Supplementary Online Content

Writing Group for the BASILAR Group. Assessment of Endovascular Treatment for Acute Basilar Artery Occlusion via a Nationwide Prospective Registry. *JAMA Neurol*. Published February 20, 2020. doi:10.1001/jamaneurol.2020.0156

This supplementary material has been provided by the authors to give readers additional information about their work.

eMethods 1. Propensity Matching Score Analysis

We performed a 1:1 propensity score matching based on the nearest-neighbor matching algorithm with a caliper width of 0.2 with the usage of SPSS 23.0 (IBM SPSS Statistics)[1]. Nine patients were excluded: 6 patients lack of baseline ASPECTS score and 3 patients had no systolic blood pressure value. The variables, parameter settings and results are listed as follows:

```
/VARS
   ID = order
   TREAT = group
   COVS = age SBP baseline ASPECTS smoking TOAST baseline NIHSS
   ADDLCOVS = hyperlipidemia diabetes mellitus ischemic stroke
   EXACT = Occlusion Sites
/MATCHIT
   MATCH=NEAREST
   EST =LOGIT
   DISCARD = NONE
   MORDER = LARGEST
   RATIO = 1
   CALIPER = .2
/PLOT HISTPLOT JITTERPLOT HISTBAL DOTPLOT INDBAL RESOLUTION = 96
/OUTPUT ALL WIDE.
```

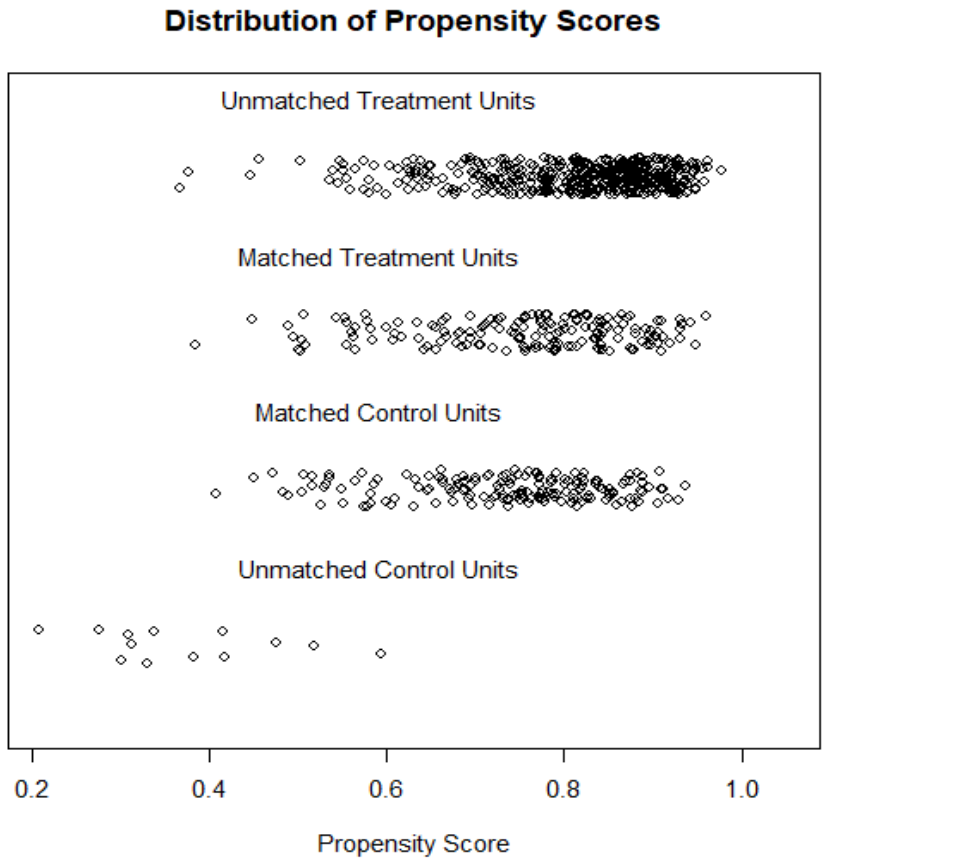
Sample Sizes		
	Control	Treated
All	180	640
Matched	167	167
Unmatched	13	473
Discarded	0	0

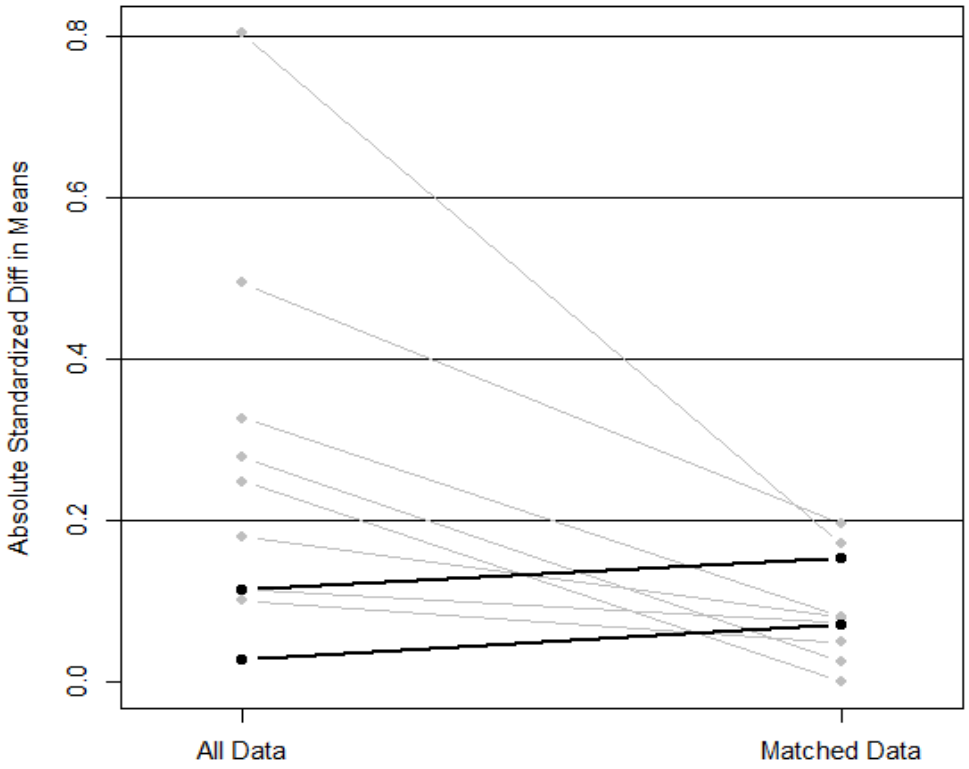
Overall balance test (Hansen & Bowers, 2010)			
	Chi-square	df	P value
Overall	7.968	9.000	.537

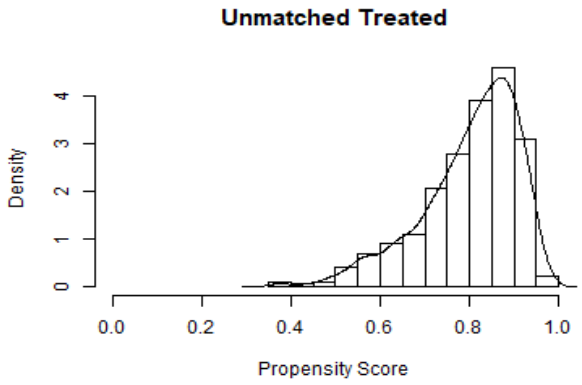
Relative multivariate imbalance L1 (Iacus, King, & Porro, 2010)		
	Before matching	After matching
Multivariate imbalance measure L1	.988	.988

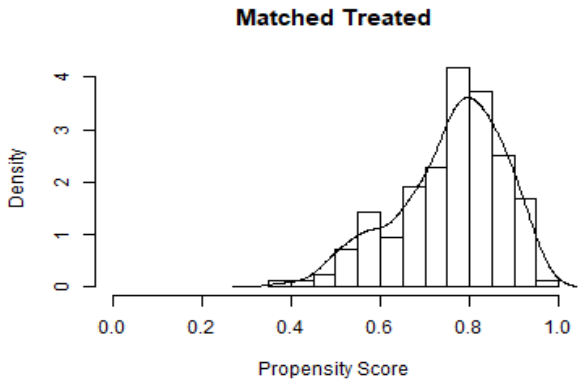
Summary of unbalanced covariates (|d| > .25)
No covariate exhibits a large imbalance (|d| > .25).

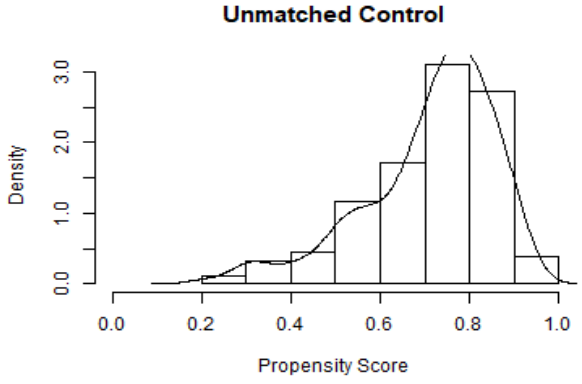
RGraph

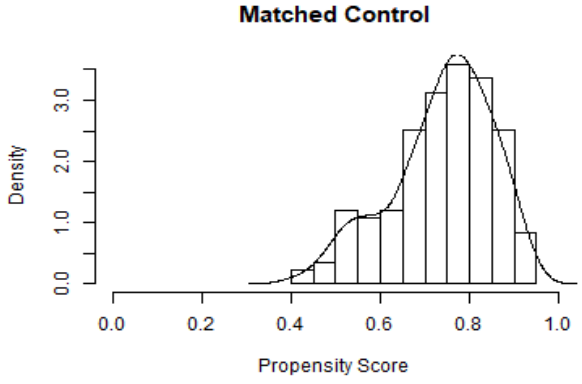

Distribution of Propensity Scores
Unmatched Treatment Units
Matched Treatment Units
Matched Control Units
Unmatched Control Units
0.2
0.4
0.6
0.8
1.0
Propensity Score

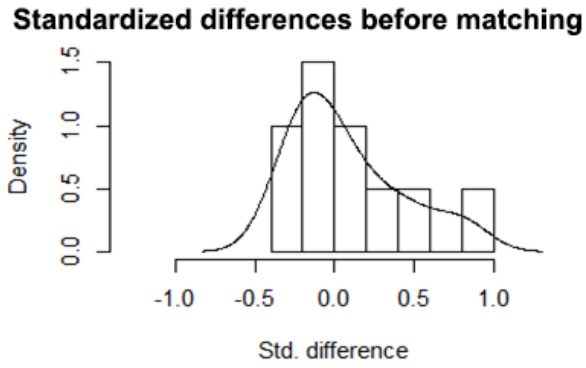

Absolute Standardized Diff in Means
0.0
0.2
0.4
0.6
0.8
All Data
Matched Data

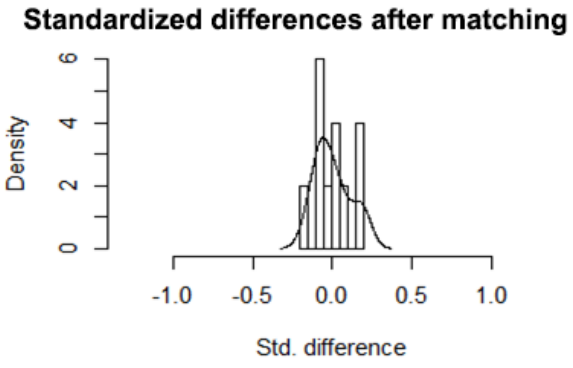

Unmatched Treated
Density
Propensity Score

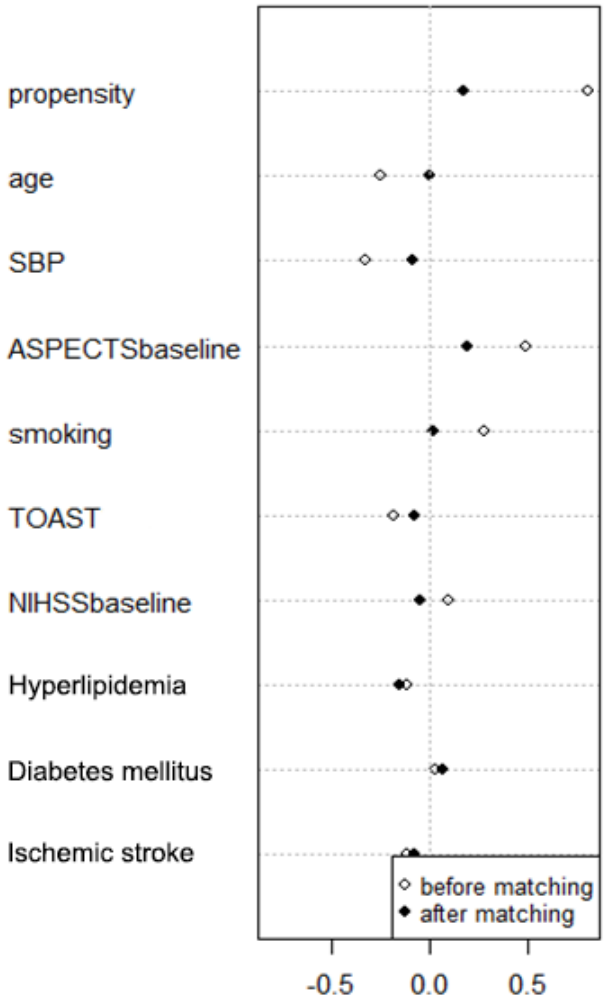

Matched Treated
Density
Propensity Score


Unmatched Control
Density
Propensity Score


Matched Control
Density
Propensity Score


Standardized differences before matching
Density
Std. difference


Standardized differences after matching
Density
Std. difference


propensity
age
SBP
ASPECTSbaseline
smoking
TOAST
NIHSSbaseline
Hyperlipidemia
Diabetes mellitus
Ischemic stroke
before matching
after matching
-0.5
0.0
0.5

eMethods 2. Treatment method

Endovascular recanalization procedures consisted of mechanical thrombectomy, thromboaspiration, balloon dilation, stenting, intra-arterial thrombolysis, or various combinations of these approaches. Re-occlusion often occurred after thrombectomy in atherosclerotic disease, therefore, rescue therapy including balloon dilation, stenting, intra-arterial thrombolysis, and glycoprotein IIb/IIIa inhibitor might be utilized to retrieve recanalization. After recanalization of the target artery, most of the patients were transferred to the neuro-intensive care unit for at least 24 hours with their systolic blood pressure maintained at 120-140 mmHg. Additionally, the patients who underwent extracranial or intracranial stent implantation were prescribed antithrombotic medication to prevent acute stent thrombosis. For the patients without prior intravenous alteplase, loading doses of clopidogrel (300 mg) and aspirin (300 mg) were given, or a low dose of glycoprotein IIb/IIIa inhibitor was bolus-injected intra-arterially and maintained for at least 24 hours, while for those with prior intravenous alteplase, clopidogrel (75 mg) and aspirin (100 mg) were given after 24h of alteplase administration, then all the patients were given clopidogrel (75 mg/d) and aspirin (100 mg/d) for 1-3 months.

eMethods 3. Definition of sICH and aICH

Intracranial hemorrhage was classified as one of the following subtype: Hemorrhagic infarction1 (HI1): scattered small petechiae, no mass effect; HI2: confluent petechiae, no mass effect; Parenchymal hematoma1 (PH1): hematoma within infarct tissue and occupied less than 30% of the infarct volume, no substantive mass effect; Parenchymal hematoma2 (PH2): hematoma occupied 30% or more of the infarct volume, with obvious mass effect; Remote parenchymal hematoma (rPH): parenchymal hematoma remote from the infarct tissue; Intraventricular hemorrhage (IVH); Subarachnoid hemorrhage (SAH); Subdural hemorrhage (SDH). sICH was diagnosed if the new observed intracranial hemorrhage was associated with any of the following conditions: 1) NIHSS score increased more than 4 points than that immediately before worsening; 2) NIHSS score increased more than 2 points in one category; 3) Deterioration led to intubation, hemicraniectomy, external ventricular drain placement or any other major interventions. Additionally, the symptom deteriorations could not be explained by causes other then the observed intracranial hemorrhage. Asymptomatic intracranial hemorrhage (aICH) was diagnosed if the new observed intracranial hemorrhage was not accompanied by any of the above conditions. For hemorrhage classified as PH2, even if the neurological function deteriorations could be attributed to infarction perse, the hemorrhage should be classified as sICH. However, for hemorrhage classified as HI1, HI2, PH1, rPH, IVH, SAH or SDH, if the neurological function deteriorations could be attributed to infarction per se, the hemorrhage should be classified as asymptomatic.

eTable 1. Ordinal regression model of primary outcome based on PSM dataset including the propensity score as a covariate

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[mRS 90 d = 0]	-9.286	2.959	9.846	1	.002	-15.086	-3.486
	[mRS 90 d = 1]	-7.967	2.945	7.320	1	.007	-13.739	-2.196
	[mRS 90 d = 2]	-7.551	2.941	6.592	1	.010	-13.316	-1.787
	[mRS 90 d = 3]	-7.303	2.939	6.175	1	.013	-13.064	-1.543
	[mRS 90 d = 4]	-6.616	2.934	5.086	1	.024	-12.366	-.866
	[mRS 90 d = 5]	-5.766	2.928	3.878	1	.049	-11.505	-.027
Location	age	.004	.012	.101	1	.751	-.020	.027
	pc-ASPECTS baseline	-.315	.112	7.894	1	.005	-.534	-.095
	NIHSS baseline	.096	.013	51.933	1	.000	.070	.123
	Onset to imaging diagnosis time	.000	.000	1.215	1	.270	-.001	.000
	Propensity score	-2.423	1.669	2.109	1	.146	-5.695	.848
	Onset to outcome measurement	-.047	.028	2.861	1	.091	-.101	.007
	[group=0]	1.086	.242	20.161	1	.000	.612	1.561
	[group=1]	0[a]			0			
	[diabetes mellitus=0]	.042	.279	.022	1	.881	-.505	.589
	[diabetes mellitus=1]	0[a]			0			
	[Ischemic stroke=0]	-.354	.290	1.487	1	.223	-.922	.215
	[Ischemic stroke=1]	0[a]			0			
	[sex=0]	-.427	.265	2.582	1	.108	-.947	.094
	[sex=1]	0[a]			0			
	[IV Thrombolysis=0]	.574	.293	3.835	1	.050	-.001	1.149
	[IV Thrombolysis=1]	0[a]			0			
	[BA Distal=1]	-.514	.418	1.507	1	.220	-1.334	.306
	[BA Middle=2]	.277	.378	.536	1	.464	-.464	1.018
	[BA Proximal=3]	.007	.529	.000	1	.989	-1.029	1.044

		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
	[VA-V4=4]	0[a]			0			

Link function: Logit.

a. This parameter is set to zero because it is redundant.

eTable 2. Multivariate regression models of outcomes based on the full dataset including the propensity score as a covariate

	Effect variable	Adjusted Value[1] (95%CI)	*P* value	Adjusted Value[2] (95%CI)	*P* value
Primary efficacy outcome					
mRS at 90 days	cOR	2.91(1.96 to 4.34)	< 0.001	2.98(2.01 to 4.42)	< 0.001
Secondary efficacy outcomes					
mRS 0~3 at 90 days	OR	4.21(2.25 to 7.90)	< 0.001	4.70(2.53 to 8.75)	< 0.001
mRS 0~2 at 90 days	OR	4.70(2.32 to 9.52)	< 0.001	4.90(2.43 to 9.87)	< 0.001
mRS 0~1 at 90 days	OR	4.57(2.17 to 9.61)	< 0.001	4.54(2.16 to 9.56)	< 0.001
NIHSS score change from baseline at 24 hours	Beta	-2.62(-4.19 to -1.04)	0.001	-2.57(-4.13 to -1.01)	0.001
NIHSS score change from baseline at 5~7 days	Beta	-5.39(-7.38 to -3.40)	< 0.001	-5.37(-7.35 to -3.40)	< 0.001
Safety outcomes					
Mortality at 90 days	OR	2.81(1.86 to 4.24)	< 0.001	2.93(1.95 to 4.40)	< 0.001

Adjusted estimates of effect were calculated using multiple ordinal and binary logistic regression and linear regression taking the following variables into account: age, baseline NIHSS, baseline pc-ASPECTS, onset to imaging diagnosis time, sex, diabetes mellitus, ischemic stroke, IVT, location of occlusion, and propensity score.

1 Model 1: Propensity score was included in model as a continuous variable.

2. Model 2: Propensity score was divided into 4 categories according interquartile and included in model as a categorical variable.

Abbreviations: CI = confidence interval; cOR = common odds ratio; mRS = modified Rankin Scale score; NIHSS= National Institutes of Health Stroke Scale; OR = odds ratio.

eTable 3. Data elements in the BASILAR cohort study

Category	Example variable
Demographics	Age and sex
Medical history	Hypertension, hyperlipidemia, diabetes, atrial fibrillation, chronic heart failure, valvular heart disease, stroke, transient ischemic attack, intracerebral hemorrhage, chronic obstructive pulmonary disease, hyperhomocysteine, chronic renal failure and current smoker
Laboratory measures	Blood cell counts, triglyceride, cholesterol, low density lipoprotein, high density lipoprotein, homocysteine, glucose, procalcitonin, HbA1C, prothrombin time, activated partial thromboplastin time, thrombin time, fibrinogen, D-dimer, international normalized ratio
Clinical characteristics	Stroke severity at time of treatment, NIHSS score at admission, GCS score at admission, premorbid mRS score, systolic blood pressure at admission and presumed stroke etiology by TOAST type[2]
Imaging characteristics	Preoperative pc-ASPECTS on non-contrast CT, occlusion sites and collateral state*
Procedural characteristics	Intravenous thrombolytic therapy, anesthesia methods, process time (onset to door time, door to imaging time, door to needle time, door to puncture time, door to recanalization time, onset to imaging time, onset to puncture time, onset to recanalization, puncture to revascularization time), operation methods, passes of thrombectomy, thrombectomy device, intraoperative medication
Outcome measures	mRS score at 90 days, proportion of mRS score 0~3 vs. 4~6, proportion of mRS score 0~2 vs. 3~6, proportion of mRS score 0~1 vs. 2~6, post-procedure mTICI, vessel recanalization evaluated by CTA or MRA at 24 hours, NIHSS score at 24 hours and at 5-7days or discharge, GCS score at 24 hours and at 5-7days or discharge
Safety aspects	Death, symptomatic intracerebral hemorrhage, gastrointestinal hemorrhage, systemic complications (e.g., stroke-associated pneumonia, cerebral hernia, heart failure, respiratory failure, urinary infection, deep venous thrombosis), procedure- and device-related complications (e.g., arterial perforation, arterial dissection, embolization to previously uninvolved arteries, device failure, access-site complications)

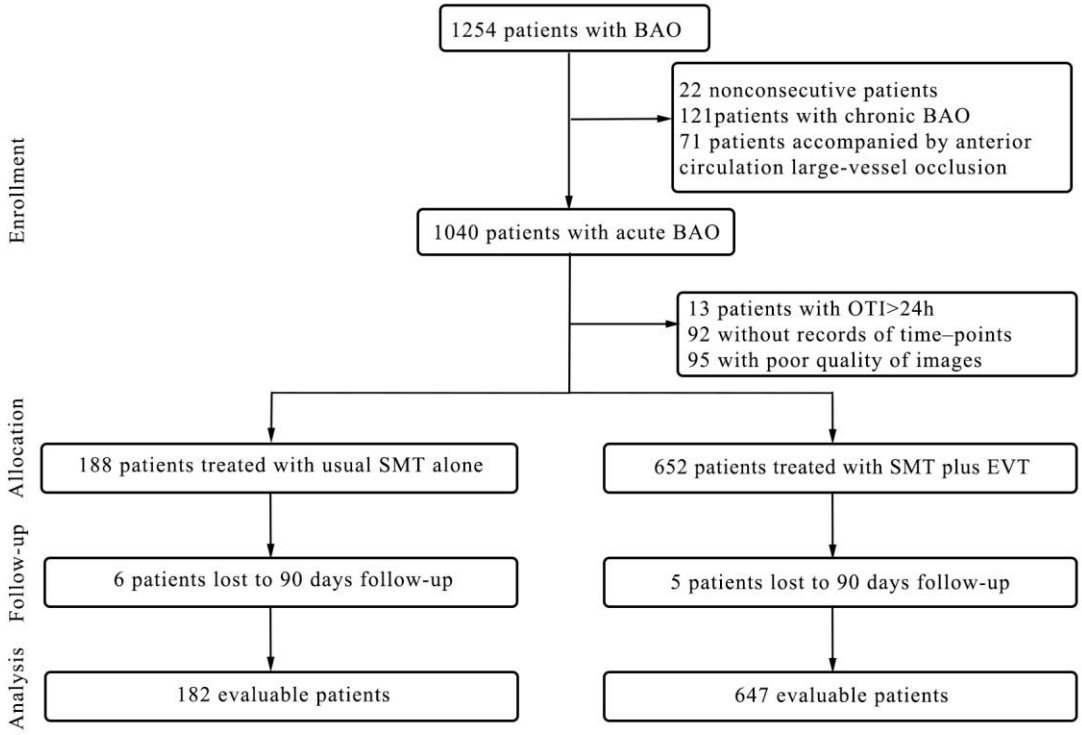
Abbreviations: BAO= basilar artery occlusion; NIHSS[3]= National Institute Health Stroke Scale; GCS= Glasgow Coma Scale; pc-ASPECTS[4]=posterior circulation-Alberta Stroke Program Early Computed Tomography Score; mRS[5]= Modified Rankin Scale; CTA= computed tomography angiography; MRA= magnetic resonance angiography; mTICI[6]=modified thrombolysis in cerebral infarction; Symptomatic intracerebral hemorrhage was assessed according to the Heidelberg Bleeding Classification[7]. * Collateral flow grading was estimated through the American Society of Interventional and Therapeutic Neuroradiology/Society of Interventional Radiology (ASITN/SIR)[8]system, Basilar Artery on Computed Tomography Angiography (BATMAN) score[9], the Posterior Circulation Collateral score (PC-CS)[10].

eTable 4. Participating centers and eligible patients

Participating centers	N=829
Nanyang Central Hospital	71(8.6%)
The First Affiliated Hospital of Jilin University	57(6.9%)
Linyi People's Hospital	45(5.4%)
Affiliated Hangzhou First People's Hospital, Zhejiang University School of Medicine	39(4.7%)
Zhangzhou Affiliated Hospital of Fujian Medical University	39(4.7%)
The 900th Hospital of The People's Liberation Army	38(4.6%)
The 924th Hospital of The People's Liberation Army	35(4.2%)
Changsha Central Hospital	31(3.7%)
Zhongshan People's Hospital	30(3.6%)
The 904th Hospital of The People's Liberation Army (Wuxi City)	28(3.4%)
Northern Theater General Hospital of The People's Liberation Army	25(3.0%)
The 909th Hospital of The People's Liberation Army	25(3.0%)
Wuhan No. 1 Hospital	24(2.9%)
Xinqiao Hospital and the Second Affiliated Hospital, Army Medical University	21(2.5%)
The First People's Hospital of Yangzhou, Yangzhou University	19(2.3%)
The First People's Hospital of Chenzhou	18(2.2%)
Ganzhou People's Hospital	17(2.1%)
Zhuzhou Central Hospital	17(2.1%)
Yijishan Hospital of Wannan Medical College	16(1.9%)
Chinese Medical Hospital of Maoming	15(1.8%)
Yunfu People's Hospital	15(1.8%)
The First Affiliated Hospital of Henan Science and Technology University	14(1.7%)
Hubei Zhongshan Hospital	14(1.7%)
Jilin Central Hospital	13(1.6%)
Yuhuangding Hospital, Qingdao University	13(1.6%)
Changle People's Hospital	12(1.4%)
Affiliated Hospital of Guangdong Medical University	12(1.4%)
Xiangyang Central Hospital, Hubei Arts and Science University	12(1.4%)
Chinese Medical Hospital of Zhongshan	12(1.4%)
Lu'an Affiliated Hospital of Anhui Medical University	11(1.3%)
Hubei Province People's Hospital	10(1.2%)
The 902th Hospital of The People's Liberation Army	10(1.2%)
The First Affiliated Hospital of Shandong First Medical University	9(1.1%)
Sichuan Provincial People's Hospital	9(1.1%)
Xuzhou Central Hospital	8(1.0%)
Taihe Affiliated Hospital of Hubei Medical University	6(0.7%)
Baise People's Hospital	5(0.6%)
The Affiliated Huaian No.1 People's Hospital of Nanjing Medical University	5(0.6%)
The Third Hospital of Shandong Province	5(0.6%)
The Chinese Armed Police Force Guangdong Armed Police Corps Hospital	5(0.6%)
The Third People's Hospital of Zigong	5(0.6%)

Participating centers	N=829
The Third Affiliated Hospital of Guangzhou Medical University	4(0.5%)
Hubei Wuchang Hospital	3(0.4%)
The First People’s Hospital of Xiangyang, Hubei Medical University	3(0.4%)
Affiliated Hospital of North Sichuan Medical College	2(0.2%)
Guiping People's Hospital	1(0.1%)
The 476th Hospital of The People’s Liberation Army	1(0.1%)

eFigure 1. Consort flow diagram of the BASILAR study

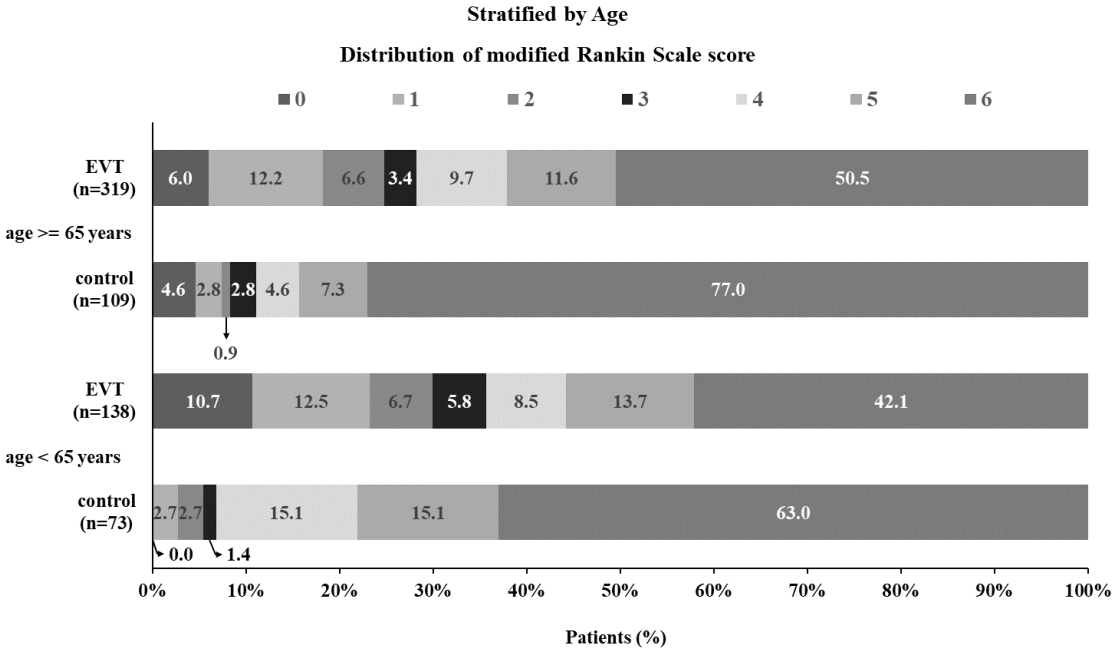


Abbreviations: BAO = basilar artery occlusion; EVT = endovascular treatment; OTI = onset to imaging diagnosis time; SMT = standard medical treatment

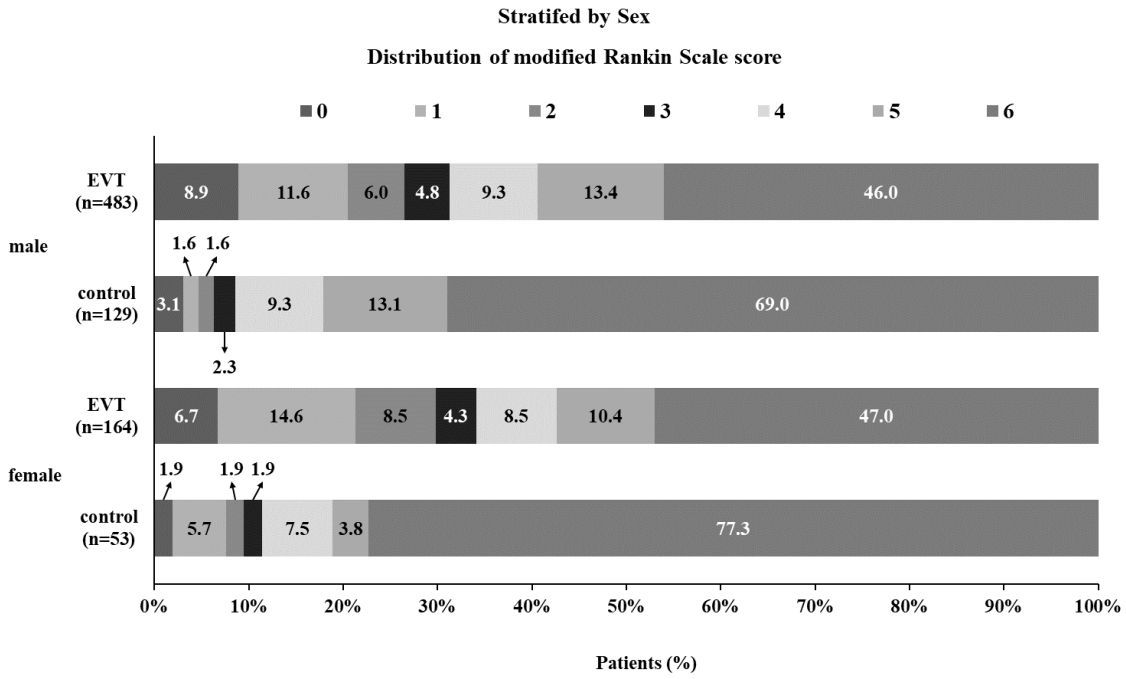
eFigure 2. Distribution of the BASILAR study centers on the map of China

The BASILAR is a nationwide prospective registry which compromised 47 comprehensive stroke centers across 15 provinces in China. These provinces account for 65.91% of the country's population and cover an area of 27.75% of China. Therefore, the patients recruited in this study are good representative.

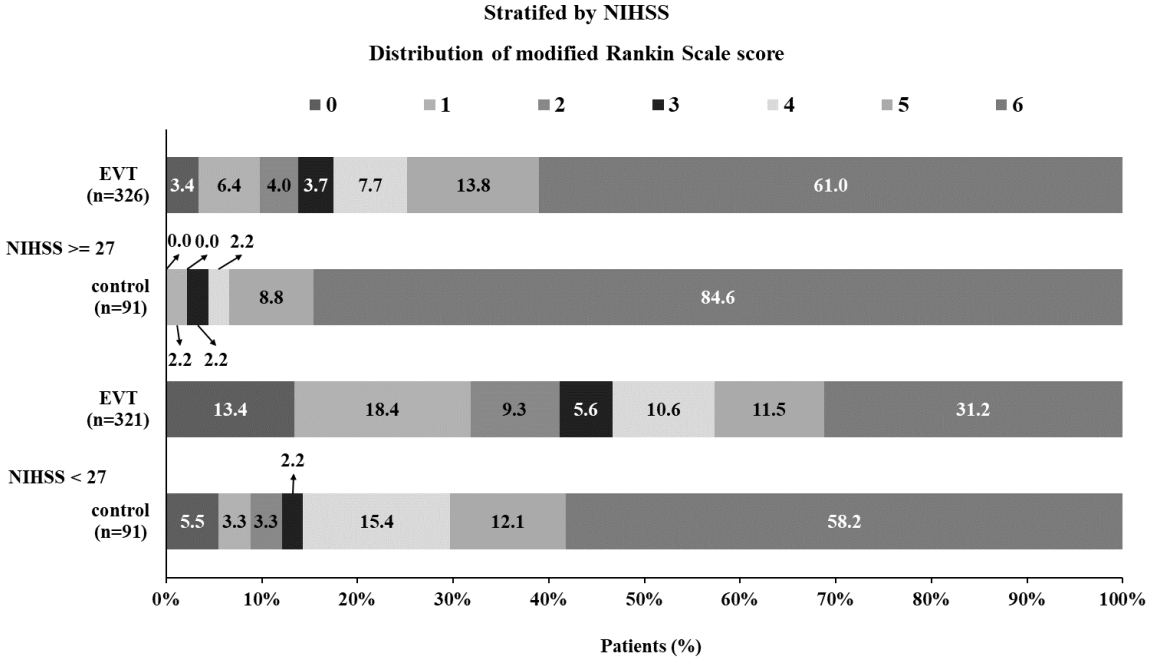
eFigure 3. Horizontal stacked bar graphs of mRS outcome by key co-variables in all subjects. Distribution of modified Rankin Scale score at 90 days of all subjects with age >= 65 years vs. < 65 years. Threshold for age was chosen at the median. EVT denotes endovascular treatment.



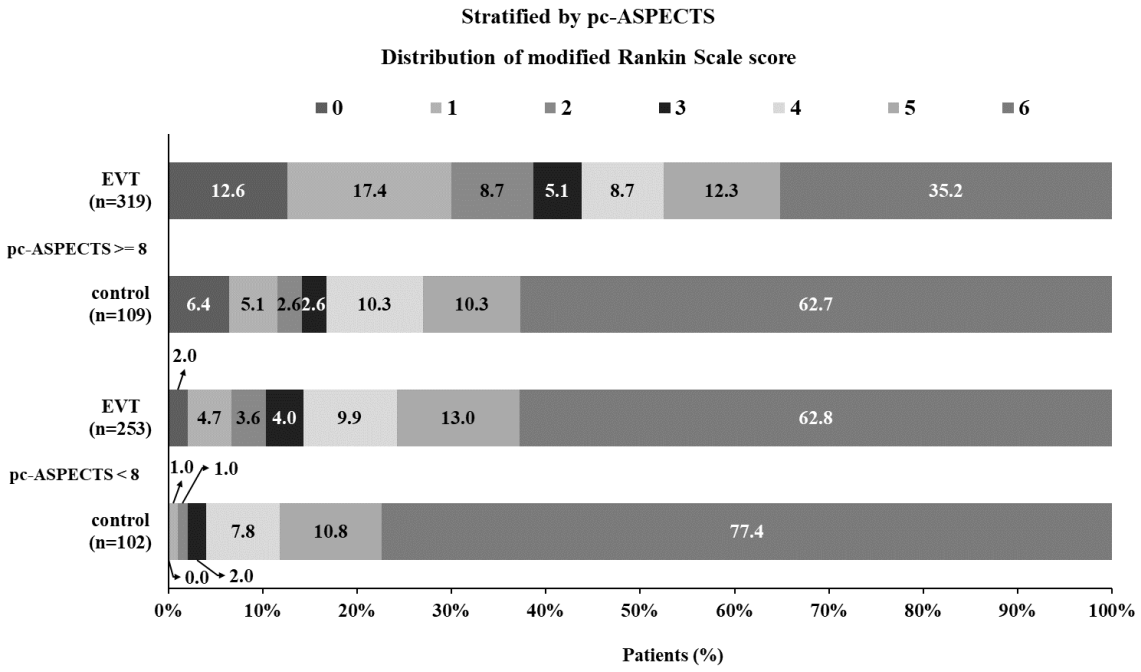
eFigure 4. Distribution of modified Rankin Scale score at 90 days of all subjects stratified by sex.



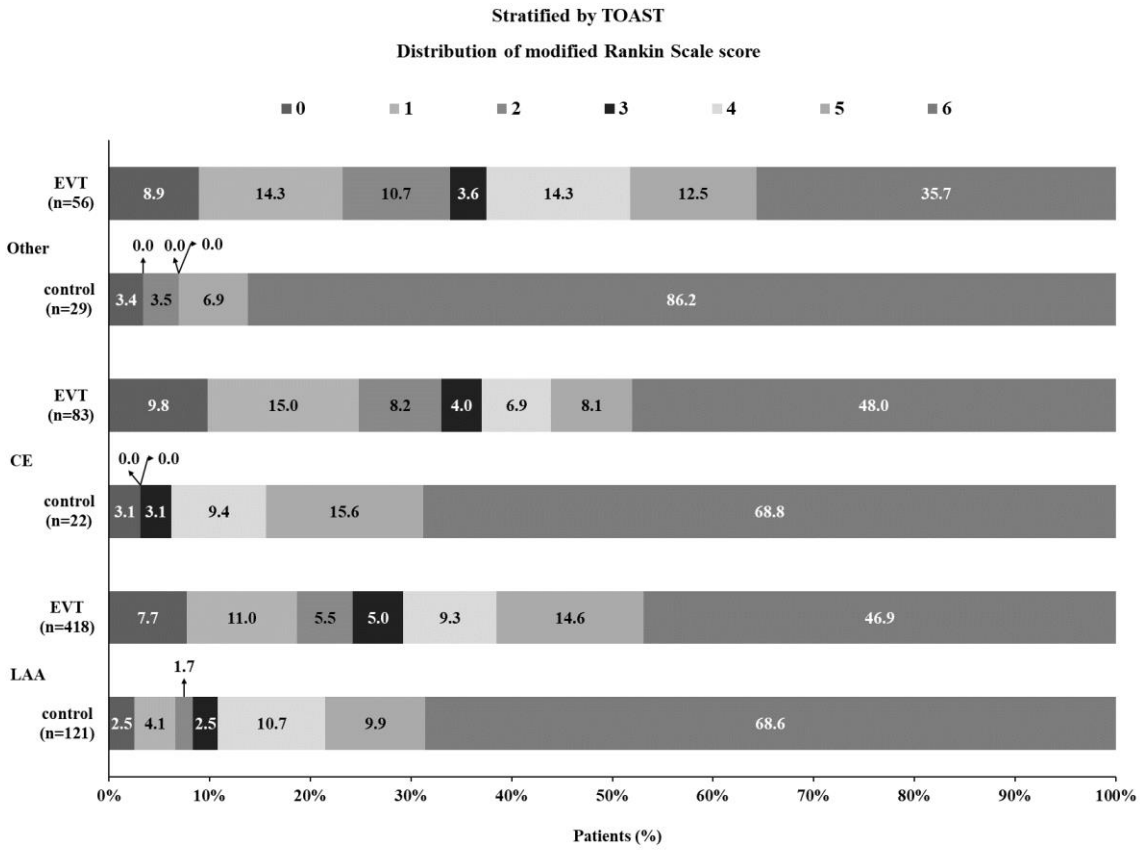
eFigure 5. Distribution of modified Rankin Scale score at 90 days of all subjects with stratified by baseline NIHSS (>= 27 or < 27). Threshold for NIHSS was chosen at the median. NIHSS denotes National Institutes of Health Stroke Scale.



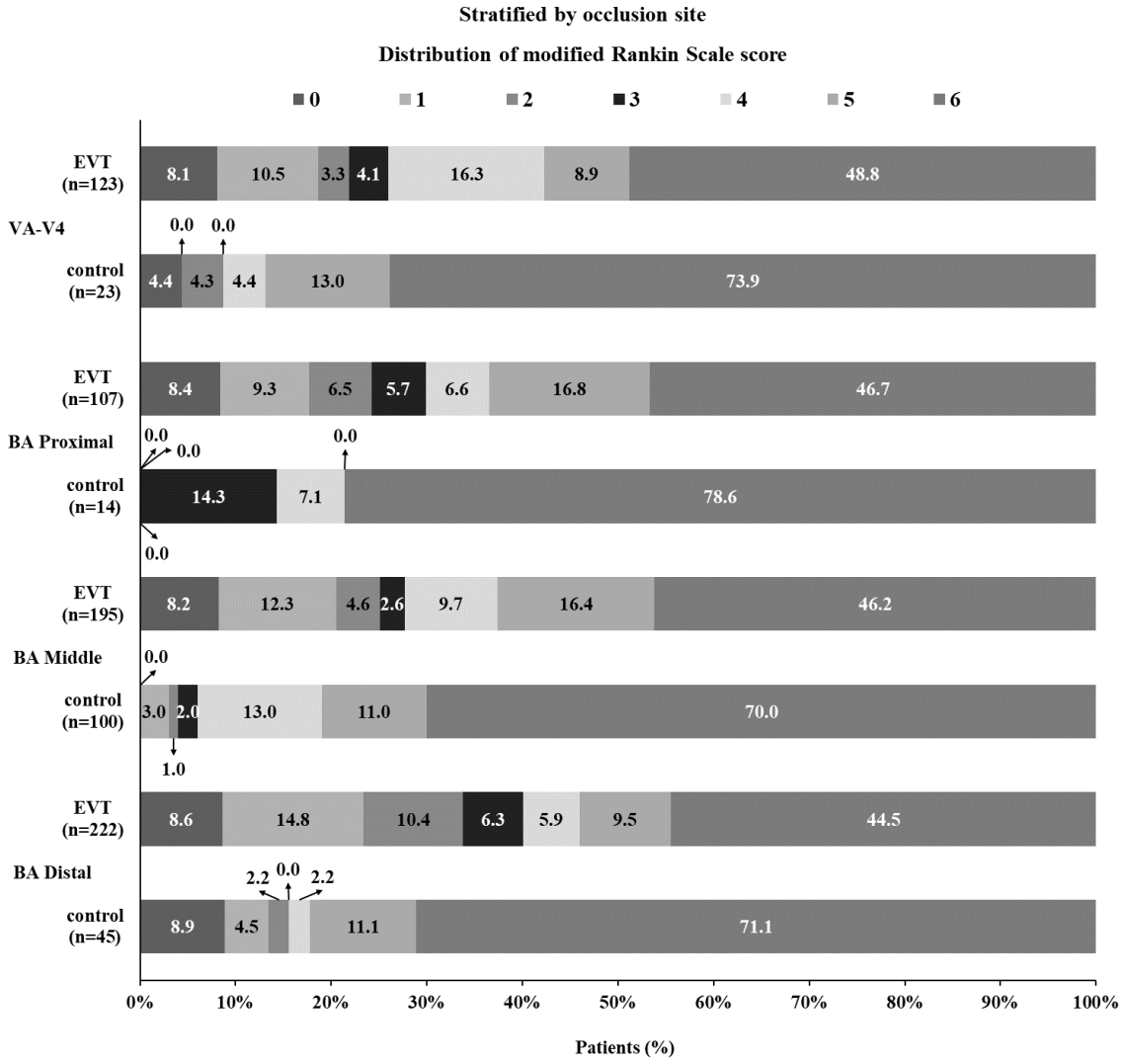
eFigure 6. Distribution of modified Rankin Scale score at 90 days of all subjects with baseline pc-ASPECTS < 8 vs. >= 8. Six subjects missing information about the pc-ASPECTS score. Threshold for pc-ASPECTS was chosen at median. pc-ASPECTS denotes posterior circulation-Alberta Stroke Program Early Computed Tomography Score.



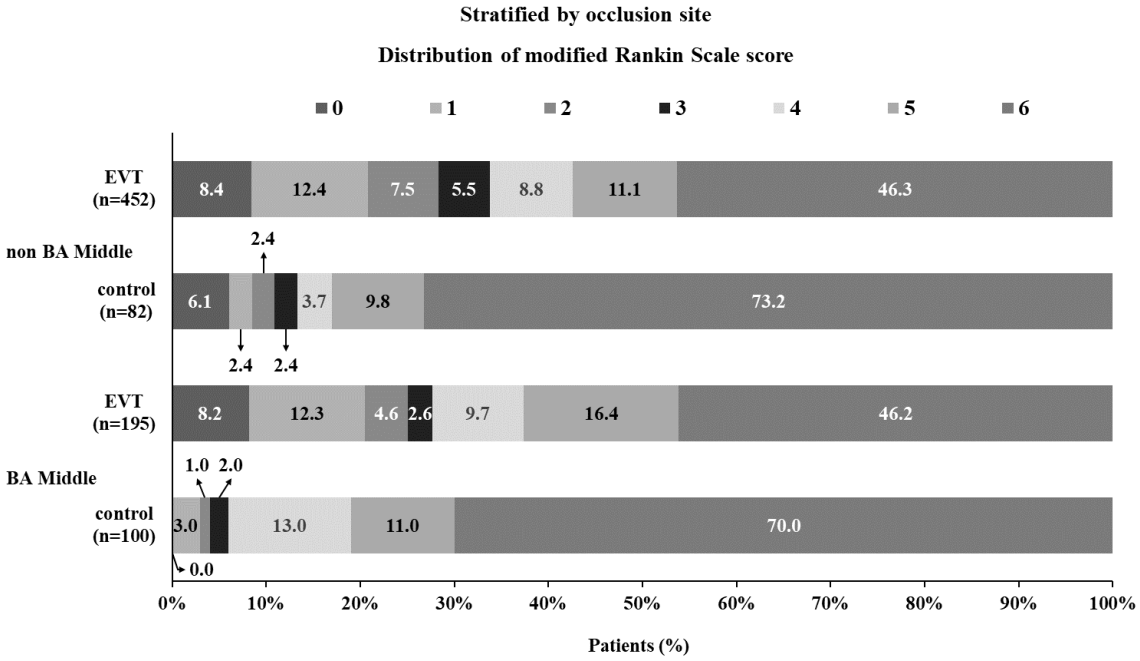
eFigure 7. Distribution of modified Rankin Scale score at 90 days of all subjects stratified by TOAST subtype (large artery atherosclerosis (LAA) or cardiac embolism (CE) or other).



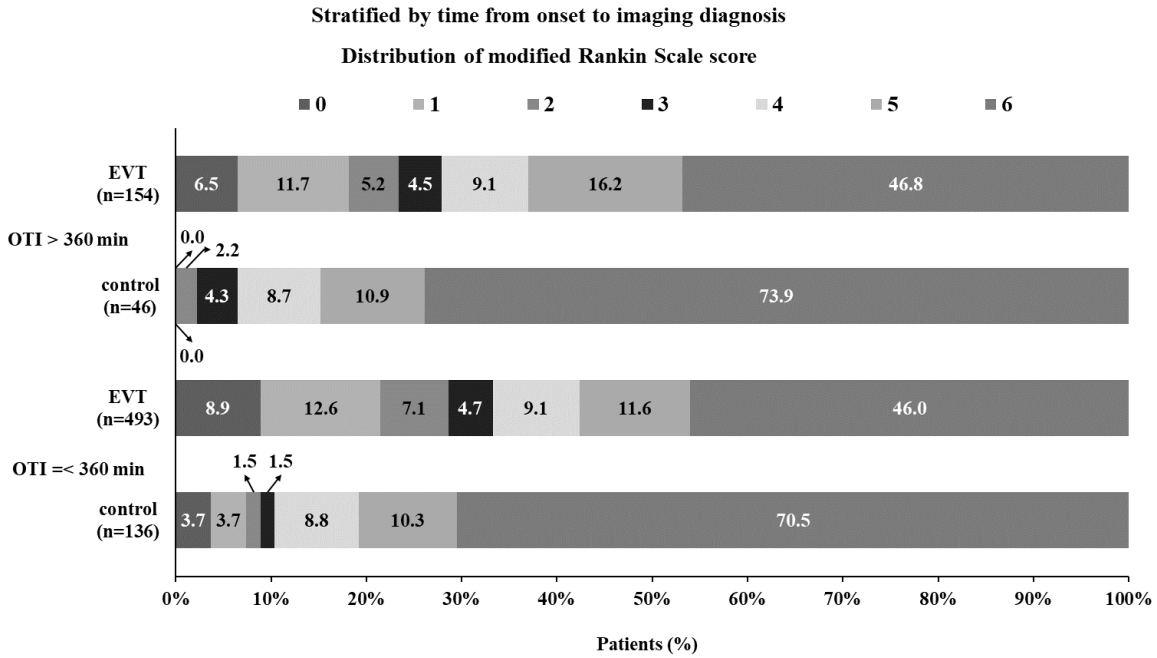
eFigure 8. Distribution of modified Rankin Scale score at 90 days of all subjects stratified by occlusion site (BA distal or BA middle or BA proximal or VA-V4). BA denotes basilar artery, VA-V4 the 4th segment of vertebral artery.



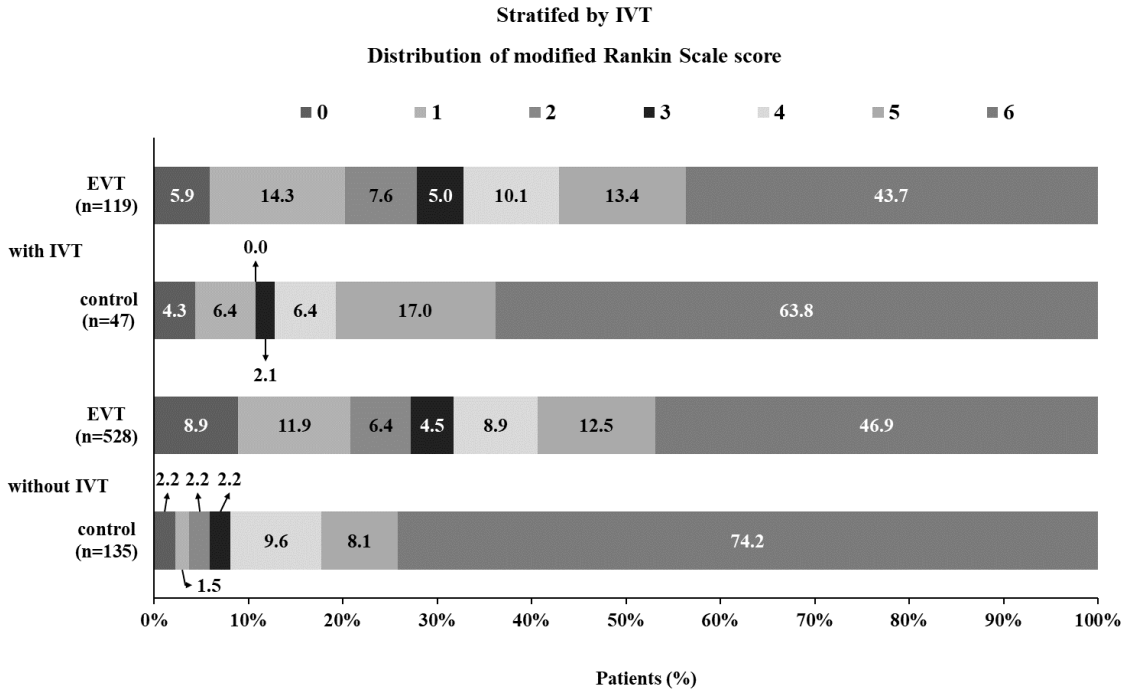
eFigure 9. Distribution of modified Rankin Scale score at 90 days of all subjects stratified by occlusion site (BA middle or non BA middle). BA denotes basilar artery.



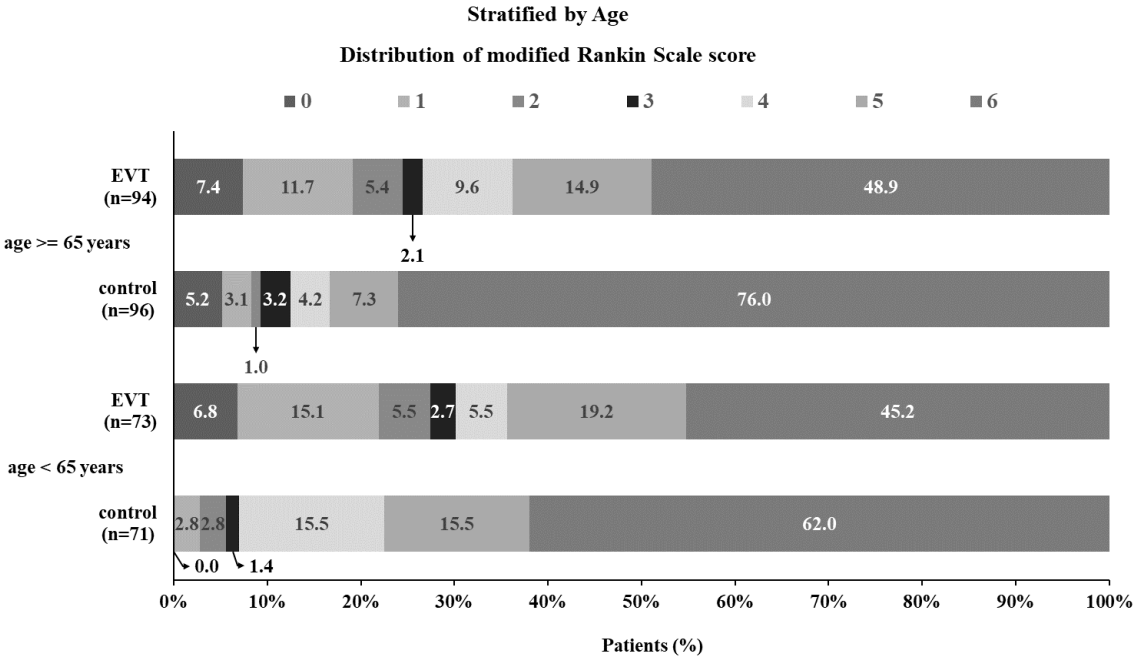
eFigure 10. Distribution of modified Rankin Scale score at 90 days of all subjects with time from stroke onset to imaging diagnosis (OTI) <= 360 min vs. > 360 min. Threshold for time was chosen at the 75th percentile.



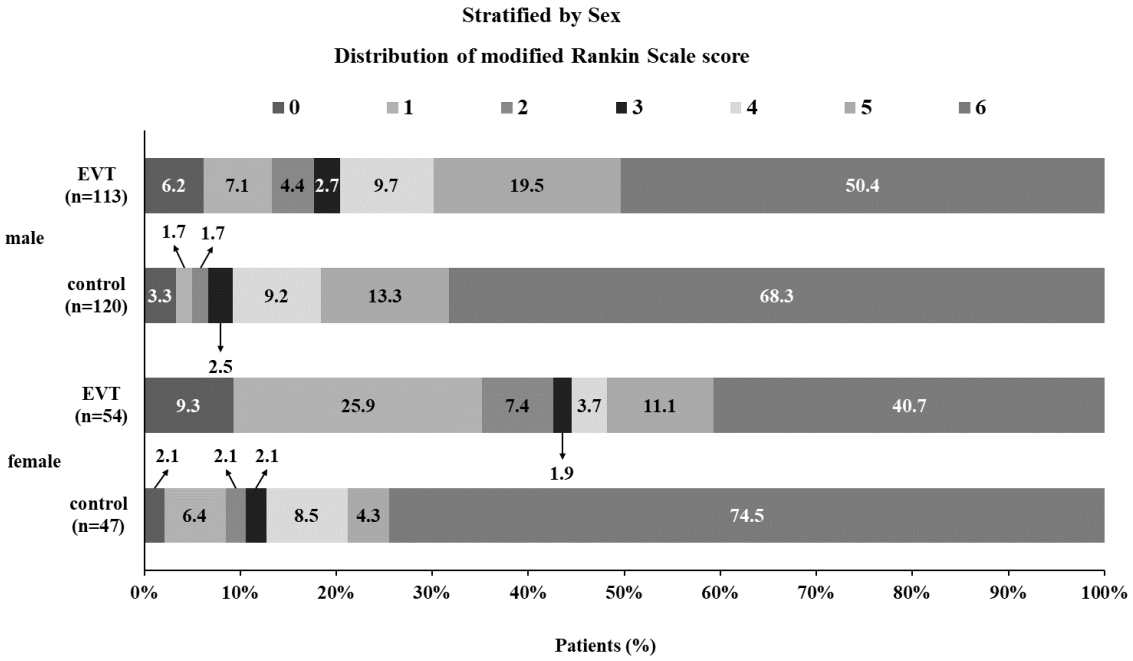
eFigure 11. Distribution of modified Rankin Scale score at 90 days of all subjects stratified by intravenous thrombolysis (IVT).



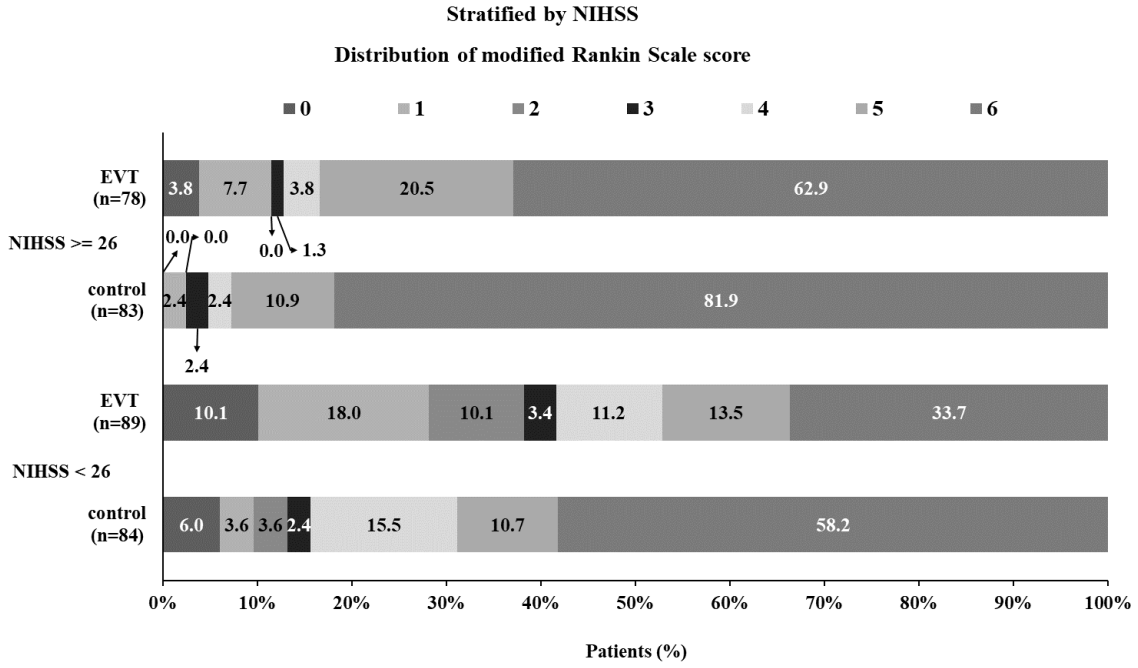
eFigure 12. Horizontal stacked bar graphs of mRS outcome by key co-variables in the propensity score matching (PSM) dataset Distribution of modified Rankin Scale score at 90 days of the patients in the PSM dataset with age >= 65 years vs. < 65 years. Threshold for age was chosen at the median. EVT denotes endovascular treatment.



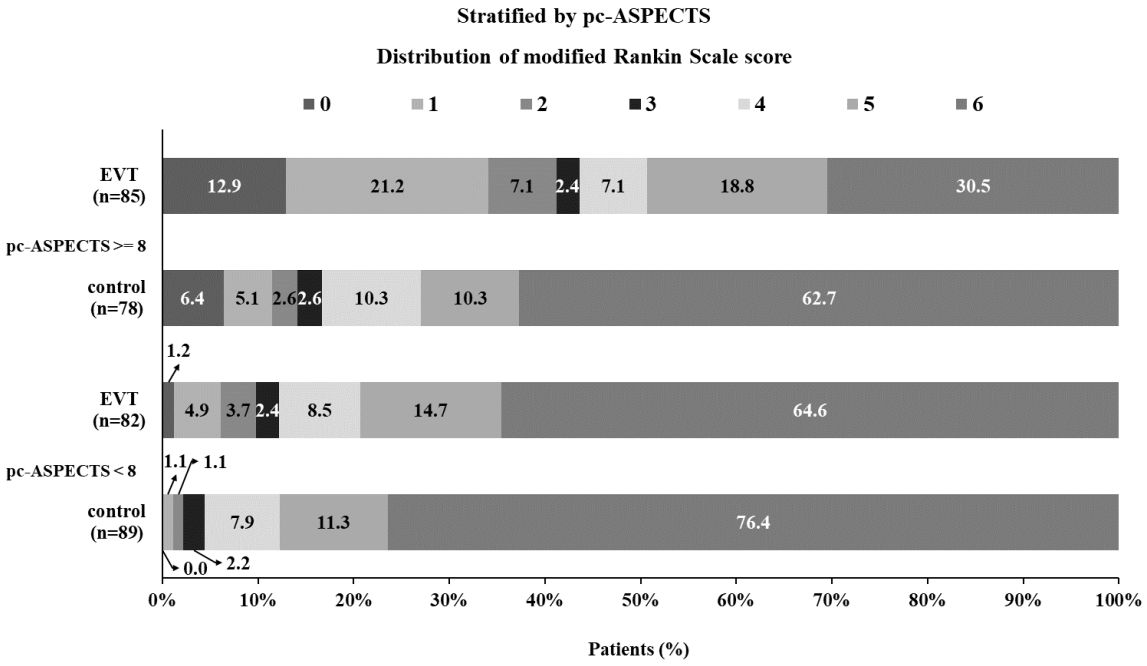
eFigure 13. Distribution of modified Rankin Scale score at 90 days of the patients in the PSM dataset stratified by sex.



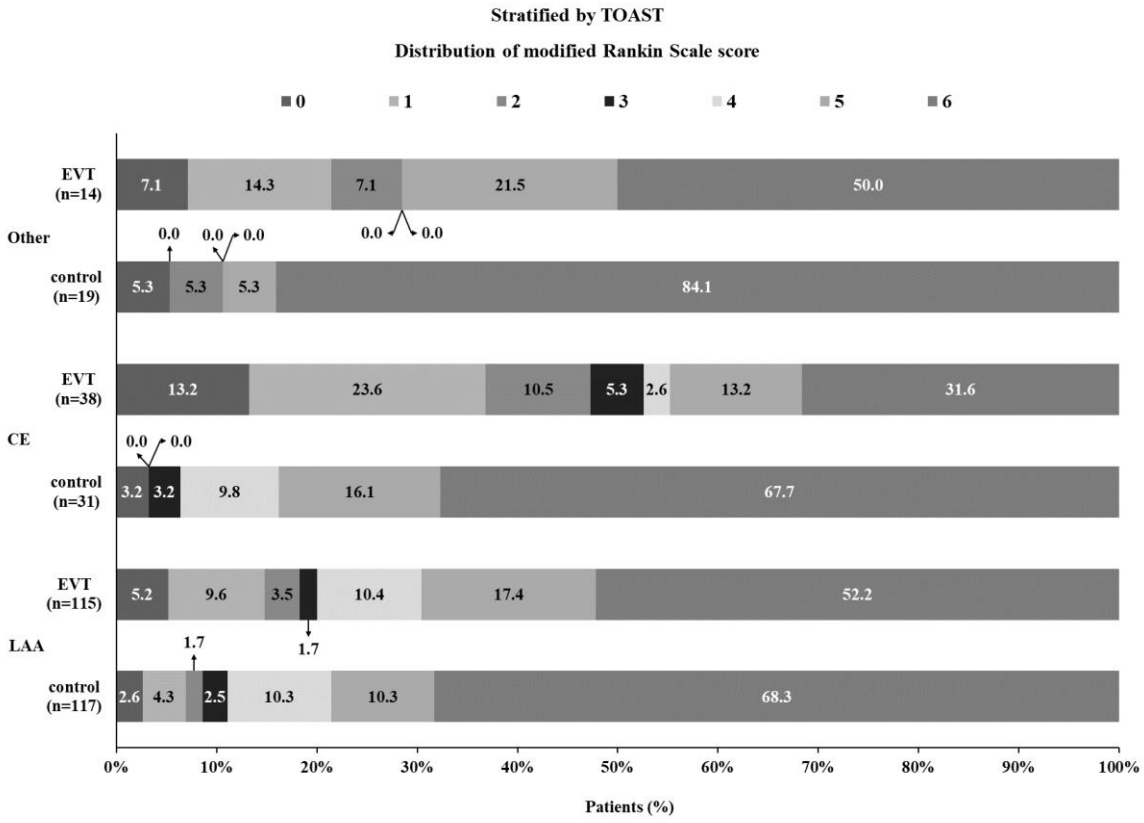
eFigure 14. Distribution of modified Rankin Scale score at 90 days of the patients in the PSM dataset with stratified by baseline NIHSS (>= 26 or < 26). Threshold for NIHSS was chosen at the median. NIHSS denotes National Institutes of Health Stroke Scale.



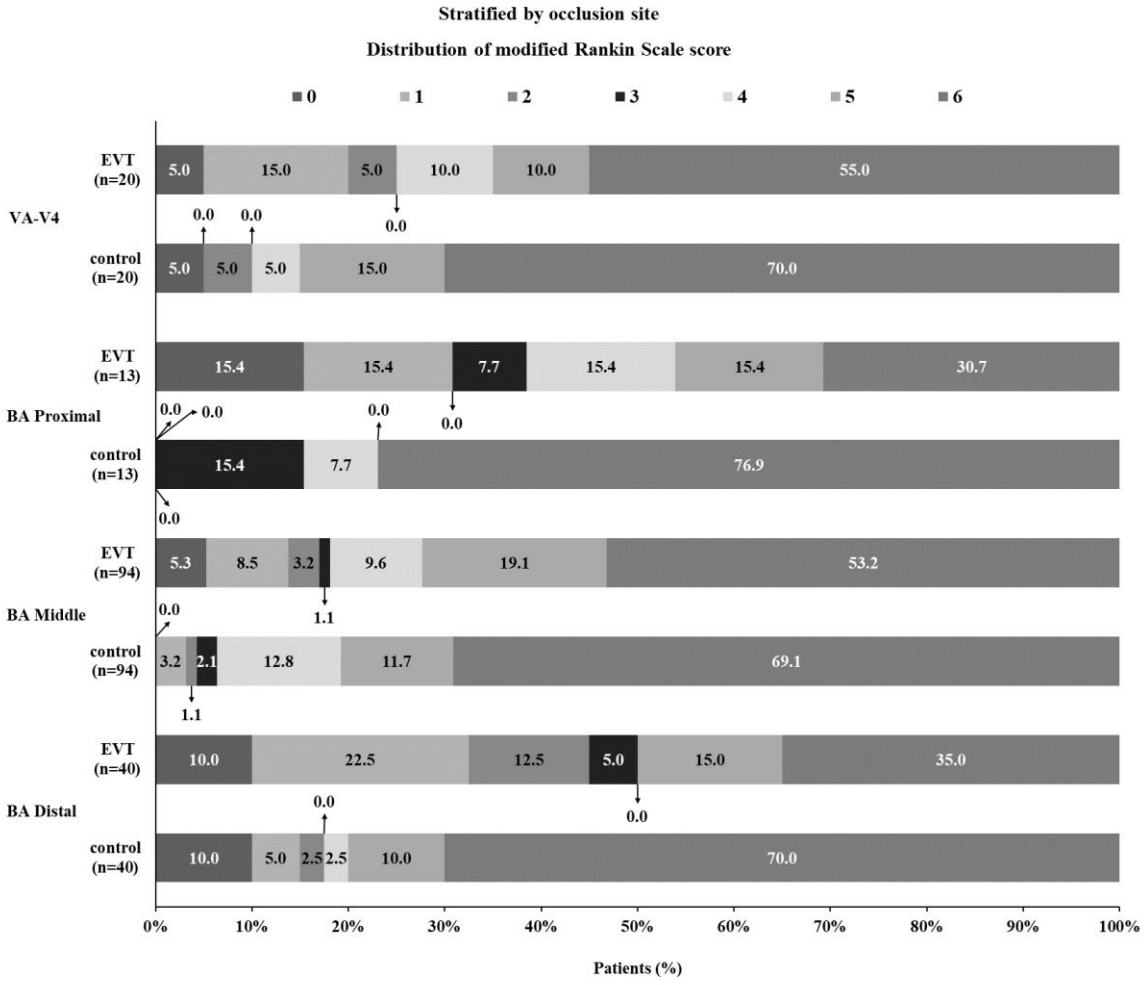
eFigure 15. Distribution of modified Rankin Scale score at 90 days of the patients in the PSM dataset with baseline pc-ASPECTS < 8 vs. >= 8. Threshold for ASPECTS was chosen at median. pc-ASPECTS denotes posterior circulation-Alberta Stroke Program Early Computed Tomography Score.



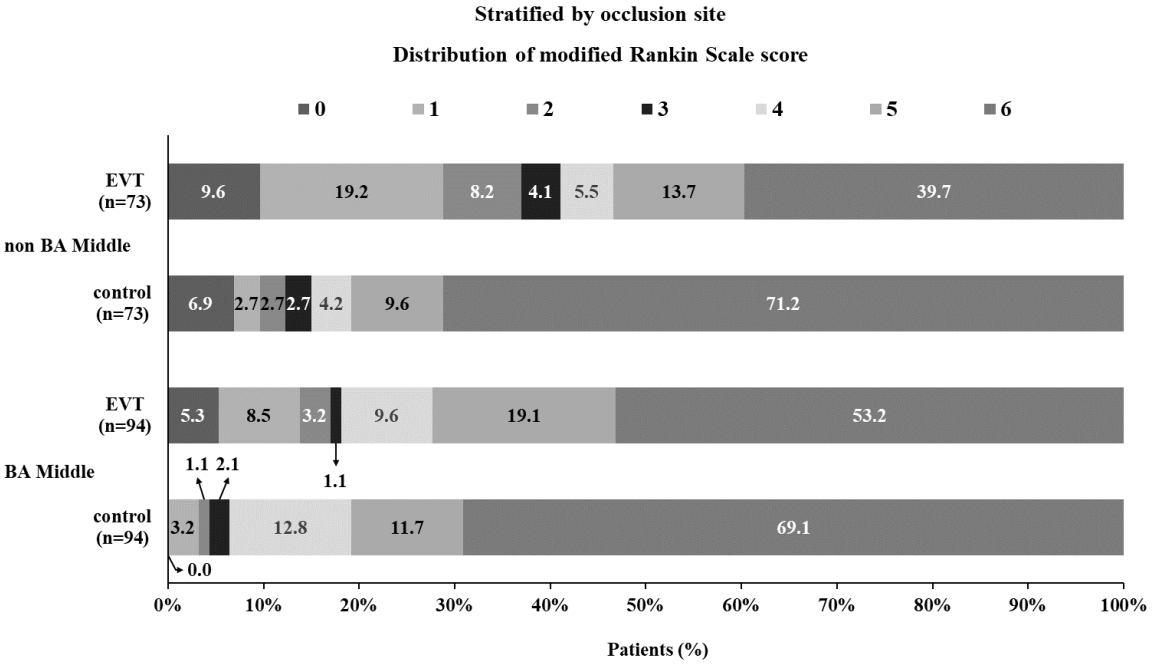
eFigure 16. Distribution of modified Rankin Scale score at 90 days of the patients in the PSM dataset stratified by TOAST subtype (large artery atherosclerosis (LAA) or cardiac embolism (CE) or other).



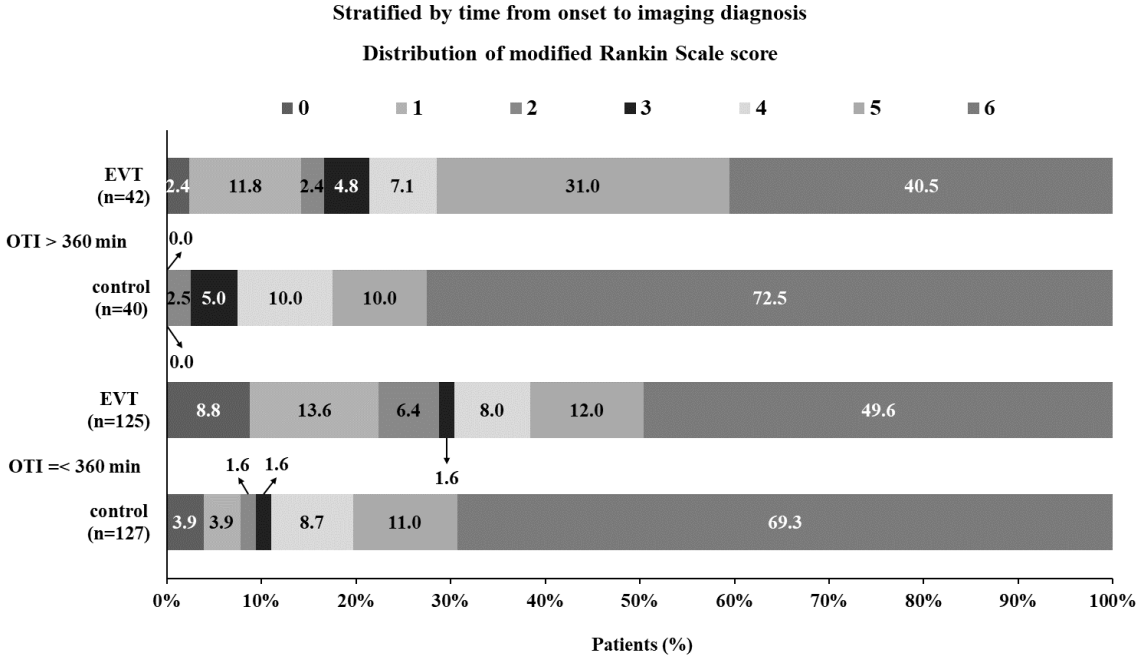
eFigure 17. Distribution of modified Rankin Scale score at 90 days of the patients in the PSM dataset stratified by occlusion site (BA distal or BA middle or BA proximal or VA-V4). BA denotes basilar artery, VA-V4 the 4th segment of vertebral artery.



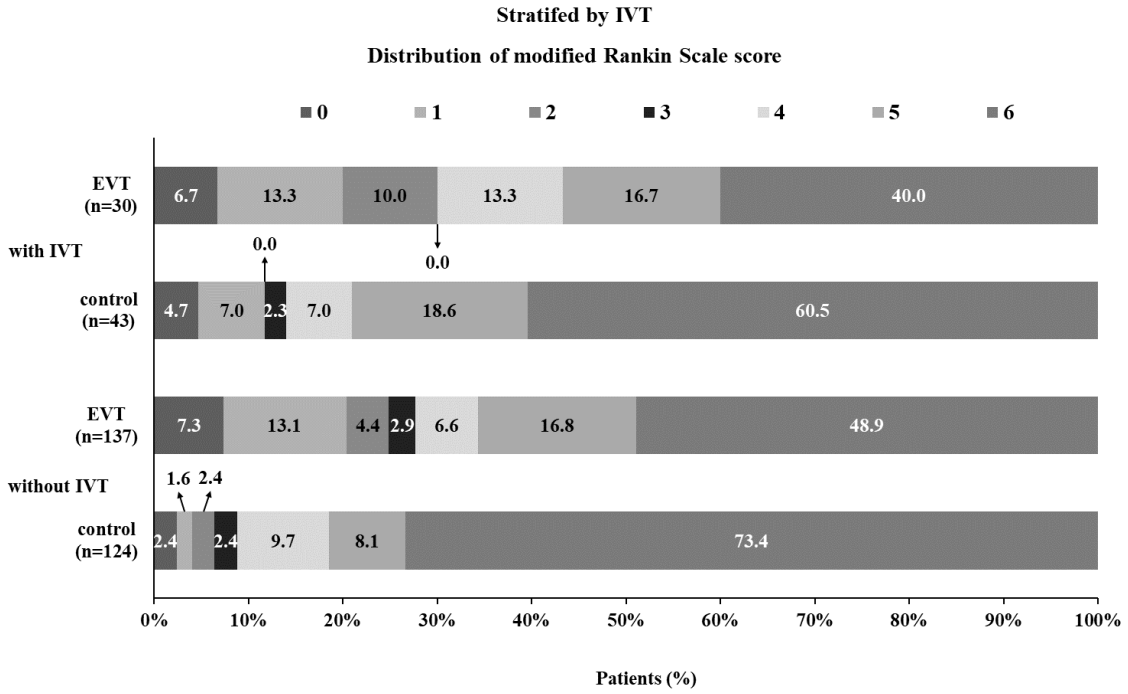
eFigure 18. Distribution of modified Rankin Scale score at 90 days of the patients in the PSM dataset stratified by occlusion site (BA middle or non BA middle). BA denotes basilar artery.



eFigure 19. Distribution of modified Rankin Scale score at 90 days of the patients in the PSM dataset with time from stroke onset to imaging diagnosis (OTI) <= 360 min vs. > 360 min. Threshold for time was chosen at the 75th percentile.



eFigure 20. Distribution of modified Rankin Scale score at 90 days of the patients in the PSM dataset stratified by intravenous thrombolysis (IVT).



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