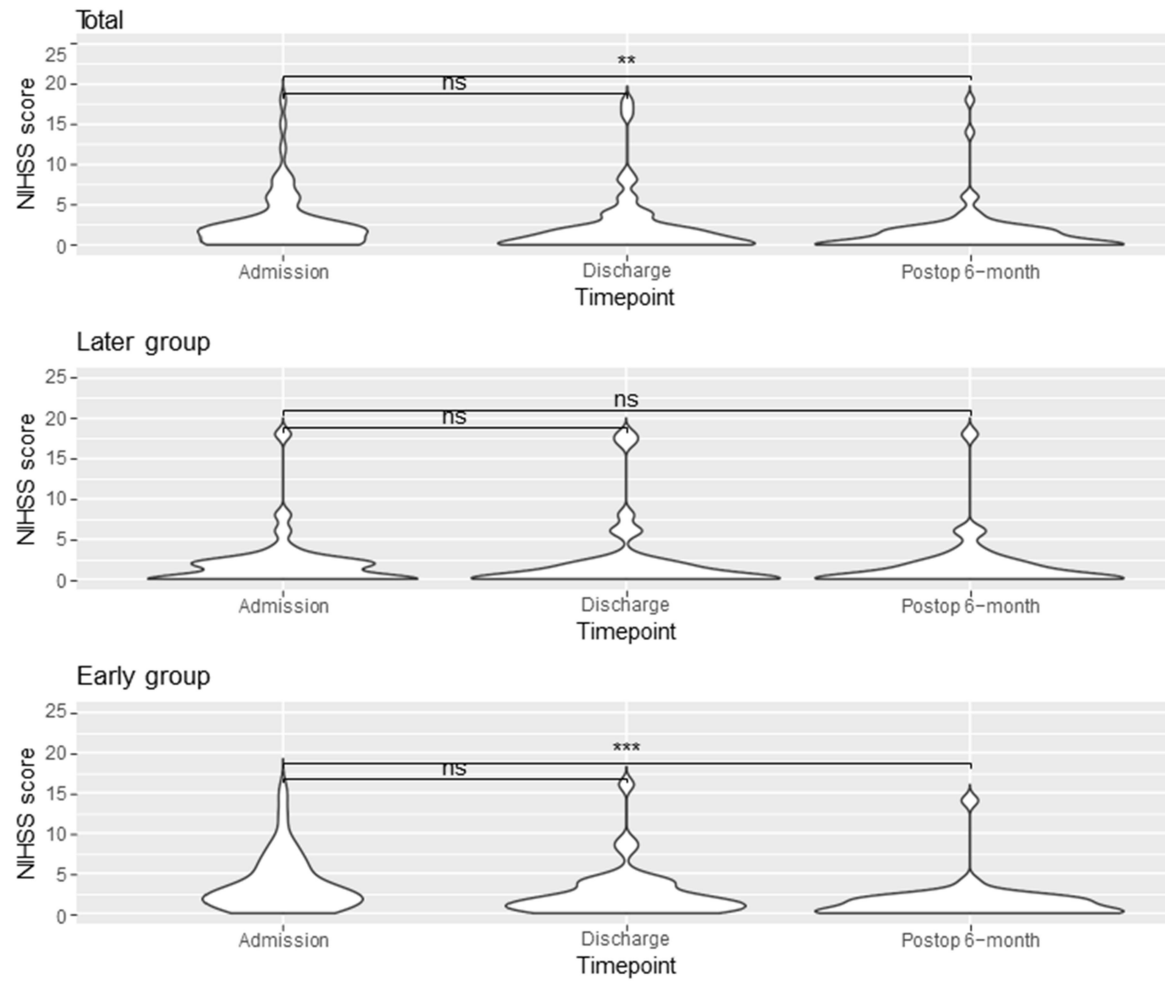
1B: Example of “Not impaired” vascularity on lateral DSA view.



DSA: Digital subtraction angiography

Supplementary Figure 2:

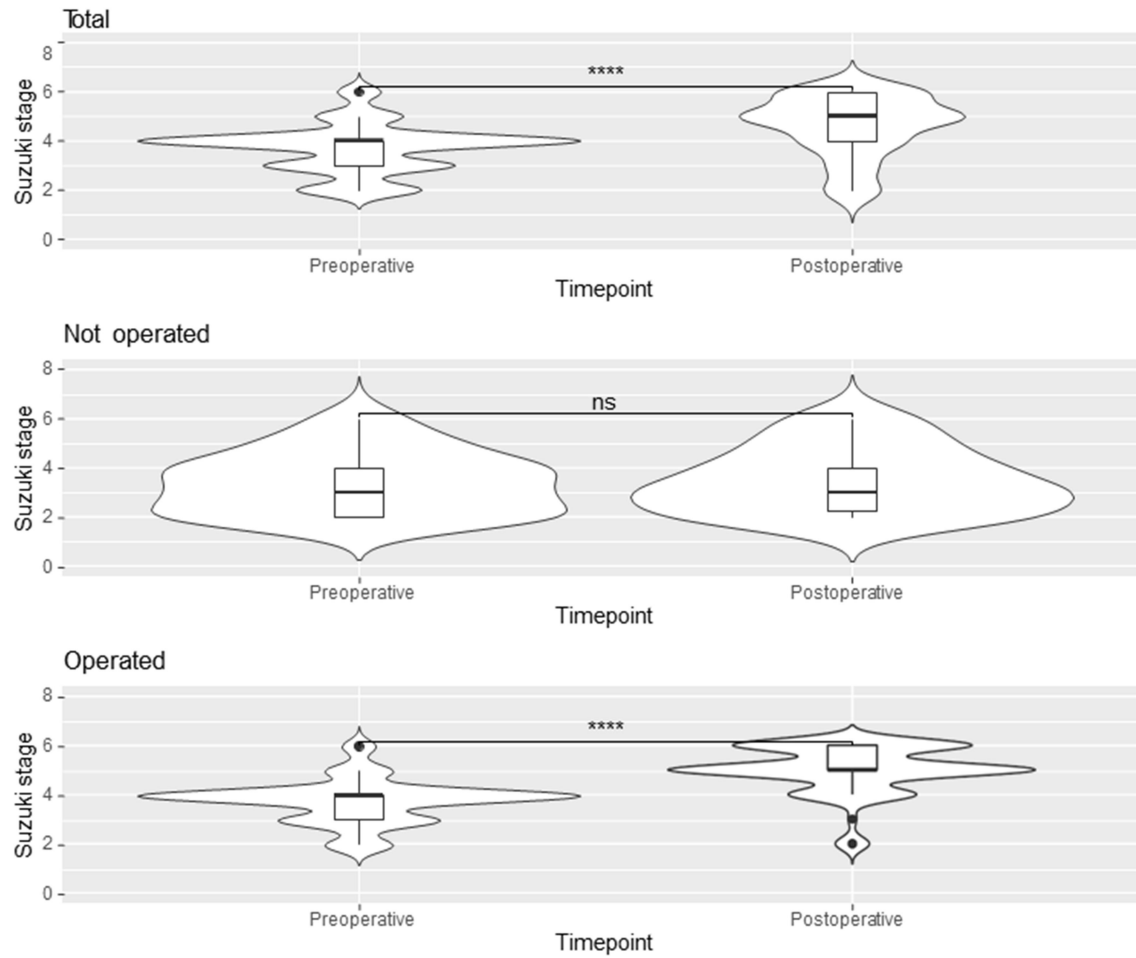
Violin plots for NIHSS scores at different timepoints



NIHSS: National Institutes of Health Stroke Scale, ns: not statistically significant, **: p-value < 0.01, ***: p-value < 0.001

Supplementary Figure 3

Violin plots for Suzuki stages at different timepoints



ns: not statistically significant, **: p-value < 0.01, ***: p-value < 0.001

Supplementary Table 1

Clinical details of patients showing fluctuations or progression in the postoperative period

Post operative clinical worsening	Age/sex	Presentation	MRI lesion	Pre operative clinical course	Detailed clinical course	Discharge mRS	6m mRS
Lesion extension 1 Progression 1	52/F	Right hemiplegia upper and lower G1 NIHSS 9	Acute, Lt MCA dotty infarct	Progression	Seven days after the procedure, the patient exhibited mixed transcortical aphasia, and an extension of the lesion was identified at the corpus callosum on MR-DWI. However, this lesion extension showed improvement with flow augmentation therapy.	4	2
Lesion extension 2 Progression 2	42/F	Clinical TIA Motor weakness, dysarthria within 2 weeks	Acute, Lt MCA dotty infarct	Fluctuation	During the first two days after the procedure, the patient experienced transient aphasia, which subsequently showed improvement. Upon routine CT scan before discharge, an extension of the lesion is observed in the left frontoparietal area.	2	2
Lesion extension 3 Fluctuation 1	57/M	Hemispheric symptoms NIHSS 22	Acute, Lt MCA Borderzone infarct	Progression	Following the combination therapy, the patient's neurological status showed improvement to an NIHSS score of 14 after 2 days. However, a follow-up CT scan revealed an extension of the hemispheric lesion.	4	4
Fluctuation 2	39/F	Clinical TIA Lt hand hypoesthesia, Headache At admission, no clinical symptoms	TIA without any parenchymal abnormality	Stable	Seven days after the procedure, the patient experienced temporary weakness in the distal upper motor (graded as G4). This weakness was successfully resolved after receiving hydration and dual antiplatelet therapy. Additionally, the MRI did not show any abnormalities.	1	1
Fluctuation 3	61/F	Aphasia, Right side weakness, one month before admission without clinical aggravation	Lt ACA dotty infarct	Stable	Five days after the procedure, the patient experienced a brief episode of transient hypoesthesia in her right finger, lasting for approximately 15 minutes. This hypoesthesia resolved on its own without the need for intervention.	0	1
Fluctuation 4	49/F	IVH treated with EVD, 6month before admission. At admission, no clinical symptoms	No parenchymal abnormality	Stable	Five days after the procedure, the patient experienced temporary weakness in her left fingers (G4). However, this weakness improved after receiving cilostazol. The MRI did not show any abnormal signals.	1	1

Fluctuation 5	31/F	Right thalamic ICH c IVH treated with EVD, Stupor mentality at admission	Not taken	Stable, Mental status was improved	Four days after the procedure, the patient's mental status declined again to a state of stupor, accompanied by left-sided eyeball deviation. However, her mental status improved after the administration of levetiracetam. The patient's general clinical status improved, leading to successful extubation and successful rehabilitation.	4	3
Fluctuation 6	38/F	Clinical TIA Lt leg hypoesthesia No focal neurologic deficit at admission	No parenchymal abnormality	Stable	Six days after the procedure, the patient experienced transient hypoesthesia in the left arm, which resolved on its own. Additionally, CT angiography did not reveal any abnormalities.	0	0
Fluctuation 7	25/F	Clinical TIA Lt hand hypoesthesia, Headache No focal neurologic deficit at admission	White matter signal change, Both internal border zone	Stable	Four days after the procedure, the patient experienced mild hypoesthesia in the left arm and leg. This symptom was resolved after administration of cilostazol.	0	0
Fluctuation 8	70/F	Lt hemiparesis, Lt homonymous hemianopsia due to infarction, 4 years before admission. Disease status was stable at admission	Rt PCA infarct, both basal ganglia dotty infarct	Stable	Three days after the procedure, the patient developed a fever and became abulic. However, her symptoms showed improvement after receiving fluid augmentation therapy and antipyretic medications.	5	3
Fluctuation 9	37/M	Dysarthria NIHSS 1	Acute, Lt MCA scattered infarct	Progression Right homonymous hemianopsia and Rt hemiparesis (upper, G4) with hypoesthesia was developed, lesion extension was seen at Lt MCA-PCA, watershed area on MR-DWI	Six days after the procedure, the patient developed additional right-sided motor weakness (graded as G4) in the lower extremity. However, this weakness showed improvement with fluid augmentation and induced hypertension therapy. There were no signs of additional acute infarction on MR-DWI. Other symptoms that worsened just before the procedure showed improvement. By the time of discharge, only subtle hypoesthesia remained.	1	1
Fluctuation 10	27/F	Clinical TIA Rt hand, leg weakness No focal neurologic deficit admission	No parenchymal abnormality	Stable	Right after the procedure, the patient experienced a focal motor onset seizure that lasted for 30 seconds. Fortunately, the seizure resolved spontaneously.	0	0
Fluctuation 11	46/F	Clinical TIA	Acute, Rt MCA dotty infarct	Progression	Immediately after the procedure, the patient reported transient hypoesthesia in the left hand, which resolved on its own. By the time of discharge, t	2	1

		Lt hand motor weakness	Motor weakness reoccured before the procedure	he motor weakness in the left hand had fully recovered.			
Fluctuation 12	35/F	Cortical TIA symptoms	Acute, Lt borderzone dotty infarct	Stable	Three days post-procedure, the patient encountered tingling in the right hand and distal weakness with a grade of 4. These symptoms resolved within a span of two hours.	0	0
Fluctuation 13	72/F	Motor weakness NIHSS 0	Acute, Lt MCA posterior borderzone dotty infarct	Stable	Two days after receiving combination therapy, the patient presented with distal handgrip weakness (graded as G4). However, this condition was successfully resolved with flow augmentation therapy.	2	0

F: Female, M: Male, Lt: Left, Rt: Right G: Motor grade, NIHSS: National Institutes of Health Stroke Scale, TIA: Transient ischemic attack, ACA: Anterior cerebral artery, MCA: Middle cerebral artery, PCA: Posterior cerebral artery, MR-DWI: Diffusion weighted image on Magnetic resonance imaging, CT: Computed tomography, EVD: External ventricular drainage, ICH: Intracerebral hemorrhage, IVH: Intraventricular hemorrhage

Supplementary Table 2:

Logistic regression for factors associated with successful regional neovascularization

	Frontal bone				Coronal suture			
	Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis	
	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>
Vascularity (DSA)								
Frontal, n								
Not impaired	ref		ref		ref			
Impaired	3.5 [1.67 - 7.54]	<0.01	1.39 [0.29 - 6.97]	0.68	1.83 [0.72 - 4.72]	0.21		
Coronal suture, n								
Not impaired	ref				ref		ref	
Impaired	2.42 [0.65 - 8.92]	0.18			3.44 [1.21 - 10.08]	0.02	5.35 [1.11 - 29.35]	0.04
Parietal, n								
Not impaired	ref				ref		ref	
Impaired	7.56 [1.94 - 34.12]	<0.01			6.4 [2.12 - 21.27]	<0.01	8.05 [1.53 - 55.54]	0.02
Posterior parietal, n								
Not impaired	ref				ref			
Impaired	0.59 [0.10 - 1.89]	0.44			0.72 [0.26 - 1.68]	0.48		
Perfusion status (CTP, MRP, SPECT)								
ACA, n								
Without RPI	ref		ref		ref		ref	
RPI without infarction	4.09 [1.08 - 16.97]	0.04	5.72 [1.07 - 41.69]	0.06	5.42 [1.81 - 17.62]	<0.01	6.05 [1.38 - 31.31]	0.02
RPI with acute infarction								
RPI with chronic infarction					4.64 [0.78 - 38.86]	0.11	2.76 [0.30 - 33.24]	0.38
MCA, n								
Without RPI	ref		ref		ref		ref	
RPI without infarction	7.43 [1.82 - 35.47]	<0.01	5.33 [1.01 - 35.42]	0.06	4.92 [1.47 - 18.33]	0.01	6.03 [1.21 - 35.21]	0.03
RPI with acute infarction	14 [1.68 - 314.47]	0.03	3.19 [0.23 - 85.74]	0.41	12.6 [1.60 - 273.73]	0.04	2.03 [0.15 - 54.05]	0.61
RPI with chronic infarction	2 [0.07 - 60.50]	0.65	2.01 [0.06 - 71.58]	0.67	0.9 [0.04 - 11.95]	0.94	2.37 [0.06 - 75.92]	0.62
PCA, n								
Without RPI	ref				ref			
RPI without infarction	1.17 [0.28 - 6.05]	0.84			2.51 [0.70 - 11.94]	0.19		
RPI with acute infarction					3.14 [0.47 - 62.34]	0.31		
RPI with chronic infarction					1.26 [0.11 - 28.00]	0.86		
Timing of surgery, n								
Later group	ref		ref		ref		ref	
Early group	5.57 [1.62 - 22.95]	<0.01	6.22 [1.27 - 40.40]	0.03	4.04 [1.54 - 11.41]	<0.01	5.82 [1.40 - 30.26]	0.02

	Parietal bone				Posterior parietal bone			
	Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis	
	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>	OR [95% CI]	<i>p</i>
Vascularity (DSA)								
Frontal, n								
Not impaired	ref				ref			
Impaired	1.62 [0.62 - 4.24]	0.33			1.8 [0.38 - 9.12]	0.46		
Coronal suture, n								
Not impaired	ref		ref		ref			
Impaired	5.54 [1.96 - 16.59]	<0.01	6.44 [1.65 - 29.07]	<0.01	5.14 [0.93 - 41.95]	0.08		
Parietal, n								
Not impaired	ref		ref		ref			
Impaired	7.86 [2.44 - 28.64]	<0.001	5.93 [1.31 - 31.29]	0.03	2.25 [0.38 - 18.57]	0.4	1.65 [0.24 - 14.76]	0.62
Posterior parietal, n								
Not impaired	ref				ref			
Impaired	0.58 [0.18 - 1.42]	0.28			0.21 [0.03 - 0.90]	0.07	0.2 [0.03 - 0.98]	0.08
Perfusion status (CTP, MRP, SPECT)								
ACA, n								
Without RPI	ref				ref			
RPI without infarction	7.2 [2.37 - 23.97]	<0.001			2.62 [0.43 - 22.15]	0.32		
RPI with acute infarction								
RPI with chronic infarction	16 [2.29 - 329.08]	0.02						
MCA, n								
Without RPI	ref		ref					
RPI without infarction	3.76 [1.05 - 14.40]	0.04	5.24 [1.17 - 25.99]	0.03				
RPI with acute infarction	8.4 [1.00 - 186.94]	0.08	2.94 [0.24 - 75.92]	0.43				
RPI with chronic infarction	1.4 [0.05 - 41.55]	0.83	3.35 [0.09 - 148.36]	0.49				
PCA, n								
Without RPI	ref				ref			
RPI without infarction	1.45 [0.43 - 5.80]	0.57			1.35 [0.20 - 8.86]	0.75		
RPI with acute infarction	2.64 [0.39 - 52.50]	0.39			6.75 [0.64 - 162.80]	0.14		
RPI with chronic infarction	1.58 [0.19 - 33.22]	0.7						
Timing of surgery, n								
Later group	ref		ref		ref			
Early group	4.16 [1.54 - 12.31]	<0.01	5.6 [1.56 - 24.86]	0.01	0.6 [0.12 - 3.00]	0.53		

DSA: Digital subtraction angiography, CTP: CT perfusion, MRP: MR perfusion, SPECT: Single-photon emission computed tomography, ACA: Anterior cerebral artery, MCA: Middle cerebral artery, PCA: Posterior cerebral artery, RPI: Regional perfusion impairment, OR: Odds ratio, CI: Confidence interval, *p*: p-value