

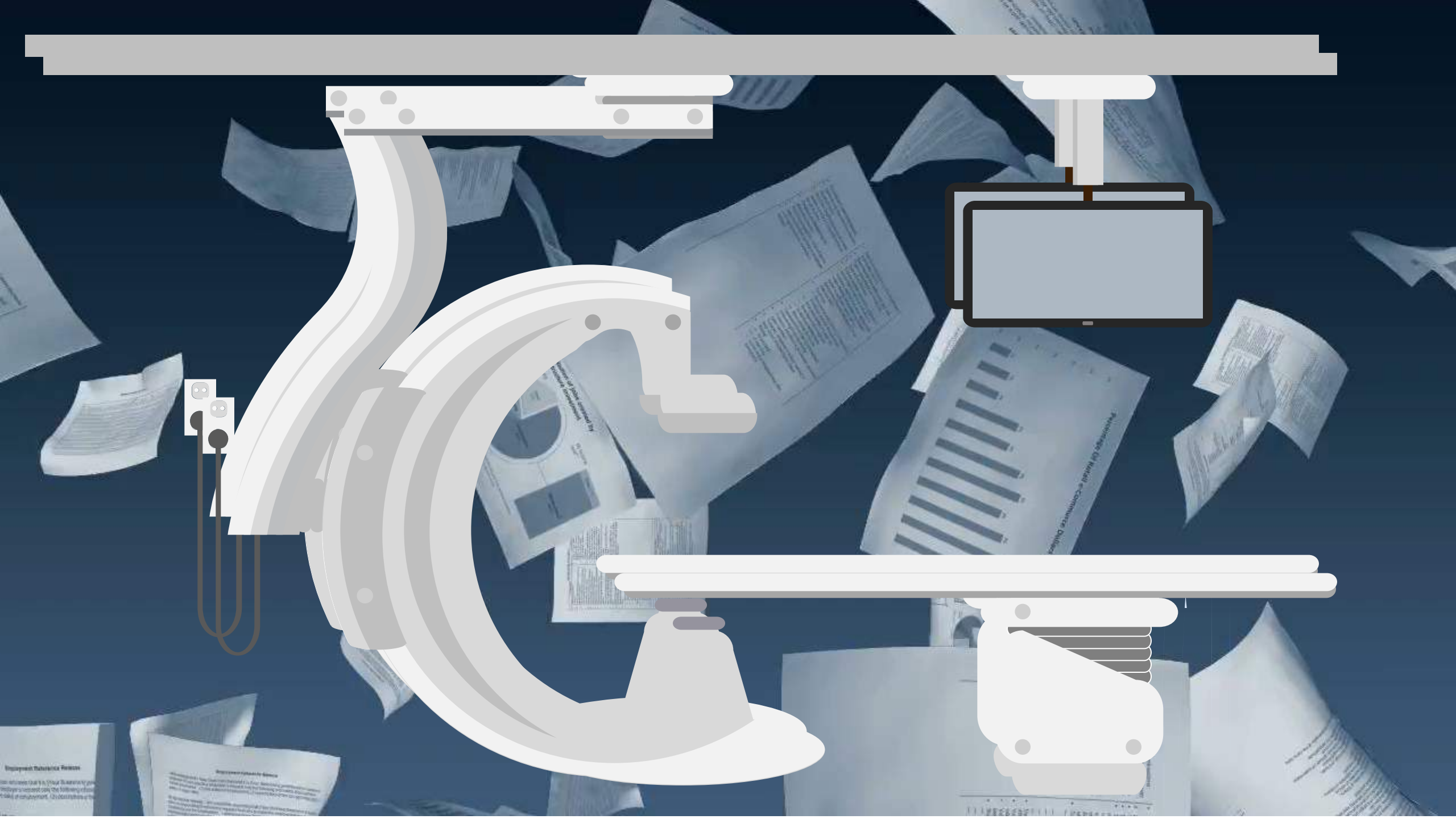


Akut İnmede Endovasküler Tedavi ile İlgili Güncel Çalışmalar



Doç. Dr. Bilgehan Atılgan ACAR

Sakarya Üniversitesi Tıp Fakültesi
Nöroloji A.D.



Stroke

CLINICAL AND POPULATION SCIENCES



Endovascular Treatment for Acute Ischemic Stroke With or Without General Anesthesia: A Matched Comparison

Benjamin Wagner¹, MD*; Johannes Lorscheider², MD*; Andrea Wiencierz³, PhD; Kristine Blackham⁴, MD; Marios Psychogios⁵, MD; Daniel Bolliger⁶, MD; Gian Marco De Marchis, MD; Stefan T. Engelter⁷, MD; Philippe Lyrer⁸, MD; Patrick R. Wright⁹, PhD; Urs Fischer¹⁰, MD; Pasquale Mordasini, MD; Stefania Nannoni¹¹, MD; Francesco Puccinelli, MD; Timo Kahles¹², MD; Giovanni Bianco¹³, MD; Emmanuel Carrera¹⁴, MD; Andreas R. Luft¹⁵, MD; Carlo W. Cereda¹⁶, MD; Georg Kägi¹⁷, MD; Johannes Weber¹⁸, MD; Krassen Nedeltchev, MD; Patrik Michel¹⁹, MD; Jan Gralla, MD; Marcel Arnold, MD; Leo H. Bonati²⁰, MD; on behalf of the Swiss Stroke Registry Investigators†

MAKALE -1

Dergi: Stroke / Mayıs 2022

Konu: Aİİ-EVT GA(+) / GA(-)

Ülke: İsviçre (Swiss Stroke Registry)
8 Merkez

Çalışma: Retrospektif

Ocak 2014 - Haziran 2017 / Anterior LVO & tüm EVT'ler

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GA (+)
n=851

GA(-)
n=433

Primer Sonlanım: 3. ay (mRS)

Sekonder sonlanım: *3.ay bağımsızlık/ölüm, *3 ay mortaslite, *3 ay içinde rekürren inme, *EVT sonrası 1. gün NIHSS, *24. saat BT'de ICH-hemorajik transformasyon, *sICH, *Dekompresif kraniektomi

Table 1. Patient Baseline Characteristics by Type of Anesthesia (Unmatched Analysis)

	GA	Non-GA	SMD
n=1284	851	433	
Sex male, n (%)	436 (51.2)	231 (53.3)	0.042
Age, mean [±SD] (range)	72.1 [13.5] (82.6)	70.6 [13.7] (80.0)	0.108
Previous event*			
Stroke, n (%)	116 (13.7)	53 (12.2)	0.043
TIA, n (%)	47 (5.5)	18 (4.2)	0.065
ICH, n (%)	12 (1.4)	8 (1.9)	0.034
Vascular risk factors*			
Hypertension, n (%)	598 (71.3)	297 (68.8)	0.055
Diabetes, n (%)	151 (17.7)	71 (16.4)	0.036
Hyperlipidemia, n (%)	583 (68.8)	236 (54.8)	0.293
Smoking, n (%)	173 (21.4)	97 (23.6)	0.054
Atrial fibrillation, n (%)	342 (40.2)	170 (39.5)	0.014
NIHSS at admission, median [IQR] (range)	16.0 [10.0–20.0] (40)	11.0 [6.0–17.0] (36)	0.581
Multiple affected vascular territories, n (%)	134 (15.7)	50 (11.5)	0.123
Symptom onset to admission in min, median [IQR] (range)	136.0 [67.0–261.0] (1436)	145.0 [67.0–311.8] (1410)	0.076
mRS prehospital, n (%)			0.305
0–1	713 (83.8)	373 (86.1)	
>1	138 (16.2)	60 (13.9)	

GA indicates general anesthesia; ICH, intracranial hemorrhage; IQR, interquartile range; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; SD, standardized difference; SMD, standardized mean difference; and TIA, transient ischemic attack.

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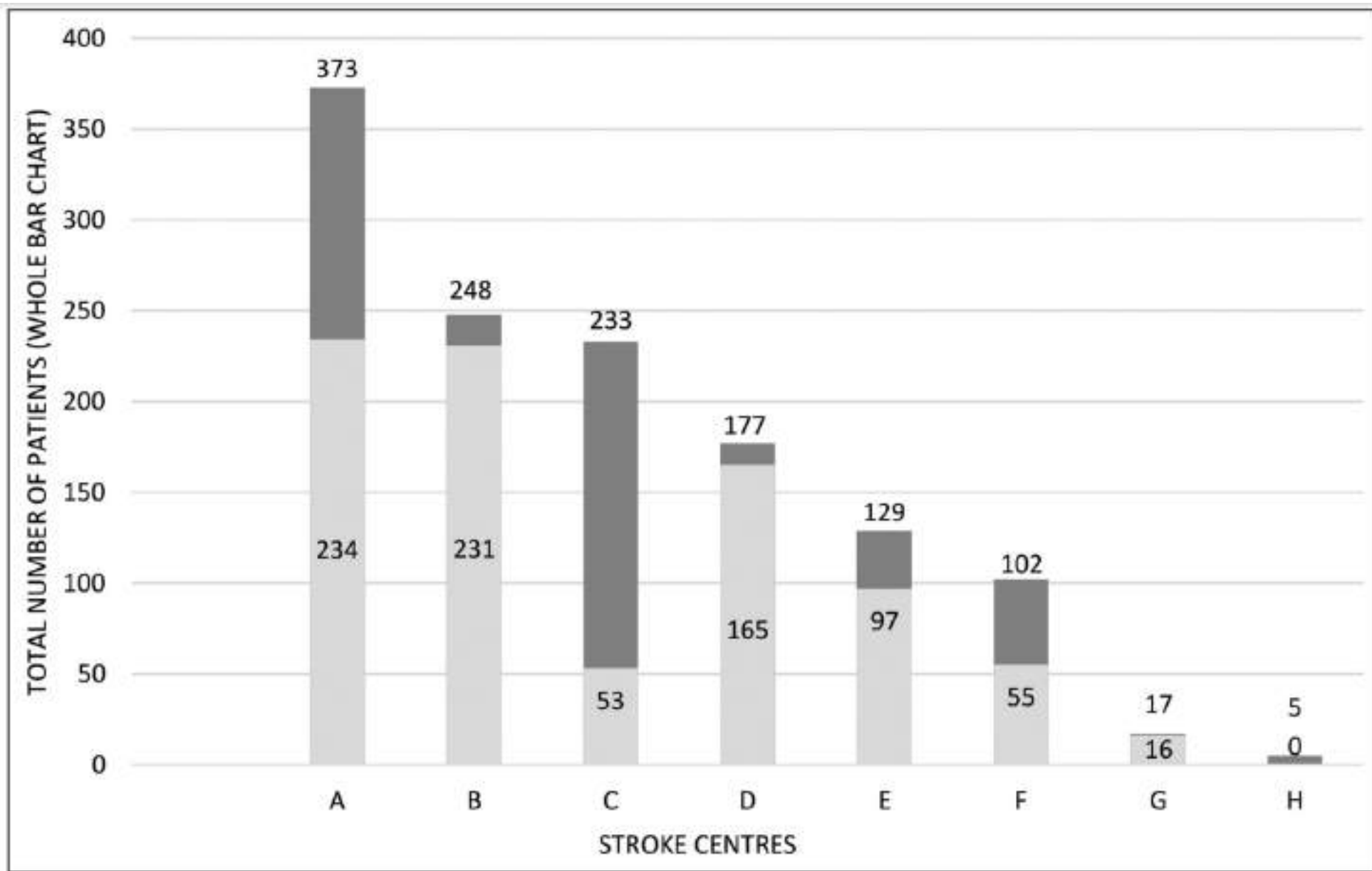


Figure 1. Use of anesthesia in the 8 participating Stroke Centers in Switzerland (A-H); light gray denotes patients treated with general anesthesia (GA); dark gray denotes patients treated with non-GA.

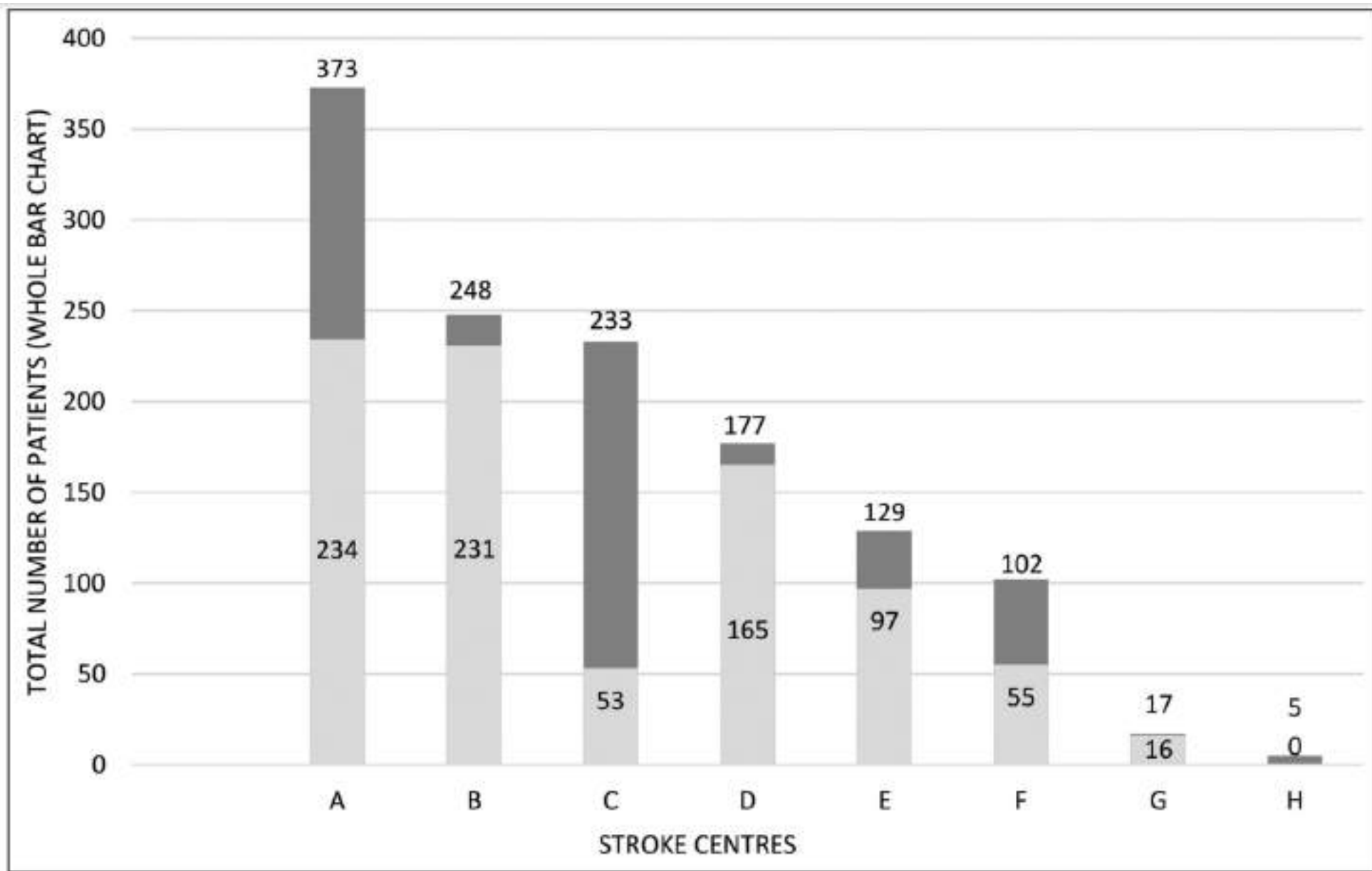
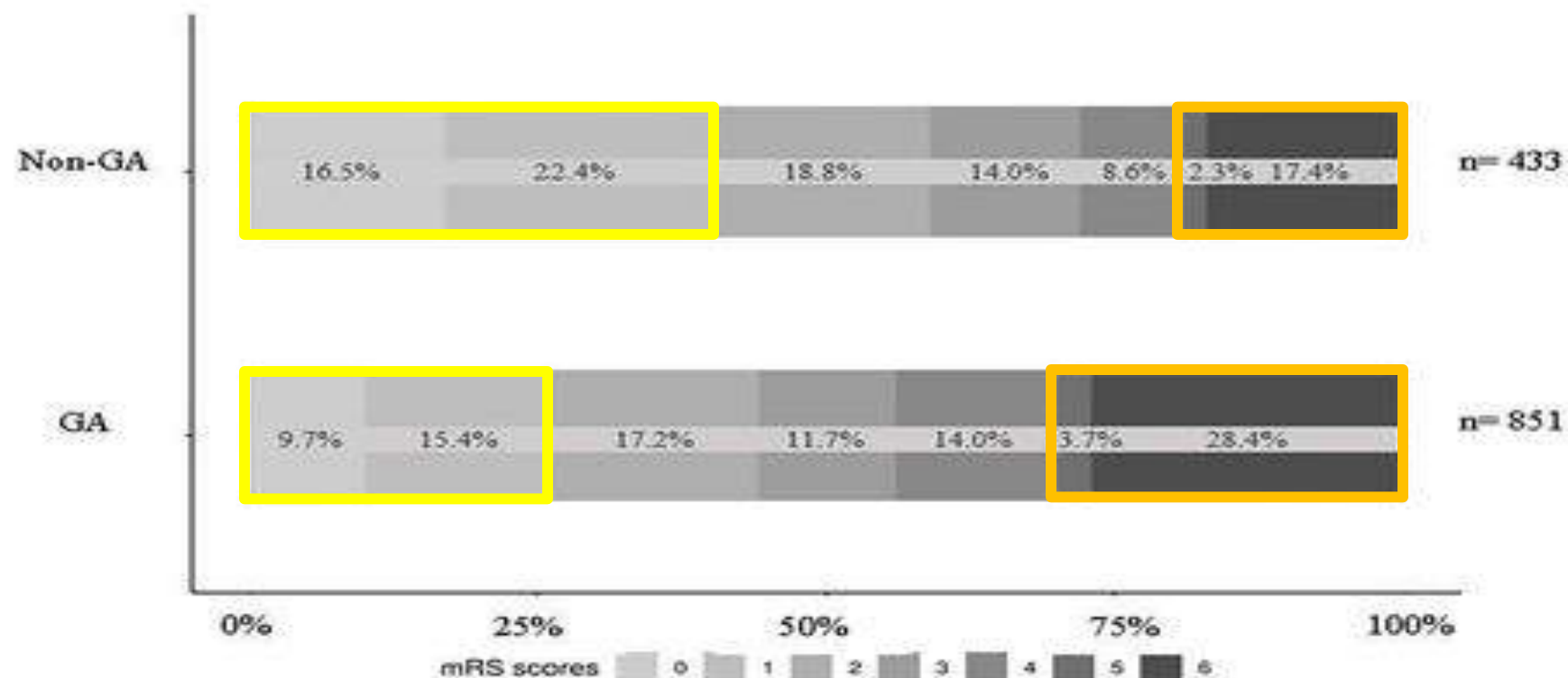


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Endovascular treatment for acute ischaemic stroke with or without general anaesthesia: A matched comparison



General anaesthesia (GA) in endovascular treatment for acute anterior circulation stroke is associated with worse functional outcome compared to treatment without GA, measured by 3-month mRS.

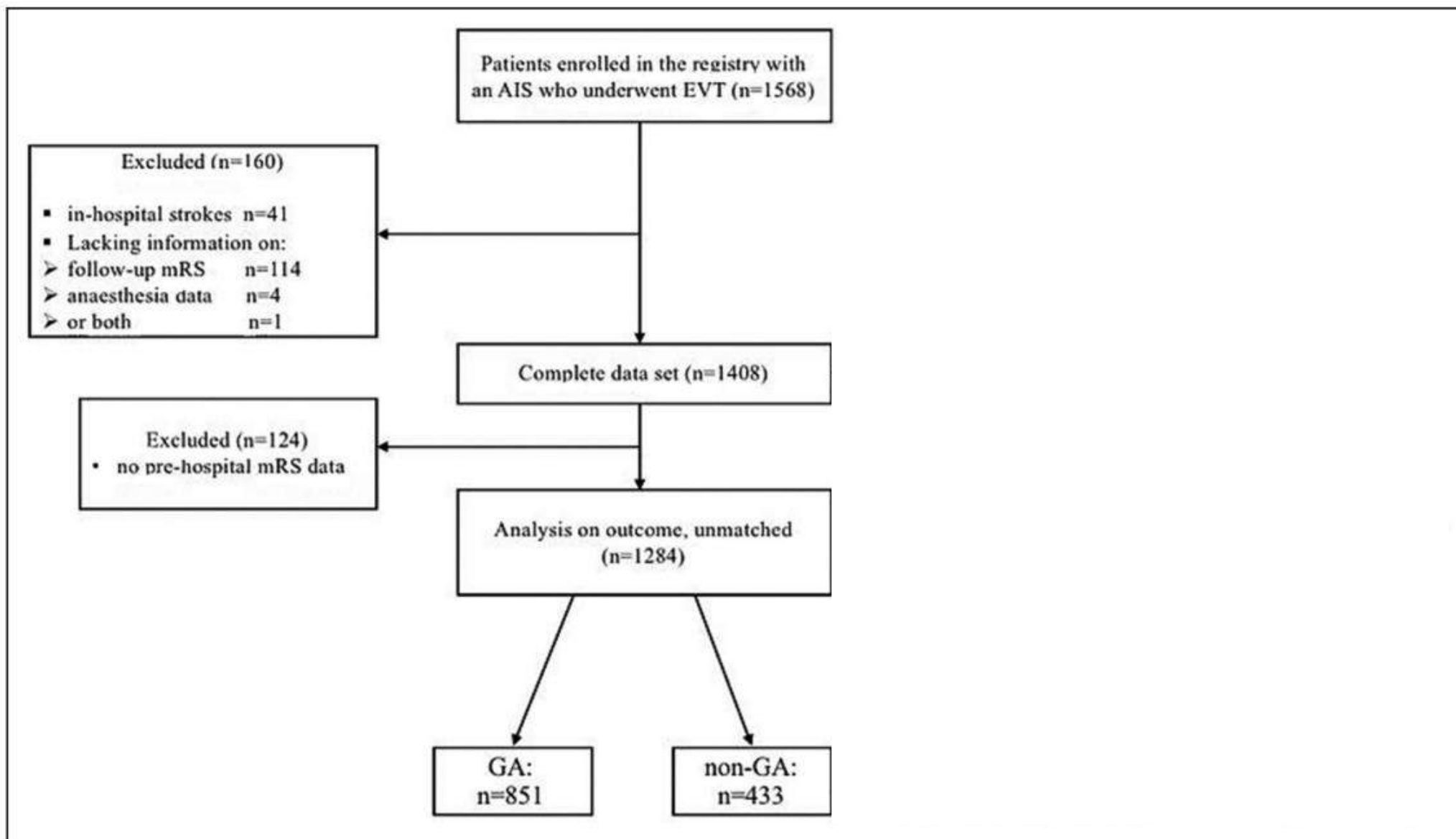


Figure 2. Flow diagram of the patients included in the study.

AIS indicates, acute ischemic stroke; CEM, coarsened exact matching; EVT, endovascular treatment; GA, general anesthesia; mRS, modified Rankin Scale; and PSM, propensity score matching.

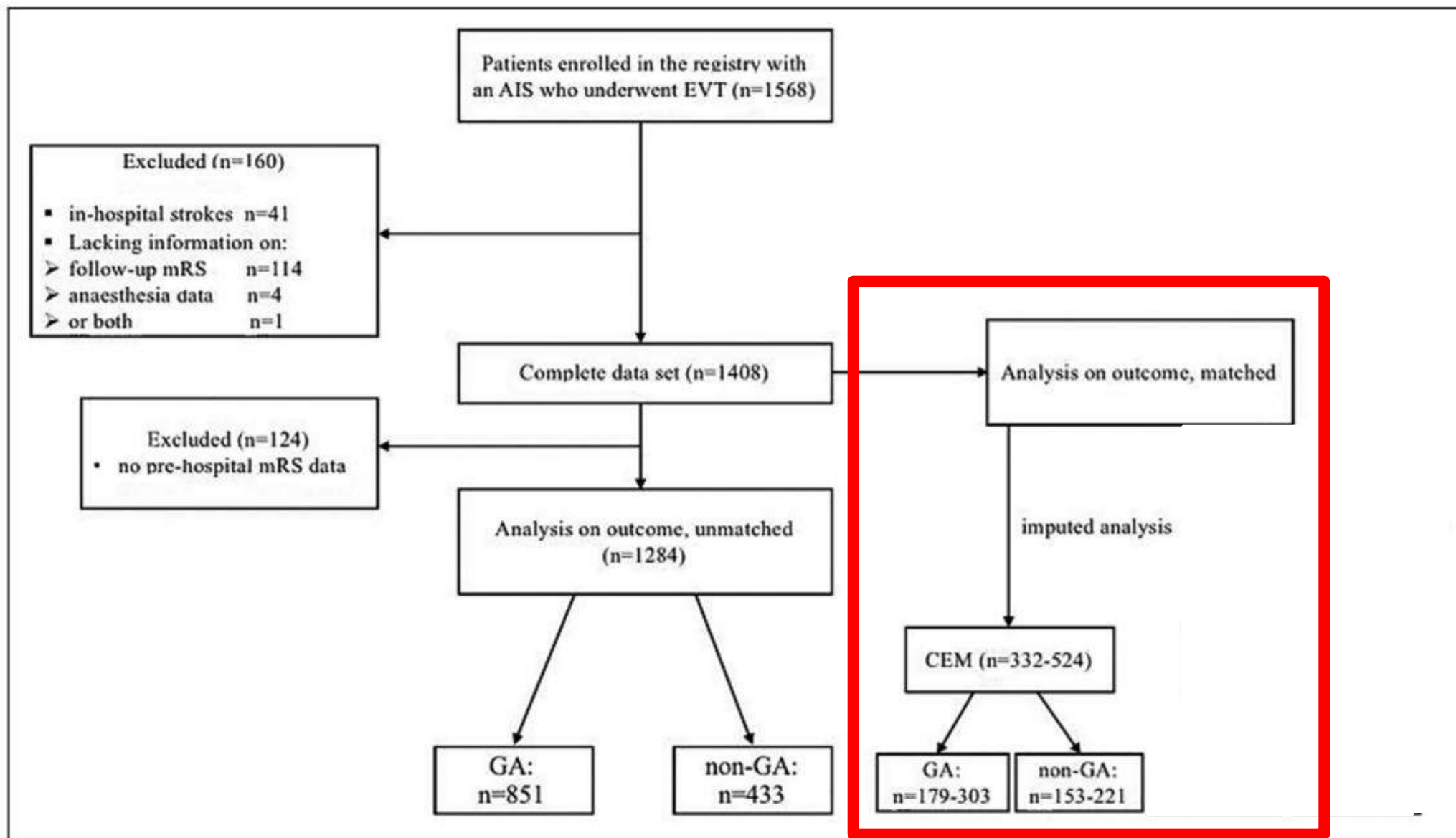


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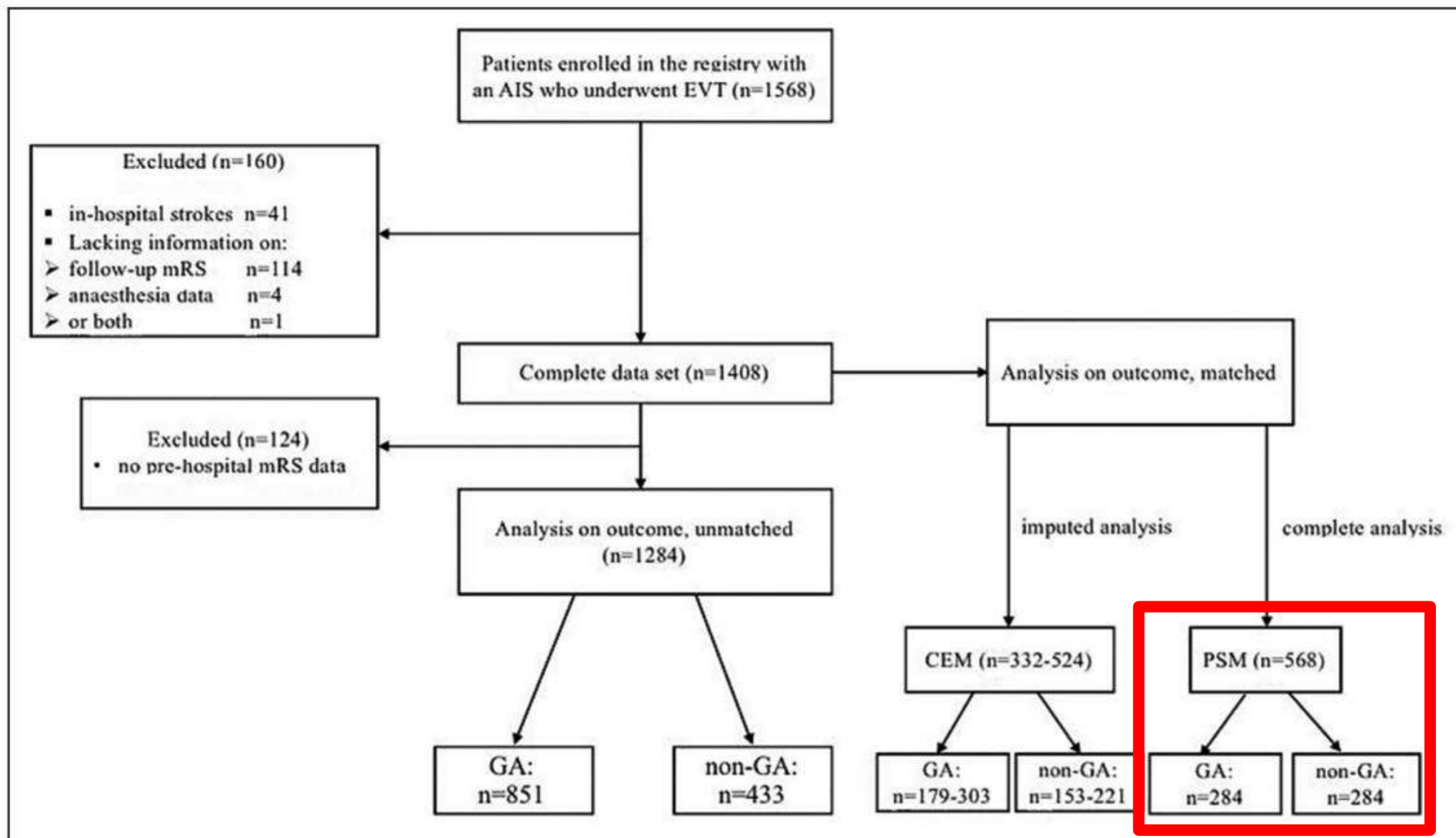


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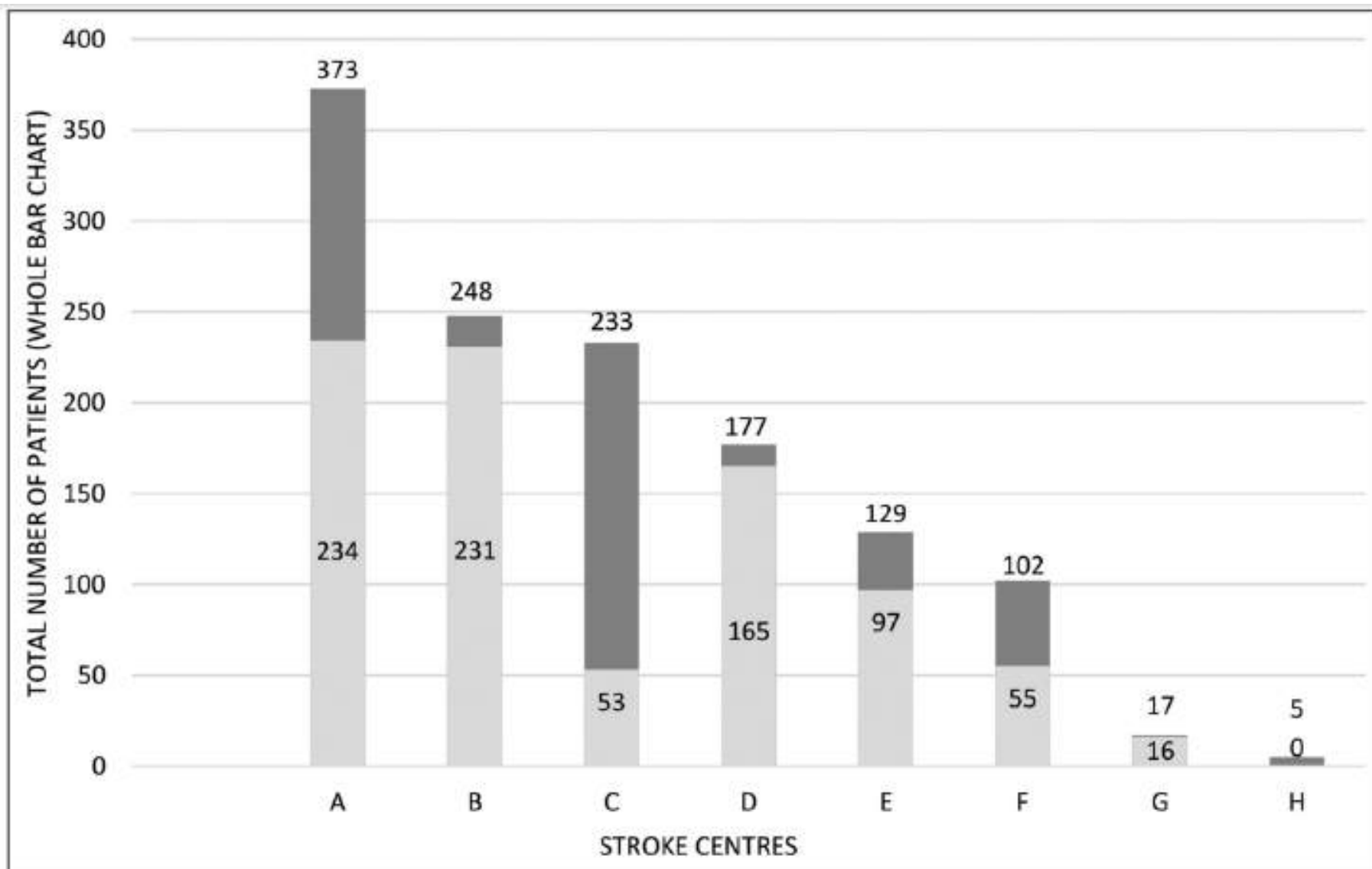


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Table 2. Primary and Secondary Outcomes, Unmatched, and Matched

N	Unmatched		
	GA	Non-GA	Effect size [95% CI]
	851	433	
Primary outcome			
mRS after 3 mo			1.75 [1.42 to 2.16]



Table 2. Primary and Secondary Outcomes, Unmatched, and Matched

N	Unmatched		Effect size [95% CI]	CEM	PSM
	GA	Non-GA		Effect size [95% CI]	Effect size [95% CI]
	851	433		332–524	568
Primary outcome					
mRS after 3 mo			1.75 [1.42 to 2.16]	1.60 [1.08 to 2.36]	1.61 [1.20 to 2.15]

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	GA	Non-GA		Effect size [95% CI]	Effect size [95% CI]
	851	433		332–524	568
Primary outcome					
mRS after 3 mo			1.75 [1.42 to 2.16]	1.60 [1.08 to 2.36]	1.61 [1.20 to 2.15]
Secondary clinical outcomes					
Dependency or death after 3 mo, mRS ≥3 (%)	537 (57.7)	202 (42.3)	1.81 [1.41 to 2.32]	1.42 [0.91 to 2.23]	1.49 [1.07 to 2.07]
Mortality within 3 mo, n (%)	264 (28.4)	83 (17.4)	1.71 [1.26 to 2.32]	1.65 [0.94 to 2.89]	1.65 [1.11 to 2.45]
Recurrent ischemic stroke within 3 mo, n (%)	45 (6.1)	18 (4.2)	1.47 [0.81 to 2.67]	2.59 [0.76 to 8.88]	1.48 [0.85 to 2.59]
NIHSS 24 h after admission, median [IQR]	10 [4 to 17]	5 [2 to 13]	3.65 [2.51 to 4.79]	2.61 [0.59 to 4.64]	3.40 [1.76 to 5.04]
NIHSS shift from admission to 1 d after EVT, median [IQR]	−4.0 [−9.0 to 0.0]	−3.0 [−7.0 to 0.0]	−0.47 [−1.50 to 0.56]	1.22 [−0.74 to 3.19]	1.75 [0.32 to 3.18]
Hemorrhagic transformation after 24 h, n (%)	184 (21)	82 (18)	1.19 [0.87 to 1.63]	0.67 [0.39 to 1.17]	1.00 [0.66 to 1.50]
Intracranial hemorrhage after 24 h, n (%)	25 (2.9)	12 (2.6)	1.23 [0.57 to 2.65]	0.87 [0.14 to 5.33]	1.51 [0.53 to 4.31]
Symptomatic ICH within 7 d, n (%)	53 (5.8)	11 (2.3)	2.59 [1.29 to 5.19]	1.06 [0.30 to 3.75]	1.77 [0.73 to 4.29]
Decompressive craniectomy, n (%)	28 (3)	10 (2.1)	1.72 [0.80 to 3.71]	0.61 [0.10 to 3.67]	1.45 [0.70 to 3.01]
Time metrics and transfer to ICU					
Symptom-groin puncture in min, median [IQR]	235 [175 to 369]	247 [177 to 443]	0.94 [0.88 to 1.02]	1.10 [0.96 to 1.26]	1.11 [1.00 to 1.23]
Door-groin puncture in min, median [IQR]	92 [66 to 123]	97 [70 to 135]	0.92 [0.85 to 0.99]	1.20 [1.04 to 1.37]	1.08 [0.96 to 1.20]
EVT duration in min, median [IQR]	70 [44 to 110]	68 [46 to 111]	0.95 [0.87 to 1.03]	1.04 [0.89 to 1.22]	1.13 [1.01 to 1.28]
Transfer to ICU=yes, n (%)	443 (47.9)	104 (21.9)	3.41 [2.59 to 4.48]	2.16 [1.30 to 3.58]	3.07 [2.15 to 4.37]

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In conclusion, in this observational study on the impact of type of anesthesia on outcome in EVT for acute ischemic stroke, we found that GA in real-world Stroke Centers was associated with worse functional outcome, which appeared to be independent of existing differences in patient characteristics between groups. Larger randomized trials are needed to study the relationship of disease-, patient- and treatment-related variables with outcomes following GA on EVT for acute ischemic stroke, and to identify the ideal type of anesthesia for individual patients.

Aile EVT & GA (+)



Kötü Fonksiyonel Sonlanım

Stroke

AHA SCIENTIFIC STATEMENTS

Endovascular Treatment and Thrombolysis for Acute Ischemic Stroke in Patients With Premorbid Disability or Dementia: A Scientific Statement From the American Heart Association/American Stroke Association

The American Academy of Neurology affirms the value of this statement as an educational tool for neurologists.

The American Association of Neurological Surgeons/Congress of Neurological Surgeons Cerebrovascular Section affirms the educational benefit of this document.

Endorsed by the Society of NeuroInterventional Surgery

Aravind Ganesh, MD, DPhil, FRCPC; Justin F. Fraser, MD, FAANS, FAHA, Vice Chair; Gillian L. Gordon Perue, MBBS, DM; Sepideh Amin-Hanjani, MD, FAHA; Thabele M. Leslie-Mazwi, MD; Steven M. Greenberg, MD, PhD, FAHA; Philippe Couillard, MD, FRCPC; Negar Asdaghi, MD, MSc, FRCPC, FAHA; Mayank Goyal, MD, PhD, FRCPC, Chair; on behalf of the American Heart Association Stroke Council

MAKALE -2

Dergi: Stroke / Mayıs 2022

Konu: Premorbid Engelli / Demanslı Aİİ
Reperfüzyon Tedavileri

Ülke: AHA / ASA

Çalışma: Bilimsel Açıklama

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WSO : Dizabilite prevalansı:

- ❑ Dünya nüfusu : %15
- ❑ USA : Yetişkinlerin %22

WSO : Dizabilite (fiziksel & zihinsel/bilişsel) prevalansı:

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Gözlemsel çalışmalar:

- ❑ İskemik inmeli hastaların 1/3'ü önceden engelli
- ❑ İskemik inmeli hastaların 1/10'u demanslı

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Alı reperfüzyon tedavileri → RKÇ Ø

European Recommendations on Organisation of Interventional Care in Acute Stroke (EROICAS)

Jens Fiehler¹, Christophe Cognard², Mauro Gallitelli³,
Olav Jansen⁴, Adam Kobayashi⁵, Heinrich P Mattle⁶,
Keith W Muir⁷, Mikael Mazighi⁸, Karl Schaller⁹ and
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Please see the acknowledgements for the list of participating societies

International Journal of Stroke
ISSN: 1747-4965 (print); 1747-4973 (online)
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DOI: 10.1177/1747496514566373
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mRS skoru $\geq 2 \rightarrow$ kanıt Ø,
Reperfüzyon $\rightarrow$ İnme öncesi mRS $\rightarrow$ 0-1 olsun

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International Journal of Stroke
ISSN: 1747-4945 (print)
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Standards

Endorsed by Stroke Alliance for Europe (SAFE).

This article is co-published in the European Stroke Journal February 2019.

Received 7 November 2018
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European Stroke Organisation (ESO) - European Society for Minimally Invasive Neurological Therapy (ESMINT) Guidelines on Mechanical Thrombectomy in Acute Ischemic Stroke

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ESO, EVT kılavuzları;

- >80 yaş, inme öncesi ciddi dizabilite (+) $\rightarrow$ fayda ?

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International Journal of Stroke
ISSN: 1744-5019 (print)
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DOI: 10.1177/1744501918788173
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2018 Guidelines for the Early Management of Patients With Acute Ischemic Stroke: A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

William J. Powers, Alejandro A. Rabinstein, Teri Ackerson, Opeola M. Adeoye, Nicholas C. Bambakidis, Kym Becker, José Biller, Michael Brown, Bart M. Demerschalk, Brian Hoh, Edward C. Jauch, Chelsea S. Kidwell, Thabele M. Leslie-Mazwi, Bruce Ovbiagele, Phillip A. Scott, Kevin N. Sherb, Andrew M. Southerland, Deborah V. Summers and David L. Tirschwell and on behalf of the American Heart Association Stroke Council

Originally published 24 Jan 2018 | <https://doi.org/10.1161/STR.0000000000000158> | Stroke. 2018;49:e46–e69

ESO, EVT kılavuzları;

- >80 yaş, önemli inme öncesi sakatlığı olan hastalarda faydaya belirsiz

AHA/ASA kılavuzları, inme öncesi sakatlığın

- tPA $\rightarrow$ kanama riski ~
- Seçilmiş vakalarda $\rightarrow$ Reperfüzyon makul ancak
 - o nörolojik iyileşme daha ↓
 - o mortalite daha ↑

Table 2. Studies EVT for AIS in Patients With Preexisting Disability or Dementia

Author and year published	Study design	Patient population	Study intervention, n patients/ study comparator, n patients	Poststroke disability outcomes	Mortality outcomes	ICH, sICH, or other safety outcomes	Other comments
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Stroke

AHA SCIENTIFIC STATEMENTS

Endovascular Treatment and Thrombolysis for Acute Ischemic Stroke in Patients With Premorbid Disability or Dementia: A Scientific Statement From the American Heart Association/American Stroke Association

The American Academy of Neurology affirms the value of this statement as an educational tool for neurologists.

The American Association of Neurological Surgeons/Congress of Neurological Surgeons Cerebrovascular Section affirms the educational benefit of this document.

Endorsed by the Society of NeuroInterventional Surgery

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□ İnme sonrası dizabilite sonlanması:

90. gün mRS ≤ 1 veya değişmeme oranları: %36,7 vs %26.7 **OR: 0,90**

□ Mortalite sonlanması:

Başvuru mRS ≥ 2 olanlarda → 90. günde ölüm ↑: **OR: 2,83**

□ ICH, sICH veya diğer güvenlik sonlanması:

Fark yok

□ Diğer yorumlar:

Trombektomi yapılan hastaların 2/3 ünde inme öncesi mRS ≥ 2 idi;
Reperfüzyon, yatış süreleri arasında fark saptanmadı

Table 2. Studies EVT for AIS in Patients With Preexisting Disability or Dementia

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□ İnme sonrası dizabilite sonlanması:

90. gün mRS ≤ 2 ile ilişki : ~

□ Mortalite sonlanması (90 günde ölüm):

Prestroke dizabilitelilerde $\uparrow$ (%50 vs %19): **p<0,0001**

□ ICH, sICH veya diğer güvenlik sonlanması:

Fark yok

□ Diğer yorumlar:

-

Table 2. Studies EVT for AIS in Patients With Preexisting Disability or Dementia

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□ İnme sonrası dizabilite sonlanımı:

%36 hasta inme öncesi temel fonksiyonel seviyeye gelmiş

□ Mortalite sonlanımı (90 günde ölüm):

%24.2 hastane içi ölüm

□ ICH, sICH veya diğer güvenlik sonlanımı:

%6.2 sICH

□ Diğer yorumlar:

%84 başarılı rekanalizasyon

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İnme sonrası dizabilite sonlanımı:

%20 hasta inme öncesi temel fonksiyonel seviyeye gelmiş; ~

Mortalite sonlanımı (90 günde ölüm):

Dizabilitesi olan grupta ↑

ICH, sICH veya diğer güvenlik sonlanımı:

sICH: ~

Diğer yorumlar:

Rekanalizasyon oranları benzer

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İnme sonrası dizabilite sonlanımı:

Fark yok (O.R.:1,08)

Mortalite sonlanımı (90 günde ölüm):

Fark yok (O.R.:1,27)

ICH, sICH veya diğer güvenlik sonlanımı:

sICH: ~

Diğer yorumlar:

Hasta grupları arasında dizabilite dışında (yaş, inme öyküsü, vasküler risk faktörleri, başvuru NIHSS skorları) belirgin farklı idi

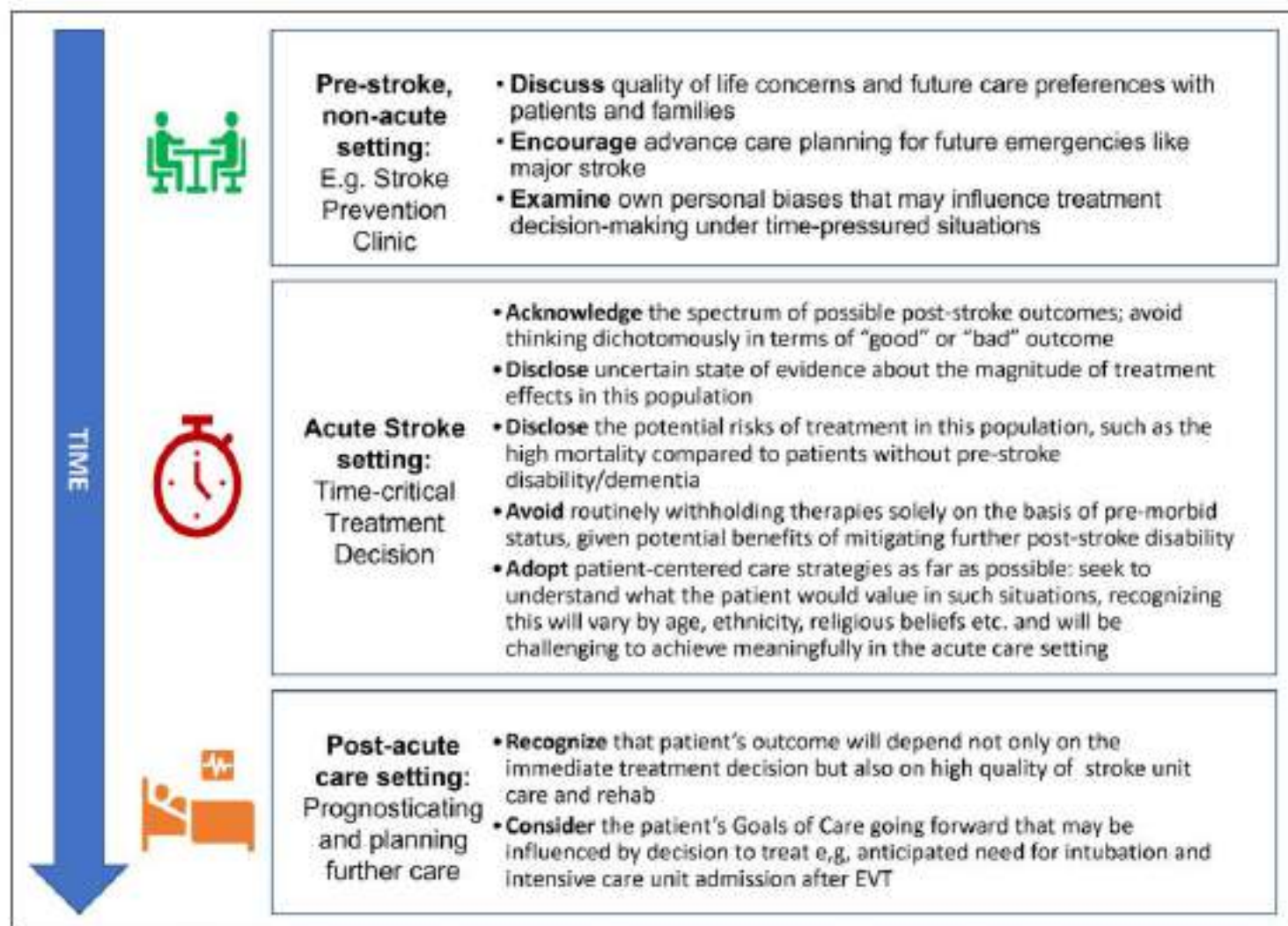
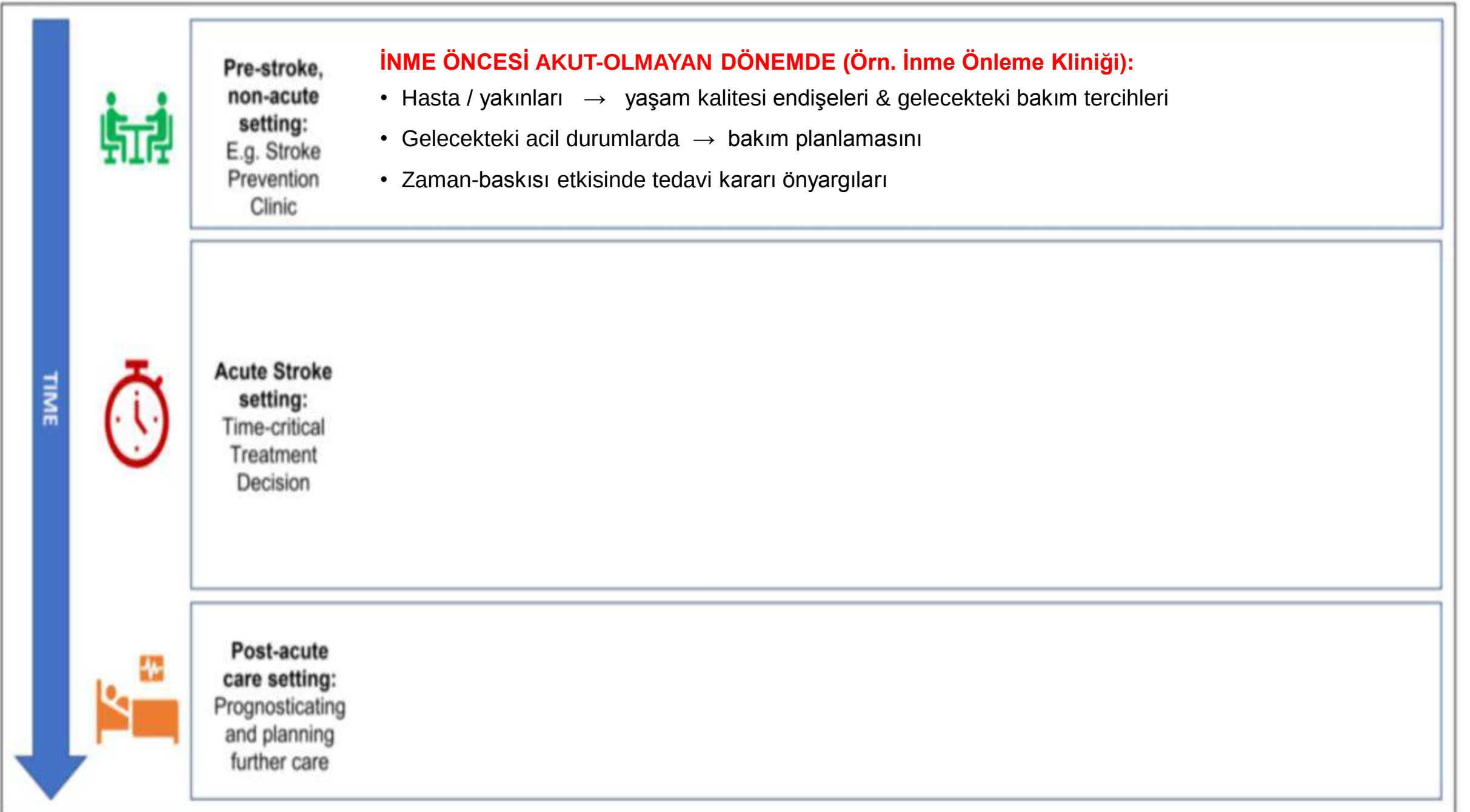
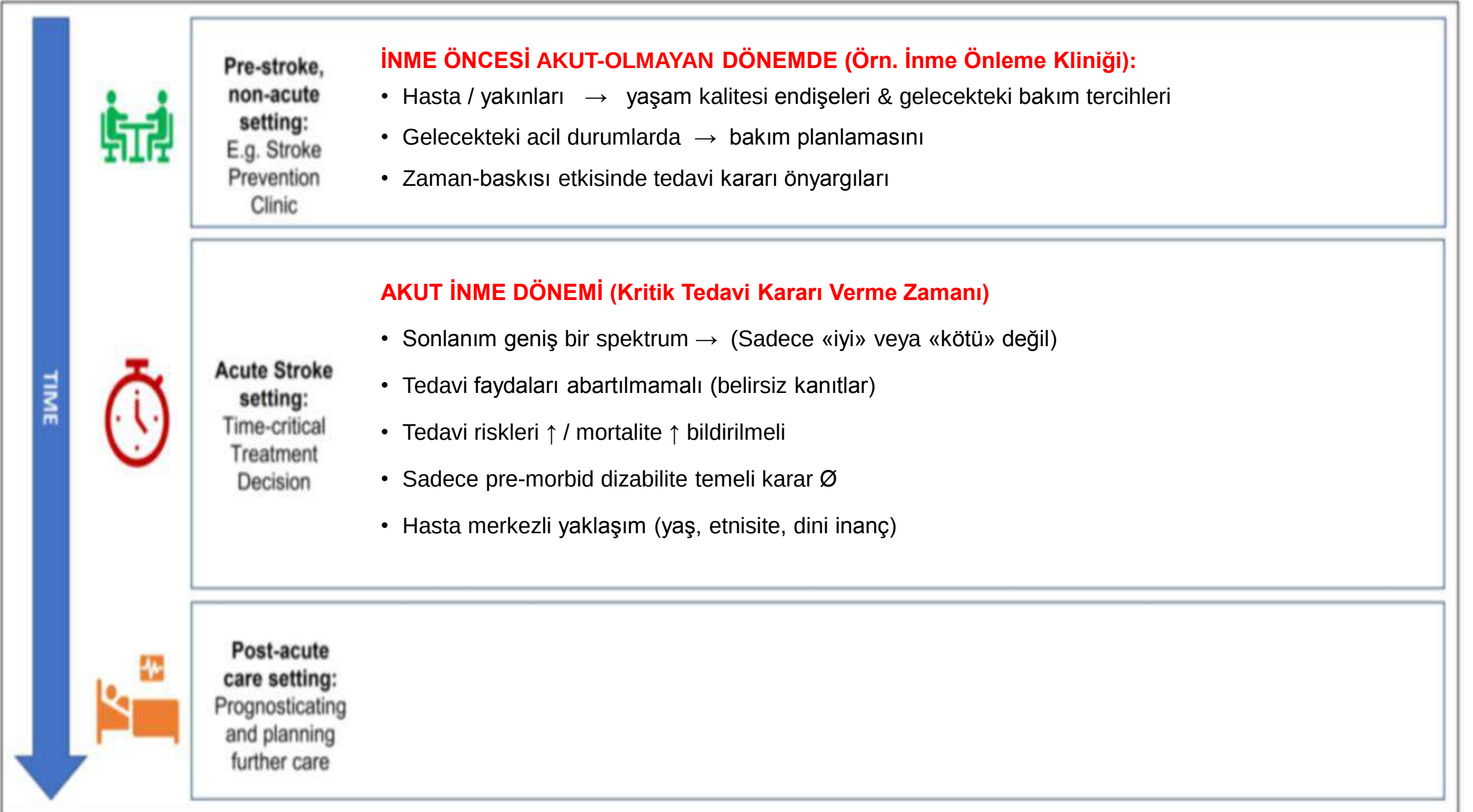
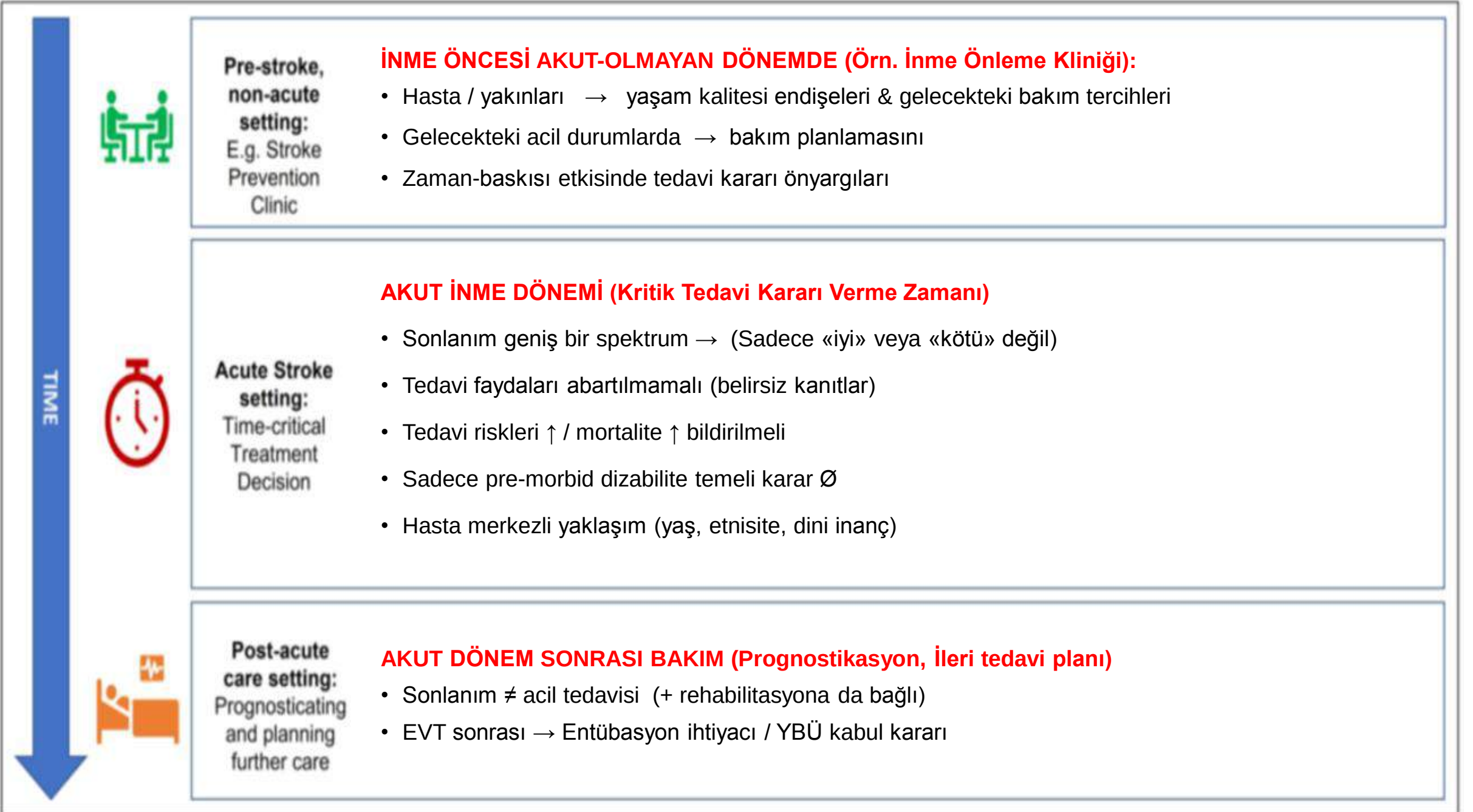


Figure 1. A pragmatic approach to the use of acute stroke therapies in patients with premorbid disability or dementia, involving discussions and considerations across the continuum of stroke care from prestroke discussions (when possible) to acute stroke decision-making to postacute care and prognostication.

EVT indicates endovascular therapy.







Stroke

CLINICAL AND POPULATION SCIENCES

Combined Approach to Eptifibatide and Thrombectomy in Acute Ischemic Stroke Because of Large Vessel Occlusion: A Matched-Control Analysis

Gaoting Ma¹, MD, PhD*; Xuan Sun, MD, PhD*; Huiran Cheng, MM; W. Scott Burgin², MD; Weiliang Luo, MD; Weihua Jia, PhD; Yajie Liu, MD; Wenlong He, MM; Xiaokun Geng, MD; Liangfu Zhu, MD; Xingyu Chen, MD; Huaizhang Shi³, MD; Haowen Xu, MD; Litong Zhang, MM; Anxin Wang⁴, PhD; Dapeng Mo⁵, MD; Ning Ma⁶, MD; Feng Gao, MD; Ligang Song, PhD; Xiaochuan Huo⁷, PhD; Yiming Deng, PhD; Lian Liu⁸, PhD; Gang Luo, PhD; Baixue Jia, PhD; Xu Tong⁹, PhD; Liping Liu¹⁰, MD; Zeguang Ren¹¹, MD, PhD; Zhongrong Miao¹², MD, PhD; on behalf of EPOCH Study and ANGEL-ACT Study Groups†

MAKALE -3

Dergi: Stroke / Mayıs 2022

Konu: MT $\pm$ Eptifibatide

Ülke: Çin (Beijing Tiantan Hospital)

Çalışma: Prospektif (ANGEL-ACT & EPOCH)

Stroke

CLINICAL AND POPULATION SCIENCES

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MAKALE -3

Dergi: Stroke / Mayıs 2022

Konu: MT $\pm$ Eptifibatide

Ülke: Çin (Beijing Tiantan Hospital)

Çalışma: Prospektif (ANGEL-ACT & EPOCH)

Stroke

CLINICAL AND POPULATION SCIENCES

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ANGEL-ACT: Endovascular Treatment Key Technique and Emergency Work Flow Improvement of Acute Ischemic Stroke
(Endovasküler Tedavi Temel Tekniği ve Akut İskemik İnmenin Acil Durum İş Akışı İyileştirmesi)

Kasım 2017 - Mart 2019 / 111 hastane

EPOCH: Eptifibatide in Endovascular Treatment of Acute Ischemic Stroke
(Akut İskemik İnmenin Endovasküler Tedavisinde Eptifibatid)

Nisan 2019 - Mart 2020 / 15 hastane



MAKALE -3

Dergi: Stroke / Mayıs 2022

Konu: MT ± Eptifibatide

Ülke: Çin (Beijing Tiantan Hospital)

Çalışma: Prospektif (ANGEL-ACT & EPOCH)

Stroke

CLINICAL AND POPULATION SCIENCES

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ANGEL-ACT: (Endovasküler Tedavi Temel Tekniği ve Akut İskemik İnmenin Acil Durum İş Akışı İyileştirmesi)

Kasım 2017 - Mart 2019 / 111 hastane

EPOCH: (Akut İskemik İnmenin Endovasküler Tedavisinde Eptifibatid)

Nisan 2019 - Mart 2020 / 15 hastane

Primer Etkinlik Sonlanması: 3. ay iyi fonksiyonel sonlanım [mRS = 0-2]

Sekonder etkinlik sonlanması: *3.ay mRS dağılımı, * Kötü fonksiyonel sonlanım [mRS 5-6] , *Başarılı rekanalizasyon dağılımı

Güvenlik sonlanması: *ICH, *sICH *3. ay mortalite



EPOCH çalışması:

- Ponksiyonundan hemen sonra → Eptifibatide
- 135-180 $\mu\text{g/kg}$ bolus (iv veya ia) → (<5 dakika)
- 0.75-2 $\mu\text{g/kg/dk}$ hızda → 24 saat iv infüzyon

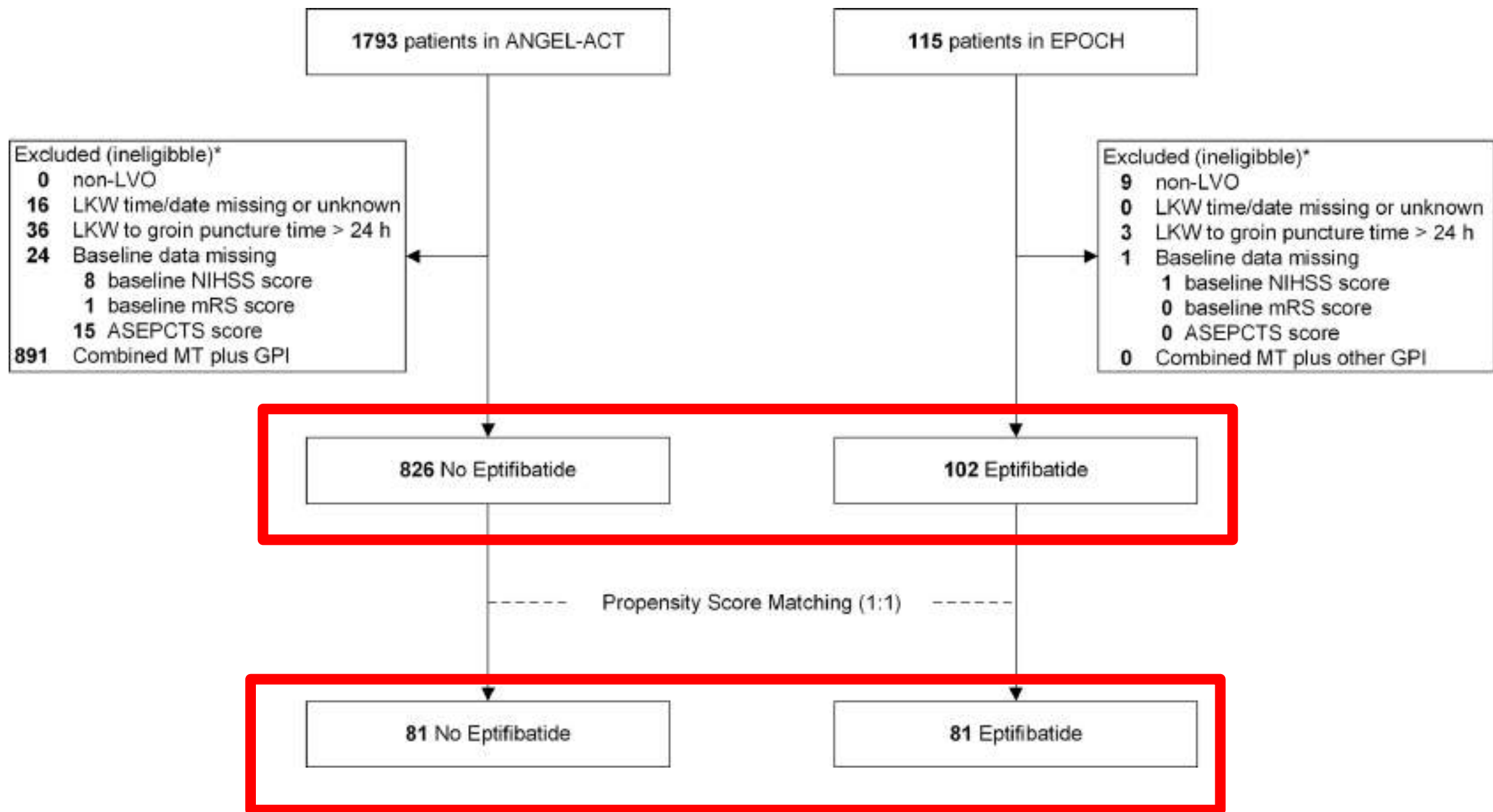


Table 2. Efficacy and Safety Outcomes

Outcome variable	Before PS matching			
	No eptifibatide	Eptifibatide	Unadjusted analysis	
	(N=826)	(N=102)	OR (95% CI)	P value
ICH	195/789 (24.7)	20/102 (19.6)	0.74 (0.44–1.24)	0.258
slCH‡	65/782 (8.3)	5/102 (4.9)	0.57 (0.22–1.45)	0.236
Successful recanalization§	713/826 (86.3)	94/101 (93.1)	2.13 (0.96–4.70)	0.062
3-mo mRS score, median (IQR)	3 (0–5)	2 (1–4)	1.15 (0.80–1.65)	0.467
3-mo good outcome	330/786 (42.0)	56/102 (54.9)	1.68 (1.11–2.55)	0.014
3-mo poor outcome¶	244/786 (31.0)	23/102 (22.6)	0.65 (0.40–1.05)	0.080
3-mo death	132/786 (16.8)	17/102 (16.7)	0.99 (0.57–1.72)	0.974

Data are shown as the event number/total number (%), unless otherwise indicated. ASPECTS indicates Alberta Stroke Program Early CT Score; ICH, intracranial hemorrhage; IQR, interquartile range; LAA, large artery atherosclerosis; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; OR, odds ratio; PS, propensity score; and slCH, symptomatic intracranial hemorrhage.

*Adjusted for age, sex, baseline NIHSS score, ASPECTS, LKW to puncture time, anterior circulation stroke, LAA, emergency stenting, thrombectomy pass numbers, and centers.

†Adjusted for centers.

‡According to the Heidelberg Bleeding Classification.

§Successful recanalization is defined by the modified Thrombolysis in Cerebral Infarction score of 2b-3 after mechanical thrombectomy.

||Good outcome is defined as modified Rankin Scale score 0–2.

¶Poor outcome is defined as modified Rankin Scale score 5–6.

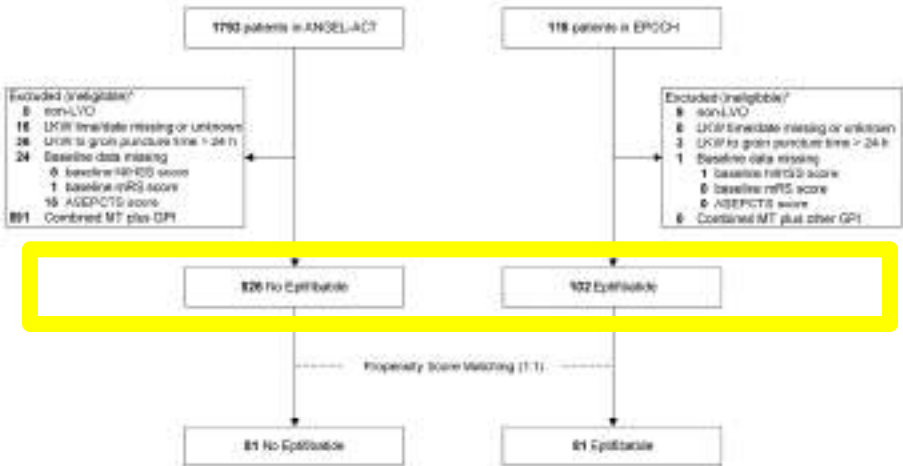


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Outcome variable	Before PS matching					
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	(N=826)	(N=102)	OR (95% CI)	P value	OR (95% CI)	P value
ICH	195/789 (24.7)	20/102 (19.6)	0.74 (0.44–1.24)	0.258	0.87 (0.42–1.80)	0.715
slCH†	65/782 (8.3)	5/102 (4.9)	0.57 (0.22–1.45)	0.236	0.51 (0.18–1.45)	0.204
Successful recanalization§	713/826 (86.3)	94/101 (93.1)	2.13 (0.96–4.70)	0.062	2.66 (1.15–6.14)	0.022
3-mo mRS score, median (IQR)	3 (0–5)	2 (1–4)	1.15 (0.80–1.65)	0.467	1.14 (0.77–1.68)	0.509
3-mo good outcome	330/786 (42.0)	56/102 (54.9)	1.68 (1.11–2.55)	0.014	1.87 (1.25–2.82)	0.003
3-mo poor outcome¶	244/786 (31.0)	23/102 (22.6)	0.65 (0.40–1.05)	0.080	0.70 (0.37–1.33)	0.280
3-mo death	132/786 (16.8)	17/102 (16.7)	0.99 (0.57–1.72)	0.974	1.02 (0.46–2.26)	0.960

Data are shown as the event number/total number (%), unless otherwise indicated. ASPECTS indicates Alberta Stroke Program Early CT Score; ICH, intracranial hemorrhage; IQR, interquartile range; LAA, large artery atherosclerosis; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke Scale; OR, odds ratio; PS, propensity score; and slCH, symptomatic intracranial hemorrhage.

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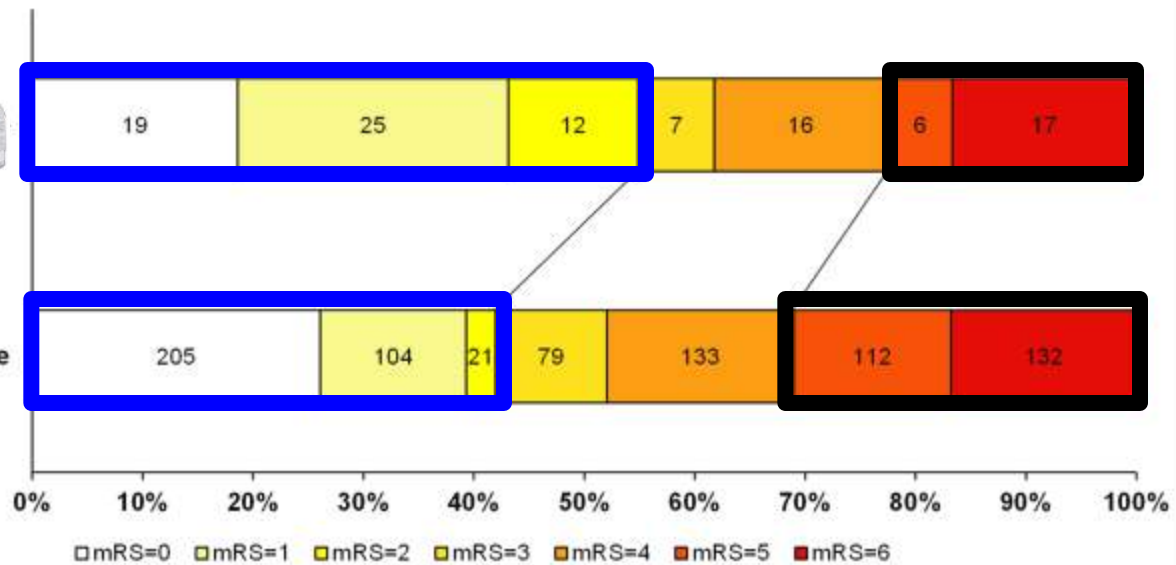
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Before PS matching



No eptifibatide



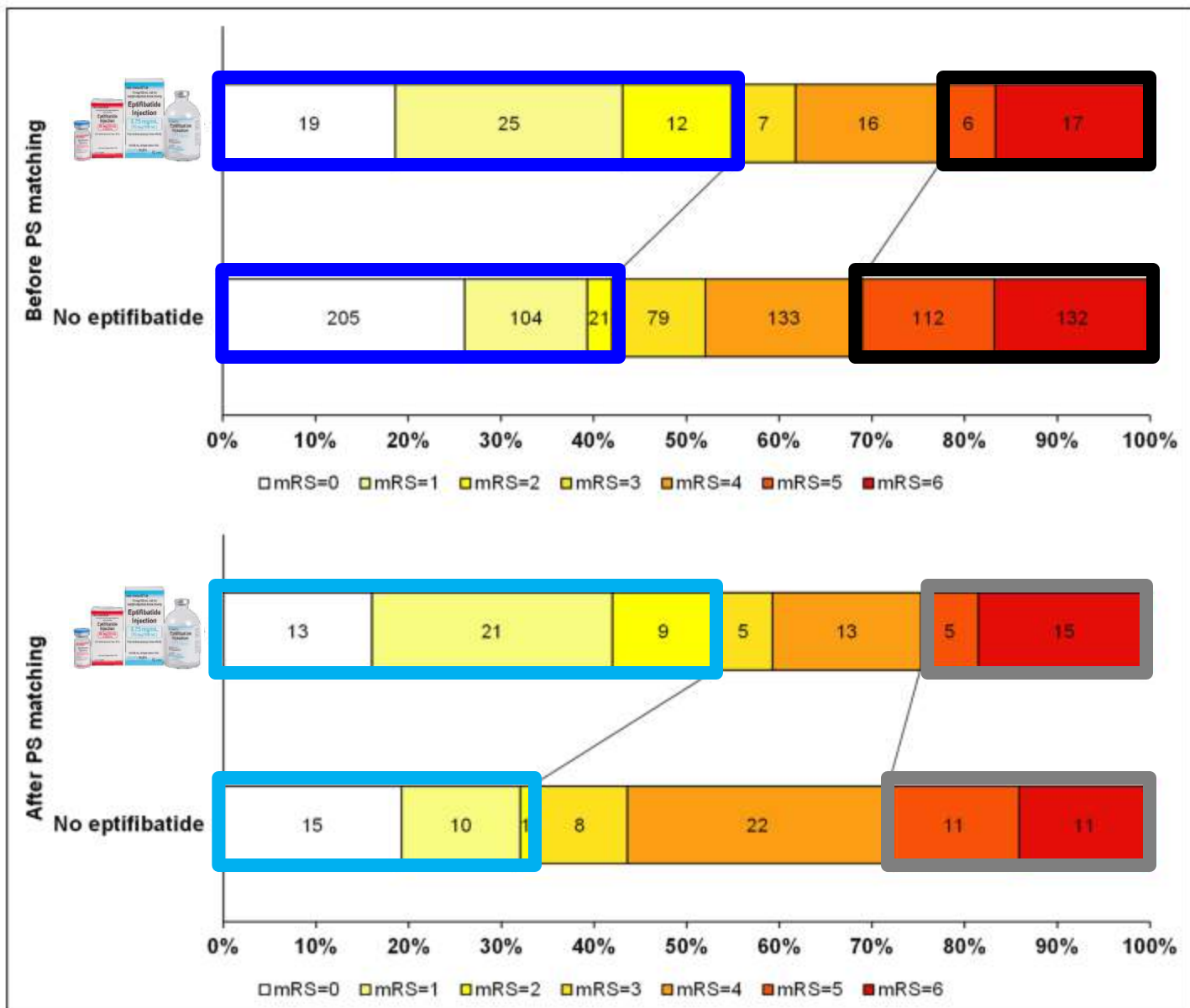


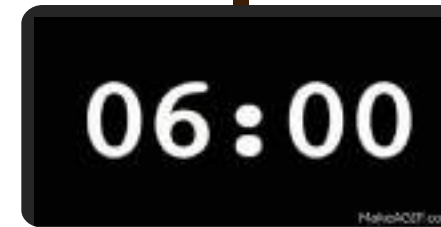
Figure 2. The shift on the 3-mo modified Rankin Scale (mRS) score of no eptifibatide vs eptifibatide.

Conclusions

This matched-control study demonstrated that MT combined with eptifibatide did not raise major safety concerns and showed a trend of better efficacy outcomes compared with MT alone. Overall, eptifibatide shows potential as a periprocedural adjunctive antithrombotic therapy when combined with MT. Further randomized controlled trials of MT plus eptifibatide should be prioritized.



+ MT → Etkin & Güvenli
RKÇ'lara öncelik verilmelidir.



Stroke

CLINICAL AND POPULATION SCIENCES



Clinical and Imaging Indicators of Hemorrhagic Transformation in Acute Ischemic Stroke After Endovascular Thrombectomy

Bing Tian¹, MD*; Xia Tian, MD*; Zhang Shi², MD; Wenjia Peng³, MD; Xuefeng Zhang⁴, MD; Pengfei Yang⁵, MD; Zifu Li, MD; Xiaoxi Zhang, MD; Min Lou⁶, MD; Congguo Yin, MD; Yongwei Zhang⁷, MD; Jianping Lu⁸, MD, Jianmin Liu, MD; for the DIRECT-MT Investigators

MAKALE -4

Dergi: Stroke / Mayıs 2022

Konu: IV-tPA + EVT → Hemorajik Transformasyon riski

Ülke: Çin

Stroke

CLINICAL AND POPULATION SCIENCES



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MAKALE -4

Dergi: Stroke / Mayıs 2022

Konu: IV-tPA + EVT → Hemorajik Transformasyon riski

Ülke: Çin

Çalışma: Prospektif RKÇ'nin sekonder analizi
(kohort temelli)

Stroke

CLINICAL AND POPULATION SCIENCES



Clinical and Imaging Indicators of Hemorrhagic Transformation in Acute Ischemic Stroke After Endovascular Thrombectomy

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DIRECT-MT (Direct Intraarterial Thrombectomy to Revascularize Acute Ischemic Stroke Patients with Large Vessel Occlusion Efficiently in Chinese Tertiary Hospitals: a Multicenter Randomized Clinical Trial).

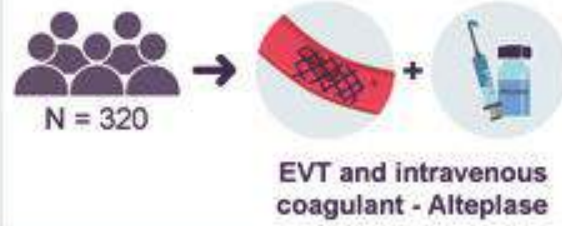
Çalışma	Primer sonlanım hedefi	Özellik	MT (n)	İVT + MT (n)	Primer sonlanım sonuç
DIRECT-MT (30)	• İnme sonrası 90. gün mRS • Noninferiorite hedef Odds oranı: 0.8	• Çin • Çok merkezli (41 merkez) • (18 Mart 2018 – 19 Ekim 2019) • ≥ 18 yaş • İKA ve/ veya OSA-M1/M2 proksimal BDO (BT-A), ilk 4.5 saatte başvurusu olup IV-tPA için uygun olan hastalar • NIHSS ≥ 2 • İVT: (0.9 mg/kg) alteplase	326	328	• Ortak Odds oranı: 1.07 (0,81–1.40) • Noninferiorite için $p=0.04$
Primer sonlanım sonuç (90. gün mRS) Median (IQR)			3 (2-5)	3 (2-5)	

DIRECT-MT trial

Endovascular thrombectomy (EVT)
group



Combination therapy (CT) group

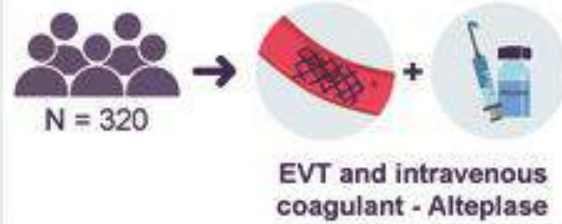


DIRECT-MT trial

Endovascular thrombectomy (EVT) group



Combination therapy (CT) group



Computed tomographic assessment of:

- Clinical features
- Imaging features



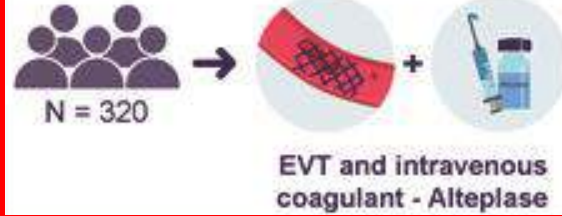
- Hemorrhagic transformation (HT) **41.2%; 261 patients**
- Symptomatic intracranial hemorrhage (sICH) **5.4%; 34 patients**
- Parenchymal hematoma **13.4%; 85 patients**

DIRECT-MT trial

Endovascular thrombectomy (EVT) group



Combination therapy (CT) group



Computed tomographic assessment of:

- Clinical features
- Imaging features



- Hemorrhagic transformation (HT) 41.2%; 261 patients
- Symptomatic intracranial hemorrhage (sICH) 5.4%; 34 patients
- Parenchymal hematoma 13.4%; 85 patients

Gruplar arasında fark yok ($p=0.33$)

Table 2. Multivariable Effect of the Clinical and Imaging Factors on HT, sICH, and PH

	HT		sICH		PH	
	Adjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Clinical						
Age, y	—	—	—	—	—	—
Male	—	—	—	—	—	—
mRS score of 1 or 2 before stroke onset	—	—	—	—	—	—
Medical history	—	—	—	—	—	—
Previous ischemic stroke	—	—	—	—	—	—
History of atrial fibrillation	—	—	—	—	—	—
History of diabetes	0.97 (0.57–1.65)	0.92	0.81 (0.30–2.20)	0.58	0.85 (0.42–1.72)	0.65
History of hypertension	—	—	5.35 (0.95–5.82)	0.06	—	—
Cause of stroke	—	—	—	—	—	—
Cardioembolic	—	—	—	—	—	—
Intracranial atherosclerosis	1.03 (0.54–1.96)	0.94	—	—	—	—
Ipsilateral intracranial obstruction	0.63 (0.29–1.39)	0.25	—	—	—	—
Undetermined	1.17 (0.78–1.75)	0.44	—	—	—	—
History of anticoagulant drugs	—	—	—	—	—	—
History of antiplatelet drugs	—	—	—	—	—	—
Use of alteplase	—	—	—	—	1.59 (0.97–2.59)	0.06
Baseline NIHSS score	1.02 (1.00–1.05)	0.10	1.06 (1.01–1.12)	0.01	1.03 (0.99–1.07)	0.12
Systolic blood pressure at hospital arrival	—	—	—	—	1.01 (1.00–1.02)	0.13
Glucose level at hospital arrival	1.19 (1.09–1.27)	<0.001	1.14 (1.00–1.29)	0.04	1.15 (1.05–1.26)	<0.01
Time from stroke onset to randomization	—	—	—	—	—	—
Time from randomization to start of alteplase	—	—	—	—	—	—
Time from randomization to groin puncture	—	—	—	—	—	—
Time from randomization to revascularization	—	—	—	—	—	—
Time from stroke onset to revascularization	1.01 (1.00–1.01)	<0.01	—	—	—	—
Time from groin puncture to revascularization	1.00 (1.00–1.01)	0.75	—	—	—	—
EVT procedure						
Number of device passes >8, no. (%)	1.04 (0.57–1.91)	0.89	—	—	—	—
gTICI, no. (%) ≥2b	—	—	—	—	—	—
Imaging						
Hypertensive artery sign	1.82 (1.20–2.77)	<0.01	—	—	—	—
ASPECTS	0.86 (0.64–1.14)	0.29	—	—	—	—
Occlusion location	—	—	—	—	—	—
ICA	—	—	—	—	—	—
M1	1.21 (0.77–1.92)	0.41	0.67 (0.30–1.49)	0.32	0.84 (0.47–1.49)	0.54
M2	1.49 (0.68–3.23)	0.32	1.27 (0.49–3.70)	0.68	1.05 (0.34–3.25)	0.93
Clot burden score	1.23 (0.78–1.95)	0.38	—	—	—	—
Collateral score	0.73 (0.57–0.95)	0.01	0.73 (0.49–1.23)	0.24	—	—

Table 2. Multivariable Effect of the Clinical and Imaging Factors on HT, sICH, and PH

	HT		sICH		PH	
	Adjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Clinical						
Age, y	—	—	—	—	—	—
Male	—	—	—	—	—	—
mRS score of 1 or 2 before stroke onset	—	—	—	—	—	—
Medical history	—	—	—	—	—	—
Previous ischemic stroke	—	—	—	—	—	—
History of atrial fibrillation	—	—	—	—	—	—
History of diabetes	0.97 (0.57–1.65)	0.92	0.81 (0.30–2.20)	0.58	0.85 (0.42–1.72)	0.65
History of hypertension	—	—	5.35 (0.95–5.82)	0.06	—	—
Cause of stroke	—	—	—	—	—	—
Cardioembolic	—	—	—	—	—	—
Intracranial atherosclerosis	1.03 (0.54–1.96)	0.94	—	—	—	—
Ipsilateral intracranial obstruction	0.63 (0.29–1.35)	0.25	—	—	—	—
Undetermined	1.17 (0.78–1.75)	0.44	—	—	—	—
History of anticoagulant drugs	—	—	—	—	—	—
History of antiplatelet drugs	—	—	—	—	—	—
Use of alteplase	—	—	—	—	1.59 (0.97–2.59)	0.06
Baseline NIHSS score	1.02 (1.00–1.05)	0.10	1.06 (1.01–1.12)	0.01	1.03 (0.99–1.07)	0.12
Systolic blood pressure at hospital arrival	—	—	—	—	1.01 (1.00–1.02)	0.13
Glucose level at hospital arrival	1.19 (1.09–1.27)	<0.001	1.14 (1.00–1.29)	0.04	1.15 (1.05–1.25)	<0.01
Time from stroke onset to randomization	—	—	—	—	—	—
Time from randomization to start of alteplase	—	—	—	—	—	—
Time from randomization to groin puncture	—	—	—	—	—	—
Time from randomization to revascularization	—	—	—	—	—	—
Time from stroke onset to revascularization	1.01 (1.00–1.01)	<0.01	—	—	—	—
Time from groin puncture to revascularization	1.00 (1.00–1.01)	0.75	—	—	—	—
EVT procedure						
Number of device passes >8, no. (%)	1.04 (0.57–1.91)	0.89	—	—	—	—
gTICI, no. (%) ≥2b	—	—	—	—	—	—
Imaging						
Hypertensive artery sign	1.82 (1.20–2.77)	<0.01	—	—	—	—
ASPECTS	0.86 (0.64–1.14)	0.29	—	—	—	—
Occlusion location	—	—	—	—	—	—
ICA	—	—	—	—	—	—
M1	1.21 (0.77–1.92)	0.41	0.67 (0.30–1.49)	0.32	0.84 (0.47–1.49)	0.54
M2	1.49 (0.68–3.23)	0.32	1.27 (0.49–3.70)	0.68	1.05 (0.34–3.25)	0.93
Clot burden score	1.23 (0.78–1.95)	0.38	—	—	—	—
Collateral score	0.73 (0.57–0.95)	0.01	0.73 (0.49–1.23)	0.24	—	—

Table 2. Multivariable Effect of the Clinical and Imaging Factors on HT, sICH, and PH

	HT		sICH		PH	
	Adjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value	Adjusted OR (95% CI)	P value
Clinical						
Age, y	—	—	—	—	—	—
Male	—	—	—	—	—	—
mRS score of 1 or 2 before stroke onset	—	—	—	—	—	—
Medical history	—	—	—	—	—	—
Previous ischemic stroke	—	—	—	—	—	—
History of atrial fibrillation	—	—	—	—	—	—
History of diabetes	0.97 (0.57–1.65)	0.92	0.81 (0.30–2.20)	0.58	0.85 (0.42–1.72)	0.65
History of hypertension	—	—	5.35 (0.95–5.82)	0.06	—	—
Cause of stroke	—	—	—	—	—	—
Cardioembolic	—	—	—	—	—	—
Intracranial atherosclerosis	1.03 (0.54–1.96)	0.94	—	—	—	—
Ipsilateral intracranial obstruction	0.63 (0.29–1.35)	0.25	—	—	—	—
Undetermined	1.17 (0.78–1.75)	0.44	—	—	—	—
History of anticoagulant drugs	—	—	—	—	—	—
History of antiplatelet drugs	—	—	—	—	—	—
Use of alteplase	—	—	—	—	1.59 (0.97–2.59)	0.06
Baseline NIHSS score	1.02 (1.00–1.05)	0.10	1.06 (1.01–1.12)	0.01	1.03 (0.99–1.07)	0.12
Systolic blood pressure at hospital arrival	—	—	—	—	1.01 (1.00–1.02)	0.13
Glucose level at hospital arrival	1.19 (1.09–1.27)	<0.001	1.14 (1.00–1.29)	0.04	1.15 (1.05–1.25)	<0.01
Time from stroke onset to randomization	—	—	—	—	—	—
Time from randomization to start of alteplase	—	—	—	—	—	—
Time from randomization to groin puncture	—	—	—	—	—	—
Time from randomization to revascularization	—	—	—	—	—	—
Time from stroke onset to revascularization	1.01 (1.00–1.01)	<0.01	—	—	—	—
Time from groin puncture to revascularization	1.00 (1.00–1.01)	0.75	—	—	—	—
EVT procedure						
Number of device passes >8, no. (%)	1.04 (0.57–1.91)	0.89	—	—	—	—
gTICI, no. (%) ≥2b	—	—	—	—	—	—
Imaging						
Hypertensive artery sign	1.82 (1.20–2.77)	<0.01	—	—	—	—
ASPECTS	0.86 (0.64–1.14)	0.29	—	—	—	—
Occlusion location	—	—	—	—	—	—
ICA	—	—	—	—	—	—
M1	1.21 (0.77–1.92)	0.41	0.67 (0.30–1.49)	0.32	0.84 (0.47–1.49)	0.54
M2	1.49 (0.68–3.23)	0.32	1.27 (0.49–3.70)	0.68	1.05 (0.34–3.25)	0.93
Clot burden score	1.23 (0.78–1.95)	0.38	—	—	—	—
Collateral score	0.73 (0.57–0.95)	0.01	0.73 (0.49–1.23)	0.24	—	—



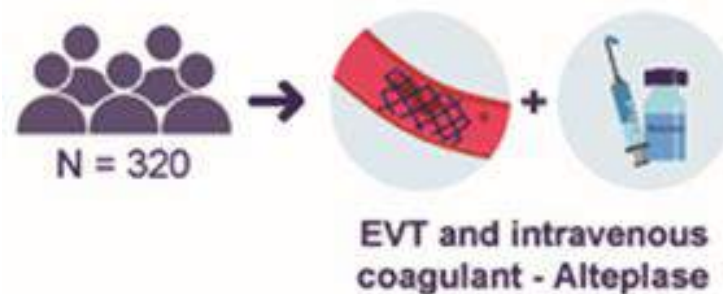
Independent risk factors for sICH

Endovascular thrombectomy (EVT) group



baseline NIHSS score

Combination therapy (CT) group



- >3 passes of device
- history of anticoagulant drugs
- glucose level at hospital arrival

DIRECT-MT trial

Endovascular thrombectomy (EVT) group



Combination therapy (CT) group



Computed tomographic assessment of:

- Clinical features
- Imaging features



- Hemorrhagic transformation (HT) **41.2%; 261 patients**
- Symptomatic intracranial hemorrhage (sICH) **5.4%; 34 patients**
- Parenchymal hematoma **13.4%; 85 patients**

sICH



baseline NIHSS score
glucose level at hospital arrival

Alteplase



HT
sICH

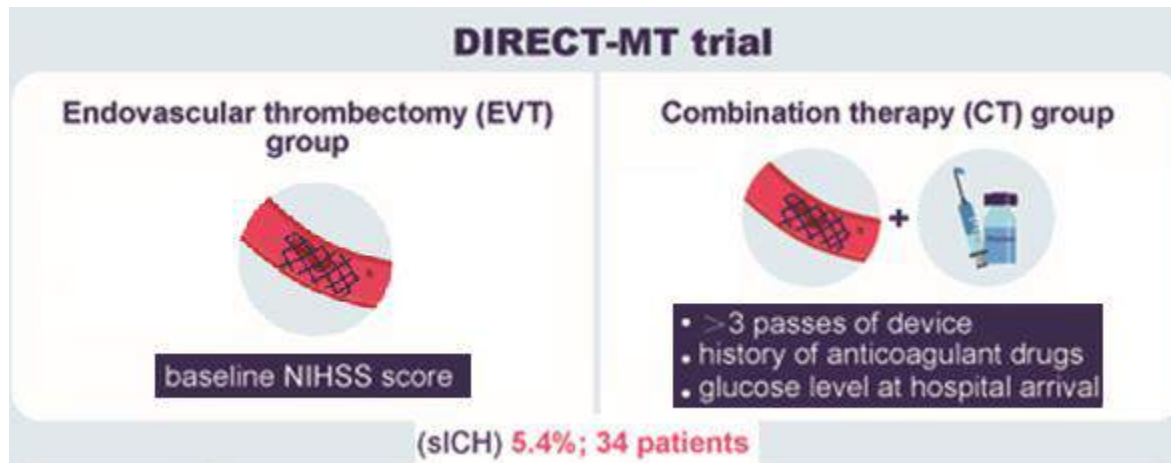


Independent risk factors for sICH

- EVT group → baseline NIHSS score
- CT group →
 - >3 passes of device
 - history of anticoagulant drugs
 - glucose level at hospital arrival

Conclusions

This study shows that higher baseline NIHSS score and higher glucose level at hospital arrival were associated with sICH in patients with acute ischemic stroke after EVT. Alteplase treatment did not increase the risk of HT, sICH, or PH after EVT. The independent predictor of sICH was different in EVT alone group and combination-therapy group.



Stroke

CLINICAL AND POPULATION SCIENCES

Endovascular Thrombectomy for Pediatric Acute Ischemic Stroke

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MAKALE -5

Dergi: Stroke / Mayıs 2022

Konu: Pediatrik Akut İskemik İnmede EVT

Ülke: A.B.D.

Çalışma: Ulusal Yatan Hasta Örneklemi

www.hcup-us.ahrq.gov

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Table 2. Overview of Baseline Demographic and Clinical Characteristics, Complications, and Outcomes for Pediatric Ischemic Stroke Patients Treated With Endovascular Thrombectomy or Medical Management Only

	Total cohort (n=7341)	Endovascular thrombectomy (n=190)	Medical management only (n=7151)
Baseline demographic and clinical characteristics			
Age (mean years; SEM)	8.6 (0.1)	13.7 (0.3)	8.4 (0.1)
0–5 y	...	NR (<6.0)	2684 (37.5)
6–12 y	2125 (28.9)	35 (18.4)	2090 (29.2)
13–17 y	2522 (34.4)	145 (76.3)	2377 (33.2)
Female	3293 (44.9)	79 (41.8)	3214 (44.9)
Non-White race and ethnicity	3199 (43.6)	50 (26.3)	3149 (44.0)
Hospital–urban/teaching	6903 (94.0)	180 (94.7)	6723 (94.0)
Primary payer–medicare/medicaid	3413 (46.5)	79 (41.8)	3334 (46.6)
APR-DRG illness severity subclass >3 (extreme)	1520 (20.7)	105 (55.3)	1415 (19.8)
Concomitant thrombolytic therapy	233 (3.2)	79 (41.6)	154 (2.2)

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	Total cohort (n=7341)	Endovascular thrombectomy (n=190)	Medical management only (n=7151)
Stroke cause			
Congenital cardiac abnormality	1236 (16.8)	30 (15.8)	1206 (16.9)
Congenital circulatory abnormality	193 (2.8)	0 (0.0)	193 (2.8)
Arteriopathy	753 (10.3)	51 (26.8)	702 (9.8)
Coagulopathy	486 (6.6)	20 (10.5)	466 (6.5)
Sickle cell disease	526 (7.6)	0 (0.0)	526 (7.7)
Malignancy	274 (3.9)	0 (0.0)	274 (4.0)
Infective endocarditis	45 (0.7)	0 (0.0)	45 (0.7)
Precerebral (carotid or vertebral) artery dissection	413 (5.6)	41 (21.6)	372 (5.2)
Infection	972 (13.2)	25 (13.2)	947 (13.2)

	Total cohort (n=7341)	Endovascular thrombectomy (n=190)	Medical management only (n=7151)
Discharge disposition			
Favorable functional outcome	6093 (83.0)	105 (55.3)	5988 (83.7)
Routine discharge (home with/without services)	5497 (74.9)	80 (42.1)	5417 (75.7)
Short-term/acute rehabilitation	596 (8.1)	25 (13.2)	571 (8.0)
Poor functional outcome	1248 (17.0)	85 (44.7)	1163 (16.3)
Discharge to skilled nursing, intermediate care, or long-term care facility	1001 (13.6)	70 (36.8)	931 (13.0)
In-hospital mortality	243 (3.3)	15 (7.9)	228 (3.2)
Hospital length of stay	8.5 (0.2)	10.0 (0.7)	8.5 (0.2)

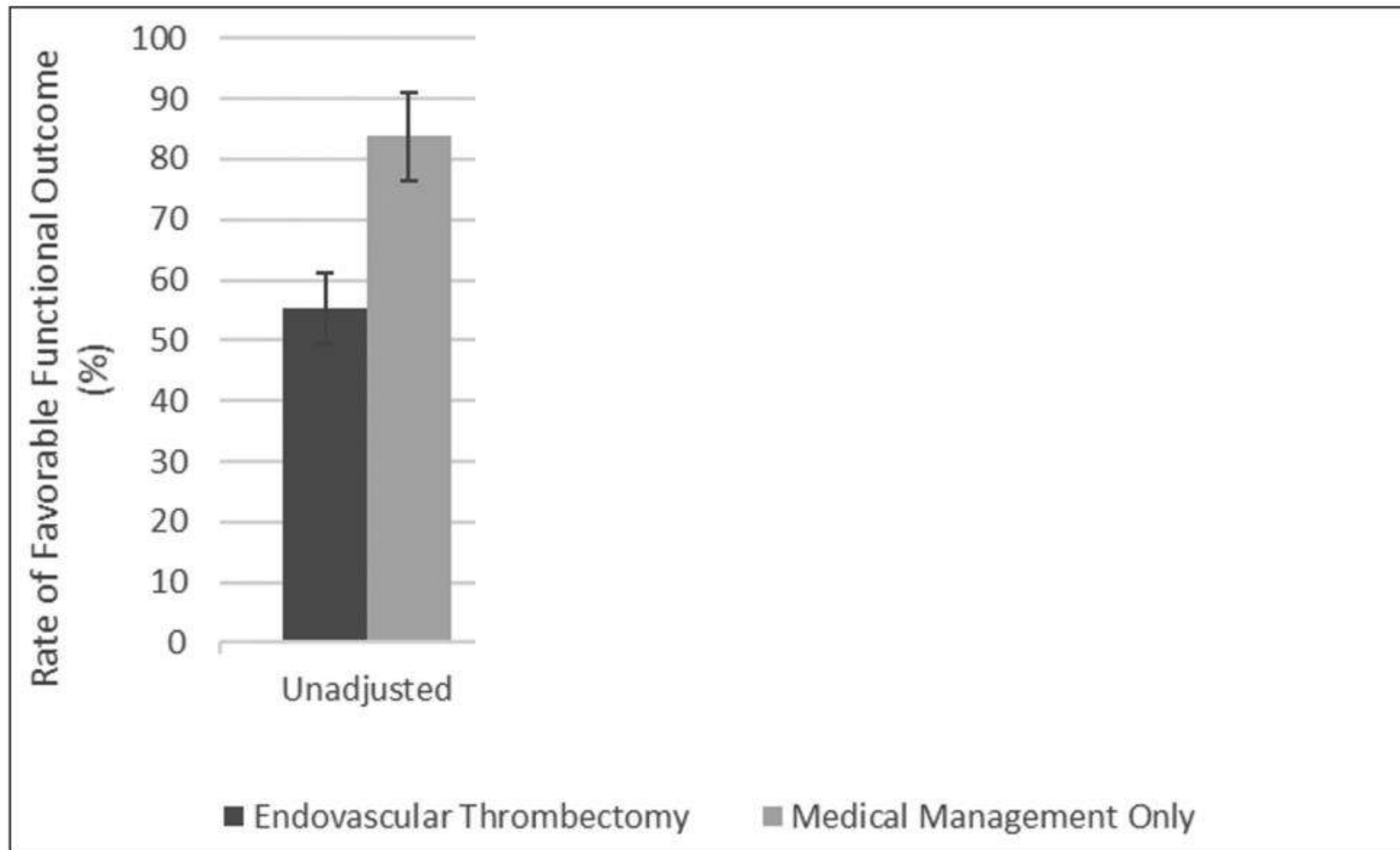


Figure 2. Evaluation of functional outcomes in pediatric ischemic stroke following treatment with endovascular thrombectomy or medical management only.

Favorable functional outcome was defined as discharge disposition to home (with or without services) or to acute rehabilitation and values presented as frequencies of occurrence (%). Unadjusted: no controlling for baseline covariate differences. Adjusted-baseline: propensity score matching adjusting baseline acute stroke severity indices and location of infarction. Adjusted National Institutes of Health Stroke Scale (NIHSS): adjustment by inverse probability of treatment weighting (IPTW) for baseline NIHSS score. Adjusted NIHSS >11: subgroup analysis of patients greater than the 75th percentile of documented NIHSS scores.

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	Total cohort (n=7341)	Endovascular thrombectomy (n=190)	Medical management only (n=7151)
Location of occlusion			
Cerebral circulation	6650 (90.6)	150 (78.9)	6500 (90.9)
Precerebral circulation	567 (7.7)	40 (21.1)	527 (7.4)
Internal carotid artery	305 (4.2)	15 (7.9)	290 (4.1)
Basilar artery	114 (1.6)	25 (13.2)	89 (1.2)
Vertebral artery	69 (0.9)	0 (0.0)	69 (1.0)

	Total cohort (n=7341)	Endovascular thrombectomy (n=190)	Medical management only (n=7151)
Acute stroke severity indices			
Aphasia	1910 (26.0)	125 (65.8)	1785 (25.0)
Cerebral edema	737 (10.0)	84 (44.4)	653 (9.1)
Coma	385 (5.2)	25 (13.2)	360 (5.0)
Paresis/plegia	285 (3.9)	0 (0.0)	285 (4.0)
Herniation	334 (4.5)	25 (13.2)	309 (4.3)
Mechanical ventilation	1006 (13.7)	60 (31.7)	946 (13.2)
Baseline NIHSS score (mean score; SEM)*	5.8 (0.2)	11.4 (0.7)	4.8 (0.3)

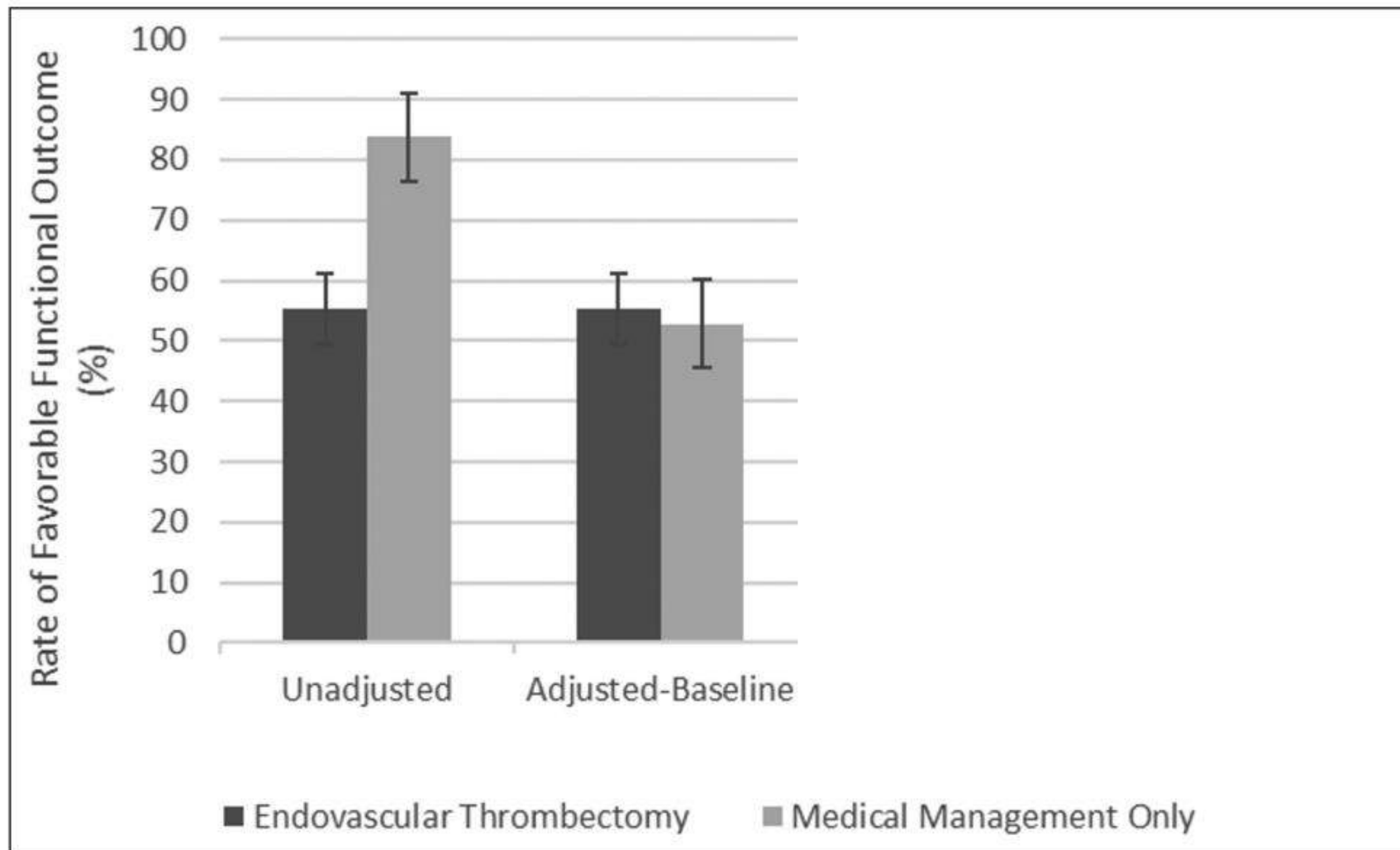


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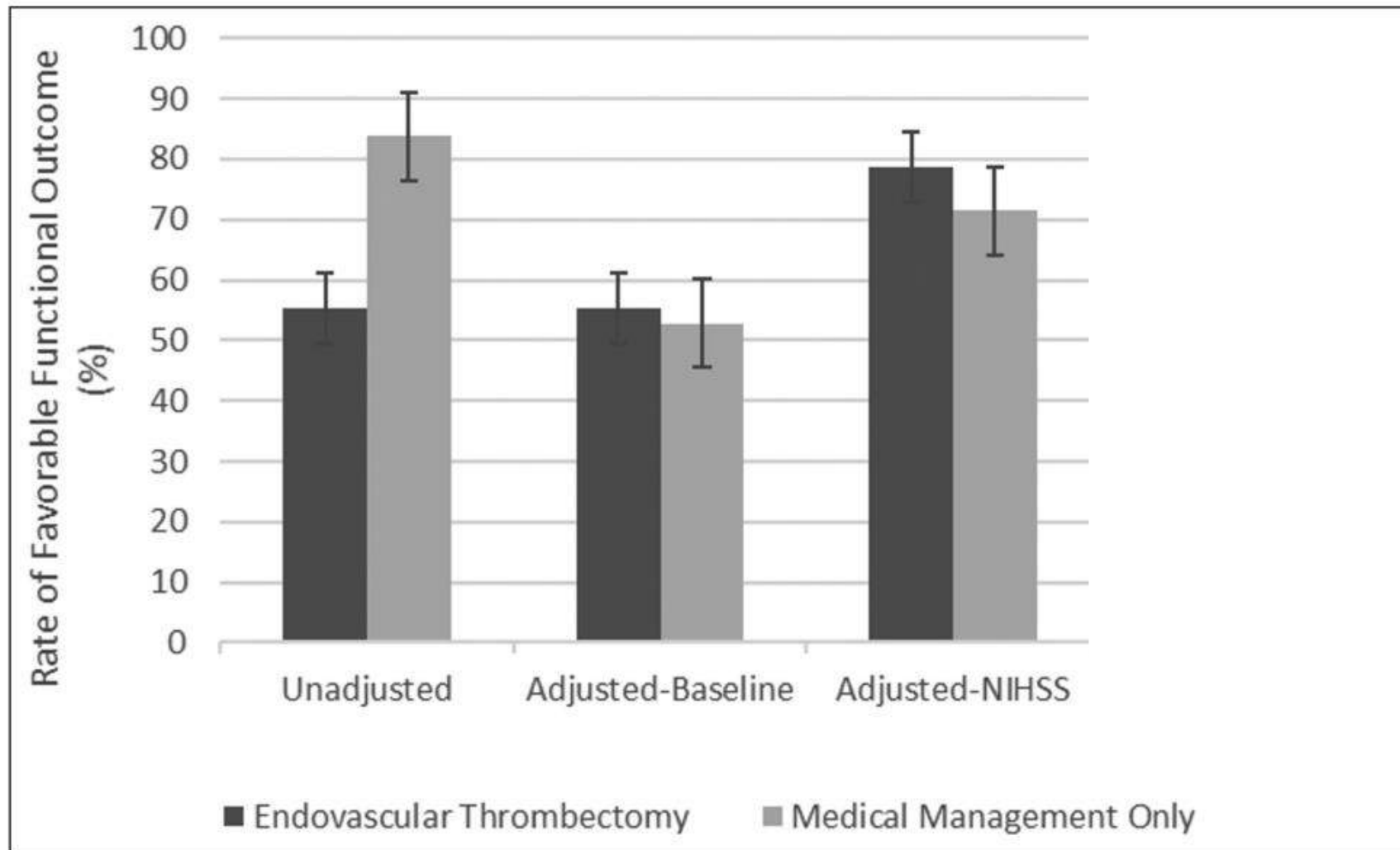


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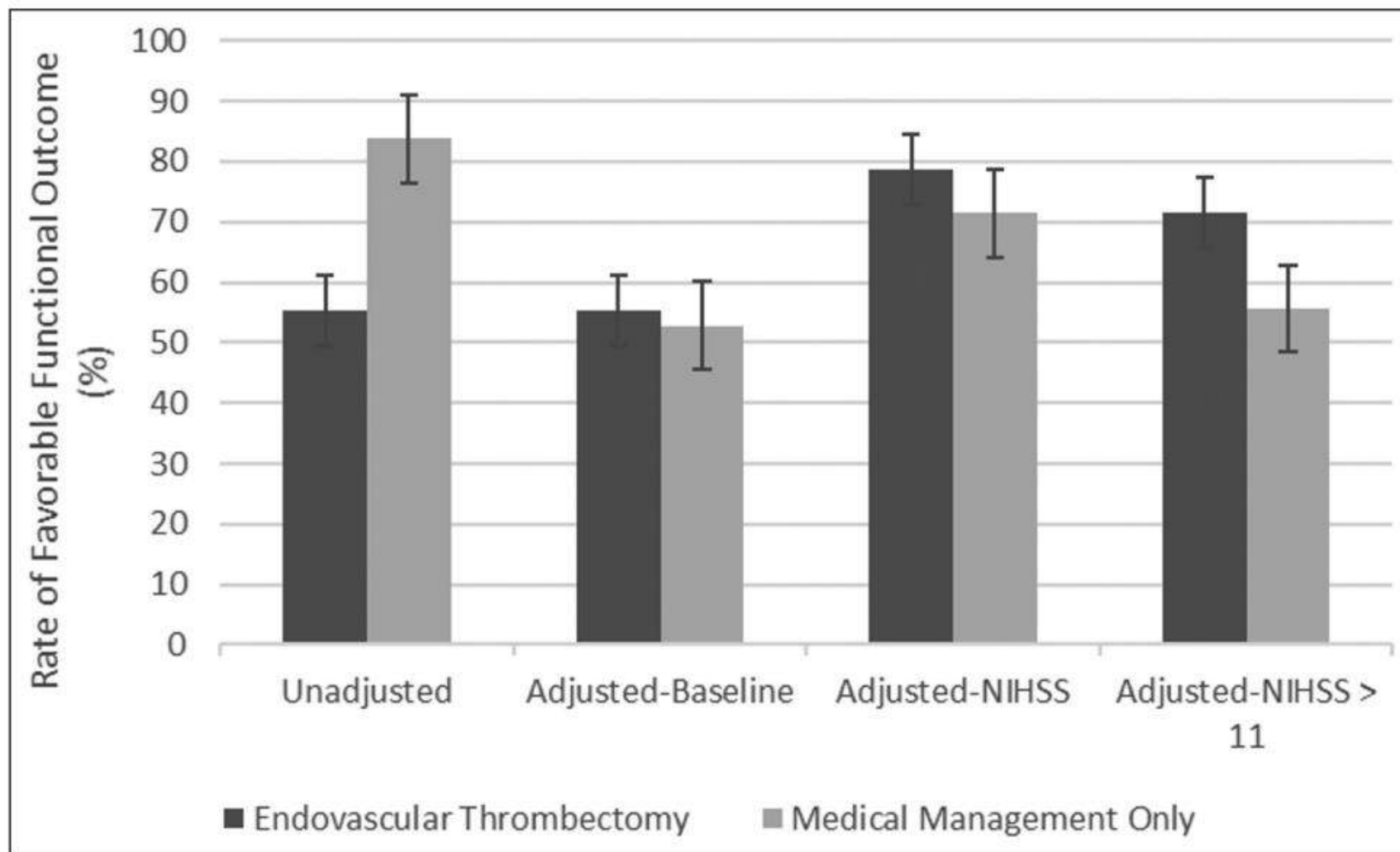


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CONCLUSIONS

This study presents a cross-sectional evaluation of the treatment of pediatric IS with EVT and is the first study to track treatment modalities over nearly a decade-long interval. Favorable findings with respect to clinical course and short-term functional outcomes suggest that EVT is likely a safe and useful treatment modality for pediatric patients with stroke. Randomized, controlled clinical trials are warranted to further evaluate the immediate and long-term outcomes of EVT in this patient population.

Pediyatrik iskemik inme → EVT → Kesitsel deęerlendirme & Tedavi modalitesi (10 yıllık izlem)

Klinik seyir & kısa vadeli fonksiyonel sonlanım → EVT güvenli & faydalı (RKÇ'ler gerekli)



TEŞEKKÜRLER

PULMONER GİRİŞİM MERKEZLERİ

Ciğerci Mustafa

4,0 ★★★★★ (2,6 B) · ₺ · Restoran
Atatürk Blv. No:137

Açık havada oturma alanı ve rahat bir atmosferi olan, geleneksel yemeklerin servis edildiği sade restoran.
İçeride servis · Paket servisi · Temassız teslimat



Ciğerci Mustafa Kemal

4,0 ★★★★★ (1,2 B) · ₺ · Restoran
Kep Kep Sk. No:23

Kapanmak üzere · 01:00

🗣️ "Diğer ciğerci mustafalar orjinal değil."

İçeride servis · Paket servisi · Temassız teslimat



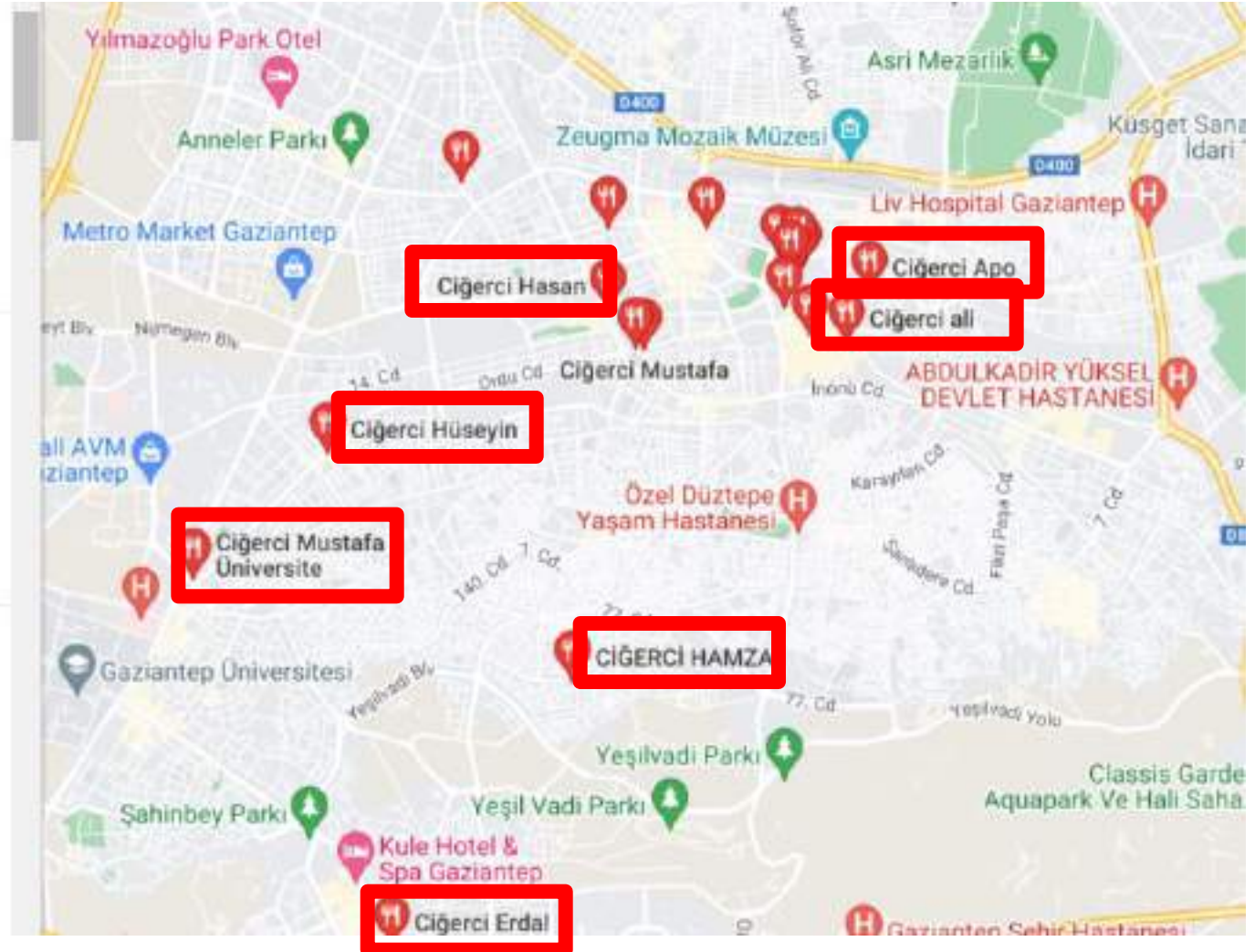
CİĞERCİ YUNUS (KEBAP - KATMER -BEYRAN)

4,1 ★★★★★ (672) · ₺ · Restoran
Değirmişem Mahallesi, Mithat Enç Cd. No...

Kapanmak üzere · 01:00

🗣️ "Adı ciğerci olup gerçekten hakkını veren bir mekan."

İçeride servis · Paket servisi · Temassız teslimat



INTER-COSTAL GİRİŞİM MERKEZLERİ

Kaburgacı Kenan

4,6 ★★★★★ (290) · Türk

Adliye Son Tramvay Durağı Önü

Kapalı · Açılış saati: 08:00

🗣️ "Kaburgası çok çok iyi."

İçeride servis · Paket servisi · Temassız teslimat



Kaburgantep Kebap

4,6 ★★★★★ (691) · Kebap Restor...

Kılıç Ali Cd. No:17

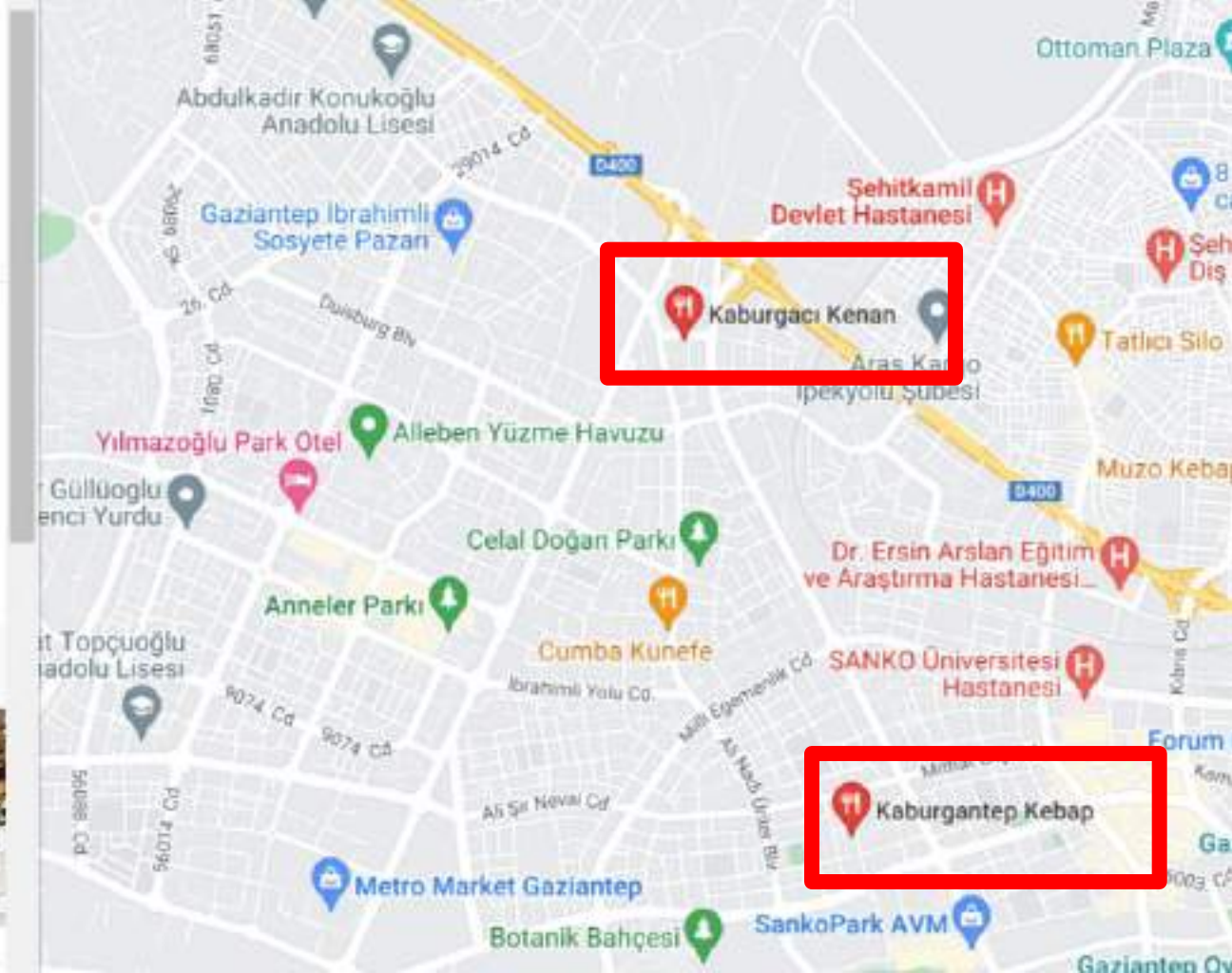
Kapalı · Açılış saati: 11:15

🗣️ "Kaburgacı kenan değil, kaburga antep."

İçeride servis · Arabaya servis · Temassız teslimat



Daha fazla yer keşfedin





Akut İnmede Baziler Arter Oklüzyonları:EVT Gerekli midir? Nasıl Müdahale Etmeliyim?

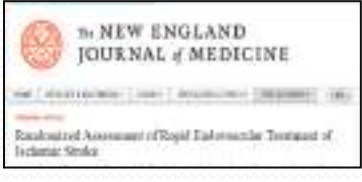
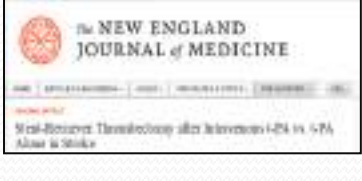
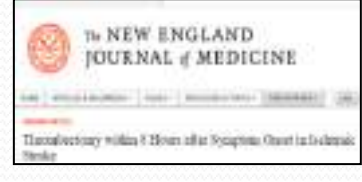
Prof Dr Semih Giray
Gaziantep Üniversitesi Tıp Fakültesi
Nöroloji Anabilim Dalı , Girişimsel Nöroloji

IV. Girişimsel Nöroloji Eğitim Toplantısı

21 - 22 MAYIS 2022

SHIMALL DELUXE OTEL, GAZİANTEP

MECHANICAL THROMBECTOMY

MR CLEAN		90 day mRS ↓	Good outcome (%32.6-%19.1)	ICH same	NNT :7.4
ESCAP E		mRS ↓	Good outcome (%53/%29)	ICH (%3.6/3.7)	Mortality↓
SWIFT PRIME		mRS ↓ (%60/%35)	Good outcome	Mortality and ICH smae	NNT:4
EXTAND 1A		mRS ↓	Good outcome (%71/%40)	Mortality same	NNT:3.2
REVASCAT		mRS ↓	Good outcome (%44/%28)	Mortality and ICH same	NNT:4

The NEW ENGLAND
JOURNAL of MEDICINE

ESTABLISHED IN 1812

APRIL 26, 2018

VOL. 378 NO. 17

Tenecteplase versus Alteplase before Thrombectomy
for Ischemic Stroke

B.C.V. Campbell, P.J. Mitchell, J. Chanlon, N. Tassi, T.J. Kleinig, R.J. Dawling, B. Yan, S.J. Bush, H.M. Dewey,
V. Thijs, R. Spragg, M. Simpson, M. Brooks, H. Acadi, T.Y. Wu, D.G. Shah, T. Wijeratne, T. Ang, F. Mitoff, C.R. Levi,
E. Rodriguez, H. Zhao, P. Salinas, C. Garcia-Experton, P. Bailey, M. Koo, L. de Villiers, H. Brown, K. Redmond,
D. Leggett, J.N. Fink, W. Collicott, A.A. Wong, C. Muller, A. Coulthard, K. Mitchell, J. Clouston, K. Mabady, D. Field,
H. Ma, T.G. Phan, W. Chong, R.V. Chandra, L.A. Slater, M. Krause, T.J. Harrington, K.C. Faulder, B.S. Strindberg,
C.F. Blader, G. Sharma, P.M. Desford, M.W. Parton, G.A. Duncan, and S.M. Davis
for the EXTEND-IA TNE Investigators*

Mechanical thrombectomy after intravenous alteplase versus alteplase alone after stroke (THRACE): a randomised controlled trial

*Serge Bracad, Xavier Ducrocq, Jean Louis Mas, Marc Soudant, Catherine Oppenheim, Thierry Moulin, Francis Guillemin, on behalf of the
THRACE investigators**

- Internal Carotid Artery (ICA)
- Middle Cerebral Artery (MCA)
- Vertebral / Basilar Artery

NATURAL COURSE OF LVO

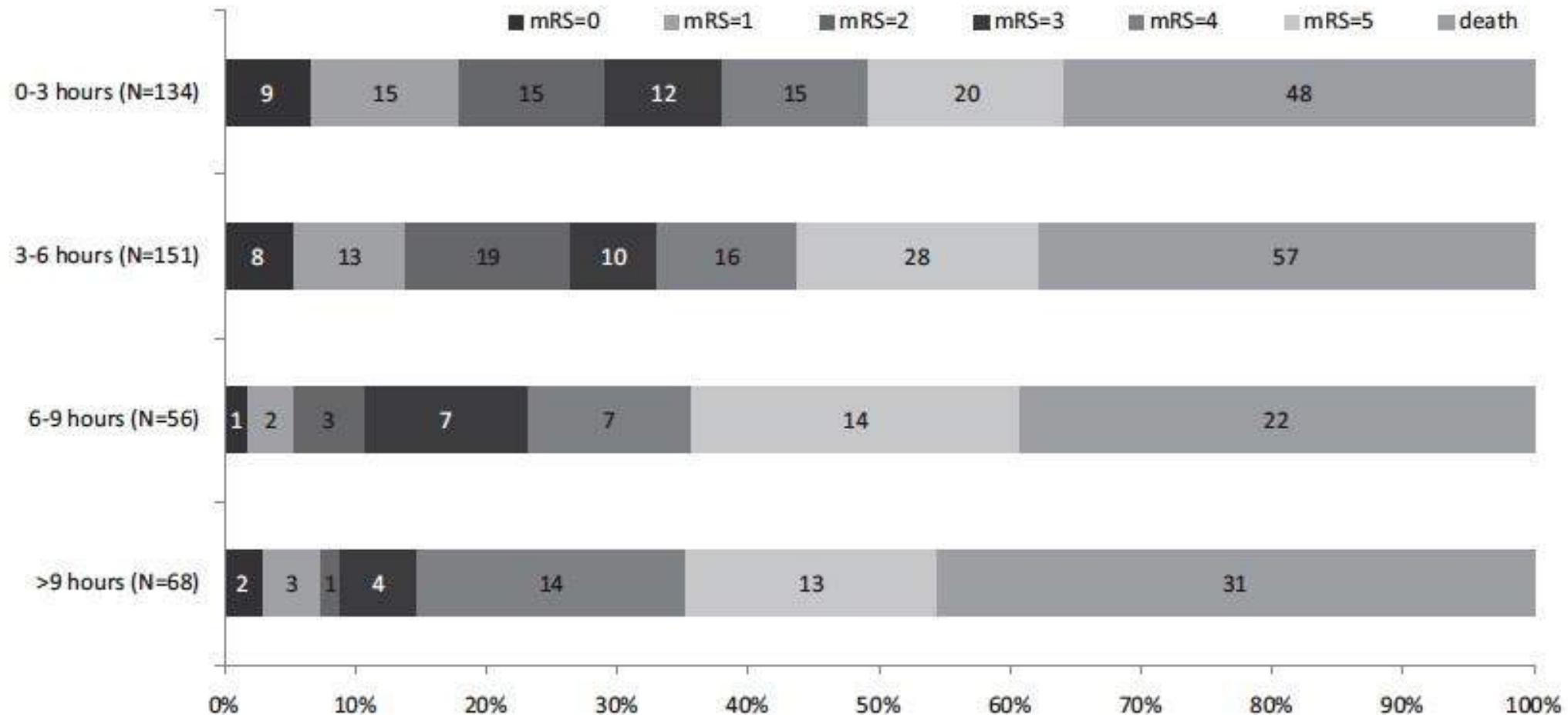
Vessel	Mortality
ICA	53% ¹
MCA	27% ²
Basilar Artery	89-90% ³

¹. Jansen O, et al.
². Furlan A et al. PROACT II Trial
³. Brückmann H et al.

Time is Brain(stem) in Basilar Artery Occlusion

Mervyn D. I. Vergouwen, MD, PhD; Ale Algra, MD, PhD; Thomas Pfefferkorn, MD;
Christian Weimar, MD; Christina M. Rueckert, MD; Vincent Thijs, MD; L. Jaap Kappelle, MD, PhD;
Wouter J. Schonewille, MD; on behalf of the Basilar Artery International Cooperation Study (BASICS)
Study Group

Conclusions—Early recanalization therapy in patients with BAO is associated with a more favorable outcome with a significant increased chance of a poor outcome when recanalization therapy is started >6 hours after estimated time of



Vaka; 66 yaşında, Kadın hasta; Hipertansiyon ve hiperlipidemi yanında iyi tanımlanmamış aritmi öyküsü olan, uyanınca sağ yüz, kol ve bacakta güçsüzlük, disartri ve başağrısı ile acile başvuran hasta. En son gece yatmadan önce iyi imiş. Sabah 05.00 de semptomlarla uyanmış. Nörolojik muayenede; sağ göz deviasyonu, sağ SFP, disartri, sağ hemiparezi üst ve altta 3/5, NIHSS 11 idi.

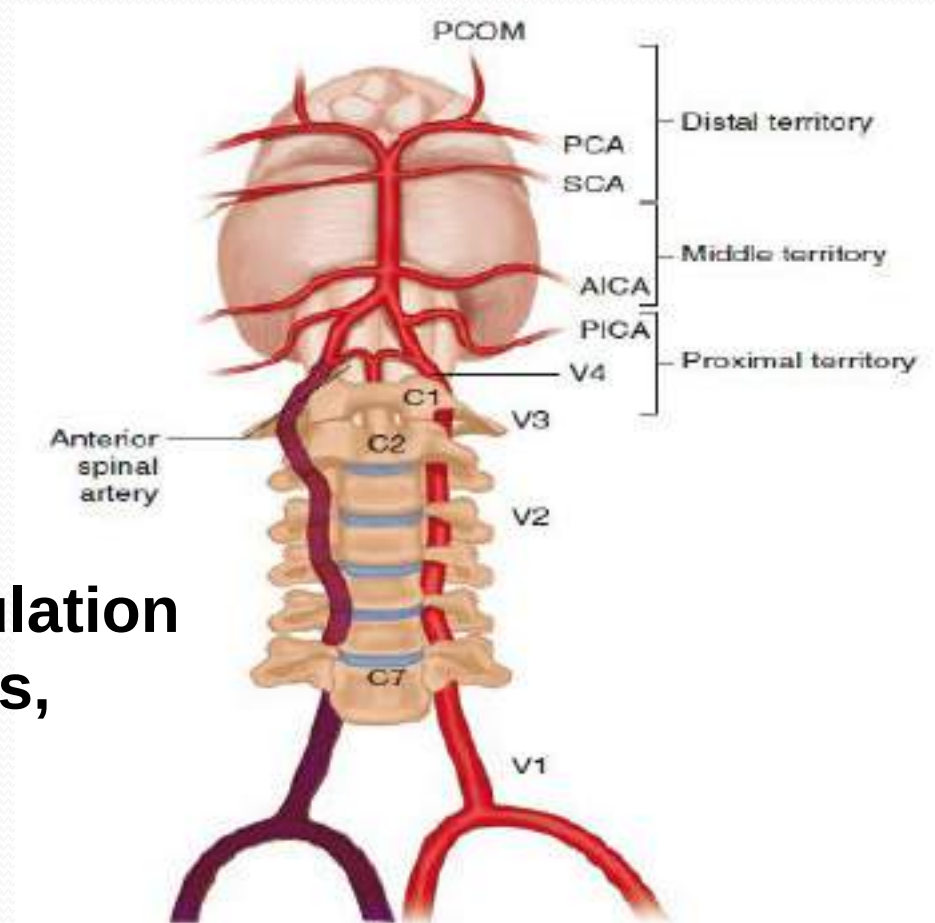
circulation LVO [5]. Although the mechanism of poor outcome despite successful recanalization has not yet been clarified, it might be associated with age, stroke severity, time from stroke onset to treatment, infarct distribution and volume, brain edema, leukoaraiosis, collateral status, subacute reocclusion, microvascular compromise, and impaired cerebral autoregulation [6]. To date, no predictive model for acute BAO has been developed to identify select suitable patients more likely to benefit from EVT.

Vascular territory	Anatomic location	Clinical presentation
PCA	Occipital lobe	Homonymous hemianopsia
	Optic radiation or supracalcarine	Inferior quadrantanopsia
	Myers loop or infracalcarine	Superior quadrantanopsia
PCA–MCA border zone	Bilateral temporal–occipital	Prosopagnosia
	Bilateral parietal–occipital	Optic ataxia, oculomotor apraxia, and simultagnosia
	Dominant temporal–parietal	Transcortical sensory aphasia
PICA	Inferior posterior cerebellar hemisphere, inferior vermis, lateral medulla	Vertigo, nausea, vomiting, ipsilateral face numbness, Horner’s syndrome, dysphagia, ataxia, and contralateral hemisensory loss below the face
SCA	Dorsolateral upper brainstem and cerebellum and superior cerebellar peduncle	Ipsilateral limb ataxia, vertigo, nystagmus, dysarthria, and gait ataxia
AICA	Ipsilateral labyrinth, lateral pontine tegmentum, brachium pontis, and inferior cerebellar peduncle	Ipsilateral dysmetria, hearing loss, Horner’s syndrome, dyskinesia, contralateral loss of pain, and temperature sensation
Top of the BA	Midbrain, thalamus, and mesial temporal lobes and occipital lobes	Somnolence, nystagmus, skew deviation, oscillatory eye movements, and vertical gaze paralysis
Mid-BA	Lateral and medial pons	Ipsilateral loss of facial sensation, ipsilateral dysmetria, contralateral arm and leg weakness, and gaze deviation
Pontine paramedian perforators	Anteromedial pons	Ipsilateral nuclear facial palsy, horizontal gaze palsy, and contralateral arm and leg weakness
Short pontine circumferential arteries	Anterolateral pons	Ipsilateral intranuclear ophthalmoplegia, palatal/ facial/ pharyngeal/ocular myoclonus, dysmetria, and contralateral limb weakness
Proximal BA	Lower pons	Quadriplegia, horizontal gaze palsy, bifacial, paralysis
VA	Medulla and cervical spinal cord	Contralateral limb weakness, hemibody loss of touch and proprioception, and ipsilateral tongue weakness
ASA	Anterior spine	Quadriparesis, bilateral pain and temperature loss, decreased sphincter tone, autonomic instability, and hyperreflexia. Proprioception spared

PC etyoloji

- LVO + atherosclerosis %35-50 (distal PC bölgelerini etkiler)
(Atherostenozis V1 V4 segment-)
- %11-24 Kardiyoembolik (distal ve middle PC bölgelerini etkiler)
- İntrinsik küçük damar hastalığı-%14-30
- Disseksiyon –V2 ve V3 segment

- Nouh A, Remke J, Ruland S. Ischemic posterior circulation stroke: a review of anatomy, clinical presentations, diagnosis, and current management. Front Neurol. 2014;5:30.
- Caplan LR, et al. New England Medical Center posterior circulation registry. Ann Neurol. 2004;56(3):389–98.



iv tPA

- Etkisiz + MT ile

Coutinho JM, et al. Combined intravenous thrombolysis and Thrombectomy vs Thrombectomy alone for acute ischemic stroke: a pooled analysis of the SWIFT and STAR studies. JAMA Neurol. 2017;74(3):268–74.

- Etkili + MT ile

- Goyal N, et al. Comparative safety and efficacy of combined IVT and MT with direct MT in large vessel occlusion. Neurology. 2018;90(15):e1274–82.

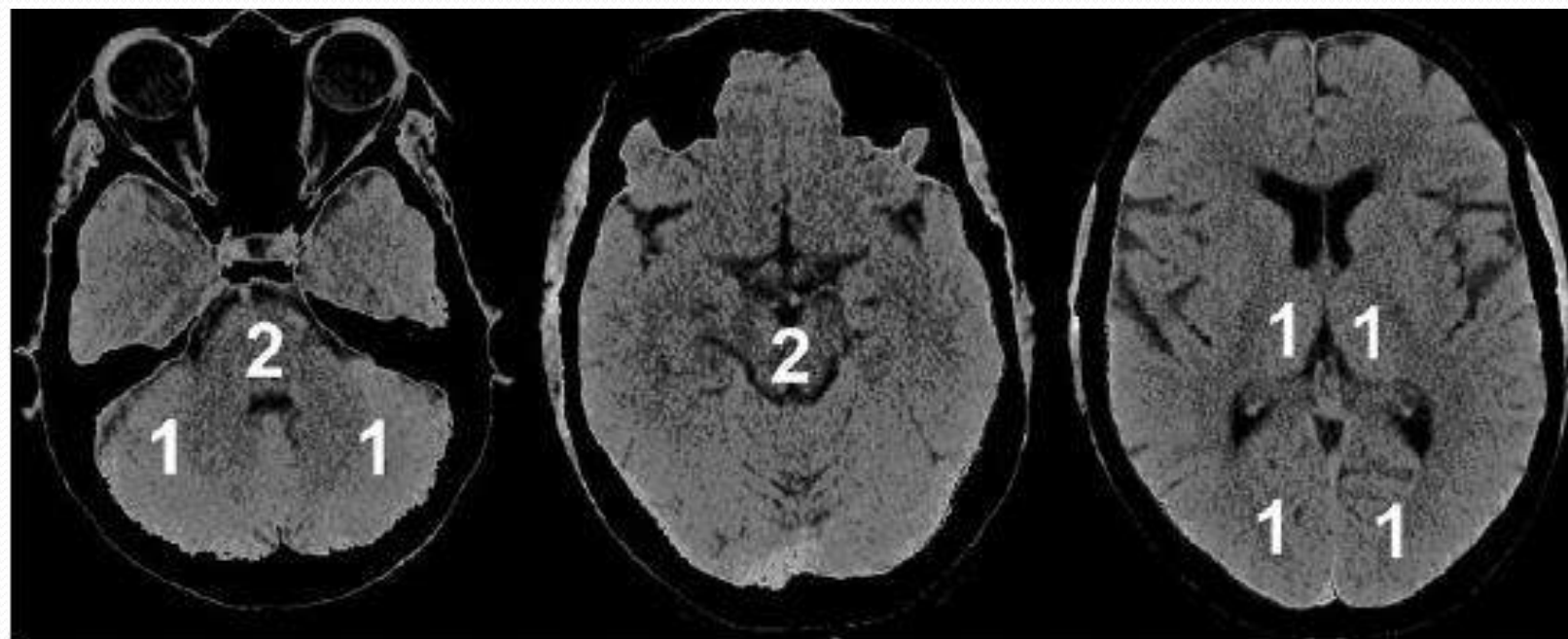
İA tPA

- Lindsberg PJ, Mattle HP. Therapy of basilar artery occlusion: a systematic analysis comparing intra-arterial and intravenous thrombolysis. Stroke. 2006;37(3):922-8.

- Tüm stroke ların %25 i PC
- Rekanalizasyon olmadan iyi sonlanım %2
- Rekanalizasyon IVT ile %53, IAT %65
- -Rekanalizasyon oranı %80-94 arası

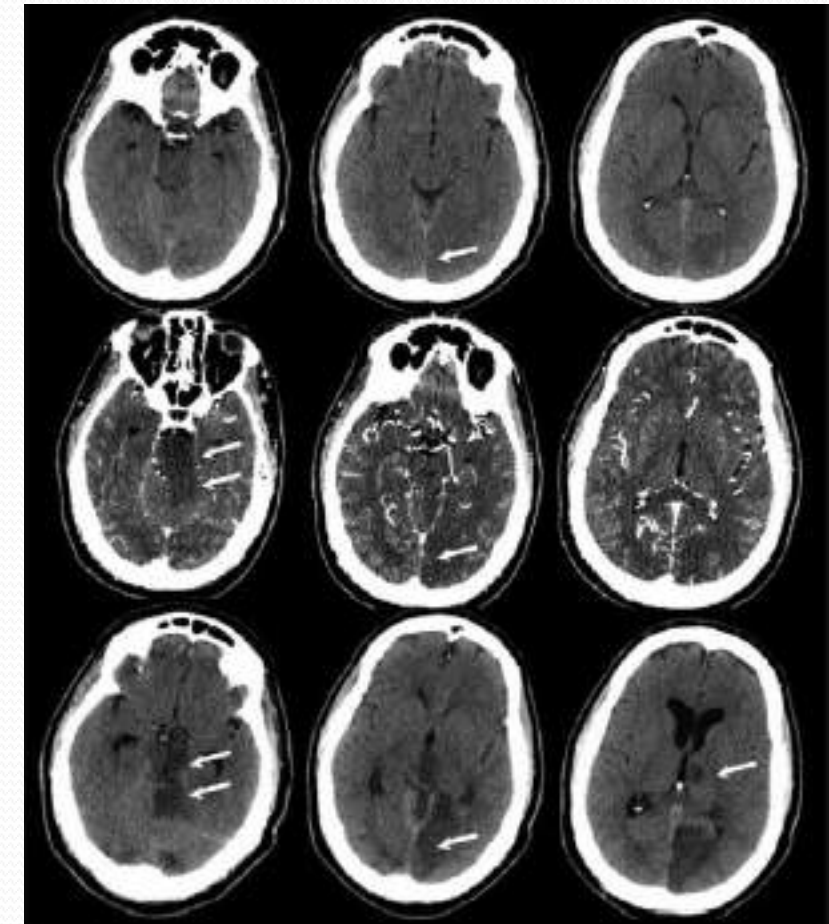
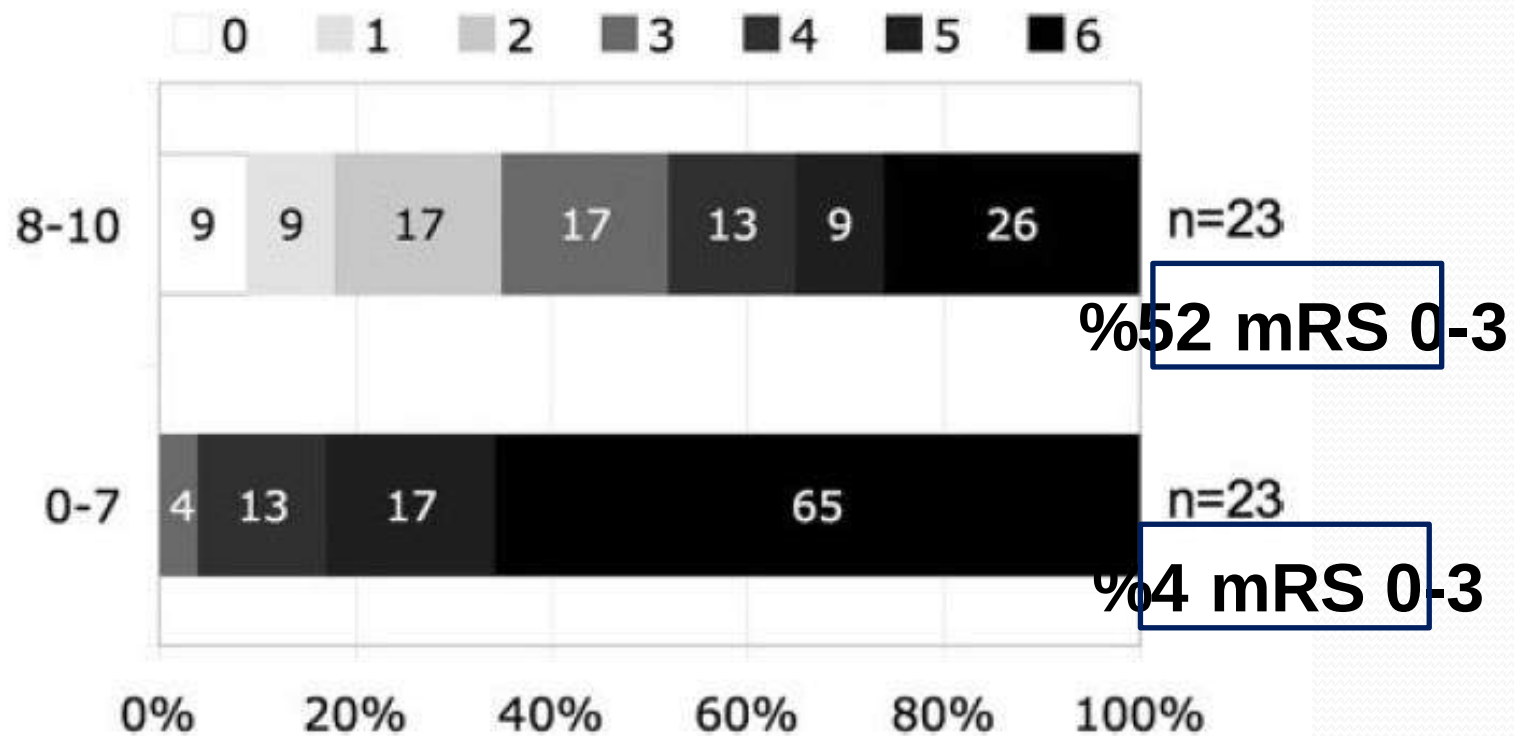
Extent of Hypoattenuation on CT Angiography Source Images Predicts Functional Outcome in Patients With Basilar Artery Occlusion

Volker Puetz, MD; P.N. Sylaja, MD; Shelagh B. Coutts, MD; Michael D. Hill, MD, MSc; Imanuel Dzialowski, MD; Pia Mueller, MD; Ulf Becker, MD; Gabriele Urban; Christine O'Reilly, BSc; Philip A. Barber, MD; Pranshu Sharma, MD; Mayank Goyal, MD; Georg Gahn, MD; Ruediger von Kummer, MD; Andrew M. Demchuk, MD



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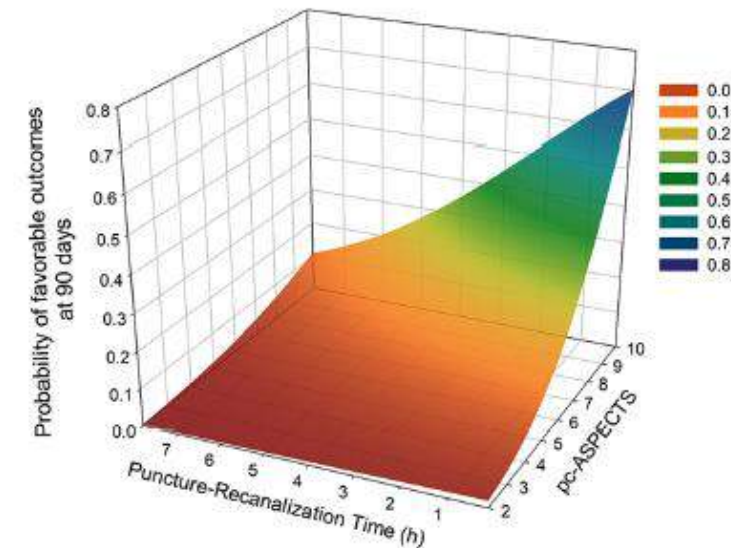
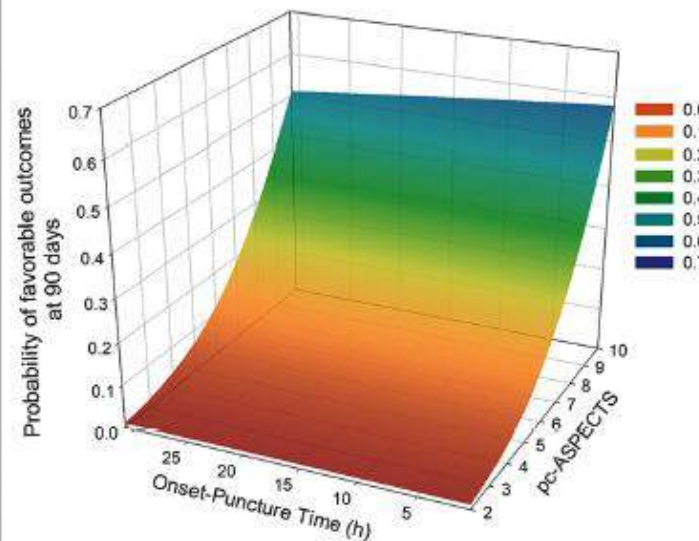
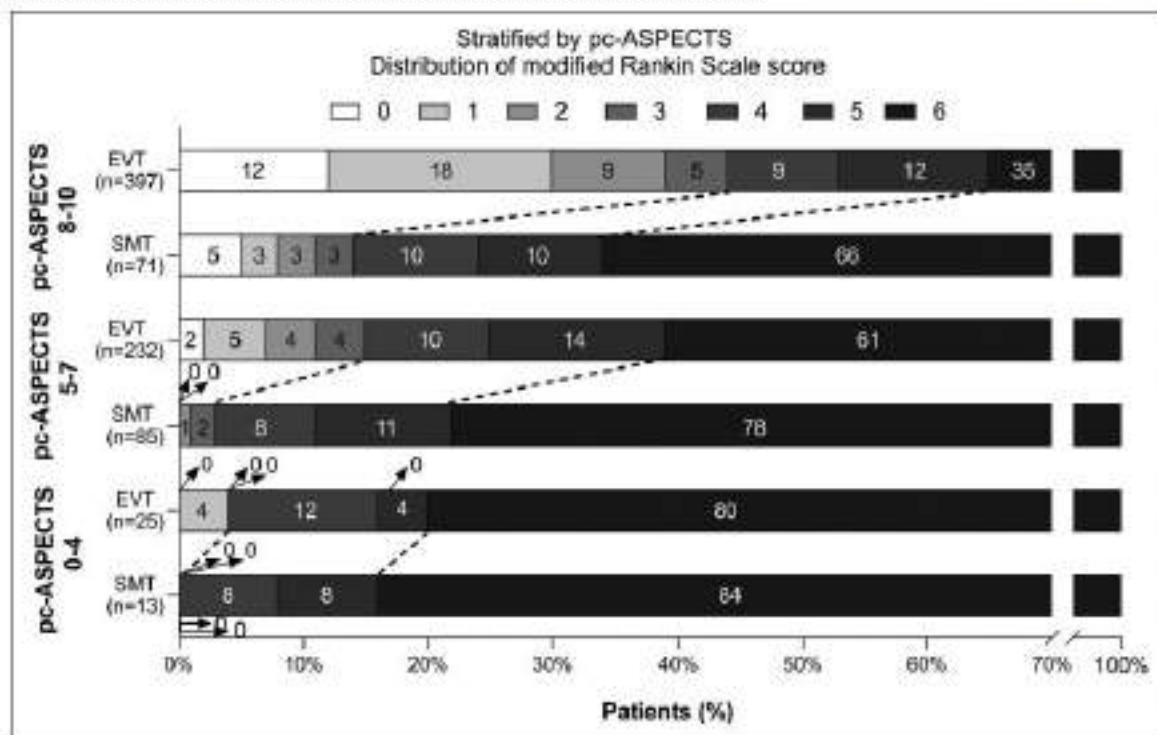


Stroke

CLINICAL AND POPULATION SCIENCES

Values of Baseline Posterior Circulation Acute Stroke Prognosis Early Computed Tomography Score for Treatment Decision of Acute Basilar Artery Occlusion 2021

Hongfei Sang¹, MD; Fengli Li², MD; Junjie Yuan, MD; Shuai Liu, MD; Weidong Luo, MD; Changming Wen, MD; Daji Zhu³, MD; Wenhua Chen⁴, MD; Min Lin, MD, PhD; Li Qi, MD; Yaoyi Zhong, MD; Zhen Wang, MD; Wenlong Ling, MD; Zhonghua Shi, MD; Huisheng Chen⁵, MD; Wenhua Liu, MD, PhD; Zhenzhong Liu, MD; Xiaoxi Yao, MD; Feng Xiong, MD; Guoyong Zeng, MD; Xiaogang Hu, MD; Hui Dong, MD; An Mao, MD; Guoqiang Yang, MD; Jiacheng Huang⁶, MD; Luming Chen, MD; Zili Gong, MD, PhD; Jian Tao, MD; Hanzheng Liu, MD; Deping Wu, MD; Zhongming Qiu⁷, MD; Qingwu Yang, MD, PhD; Wenjie Zhi⁸, MD, PhD; Fangfei Li⁹, MD, PhD

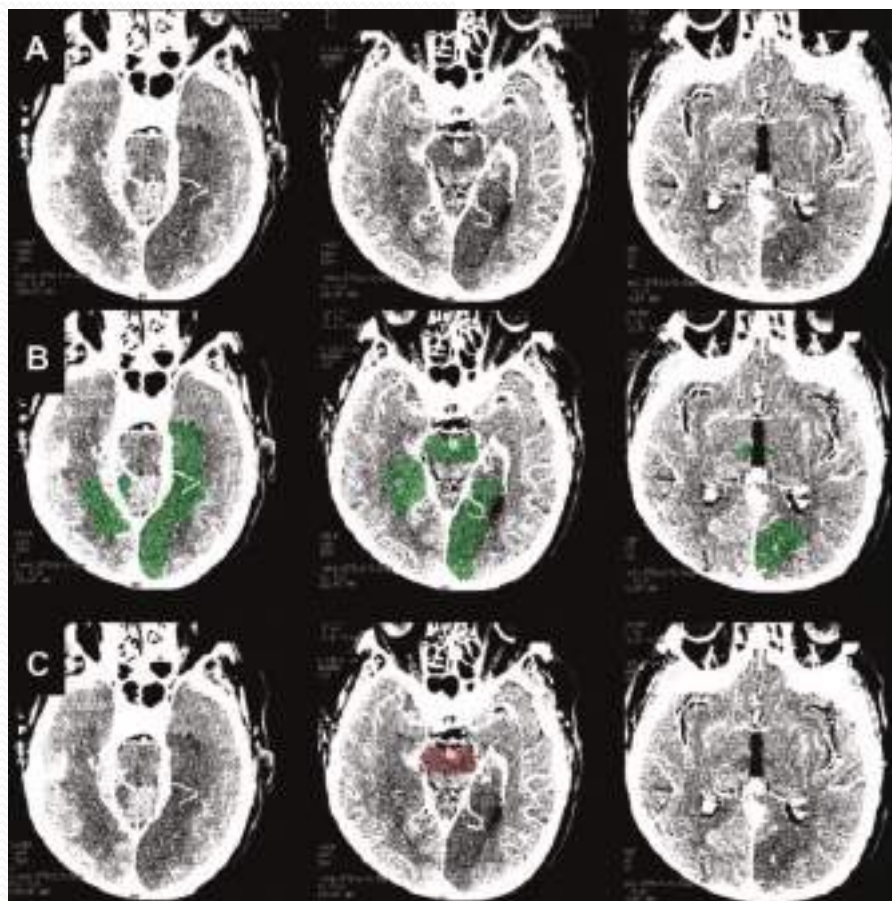


CONCLUSIONS: Patients of basilar artery occlusion with **pc-ASPECTS ≥ 5** could benefit from EVT. The baseline pc-ASPECTS appears more important for decision making and predicting prognosis than time to EVT.

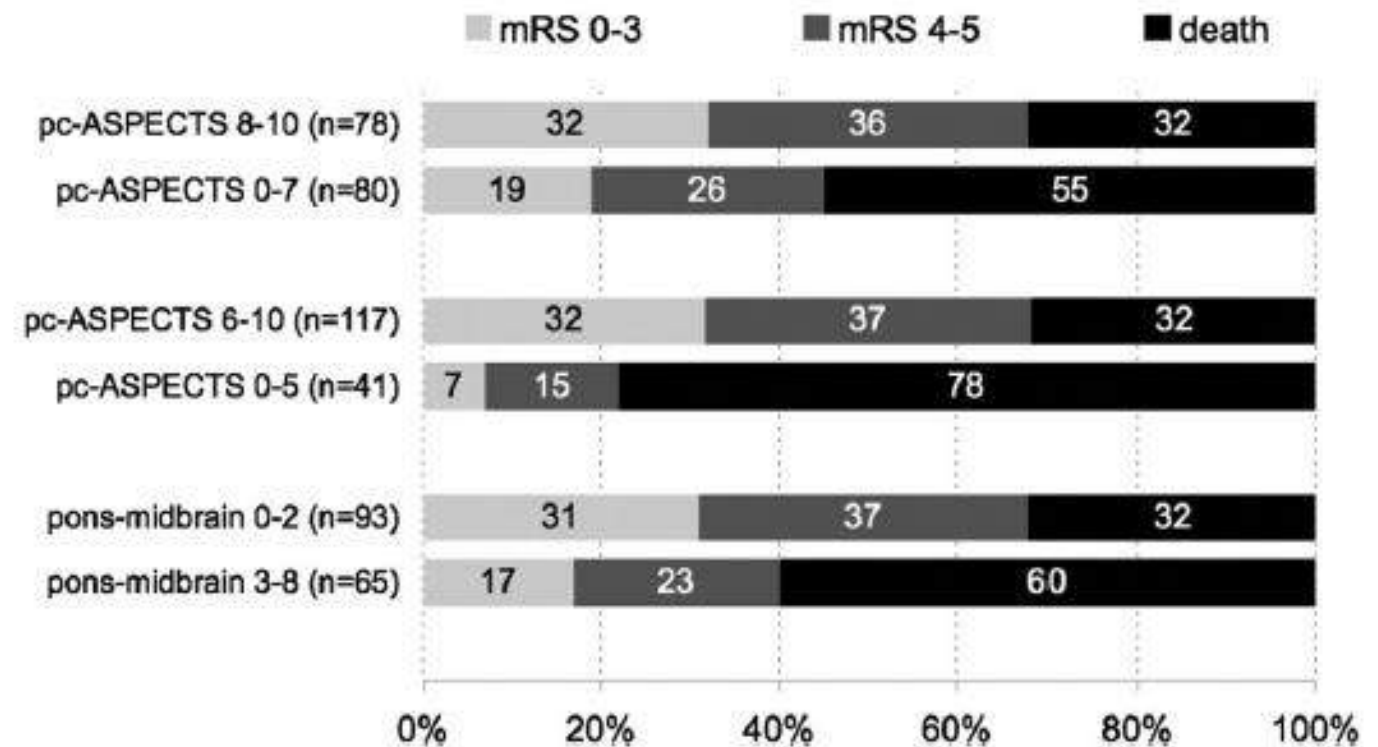
Extent of Hypoattenuation on CT Angiography Source Images in Basilar Artery Occlusion

Prognostic Value in the Basilar Artery International Cooperation Study

Volker Puetz, MD; Andrei Khomenko, MD; Michael D. Hill, MD; Imanuel Dzialowski, MD; Patrik Michel, MD; Christian Weimar, MD; Christine A.C. Wijman, MD; Heinrich P. Mattle, MD; Stefan T. Engelter, MD; Keith W. Muir, MD; Thomas Pfefferkorn, MD; David Tanne, MD; Kristina Szabo, MD; L. Jaap Kappelle, MD; Ale Algra, MD; Ruediger von Kummer, MD; Andrew M. Demchuk, MD; Wouter J. Schonewille, MD; on behalf of the Basilar Artery International Cooperation Study (BASICS) Group



pc-ASPECT –pons midbrain index (0-8)



Anatomik varyasyonlar

- Bilateral f PCA varsa küçük kalibrede BA olur
- Çoğunda f PCA unilatereldir
- Persistan trigeminal arter ön-arka sistem arası en sık görülen anomali
- Persistan hypoglossal arter –bittiği yerde sıklıkla anevrizma yol açar
- -Labirint arter bazen direkt BA dan çıkar
- İndominant VA, PICA ile sonlanır

Key Points

- Acute PC occlusion can have a variety of symptoms, many times misleading. These may include and are not limited to syncope, seizures, altered mental status, and double vision.
- Vascular imaging is essential to diagnose PC strokes.
- There are no accepted standards established for perfusion imaging to help triage patients for MT. MRI might need to be performed for late presenting patients to assess stroke burden and parenchymal damage (DWI and FLAIR).
- Clinical outcomes in patients with LVO in PC could be devastating. Therefore, aggressive mechanical recanalization must be considered.
- If routine access is not feasible, alternative approaches should be made for recanalization.

11/16/13



12/1/13

- In atherosclerotic etiology of the LVO, emergent angioplasty/stenting might need to be performed.

References

1. Merwick A, Werring D. Posterior circulation ischaemic stroke. *BMJ*. 2014;348:g3175.
2. Goyal M, et al. Endovascular thrombectomy after large-vessel ischaemic stroke: a meta-analysis of individual patient data from five randomised trials

- Ön ve arka sistemler arasında belirgin anatomi farklılıkları var.
- VB strok tüm iskemik strokların %20'sini oluşturuyor.
- Rekürren strok riski, ön sistemden daha fazla: OXFORD VASKÜLER ÇALIŞMASINDA * , akut evrede rekürren riski OR:9.29(%95 CI=2.31-33.27) $p<0,001$; 90 günlük risk ise OR:3.2 (%95 CI=1.4-7.0) $p=0,006$.
- Ölüm riski Baziler Arter oklüzyonunda %30-75, rekanalize edilmezse % 100'e (%90) yaklaşır.(MCA okl. %41-79)

****Brain 2009; 132:982-988***
Stroke 2011; 40:134-139
Stroke 2014; 40: 2732-2737

VBS İskemik Strok Mekanizmaları:

HİPOPLAZİK Vertebral Arter (HVA):

- HVA, eğer VA de akım 30-40 ml/dak.'nın yada VA'nın çapı 3mm yada 2mm'nin altındaysa tanımlanabiliyor.
- HVA, tarafında serebellum yada medullada küçük enfarktların görülmesi, HVA de aterosklerozun geliştiğini ve arterden artere embolik mekanizmayı düşündürmüştür.
- Güney Kore'den Park ve ark.'ın çalışması, HVA da düşük kan akımı ve hızının atherosklerotik süreci başlatabileceğini göstermiştir.

J Neurol Neurosurg Psychiatry 2007;78:954-958

J Neurological Sciences 2009;287: 227-235

Hangi ERT seçilmeli

- İskemik inme heterojinitesi ; **Trombüs kompozisyonu, oklüzyon lokalizasyonu, trombüs volüm yükü, kolleteral perfüzyon ERT seçiminde yönlendirici olmaktadır**
- Baziler Proksimalde olay parsiyel ise İV veya IA, komplet ise mekanik yöntemler, mid basiler veya distalde ise kombine tedaviler veya mekanik yaklaşım öncelikle
- PCA larda, IA ön plana çıkarken, mekanik işlemlerin komplikasyonlarına dikkat etmek gerekir.

Although acute basilar artery occlusion (BAO) accounts for about 1% of all stroke diseases, it can lead to high disability and mortality rates.¹⁻³

Even if the recanalization rate was significantly improved after intra-artery thrombolysis, there was no significant difference in clinical outcome between patients who had intravenous thrombolysis and patients who had intra-arterial thrombolysis, according to the Basilar Artery International Cooperation Study (BASICS).³ Similarly, mechanical thrombectomy improved the recanalization rate, whereas the favorable prognosis of BAO was only approximately 35%.^{4,5} Several factors affected the clinical outcome including baseline National

3. Schonewille WJ, Wijman CA, Michel P, et al. Treatment and outcomes of acute basilar artery occlusion in the Basilar Artery International Cooperation Study (BASICS): a prospective registry study. *Lancet Neurol* 2009;8:724-730.
4. Singer OC, Berkefeld J, Nolte CH, et al. Mechanical recanalization in basilar artery occlusion: the ENDOSTROKE study. *Ann Neurol* 2015;77:415-424.
5. Mokin M, Sonig A, Sivakanthan S, et al. Clinical and procedural predictors of outcomes from the endovascular treatment of posterior circulation strokes. *Stroke* 2016;47:782-788.

The Basilar Artery on Computed Tomography Angiography Prognostic Score for Basilar Artery Occlusion

Fana Alemseged, MD; Darshan G. Shah, MBBS; Marina Diomedi, MD;
Fabrizio Sallustio, MD; Andrew Bivard, PhD; Gagan Sharma, MCA; Peter J. Mitchell, MD;
Richard J. Dowling, MBBS; Steven Bush, MBBS; Bernard Yan, MBBS;
Carlo Caltagirone, MD; Roberto Floris, MD; Mark W. Parsons, MBBS, PhD;
Christopher R. Levi, MBBS; Stephen M. Davis, MD; Bruce C.V. Campbell, MBBS, PhD

Background and Purpose—Basilar artery occlusion is associated with high risk of disability and mortality. This study aimed to assess the prognostic value of a new radiological score: the Basilar Artery on Computed Tomography Angiography (BATMAN) score.

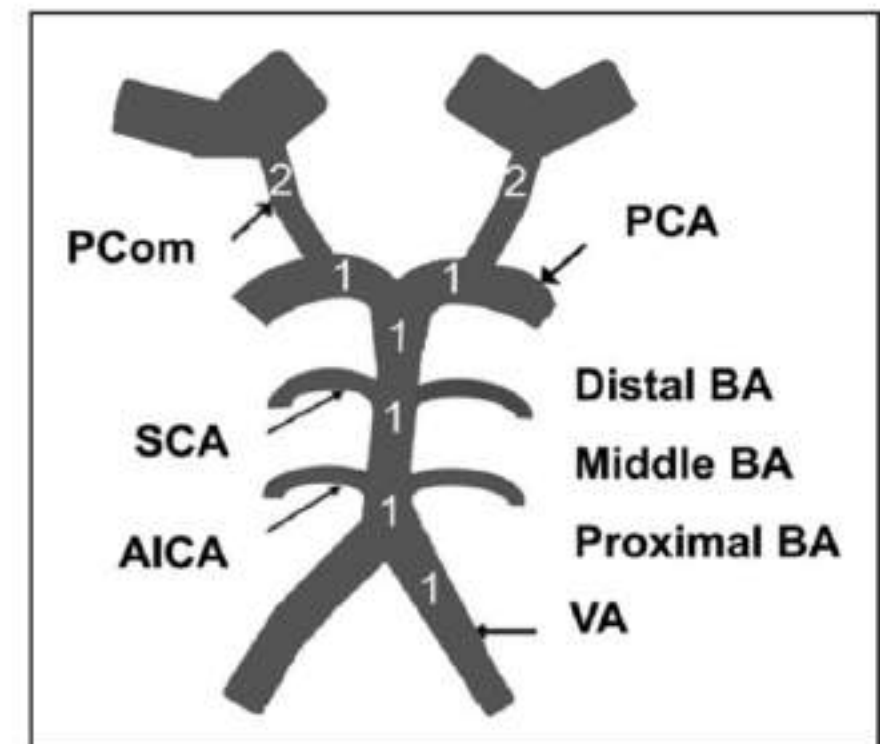
Methods—A retrospective analysis of consecutive stroke patients with basilar artery occlusion diagnosed on computed tomographic angiography was performed. BATMAN score is a 10-point computed tomographic angiography-based grading system which incorporates thrombus burden and the presence of collaterals. Reliability was assessed with intraclass coefficient correlation. Good outcome was defined as modified Rankin Scale score of ≤ 3 at 3 months and successful reperfusion as thrombolysis in cerebral infarction 2b-3. BATMAN score was externally validated and compared with the Posterior Circulation Collateral score.

Results—The derivation cohort included 83 patients with 41 in the validation cohort. In receiver operating characteristic (ROC) analysis, BATMAN score had an area under receiver operating characteristic curve of 0.81 (95% confidence interval [CI], 0.7–0.9) in derivation cohort and an area under receiver operating characteristic curve of 0.74 (95% CI, 0.6–0.9) in validation cohort. In logistic regression adjusted for age and clinical severity, BATMAN score of < 7 was associated with poor outcome in derivation cohort (odds ratio, 5.5; 95% CI, 1.4–21; $P=0.01$), in validation cohort (odds ratio, 6.0; 95%

Imaging Analysis: Grading System

We developed the Basilar Artery on Computed Tomography Angiography (BATMAN) score as a semiquantitative CTA-based grading system to quantify both the extent of the BAO and the presence of collateral circulation from PComs.

We divided the vertebrobasilar system into 6 segments, including vertebral arteries (considered as 1 segment), each PCA (considered separately), and the 3 segments of basilar artery.¹ In binary logistic regression, including all the above segments plus PComs, absence of PComs (bilateral or unilateral) was the strongest predictor of poor clinical outcome with an odds ratio (OR) of 6.8 (95% confidence interval [CI], 2–21; $P=0.001$; Table 1). Therefore, we decided to allocate 2 points for each PCom and 1 point for a hypoplastic PCom (defined as smaller than 1 mm)²² if in continuity with the top of the basilar artery via a P1 PCA segment, or 3 points for each fetal PCom (to incorporate the point otherwise attributed to a patent P1 segment).



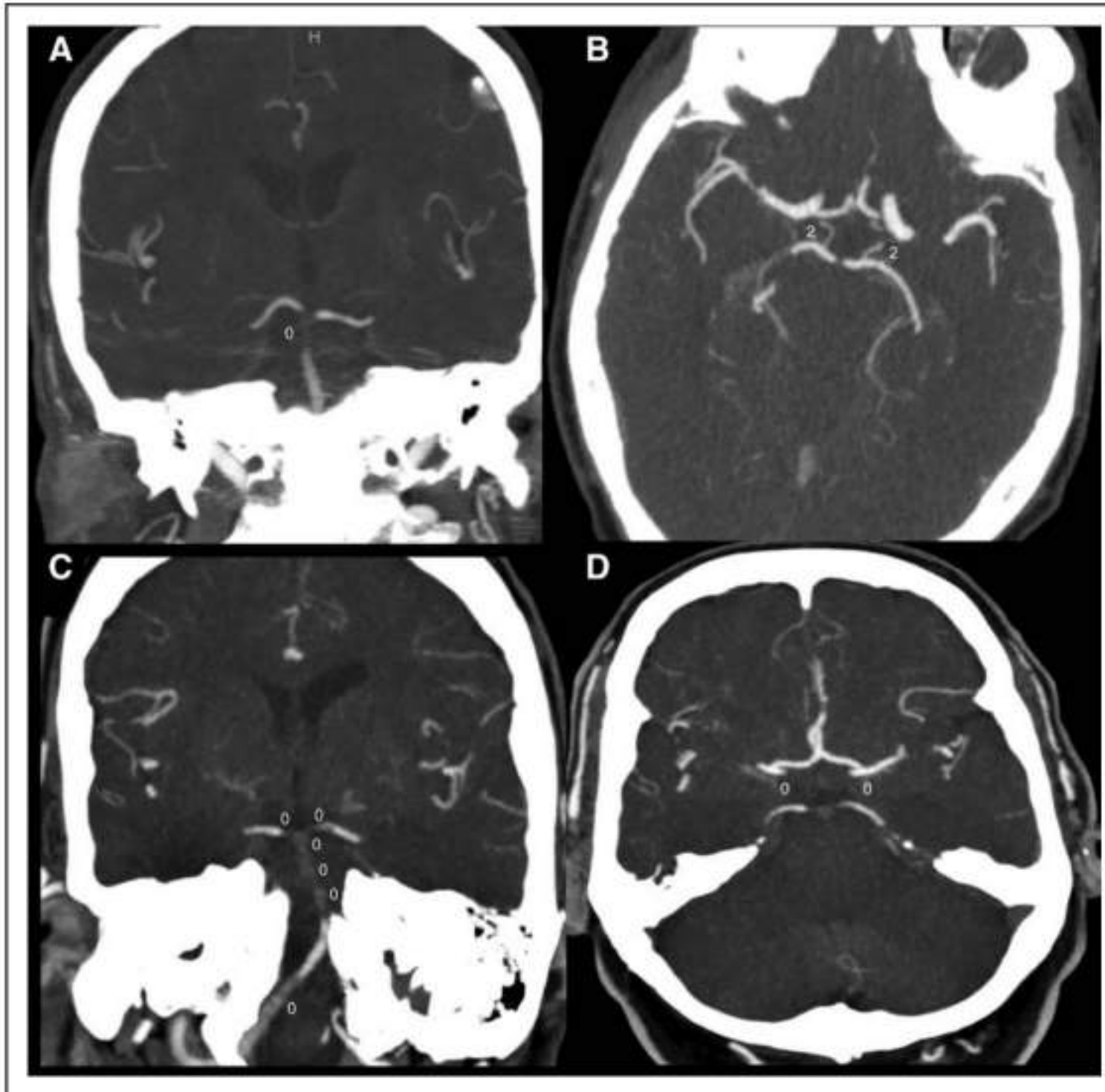


Figure 2. A and B, A patient with BATMAN score=9 (distal basilar occlusion only and bilateral PCoMs). C and D, A patient with BATMAN score=0 (extensive occlusion of basilar artery and absence of PCoMs). BATMAN indicates Basilar Artery on Computed Tomography Angiography; and PCoMs, posterior communicating arteries.

Results—The derivation cohort included 83 patients with 41 in the validation cohort. In receiver operating characteristic (ROC) analysis, BATMAN score had an area under receiver operating characteristic curve of 0.81 (95% confidence interval [CI], 0.7–0.9) in derivation cohort and an area under receiver operating characteristic curve of 0.74 (95% CI, 0.6–0.9) in validation cohort. In logistic regression adjusted for age and clinical severity, BATMAN score of <7 was associated with poor outcome in derivation cohort (odds ratio, 5.5; 95% CI, 1.4–21; $P=0.01$), in validation cohort (odds ratio, 6.9; 95% CI, 1.4–33; $P=0.01$), and in endovascular patients, after adjustment for recanalization and time to treatment (odds ratio, 4.8; 95% CI, 1.2–18; $P=0.01$). BATMAN score of <7 was not associated with recanalization. Interrater agreement was substantial (intraclass coefficient correlation, 0.85; 95% CI, 0.8–0.9). BATMAN score had greater accuracy compared with Posterior Circulation Collateral score ($P=0.04$).

Conclusions—The addition of collateral quality to clot burden in BATMAN score seems to improve prognostic accuracy in basilar artery occlusion patients. (*Stroke*. 2017;48:00-00. DOI: 10.1161/STROKEAHA.116.015492.)

Table III. Univariate analysis in the pooled cohort of endovascular patients.

	Good outcome (n=31)	Poor outcome (n=42)	OR [‡] (95% CI [§])	p
Time to treatment, n (%)				
0-6 hours	21 (68)	20 (48)	2.2 (1.0-4.7)	0.05
6-12 hours	9 (29)	16 (38)		
>12 hours	1 (3)	6 (14)		
Successful recanalization, TICI* 2b-3, n (%)	29 (93.5)	28 (67)	0.1 (0.0-0.7)	0.01
BATMANs, median (IQR)	7 (6-8)	4 (3-5)	0.6 (0.4-0.8)	0.001

*TICI Thrombolysis in Cerebral Infarction; [†]BATMANs Basilar artery on Tomography Angiography score; [‡]OR, odd ratio for poor outcome; [§]CI confidence interval

The Basilar Artery on Computed Tomography Angiography Score for Acute Basilar Artery Occlusion Treated with Mechanical Thrombectomy

Haihua Yang, MD,^{*,†} Ning Ma, MD,^{*} Lian Liu, MD,^{*} Feng Gao, MD,^{*}
Dapeng Mo, MD,^{*} and Zhongrong Miao, MD^{*}

Background: Recently, the Basilar Artery on Computed Tomography Angiography (BATMAN) score predicts clinical outcome of acute basilar artery occlusion (BAO), yet there is no extensive external validation. The purpose of this study was to validate the prognostic value of BATMAN scoring system for the prediction of clinical outcome in patients with acute BAO treated with endovascular mechanical thrombectomy by using cerebral digital subtraction angiography (DSA).

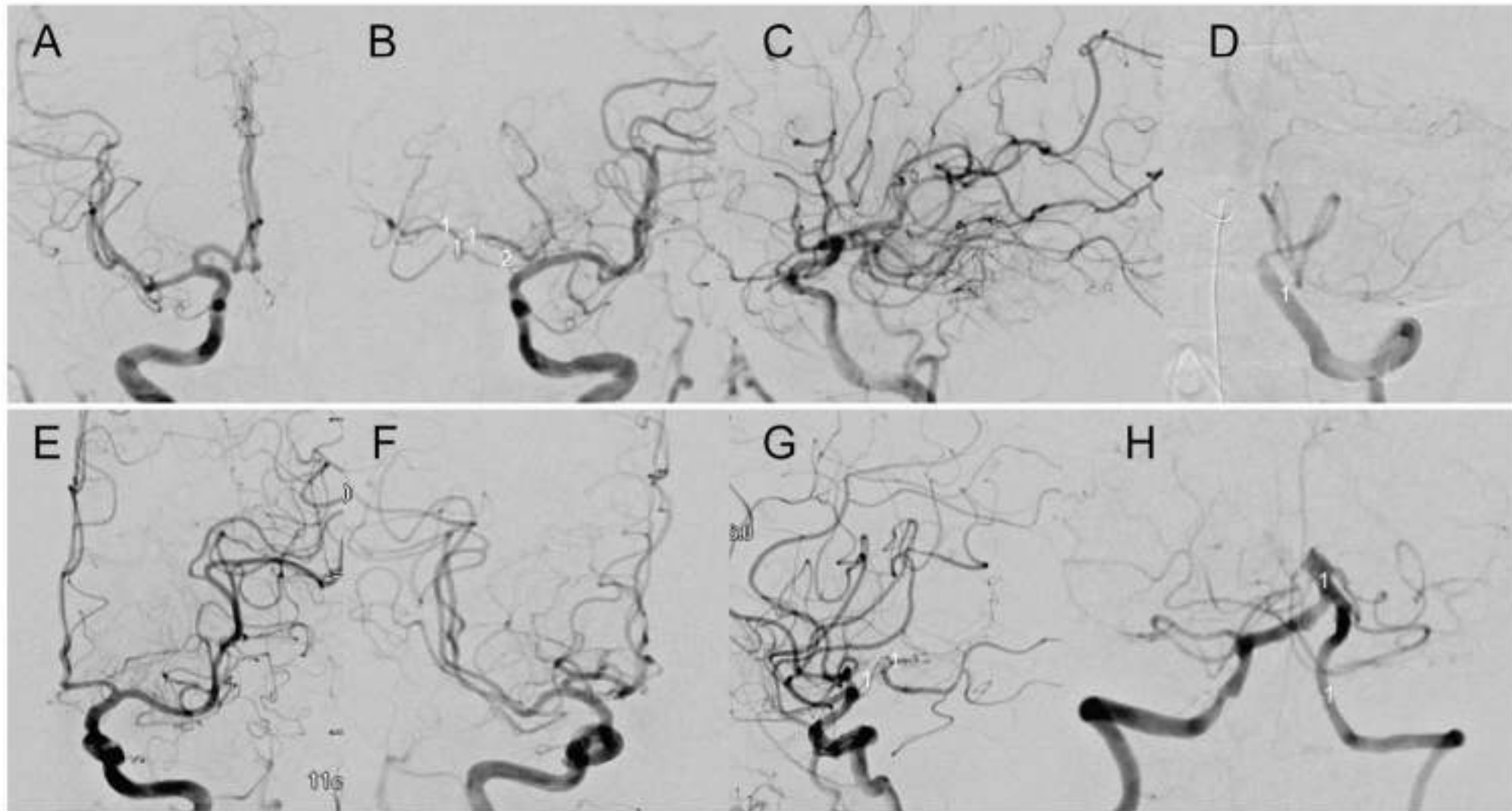


Figure 1. A patient with acute vertebrabasilar artery occlusion (A to D). (A) There are no collaterals between the right anterior circulation and the posterior circulation. (B and C) The apex of basilar artery including bilateral posterior cerebral artery and superior cerebellum artery are irrigated from the left anterior circulation via the left PCom. (D) Occlusion of distal vertebral artery after origin of posterior inferior cerebellar artery is found. The BATMAN score is 6 (1 for right P1 segment, 1 for left P1 segment, 1 for distal basilar artery, 2 for left PCom, and 1 for vertebral artery) for this case. Another patient with acute basilar artery occlusion (E to H). (E) There are no collaterals between the left anterior circulation and the posterior circulation. (F and G) The right posterior cerebral artery is irrigated via a hypoplastic PCom. (H) Occlusion of the basilar artery after origin of bilateral anterior inferior cerebellar arteries is found. The BATMAN score is 4 (1 for right hypoplastic PCom, 1 for right P1 segment, 1 for proximal basilar artery, and 1 for vertebral artery) for this case. Abbreviations: BATMAN, Basilar Artery on Computed Tomography Angiography; PCom, posterior communicating artery.

Table 1. Clinical and imaging parameters in acute basilar artery occlusion

	All patients, n = 63	Favorable outcome (mRS score ≤ 2 , n = 22)	Poor outcome (mRS score > 2 , n = 41)	P value
Age, y, mean (SD)	57.2 $\pm$ 9.3	55.7 $\pm$ 10.6	58.1 $\pm$ 8.6	.335
Sex, male (%)	54 (85.7)	19 (86.4)	35 (85.4)	1.0
Hypertension, n (%)	46 (74.2)	15 (68.2)	31 (77.5)	.546
Atrial fibrillation, n (%)	7 (11.3)	3 (13.6)	4 (10.0)	.691
Diabetes mellitus, n (%)	21 (33.9)	7 (31.8)	14 (35)	1.0
History of stroke or TIA, n (%)	13 (21)	5 (22.7)	8 (20)	1.0
Smoking, n (%)	45 (72.6)	16 (72.7)	29 (72.5)	1.0
Baseline NIHSS*, median (IQR)	22 (16-28)	16.5 (11.3-22)	25 (20-30)	.001
BAO site				.888
Proximal BA, n (%)	29 (46)	11 (50)	18 (43.9)	
Mid-BA, n (%)	21 (33.3)	7 (31.8)	14 (34.1)	
Distal BA, n (%)	13 (20.6)	4 (18.2)	9 (22.0)	
BATMAN score, median (IQR)	3 (2-5)	5 (3-6.3)	3 (2-5)	.004
PCom, n (%)	35 (55.6)	16 (72.7)	19 (46.3)	.063
Stroke etiology				.491
Large artery disease, n (%)	49 (77.8)	16 (72.7)	33 (80.5)	
Cardioembolic, n (%)	5 (7.9)	3 (13.6)	2 (4.9)	
Other etiology, n (%)	9 (14.3)	3 (13.6)	6 (14.6)	

Table 2. Time and treatment data in acute basilar artery occlusion

	Overall, n = 63	Favorable outcome (mRS score ≤ 2 , n = 22)	Poor outcome (mRS score > 2 , n = 41)	P value
Onset to door (min), median (IQR)	210 (90-411)	168.5 (82.5-288.3)	240 (97.5-450)	.26
Onset to puncture (min), median (IQR)	480 (350-630)	370 (305-512.5)	540 (362.5-720)	.03
Onset to recanalization (min), median (IQR)	540 (462-752)	488 (410.8-633)	645 (468-807.5)	.063
Intravenous tPA administration, n (%)	9 (14.3)	5 (22.7)	4 (9.8)	.256
Intra-arterial tPA administration, n (%)	14 (22.2)	5 (22.7)	9 (22.0)	1.0
TICI, 2b or 3, n (%)	57 (90.5)	22 (10.0)	35 (85.4)	.083
Symptomatic ICH, n (%)	5 (7.9)	0 (0)	5 (12.2)	.153

Abbreviations: ICH, intracerebral hemorrhage; IQR, interquartile range; mRS, modified Rankin Scale; TICI, thrombolysis in cerebral infarction; tPA, tissue-type plasminogen activator.

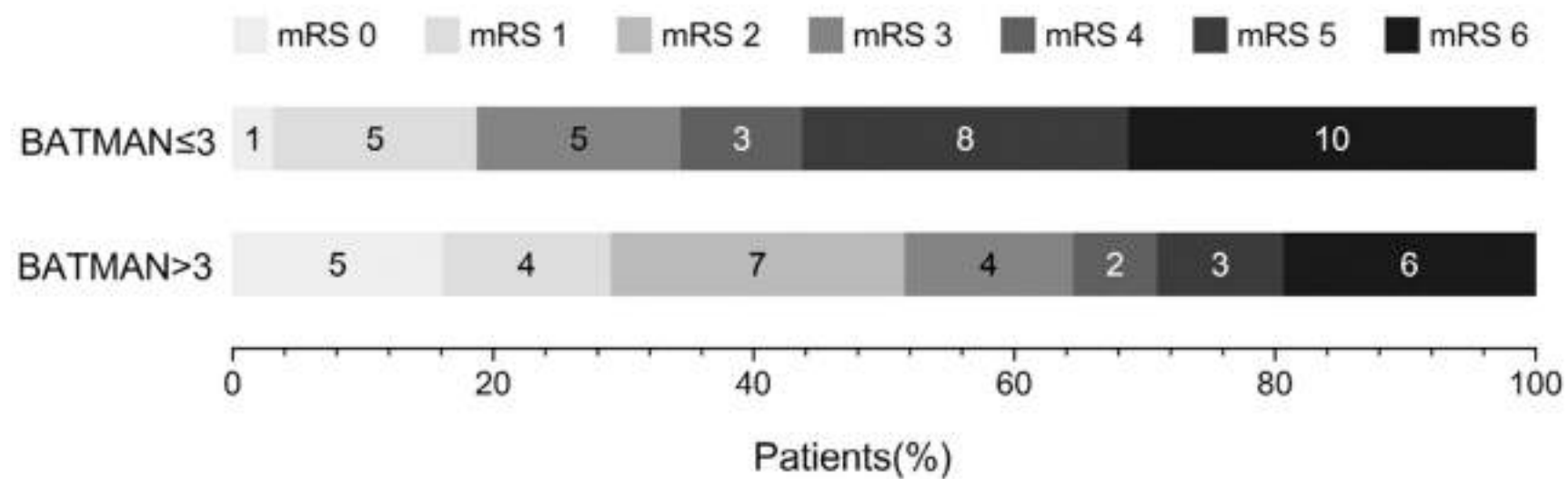


Figure 2. Distribution of modified Rankin scale score according to Basilar Artery on Computed Tomography Angiography score at 3 months.

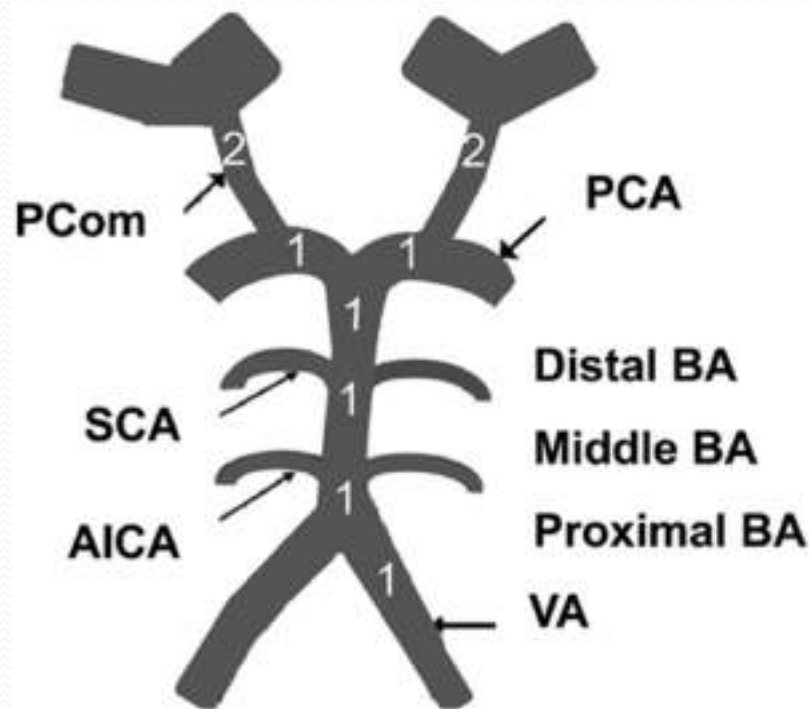
The length of thrombus may also be associated with the clinical outcome of acute BAO. Brandt et al⁸ defined 1 segment of the BAO as “short” thrombus, and 2 or more segments as “long” thrombus. They reported that long thrombus was associated with mortality. The patients with short thrombus of BAO would benefit from thrombolytic treatment. Gilberti et al¹⁵ also reported that length of BAO was a predictor of functional outcome, and increased length of thrombus was associated with poor outcome at 3 months.

The PCom is the most important way of collateral circulation in acute BAO. Goyal et al⁶ reported that patients with patent bilateral PCom had a good prognosis. Hong et al¹³ reported that the patent posterior cerebral artery was a predictor of good prognosis. In the BASICS, at least 1

PCom and a larger caliber PCom could significantly reduce the risk of a poor clinical outcome.⁷

The Basilar Artery on Computed Tomography Angiography Prognostic Score for Basilar Artery Occlusion

Fana Alemseged, MD; Darshan G. Shah, MBBS; Marina Diomedi, MD;
Fabrizio Sallustio, MD; Andrew Bivard, PhD; Gagan Sharma, MCA; Peter J. Mitchell, MD;
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Carlo Caltagirone, MD; Roberto Floris, MD; Mark W. Parsons, MBBS, PhD;
Christopher R. Levi, MBBS; Stephen M. Davis, MD; Bruce C.V. Campbell, MBBS, PhD



- Flow in Both vertebral arteries + 1(considered as 1 segment)
- Flow in Proximal segment of the basilar artery + 1
- Flow Middle segment of the basilar artery +1
- Flow Distal segment of the basilar artery +1
- Flow P-1 segment of the PCA +1
- Filling of each PCOM +2
- Filling in a hypoplastic PCOM +1
- A score of 10 suggests normal arterial filling of the posterior circulation and a score of 0 suggests no filling of the posterior circulation. In their multivariate analysis, an unfavorable BATMAN score (defined as < 7) was independently associated with poor outcome (defined as an mRS of 4 or greater)

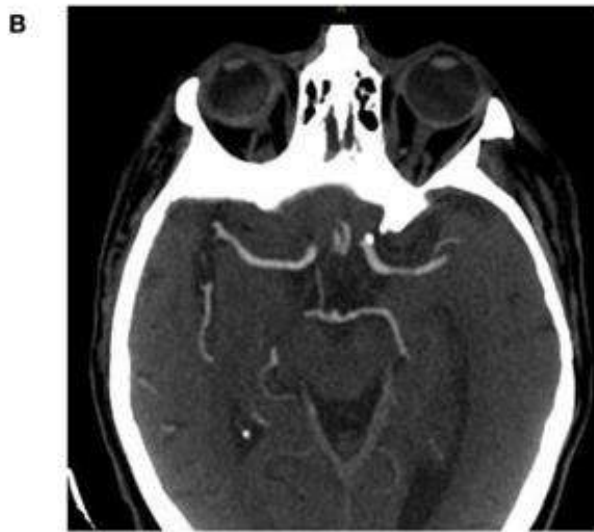
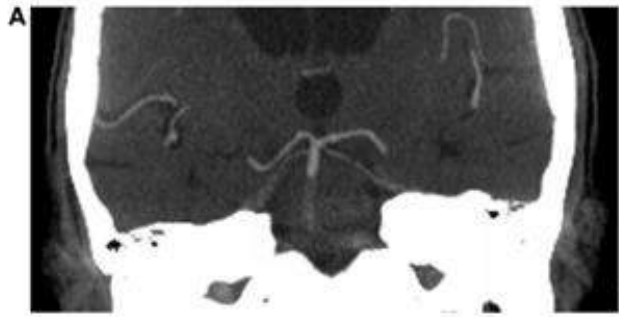
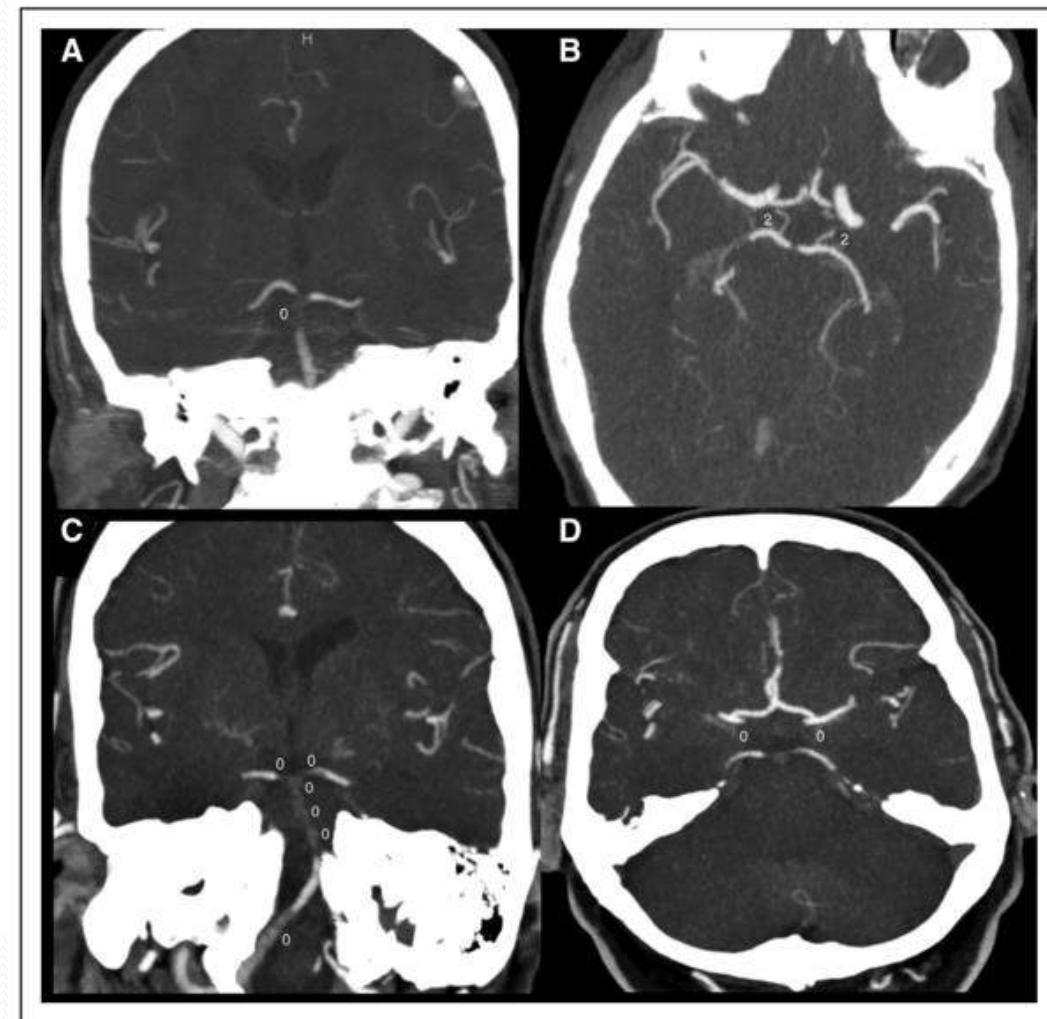


Table 1. Logistic Regression Preliminary to Basilar Artery on Computed Tomography Angiography Score

	OR (95% CI)	P Value
Vertebral artery	1.1 (0.5–2.2)	0.8
Proximal basilar artery	1.6 (0.4–7.3)	0.6
Middle basilar artery	2.8 (0.9–8.8)	0.07
Distal basilar artery	1.2 (0.3–5.6)	0.8
Posterior cerebral arteries	2.0 (0.6–8.2)	0.2
Absence of PComs (unilateral or bilateral)	6.8 (2–21)	0.001

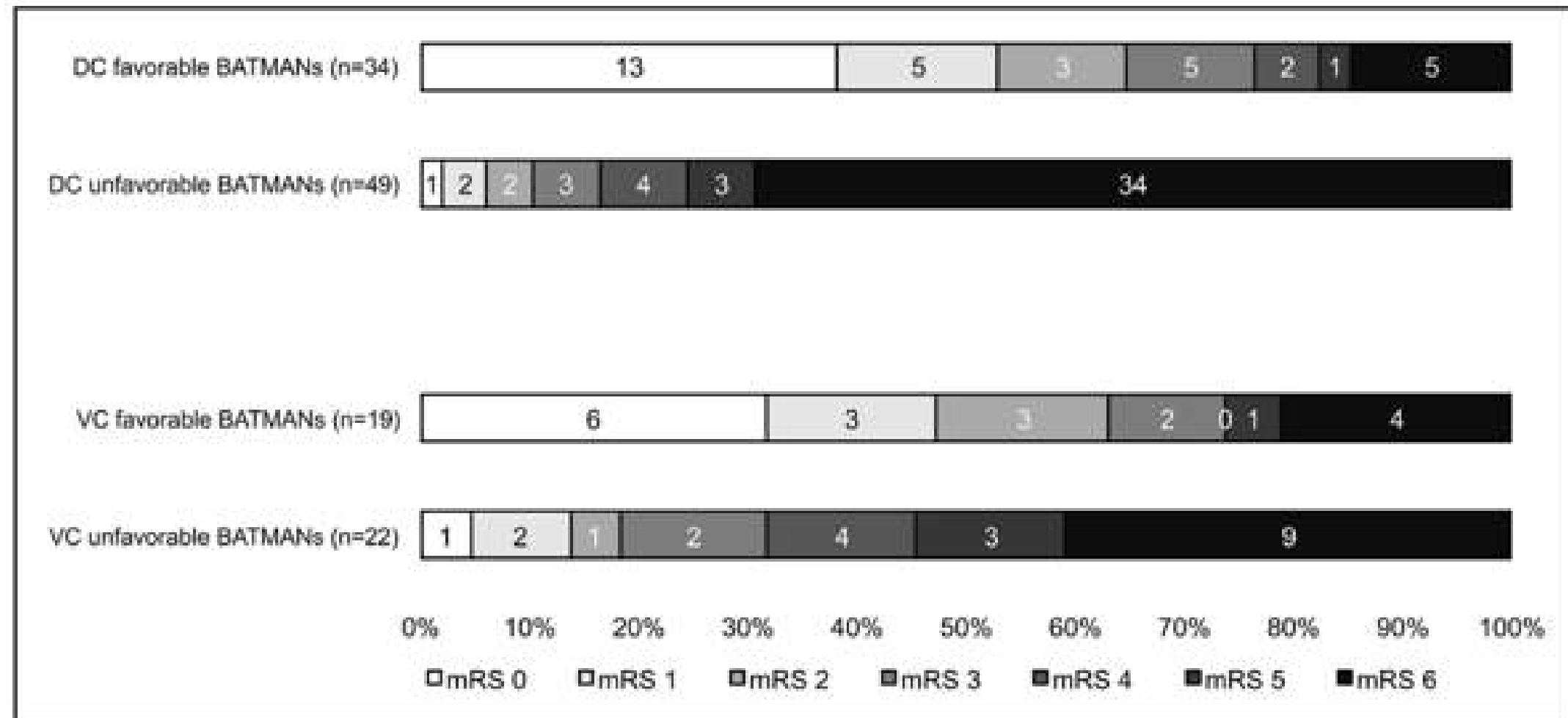
CI indicates confidence interval, OR, odds ratio, and PCom posterior communicating artery.



BATMAN score=5

The Basilar Artery on Computed Tomography Angiography Prognostic Score for Basilar Artery Occlusion

Fana Alemseged, MD; Darshan G. Shah, MBBS; Marina Diomedi, MD;
Fabrizio Sallustio, MD; Andrew Bivard, PhD; Gagan Sharma, MCA; Peter J. Mitchell, MD;
Richard J. Dowling, MBBS; Steven Bush, MBBS; Bernard Yan, MBBS;
Carlo Caltagirone, MD; Roberto Floris, MD; Mark W. Parsons, MBBS, PhD;
Christopher R. Levi, MBBS; Stephen M. Davis, MD; Bruce C.V. Campbell, MBBS, PhD



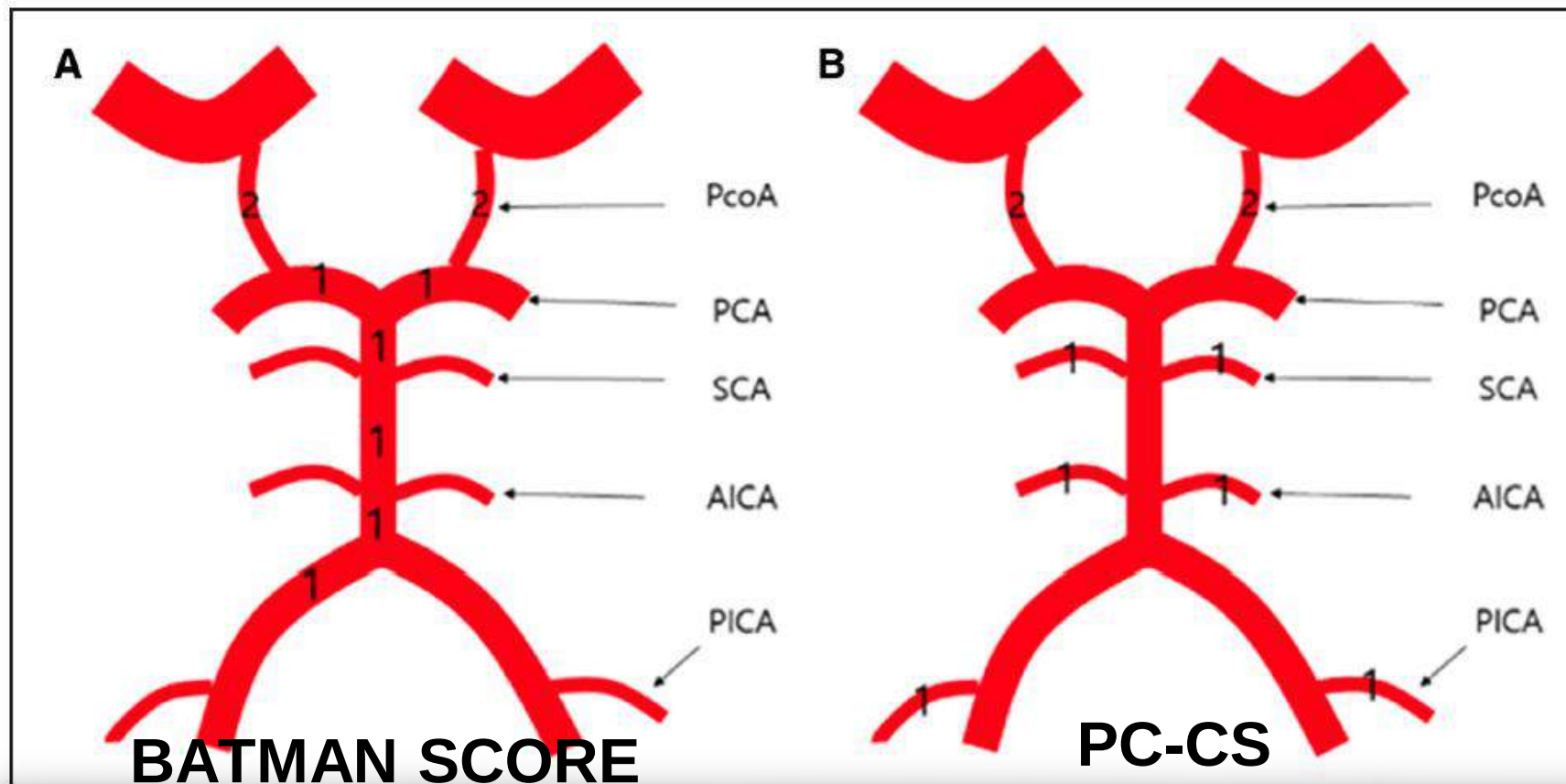
CLINICAL AND POPULATION SCIENCES

Mechanical Thrombectomy in Basilar Artery Occlusion

Clinical Outcomes Related to Posterior Circulation Collateral Score

Hyo Sung Kwak, MD, PhD; Jung Soo Park, MD, PhD

Stroke 2020



BATMAN score (CTA) evaluates thrombus burden and collaterals –BATMAN<7=poor prognosis

PC-CS (CTA) evaluates collaterals-PC-CS <7= poor prognosis

CLINICAL AND POPULATION SCIENCES

Mechanical Thrombectomy in Basilar Artery Occlusion

Clinical Outcomes Related to Posterior Circulation Collateral Score

Hyu Sung Kwak, MD, PhD; Jung Soo Park¹, MD, PhD

Table 4. Variables Associated With Good Functional Outcome (mRS Score 0–2 at 3 Months)

	Univariate Analysis	P Value	Multivariate Analysis	P Value
	Odds Ratio (95% CI)		Odds Ratio (95% CI)	
Age<80	1.50 (0.53–4.22)	0.440		
Baseline NIHSS score <15	6.25 (1.90–20.49)	0.002	8.49 (2.01–35.82)	0.004
BATMAN score ≥6	5.46 (2.03–14.67)	0.001	1.95 (0.56–6.73)	0.292
PC-CS ≥6	4.39 (1.67–11.50)	0.003	3.79 (1.05–13.66)	0.042
Distal BA occlusion	7.08 (2.57–19.53)	<0.001	3.67 (1.10–12.26)	0.035
Onset to recanalization<6 h	0.99 (0.40–2.47)	0.986		
Onset to recanalization<12 h	1.20 (0.28–5.20)	0.807		
Underlying BA stenosis	0.931 (0.38–2.31)	0.877		
Diabetes mellitus	0.56 (0.16–1.95)	0.361		
Hypertension	0.55 (0.22–1.37)	0.204		
Hyperlipidemia	1.02 (0.23–4.62)	0.977		
Smoking	0.66 (0.19–2.32)	0.513		
Previous stroke history	0.59 (0.19–1.84)	0.360		
Atrial fibrillation or cardiac disease	0.98 (0.38–2.48)	0.958		
Successful recanalization (TICI 2b, 3)	1.54 (0.48–4.90)	0.466		

Endovascular Therapy for Basilar-Artery Occlusion — Still Waiting for Answers

Marc Fisher, M.D.

May 20, 2021

N Engl J Med 2021; 384:1954-1955

DOI: 10.1056/NEJMe2104814

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Related Articles

ORIGINAL ARTICLE MAY 20, 2021

The benefits of endovascular therapy provided soon after the onset of acute ischemic stroke due to large-vessel occlusion in the proximal anterior cerebral circulation were established by five clinical trials, the results of which were published in 2015.¹ The DAWN (DWI or CTP Assessment with Clinical Mismatch in the Triage of Wake-Up and Late Presenting Strokes Undergoing Neurointervention with Trevo) trial² and the DEFUSE 3 (Endovascular Therapy Following Imaging Evaluation for Ischemic Stroke) trial³ subsequently showed that endovascular therapy was beneficial up to 24 hours after the onset of stroke in patients who were selected on the basis of advanced . . .

The **NEW ENGLAND JOURNAL of MEDICINE**

ORIGINAL ARTICLE

Endovascular Therapy for Stroke Due to Basilar-Artery Occlusion

L.C.M. Langezaal, E.J.R.J. van der Hoeven, F.J.A. Mont'Alverne, J.J.F. de Carvalho, F.O. Lima, D.W.J. Dippel, A. van der Lugt, R.T.H. Lo, J. Boiten, G.J. Lycklama à Nijeholt, J. Staals, W.H. van Zwam, P.J. Nederkoorn, C.B.L.M. Majoie, J.C. Gerber, M. Mazighi, M. Piotin, A. Zini, S. Vallone, J. Hofmeijer, S.O. Martins, C.H. Nolte, K. Szabo, F.A. Dias, D.G. Abud, M.J.H. Wermer, M.J.M. Remmers, H. Schneider, C.M. Rueckert, K.F. de Laat, A.J. Yoo, P.-J. van Doormaal, A.C.G.M. van Es, B.J. Emmer, P. Michel, V. Puetz, H.J. Audebert, O.M. Pontes-Neto, J.-A. Vos, L.J. Kappelle, A. Algra, and W.J. Schonewille, for the BASICS Study Group*

ABSTRACT

BACKGROUND

The effectiveness of endovascular therapy in patients with stroke caused by basilar-artery occlusion has not been well studied.

METHODS

We randomly assigned patients within 6 hours after the estimated time of onset of a stroke due to basilar-artery occlusion, in a 1:1 ratio, to receive endovascular therapy or standard medical care. The primary outcome was a favorable functional

The authors' full names, academic degrees, and affiliations are listed in the Appendix. Address reprint requests to Dr. Schonewille at the St. Antonius Hospital, Koekoekslaan 1, 3435 CM, Nieuwegein, the Netherlands, or at w.schonewille@antoniuziekenhuis.nl.

BASICS STUDY

Table. Basilar Artery Occlusion Randomized Trials

	BASICS	BEST
Primary outcome	mRS ≤3 at 90 d	mRS ≤3 at 90 d
Symptom onset to randomization	6 h	8 h
Years trial conducted	2011–2019	2015–2017
Screened patients	424	288
No. of patients enrolled/target sample size	300/300 (154 endovascular and 146 medical)	131/344 (66 endovascular and 65 medical)
Crossover rate	Overall: 3% (10/300) 3/154 (1.9%) patients in the endovascular group and 7/146 (4.8%) in the medical group	Overall: 13% (17/131) 3/66 (4.5%) patients in the endovascular group and 14/65 (21.5%) in the medical group
Time to randomization: EVT vs MM		
Early (BASICS ≤6 h; BEST ≤260 min)	Reference	OR, 0.86 (95% CI, 0.31–2.38)
Late (BASICS >6 h; BEST >260 min)	RR, 0.83 (95% CI, 0.53–1.30)	OR, 2.86 (95% CI, 1.02–7.97)
NIHSS, median (IQR)	22	30 (18–38)
NIHSS: EVT vs MM primary outcome		
<10	20/31 (65%) vs 24/30 (80%); RR, 0.85 (95% CI, 0.62–1.16)	Not available
10–19	31/42 (74%) vs 17/36 (47%); RR, 1.55 (95% CI, 1.06–2.27)	
>19	17/81 (21%) vs 14/80 (18%); RR, 1.28 (0.67–2.46)	
NIHSS: EVT vs MM primary outcome		
≤29	Not available	OR, 1.56 (95% CI, 0.6–4.1)
>29		OR, 1.91 (95% CI, 0.61–6.0)
IV thrombolysis		
Yes	RR, 1.16 (95% CI, 0.88–1.53)	OR, 1.60 (95% CI, 0.44–5.86)
No	RR, 1.08 (95% CI, 0.53–2.23)	OR, 1.53 (95% CI, 0.65–3.6)
Results		
Primary outcome	68/154 (44%) intervention vs 55/146 (38%) control group (RR, 1.2 [95% CI, 0.92–1.50])	28/66 (42%) intervention vs 21/65 (32%) control group (aOR, 1.74 [95% CI, 0.8–3.7])
Symptomatic intracranial hemorrhage	4.5% intervention vs 0.7% control group	8% intervention vs 0 control group
Mortality 90 d	38% intervention vs 43% control group (RR, 0.87 [95% CI, 0.68–1.12])	33% intervention vs 38% control group, (OR, 0.80 [95% CI, 0.37–1.64])

aOR indicates adjusted odds ratio; BASICS, Basilar Artery International Cooperation Study; BEST, Basilar Artery Occlusion Endovascular Intervention Versus Standard Medical Treatment; EVT, endovascular therapy; IQR, interquartile range; MM, medical management; mRS, modified Rankin Scale; NIHSS, National Institutes of Health Stroke; OR, odds ratio; and RR, risk ratio.



Randomization 1.1 ratio (145 EVT, 146 MBT)

Inclusion criteria

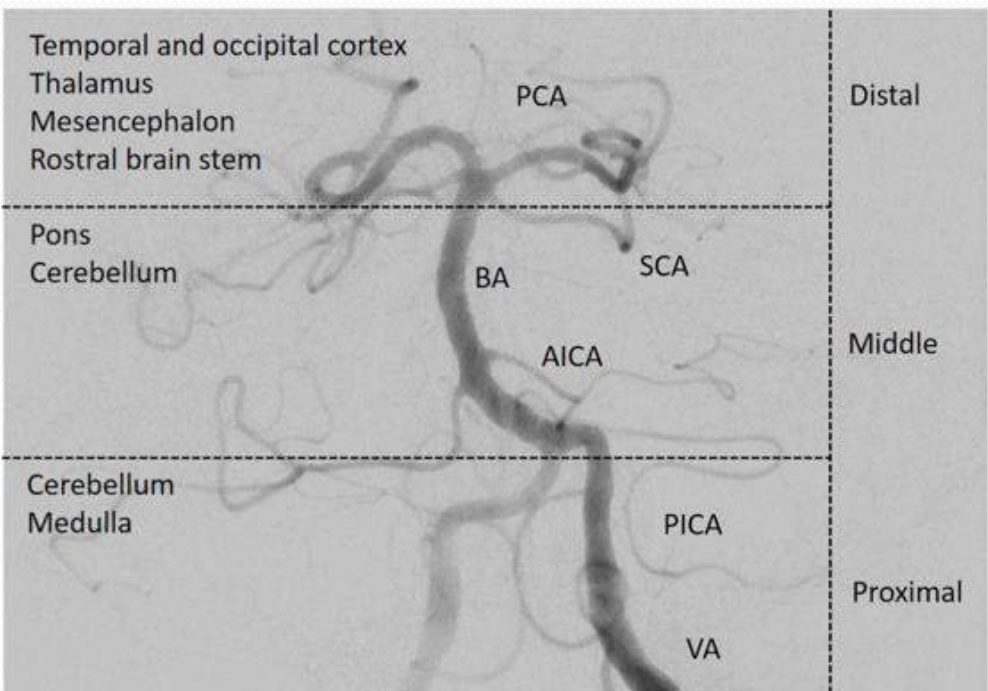
- EVT feasible < 6 hours of estimated time BAO
- IVT, if indicated <4.5 hours of BAO
- Basilar occlusion

Exclusion criteria

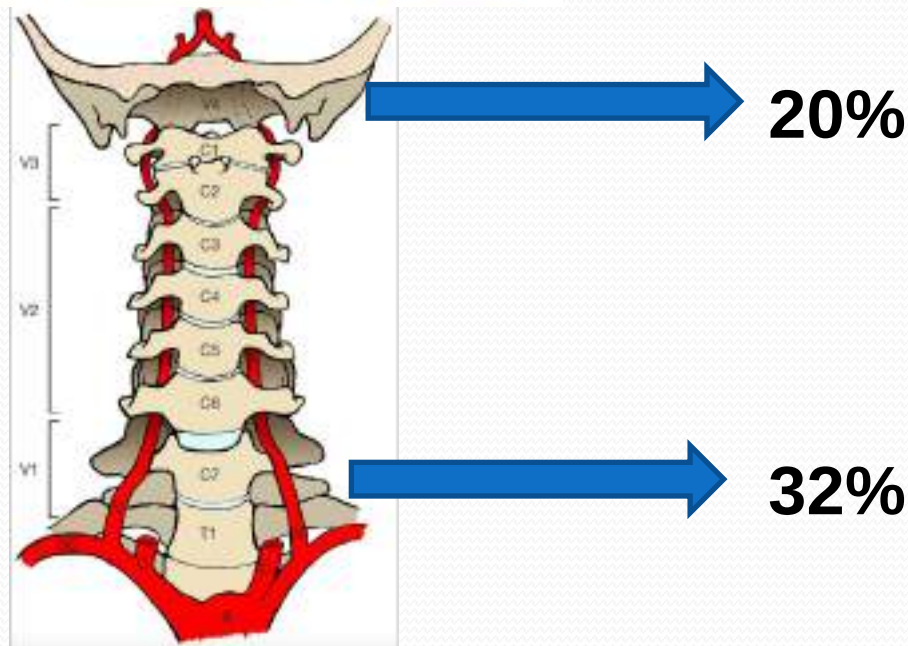
- ICH
- Extensive brainstem ischemia
- Cerebellar mass effect or acute hydrocephalus



	Endovascular therapy (n=154)	Medical management (n=146)
Age ≤50 years	19/154 (12.3%)	15/146 (10.3%)
Age ≥70 years	74/154 (48.1%)	69/146 (47.3%)
History of		
Any stroke	26/154 (16.9%)	26/146 (17.8%)
Any TIA	12/152 (7.9%)	15/145 (10.3%)
Posterior circulation TIA	5/152 (3.3%)	3/145 (2.1%)
Hyperlipidemia	43/134 (32.1%)	42/133 (31.6%)
Current or former smoker	64/104 (61.5%)	56/103 (54.4%)
Current or former alcohol drinker	58/96 (60.4%)	45/90 (50.0%)
Coronary artery disease	21/154 (13.6%)	19/145 (13.1%)
Atrial fibrillation		
history only	29/154 (18.8%)	14/146 (9.6%)
ECG only	29/130 (22.3%)	16/118 (13.6%)



Details of endovascular treatment by period



Endovascular

BMT

Intubated within 24h of stroke onset	95/150 (63.3%)	68/138 (49.3%)
Radiology assessments		
PC-ASPECTS score at baseline NCCT*	10 (10, 10) (n=146)	10 (10, 10) (n=140)
PC-ASPECTS score at CTA baseline*	10 (8, 10) (n=145)	10 (8, 10) (n=137)
Clot length at CTA baseline*	10.5 (6.5, 18.0) (n=143)	11.0 (6.0, 17.0) (n=128)
Basilar artery occlusion site (CTA baseline)		
proximal third	46/145 (31.7%)	49/137 (35.8%)
middle third	49/145 (33.8%)	41/137 (29.9%)
distal third	50/145 (34.5%)	47/137 (34.3%)

Endovascular

BMT

Presentation type		
Fluctuating onset	23/153 (15.0%)	20/145 (13.8%)
Progressive stroke	60/153 (39.2%)	49/145 (33.8%)
Maximum deficit from onset	70/153 (45.8%)	76/145 (52.4%)
Cause of stroke (TOAST)		
Large artery atherosclerosis	53/146 (36.3%)	43/132 (32.6%)
Cardioembolism	51/146 (34.9%)	24/132 (18.2%)
Small artery occlusion	0/146 (0%)	1/132 (0.8%)
Other determined etiology	12/146 (8.2%)	9/132 (6.8%)
Undetermined etiology	30/146 (20.5%)	55/132 (41.7%)



Primary outcome

■ mRS=0 ■ mRS=1 ■ mRS=2 ■ mRS=3 ■ mRS=4 ■ mRS=5 ■ death

EVT + BMM (n=154)



mRS 0-2=35%

44.2%

vs.

37.7%

ARR 6.5%

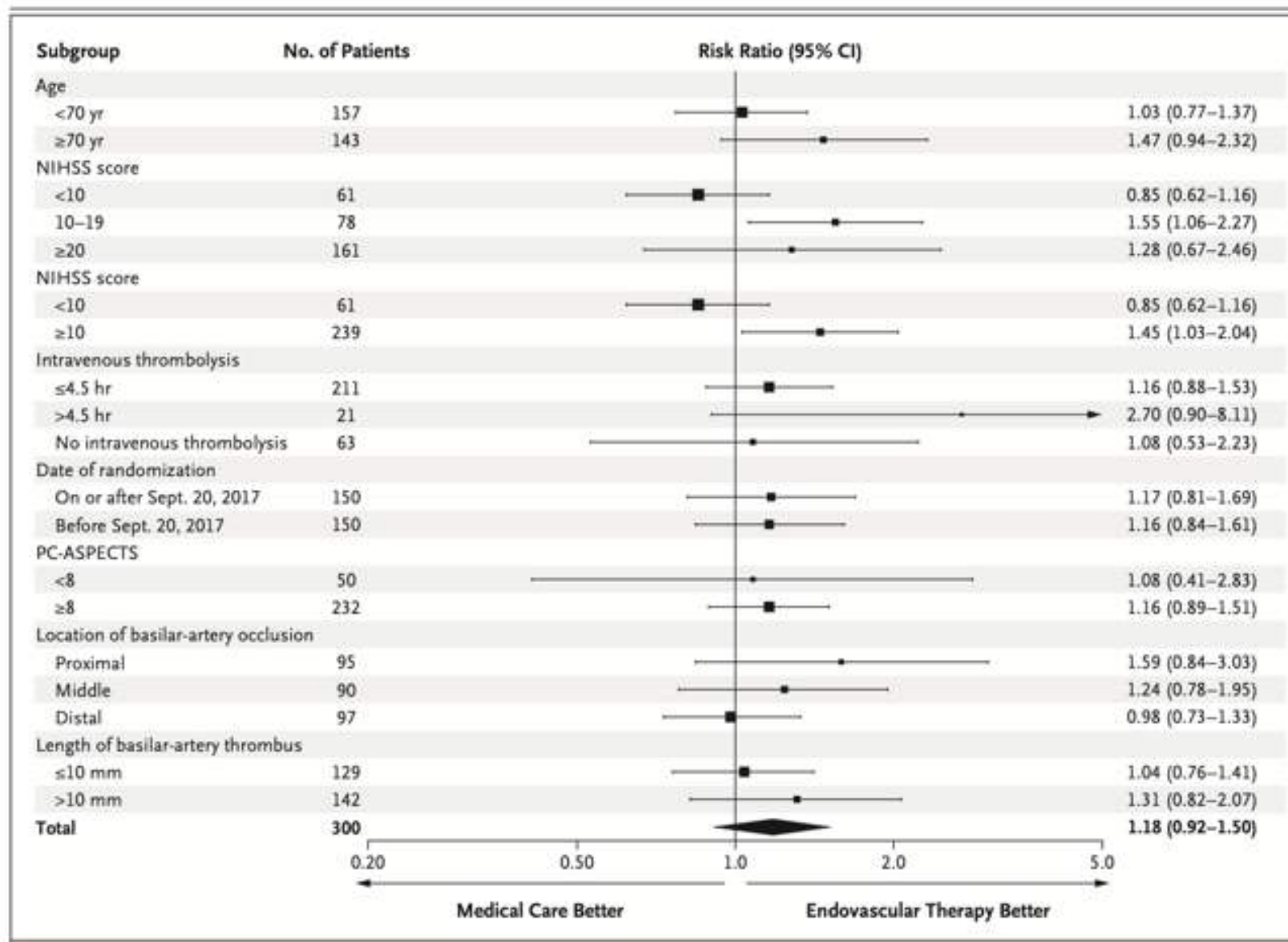
BMM (n=146)



mRS 0-2=30%

0% 20% 40% 60% 80% 100%

Expected %16



Nonstandard Abbreviations and Acronyms

BAOCHE	Basilar Artery Occlusion Chinese Endovascular
BASICS	Basilar Artery International Cooperation Study
BEST	Basilar Artery Occlusion Endovascular Intervention Versus Standard Medical Treatment

FUTURE

A combined analysis of the BASICS and BEST trials is in progress, with final results pending.¹⁵ The BAOCHE trial (Basilar Artery Occlusion Chinese Endovascular; <https://www.clinicaltrials.gov>; unique identifier: NCT02737189) is evaluating the efficacy of EVT 6 to 24 hours after symptom onset in patients with basilar artery occlusion, with NIHSS score ≥ 6 . The Endovascular Treatment for

Acute Basilar Artery Occlusion (<https://www.clinicaltrials.gov>; unique identifier: NCT04751708) is evaluating basilar artery occlusion patients up to 12 hours from symptom onset in China, with an NIHSS score ≥ 10 . It is hoped that the neutral results of the BASICS and BEST trials will propel enrollment in these ongoing randomized trials or any future basilar artery occlusion trial, similar to how the 2013 neutral stroke trials^{16,17} led to a plethora of the positive endovascular trials of the anterior circulation in 2015 onward.

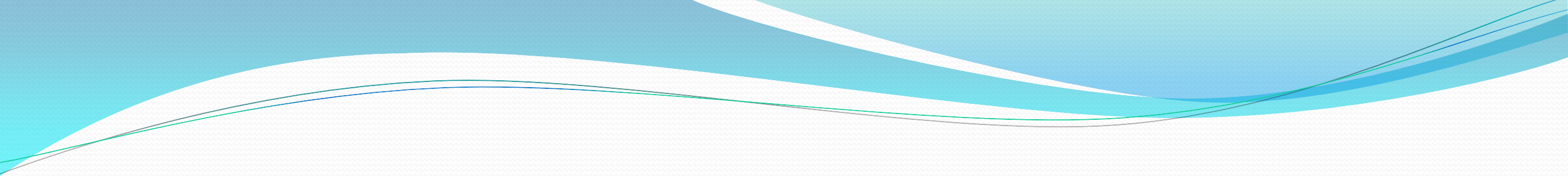
CRITIQUE

The BASICS study adds valuable information to the neuroscience community in the management of patients with basilar artery occlusion and NIHSS score <10 . As was seen with the prospective BASICS registry, medical management performed better than expected compared with EVT, recognizing that most patients in the medical arm (80%) received IVT. On the other hand, in the subgroup analysis of patients with NIHSS score ≥ 10 , patients did better with endovascular management compared with medical management; however, this arm was underpowered to draw definitive conclusions.



A RANDOMIZED ACUTE STROKE TRIAL OF
ENDOVASCULAR THERAPY IN ACUTE BASILAR
ARTERY OCCLUSION

Wouter J. Schonewille MD, PhD
On behalf of the BASICS study group



*In case clinical benefit is not achieved with IVT and there is a high risk for neurological worsening and Locked-in syndrome, an endovascular approach may be considered

Critique

1

Trial –underpowered-randomization problems-widened criteria for NIHSS

2

79% of the eligible patients treated outside the trial received-EVT-BIAS

3

Atrial fibrillation –higher in EVT group
High ICAD rate 33%

Suprise!!!!

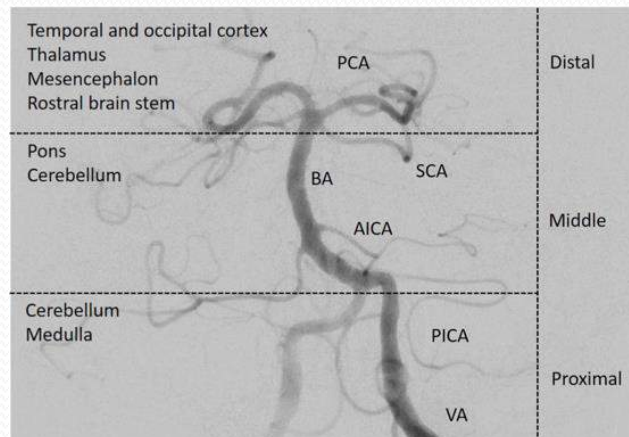
4

- ✓ Clot size-treatment modality-no relation
- ✓ Patency of basilar artery at 24 hr-CTA-56% for BMT
- ✓ Patency of basilar artery at 24 hr-CTA-85% for EVT

5

NIHSS-posterior circulation
BATMAN score was not included

BASICS STUDY



1

ICH 4.5% in EVT group

2

EVT appears effective in patients with BAO and a moderate or severe deficit (NIHSS $\geq$ 10)

3

For mild deficit –BMT ??

4

So many questions ?????

Endovascular treatment versus standard medical treatment for vertebrobasilar artery occlusion (BEST): an open-label, randomised controlled trial



Xinfeng Liu*, Qiliang Dai, Ruidong Ye, Wenjie Zi, Yuxiu Liu, Huaiming Wang, Wusheng Zhu, Minmin Ma, Qin Yin, Min Li, Xinying Fan, Wen Sun, Yunfei Han, Qiusi Lv, Rui Liu, Dong Yang, Zhonghua Shi, Dequan Zheng, Xiaorong Deng, Yue Wan, Zhen Wang, Yu Geng, Xingyu Chen, Zhiming Zhou, Geng Liao, Ping Jin, Yumin Liu, Xintong Liu, Meng Zhang, Feng Zhou, Hongchao Shi, Yunfeng Zhang, Fuqiang Guo, Congguo Yin, Guozhong Niu, Mei Zhang, Xueli Cai, Qiye Zhu, Zhonglun Chen, Yingchun Liang, Bing Li, Min Lin, Wei Wang, Haowen Xu, Xinmin Fu, Wenhua Liu, Xiguang Tian, Zili Gong, Haicun Shi, Chuanming Wang, Penghua Lv, Zhonghai Tao, Liangfu Zhu, Shiquan Yang, Wei Hu, Pingzhou Jiang, David S Liebeskind, Vitor M Pereira, Thomas Leung, Bernard Yan, Stephen Davis, Gelin Xu, Raul G Nogueira*, on behalf of the BEST Trial Investigators†

1

8 hours of symptom onset-randomized

2

Terminated earlier due to a high crossover rate-21.5%

3

Progressive drop in recruitment

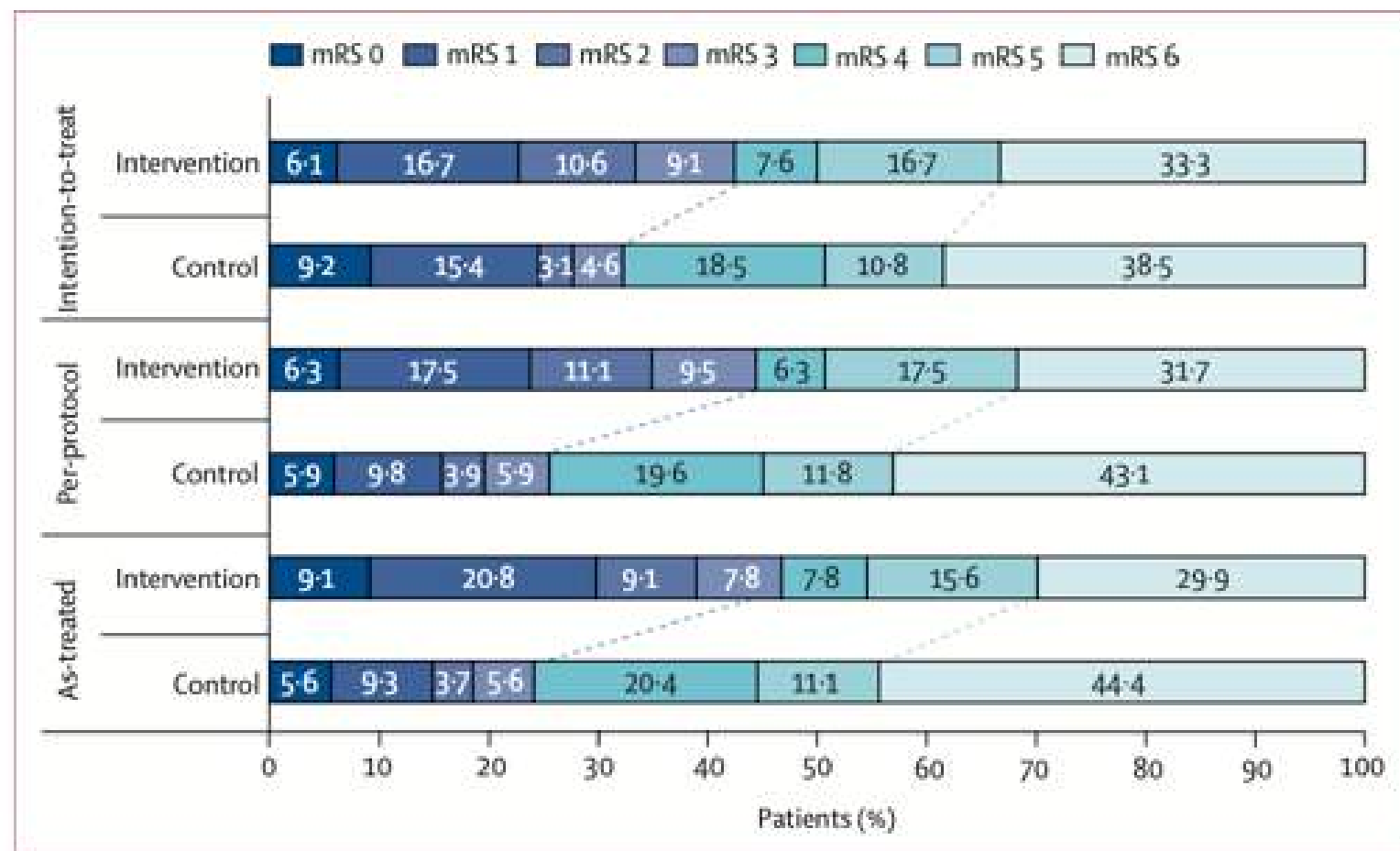
4

Half of patients had ICAD

Endovascular treatment versus standard medical treatment for vertebrobasilar artery occlusion (BEST): an open-label, randomised controlled trial



Xinfeng Liu*, Qiliang Dai, Ruidong Ye, Wenjie Zi, Yuxiu Liu, Huaiming Wang, Wusheng Zhu, Minmin Ma, Qin Yin, Min Li, Xinying Fan, Wen Sun, Yunfei Han, Qiusi Lv, Rui Liu, Dong Yang, Zhonghua Shi, Dequan Zheng, Xiaorong Deng, Yue Wan, Zhen Wang, Yu Geng, Xingyu Chen, Zhiming Zhou, Genq Liao, Ping Jin, Yumin Liu, Xintong Liu, Meng Zhang, Feng Zhou, Hongchao Shi, Yunfeng Zhang, Fualang Guo, Congqiao Yin, Guazhong Niu.



Late window –basilar thrombosis ???

Response to Late-Window Endovascular Revascularization Is Associated With Collateral Status in Basilar Artery Occlusion

Fana Alemseged, MD; Erik Van der Hoeven, MD; Francesca Di Giuliano, MD; Darshan Shah, MBBS; Fabrizio Sallustio, MD; Francesco Arba, MD; Timothy J. Kleinig, MBBS; Steven Bush, MBBS; Richard J. Dowling, MBBS; Bernard Yan, MBBS; Gagan Sharma, MCA; Nicola Limbucci, MD; Roberto Floris, MD; Geoffrey A. Donnan, MD; Volker Puetz, MD, PhD; Marina Diomedi, MD, PhD; Mark W. Parsons, MBBS, PhD; Peter J. Mitchell, MBBS, MMed; Stephen M. Davis, MD; Nawaf Yassi, MBBS, PhD; Wouter J. Schonewille, MD, PhD; Bruce C.V. Campbell, MBBS, PhD; on behalf of the Basilar Artery Treatment and Management (BATMAN) Collaboration*

Stroke. 2019

Late presenters with favorable BATMAN score may benefit from EVT only

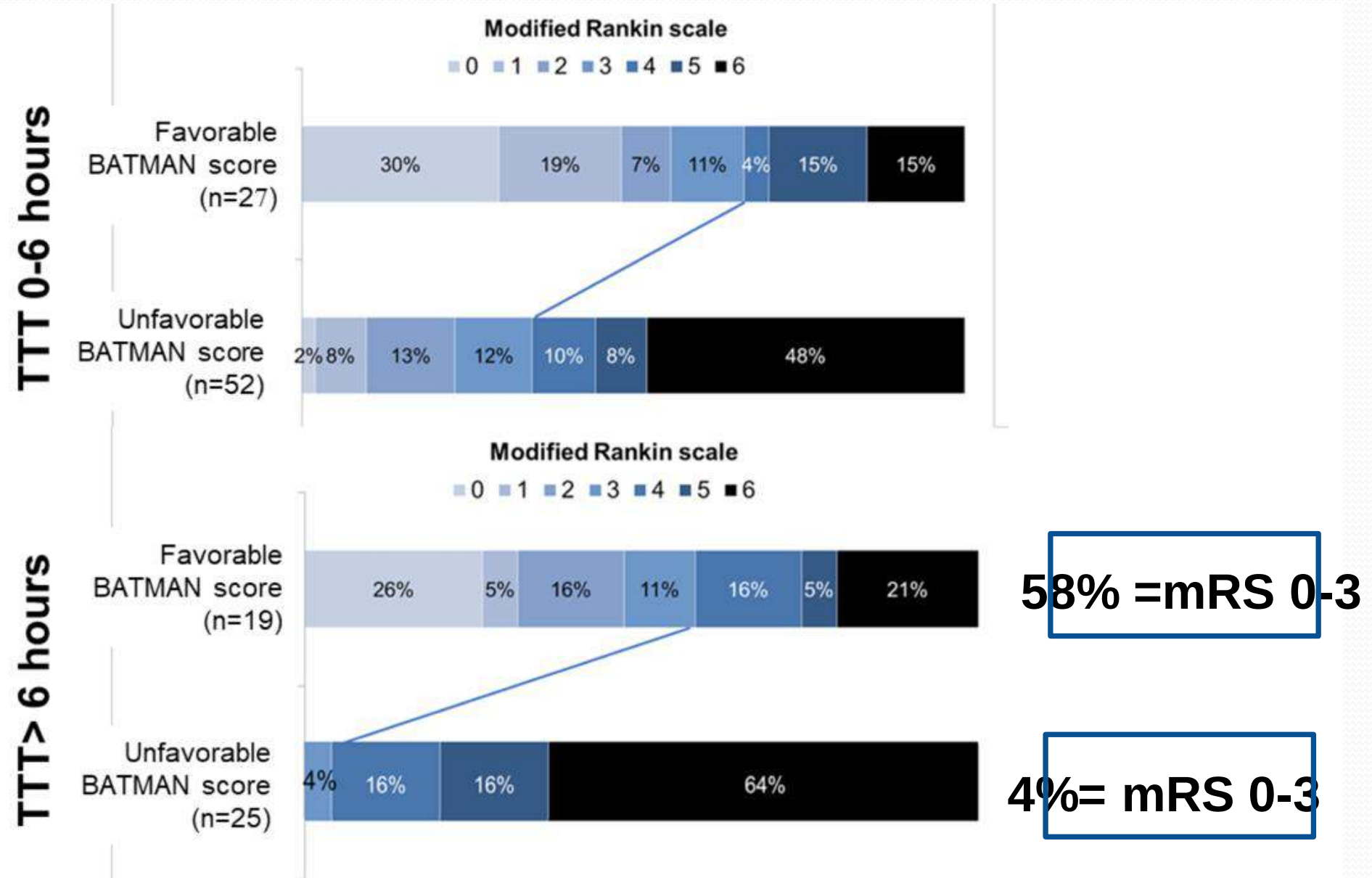
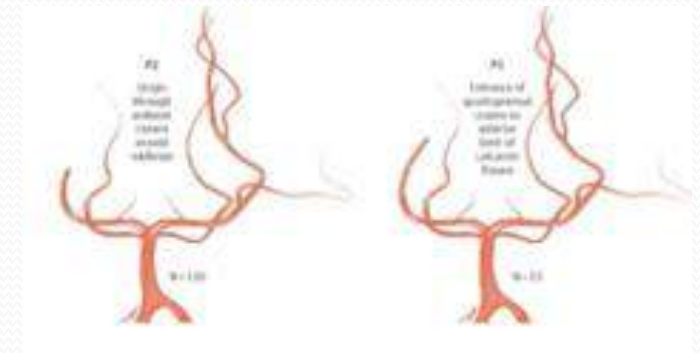


Figure I. Distribution of mRS within 3 months according to BATMAN score groups in patients with revascularization ≤ 6 and > 6 hours. TTT time to treatment.

Thrombectomy for Primary Distal Posterior Cerebral Artery Occlusion Stroke The TOPMOST Study

Lukas Meyer, MD; Christian Paul Stracke, MD; Noël Jungi, MD; Marta Wallocha, MD; Gabriel Broocks, MD; Peter B. Sporns, PD, MD, MHBA; Christian Maegerlein, MD; Franziska Dorn, MD; Hanna Zimmermann, MD; Weis Naziri, MD; Nuran Abdullayev, MD; Christoph Kabbasch, MD; Daniel Behme, MD; Ala Jamous, MD; Volker Maus, MD; Sebastian Fischer, MD; Markus Möhlenbruch, MD; Charlotte Sabine Weyland, MD; Sönke Langner, MD; Dan Meila, MD; Milena Miszczuk, MD; Eberhard Siebert, MD; Stephan Lowens, MD; Lars Udo Krause, MD; Leonard L. L. Yeo, MBBS; Benjamin Yong-Qiang Tan, MD, PhD; Gopinathan Anil, MD; Benjamin Gory, MD, PhD; Jorge Galván, MD; Miguel Schüller Arteaga, MD; Pedro Navia, MD; Eytan Raz, MD; Maksim Shapiro, MD; Fabian Amberg, MD, PhD; Kamil Zelenák, MD, PhD; Mario Martinez-Galdamez, MD; Urs Fischer, MD; Andreas Kastrup, MD; Christian Roth, MD; Panagiotis Papanagiotou, MD; André Kemmling, MD; Jan Gralla, MD; Marios-Nikos Psilodimitrakopoulos, MD; Tommy Andersson, MD; Rene Chapot, MD; Jens Fiehler, MD; Johannes Kaesmacher, MD; Uta Hanning, MD

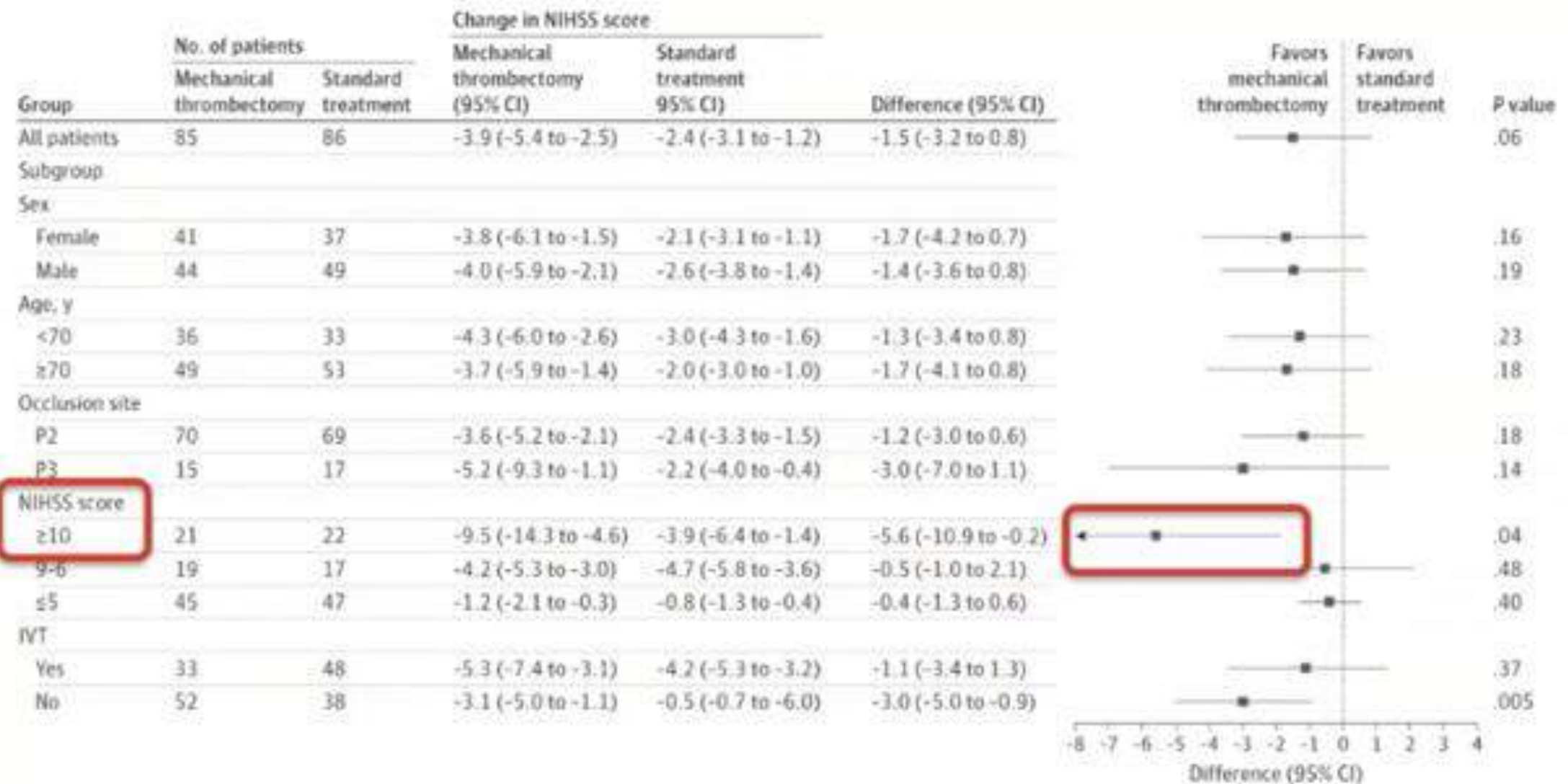


143 patients = P2-P3 occlusions

Table 2. Main Outcome and Safety Parameter Compared by Treatment Group Before and After Propensity Score Matching

Outcome	Before PSM			After PSM		
	No. (%)		P value	No. (%)		P value
	Mechanical thrombectomy cohort (n = 143)	Standard medical treatment cohort (n = 100)		Mechanical thrombectomy cohort (n = 92)	Standard medical treatment cohort (n = 92)	
NIHSS score change						
Mean (SD)	-4.0 (6.4)	-2.4 (3.9)	.02 ^a	-3.9 (6.7)	-2.4 (3.6)	.06
Median (IQR)	-3 (-6 to -1)	-1 (-4 to 0)	.005 ^a	-2 (-5 to -1)	-1.5 (-4.2 to 0)	.06
Binary ENI	73 (56.6)	41 (43.6)	.056	36 (42.4)	32 (37.2)	.49
mRS score at 90-d follow-up						
0-1	72 (66.1)	29 (50.9)	.057	51 (66.2)	31 (54.4)	.16
0-2	86 (78.9)	41 (71.9)	.31	59 (76.6)	43 (75.4)	.87
Safety outcomes						
sICH	5 (3.5)	4 (4)	.83	4 (4.3)	4 (4.3)	>.99
Mortality						
In-hospital	7 (5.6)	5 (9.1)	>.99	4 (4.4)	5 (5.4)	>.99
At 90-d follow-up	12 (11)	9 (17.5)	.23	9 (11.8)	9 (15.8)	.40

Figure 2. Early Clinical Outcome at Discharge



Clin Neuroradiol (2021) 31:791–798

<https://doi.org/10.1007/s00062-020-00970-7>

ORIGINAL ARTICLE



Approaching the Boundaries of Endovascular Treatment in Acute Ischemic Stroke

Multicenter Experience with Mechanical Thrombectomy in Vertebrobasilar Artery Branch Occlusions

Hanna Styczen¹ · Sebastian Fischer² · Leonard LL Yeo^{3,12} · Benjamin Yong-Qiang Tan^{3,12} · Christoph J. Maurer⁴ · Ansgar Berlis⁴ · Nuran Abdullayev⁵ · Christoph Kabbasch⁵ · Andreas Kastrup⁶ · Panagiotis Papanagiotou^{7,8} · Christin Clajus⁹ · Donald Lobsien⁹ · Eike Piechowiak¹⁰ · Johannes Kaesmacher^{10,11} · Volker Maus²

Received: 1 August 2020 / Accepted: 1 October 2020 / Published online: 27 October 2020

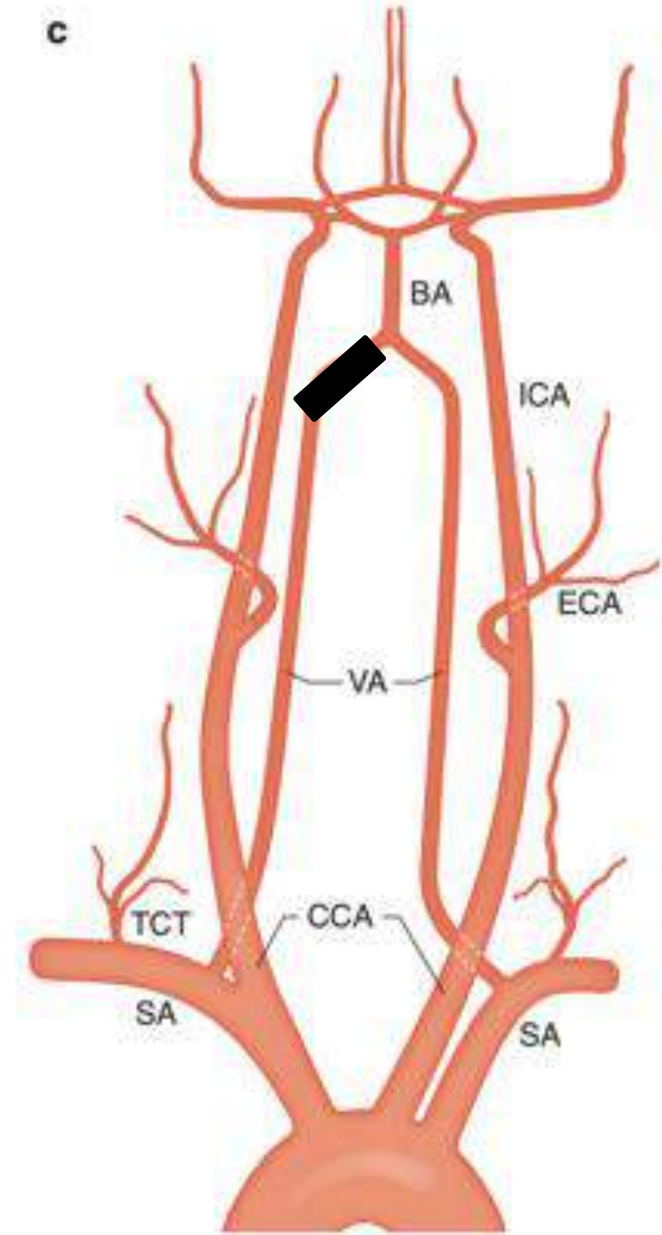
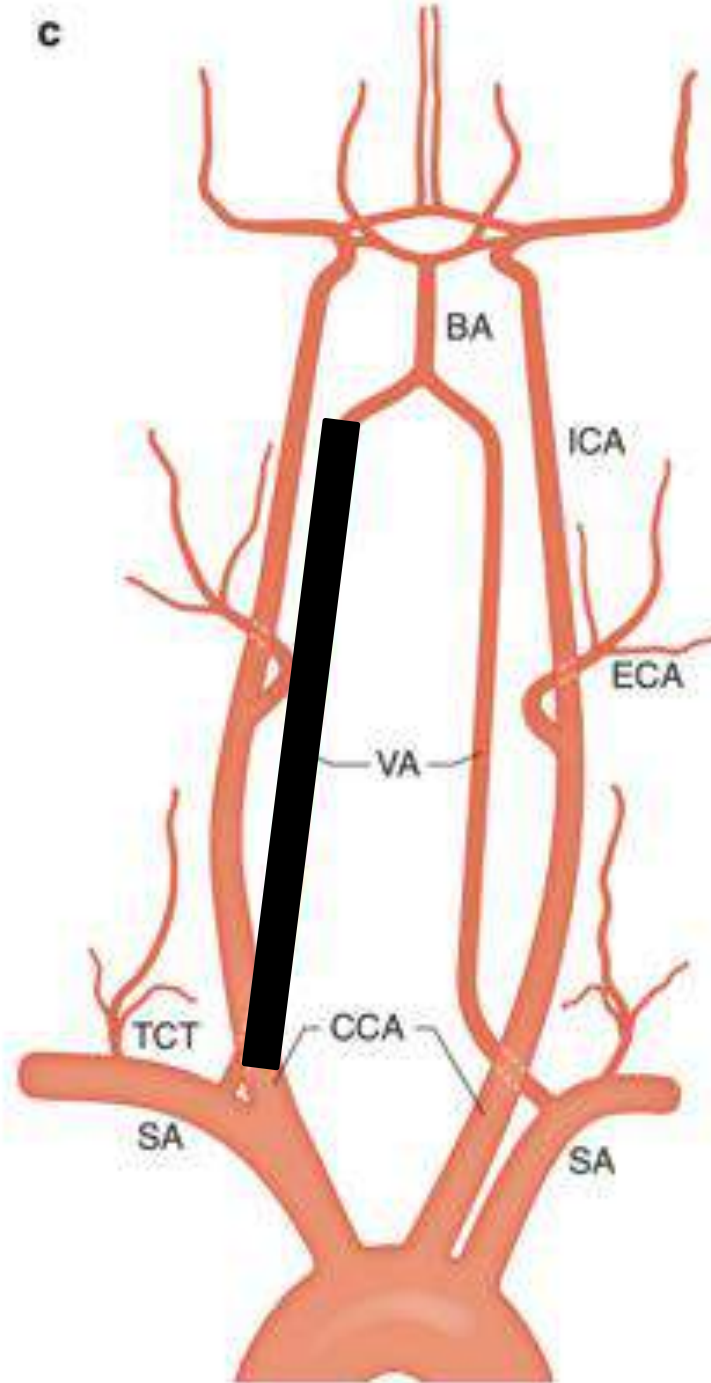
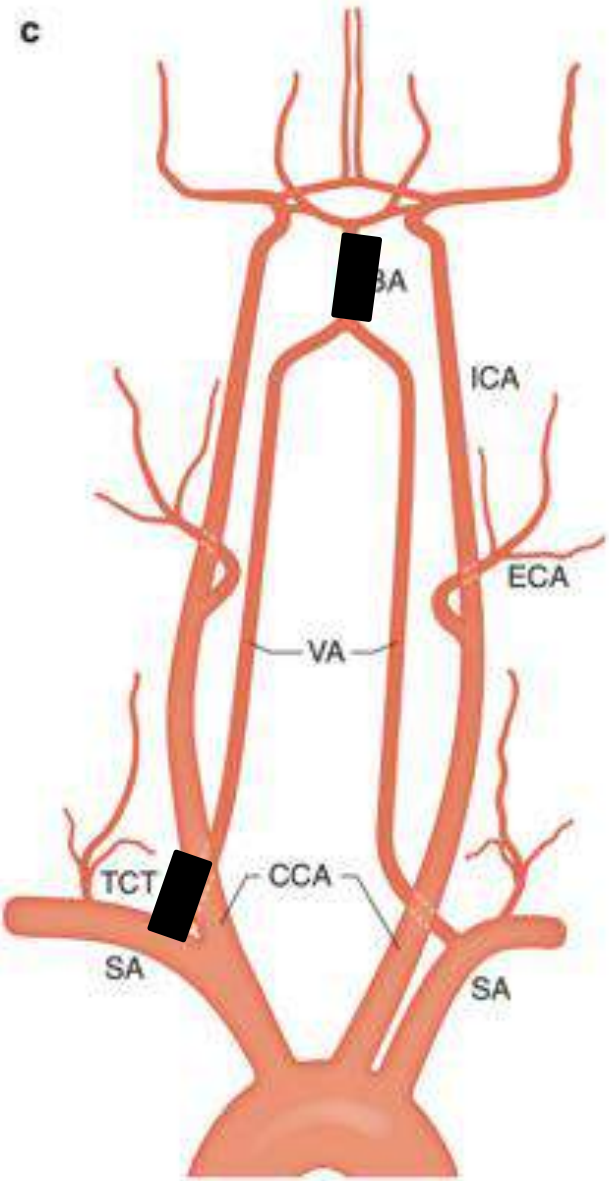
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PICA, AICA, SCA branch occlusions

High rate of procedure related ICH, SAH 19%

Nöroanatomî-Varyasyonlar

**Disseksiyon??
ICAD ???**

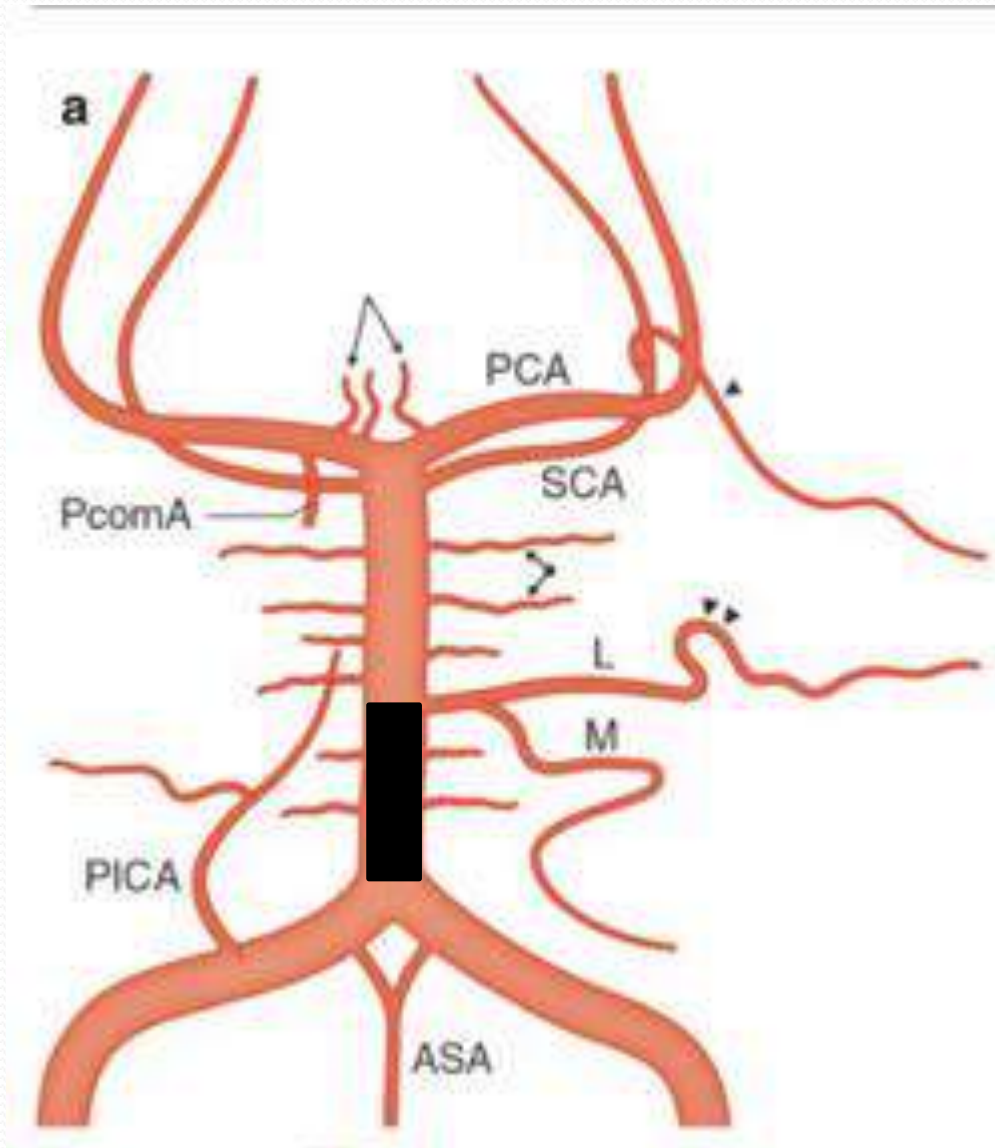


Oklude olmayan taraf vertebral hipoplazi

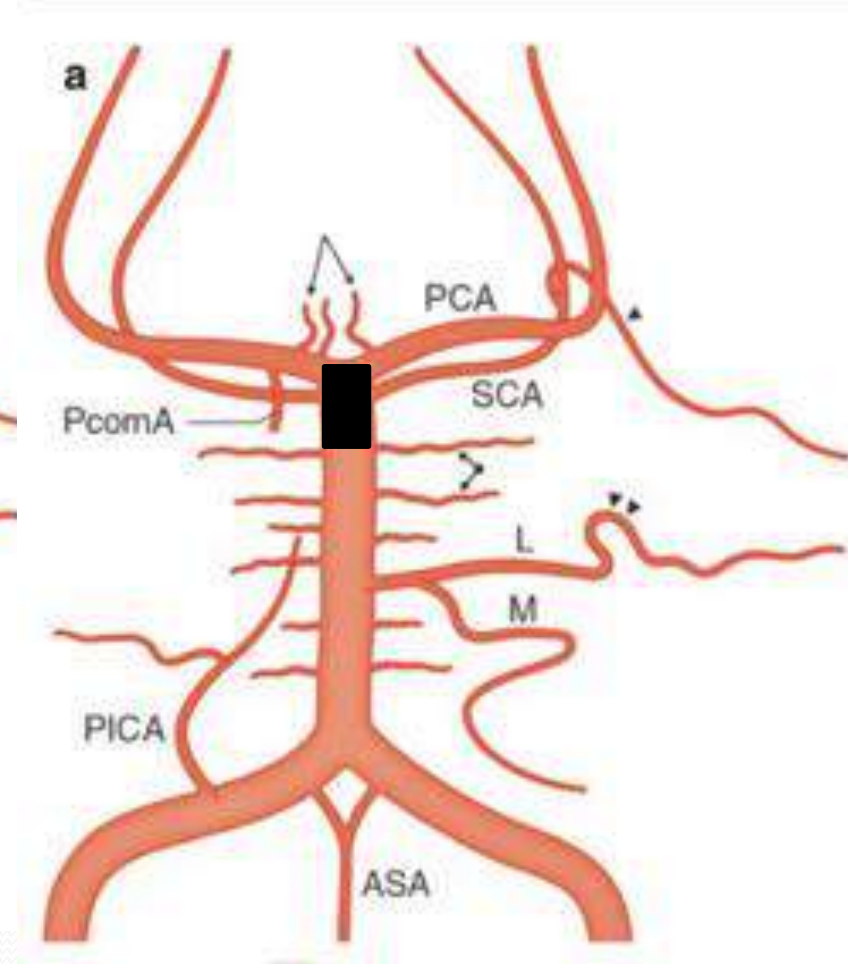
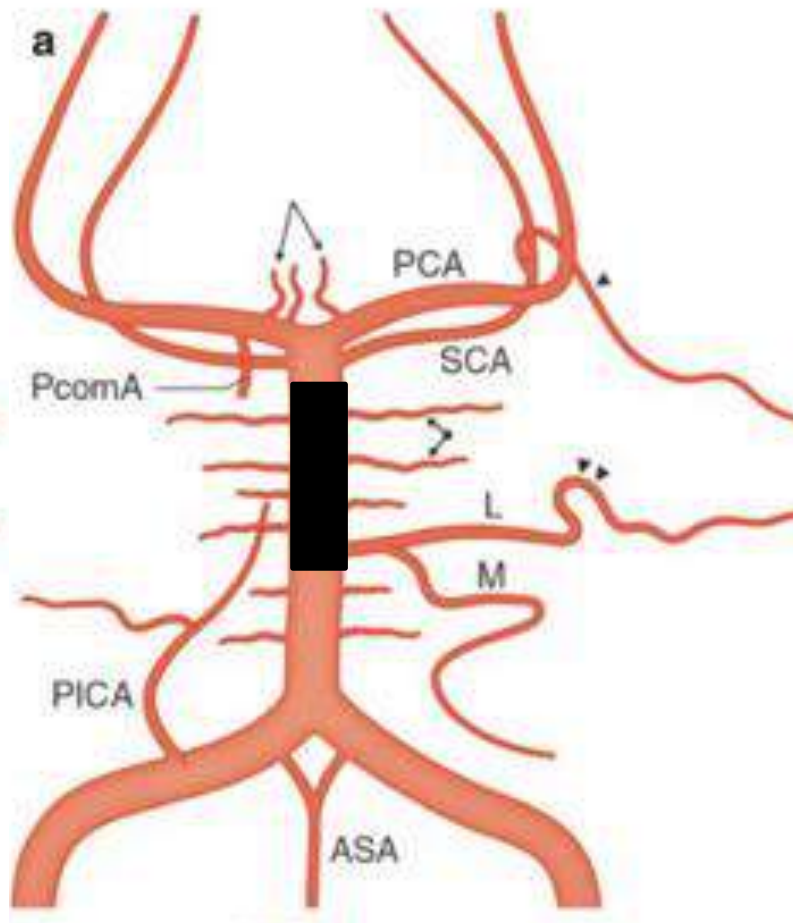
Vertebral hipoplazi- oklüde olmayan taraf??

Ciddi klinik ile prezentasyon

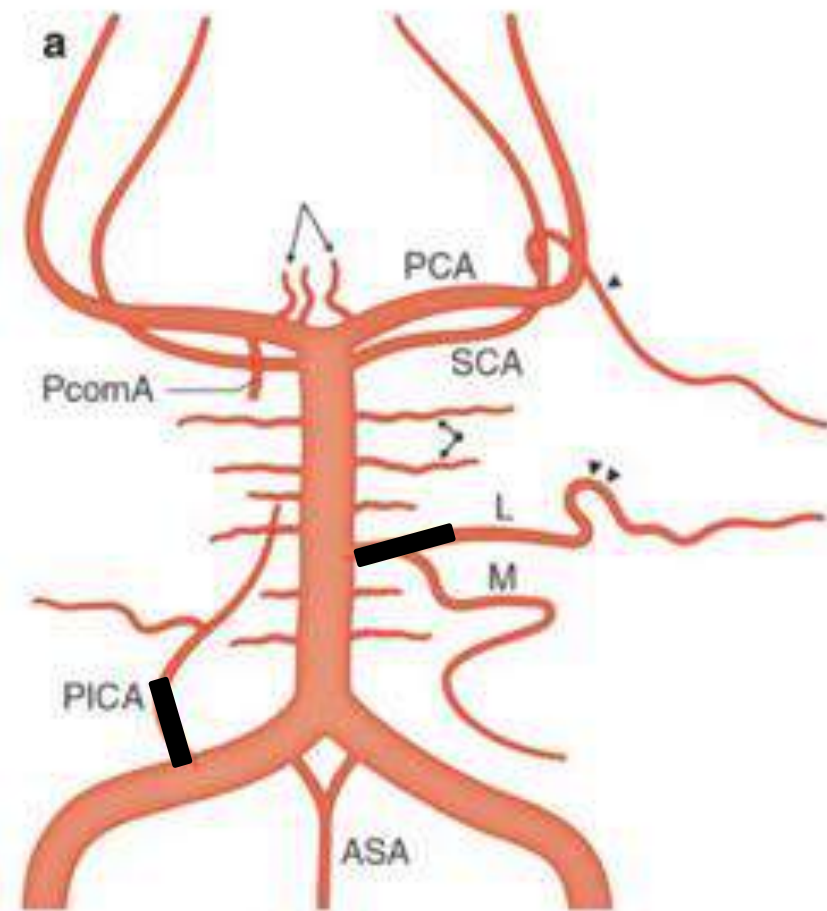
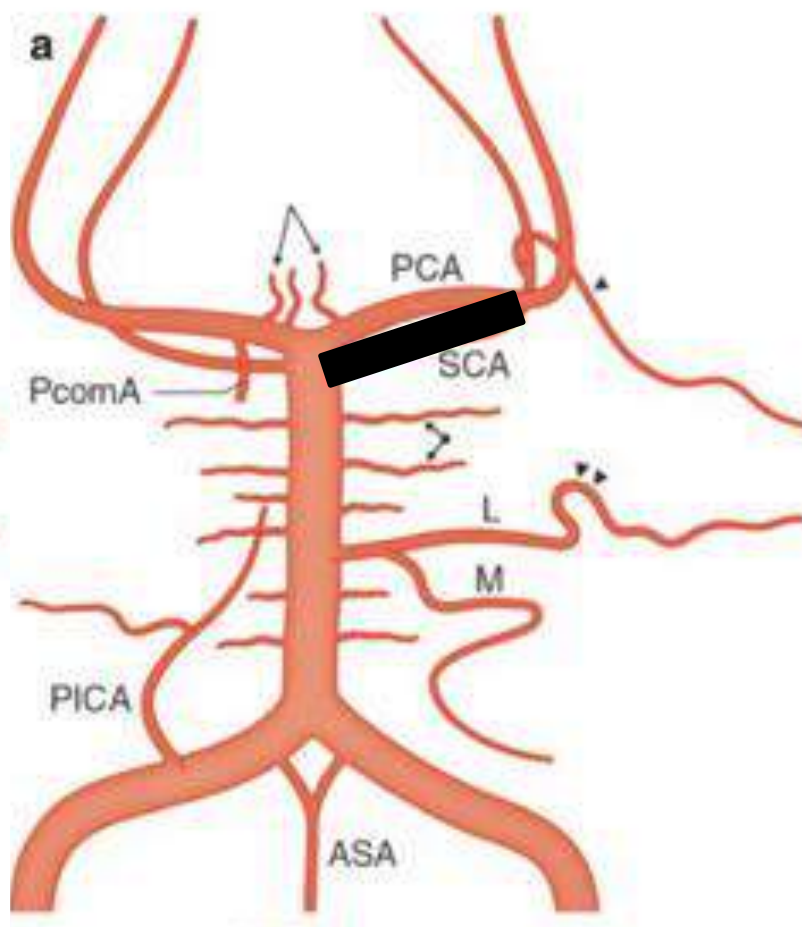
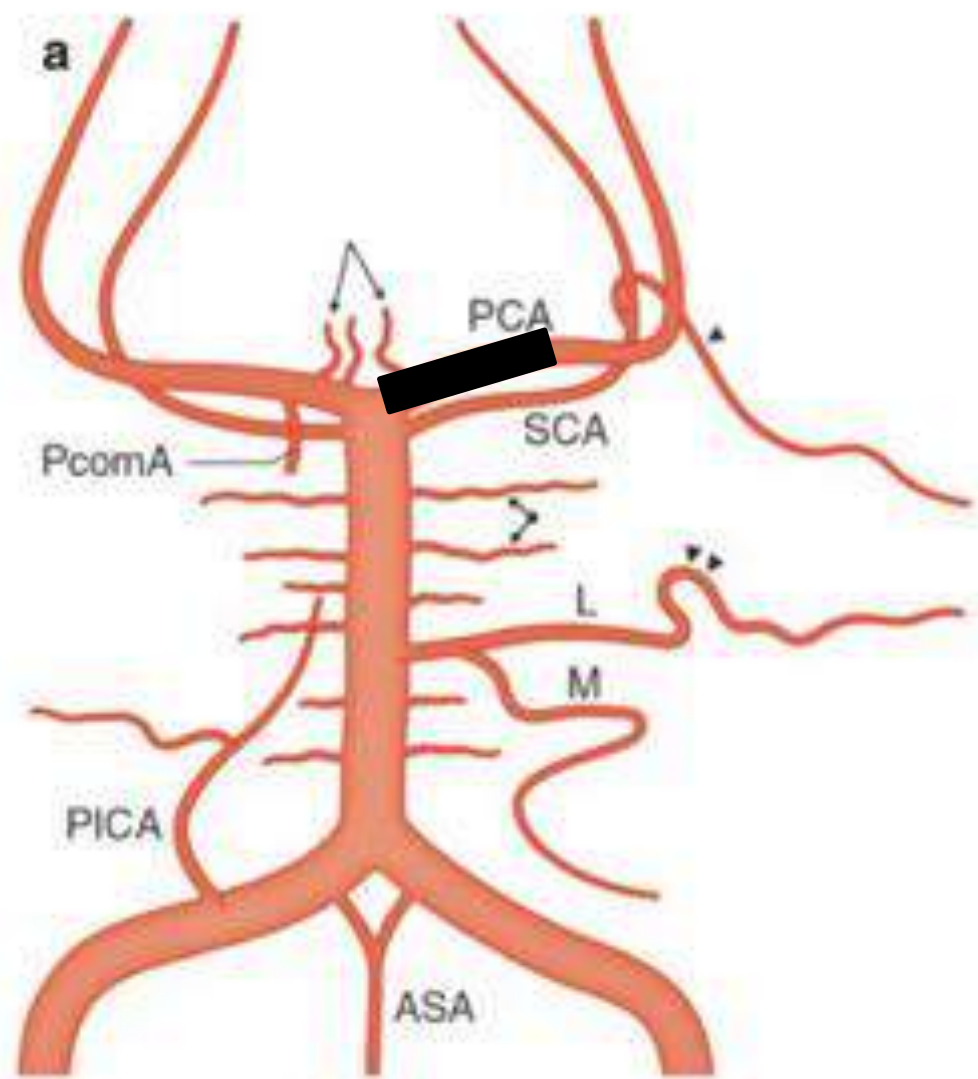
Aterosklerotik, embolik, disseksiyon

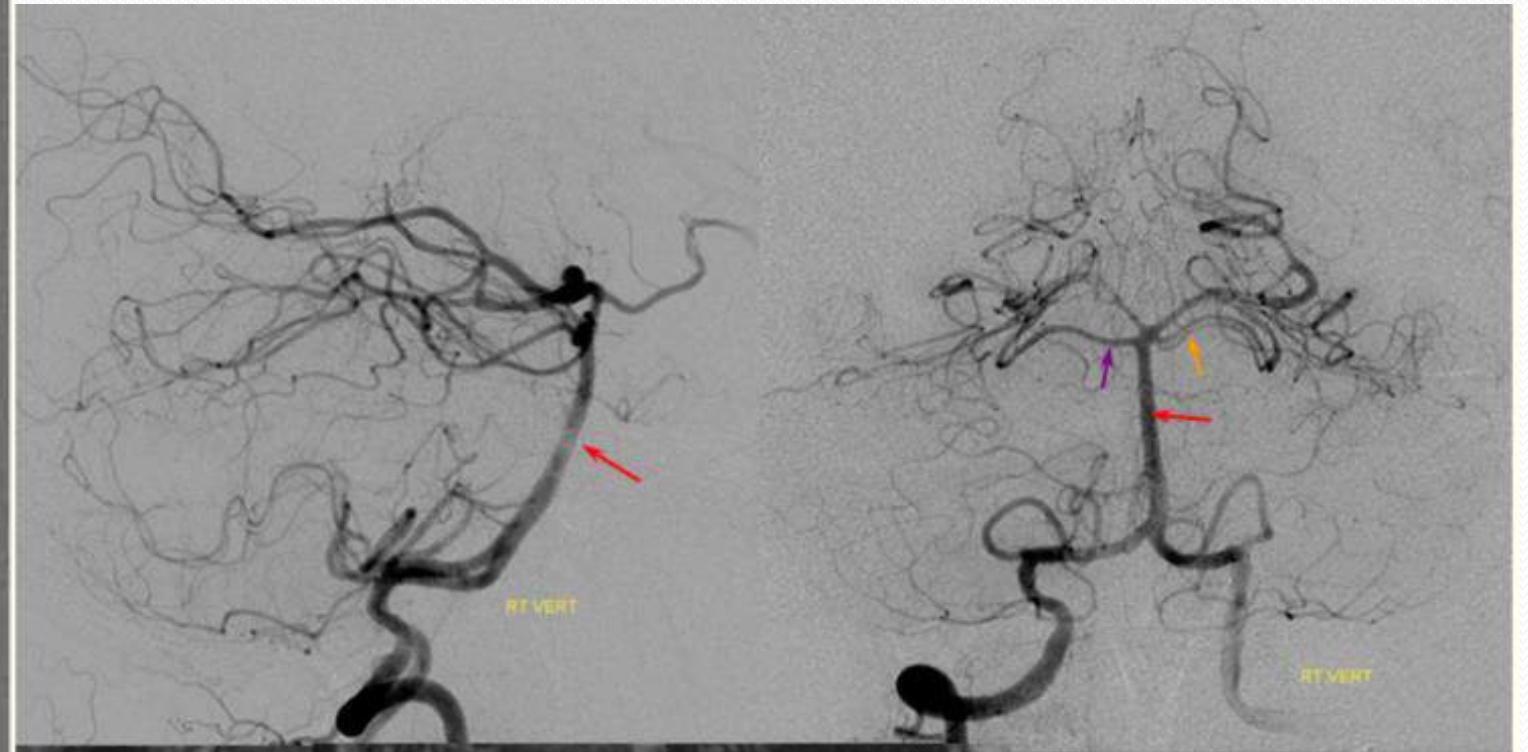
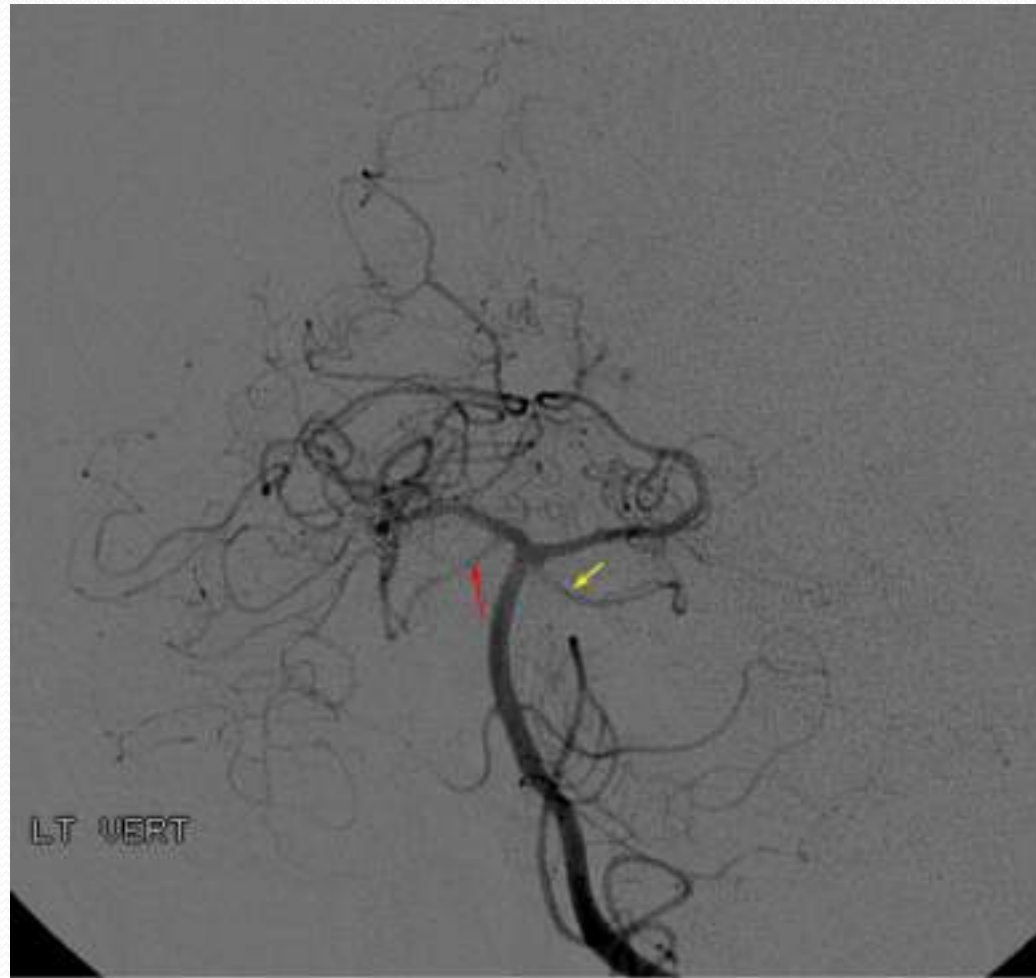


ICAD ???

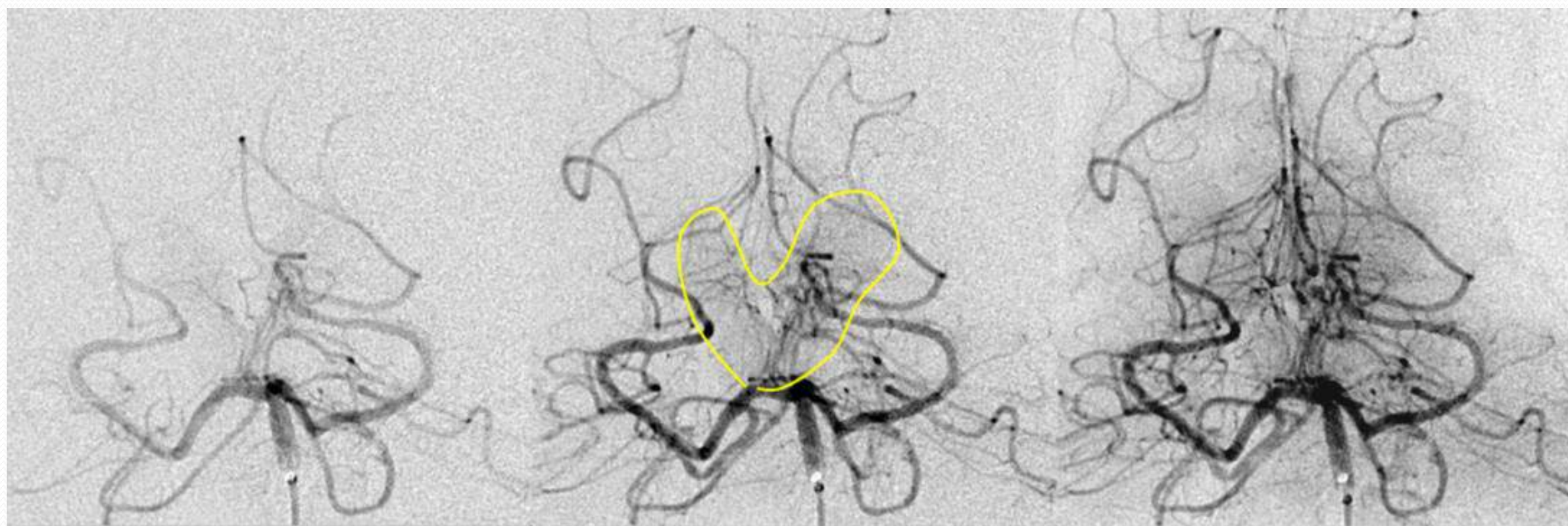


Tipik embolik kaynak



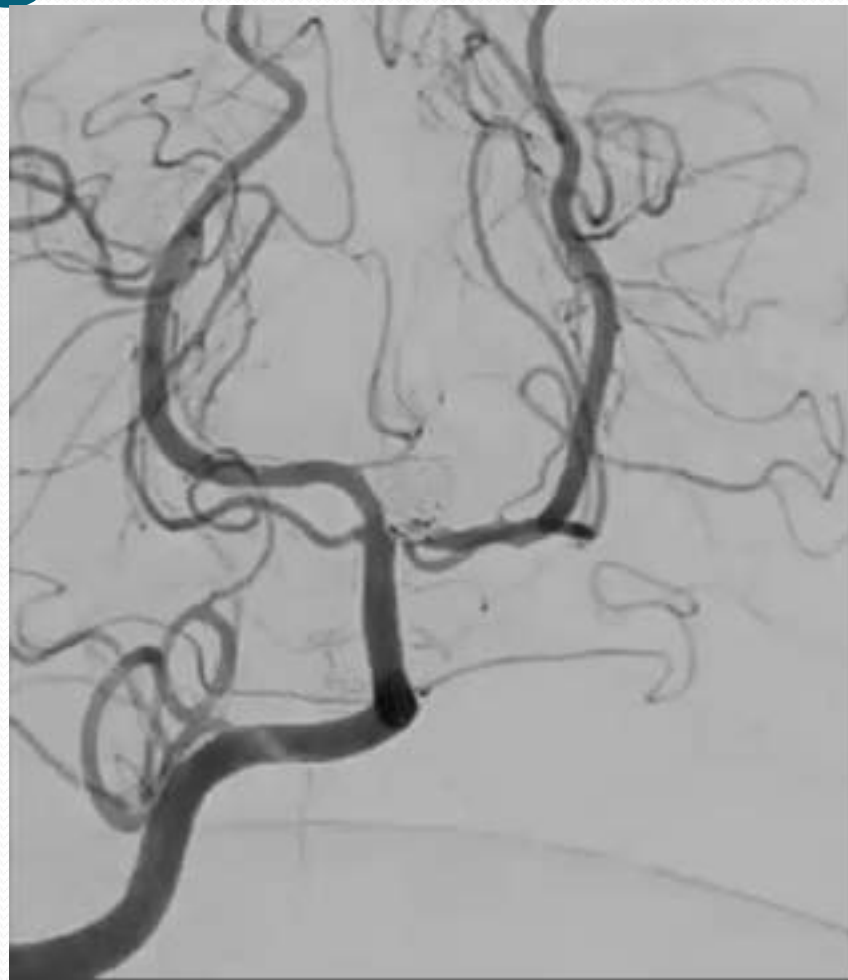


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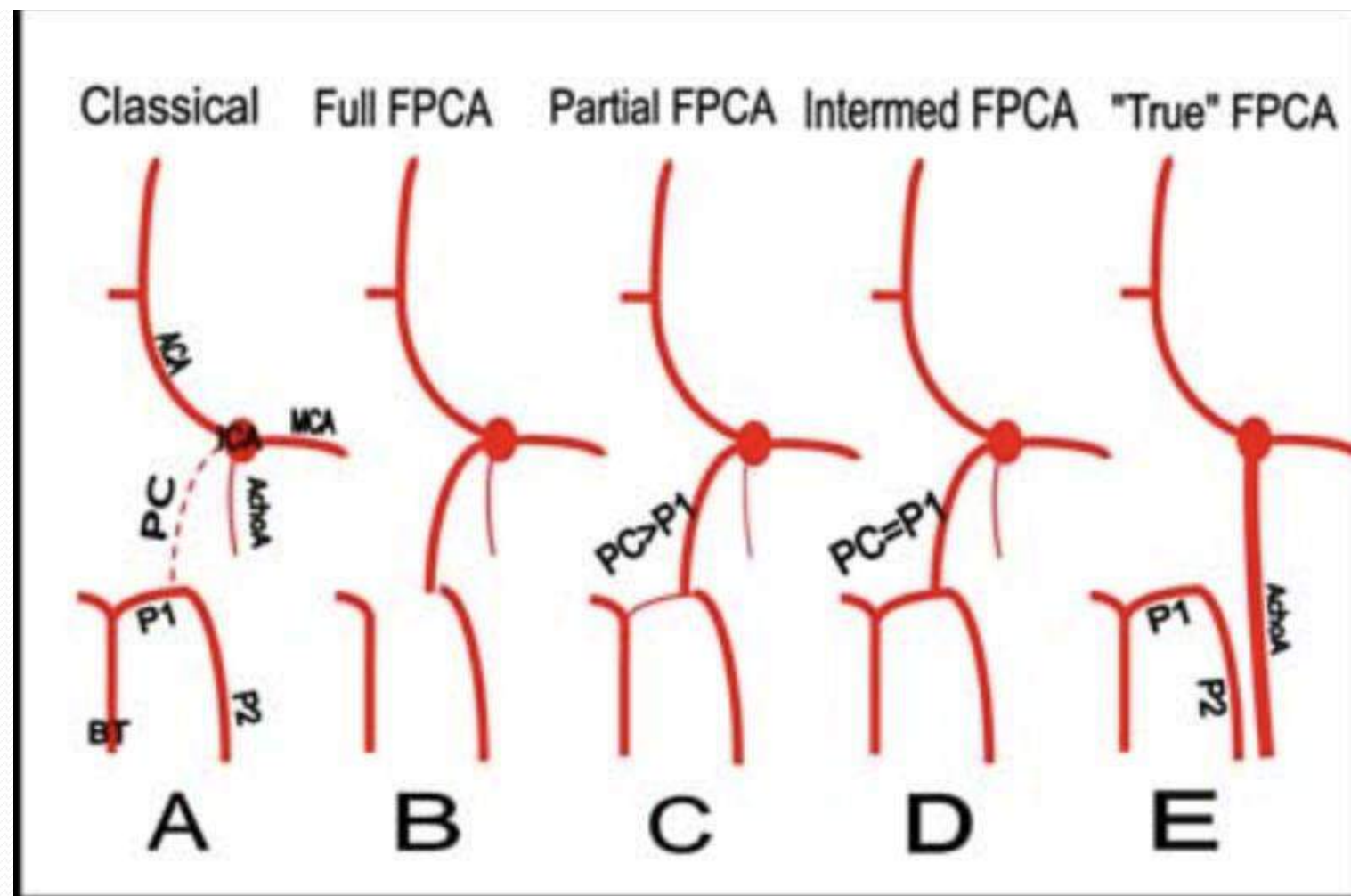
Artery of Pecheron-Asymmetric trigeminal fusion

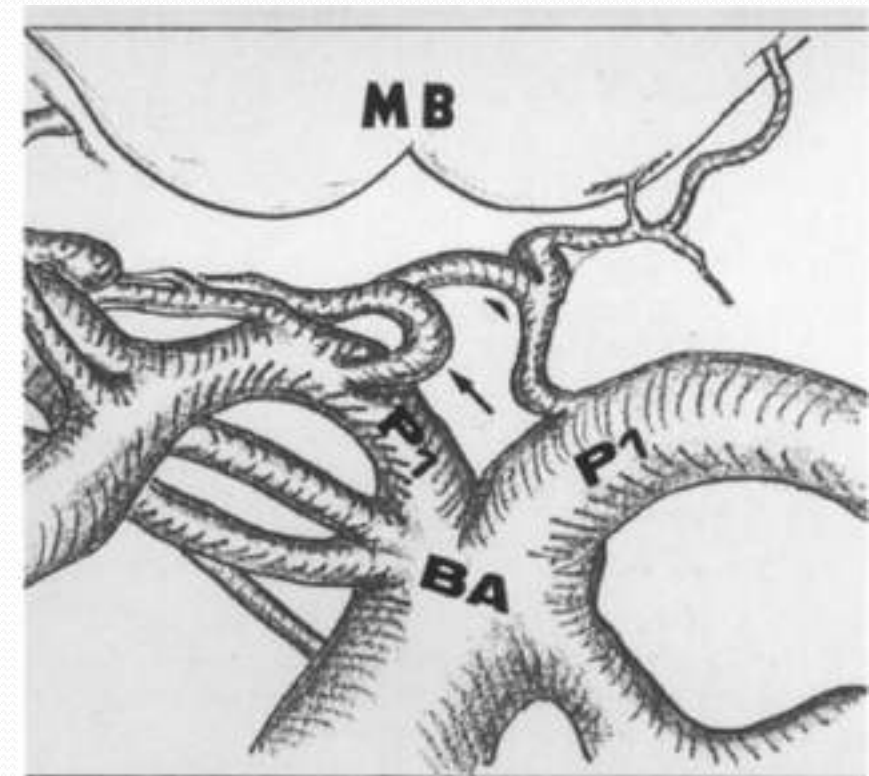
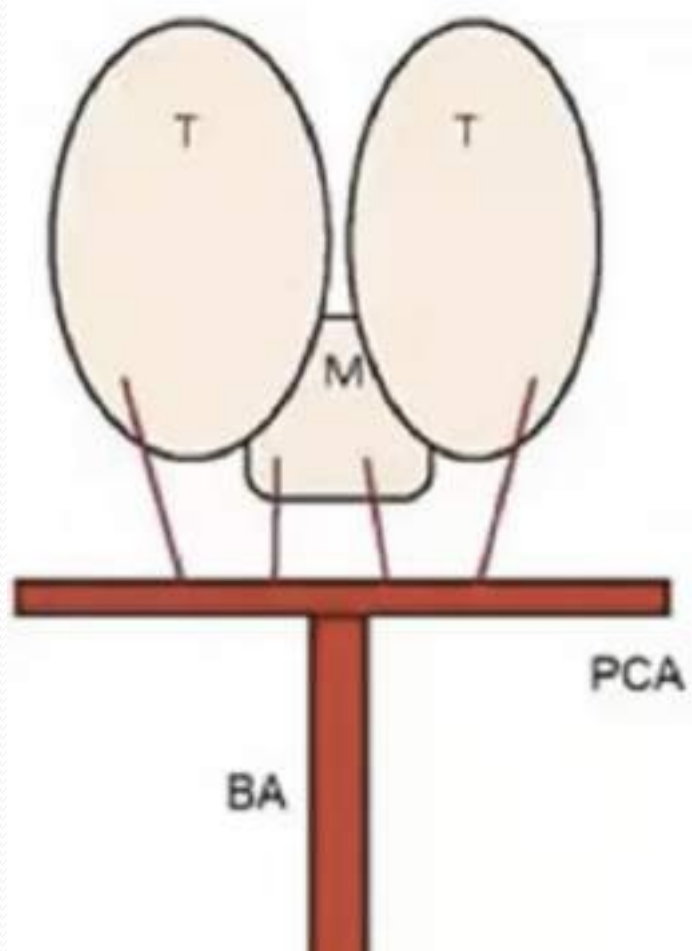


Images in Clinical Radiology

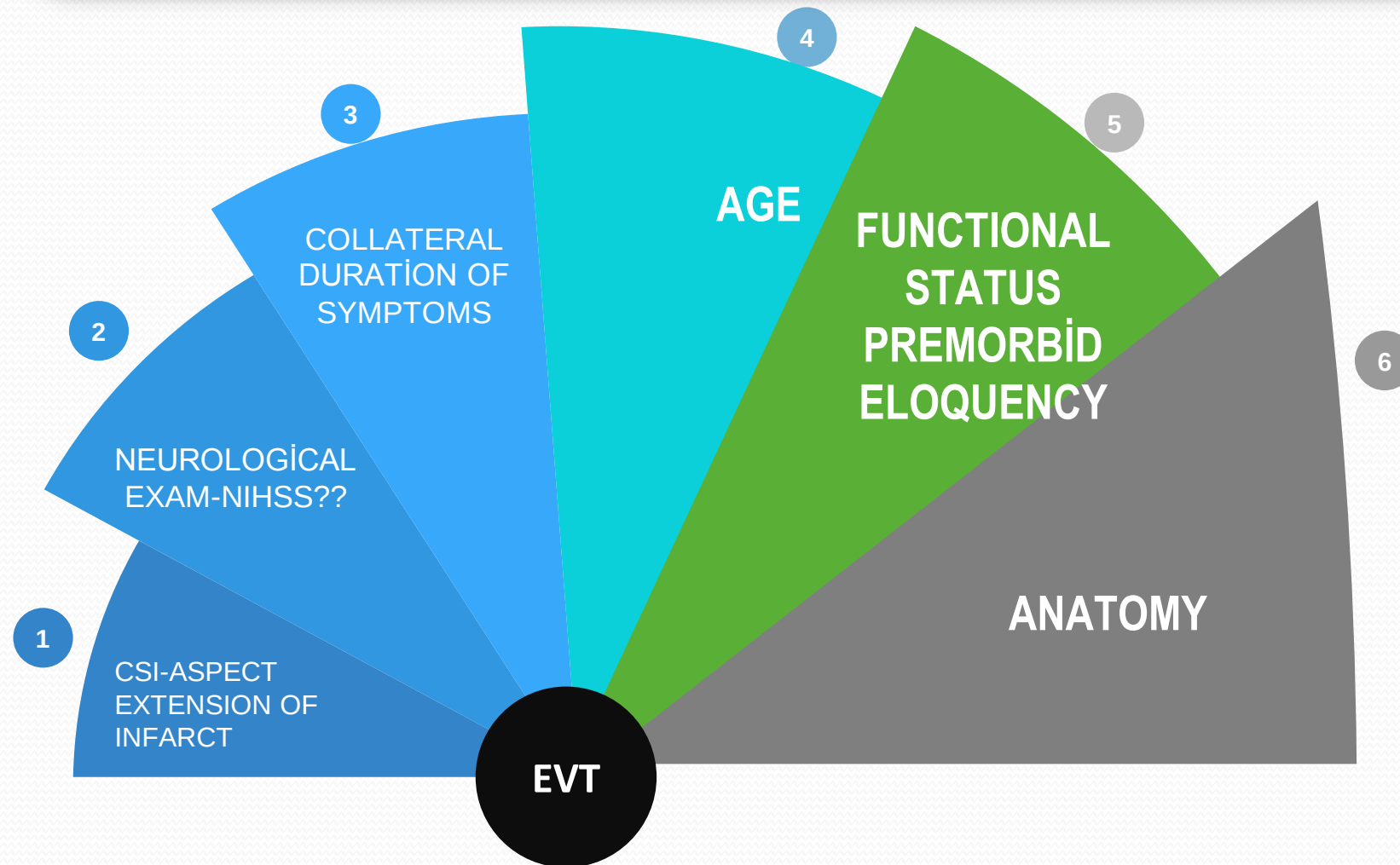
Duplication of the Posterior Cerebral Artery (PCA) or "True Fetal PCA": An Extremely Rare Variant

Author: Bruno Coulier ✉





Karar verme aşaması



Teknik açıdan bakış

Review Article

Aspiration Thrombectomy for Posterior Circulation Stroke: A Systematic Review and Meta-Analysis

Abstract

Purpose: This study aims to analyze the efficacy of aspiration thrombectomy for large vessel occlusion of the posterior circulation, with an emphasis on comparison with stent retriever thrombectomy. **Methods:** A systematic review and meta-analysis were performed to analyze the outcomes of aspiration thrombectomy for acute posterior circulation stroke. For those studies that included data for both aspiration and stent-retriever thrombectomy, we additionally performed a second meta-analysis comparing their outcomes against each other. **Results:** A total of 17 articles were included. For the primary outcomes, the weighted pooled rate of mortality was 26.71% (95% confidence interval [CI] 19.35%–34.71%), modified Ranking Score (mRS) 0–2 at 3 months was 36.71 (95% CI 32.02%–41.52%), and successful recanalization 89.26% (95% CI 83.12%–94.31%). Primary stent retriever thrombectomy was inferior to primary aspiration thrombectomy for the outcomes of successful recanalization (odds ratio [OR] 0.57, 95% CI 0.36–0.91, $P = 0.018$), complete recanalization (OR 0.65, 95% CI 0.42–0.1.00, $P = 0.048$), procedure time (mean difference 28.17, 95% CI 9.47–46.87), and rate of embolization to new territory (OR 5.01, 95% CI 1.20–20.87, $P = 0.027$). No significant difference was seen for other outcomes. Further subgroup analysis suggests that for the outcome of recanalization, this may be dependent on the availability of second-line stent retriever thrombectomy. **Limitations:** The included studies were observational in nature. There was unresolved heterogeneity in some of the outcomes. **Conclusions:** There was no statistically significant difference seen for the primary outcomes of mortality and favorable outcome (mRS score 0–2) at 3 months. While superior rates of successful recanalization, complete recanalization, faster procedural time, and improved safety profile for primary aspiration thrombectomy were seen compared to primary stent retriever thrombectomy, this did not translate into superior clinical outcomes.

Keywords: Aspiration, posterior circulation, stent retriever, stroke, thrombectomy

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Australia

Mechanical thrombectomy in basilar artery occlusion: influence of reperfusion on clinical outcome and impact of the first-line strategy (ADAPT vs stent retriever)

Benjamin Gory, MD, PhD,¹ Mikael Mazighi, MD, PhD,^{2–5} Raphael Blanc, MD, MSc,² Julien Labreuche, BST,⁶ Michel Piotin, MD, PhD,² Francis Turjman, MD, PhD,⁷ and Bertrand Lapergue, MD, PhD,⁸ on behalf of the Endovascular Treatment in Ischemic Stroke (ETIS) Research Investigators

¹Department of Diagnostic and Interventional Neuroradiology, INSERM U947, University Hospital of Nancy, University of Lorraine, Nancy; ²Department of Interventional Neuroradiology, Rothschild Foundation, Paris; ³DHU NeuroVasc Sorbonne Paris Cité; ⁴Paris Diderot University (Paris 7), Paris; ⁵Laboratory of Vascular Translational Science, INSERM U1148, Paris; ⁶Department of Biostatistics, EA2694-Santé publique: épidémiologie et qualité des soins, Lille University, Lille; ⁷Department of Interventional Neuroradiology, Hospices Civils de Lyon; and ⁸Department of Neurology, Stroke Center, Foch Hospital, Université de Versailles Saint-Quentin-en-Yvelines, Suresnes, France

Neurosurgery

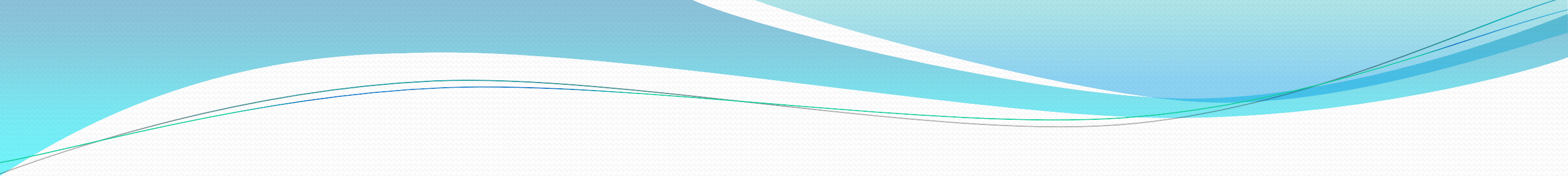
Contact Aspiration

Faster procedural time

Higher rate of complete reperfusion

No effect on mortality-clinical outcome

Asian Neurosurgery



teşekkürler



MEVO (Medium Vessel Occlusion) ve Distal Serebral Damar Oklüzyonlarına Endovasküler Yaklaşım: Ne Zaman? Nasıl?

Doç Dr Songül ŞENADIM
İstanbul Aydın Üniversitesi Tıp Fakültesi
Nöroloji anabilim dalı

- Distal medium arteriyel dallar

- Anterior serebral arter [ACA]
- M2-M4 orta serebral arter [MCA]
- Posterior serebral arter [PCA]
- Posterior inferior serebellar arter [PICA]
- Anterior inferior serebellar arter [AICA]
- Superior serebellar arter [SCA]

- tipik olarak 25 anatomik segmente sahiptir.

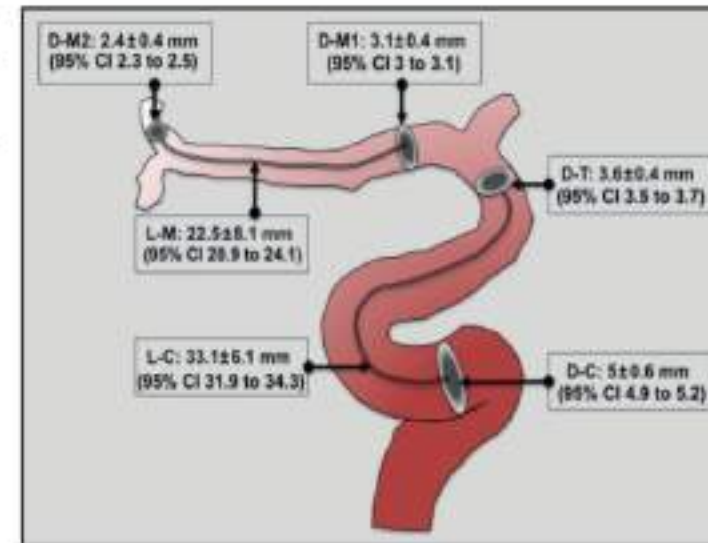
ORIGINAL RESEARCH

Cerebrovascular geometry in the anterior circulation: an analysis of diameter, length and the vessel taper

Ansaar T Rai,¹ Jeffery P Hogg,¹ Brendan Cline,¹ Gerald Hobbs²

J Neurointerv Surg. 2013
Jul;5(4):371-5.

Figure 2 Drawing of the right internal carotid artery (ICA) in an oblique projection showing the mean values for diameter and length for all patients (n=100). D-C, proximal cavernous ICA diameter; D-T, ICA terminus diameter; L-C, length of the ICA segment between D-C and D-T; D-M1, middle cerebral artery (MCA) origin diameter; D-M2, M2 origin diameter; L-M, length of the MCA segment between D-M1 and D-M2. The vessel taper for the ICA was along L-C.



- **Large vessel:** lümen çapı >2.0 mm
- **Medium vessel:** lümen çapı 0,75 ile 2,0 mm
 - M3 MCA arteries (typical diameters at origin, 1.1–1.5 mm), M4 MCA,
 - A2 - A5 ACA,
 - P2 - P5 PCA
- **Small vessel arterler** <0,75 mm
 - lentikülostriat arter çapı 0,5 mm
 - pial arter çapı, 0,2–0,7 mm
- **However, categorization of M2 MCA, A1 ACA, and P1 PCA ????**

Akut iskemik inme

- %35 - 40 akut PLVO
- %20-25 akut küçük damar (derin ve uzun pial penetratör) tıkanıklıklar
- %2 - 5 oranında hemodinamik watershed iskemisi
- %1 - 5 olağandışı durumlar (örn: reversible vasoconstriction syndrome, hiperviskozite, moyamoya)
- %25 - 40'ı akut DMVO'lardan kaynaklanmaktadır

RİSK

- Distal vasküler bölgede trombektomide daha yüksek risk.
 - Distal damarlar daha ince kalibrasyonda.
 - Duvarlar daha ince.
 - Tortiyoz anatomi: perforasyon, diseksiyon ve vazospazm gibi endovasküler komplikasyonlara daha yatkın hale getiren anatomi.

- DMVO'lar, randomize klinik çalışmalarda oldukça yetersiz temsil edilmektedir.
- Interventional Management of Stroke III (IMS-III)<<< sadece %8'inde M3/M4 oklüzyonları vardı.
- MR CLEAN<<<< sadece 3 ACA vardı ve hiçbirinde MCA-M3 oklüzyonu yoktu.

DMVO - IV tpa/EVT

- Her DVO hastaları tipik olarak endovasküler reperfüzyon için ideal aday olarak kabul edilmez.
- IV tpa DVO'da PVO'dan daha etkili olmasına rağmen, DAO'lu hastalarda kontrendikasyon veya geç saatte gelmeleri!!!
- DAO trombektomisi, özellikle eloquent alanlarını içeren ve dizabiliteye neden olan hastalar için makul bir seçenek!!!
- **Eloquent area <<< motor cortex-tissue, sensorimotor, memory, and language.**

- IV Tpa distalde proksimal oklüzyonlardan daha etkili olmakla birlikte, DMVO'ların 1/2 - 2/3 rekanalize edemezler.
- Uygun, daha küçük, daha kolay navige edilebilir stent retriever ve tromboaspirasyon cihazların kullanıldığı çalışmalarda, DMVO'lar için EVT'nin güvenli, teknik olarak etkili ve klinik olarak faydalı olduğu ortaya çıkmıştır.

DMVO -Klinik

- PLVO'ları oldukça homojen klinik verirken, DMVO'lar, farklı defisit gösterir.
- ACA'ya bağlı izole abuli,
- MCA'ya bağlı agrafili aleksi,
- PCA'ya bağlı kuadrantanopi
- PICA dal enfarktüsüne bağlı tek taraflı ataksisi olan hastalar.
- -----NIHSS ve mRS tarafından genellikle iyi yakalanmaz.

- **İzole alt ekstremitte monoplejisi olan bir distal ACA inmesi olan bir hasta>>>NIHSS:4???**
- **Şiddetli afaziye veya hemiplejiye** neden olan distal MCA tıkanıklıklarında da dizabilite ortaya çıkabilir.
- **PCA oklüzyonu>>> düşük NIHSS ile ortaya çıkabilir*****

ÖNEMLİ OLAN DİZABİLİTE DÜZEYİ

4. Although the benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for carefully selected patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have causative occlusion of the MCA segment 2 (M2) or MCA segment 3 (M3) portion of the MCAs.	IIb	B-R	Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE revised. See Table LXXXIII in online Data Supplement 1 for original wording.
In pooled patient-level data from 5 trials (HERMES, which included the 5 trials MR CLEAN, ESCAPE, REVASCAT, SWIFT PRIME, and EXTEND-IA), the direction of treatment effect for mechanical thrombectomy over standard care was favorable in M2 occlusions, but the adjusted common OR was not significant (1.28; 95% CI, 0.51–3.21).¹⁷² In patient-level data pooled from trials in which the Solitaire was the only or the predominant device used, a prespecified meta-analysis (SEER Collaboration: SWIFT PRIME, ESCAPE, EXTEND-IA, REVASCAT) showed that the direction of treatment effect was favorable for mechanical thrombectomy over standard care in M2 occlusions, but the OR and 95% CI were not significant.¹⁷³ In an analysis of pooled data from SWIFT (Solitaire With the Intention for Thrombectomy), STAR (Solitaire Flow Restoration Thrombectomy for Acute Revascularization), DEFUSE 2, and IMS III, among patients with M2 occlusions, reperfusion was associated with excellent functional outcomes (mRS score 0–1; OR, 2.2; 95% CI, 1.0–4.7).¹⁷⁵ Therefore, the recommendation for mechanical thrombectomy for M2/M3 occlusions does not change substantively from the 2015 AHA/American Stroke Association focused update.			See Tables XXIII and XLI in online Data Supplement 1.
5. Although the benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for carefully selected patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have causative occlusion of the anterior cerebral arteries, vertebral arteries, basilar artery, or posterior cerebral arteries.	IIb	C-EO	Recommendation reworded for clarity from 2015 Endovascular. Class unchanged. LOE amended to conform with ACC/AHA 2015 Recommendation Classification System. See Table LXXXIII in online Data Supplement 1 for original wording.

- AHA Kılavuzları, semptomdan sonraki 6 saat içinde dikkatle seçilmiş AIS hastalarında **MCA-M2, MCA–M3, ACA ve PCA** trombektomisinin makul olabileceğini belirtmektedir (Klass IIb).

MeVO: the next frontier?

Mayank Goyal ^{1,2} Johanna Maria Ospel ^{1,3} Bijoy K Menon,^{1,2}
Michael D Hill ^{1,2}

J Neurointerv Surg. 2020 Jun;12(6):545-547

M2 oklüzyonlarının doğal seyri kötü.

M2 oklüzyonu olan hastaların sadece yarısı 90 günde iyi bir fonksiyonel sonuç elde eder.

A2/3 ve P2/3, M3 oklüzyonlarının klinik seyri bilinmemekte.

MR CLEAN çalışması M2 oklüzyonu olan hastaları içeren tek çalışmaydı ve bunlar çalışmanın yalnızca %8'ini oluşturuyordu.

MeVO tanım

- LVO'lar için bile nasıl tanımlanmaları gerektiği tam olarak açık değildir.
- MeVO'ları tanımlarken durum daha da karmaşıktır.
- Kavramsal olarak, **primer MeVO'lar**, EVT sırasında veya özellikle IV tpa uygulamasından sonra iyatrojenik trombüs parçalanmasından kaynaklanabilen **sekonder MeVO'lardan** ayırt edilmelidir.

MeVO tanım

Table 1 Proposed definition of medium vessel occlusion (both A and B have to apply)*

A) Occlusion in one of the following vessel segments	
Anatomical	M2 segment (from the main MCA bifurcation/trifurcation to the circular sulcus of the insula) ¹²
	M3 segment (from the circular sulcus of the insula to the external/superior surface of the Sylvian fissure) ¹²
	A2 segment (from the origin of the anterior communicating artery to the origin of the callosomarginal artery) ¹³
	A3 segment (from the origin of the callosomarginal artery to the artery's posterior turn above the corpus callosum) ¹³
	P2 segment (from the origin of the posterior communicating artery to the point of entrance in the quadrigeminal cistern) ¹⁴
	P3 segment (segment within the quadrigeminal cistern) ¹⁴
B) Substantial clinical deficit (one of the following)	
Functional	NIHSS ≥ 5
	NIHSS < 5 with disabling deficit†

*Vessel size allows for safe endovascular thrombectomy based on available technology and techniques (typical vessel size in MeVOs ranges from 1 to 3 mm¹⁵).

†Particularly important for P2/3 segment occlusions, since the NIHSS score does not accurately capture clinical deficits caused by posterior circulation occlusions.¹⁶

MCA, middle cerebral artery; MeVO, medium vessel occlusion ; NIHSS, National Institutes of Health Stroke Scale.

MeVO'yu tanımlamak için kullanılabilecek

üç özellik vardır:

(a) damar anatomisi

(b) damar çapı

(c) klinik defisit

MeVO tedavi yaklaşımları

Table 2 Detailed description of medium vessel occlusion case scenarios

Occlusion site	Case vignette
M3	A patient in their late 60s presents with dysphasia. The NIHSS is 4, ASPECTS on non-contrast CT is 10. CT angiography shows an M3 occlusion. Symptom onset was 2 hours ago. The premorbid functional status was normal. How would you treat this patient?
A2	A patient in their early 60s presents with right sided leg paralysis. The NIHSS is 3, ASPECTS on non-contrast CT is 10. CT angiography shows an A2 occlusion. Symptom onset was 4 hours ago. The premorbid functional status was normal. How would you treat this patient?
P2	A patient in their mid-50s presents with left sided hemianopia. Their NIHSS is 2, ASPECTS on non-contrast CT is 10. CT angiography shows a P2 occlusion. Symptom onset was 3.5 hours ago. The premorbid functional status was normal. The patient is an Air Canada pilot. How would you treat this patient?

ASPECTS, Alberta Stroke Program Early CT Score; NIHSS, National Institutes of Health Stroke Scale.

Doktorların MeVO vakalarına nasıl yaklaştıklarını araştırmak için nörogirişimciler (n=184) arasında çok uluslu bir anket (**ESCAPE ALICE**) gerçekleştirildi.

sırasıyla M3, A2 ve P2 oklüzyonu olan hastaları içeren üç MeVO vakayı nasıl tedavi edecekleri soruldu.

Commentary

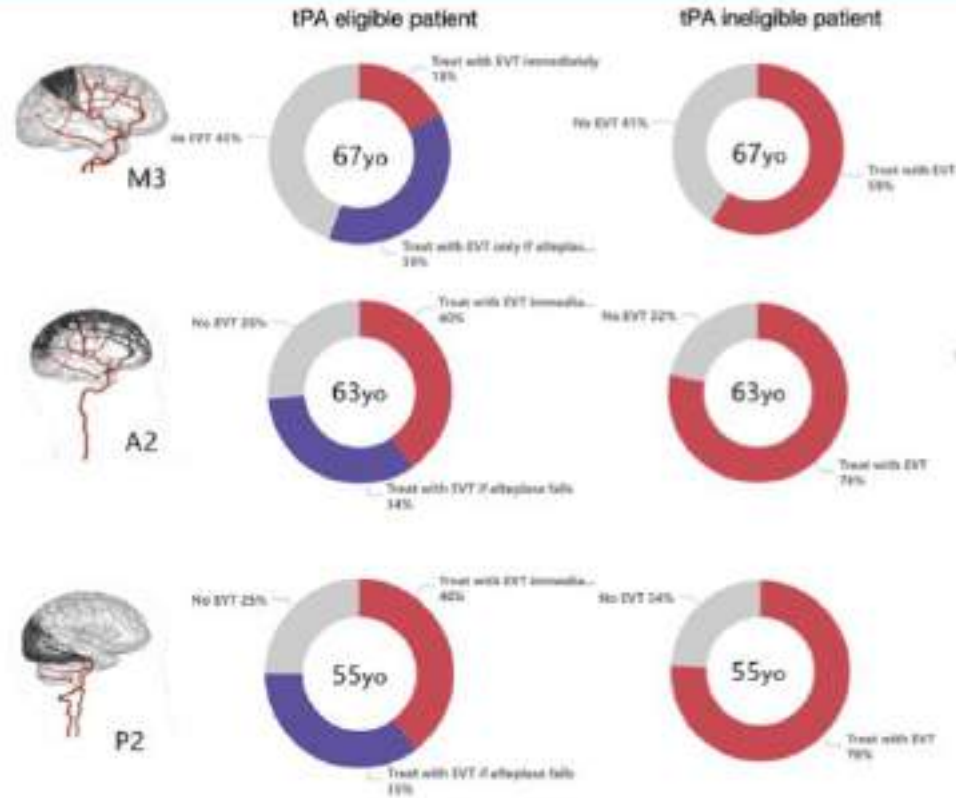


Figure 2 Treatment decision of the ESCAPE ALICE participants (n=184) for the three medium vessel occlusion case scenarios. Assuming eligibility for intravenous alteplase (tPA), 18–40% of physicians would offer endovascular treatment (EVT). In the case of ineligibility for intravenous alteplase, 59–78% would proceed with EVT.

Hastanın intravenöz alteplaz için uygun olduğu varsayılırsa, A2 ve P2 senaryolarında %40'ı EVT, M3 senaryoları için EVT oranı %18 ile daha düşüktü.

Alteplaz uygun olmaması durumunda, EVT oranları çok daha yüksekti (A2: %78, P2: %76, M3: %59).

MeVO da gelecek?

- MeVO strokalarında bir EVT çalışması gerekiyor
- MeVO trombektomisine uygun cihaz ve tekniklerin tasarlanması ve test edilmesi gerekir, bu da biraz zaman alacaktır.
- LVO stroklarına kıyasla komplikasyon riski daha yüksek olduğundan, bir MeVO çalışması için **kapsamlı merkezler ve deneyimli operatörler** dikkatle seçilmelidir.

ELVO: an operational definition

Thabele Leslie-Mazwi,¹ Ronil V Chandra,² Blaise W Baxter,³ Adam S Arthur,⁴ Muhammad S Hussain,⁵ I Paul Singh,⁶ Don F Frei,⁷ Richard P Klucznik,⁸ Felipe C Albuquerque,⁹ Joshua A Hirsch,¹⁰ the Society of NeuroInterventional Surgery

INTRODUCTION

Recent landmark randomized controlled trial data¹⁻⁷ have initiated a global transformational change in acute stroke therapy for ischemic stroke patients with large vessel occlusion. With endovascular thrombectomy established as the new standard of care for patients with large vessel occlusions, increased attention has turned towards service delivery to as many eligible patients as possible. The SNIS, in concert with other regional, national and international societies, has focused on this agenda.^{8,9} As both the need for and availability of endovascular thrombectomy grows, the terminology describing eligible patients requires uniformity. An operational definition of the clinical scenario in which a stroke patient has an urgent need for endovascular thrombectomy becomes increasingly important.^{10,11} A standardized nomenclature that uses consistently defined terms will facilitate continuous quality improvement as the field grows and understanding is advanced.¹²

Endovascular thrombectomy is a therapy specifically directed towards proximal cerebral vascular occlusions. Earlier studies with equivocal results for the benefit of this therapy¹³⁻¹⁵ were noteworthy for the absence of confirmation

requirement that vascular occlusion be documented as a requisite for patient enrollment in the trials.¹⁻⁷ However, across these recent landmark trials there was significant variability in the definition of large vessel occlusion (table 1). The purpose of this document is to provide a standardized operational definition.

ORIGINS OF 'ELVO'

The term 'Emergent Large Vessel Occlusion' or 'ELVO' was coined by the SNIS in 2015. It was felt that an acronym (like STEMI) would provide a rallying point for care providers and patients. The choice of language was to emphasize the time-critical nature of large vessel strokes. However, despite the term appearing in the peer reviewed literature and in multiple other contexts, no formal definition of ELVO has been crafted. It was presumed that ELVO referenced internal carotid and M1 occlusions given data available at the time, and use of the term proliferated through societal guidelines and papers.^{16,17} Thus, while the informal introduction of this term has been successful, as the field continues to advance there is an increasing imperative for a formal operationalized definition of ELVO.

clinical deficit, and is accessible for endovascular thrombectomy.

Applying our ideal criteria above:

1. Concise: the definition concisely covers the concepts of vascular occlusion, neurological deficit, and therapeutic options.
2. Flexible and readily adaptable to clinical advances: the definition includes internal carotid artery (ICA), middle cerebral artery (MCA) M1 and proximal M2, distal vertebral and the basilar trunk vessels. However, as device technology and our evidence evolves, this may include distal M2, M3, A1, A2 segments and P1 and P2 posterior cerebral artery branches in the future. Specific criteria for measured vessel diameter are absent from the definition for this reason. Current trial data have not evaluated these distal smaller vessels and therefore do not currently support distal vessel thrombectomy.
3. Encompassing: the definition encompasses both anterior and posterior circulation, and extracranial and intracranial vasculature. 'Emergent' captures the time sensitivity of large vessel stroke. Use of the term 'significant clinical deficit' incorporates patients with syndromes that may not generate typical deficits but still cause considerable disability, such as isolated aphasia or dense hemianopia.
4. Easily applicable: the definition is easy to understand and apply.
5. Readily translatable into clinical practice: this allows clinical application

Significance of Large Vessel Intracranial Occlusion Causing Acute Ischemic Stroke and TIA

Wade S. Smith, MD, PhD; Michael H. Lev, MD, FAHA; Joey D. English, MD, PhD; Erica C. Camargo, MD, MMSc; Maggie Chou; S. Claiborne Johnston, MD, PhD; Gilberto Gonzalez, MD, PhD; Pamela W. Schaefer, MD; William P. Dillon, MD; Walter J. Koroshetz, MD; Karen L. Furie, MD, MPH

Smith WS, et al. *Stroke*. 2009.
Multicenter STOP Stroke study

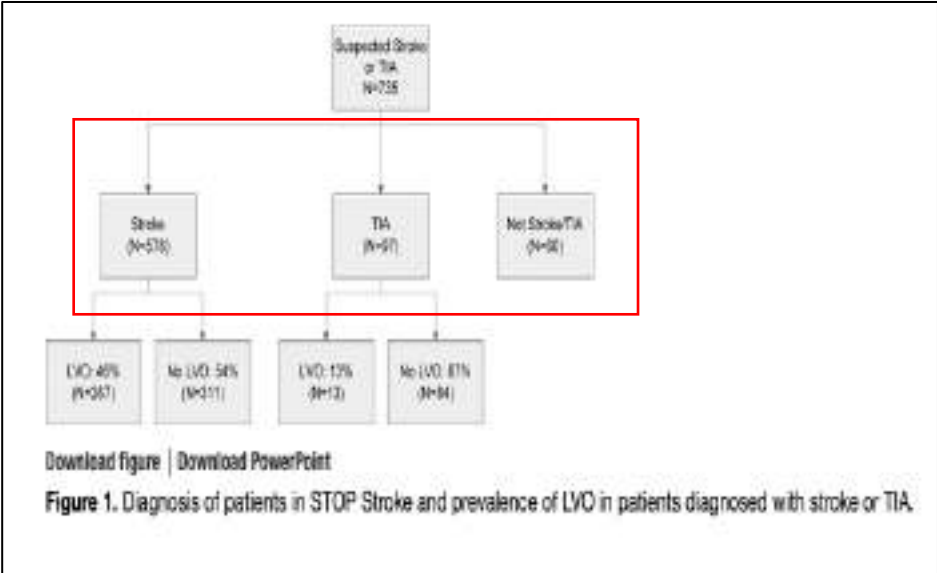


Table 2. NIHSS Scores of Patients With Stroke and Those With TIA at Presentation for Each Location of Vascular Occlusion (Table view)

Vascular Location	N (%)	NIHSS, Mean±SD
All patients	675 (100%)	7.63±7.29
Any large vessel	280 (41%)	12.2±7.82
No large vessel	395 (59%)	4.37±4.68
ICA	43 (6.3%)	16.2±6.98
M1	119 (18%)	13.4±6.39
M2	136 (20%)	11.5±6.74
A1	2 (0.3%)	8.50±3.54
A2	7 (1.0%)	12.4±5.13
BA	14 (2.1%)	17.1±12.8
VA	16 (2.4%)	8.43±11.4
P1	8 (1.2%)	16.3±14.0
P2	9 (1.3%)	10.4±6.25
Intravenous tPA	109 (16%)	13.7±6.28
No intravenous tPA	566 (84%)	6.46±6.88

Treatment	
Intravenous tPA	109 (16%)
IA treatment	36 (5.3%)
Intravenous and IA treatment	18 (2.7%)
SSS-TOAST indicates Stop Stroke Study-TOAST.	

Table 3. Univariate and Multivariate Model of Good and Merial Outcome for Stroke and TIA

	Good Outcome (mRS <2)			Mortality		
	Mean (SD) or N (%)	Univariate OR (P Value)	Multivariate OR* (P Value)	Mean (SD) or N (%)	Univariate OR (P Value)	Multivariate OR† (P Value)
All patients	363 (54%)			90 (13%)		
Age, years	65 (15)	0.96 (<0.001)	0.97 (<0.001)	75 (13)	1.04 (<0.001)	1.03 (0.001)
Female	143 (44%)	0.48 (<0.001)	0.59 (0.002)	54 (17%)	1.76 (0.014)	1.29 (0.320)
NIHSS score	4.7 (4.8)	0.88 (<0.001)	0.88 (<0.001)	18 (9.2)	1.17 (<0.001)	1.17 (<0.001)
Risk factors						
Hypertension	205 (49%)	0.53 (0.004)	0.86 (0.503)	67 (16%)	1.98 (0.007)	1.40 (0.267)
Diabetes mellitus	56 (46%)	0.58 (0.055)	0.73 (0.165)	23 (19%)	1.88 (0.049)	1.74 (0.071)
Coronary artery disease	75 (48%)	0.76 (0.126)	0.78 (0.270)	30 (19%)	1.84 (0.013)	1.51 (0.154)
Congestive heart failure	13 (28%)	0.31 (0.001)	0.78 (0.520)	16 (36%)	4.00 (<0.001)	1.88 (0.181)
Peripheral vascular disease	9 (36%)	0.47 (0.075)	0.59 (0.280)	4 (16%)	1.25 (0.690)	0.83 (0.766)
Hyperlipidemia	108 (56%)	1.13 (0.472)	1.23 (0.203)	22 (11%)	0.78 (0.350)	0.73 (0.287)
Smoking	131 (63%)	1.75 (0.001)	1.38 (0.101)	21 (10%)	0.85 (0.107)	0.83 (0.645)
Atrial fibrillation	67 (39%)	0.47 (<0.001)	0.92 (0.723)	33 (23%)	2.46 (<0.001)	1.10 (0.742)
Vessels						
Any large vessel (N=286)	106 (38%)	0.33 (<0.001)	0.82 (0.364)	65 (23%)	4.47 (<0.001)	1.42 (0.260)
No large vessel (N=383)	257 (66%)	3.08 (<0.001)	1.21 (0.364)	25 (6.3%)	0.22 (<0.001)	0.71 (0.260)
ICA (N=43)	8 (19%)	0.18 (<0.001)	0.47 (0.097)	15 (35%)	3.98 (<0.001)	1.27 (0.557)
M1 (N=119)	41 (34%)	0.38 (<0.001)	0.92 (0.752)	28 (24%)	2.45 (<0.001)	1.12 (0.701)
M2 (N=136)	54 (40%)	0.49 (<0.001)	1.00 (0.986)	32 (24%)	2.55 (<0.001)	1.45 (0.187)
A1 (N=2)	1 (50%)	0.86 (0.915)	0.40 (0.524)	0 (0%)		
A2 (N=7)	2 (29%)	0.34 (0.199)	0.81 (0.824)	0 (0%)		
BA (N=14)	3 (21%)	0.23 (0.024)	0.40 (0.243)	7 (50%)	6.96 (<0.001)	2.69 (0.175)
VA (N=16)	10 (63%)	1.40 (0.481)	1.19 (0.790)	4 (25%)	2.22 (0.175)	3.12 (0.142)
P1 (N=8)	1 (13%)	0.12 (0.046)	0.14 (0.064)	2 (25%)	2.19 (0.341)	0.53 (0.663)
P2 (N=9)	2 (22%)	0.24 (0.078)	0.34 (0.208)	0 (0%)		
BA or ICA (N=57)	11 (19%)	0.18 (<0.001)	0.44 (0.039)	22 (39%)	2.36 (<0.001)	1.60 (0.215)

*Final model included age, gender, and NIHSS score; values shown for other variables are for the individual variable added alone to the final model.

†Final model included age and NIHSS score; values shown for other variables are for the individual variable added alone to the final model.

mRS indicates modified Rankin Scale.

Multicenter STOP Stroke study

-Medikal tedavi altında

-M2 occlusions >>> [mRS] score, 3–6) in 60% of patients and mortality in 24%.

-Proximal ACA and PCA occlusions >>>(mRS score, 3–6) in 77% and mortality in 8%.

-Dependency or death (mRS score, 3–6) in medically treated DMVO patients occurred frequently: 50- 87% of A1, A2, M2, P1, and P2 occlusions.

ORIGINAL RESEARCH

Efficacy of endovascular thrombectomy in patients with M2 segment middle cerebral artery occlusions: meta-analysis of data from the HERMES Collaboration

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MR CLEAN, ESCAPE, REVASCAT, SWIFT PRIME, THRACE, EXTEND IA, PISTE

Ischemic Stroke

Table 2 Unadjusted and adjusted clinical and safety outcomes in patients with M2 segment MCA occlusions

Outcome	Endovascular treatment group, % (n/N)	Control group, % (n/N)	Unadjusted		Adjusted	
			Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value
mRS 0–2	58.2% (39/67)	39.7% (25/63)	2.13 (1.05 to 4.35)	0.04	2.39 (1.08 to 5.28)	0.03
mRS at 90 days	N/A	N/A	1.88 (1.01 to 3.49)	0.05	1.77 (0.94 to 3.36)	0.08
mRS 0–1	37.3% (25/67)	20.6% (13/63)	2.62 (0.92 to 7.45)	0.07	2.71 (0.83 to 8.83)	0.10
NIHSS 0–2 at 24 hours	26.9% (18/67)	8.2% (5/61)	4.11 (1.42 to 11.9)	0.01	3.82 (1.22 to 11.95)	0.02
sICH	0.0% (0/67)	7.9% (5/63)	0	0.03	—	—
Death	11.9% (8/67)	9.5% (6/63)	1.29 (0.42 to 3.95)	0.66	1.33 (0.38 to 4.7)	0.66

mRS, modified Rankin Scale; NIHSS, National Institute of Health Stroke Score; sICH, symptomatic intracerebral hemorrhage.

M2 MCA oklüzyonu olan 130 hastanın alındığı yedi büyük çalışmayı içeren HERMES meta analizinde, **proximal M2 89%**, distal M2 11%, **dominant divizyon 56%**, codominant 38%, ve nondominant 5%.

mTICI] 2b–3: %59'da elde edildi.

EVT ile tedavi edilen hastalarda semptomatik intrakraniyal kanama (%0).kontrol kolunda %7,9 idi.

EVT'nin, özellikle proksimal veya dominant M2 segmenti MCA'sı olan hastalarda, tıbbi tedavi ile karşılaştırıldığında 90 günde fonksiyonel yeteneği iyileşme ile sonuçlandığını gösterilmiştir. (mrs 0-2: %58 vs %40; P= 0.03).

Original research

Endovascular therapy in the distal neurovascular territory: results of a large prospective registry

Raul G Nogueira,¹ Mahmoud H Mohammaden ,¹ Diogo C Haussen,¹ Ronald F Budzik,² Rishi Gupta,³ Antonin Krajina,⁴ Joey D English,⁵ Ali R Malek,⁶ Amrou Sarraj ,⁷ Ana Paula Narata,⁸ Muhammad Asif Taqi,⁹ Michael R Frankel,¹ Timothy Ryan Miller,¹⁰ Thomas Grobelny,¹¹ Blaise W Baxter,¹² Bruno Mario Bartolini,¹³ Paul Jenkins,¹⁴ Laurent Estrade,¹⁵ David Liebeskind,¹⁶ Erol Veznedaroglu,¹⁷ on behalf of the Trevo Registry Investigators

J Neurointerv Surg. 2021 Nov;13(11):979-984.

407 DAOs including

350 (86.0%) M2

25 (6.1%) M3

10 (2.5%) ACA

22 (5.4%) PCA occlusions



1260 PAO >> 294 (%21,1) intrakraniyal ICA ve 1098 (%78.9) M1

(PAO: intracranial internal carotid artery (ICA) and MCA–M1 and DAO: MCA–M2, MCA–M3, ACA, and PCA according to their primary site of occlusion)

Ischemic stroke

Table 2 Baseline characteristics, procedural and clinical outcomes in DAO vs PAO with pre-morbid mRS 0–2

	DAO (n=376)*	PAO (n=1268)*	P-value	Non-M2 DAO (n=52)*	PAO (n=1268)*	P-value
Baseline characteristics % (n)						
Age (years), mean±SD	68.3±13.5	67.9±14.9	0.747	66.4±13.4	67.9±14.9	0.418
Female	51.1 (192)	52.9 (671)	0.527	42.3 (22)	52.9 (671)	0.133
Hypertension	75.5 (283/375)	72.5 (913/1265)	0.253	78.4 (40)	72.5 (913/1265)	0.350
Atrial fibrillation	34.5 (129/374)	37 (468/1264)	0.371	27.5 (14)	37 (468/1264)	0.164
Diabetes mellitus	21.9 (82/375)	21.8 (276/1266)	0.978	27.5 (14)	21.8 (276/1266)	0.340
Previous ICAO	0.0 (0/375)	0.6 (8/1265)	0.211	0 (0)	0.6 (8/1265)	0.778
Baseline NIHSS score, median (IQR)	13 (8–18)	16 (12–20)	<0.001	13.5 (8–16)	16 (12–20)	0.0003
Pre-morbid mRS 0–1	93.1 (350)	91.4 (1159)	0.297	96.2 (50)	91.4 (1159)	0.310
IV-tPA use	53.1 (199/375)	56.3 (705/1252)	0.268	54.9 (28)	56.3 (705/1252)	0.842
TLWM to puncture (hours), median (IQR)	4.2 (2.8–6.7)	4.2 (3.0–6.6)	0.852	4.3 (2.8–8.4)	4.2 (3.0–6.6)	0.811
General anesthesia	46.0 (173)	39.1 (496)	0.017	44.2 (23)	39.1 (496)	0.459
Number of device passes, median (IQR)	1 (1–2)	1 (1–3)	0.002	1 (1–2)	1 (1–3)	0.476
Procedural and clinical outcomes % (n)						
mTICI 2b–3	92.6 (348)	92.7 (1176)	0.900	96.2 (50/52)	92.7 (1176)	0.349
mTICI 3	55.1 (207)	56.2 (712)	0.706	63.5 (33)	56.2 (712)	0.297
RNI	47.1 (172/365)	47.4 (575/1212)	0.915	54.9 (28/51)	47.4 (575/1212)	0.296
sICH	1.3 (5)	1.6 (20)	0.731	1.9 (1/52)	1.6 (20)	0.573
Vessel perforation	0.4 (1/276)	0.8 (8/997)	0.693	0.0 (0)	0.8 (8/997)	0.691
Embol to new territory	2.1 (8)	2.2 (28/1261)	0.914	3.9 (2/52)	2.2 (28/1261)	0.335
90-day mRS 0–2	68.3 (256/375)	56.5 (713/1262)	<0.001	65.4 (34/52)	56.5 (713/1262)	0.205
90-day mortality	48 (17/35)	11 (1/35)	0.233	13.5 (7/52)	11 (1/35)	0.573

*Subsetted to only pre-stroke mRS 0–2.

ACA, anterior cerebral artery; IV-tPA, intravenous tissue plasminogen activator; MCA, middle cerebral artery; mRS, modified Rankin Scale; mTICI, modified Thrombolysis In Cerebral Infarction; NIHSS, National Institute of Health Stroke Scale; PCA, posterior cerebral artery; RNI, rapid neurological improvement; SAE, serious adverse event; sICH, symptomatic intracerebral hemorrhage; TLWM, time last seen well.

- NIHSS skoru DAO hastalarıyla karşılaştırıldığında daha düşüktü. ↓
- IV-tPA kullanımı açısından fark yoktu.
- DAO'lu hastalarda genel anestezi daha yüksekti. ↑
- DAO'da pass sayısı daha azdı. ↓
- Başarılı reperfüzyon (mTICI2b–3) ve tam reperfüzyon (mTICI3) oranları, DAO ve PAO arasında fark yoktu.
- SICH, damar perforasyonu ve hızlı iyileşme oranları da her iki grupta da benzerdi.
- 90 günlük mRS 0–2 oranı DAO'da yüksek. ↑
- 90 günlük mortalite oranları benzer.

Sonuç

- Arteriyel oklüzyonun yeri/seviyesinden ziyade klinik şiddet derecesinin ve öngörülen uzun vadeli dizabilitenin endovasküler reperfüzyonla ilgili karar verme sürecine rehberlik etmesi gerektiği vurgulanmıştır.

Stroke

SPECIAL REPORT

Thrombectomy for Distal, Medium Vessel Occlusions

A Consensus Statement on Present Knowledge and Promising Directions

Jeffrey L. Saver, MD; Rene Chapot, MD; Ronit Agid, MD; Ameer Hassan, DO; Ashutosh P. Jadhav, MD; David S. Liebeskind, MD; Kyriakos Lobotesis, MD; Dan Meila, MD; Lukas Meyer, MD; Guy Raphaeli, MD; Rishi Gupta, MD; for the Distal Thrombectomy Summit Group^{††}

Saver et al. Thrombectomy for Distal, Medium Vessel Occlusions: A Consensus Statement on Present Knowledge and Promising Directions. *Stroke*. 2020.

-Son dönemlerde stentretrieve ve aspirasyon teknolojisinde ilerleme ile daha küçük ve distal damarlara ulaşabilen küçük cihazların ortaya çıkması.

_PLVO için EVT sırasında fragmantasyon—Kurtarma tedavisi

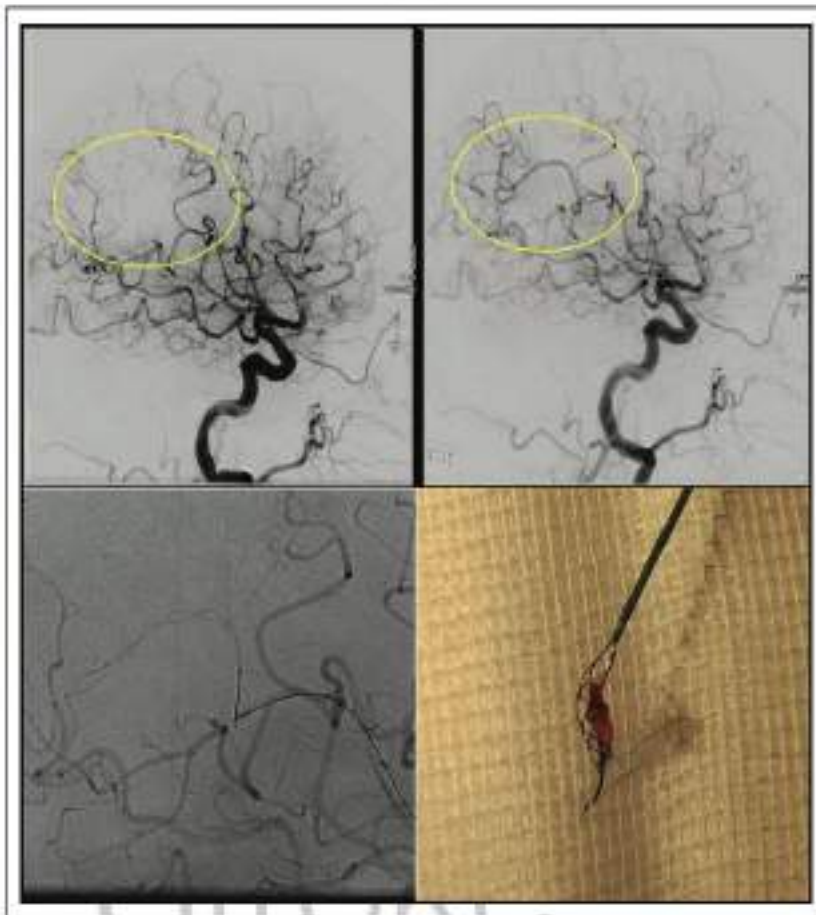


Figure 2. Distal medium vessel occlusion reperfusion by stent retriever.

Upper left. Following endovascular thrombectomy for an M1 middle cerebral artery (MCA) occlusion, angiography showed a residual or new distal M4 MCA branch occlusion (yellow circle). **Upper right.** Reperfusion of M4 after distal thrombectomy procedure (yellow circle). **Lower left.** Tiger 13 stentriever advanced through Headway27 microcatheter into target branch artery. **Lower right.** Retrieved thrombus. Image courtesy of Rene Chapot, MD.

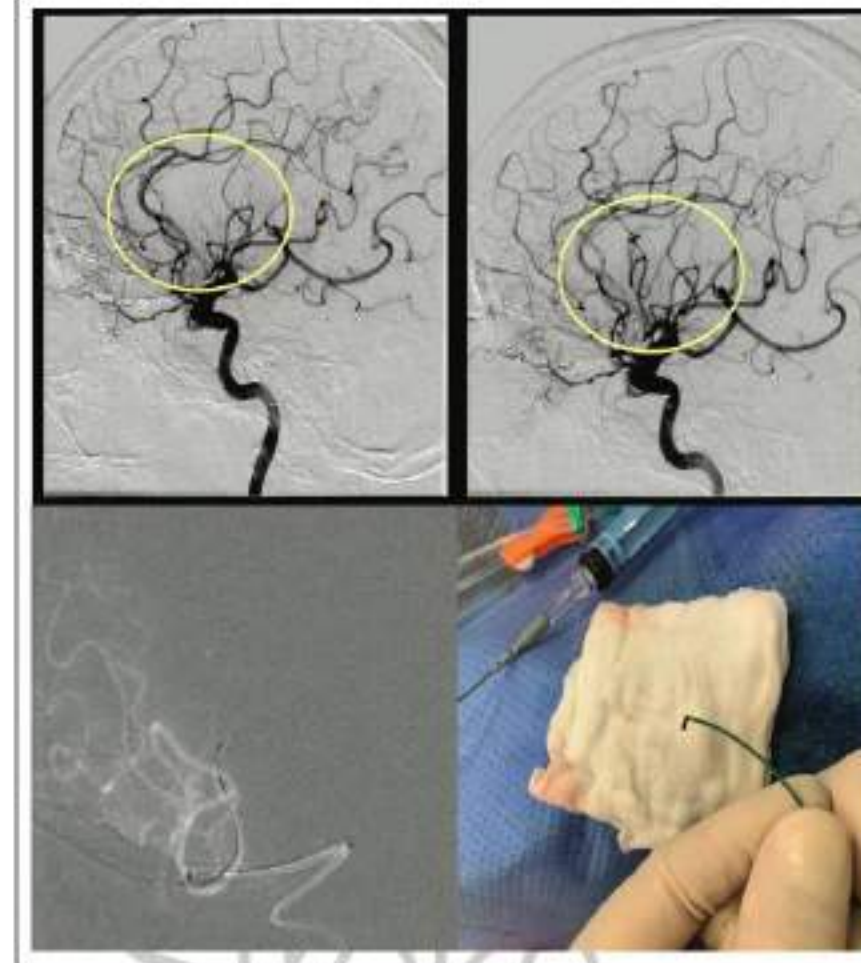


Figure 3. Distal medium vessel occlusion reperfusion by endovascular thromboaspiration.

Upper left. Initial angiography showed a primary cardioembolic M3 middle cerebral artery branch occlusion (yellow circle). **Upper right.** Reperfusion at the end of distal thrombectomy procedure (yellow circle). **Lower left.** Headway27 microcatheter advanced into target artery. **Lower right.** Retrieved thrombus. Image courtesy of Dan Wells, MD.

DMVO ve Anestezi

- Genel anestezi, DMVO'lar için EVT için prosedürel sedasyona kıyasla daha büyük avantaja sahip olabilir.
- Çünkü azalmış hasta hareketi kateterin daha uzak ve fragil olan hedef arterlere navigasyonunu kolaylaştırır.
- Ancak, bununla birlikte, genel anestezinin prosedürü başlatmayı geciktirme, kan basıncını düşürme ve kollaterali bozma potansiyeli!!!

Mechanical Thrombectomy for Distal Occlusions: Efficacy, Functional and Safety Outcomes: Insight from the STAR Collaboration

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World Neurosurg. 2021 Jul;151:e871-e879.

- Bu, Ocak 2015 ile Aralık 2018 arasında 15 kapsamlı merkezde MT ile tedavi edilen hastaların çok merkezli retrospektif bir çalışmasıdır.
- Çalışma grubu, oklüzyonun konumuna göre (proksimal ve distal) 2 gruba ayrıldı.
- Distal oklüzyon, MCA M3 segmentinin, ACA'nın herhangi bir segmentinin veya PCA'nın herhangi bir segmentinin tıkanması olarak tanımlandı.
- Sadece izole distal oklüzyon dahil edildi.
- İyi sonuç, 90 günlük modifiye Rankin ölçeği skoru 0-2 olarak tanımlandı.

Table 1. Baseline Characteristics

Variable	N	Proximal	N	Distal	P Value
Demographics					
Age, years	4521	68 (15)	189	67 (15)	0.66
Female, N (%)	4521	2271 (50%)	189	101 (53%)	0.41
White, N (%)	3434	1984 (58%)	150	79 (53%)	0.24
Comorbidities, N (%)					
Diabetes	4494	1273 (28%)	189	56 (30%)	0.68
Hypertension	4505	3370 (75%)	189	145 (77%)	0.61
Afib	4494	1606 (36%)	189	65 (34%)	0.76
Hyperlipidemia	4500	2713 (60%)	189	103 (54%)	0.11
History of stroke	3264	534 (16%)	144	21 (15%)	0.65
Pre-stroke mRS, median (IQR)	4505	0 (1)	189	0 (1)	0.969
Baseline NIHSS, mean (SD)	4468	15.6 (7)	189	11 (7)	<0.01
ASPECTS, median (IQR)	2721	8 (2)	189	9 (1.5)	<0.01
ASPECT ≥ 6 , N (%)	2719	2506 (92%)	189	184 (97%)	0.01
IV-tPA, N (%)	4232	2078 (49%)	185	96 (52%)	0.5
Posterior circulation, N (%)	4521	405 (9%)	189	77 (41%)	<0.01
Onset to groin, H, Mean (SD)	3572	6.5 (8.5)	189	6.5 (6)	0.39
Procedural details					
First Line strategy					0.01
Direct Aspiration, N (%)	3532	1318 (37%)	161	85 (53%)	
Stent retriever, N (%)	3532	1097 (31%)	161	37 (23%)	
Solusbra, N (%)	3532	1117 (32%)	161	39 (24%)	
IA-tPA, N (%)	3875	504 (13%)	187	31 (17%)	0.38
Total number of attempts, median (IQR)	3333	2.2 (1.7)	173	2.1 (1.7)	0.20
Time to reperfusion, median (IQR)	4078	55 (48)	173	55 (92)	0.91
Procedure complication, N (%)	3101	266 (9%)	169	7 (4%)	0.67
Afib, atrial fibrillation; ASPECT, Alberta stroke program early CT score; mRS, modified Rankin Scale; NIHSS, National Institute of Health Stroke Scale; mTICI, modified treatment in cerebral infarction score. Statistical tests were done using t tests, χ^2 tests, or Mann-Whitney tests.					

- NIHSS, distalde düşük,
- ASPECT: distalde yüksek
- Iv tpa uygulamada fark yok
- Direkt aspirasyon tekniği, distal oklüzyon grubunda daha sık

Table 3. Predictors of Good Outcome in Distal Occlusion Patients

Variable	aOR	95% CI	P Value
Age	0.955	0.92–0.99	0.019
Female sex	0.636	0.24–1.66	0.355
Caucasian	0.750	0.27–2.12	0.586
Diabetes	0.677	0.24–1.89	0.457
Atrial fibrillation	1.380	0.47–4.08	0.560
Hyperlipidemia	1.042	0.39–2.8	0.934
History of stroke	1.093	0.3–4.02	0.893
Pre-stroke mRS	0.770	0.43–1.39	0.384
Posterior location	0.672	0.25–1.82	0.435
Admission NIHSS	0.906	0.84–0.98	0.016
IV-tPA	2.836	0.97–8.29	0.057
Onset to groin time, minutes	0.998	0.99–1.001	0.083
First-line strategy			
Direct aspiration	Reference	Reference	Reference
Stent retriever	0.511	0.15–1.74	0.283
Combined technique	1.510	0.34–6.7	0.588
Successful reperfusion	4.720	1.2–18.55	0.026

Bolded variables indicate statistically significant.

aOR, adjusted odds ratio; CI, confidence interval; ASPECT, Alberta stroke program early CT score; IV-tPA, intravenous tissue plasminogen activator; NIHSS, National Institute of Health Stroke Scale.

- 2 grup arasında mortalite oranları açısından bir fark yoktu.
- Distal gruptaki hastaların 90 günde (mRS 0-2) daha yüksekti (%45'e karşı %36; P = 0.031).
- Başarılı reperfüzyon, yaş ve NIHSS ile birlikte iyi prognozun öngörücüsü olarak ortaya çıktı.
- Buna karşılık, IV-tPA uygulaması iyi prognozun bir göstergesi değildi.

Stroke

Volume 49, Issue 7, July 2018; Pages 1662-1668

<https://doi.org/10.1161/STROKEAHA.118.020567>



CLINICAL SCIENCES

Beyond Large Vessel Occlusion Strokes

Distal Occlusion Thrombectomy

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Michael R. Frankel, MD; Raul G. Nogueira, MD

Table 2. Detailed Demographic and Procedural Information for the Distal Thrombectomy Population

	Overall	ACA Primary	ACA+Any MCA-M1/2	ACA Rescue	M3 Primary	M3 Rescue	PCA Primary	PCA Rescue
N	69	11*	11‡	8†	24*	13†x	3	4
Age, y	66.7±15.8	64.3±12.3	68.5±13.6	68±16.8	66.4±16.3	61.5±19.1	66±26.5	74.3±7.3
Gender (male)	39 (57%)	7 (64%)	7 (64%)	4 (50%)	13 (54%)	7 (54%)	3 (100%)	1 (25%)
Hypertension	54 (78%)	9 (82%)	8 (73%)	6 (75%)	20 (83%)	8 (62%)	3 (100%)	2 (50%)
Dyslipidemia	15 (22%)	5 (45%)	3 (27%)	0	5 (21%)	1 (8%)	0	2 (50%)
Atrial fibrillation	28 (41%)	3 (27%)	3 (27%)	4 (50%)	12 (50%)	5 (38%)	1 (33%)	1 (25%)
Diabetes mellitus	16 (23%)	2 (18%)	2 (18%)	1 (13%)	8 (33%)	1 (8%)	1 (33%)	2 (50%)
Smoking	10 (14%)	3 (27%)	1 (9%)	1 (13%)	3 (13%)	2 (15%)	0	0
Minutes from LKN to puncture	343±221	371.6±220.2	298±190	482.5±284.5	236.2±63.1	414.1±305	124	586.3±201.6
Intravenous tPA	29 (42%)	3 (27%)	5 (45%)	3 (38%)	13 (54%)	3 (23%)	2 (67%)	1 (25%)
bNIHSS	18 (IQR, 13–23)	15 (IQR, 11–18)	23 (IQR, 18–26)	18.5 (IQR, 12.5–22)	18 (IQR, 15.5–21)	17 (IQR, 12–22)	14 (IQR, 8–22)	24 (IQR, 11.5–29)
ASPECTS	8 (IQR, 7–9)	8.5 (IQR, 7–10)	8.5 (IQR, 8–9)	7 (IQR, 6–9)	8 (IQR, 7–9)	8 (IQR, 6–8)	N/A	N/A
MAC	48 (70%)	8 (73%)	7 (64%)	4 (50%)	18 (75%)	10 (77%)	3 (100%)	0
Stent-retriever	37 (54%)	7 (64%)	5 (45%)	4 (50%)	10 (42%)	6 (46%)	3 (100%)	3 (75%)
Thromboaspiration	31 (45%)	2 (18%)	6 (55%)	5 (68%)	10 (42%)	8 (62%)	1 (33%)	1 (25%)
IA tPA	36 (52%)	6 (55%)	6 (55%)	5 (68%)	16 (67%)	6 (46%)	0	2 (50%)
IA tPA+wire maceration	10 (14%)	4 (36%)	0	1 (13%)	7 (29%)	0	0	0
Reperfusion								
mTICI 2b-3	57 (83%)	10 (91%)	10 (91%)	7 (88%)	17 (71%)	7 (54%)	2 (67%)	3 (75%)
mTICI 3	31 (45%)	7 (64%)	6 (55%)	5 (68%)	7 (29%)	4 (31%)	2 (67%)	2 (50%)
Any PH	5 (7%)	0	1 (9%)	1 (13%)	2 (8%)	0	0	1 (25%)
mRS 0–1 at 3 mo	9 (13%)	0	0	0	5 (21%)	3 (23%)	0	1 (25%)
mRS 0–2 at 3 mo	21 (30%)	2 (18%)	3 (27%)	3 (38%)	9 (38%)	7 (54%)	0	1 (25%)
Mortality 90 d	14 (20%)	0	3 (27%)	3 (38%)	5 (21%)	1 (8%)	0	2 (50%)

ACA indicates anterior cerebral artery; ASPECTS, Alberta Stroke Program Early CT Score; bNIHSS, baseline National Institutes of Health Stroke Scale; IQR, interquartile range; LKN, last known normal; MAC, monitored anesthesia care; MCA, middle cerebral artery; mRS, modified Rankin Scale; mTICI, modified Treatment In Cerebral Ischemia; PCA, posterior cerebral artery; PH, parenchymal hematoma; and tPA, tissue-type plasminogen activator.

*Includes 3 cases of concomitant treated primary MCA-M3 and primary ACA occlusion.

†Includes 1 case of concomitant rescue MCA-M3 and rescue ACA.

‡Includes one case of concomitant primary ACA and MCA-M2 occlusion which led to a rescue MCA-M3 thrombectomy.

- 69 distal oklüzyonu olan hasta.
- 45 hastada izole distal oklüzyon,
- 23 hastada distal oklüzyon bir kurtarma stratejisi olarak tedavi edildi.
- 1 hastaya hem birincil hem de kurtarma tedavisi uygulandı.
- izole MCA-M3 (n=21), izole ACA (n=8),
- Kurtarma vakalarının yerleri MCA-M3 (n=11), ACA (n=7),
- En sık kullanılan tedavi stent retriever (n=37, %54)
- 3 parankimal hematoma (%4) >>>>bu hastalardan 2'si ayrıca intravenöz tPA aldı.
- 90 günde, 21 hastanın (%30) mRS 0-2 ve 14'ü (%20) mortal.

- %7'lik PH oranı<<< önemli trombektomi klinik çalışmalarda semptomatik kanamanın %2 ila %8 aralığında
- **Özellikle, ACA, PCA veya alt divizyon MCA dallarına kıyasla daha fazla kıvrımları göz önüne alındığında, distal superior divizyon dallarında mekanik cihazların kullanımından özellikle kaçınma eğiliminde.**
- **Belirgin kıvrımlı durumlarda, intra-arteriyel trombolitiklerin kullanımı tipik olarak tercih edilmiştir**
- **Ayrıca, nikardipin veya milrinon gibi vazodilatörlerin intra-arteriyel infüzyonu ile vazospazm önlemenin daha küçük damarları tedavi ederken faydalı olabileceği**

Table 2. Selected Promising Imaging Research Directions in DMVOs

Parenchymal imaging
CT hyperdense vessel signs: human and AI approaches to systematic identification
MR susceptibility vessel signs: human and AI approaches to systematic identification
Standard CTA/MRA
Human and AI approaches to systematic identification
Longer acquisition CTA/MRA
Multiphase CTA
Time-resolved MRA
High spatial resolution MR vessel wall imaging
Distal territory hypoperfusion patterns
AI classification on perfusion CT/MRI
Novel CTA techniques for DMVO visualization
WaveletCTA
Ultra-high-resolution CTA
Dual-energy CTA
Novel MRA techniques for DMVO visualization
Ultra-high high-field (7T–11.7T) MRA
Vessel segmentation algorithms: multiscale vesselness, diffusion-based filters
Salvageable tissue identification
Perfusion-core/collateral-core/FLAIR-diffusion/clinical-core mismatch

AI indicates artificial intelligence; CT, computed tomography; CTA, computed tomography angiography; DMVO, distal medium vessel occlusion; FLAIR, fluid attenuation inversion recovery; MR, magnetic resonance; MRA, magnetic resonance angiography; and MRI, magnetic resonance imaging.

DMVO görüntüleme

Saver et al. Thrombectomy for Distal, Medium Vessel Occlusions: A Consensus Statement on Present Knowledge and Promising Directions. *Stroke*. 2020.

DMVO görüntüleme

Stroke

CLINICAL AND POPULATION SCIENCES

Distal Medium Vessel Occlusions Can Be Accurately and Rapidly Detected Using *Tmax* Maps

Shalini A. Amukotuwa¹, MD; Angel Wu², MD; Kevin Zhou, MD; Inna Page³, MD; Peter Brothie, MD; Roland Bammer, PhD

Stroke. 2021;52:3308–3317.

- BT anjio'da DMVO'ları saptamak zor olabilir.
- BTA'da DMVO'ları tespit etme duyarlılığının %33 kadar düşük olduğu gösterilmiştir.
- Yakın zamanda yapılan bir çalışmada M2 oklüzyonlarının %28'i branş dışı ve genel radyologlar tarafından gözden kaçırılmıştır.
- Bunun nedeni, proksimal büyük damarlara kıyasla distal arterlerin küçük kalibreli, daha fazla sayıda ve daha zayıf opaklaşmasının yanı sıra dal anatomisindeki değişkenlik ve kortikal venlerdir.

- Bölgesel Tmax gecikmesinin bulunması, BTA'da gözden kaçabilecek arteriyel tıkanıklıklara dikkat çekmek için de değerlidir.
- Bu çalışmada **CT perfüzyonundan türetilen (Tmax) haritalarının**, DMVO'lu hastaları doğru ve hızlı bir şekilde tanımlamak için bir triyaj tarama aracı olarak kullanılıp kullanılamayacağını belirlemek amaçlanmıştır.

Tmax:time of maximum-Serebral kan akımının en yüksek olduğu zaman (sn)

Table 1. Patient Demographics and Location of Vessel Occlusions

	All patients (N=373)	Patients with a DMVO (n=70)	Patients without a DMVO (n=303)	
			Controls (selected for part 1; n=70)	All (included in part 2; n=303)
Age, y, median (interquartile range)	70 (58–80)	76 (69–84)	68 (55–82)	68 (56–79)
NIHSS, median (interquartile range)	5 (1–7)	5 (1–8)	4 (1–7)	4 (1–7)
Male, %	211 (56.5%)	43 (61.1%)	34 (48.6%)	168 (55.4%)
Location of DMVO				
MCA				
M2	38			
Proximal	22			
Distal	16			
M3	5			
M4	8			
ACA				
A2	0			
A3 or distal	3			
PCA	5			
P2	5			
P3 or P4	8			
PICA	2			
SCA	1			

ACA indicates anterior cerebral artery; DMVO, distal medium vessel occlusion; MCA, middle cerebral artery; NIHSS, National Institutes of Health Stroke Scale; PCA, posterior cerebral artery; PICA, posterior inferior cerebellar artery; and SCA, superior cerebellar artery.

DMVO'lu ardışık 70 hasta ve rastgele seçilmiş 70 kontrol

Table 2. Diagnostic Performance for Detection of a DMVO on CTA Versus T_{max} Maps Alone (Results of Part 1)

	Reader 1 (fellow)		Reader 2 (general radiologist)		Reader 3 (scientist)		Reader 4 (resident)	
	CTA	T_{max}	CTA	T_{max}	CTA	T_{max}	CTA	T_{max}
Sensitivity	60.0	95.7	77.1	98.6	71.4	95.7	74.3	97.1
CI_{95}	47.6–71.5	88.0–99.1	65.6–86.3	92.3–100.0	59.4–81.6	88.0–99.1	62.4–84.0	90.1–99.7
Specificity	78.6	88.6	90.0	91.4	95.7	97.1	85.7	84.3
CI_{95}	67.1–87.5	78.7–94.9	80.5–95.9	82.3–96.8	88.0–99.1	90.1–99.7	75.3–92.9	73.6–91.9
AUC	0.693	0.920	0.836	0.950	0.836	0.964	0.800	0.907
CI_{95}	0.617–0.768	0.877–0.966	0.775–0.897	0.914–0.986	0.777–0.894	0.933–0.995	0.734–0.866	0.860–0.954
ΔAUC	0.229		0.114		0.129		0.107	
CI_{95}	0.144–0.314		0.047–0.182		0.069–0.188		0.039–0.175	
P	<0.001		<0.001		<0.001		<0.001	

AUC indicates areas under the receiver-operating characteristic curves; CTA, computed tomography angiography; DMVO, distal medium vessel occlusion; and T_{max} , time-to-maximum of tissue residue function.

Tüm okuyucular için duyarlılık > %95 (ortalama %96.8), özgüllük > %84 (ortalama %90.3)

CTA'da bir DMVO'yu saptamak için ortalama duyarlılık %70.7 ve ortalama özgüllük %87.5 idi.

AUC ile ölçülen **tanı performansı**, tüm okuyucular için T_{max} 'ta CTA'ya göre önemli ölçüde daha iyiydi ($P<0.001$).

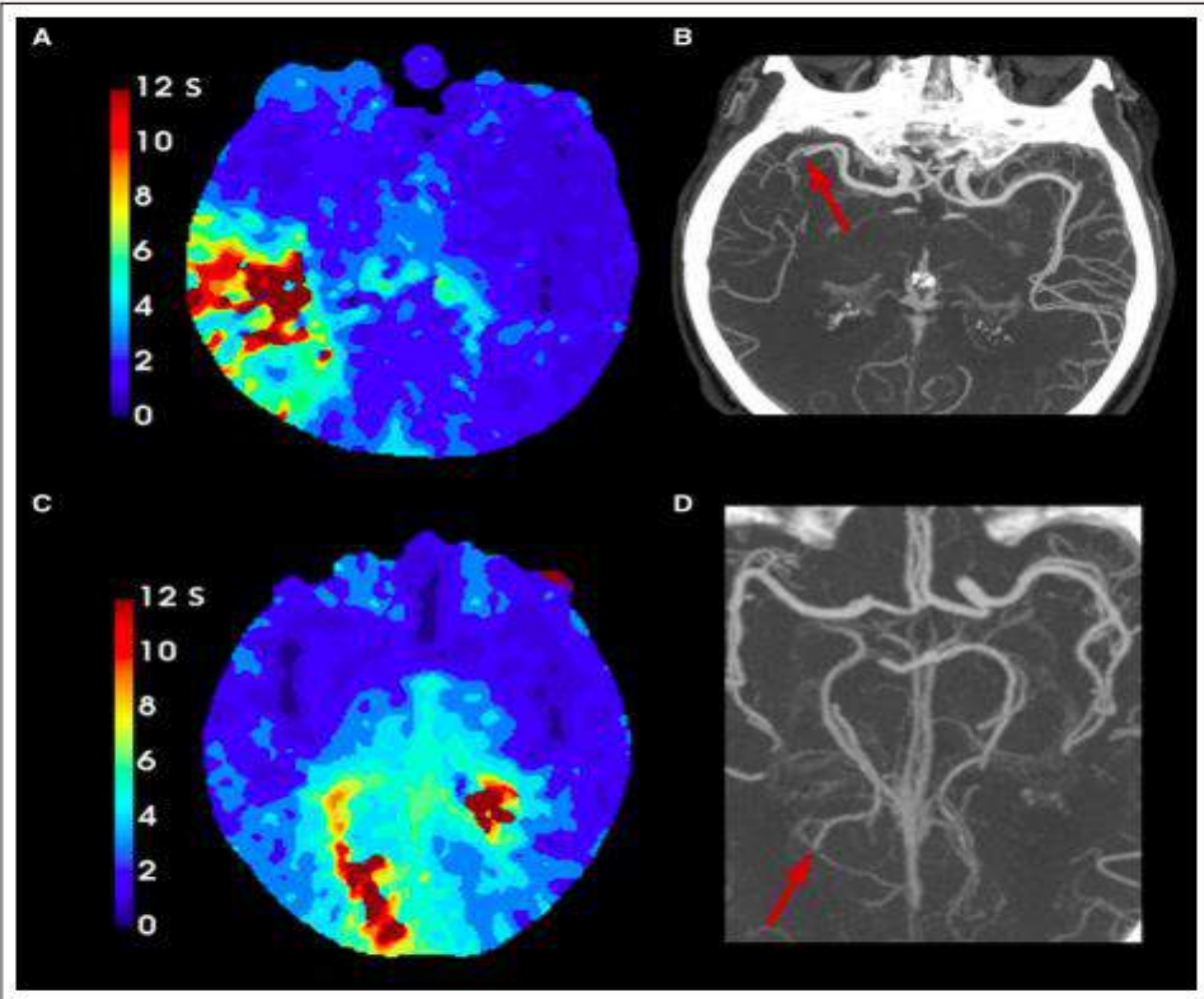


Figure 1. Examples of territorial time-to-maximum of tissue residue function (T_{max}) delay due to distal medium vessel occlusion in 2 different patients.

A. T_{max} map showing territorial T_{max} delay in a 60-y-old woman. This is the characteristic pattern of T_{max} delay seen with inferior M2 segment occlusions. **B.** Computed tomography angiography (CTA) thick maximum intensity projection (MIP) demonstrating the causative dominant inferior M2 segment occlusion (red arrow). **C.** T_{max} delay in the distal right posterior cerebral artery (PCA) territory in a 72-y-old man with left superior quadrantanopia. T_{max} in tissue is displayed in 2-s increments up to 12 s. **D.** CTA thick MIP shows the causative P4 segment PCA occlusion.

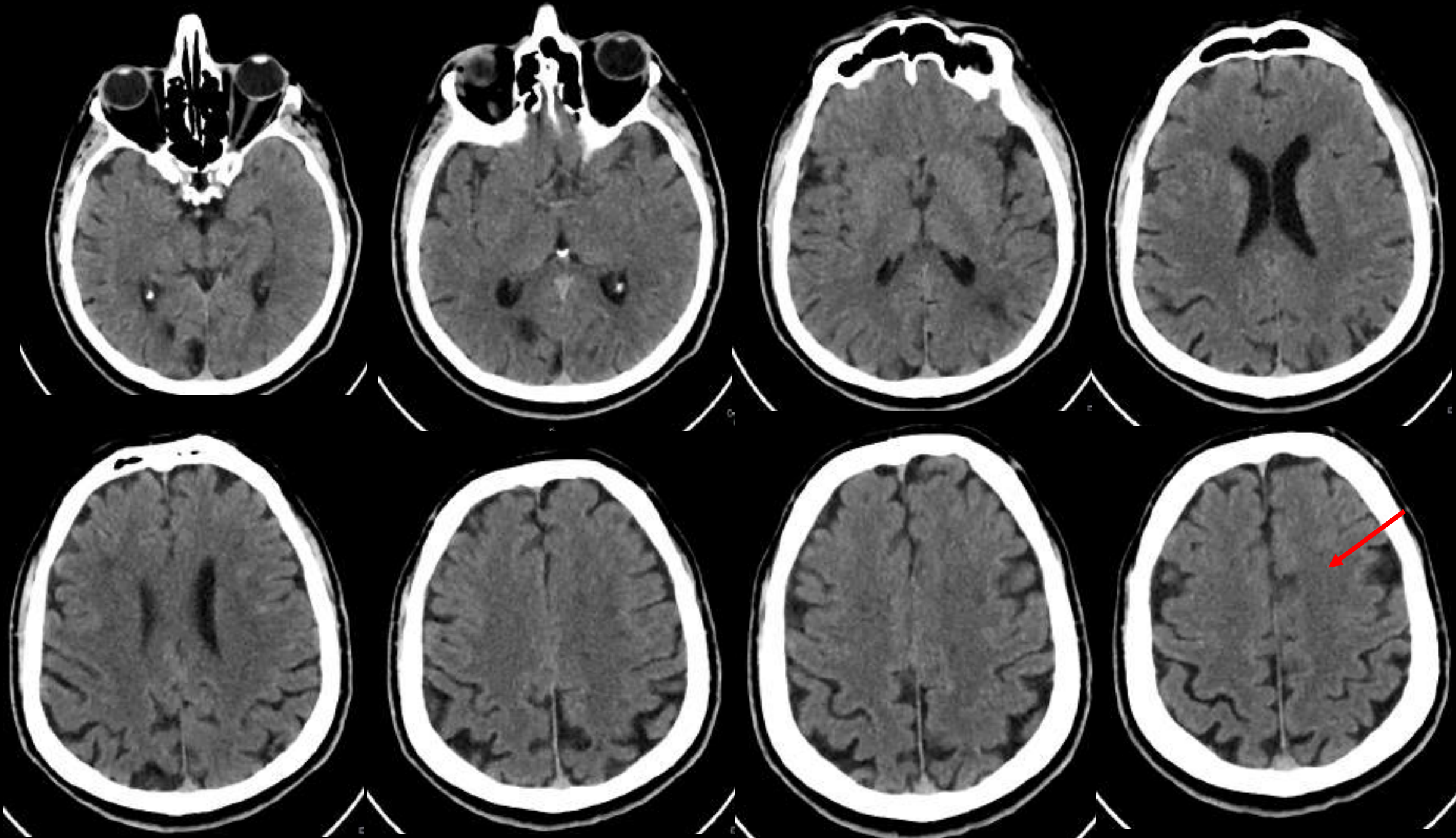
Vaka 1

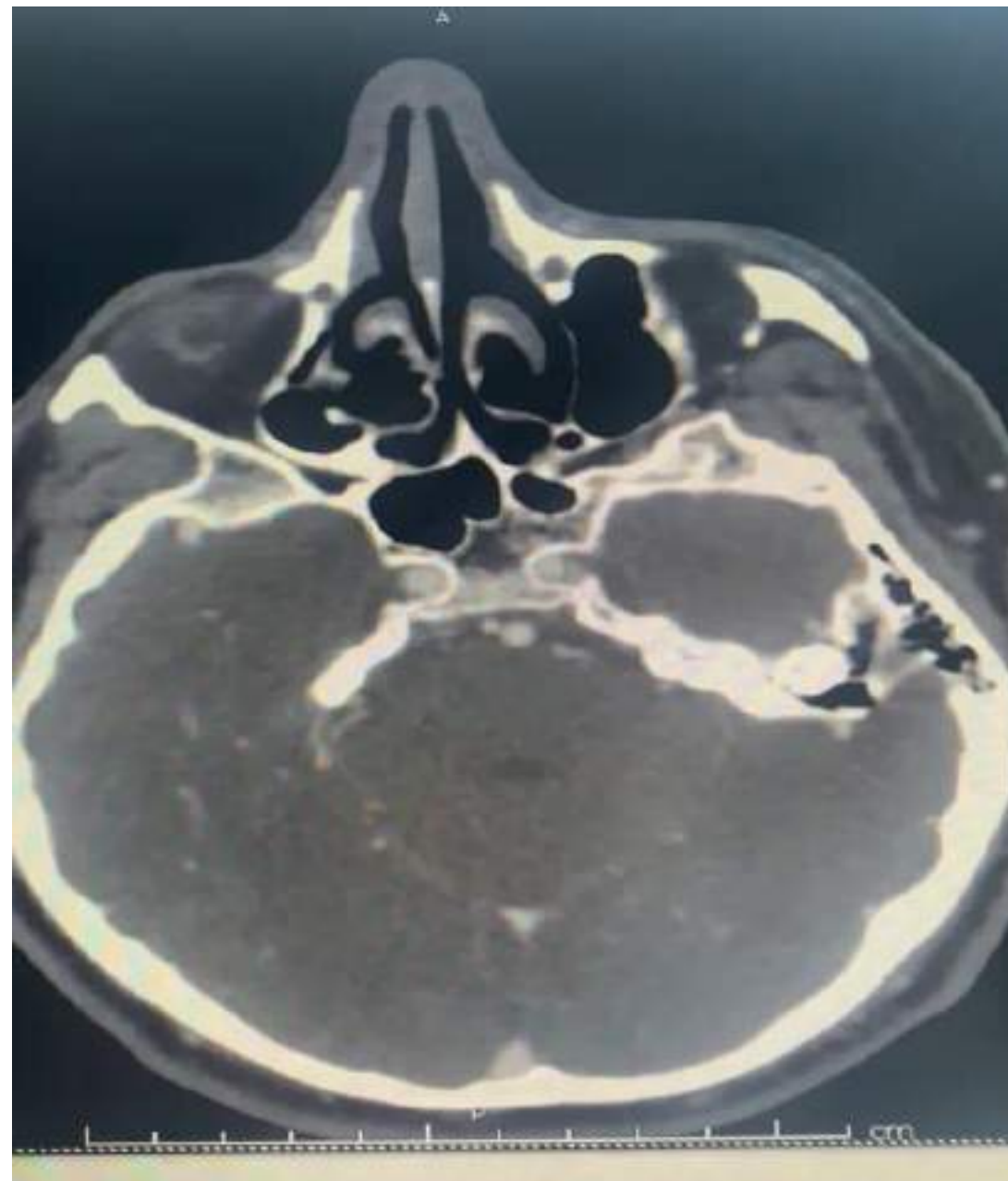
57,E A.R.A. 06.05.2022

- **Acute right hp + aphasia**
- **onset/ door : 3,5 h**
- **NIHSS = 14**

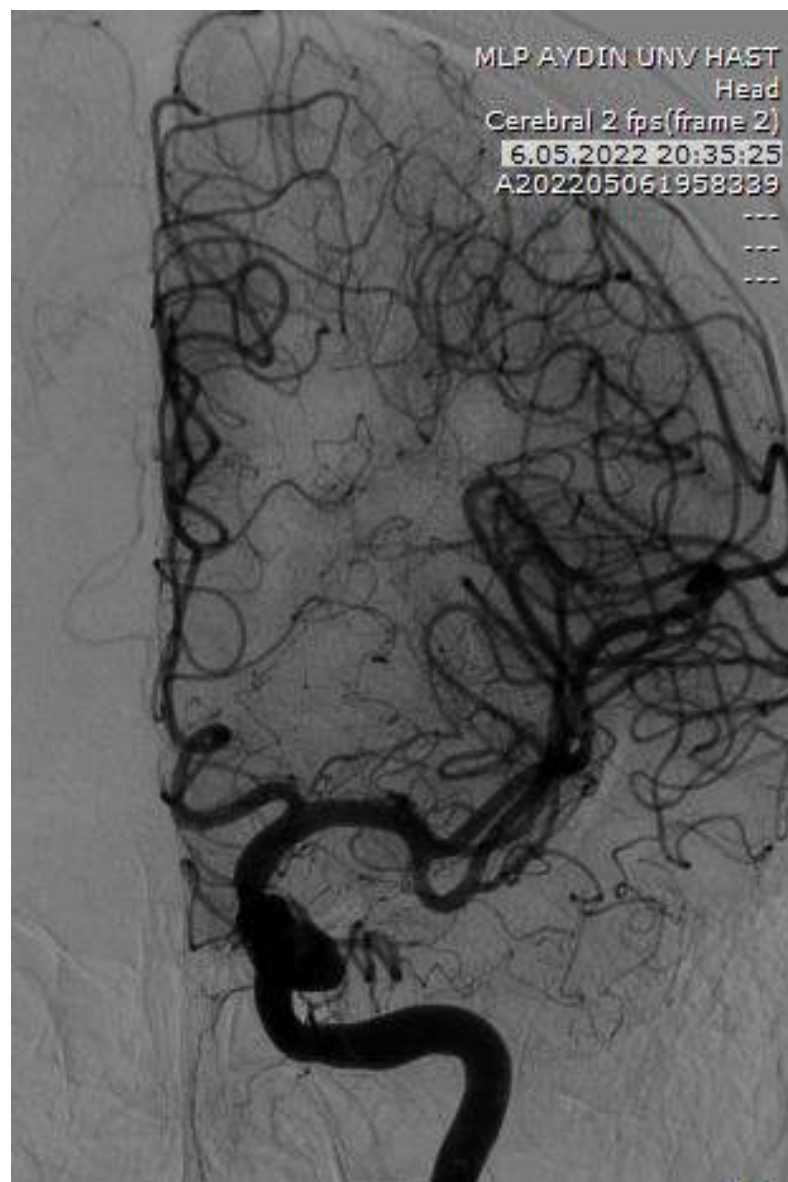
- **Pacemaker+**

1a Level of Consciousness	0
1b LOC Questions	0
1c LOC Commands	1
Best Gaze	0
Visual Fields	0
Facial Palsy	2
5a Left Motor Arm	0
5b Right Motor Arm	2
6a Left Motor Leg	0
6b Right Motor Leg	4
Limb Ataxia	0
Sensory	1
Best Language	2
Dysarthria	2
Extinction and Inattention	0
Total	14

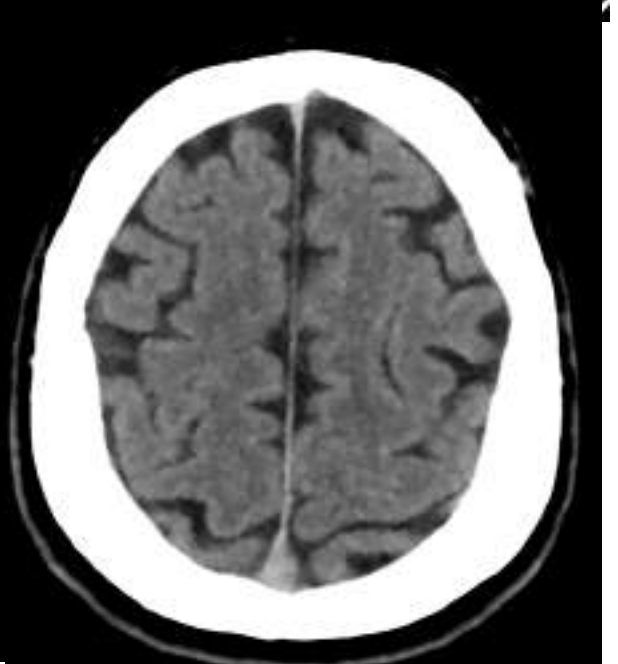
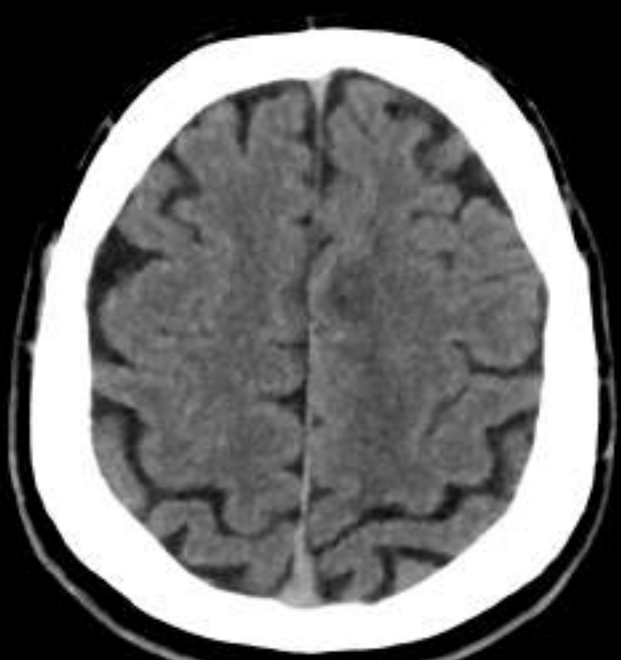
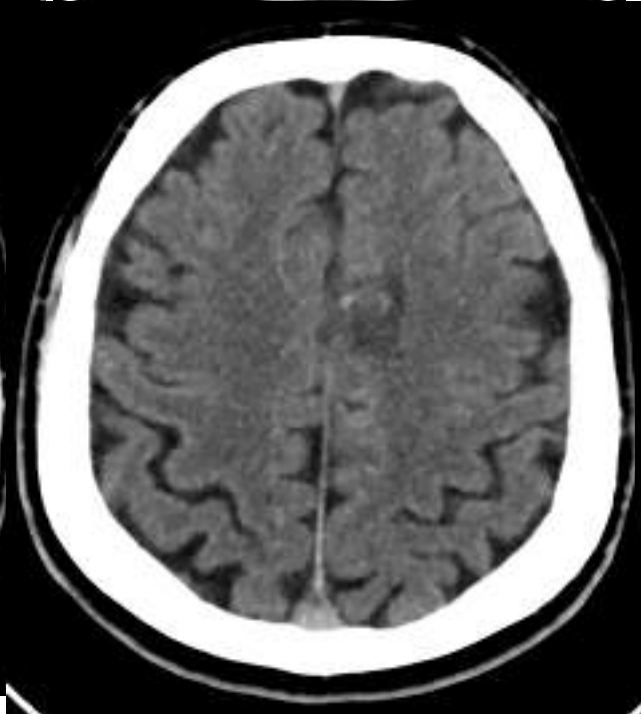
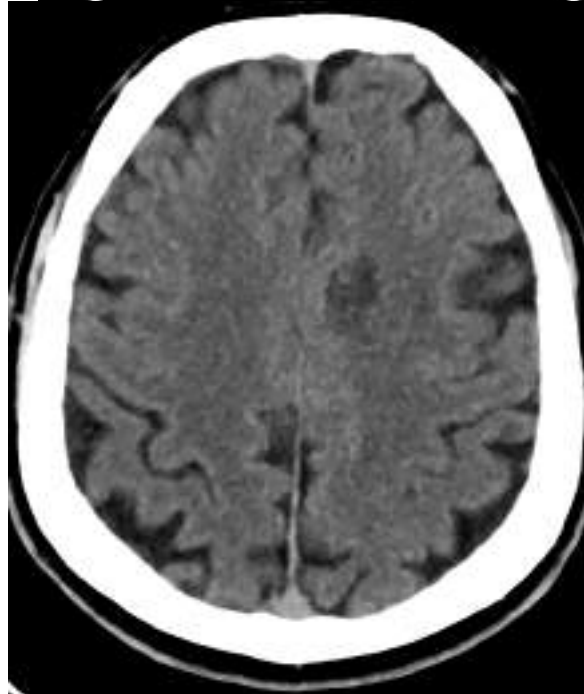
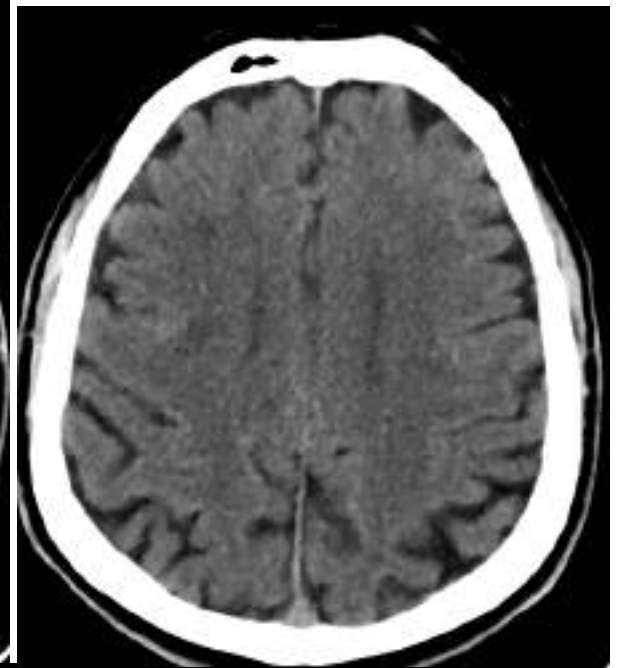
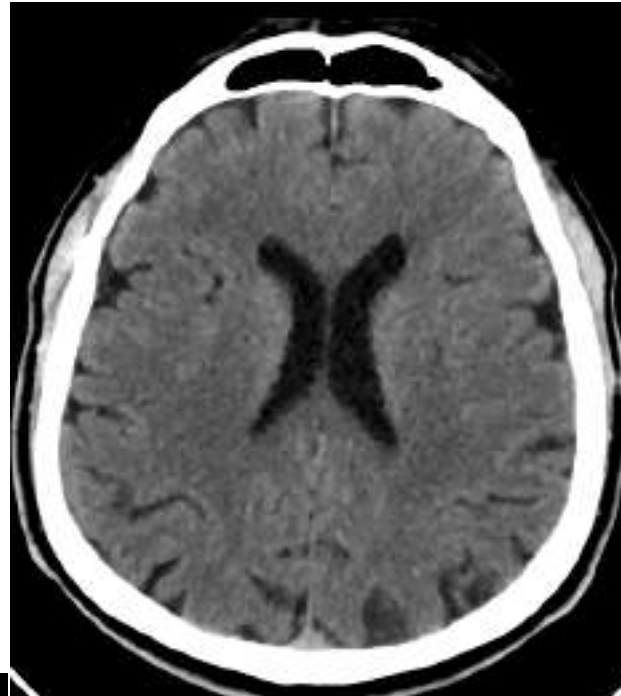
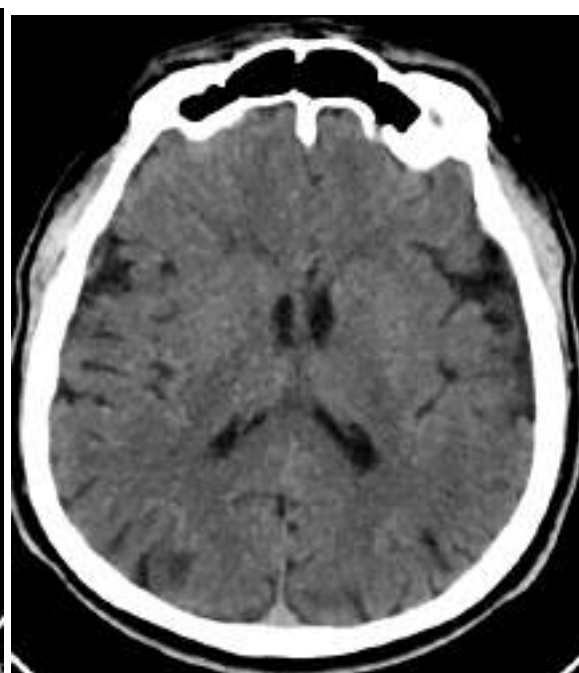








ACA A3- Trevo 3x25 mm



57,E A.R.A. 06.05.2022

• Çıkış NIHSS:0

1a Level of Consciousness	0
1b LOC Questions	0
1c LOC Commands	0
Best Gaze	0
Visual Fields	0
Facial Palsy	0
5a Left Motor Arm	0
5b Right Motor Arm	0
6a Left Motor Leg	0
6b Right Motor Leg	0
Limb Ataxia	0
Sensory	0
Best Language	0
Dysarthria	0
Extinction and Inattention	0
Total	0

Vaka 2

70 yo/E

R monoparesia (1/5)+ Dysarthria

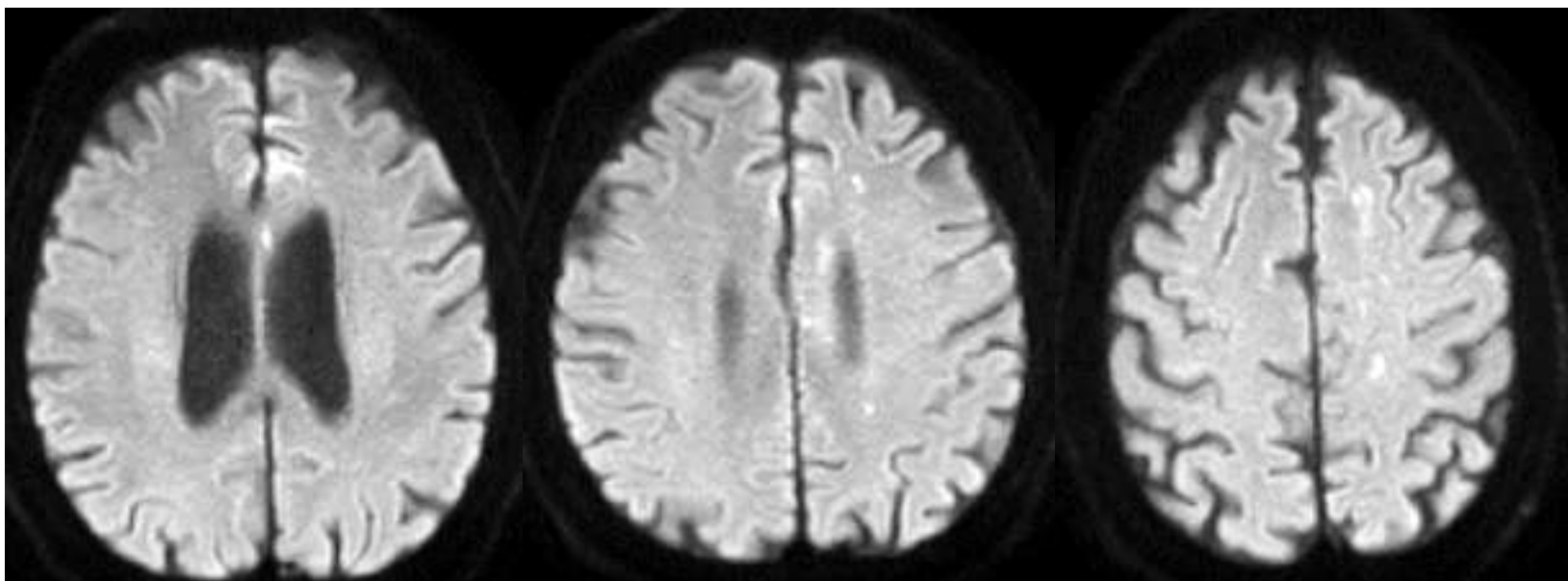
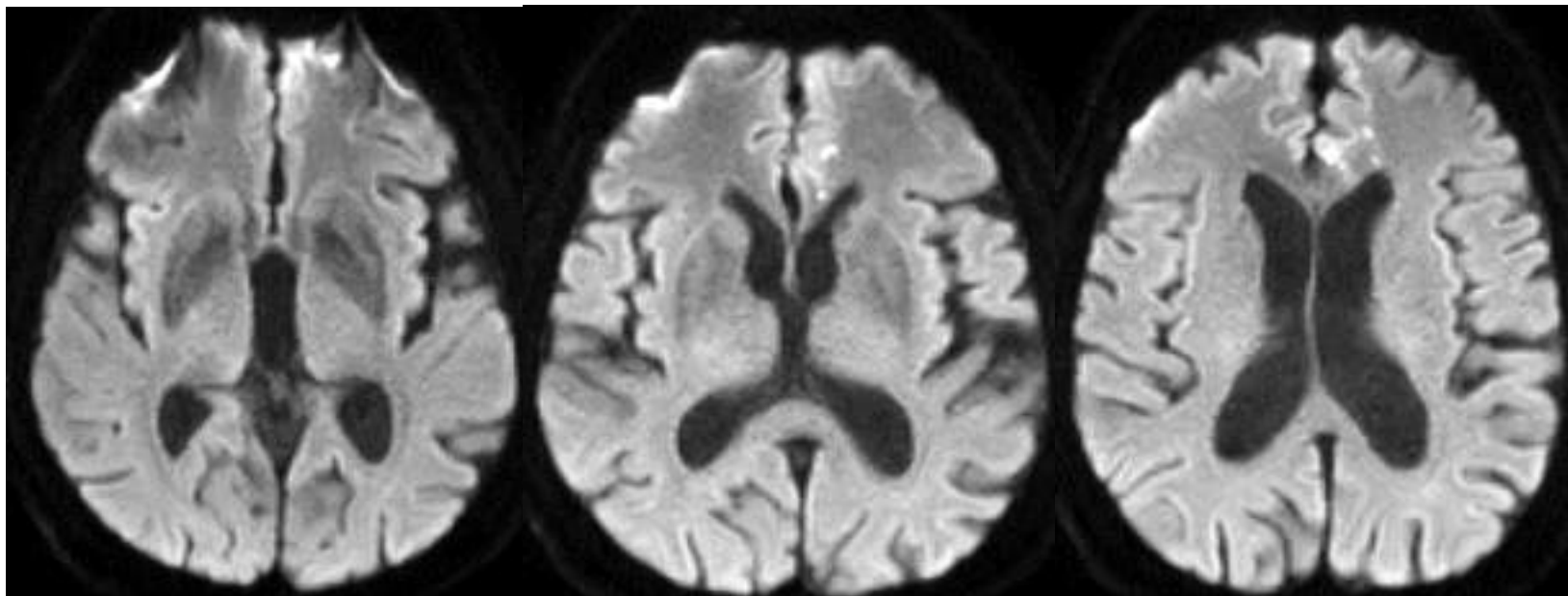
Onset-door: 13 h

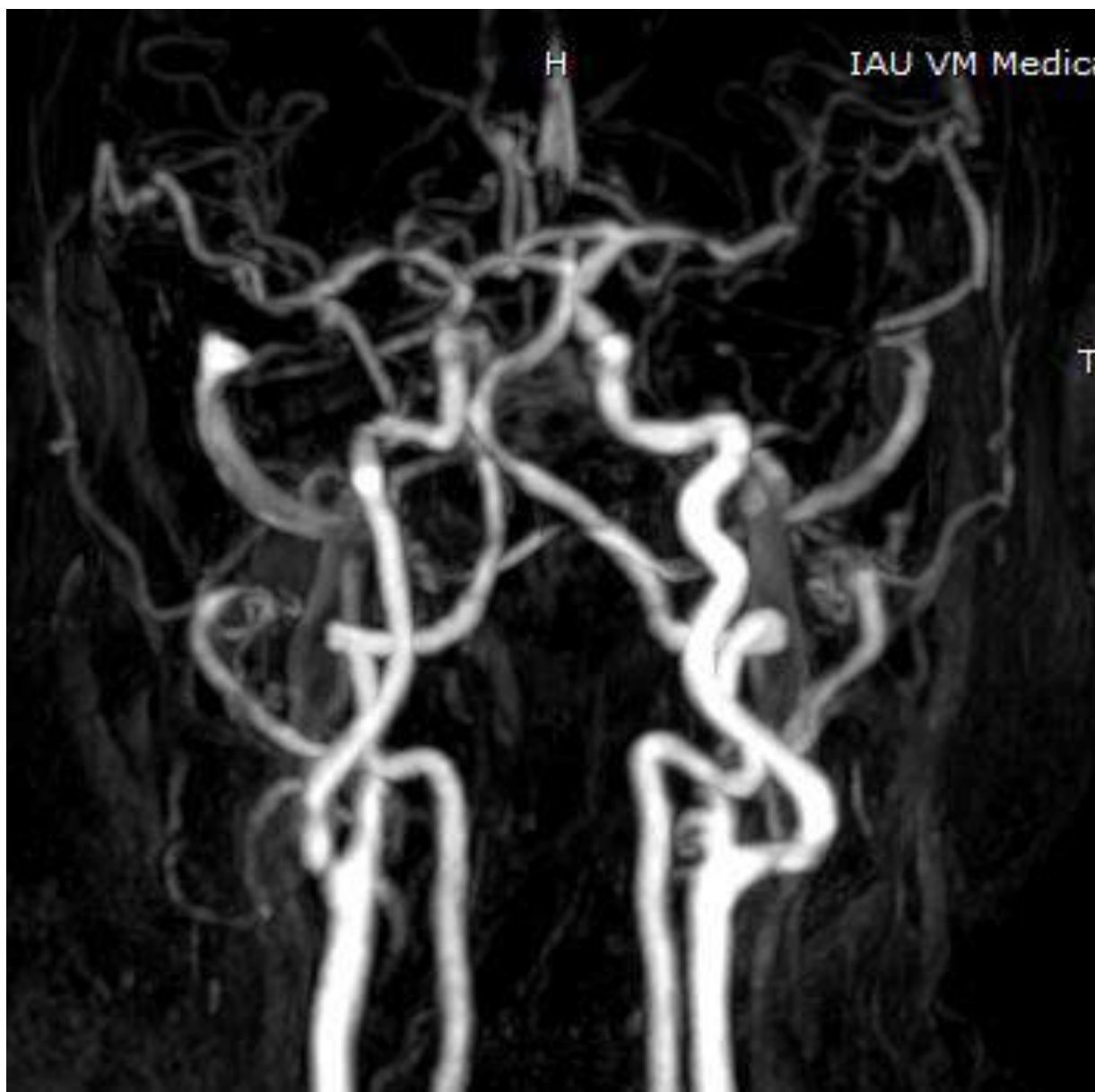
NIHSS: 4

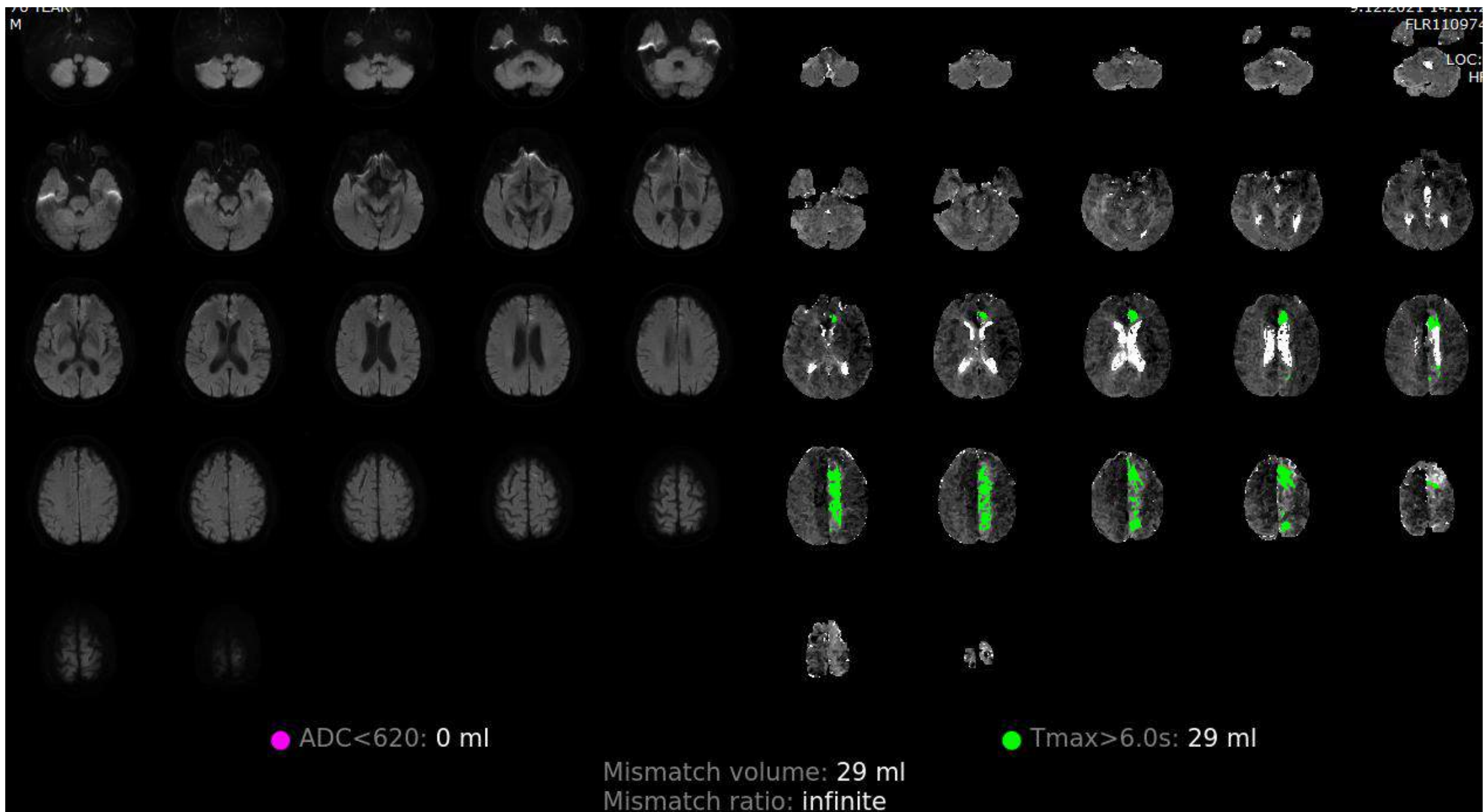
RF: HT, DM, HL, CAD

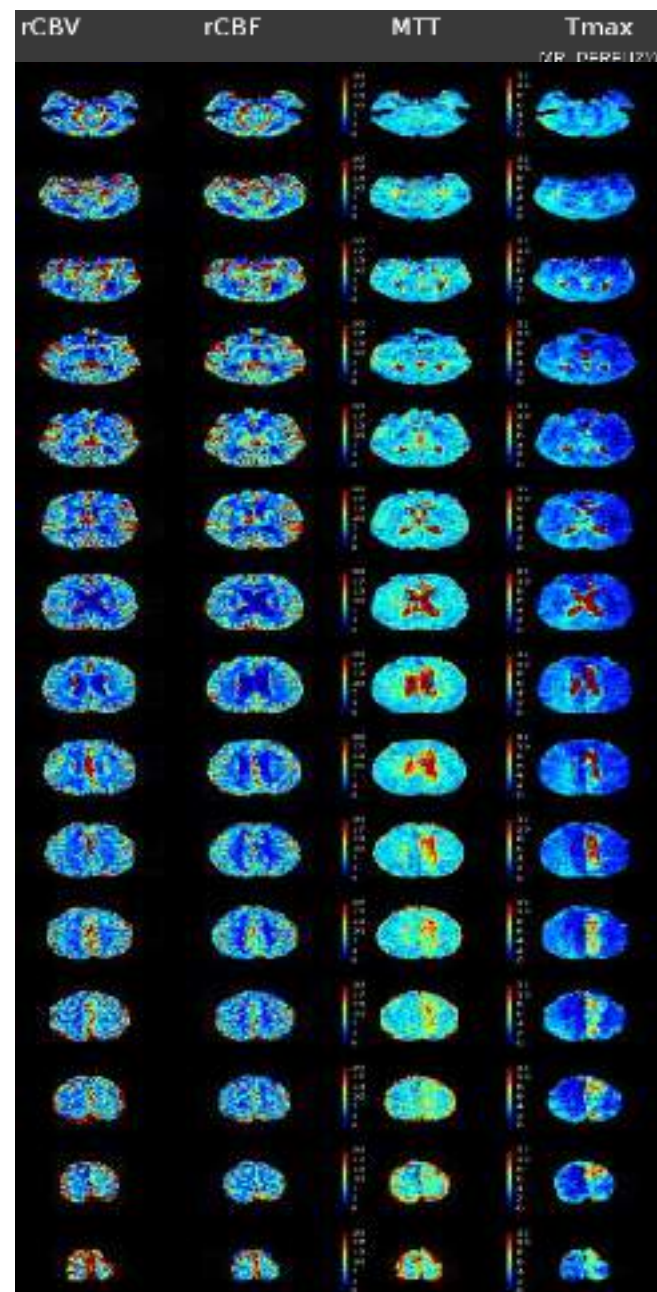
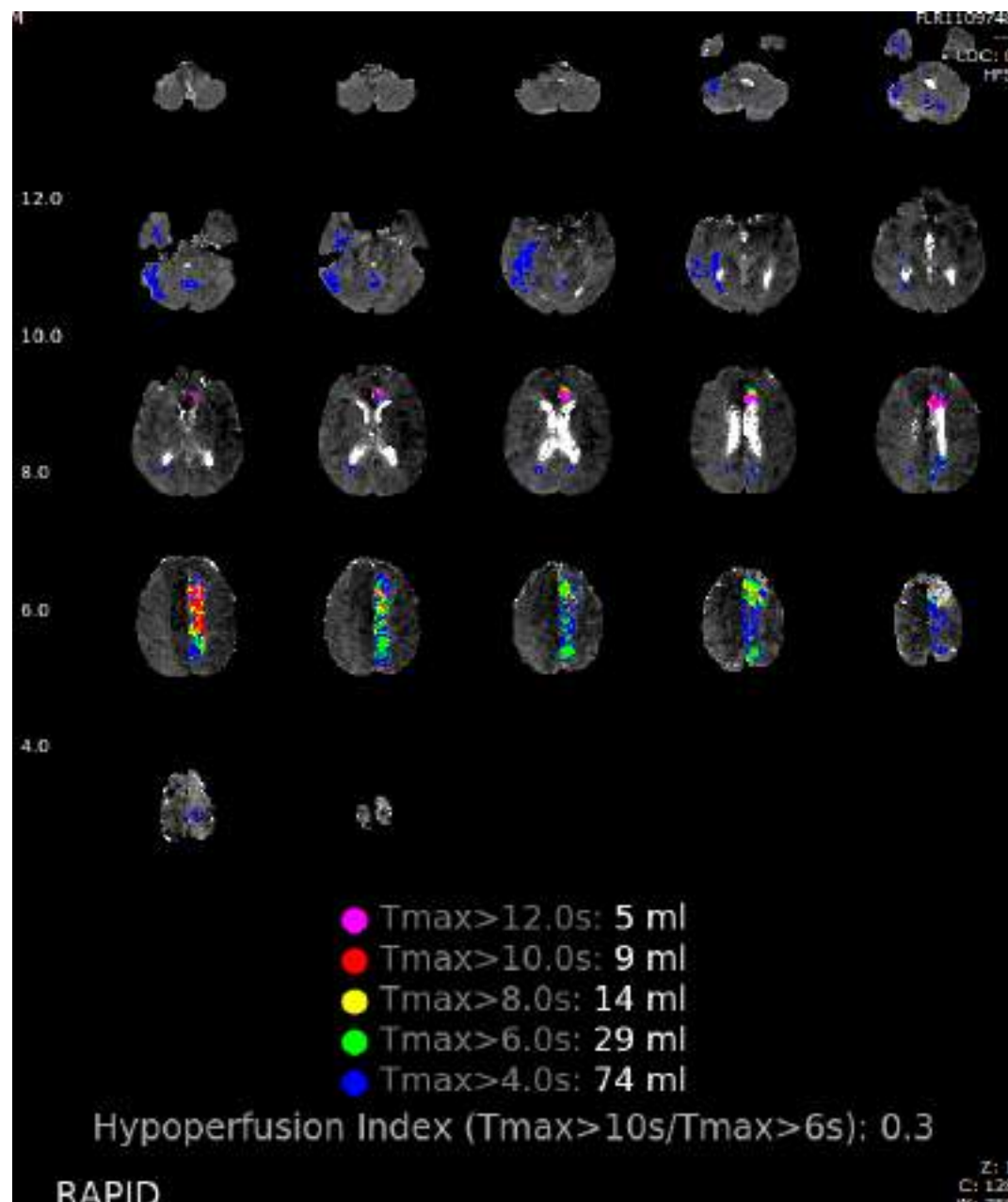
door time	
1a Level of Consciousness	0
1b LOC Questions	0
1c LOC Commands	0
Best Gaze	0
Visual Fields	0
Facial Palsy	0
5a Left Motor Arm	0
5b Right Motor Arm	0
6a Left Motor Leg	0
6b Right Motor Leg	3
Limb Ataxia	0
Sensory	0
Best Language	0
Dysarthria	1
Extinction and Inattention	0
Total	4

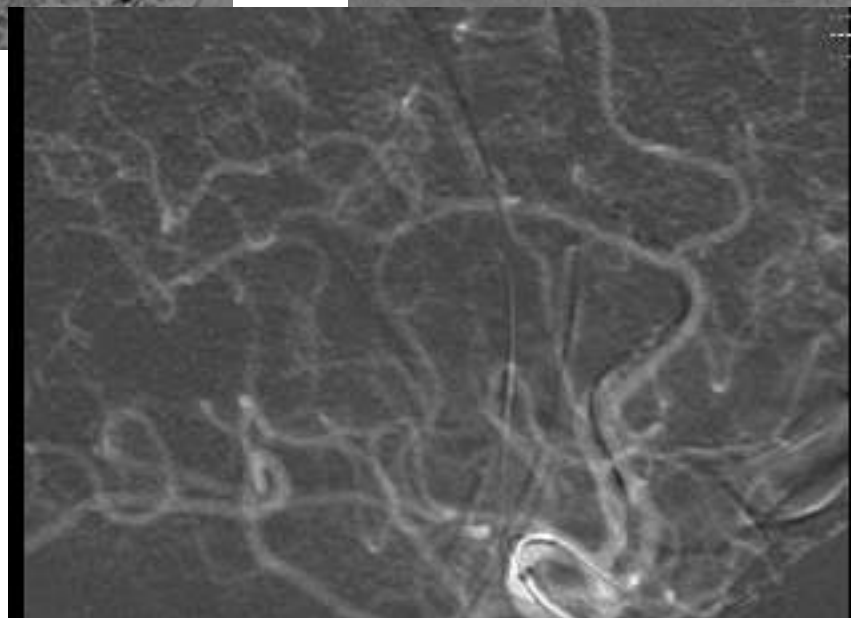
Onset DWI



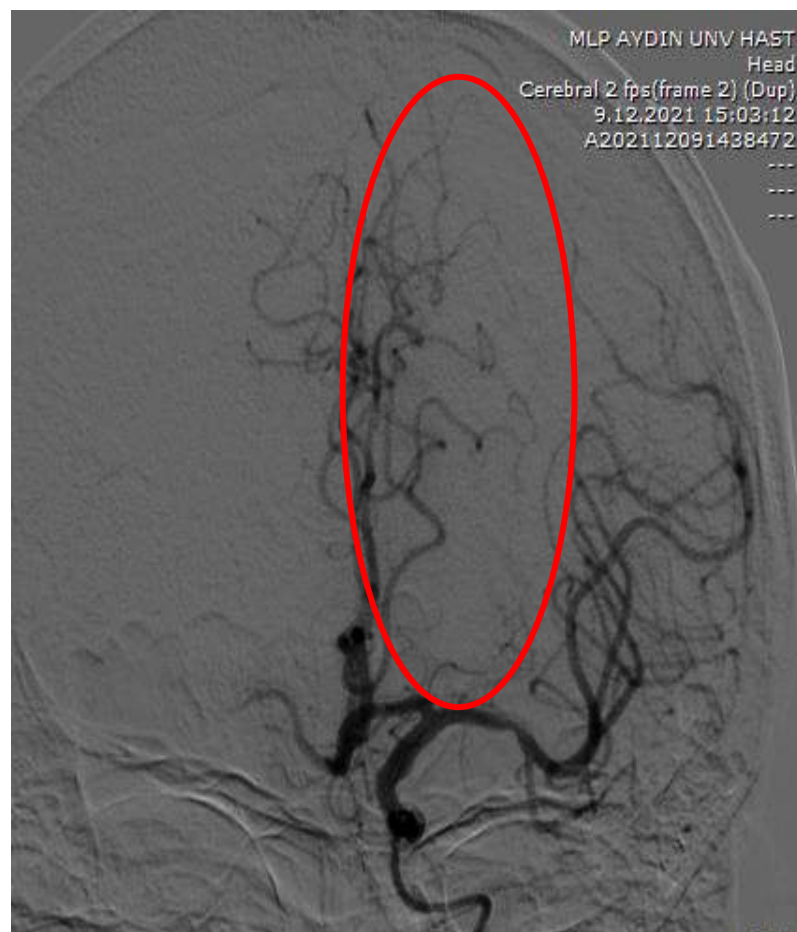




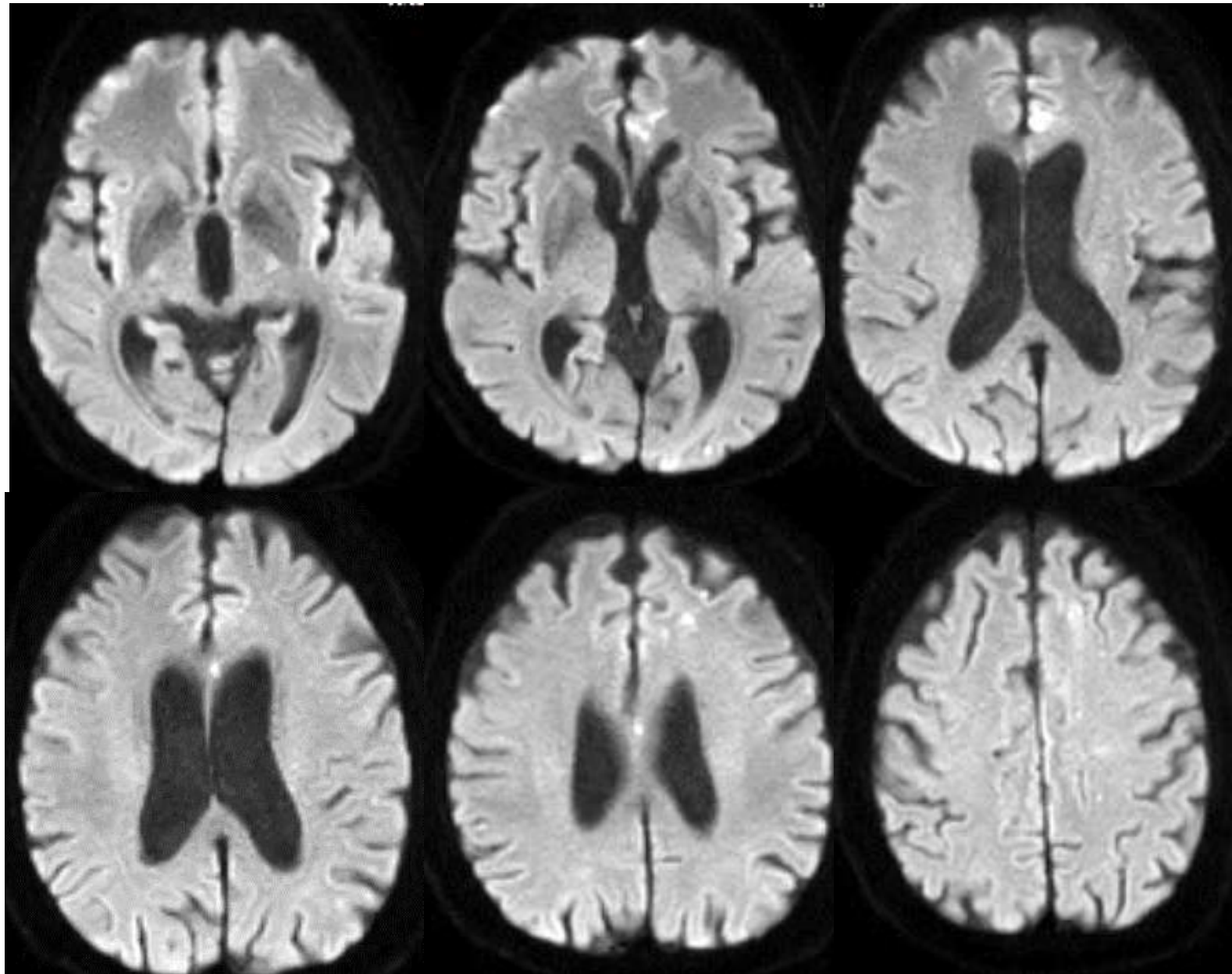




Trevo 3x25 mm stent retriever



24 h DWI



70 yo/M

- **24.h NIHSS: 0**
- **3. mo mrs:0**

Discharge NIHSS	
1a Level of Consciousness	0
1b LOC Questions	0
1c LOC Commands	0
Best Gaze	0
Visual Fields	0
Facial Palsy	0
5a Left Motor Arm	0
5b Right Motor Arm	0
6a Left Motor Leg	0
6b Right Motor Leg	0
Limb Ataxia	0
Sensory	0
Best Language	0
Dysarthria	0
Extinction and Inattention	0
Total	0

TEŞEKKÜRLER

Karotis T,L okluzyonlarında endovasküler tedavi nasıl olmalı



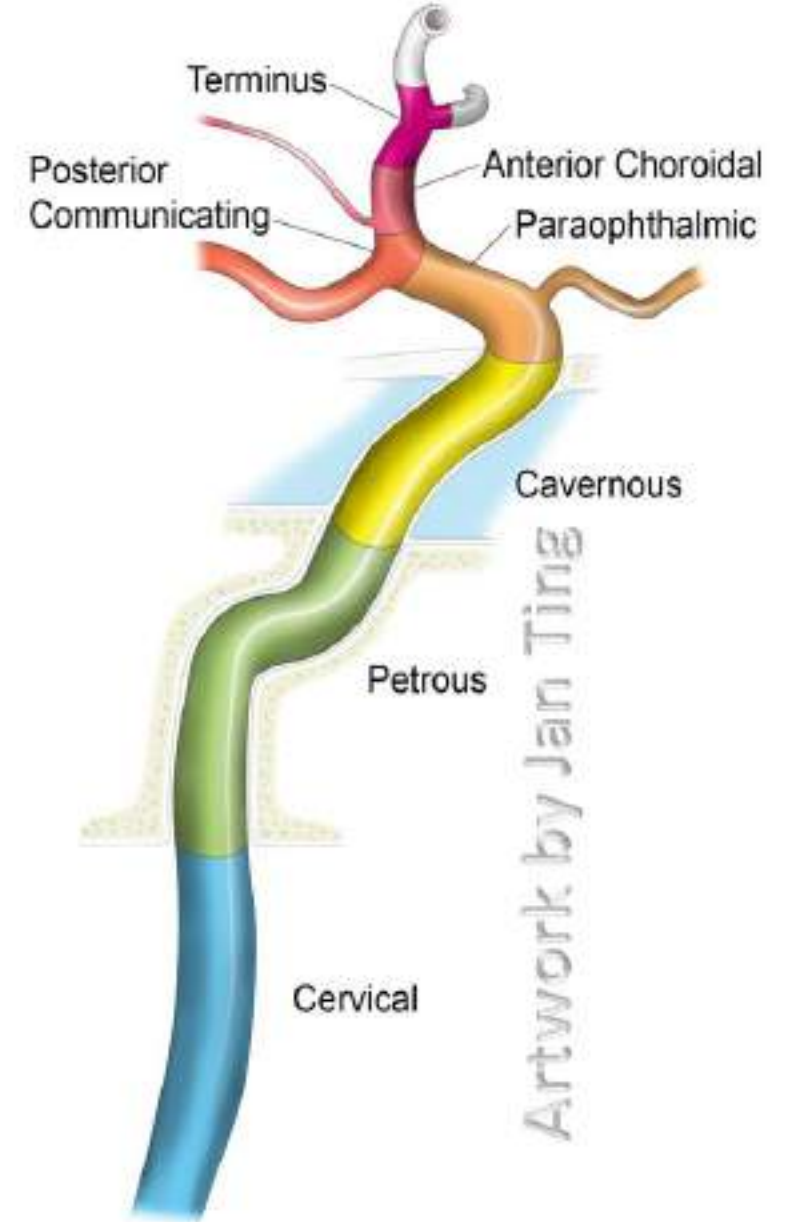
DR. YUSUF İNANÇ

GAZİANTEP ÜNİVERSİTESİ TIP FAKÜLTESİ

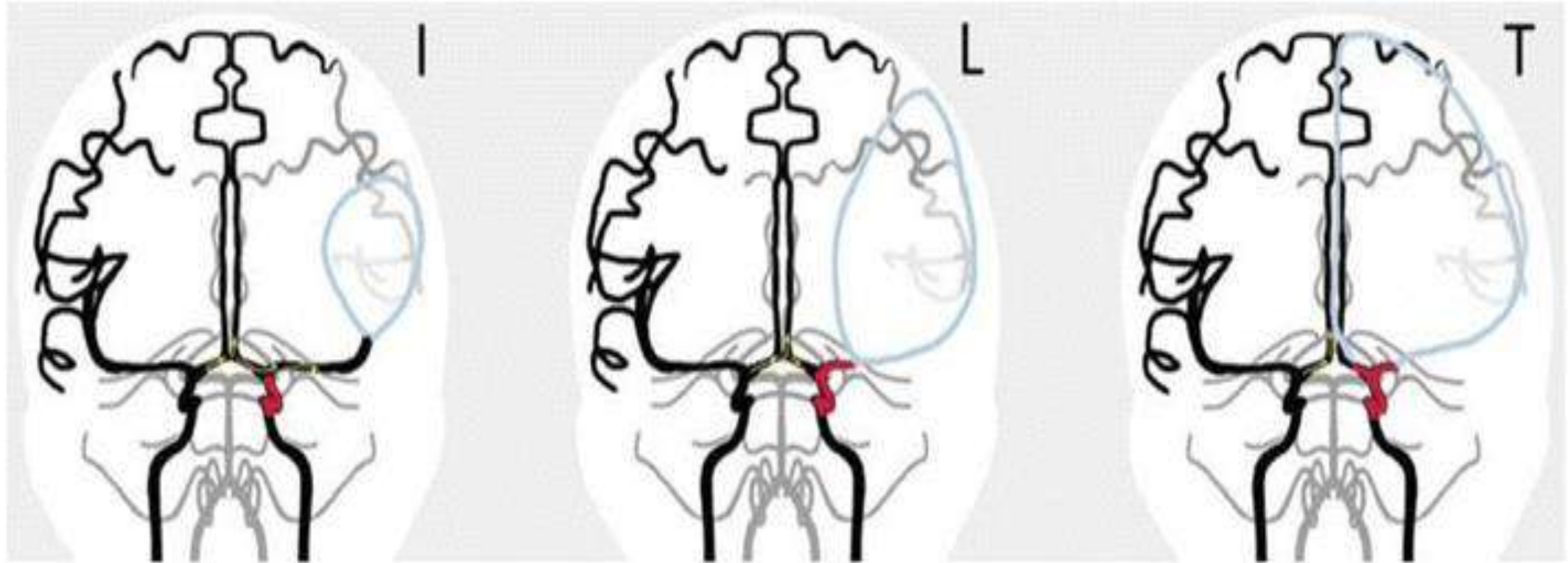
GİRİŞİMSEL NÖROLOJİ

Terminal İCA

- Subraklinoid segment sonrası veya İCA bifurkasyon için kullanılır
- Büyük damar oklüzyon iskemik inmelerin yaklaşık %5
- İnternal karotid arter akut oklüzyonlarının yaklaşık %20'sini oluşturur
- %80 Kardioembolik olarak ortaya çıkar.
- Proksimal İCA veya proksimal MCA tıkanıklıklarına göre pıhtı yükü ve strok şiddeti daha fazladır.
- Eğer kollateral dolaşımı iyi ise asemptomatik olabilir.



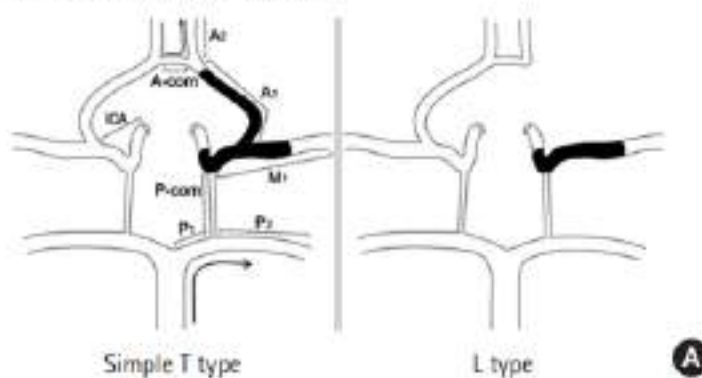
Anatomik lokalizasyon



ENDOVASKÜLER TEDAVİ SEÇENEKLERİ

- Tanısı zordur.
- DSA gerekli.
- Psödo İCA okluzyon olarakta adlandırılır.
- İV tpa da rekanalizasyon oranı MCA okluzyonlarına göre 7 kat daha düşük
- İA ve İV tedavi sonrası başarı şansı MCA okluzyonlarının yarısı kadardır.

Simple ICA terminus occlusions



Complex ICA terminus occlusions

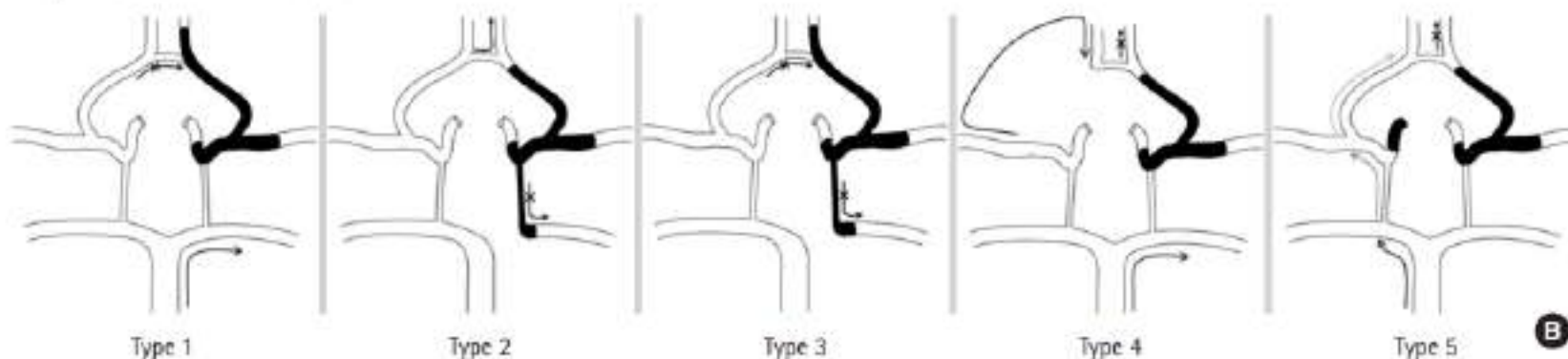


Figure 1. Simple and complex internal carotid artery (ICA) terminus occlusions. (A) Simple ICA terminus occlusion: the thrombus is confined to the bifurcation of the ICA, ipsilateral M1±A1. The ipsilateral A2 is irrigated by the collateral flow via the anterior communicating artery (A-com). (B) Complex ICA terminus occlusions. Type 1: the thrombus extends beyond the ipsilateral A1 to involve the A2, or agenesis of the anterior communicating artery halts the anterior cerebral artery leptomenigeal collaterals. Type 2: the ipsilateral posterior cerebral artery is also occluded by the distal ICA occlusion. Type 3: combination of types 1 and 2. Type 4: absence of the contralateral A1. Type 5: occlusion of the contralateral ICA. P-com, posterior communicating artery.

ENDOVASKÜLER TEDAVİ SEÇENEKLERİ

- Endovasküler tedavi seçenekleri konusunda kesin net bir konsensüs yoktur
- Aspirotrombektomi
- Mekanik trombektomi
- Kombine tedavi (aspirasyon ve trombektomi)
- Mekanik trombektomi kombinasyonları(duble stentretriever)

ADAPT (A Direct Aspiration first Pass Technique)

Aspirotrombektomi

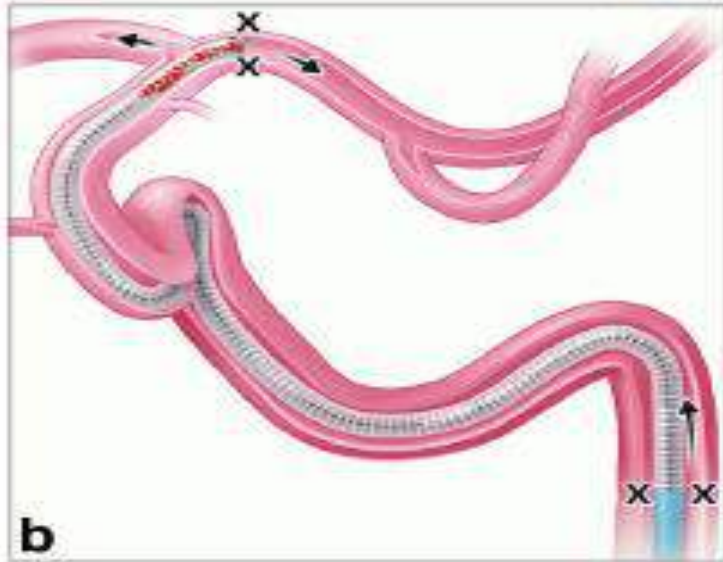
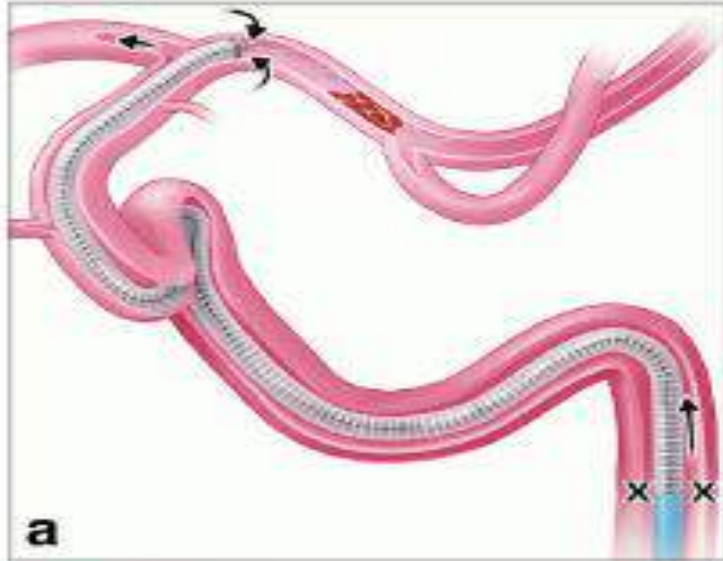
ACE™ Procedure Video

Stent-Retriever Mekanik trombektomi

wevideo

SOLUMBRA

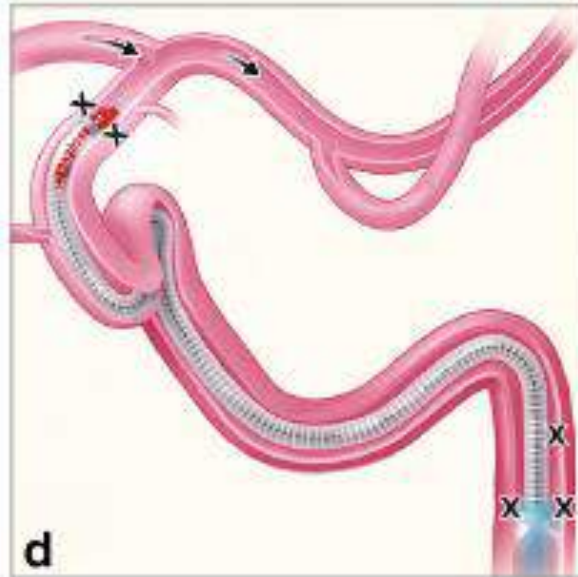
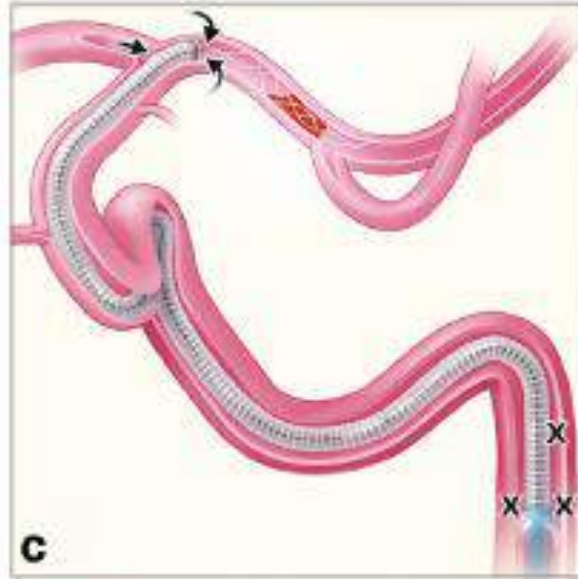
"SOLUMBRA" TECHNIQUE



- One of the most commonly used techniques
- In this technique, after opening the stent retriever at the center of the thrombus, the distal access catheter is advanced towards the thrombus.
- The stent retriever is withdrawn into the aspiration catheter, while aspiration catheter is aspirated under negative pressure.
- In this technique, only stent retriever is removed with negative aspiration, and the DAC is not withdrawn.
- Usually 6 F long sheath or Balloon guiding catheters are used
- Proximal aspiration is not applied during stent retriever retraction.

ARTS

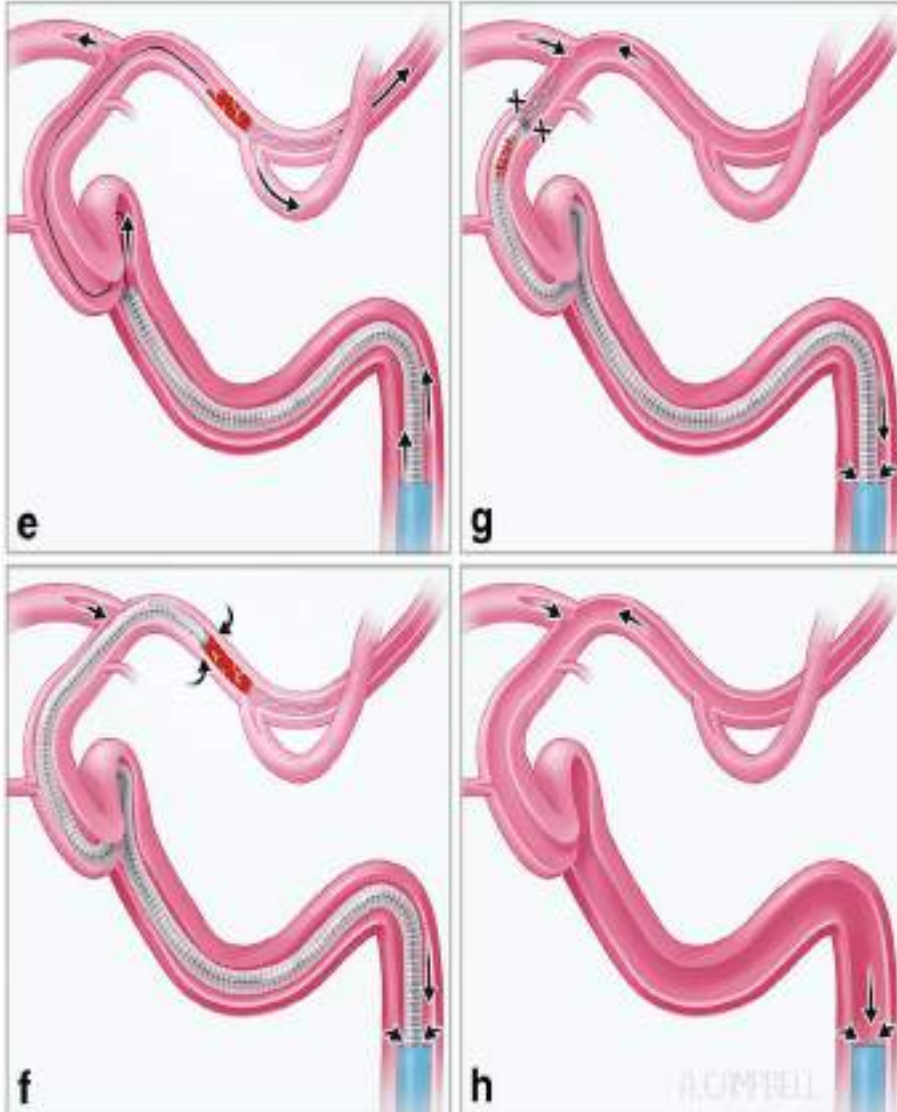
"ARTS" TECHNIQUE



- The aspiration catheter is advanced to the face of the thrombus under permanent aspiration and withdrawn as a unit with a stent retriever.
- Generally, balloon guiding catheter is used, but aspiration is not performed from the guiding catheter.
- There is a risk of distal embolization due to retrograde flow.
- In this position, the aspiration catheter is clogged with the clot, keep going aspiration continues under a negative pressure , DAC and the stent retriever are withdrawn together.
- Similar to the CAPTIVE (continuous aspiration prior to intracranial vascular embolectomy) Method.

SAVE

"SAVE" TECHNIQUE

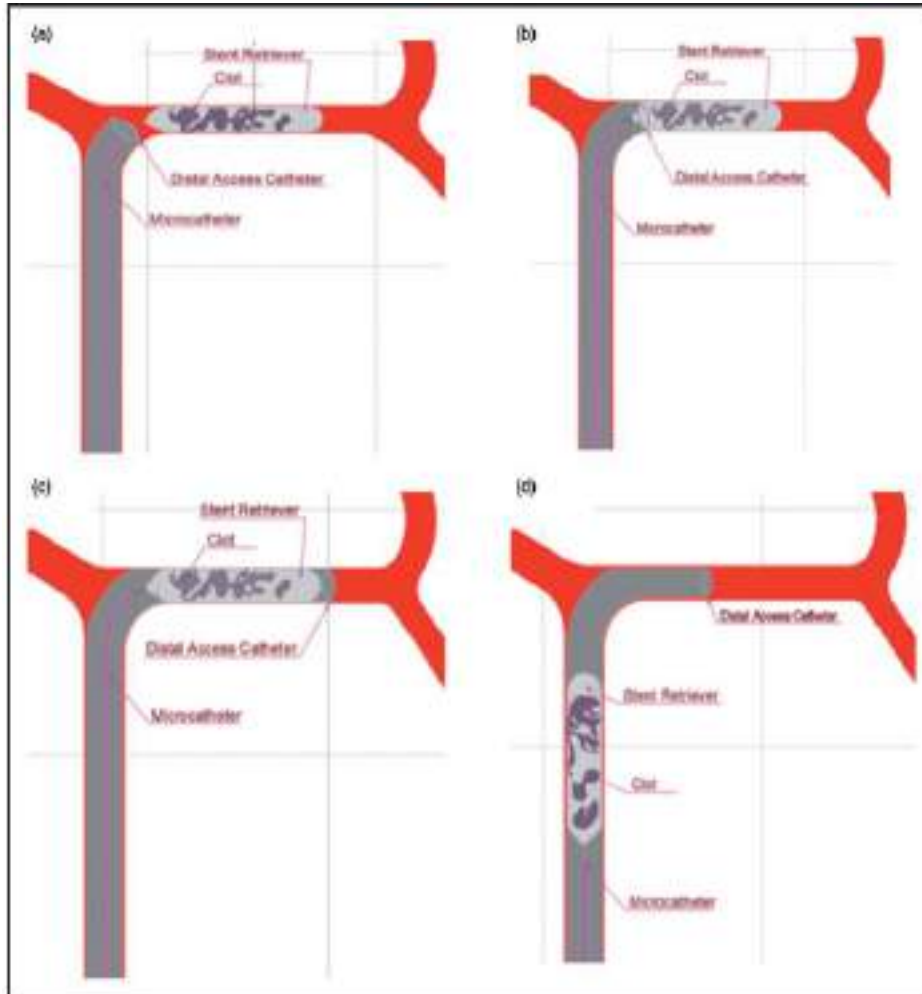


- The stent retriever is placed in the proximal third of the clot.
- Anterograde flow is usually observed immediately after stent retriever insertion.
- After that Aspiration catheter is advanced to the surface of the clot and aspiration is started with the pump.
- The stent retriever is minimally withdrawn while pushing the aspiration catheter until it reaches a wedge position. In this position the aspiration catheter is obviously clogged with the clot
- In this position, aspiration catheter is clogged with the clot, Continuous aspiration keep going under a negative pressure, and the DAC is withdrawn together with the stent.
- Meanwhile, aspiration continues through the guide catheter (usually 8f balloon guide catheter) and tried to be prevented distal embolization

ADVANCE

ADVANCE: An effective and feasible technique in acute stroke treatment

Erdem Gurkas¹, Cetin Kursad Akpinar² and Emrah Aytac³



After the guiding catheter is placed in the ICA, the micro guidewire and microcatheter insert into the MCA, The stent retriever advance and place through the thrombus.

DAC uses for all patients.

Wait for five minutes after stent deployment, then the DAC advance through the thrombus over the stent retriever while create manual negative suction with a 50 cc locked syringe.

As soon as the DAC reaches the distal tip of the stent retriever with continuous negative suction.

When the stent retriever totally remove negative suction continue through the DAC while slowly drawing back proximally.

If blood flow was maintaine, at least 20 ml of blood withdrawn until no thrombus seems in the withdrawn blood. If there is a blockade of blood flow in the DAC, then the DAC totally remove under continuous suction.

Comparison of Aspiration versus Stent Retriever Thrombectomy as the Preferred Strategy for Patients with Acute Terminal Internal Carotid Artery Occlusion: A Propensity Score Matching Analysis

P.F. Xing, P.F. Yang, Z.F. Li, L. Zheng, H.J. Shen, Y.X. Zhang, Y.W. Zhang, and J.M. Liu

Q*

ABSTRACT

BACKGROUND AND PURPOSE: There is no consensus on endovascular treatment for terminal ICA. The purpose of this study was to evaluate the comparative safety and efficacy of preferred aspiration thrombectomy and stent retriever thrombectomy for revascularization in patients with isolated terminal ICA occlusion.

MATERIALS AND METHODS: We conducted a retrospective analysis of patients with terminal ICA occlusion treated with aspiration thrombectomy or stent retriever thrombectomy in our center, from September 2013 to November 2018. To minimize the case bias, propensity score matching was performed. The primary outcomes were successful reperfusion defined by expanded TICI grades 2b–3 at the end of all endovascular procedures and puncture-to-reperfusion time.

RESULTS: A total of 129 consecutive patients with terminal ICA occlusion were divided into the aspiration thrombectomy group (40 patients) and the stent retriever thrombectomy group (89 patients), and 30 patients were included in each group after propensity score matching. The proportion of complete reperfusion was significantly higher in the aspiration thrombectomy group (OR 4.75 [95% CI, 1.10–1.38]; $P = .002$). The median puncture-to-reperfusion time in the aspiration thrombectomy group was shorter than that in the stent retriever thrombectomy group (38 versus 69 minutes; $P = .001$). Fewer intracerebral hemorrhage events were recorded in the aspiration thrombectomy group (OR 0.29 [95% CI, 0.09–0.90]; $P = .028$). No significant differences were observed for good outcomes (OR 1.92 [95% CI, 0.86–4.25]) and mortality (OR 0.84 [95% CI, 0.29–2.44]) at 90 days.

CONCLUSIONS: For the treatment of terminal ICA occlusion, aspiration thrombectomy was technically superior to stent retriever thrombectomy in the absence of a balloon guide catheter in achieving successful reperfusion with shorter puncture-to-reperfusion time and procedure-related adverse events.

ABBREVIATIONS: ASITH/SRT = American Society of Interventional and Therapeutic Neuroendovascular Society/Society of Interventional Radiology; ASPECTS = Alberta Stroke Program Early CT Score; AT = aspiration thrombectomy; BGC = balloon guide catheter; eTICI = expanded TICI; ICH = intracerebral hemorrhage; ID = internal diameter; PRT = puncture-to-reperfusion time; PSM = propensity score matching; SRT = stent retriever thrombectomy.

Terminal ICA occlusion is a strong predictor of both lower revascularization success and subsequent clinical outcomes, which occur due to a large clot burden, insufficient collateral flow mediated via the contralateral ICA, and new territory emboli

being present during treatment.^{1–3} No consensus has been reached on the preferred endovascular treatment for isolated terminal ICA occlusion that leads to the use of either aspiration thrombectomy (AT) by using a large bore aspiration catheter or stent retriever thrombectomy (SRT). A previous study indicated that AT was useful for rapid clot burden reduction in endovascular therapy for ICA T/L occlusion (T or L indicate the shape of occlusive lesion), and it could facilitate thrombectomy of a large cerebral clot burden.⁴ In contrast to these findings, a retrospective study demonstrated that patients with a higher initial NIHSS score and ICA clot location should be considered for early crossover (manual AT crossed over to stent retriever-mediated AT) or even initial stent retriever-mediated AT for their clots.⁵ The randomized controlled trials, systematic reviews, and meta-analyses previously conducted did not yield consistent

Received October 20, 2019; accepted after revision December 26.

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This study was funded by the Project of Research and Application of Effective Intervention Techniques for High-Risk Stroke Population of China in 2017 (20180003).

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<http://dx.doi.org/10.3174/ajnr.A6064>

Comparison of Aspiration versus Stent Retriever Thrombectomy as the Preferred Strategy for Patients with Acute Terminal Internal Carotid Artery Occlusion: A

PF. Xing, P.F.

ABSTRACT

BACKGROUND AND PURPOSE: There is no to evaluate the comparative safety and efficacy of aspiration versus stent retriever thrombectomy in patients with isolated terminal internal carotid artery occlusion.

MATERIALS AND METHODS: We conducted a retrospective study comparing aspiration thrombectomy and stent retriever thrombectomy in patients with isolated terminal internal carotid artery occlusion. Propensity score matching was performed. Data were analyzed at the end of all endovascular procedures.

RESULTS: A total of 129 consecutive patients (40 patients) and the stent retriever thrombectomy group were included in the propensity score matching. The proportion of core perfusion (eTICI 2b–3) was 47.5% [95% CI, 33.0–62.0]. The median time to reperfusion was 100 minutes (IQR, 60–140 minutes) in the aspiration thrombectomy group and 120 minutes (IQR, 80–160 minutes) in the stent retriever thrombectomy group for good outcomes (OR 1.92 [95% CI, 0.86–4.28]).

CONCLUSIONS: For the treatment of terminal internal carotid artery occlusion, aspiration thrombectomy is a safe and effective strategy in the absence of a balloon catheter and procedure-related adverse events.

ABBREVIATIONS: ASHA/SPR = American Society of Interventional Neuroradiology; ASHA = American Society of Hematology; ASHA = American Society of Hematology; ASHA = American Society of Hematology; ASHA = American Society of Hematology.

Terminal ICA occlusion is a strong predictor of poor outcome and subsequent death, which occur due to a large clot burden, insufficient collateral flow, and/or a large territory of infarction mediated via the contralateral ICA, and new

Received October 20, 2019; accepted after revision December 10, 2019. From the Department of Stroke Center, Changshu Hospital, Soochow University, Shanghai, China.

P.F. Xing and P.F. Tang contributed equally to this work. This study was funded by the Project of Research and Application Innovation Technology for High-Risk Stroke Population of C (20180003).

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	AT Group (n = 40)	SRT Group (n = 69)	OR (95% CI)	P	A
eTICI 2b–3, n (%)	40 (100)	56 (81.2)	1.23 (1.10–1.38)	.002	30
eTICI 2c–3, n (%)	34 (85.0)	38 (55.1)	4.62 (1.72–12.43)	.001	20
eTICI 3, n (%)	29 (72.5)	32 (46.4)	3.05 (1.32–7.06)	.008	20
First pass to eTICI 2b–3, n (%)	10 (25.0)	15 (21.7)	1.20 (0.48–3.00)	.696	9
First pass to eTICI 2c–3, n (%)	10 (25.0)	12 (17.4)	1.58 (0.61–4.01)	.340	9
First pass to eTICI 3, n (%)	8 (20.0)	11 (15.9)	1.32 (0.48–3.61)	.590	8
No. passes of thrombectomy, median (IQR)	2 (2–3.7)	3 (2–4)	NA	.900	2
Rescue treatment, n (%)	6 (15.0)	8 (11.6)	1.35 (0.43–4.20)	.608	5
PRT, median (IQR) (min)	46 (24–68)	83 (55–120)	NA	.001	38
Onset to reperfusion time, median (IQR) (min)	355 (222–550)	337 (264–420)	NA	.900	245
Use of rtPA, n (%)	12 (30.0)	33 (47.8)	0.47 (0.21–1.07)	.068	1
Administration of GPI, n (%)	2 (5.0)	10 (14.5)	0.31 (0.06–1.50)	.227	1
Balloon angioplasty, n (%)	1 (2.5)	2 (2.9)	0.86 (0.08–9.78)	.999	1
Stent placement, n (%)	0 (0)	5 (7.2)	0.33 (0.04–2.91)	.156	0
IV heparin, n (%)	28 (70.0)	36 (52.2)	2.14 (0.94–4.88)	.068	15
mRS score 0–1 at 90 days, n (%)	13 (32.5)	15 (21.7)	1.73 (0.72–4.16)	.215	1
mRS score 0–2 at 90 days, n (%)	17 (42.5)	22 (31.9)	1.92 (0.86–4.25)	.265	11
mRS score 3–5 at 90 days, n (%)	17 (42.5)	35 (50.7)	0.72 (0.33–1.57)	.407	10

● P.F. Xing, ● P.F.

ABBREVIATIONS: ASHA/SFz = American Society of Alberta Stroke Program Early CT Score; AT = aspic (happ); ID = internal diameter; PRT = parietal-occipital

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<http://dx.doi.org/10.1093/ajph.2014.049444>

	Overall Sample				
	AT Group, <i>n</i> (%) (<i>n</i> = 40)	SRT Group, <i>n</i> (%) (<i>n</i> = 69)	OR (95% CI)	<i>P</i>	
Overall adverse events	21 (52.5)	50 (72.5)	0.42 (0.19–0.95)	.035	
Any ICH	12 (30.0)	28 (40.6)	0.63 (0.27–1.44)	.269	
Symptomatic ICH	4 (10.0)	14 (20.3)	0.44 (0.13–1.43)	.260	
Downstream territory embolism	17 (42.5)	31 (44.9)	0.91 (0.41–1.99)	.806	
Malignant cerebral edema	4 (10.0)	19 (27.5)	0.29 (0.09–0.93)	.050	
All-cause mortality at 90 days	6 (15.0)	12 (17.4)	0.84 (0.29–2.44)	.746	
mRS score 0–2 at 90 days, <i>n</i> (%)	17 (42.5)	22 (31.9)	1.92 (0.86–4.25)	.265	11
mRS score 3–5 at 90 days, <i>n</i> (%)	17 (42.5)	35 (50.7)	0.72 (0.33–1.57)	.407	10

Comparison of Aspiration versus Stent Retriever Thrombectomy as the Preferred Strategy for Patients with Acute Terminal Internal Carotid Artery Occlusion: A

PF. Xing, P.F.

ABSTRACT

BACKGROUND AND PURPOSE: There is no to evaluate the comparative safety and efficacy of aspiration versus stent retriever thrombectomy in patients with isolated terminal internal carotid artery occlusion.

MATERIALS AND METHODS: We conducted a retrospective study comparing aspiration and stent retriever thrombectomy in patients with isolated terminal internal carotid artery occlusion. Propensity score matching was performed.

RESULTS: A total of 129 consecutive patients (40 patients) and the stent retriever thrombectomy group (89 patients) were included in the study. The proportion of complete recanalization was significantly higher in the aspiration group (47.5%) than in the stent retriever group (30.3%).

CONCLUSIONS

For acute ischemic stroke due to terminal ICA occlusion, the results demonstrated that the use of AT as the preferred treatment was technically superior to SRT without proximal flow arrest when using a BGC in achieving complete recanalization, shortening PRT, and reducing the rate of ICH events. Additional studies are required to validate our findings in the context of BGC-assisted SRT and to determine the optimal treatment strategy for terminal ICA occlusion.

Terminal internal carotid artery occlusion is a common cause of acute ischemic stroke, which occurs in the terminal internal carotid artery.

Received October 1, 2019; revised March 1, 2020; accepted March 1, 2020. From the Department of Neurology, Shanghai Medical University, Shanghai, China (P.F. Xing and P.F.). This study was supported by the National Natural Science Foundation of China (81873000).

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	AT Group (n = 40)	SRT Group (n = 69)	OR (95% CI)	P	A
eTICI 2b–3, n (%)	40 (100)	56 (81.2)	1.23 (1.10–1.38)	.002	30
eTICI 2c–3, n (%)	34 (85.0)	38 (55.1)	4.62 (1.72–12.43)	.001	20
eTICI 3, n (%)	29 (72.5)	32 (46.4)	3.05 (1.32–7.06)	.008	20
First pass recanalization, n (%)	10 (25.0)	15 (21.7)	1.20 (0.48–3.00)	.696	6

Table 3: Adverse events after mechanical thrombectomy in the 2 groups

	Overall Sample			A
	AT Group, n (%)	OR (95% CI)	P	
ICH, n (%)	10 (25.0)	0.42 (0.19–0.95)	.035	1
SAH, n (%)	18 (40.6)	0.63 (0.27–1.44)	.269	1
Stroke, n (%)	14 (20.3)	0.44 (0.13–1.43)	.260	1
Death, n (%)	31 (44.9)	0.91 (0.41–1.99)	.806	1
Other, n (%)	19 (27.5)	0.29 (0.09–0.93)	.050	1
Total, n (%)	12 (17.4)	0.84 (0.29–2.44)	.746	1

n (%)

Importance of Occlusion Site for Thrombectomy Technique in Stroke

Comparison Between Aspiration and Stent Retriever

Marie Louise E. Bensen, MD; Robert-Jan B. Goldboom, MD; Hester F. Lingsma, PhD; Robert J. van Oostenbrugge, MD, PhD; Wim H. van Zwam, MD, PhD; Maarten Uytendaele, MD, PhD; Yvo B.W.E.M. Roos, MD, PhD; Jasper M. Marlers, MD; Jeannette Hofmeijer, MD, PhD; on behalf of the MR CLEAN Registry Investigators*

BACKGROUND AND PURPOSE: Thrombectomy with stent retriever and direct aspiration are equally effective in the endovascular treatment of anterior circulation acute ischemic stroke. We report efficacy and safety of initial treatment technique per occlusion segment.

METHODS: For this study, we analyzed data from the MR CLEAN Registry, a prospective, observational study in all centers that perform endovascular therapy in the Netherlands. We used ordinal logistic regression analysis to compare clinical and technical results of first-line direct aspiration treatment with that of stent retriever thrombectomy stratified for occlusion segment. Primary outcome measure was functional outcome at 3 months. Secondary outcome measures included reperfusion grade expressed as the extended Thrombolysis in Cerebral Infarction score, periprocedural complication risk, time to reperfusion, and mortality.

RESULTS: Of the 2282 included patients, 1658 (73%) were initially treated with stent retriever and 624 (27%) with aspiration. Four hundred sixty-two patients had an occlusion of the intracranial part of the carotid artery, 1349 of the proximal middle cerebral artery, and 471 of the distal parts of the middle cerebral artery. There was no difference in functional outcome between aspiration and stent retriever thrombectomy (odds ratio, 1.0 [95% CI, 0.9–1.2]) in any of the occlusion segments (*P* value for interaction=0.2). Reperfusion rate was higher in the aspiration group (odds ratio, 1.4 [95% CI, 1.1–1.6]) and did not differ between occlusion segments (*P* value for interaction=0.6). Procedure times were shorter in the aspiration group (minutes 50 versus 65 minutes; *P*=0.0001). There was no difference in periprocedural complications or mortality.

CONCLUSIONS: In unselected patients with anterior circulation infarcts, we observed equal functional outcome of aspiration and stent retriever thrombectomy in all occlusion segments. When aspiration was the first-line treatment modality, reperfusion rates were higher and procedure times shorter in all occlusion segments.

Key Words: carotid arteries ■ endovascular procedure ■ middle cerebral artery ■ reperfusion ■ stent ■ stroke ■ thrombectomy

Stent retriever and direct aspiration thrombectomy are equally effective and safe in the endovascular treatment (EVT) of acute ischemic stroke.^{1–6} However, safety and efficacy have not been compared in relation to the site of arterial occlusion.

Most patients with anterior circulation infarcts who are eligible for EVT have an occlusion in the proximal middle cerebral artery (MCA-M1).^{4,7} Second most common

occlusions are located in the more distal parts of the middle cerebral artery (MCA-M2) or in the intracranial part of the carotid artery (IC-ICA). Occlusions in the anterior cerebral artery are relatively rare.

It has been suggested that stent retrievers are especially effective in patients with proximal occlusions, such as internal carotid artery and M1 occlusions.⁸ More distal occlusion sites have been associated with longer procedure times

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*A list of MR CLEAN Registry Investigators is provided in the Data Supplement.

The Data Supplement is available with this article at <https://www.ahajournals.org/doi/suppl/10.1161/STROKEAHA.120030001>.

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Importance of Occlusion Site for Thrombectomy Technique in Stroke

Comparison Between A

Maria Louisa E. Bensen, MD; Robb W. H. van Zwam, MD, PhD; Maarten Jeannette Hofmeijer, MD, PhD; on behalf of the MR CLEAN Investigators

BACKGROUND AND PURPOSE: Thrombectomy treatment of anterior circulation occlusion segment.

METHODS: For this study, we analyzed performance of endovascular therapy in the results of first-line direct aspiration in the outcome measure was functional outcome as the extended Thrombolysis in Cerebral Infarction (TICI) 2B-3.

RESULTS: Of the 2282 included patients, 400 were treated with direct aspiration and 471 with stent retriever. The difference between aspiration and stent retriever (P value for interaction = 0.2). Results did not differ between occlusion segments (minutes 50 versus 65 minutes; P = 0.1).

CONCLUSIONS: In unselected patients, stent retriever thrombectomy in all rates were higher and procedure time

Key Words: cerebral arteries; endovascular therapy

Stent retriever and direct aspiration are equally effective and safe treatment (EVT) of acute ischemic stroke (AIS). However, safety and efficacy have not been evaluated for the site of arterial occlusion.

Most patients with anterior circulation stroke (ACS) are eligible for EVT have an occlusion in the cerebral artery (MCA-M1).^{1,2}

	Aspiration n = 134		Stent retriever n = 328		
IC-ICA, n (%)					
Time from onset to reperfusion/last contrast bolus (minutes), median (IQR)	237	(163-293)	265	(210-320)	0.008
Duration of procedure (minutes), median (IQR)	62	(45-86)	75	(50-99)	0.003
Successful reperfusion at the end of all procedures (eTICI 2B-3), n (%)	98	(73%)	216	(66%)	0.2
Successful reperfusion after first pass (eTICI 2B-3), n (%)	57	(43%)	143	(44%)	0.8
Excellent reperfusion at the end of all procedures (eTICI 2C-3), n (%)	68	(51%)	135	(41%)	0.06
Post EVT eTICI					0.5
0	13	(10%)	37	(11%)	
1	3	(2%)	12	(4%)	
2A	20	(15%)	63	(19%)	
2B	30	(22%)	81	(25%)	
2C	19	(14%)	34	(10%)	
3	49	(37%)	101	(31%)	
SAE any, n (%)	64	(48%)	157	(48%)	1.0
SICH, n (%)	9	(7%)	23	(7%)	1.0
Stroke progression resulting in neurodeterioration or death	16	(12%)	49	(15%)	0.5
New ischemic stroke resulting in neurodeterioration or death	1	(1%)	5	(2%)	0.7
Mortality (3 months), n (%)	45	(34%)	117	(36%)	0.5
mRS 0-2 at 3 months follow-up	48	(36%)	81	(25%)	0.04

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The Data Supplement is available with this article at <https://www.ahajournals.org/doi/suppl/10.1161/STROKEAHA.120030001>.

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Importance of Occlusion Site for Thrombectomy Technique in Stroke

Comparison Between A

Maria Louisa E. Bensen, MD; Robbe Wim H. van Zwam, MD, PhD; Maarten Jeannette Hofmeijer, MD, PhD; on behalf of the MR CLEAN Investigators

BACKGROUND AND PURPOSE: Thrombectomy treatment of anterior circulation occlusion segment.

METHODS: For this study, we analyzed periprocedural and clinical outcomes of first-line direct aspiration in the results of first-line direct aspiration in the outcome measure was functional outcome as the extended Thrombolysis in Cerebral Infarction (ECAS) score.

RESULTS: Of the 2282 included patients, 400 patients had anterior circulation occlusion segment, and 471 of the distal between aspiration and stent retriever (P-value for interaction=0.02). Repeat not differ between occlusion segments (minutes 50 versus 55 minutes; P=0.001).

CONCLUSIONS: In unselected patients, stent retriever thrombectomy in all rates were higher and procedure time

Key Words: cerebral arteries; endovascular therapy; stroke; thrombectomy

Stent retriever and direct aspiration are equally effective and safe treatment (EVT) of acute ischemic stroke (AIS). However, safety and efficacy have not been evaluated for the site of arterial occlusion.

Most patients with anterior circulation occlusion are eligible for EVT have an occlusion in the cerebral artery (MCA-M1).^{1,2}

Importance of occlusion site for thrombectomy technique

Table 2 continued.

	Aspiration n = 346		Stent retriever n = 1003		
MCA-M1, n (%)					
Time from onset to reperfusion/last contrast bolus (minutes), median (IQR)	226	(186-285)	258	(204-322)	<0.0001
Duration of procedure (minutes), median (IQR)	48	(32-69)	63	(41-88)	<0.0001
Successful reperfusion at the end of procedures (eTICI 2B-3), n (%)	248	(72%)	656	(65%)	0.02
Successful reperfusion after first pass (eTICI 2B-3), n (%)	200	(58%)	501	(50%)	0.01
Excellent reperfusion at the end of all procedures (eTICI 2C-3), n (%)	186	(55%)	447	(45%)	0.003
Post EVT eTICI					0.001
0	19	(5%)	79	(8%)	
1	1	(0.3%)	40	(4%)	
2A	73	(21%)	219	(22%)	
2B	62	(18%)	209	(21%)	
2C	56	(16%)	119	(12%)	
3	130	(38%)	328	(33%)	
SAE any, n (%)	132	(38%)	401	(40%)	0.6
sICH total, n (%)	19	(5%)	57	(6%)	1.0
Stroke progression resulting in neurodeterioration or death	29	(8%)	74	(7%)	0.3
New ischemic stroke resulting in neurodeterioration or death	8	(2%)	15	(1%)	0.3
Mortality (3 months), n (%)	83	(24%)	246	(25%)	1.0
mRS 0-2 at 3 months follow-up	143	(41%)	385	(38%)	0.2

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The Data Supplement is available with this article at <https://www.ahajournals.org/doi/suppl/10.1161/STROKEAHA.120030001>.

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Importance of Occlusion Site for Thrombectomy Technique in Stroke

Comparison Between A

Maria Louisa E. Bensen, MD; Robb W. H. van Zwam, MD, PhD; Maarten Jeannette Hofmeijer, MD, PhD; on behalf of the MR CLEAN Investigators

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METHODS: For this study, we analyzed performance of endovascular therapy in the results of first-line direct aspiration in the outcome measure was functional outcome as the extended Thrombolysis in Cerebral Infarction (eTICI) 2B-3.

RESULTS: Of the 2282 included patients, 400 patients had cerebral artery, and 471 of the distal between aspiration and stent retriever (P-value for interaction=0.2). Results did not differ between occlusion segments (minutes 50 versus 65 minutes; P=0.3).

CONCLUSIONS: In unselected patients, stent retriever thrombectomy in all rates were higher and procedure time

Key Words: cerebral arteries; end

Stent retriever and direct aspiration are equally effective and safe treatment (EVT) of acute ischemic stroke, safety and efficacy have not been proven to the site of arterial occlusion.

Most patients with anterior circulation stroke eligible for EVT have an occlusion in the cerebral artery (MCA-M1),^{1,2} but

Importance of occlusion site for thrombectomy technique

	Aspiration n = 144		Stent retriever n = 327		
MCA-M2, n (%)					
Time from onset to reperfusion/last contrast bolus (minutes), median (IQR)	235	(197-300)	254	(199-326)	0.2
Duration of procedure (minutes), median (IQR)	48	(35-70)	62	(45-85)	<0.0001
Successful reperfusion at the end of all procedures (eTICI 2B-3), n (%)	104	(72%)	199	(61%)	0.04
Successful reperfusion after first pass	77	(53%)	150	(46%)	0.03
Excellent reperfusion at the end of all procedures (eTICI 2C-3), n (%)	69	(48%)	133	(41%)	0.2
Post EVT eTICI					0.3
0	13	(9%)	44	(13%)	
1	4	(3%)	12	(4%)	
2A	23	(16%)	67	(21%)	
2B	35	(24%)	66	(20%)	
2C	14	(10%)	35	(11%)	
3	55	(38%)	98	(30%)	
SAE any, n (%)	56	(39%)	114	(35%)	0.4
siCH total, n (%)	13	(9%)	20	(6%)	0.3
Stroke progression resulting in neurodeterioration or death	12	(8%)	29	(9%)	1.0
New ischemic stroke resulting in neurodeterioration or death	1	(1%)	8	(2%)	0.3
Mortality (3 months), n (%)	42	(29%)	73	(22%)	0.06
mRS 0-2 at 3 months follow-up	54	(38%)	146	(45%)	0.3

Abbreviations: IC-ICA, internal carotid artery; MCA-(M); middle cerebral artery (segment); IQR, interquartile range; eTICI, extended Thrombolysis in Cerebral Infarction; SAE, serious adverse events; siCH, symptomatic intracranial haemorrhage; mRS, modified Rankin Scale.

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The Data Supplement is available with this article at <http://www.ahajournals.org/doi/suppl/10.1161/STROKEAHA.119.024444>. For Sources of Funding and Disclosures, see page 90.

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Case Report

Crossing double stent retriever technique for refractory terminal internal carotid artery occlusion ☆

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ARTICLE INFO

Article history:

Received 26 February 2022

Accepted 4 March 2022

Available online 4 April 2022

Keywords:

Acute ischemic stroke

Large vessel occlusion

Endovascular treatment

Mechanical thrombectomy

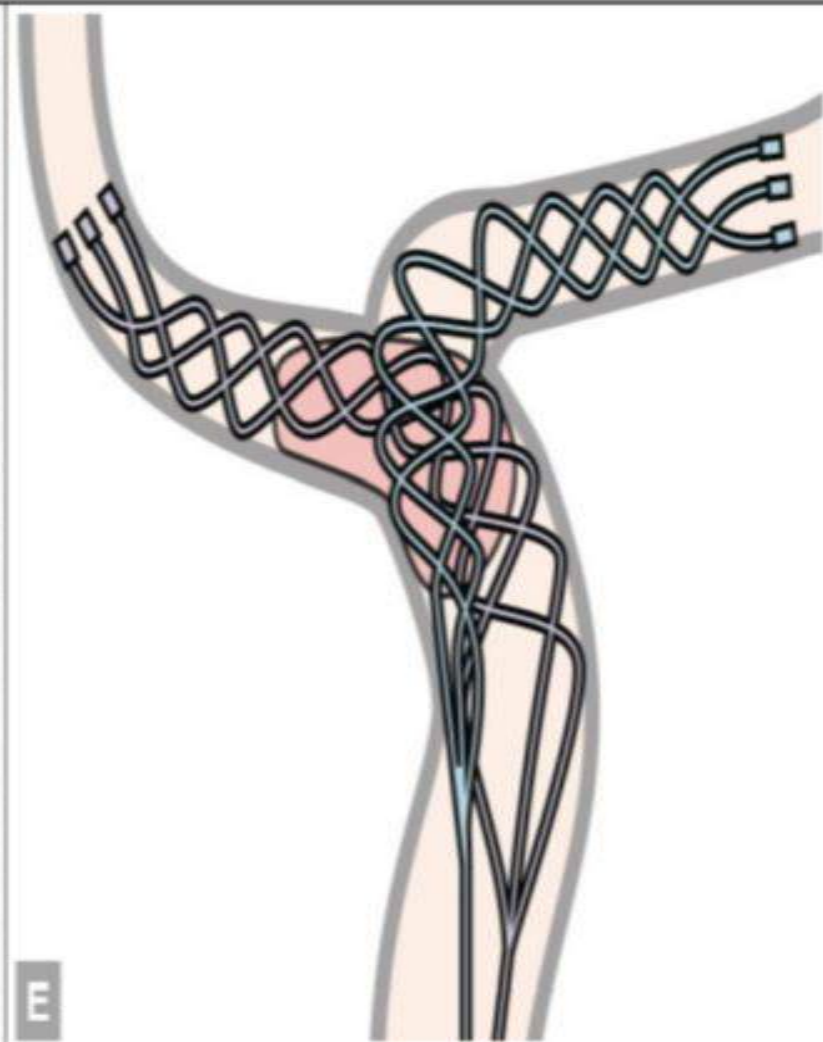
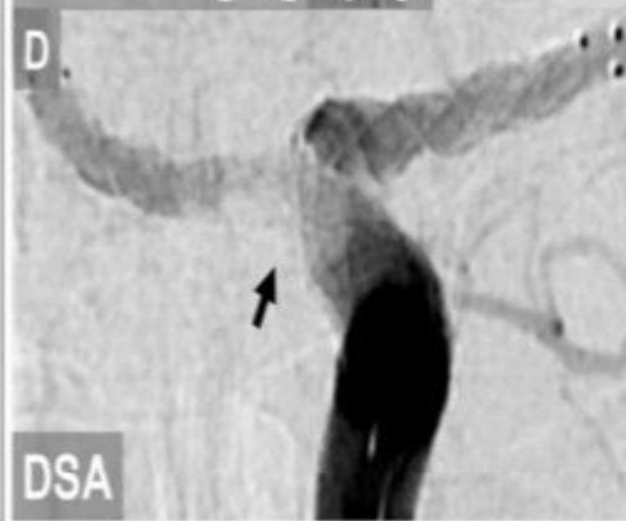
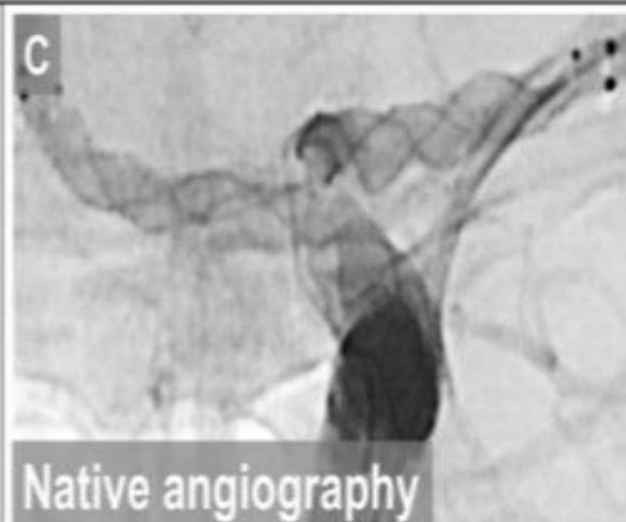
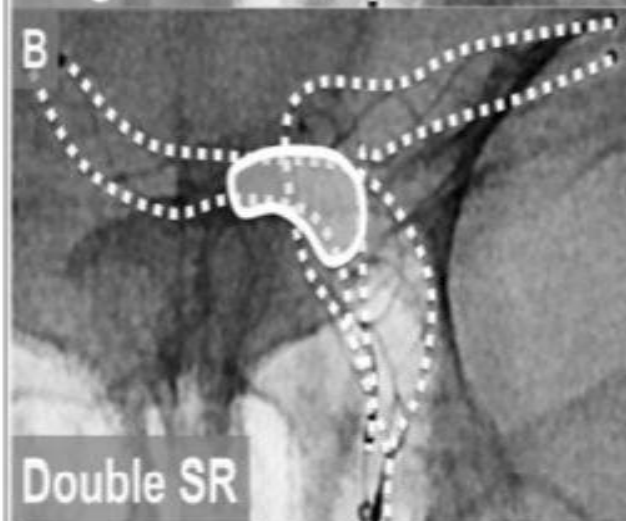
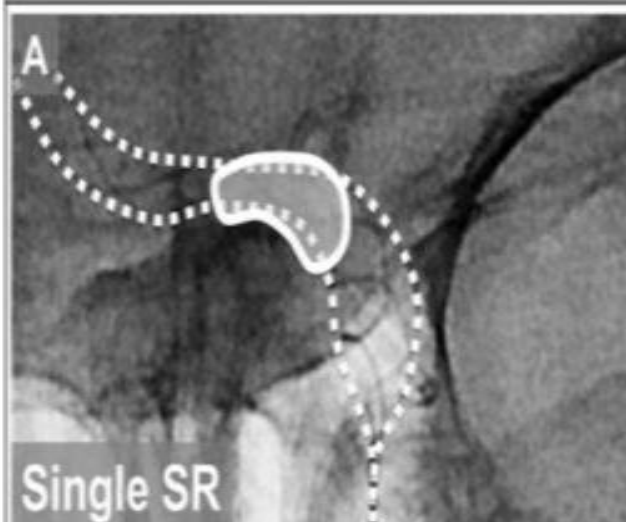
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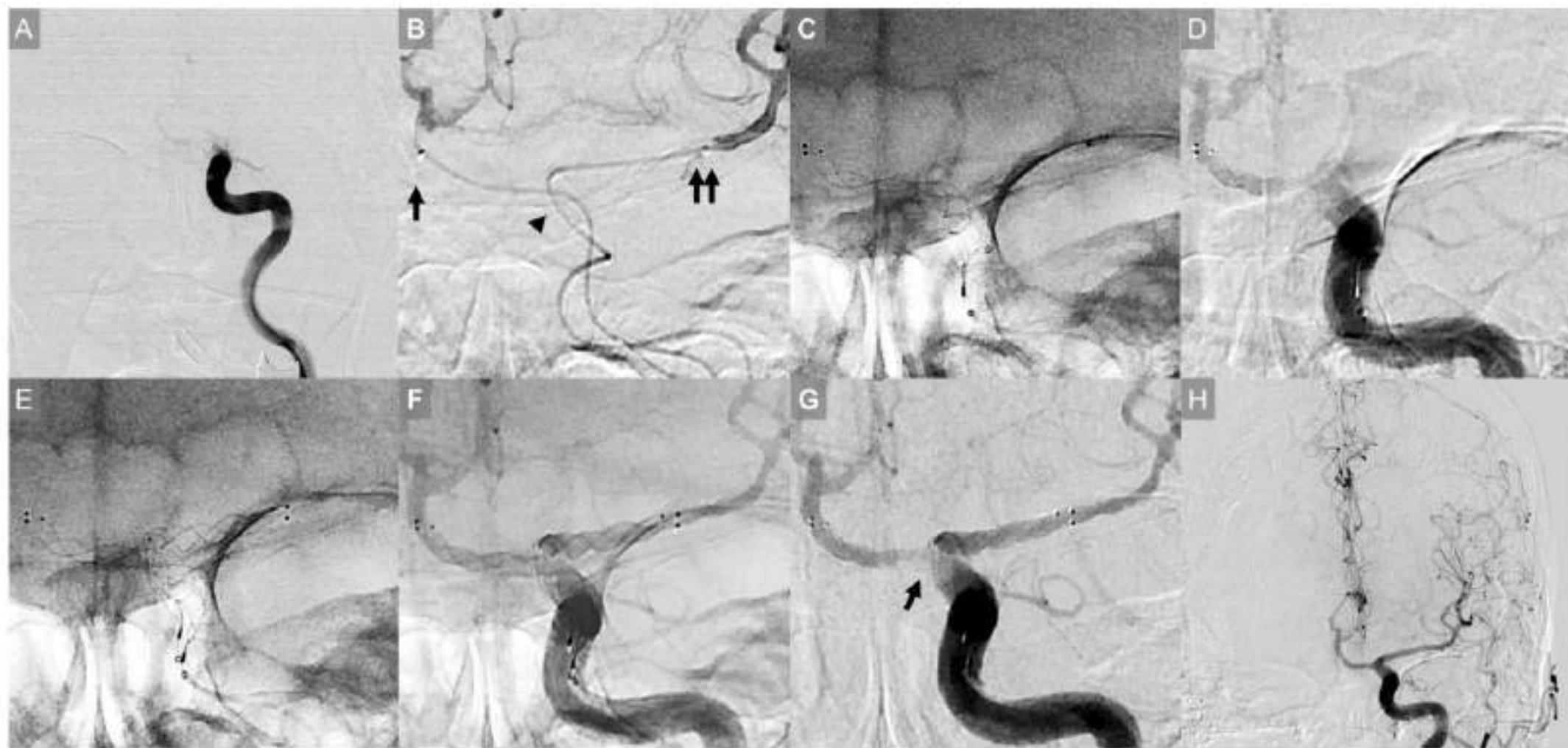
Device-clot-vessel interaction

ABSTRACT

Mechanical thrombectomy is highly effective for the recovery of acute ischemic stroke with large vessel occlusion. However, refractory occlusions are still encountered despite the use of currently available devices. In this article, we present a case of refractory terminal internal carotid artery occlusion treated with the “crossing double stent retriever technique.” Two thrombectomy procedures with the combined technique using a stent retriever and aspiration catheter failed to recanalize the terminal internal carotid artery occlusion that involved the dominant anterior cerebral artery. We then applied the crossing double stent retriever technique as a rescue technique. Two microcatheters were advanced across the occlusion: one to the anterior cerebral artery and the other to the middle cerebral artery. First, a Trevo NXT 4 mm stent retriever was deployed from the anterior cerebral artery. Next, an additional Trevo NXT 4 mm stent retriever was deployed from the middle cerebral artery, and full immediate restoration of flow was achieved on angiography. Intraprocedural radiological images showed that the 2 microcatheters traversed different pathways, and the 2 stent retrievers completely covered the entire vessel with apparent in-stent clot sign. Both stent retrievers were then pulled back together, and a hard clot was retrieved. Subsequent angiography revealed complete recanalization. The crossing double stent retriever technique seems an effective rescue technique for treating refractory terminal internal carotid artery

Crossing double SR technique





TROMBEKTOMİ VAKA ÖRNEKLERİ

75 yaşında bayan hasta

- Ani gelişen bilinç bulanıklığı
- Anlamsız konuşmalar
- Sağ hemiparezi
- 2.Saat
- NIHHS 18
- İV trombolitik verildi fayda olmayınca
- Aspect skoru 10





Asprasyon



TROMBEKTOMI



PIHTI



KONTROL GÖRÜNTÜ



TROMBEKTOMİ



TROMBEKTOMİ



KATETER ASPIRASYONU



SONUÇ GÖRÜNTÜ



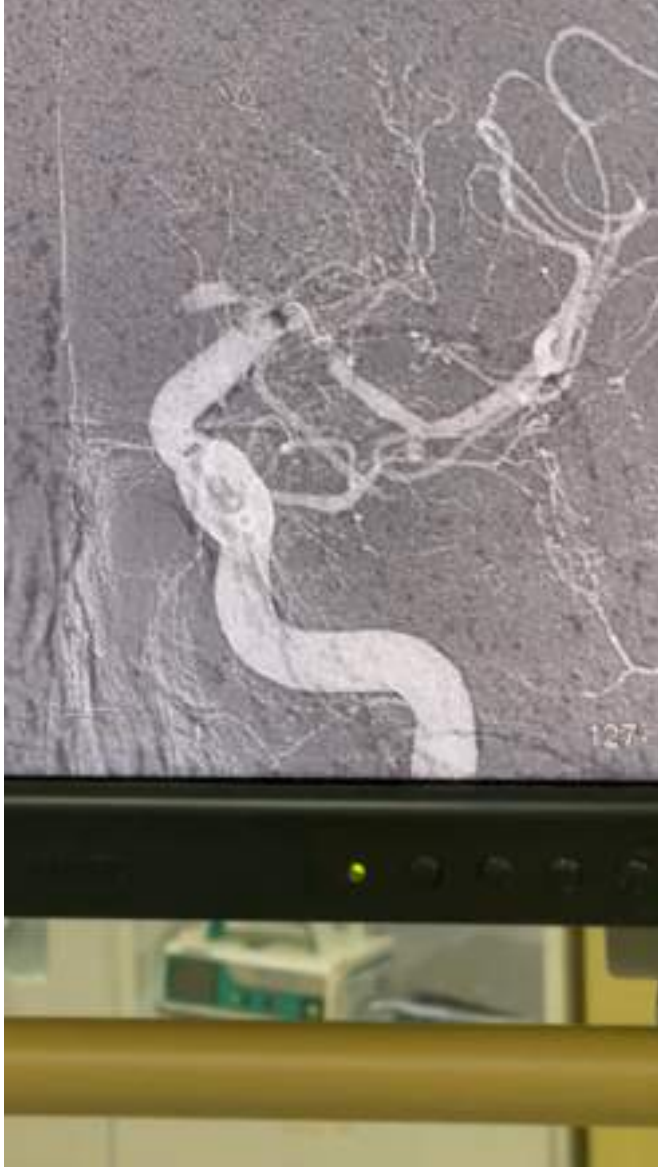
BIÇAKÇILAR



SONUÇ



ASPIRASYON



SONUÇ



TROMBEKTOMİ



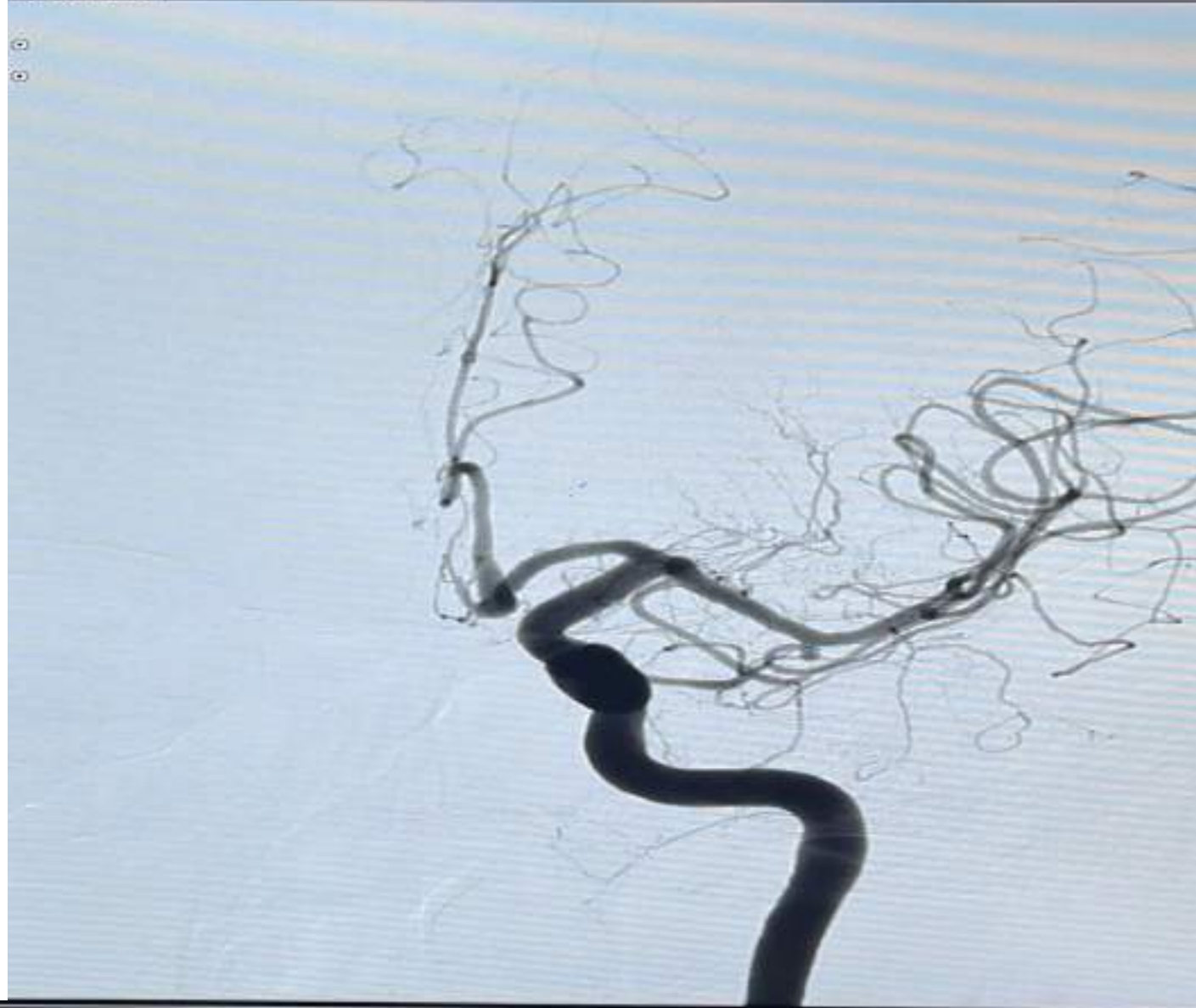
ASPIRASYON

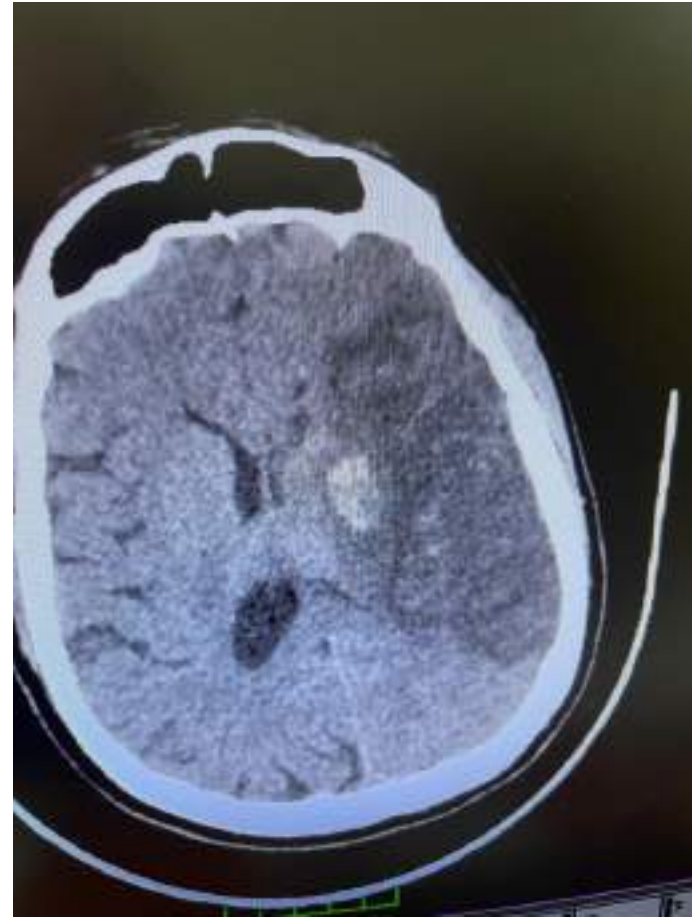




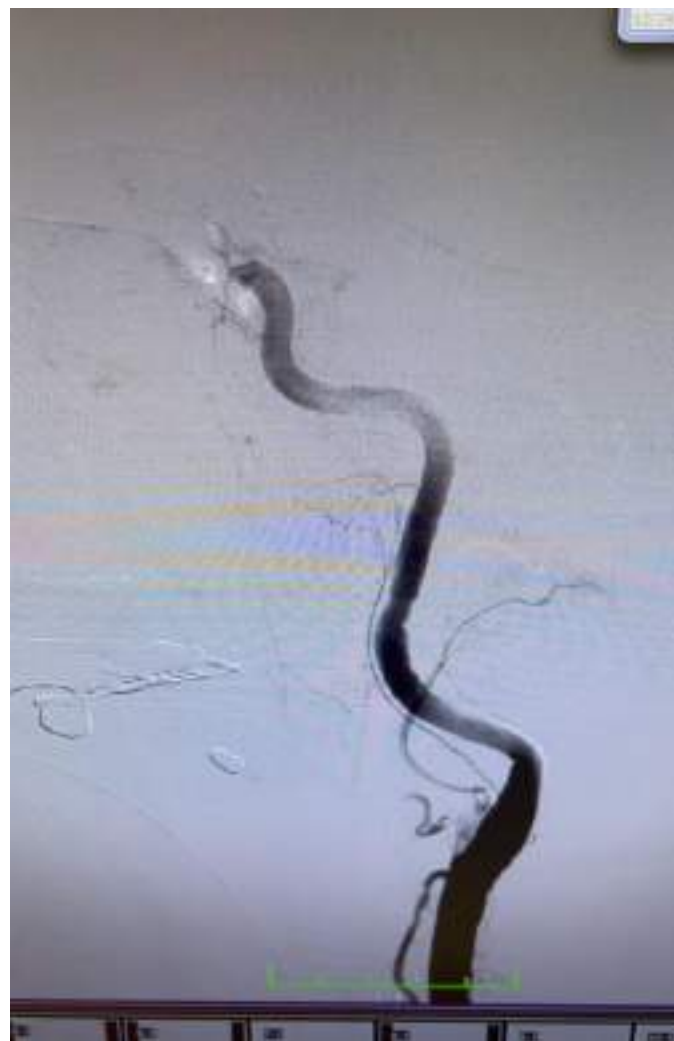


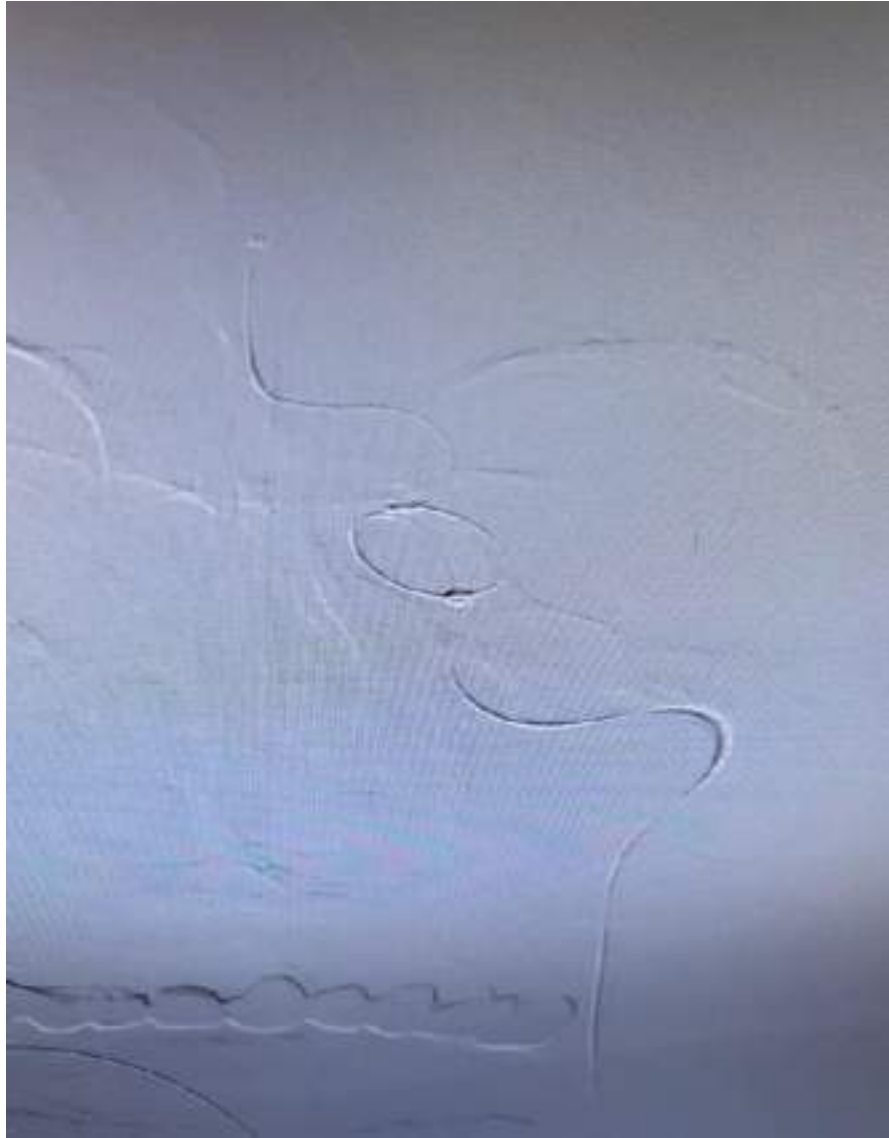
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- 57 yaş bayan
- Ht+
- Dm+
- 4. saat
- Aspect 10
- NIHSS 16
- Doğrudan DSA alındı

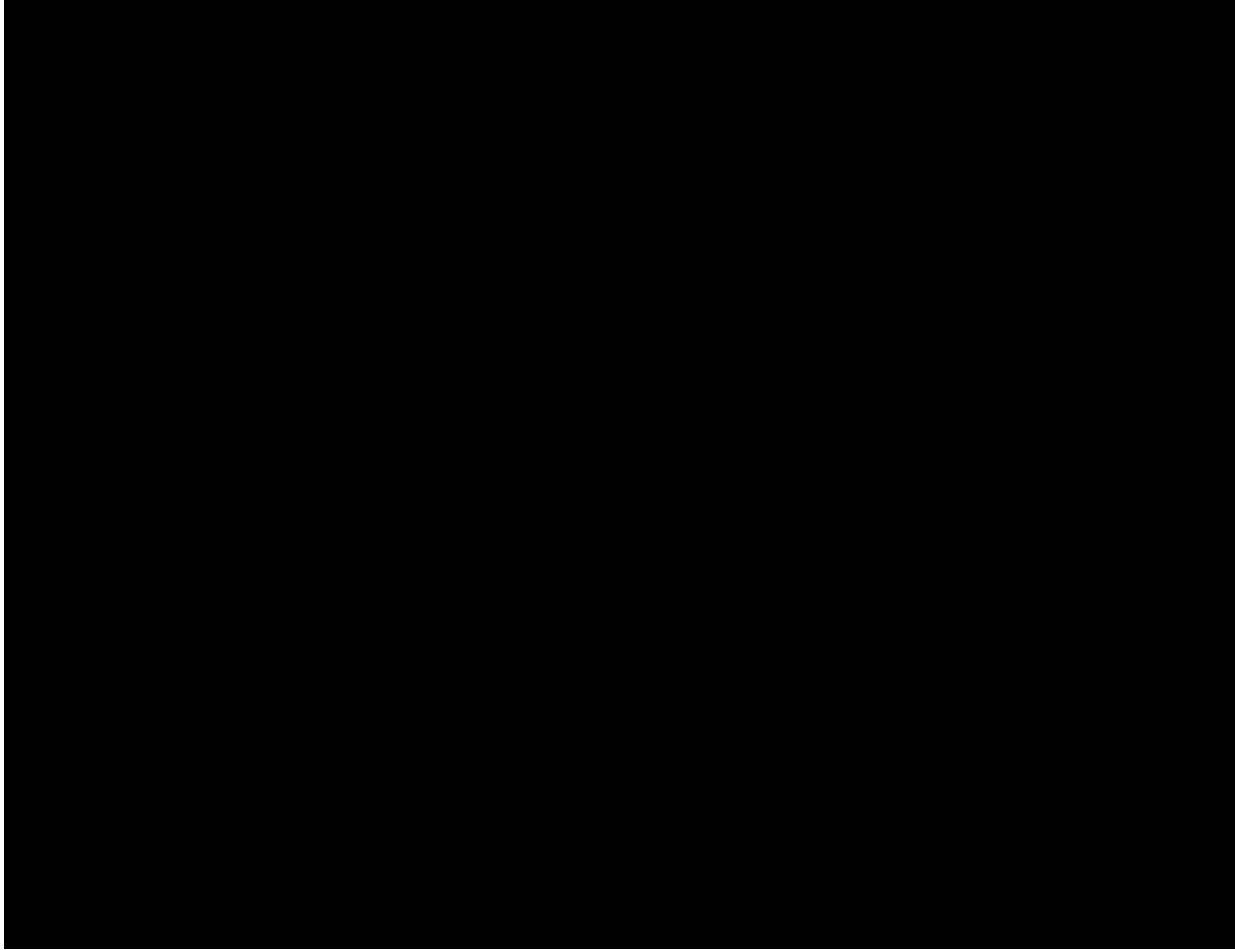




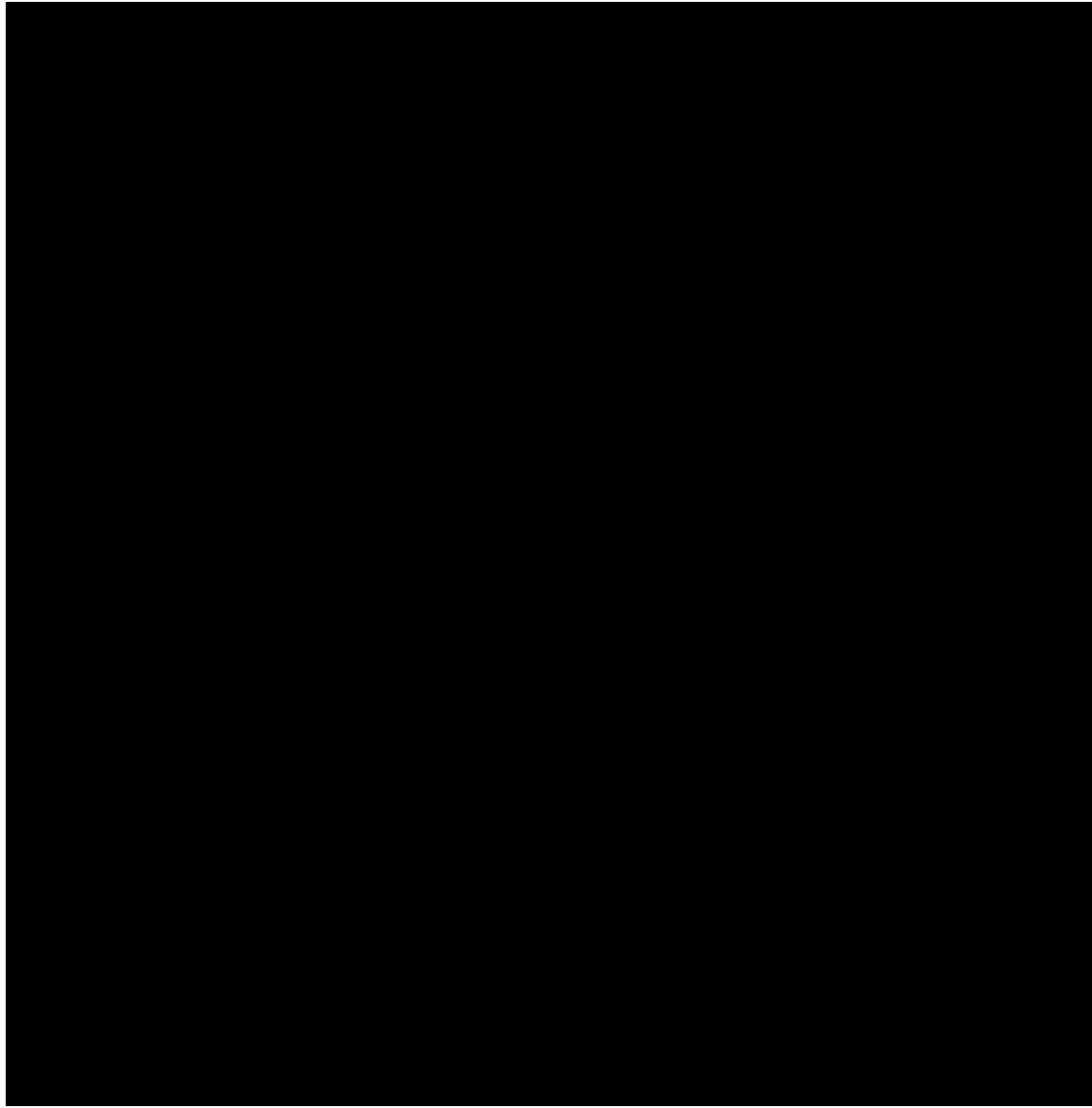








2ay sonra



6.Ay