Frontiers in Stroke Thrombectomy:
MeVo, Large Core, Low NIHSS, Etc.

1

Disclosures

National/International PI/Co-PI:

- INVEST (PI)
- COMPASS (Co-PI)
- THERAPY (PI)
- FEAT (PI)
- POSITIVE (Co-PI)
- PHIL (Co-PI)

Investor: Cerebrotech, Imperative Care, Endostream, Viseon, BlinkTBI, Serenity, Cardinal Consulting, NTI, RIST, Viz.ai, Synchron, Truvic

Consultant: Imperative Care, Cerebrotech, Viseon, Endostream, Vastrax, RIST, Synchron, Viz.ai, Perflow, Viz.ai, CVAid

2

Disclosures

I take stroke thrombectomy call

I believe in the power of thrombectomy

I believe we have an obligation to prove, not assume, benefit

I believe in StrokeNet

If we can apply the power of an efficient platform, such as StrokeNet, to the continued investigation of thrombectomy, we will learn much and doubtless save countless lives.

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Current State?

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Current State:

AHA/ASA Guideline

Guidelines for the Early Management of Patients With Acute Ischemic Stroke: 2019 Update to the 2018 Guidelines for the Early Management of Acute Ischemic Stroke

A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

Endorsed by the Society for Academic Emergency Medicine and The Neurocritical Care Society

Reviewed for evidence-based integrity and endorsed by the American Association of Neurological Surgeons and Congress of Neurological Surgeons.

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Current State:

Patients should receive mechanical thrombectomy with a stent retriever if they meet all the following criteria: (1) prestroke mRS score of 0 to 1; (2) causative occlusion of the internal carotid artery or MCA segment 1 (M1); (3) age ≥18 years; (4) NIHSS score of ≥6; (5) ASPECTS of ≥6; and (6) treatment can be initiated (groin puncture) within 6 hours of symptom onset.

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Direct aspiration thrombectomy as first-pass mechanical thrombectomy is recommended as noninferior to stent retriever for patients who meet all the following criteria: (1) prestroke mRS score of 0 to 1; (2) causative occlusion of the internal carotid artery or M1; (3) age ≥18 years; (4) NIHSS score of ≥6; (5) ASPECTS ≥6; and (6) treatment initiation (groin puncture) within 6 hours of symptom onset.

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8

Patients with Pre-Stroke Disability

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Patients with Pre-Stroke Disability

Mechanical Thrombectomy in Patients With Ischemic Stroke With Prestroke Disability

Sanjana Salwi, BA*; Shawna Cutting, MD*; Alan D. Salgado, MD; Kiersten Espaillat, DNP; Matthew R. Fusco, MD; Michael T. Froehler, MD, PhD; Rohan V. Chitale, MD; Howard Kirshner, MD; Matthew Schrag, MD, PhD; Adam Jasne, MD; Tina Burton, MD; Brian MacGrory, MB BCh, BAO, MRCP; Ali Saad, MD; Mahesh V. Jayaraman, MD; Tracy E. Madsen, MD, ScM; Katarina Dakay, DO; Ryan McTaggart, MD; Shadi Yaghi, MD; Pooja Khatri, MD, MSc; Akshitkumar M. Mistry, MD; Eva A. Mistry, MBBS

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Patients with Pre-Stroke Disability

Prospective observational study across 2 CSCs

761 mRS 0-3 patients
2 cohorts; mRS 0-1 v. mRS 2-3

Good outcome:
90-d mRS 0–1 or no worsening of prestroke mRS

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Patients with Pre-Stroke Disability

mRS 0-1: 36.7% versus 26.7%, p=0.008

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Multivariate Analysis: OR 0.90 [0.60–1.35], *P*=0.6
Propensity Score Matched: OR 1.16 [0.75– 1.8], *P*=0.49

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Higher Mortality in disabled patients 14% vs 40%, P<0.001

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Higher Mortality in disabled patients 14% vs 40%, P<0.001

34% of ant. circulation thrombectomy patients mRS 2-3

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Patients with Pre-Stroke Disability

Although its benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have prestroke mRS score >1, ASPECTS <6, or NIHSS score <6, and causative occlusion of the internal carotid artery (ICA) or proximal MCA (M1).

We need RCTs

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MeVo and other distal occlusions

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MeVo and other distal occlusions

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 E. 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*†

Distal Occlusions 24-40% of AIS

IV tPA fails to recanalize 1/3 to 1/2 of such occlusions

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MeVo and other distal occlusions

Endovascular Treatment of Middle Cerebral Artery M2 Occlusion Strokes: Clinical and Procedural Predictors of Outcomes

	Number of patients	NIHSS, median	TICI 2/b3 (%)	mRS 0-2 at 3 months (%)	Mortality at 3 months (%)
Current series	117	15	85	56	18
Dorn et al 2015[3]	15	13.7 ± 8.3 (mean)	93	60	7
Flores et al 2015[19]	65	16	79	60	16
Coutinho et al 2016[2]	50	13	85	60	12
Munich et al 2016[5]	52	16	77	Not reported	Not reported
Park et al 2016[23]	32	10	84	78	3
Kim et al 2016[25]	41	13	78	81	2

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Neurosurgery 81:795–802, 2017

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MeVo and other distal occlusions

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MeVo and other distal occlusions

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

Bijoy K Menon,[1] Michael D Hill,[2] Antoni Davalos,[3] Yvo B W E M Roos,[4] Bruce C V Campbell,[5,6] Diederik W J Dippel,[7] Francis Guillemin,[8,9] Jeffrey L Saver,[10] Aad van der Lugt,[11] Andrew M Demchuk,[12] Keith Muir,[13] Scott Brown,[14] Tudor Jovin,[15] Peter Mitchell,[16] Phil White,[17,18] Serge Bracard,[19] Mayank Goyal[20]

Menon BK, *et al. J NeuroIntervent Surg* 2019;**11**:1065–1069. doi:10.1136/neurintsurg-2018-014678

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MeVo and other distal occlusions

Endovascular treatment group, % (n/N)	Control group, % (n/N)	Unadjusted		Adjusted	
		Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value
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

Menon BK, *et al. J NeuroIntervent Surg* 2019;**11**:1065–1069. doi:10.1136/neurintsurg-2018-014678

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MeVo and other distal 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
Proximal M2 segment MCA (n=116)						
mRS 0–2	57.1% (36/63)	37.7% (20/53)	2.24 (1.04 to 4.81)	0.04	2.68 (1.13 to 6.37)	0.027
Dominant M2 segment MCA (n=73)						
mRS 0–2	61.5% (24/39)	44.1% (15/34)	1.91 (0.72 to 5.1)	0.198	4.08 (1.08 to 15.48)	0.042

Menon BK, *et al. J NeuroIntervent Surg* 2019;**11**:1065–1069. doi:10.1136/neurintsurg-2018-014678

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MeVo and other distal occlusions

Mechanical Thrombectomy in Distal Vessels: Revascularization Rates, Complications, and Functional Outcome

Ahmad Sweid[1], Jeffery Head[1], Stavropoula Tjoumakaris[1], Vivian Xu[1], Kavya Shivashankar[1], Tyler D. Alexander[1], Jaime A. Dougherty[1], Michael R. Gooch[1], Nabeel Herial[1], David Hasan[2], Maureen DePrince[1], Robert H. Rosenwasser[1], Pascal Jabbour[1]

WORLD NEUROSURGERY, https://doi.org/10.1016/j.wneu.2019.07.209

- Retrospective review (2010-2018)
- 76/453 (17%) patients had distal occlusion
  - M2 (89%), M3/4 (5%), A2 (3%), PCA (3%)
- Mean NIHSS 12
- TICI IIb/III achieved in 89% of patients
- Mortality 8%, mRS (0-2) at three months in 64.7%

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MeVo and other distal occlusions

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MeVo and other distal occlusions

Beyond Large Vessel Occlusion Strokes
Distal Occlusion Thrombectomy

Jonathan A. Grossberg, MD; Leticia C. Rebello, MD; Diogo C. Haussen, MD; Mehdi Bouslama, MD; Meredith Bowen, BA; Clara M. Barreira, MD; Samir R. Belagaje, MD; Michael R. Frankel, MD; Raul G. Nogueira, MD

Originally published 1 Jul 2018 | https://doi.org/10.1161/STROKEAHA.118.020567 | Stroke. 2018;49:1662–1668

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MeVo and other distal occlusions

Retrospective review

69 patients with distal thrombectomies

out of 949 patients in database

ACA, PCA, MCA opercular (M3) and beyond

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MeVo and other distal occlusions

42% received intravenous tPA
Median NIHSS 18
Distal occlusion primary location in 45 patients

23 patients - distal occlusion thrombectomy was a rescue strategy after successful proximal LVO

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MeVo and other distal occlusions

Location (primary distal)→45 patients
- MCA-M3 (n=21)
- ACA alone (n=8)
- ACA with concomitant MCA-M1/MCA-M2 (n=10)
- ACA with concomitant MCA-M3 (n=3)
- PCA (n=3)

Location (rescue)→23 patients
- MCA-M3 (n=11)
- ACA (n=7)
- PCA (n=4)
- MCA-M3 and ACA (n=1)

One patient had both primary and rescue
- ACA (primary) and MCA-M2 (proximal LVO) occlusions treated, followed by rescue MCA-M3 (distal) thrombectomy

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MeVo and other distal occlusions

TICI 2b/3 reperfusion (n=57, 83%)

Intraparenchymal hematoma (n=3, 4%)

No vessel perforations or extravasations

mRS 0-2 at 90d: 30%
Mortality: 20%

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MeVo and other distal occlusions

83 yo F with HTN, Afib and CHF presented with acute onset aphasia, L gaze deviation and R side weakness

NIHSS 17

Head CT ASPECTS 10

CTA suggesting distal L MCA M3/M4 occlusion

Patient out of window for IV thrombolytic therapy

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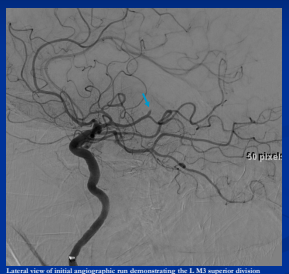
MeVo and other distal occlusions



Lateral view of initial angiographic run demonstrating the L M3 superior division occlusion (arrow).

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MeVo and other distal occlusions

Lateral roadmap view demonstrating navigation of 035 aspiration catheter into the M3 branch

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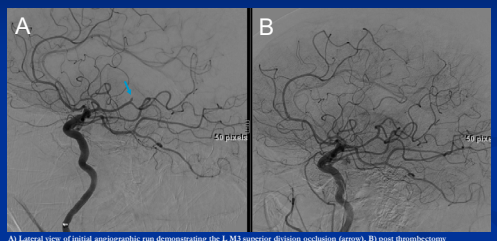
MeVo and other distal occlusions



A) Lateral view of initial angiographic run demonstrating the L M3 superior division occlusion (arrow). B) post thrombectomy angiographic run demonstrating recanalization of previously occluded L M3 branch for TICI2C.

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MeVo and other distal occlusions

Patient significant improved
- complete resolution of hemiplegia
- moderate residual expressive aphasia

NIHSS 3

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MeVo and other distal occlusions

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We need RCTs

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Thrombectomy in Children

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Thrombectomy in Children

Mechanical thrombectomy in pediatric stroke: systematic review, individual patient data meta-analysis, and case series

Kartik Bhatia, MBBS, PhD, FRANZCR,[1,2] Hans Kortman, MD,[1] Christopher Blair, MBBS, PhD,[3] Geoffrey Parker, BMBS, F
Timothy Ang, MBBS, FRACP,[2,3] John Worthington, MBBS, FRACP,[3]
Prakash Muthusami, MBBS, MD,[4] Hazem Shoirah, MD,[5] J Mocco, MD,[6] and Timo Krings, MD, PhD[1]

[1]Department of Neuroradiology, Toronto Western Hospital; [2]Department of Interventional Radiology, The Hospital for Sick Children, Toronto, Ontario, Canada; Departments of [3]Interventional Neuroradiology and [5]Neurology, Royal Prince Alfred Hospital, Camperdown, New South Wales, Australia; [4]Department of Neurosurgery, Icahn School of Medicine at Mount Sinai; and [6]Department of Neurosurgery, The Mount Sinai Health System, New York, New York

J Neurosurg Pediatr Volume 24 • November 2019

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Thrombectomy in Children

We need Registries

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Low NIHSS

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Epidemiology of minor Stroke

790K annual incidence of stroke in the US.

87% ischemic.

35-50% of acute ischemic stroke are minor stroke symptoms (MSS).

Mozaffarian D, Benjamin EJ, Go AS, Arnett DK, Blaha MJ, Cushman M, et al. Heart disease and stroke statistics--2015 update: a report from the American Heart Association. Circulation. 2015 Jan;131(4):e29–322.
Zhu W, Churilov L, Campbell BCV, Lin M, Liu X, Davis SM, et al. Does Large Vessel Occlusion Affect Clinical Outcome in Stroke with Mild Neurologic Deficits after Intravenous Thrombolysis? Journal of Stroke and Cerebrovascular Diseases. 2014 Nov;23(10):2888–93.
Nedeltchev K, Schwegler B, Haefeli T, Brekenfeld C, Gralla J, Fischer U, et al. Outcome of Stroke With Mild or Rapidly Improving Symptoms. Stroke. 2007 Aug 27;38(9):2531–5.

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Natural history of minor stroke

23.5% of MSS with unfavorable outcome.

Early neurological deterioration is common.

Nedeltchev K, Schwegler B, Haefeli T, Brekenfeld C, Gralla J, Fischer U, et al. Outcome of Stroke With Mild or Rapidly Improving Symptoms. Stroke. 2007 Aug 27;38(9):2531–5.
Kim J-T, Heo S-H, Yoon W, Choi K-H, Park M-S, Saver JL, et al. Clinical outcomes of patients with acute minor stroke receiving rescue IA therapy following early neurological deterioration. Journal of NeuroInterventional Surgery. 2016 Apr 14;8(5):461–5.

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Early Neurological Deterioration

Early neurological deterioration (END): 23-41%

Associated with worse outcome - up to 60% poor outcome

LVO increases the risk of END (OR 2.2) and is present in 44% of patients with END.

Occurs within 5-16 h of presentation.

Kim J-T, Heo S-H, Yoon W, Choi K-H, Park M-S, Saver JL, et al. Clinical outcomes of patients with acute minor stroke receiving rescue IA therapy following early neurological deterioration. Journal of NeuroInterventional Surgery. 2016 Apr 14;8(5):461–5.
Kim J-T, Park M-S, Chang J, Lee JS, Choi K-H, Cho K-H. Proximal Arterial Occlusion in Acute Ischemic Stroke with Low NIHSS Scores Should Not Be Considered as Mild Stroke. Baron J-C, editor. PLoS ONE. Public Library of Science; 2013 Aug 16;8(8):e70996.

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Epidemiology of LVO in Minor stroke

Up to 70% of patients with MSS, do not undergo vessel imaging.

Annual incidence of MSS-LVO is ~70K per year.

Kim J-T, Heo S-H, Yoon W, Choi K-H, Park M-S, Saver JL, et al. Clinical outcomes of patients with acute minor stroke receiving rescue IA therapy following early neurological deterioration. Journal of NeuroInterventional Surgery. 2016 Apr 14;8(5):461–5.

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Natural History of MSS-LVO

MSS-LVO - 7.13 odds of poor outcome (CI 1.1–45.5, p <0.038)

- compared to MSS without LVO.

Untreated MSS-LVO - 32-45% poor outcome.

6% mortality

Heldner MR, Jung S, Zubler C, Mordasini P, Weck A, Mono ML, et al. Outcome of patients with occlusions of the internal carotid artery or the main stem of the middle cerebral artery with NIHSS score of less than 5: comparison between thrombolysed and non-thrombolysed patients. Journal of Neurology, Neurosurgery & Psychiatry. 2015 Jun 12;86(7):755–60.

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IAT for MSS-LVO

3 of the 5 HERMES trials excluded MS-LVO
(ESCAPE, REVASCAT ≥ 6 and SWIFT PRIME ≥ 8)

Our knowledge and experience is therefore limited

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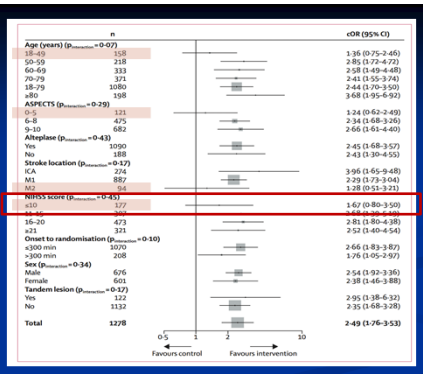

Non-significant impact on outcome for NIHSS <10 in the HERMES trials OR 1·67 (0·80–3·50)

Goyal M, Menon BK, van Zwam WH, Dippel DWJ, Mitchell PJ, Demchuk AM, et al. Endovascular thrombectomy after large-vessel ischaemic stroke: a meta-analysis of individual patient data from five randomised trials. Lancet. 2016 Apr 23;387(10029):1723–31.

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Data for MSS-LVO

Series		Bowen et al, 2017	Dargazanli et al, 2017	Pfaff et al, 2016
n		72	138	33
Design		Retrospective, single center, single arm	Retrospective, single arm, Matched control analysis	Retrospective, single arm
Outcome	Recanalization	93%	81.2%	78.7%
	Other			
	Favorable Outcome	72%	78.3%	63.6%
Complication		6% ICH, 10% 90 day mortality	5.1% mortality	15.1% occult SAH 6.1% mortality
Conclusion		Successful reperfussion independent predictor of good outcome	Successful recanalization associated with better outcome OR 3.09 (CI 1.06-9.03).	

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Data for MSS-LVO

Series		Haussen et al, 2016	Kim et al, 2016	Heldner et al, 2015	Urra et al, 2014
n		32	92	88	78
Design		Non-randomized, case-control (10 IAT)	Non-randomized, case-control for MSS-LVO + END (21 IAT)	Non-randomized case-control (41 thrombolysis)	Non-randomized case-control (41 thrombolysis)
Outcome	Recanalization	100%		78.9% vs 10.5%	91.2 vs 63.4%
	Other		Improvement in NIHSS shift 5 vs 8 (p 0.004)		
	Favorable Outcome	No difference	52.4 vs 22.5%	85 vs 66.7%	No difference, trend for better with medical
Complication		0%	No difference	4.9% sICH	sICH in 11.8%
Conclusion		No difference in outcome	IAT with better outcome	IAT with better outcome	No difference, trend for better outcome with medical

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Data for MSS-LVO

Series		Sarraj et al - 2018 (Stroke)		
n		124 EVT	90 Medical	
Design		Retrospective cohort followed by propensity matching		
Baseline ece		Matched		
Outcome	mRS 0-1	55.7%	54.4%	P = 0.47
	mRS 0-2	63.3%	67.8%	P = 0.77
	Propensity matching	53.3%	48.4%	P = 0.69
Safety (sICH)		5.8%	0%	P = 0.02
Conclusion		No improvement in outcome, with higher rate of symptomatic ICH in EVT		

Sarraj A, Hassan A, Savitz SI, Grotta JC, Cai C, Parsha KN, et al. Endovascular Thrombectomy for Mild Strokes: How Low Should We Go? Stroke. 2018 Oct:49(10):2398–405.

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Data for MSS-LVO

Proximal (ICAT + M1) occlusions

Dichotomized outcome:
53% EVT vs 30% Medical Management
OR 2.68; 95% CI 0.98-7.32

Distal (M2-M4 + ACA) occlusions

No Difference

Sarraj A, Hassan A, Savitz SI, Grotta JC, Cai C, Parsha KN, et al. Endovascular Thrombectomy for Mild Strokes: How Low Should We Go? Stroke. 2018 Oct;49(10):2398–405.

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Data for MSS-LVO

Series	Messer et al - 2017 (AJNR)		
n	8 immediate EVT	6 delayed EVT	40 Medical
Design	Retrospective		
Baseline ecc	Prospectively collected concurrent medical treatment		
Outcome mRS 0-1	75%	33%	55%
Safety (sICH)	0%	0%	0%
Conclusion	Promising signal		

Messer MP, Schoenenberger S, Mohlenbruch MA, Pfaff J, Herweh C, Ringleb PA, Nagel S. AJNR 2017

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Low NIHSS

JAMA Neurology | Original Investigation

Medical Management vs Mechanical Thrombectomy for Mild Strokes
An International Multicenter Study and Systematic Review and Meta-analysis

Nitin Goyal, MD; Georgios Tsivgoulis, MD; Konark Malhotra, MD; Muhammad F. Ishfaq, MD; Abhi Pandhi, MD; Michael T. Frohler, MD; Alejandro M. Spiotta, MD; Mohammad Anadani, MD; Marios Psychogios, MD; Volker Maus, MD; Adnan Siddiqui, MD; Muhammad Waqas, MD; Peter D. Schellinger, MD; Marcel Groen, MD; Christos Krogias, MD; Daniel Richter, MD; Maher Saqqur, MD; Pablo Garcia-Bermejo, MD; Maxim Mokin, MD; Ronen Leker, MD; Jose E. Cohen, MD; Aristeidis H. Katsanos, MD; Georgios Magoufis, MD; Klearchos Psychogios, MD; Vasileios Lioutas, MD; Meg VanNostrand, MD; Vijay K. Sharma, MD; Maurizio Paciaroni, MD; Alexandros Rentzos, MD; Hazem Shoirah, MD; J. Mocco, MD; Christopher Nickele, MD; Violiza Inoa, MD; Daniel Hoit, MD, MPH; Lucas Eljovich, MD; Andrei V. Alexandrov, MD; Adam S. Arthur, MD, MPH

251 patients (138 ST v. 113 MM)

No benefit in outcome

JAMA Neurol. 2020;77(1):16-24.

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Predictors of poor outcome

Clinical fluctuation: Baseline of NIHSS >10 had 16.9 fold risk of poor outcome (CI 1.8–159.5, p 0.013).

Rescue intervention: good outcome achieved in 33% of delayed (rescue) IAT vs 75% of early IAT.

Nedeltchev K, Schwegler B, Haefeli T, Brekenfeld C, Gralla J, Fischer U, et al. Outcome of Stroke With Mild or Rapidly Improving Symptoms. Stroke. 2007 Aug 27;38(9):2531–5.
Messer MP, Schönenberger S, Möhlenbruch MA, Pfaff J, Herweh C, Ringleb PA, et al. Minor Stroke Syndromes in Large-Vessel Occlusions: Mechanical Thrombectomy or Thrombolysis Only? American Journal of Neuroradiology. 2017 Apr 13.

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Low NIHSS

END is associated with poor outcome

IAT protects against END

Early IAT is better than rescue IAT

But IAT is not without risks (up to 12% sICH)

Better way of identifying and selecting patients at risk of END

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Low NIHSS

can we identify the

40%

of the patients that are likely to have collateral failure

and treat them

EARLY?

59

Low NIHSS

can we identify the

40%

of the patients that are likely to have collateral failure

and treat them

EARLY?

Or do the numbers demonstrate enough safety to justify treating

ALL MSS-LVO?

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ORIGINAL RESEARCH
INTERVENTIONAL

Mechanical Thrombectomy in Patients with Acute Ischemic Stroke and Lower NIHSS Scores: Recanalization Rates, Periprocedural Complications, and Clinical Outcome

J. Pfaff, C. Herweh, M. Pham, S. Schönenberger, S. Nagel, P.A. Ringleb, M. Bendszus, and M. Möhlenbruch

AJNR 2016

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33 pts NIHSS < 8

Median post procedure NIHSS 5

Recanalization of TICI 2b or 3 achieved in 79%

6% symptomatic ICH

mRS 0-2 63%

mRS 0-3 in 91%

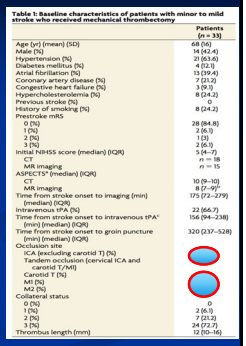

Table 1: Baseline characteristics of patients with minor to mild stroke who received mechanical thrombectomy

	Patients (n = 33)
Age (yr) (mean) (SD)	68 (16)
Male (%)	14 (42.4)
Hypertension (%)	21 (63.6)
Diabetes mellitus (%)	4 (12.1)
Atrial fibrillation (%)	13 (39.4)
Coronary artery disease (%)	7 (21.2)
Congestive heart failure (%)	3 (9.1)
Hypercholesterolemia (%)	8 (24.2)
Previous stroke (%)	0
History of smoking (%)	8 (24.2)
Prestroke mRS	
0 (%)	28 (84.8)
1 (%)	2 (6.1)
2 (%)	1 (3)
3 (%)	2 (6.1)
Initial NIHSS score (median) (IQR)	5 (4–7)
CT	*n* = 18
MR imaging	*n* = 15
ASPECTS* (median) (IQR)	
CT	10 (9–10)
MR imaging	8 (7–9)†
Time from stroke onset to imaging (min) (median) (IQR)	175 (72–279)
Intravenous tPA (%)	22 (66.7)
Time from stroke onset to intravenous tPA‡ (min) (median) (IQR)	156 (94–238)
Time from stroke onset to groin puncture (min) (median) (IQR)	320 (237–528)
Occlusion site	
ICA (excluding carotid T) (%)	
Tandem occlusion (cervical ICA and carotid T/MI)	
Carotid T (%)	
M1 (%)	
M2 (%)	
Collateral status	
0 (%)	0
1 (%)	2 (6.1)
2 (%)	7 (21.2)
3 (%)	24 (72.7)
Thrombus length (mm)	12 (10–16)

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Low NIHSS

Although its benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have prestroke mRS score >1, ASPECTS <6, or NIHSS score <6, and causative occlusion of the internal carotid artery (ICA) or proximal MCA (M1).

We need RCTs

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Large Core

Patients should receive mechanical thrombectomy [redacted] if they meet all the following criteria: (1) prestroke mRS score of 0 to 1; (2) causative occlusion of the internal carotid artery or MCA segment 1 (M1); (3) age ≥18 years; (4) NIHSS score of ≥6; (5) ASPECTS of ≥6; and (6) treatment can be initiated (groin puncture) within 6 hours of symptom onset.

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Favorable revascularization therapy in patients with ASPECTS ≤ 5 on DWI in anterior circulation stroke

Isabelle Mourand,[1] Eitan Abergel,[2] Daniel Mantilla,[3] Xavier Ayrignac,[1] Tzvika Sacagiu,[3] Omer Faruk Eker,[4] Gregory Gascou,[1] Cyril Dargazanli,[1] Carlos Riquelme,[1] Marinette Moynier,[4] Alain Bonafé,[1] Caroline Arquizan,[1] Vincent Costalat[1]

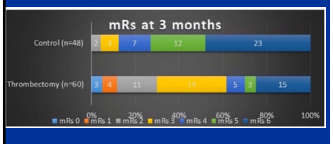

Table 1 Baseline characteristics of the thrombectomy group (n=60) and the control group (n=48)

Baseline characteristics	Thrombectomy (n=60)	Control (n=48)
Median age (IQR)	66 (22–86)	67 (41–87)
Male, n (%)	40 (66.7%)	30 (62.5%)
Female, n (%)	20 (33.3%)	18 (37.5%)
Hypertension, n (%)	28 (46.7%)	23 (47.9%)
Dyslipidemia, n (%)	19 (31.7%)	15 (31.3%)
Diabetes, n (%)	11 (18.3%)	9 (18.8%)
Previous CVA, n (%)	22 (36.7%)	16 (33.3%)
Initial median NIHSS (IQR)	20 (9–28)	22 (5–40)
Median ASPECTS (IQR)	5 (2–5)	3 (0–5)
Occluded artery, n (%)		
MCA M1	34 (56.7%)	27 (56.3%)
MCA distal	5 (8.3%)	3 (6.3%)
Tandem	13 (21.7%)	9 (18.8%)
T carotid	8 (13.3%)	9 (18.8%)
Median delay, min (IQR)		
Symptoms, onset to admission	140 (10–380)	171 (37–642)
Symptoms, onset to MRI	164 (20–392)	172 (58-667)
Symptoms, onset to recanalization	327 (153–514)	NA
MRI to recanalization	132 (55–382)	NA

Mourand I, *et al. J NeuroIntervent Surg* 2018;**10**:5–9. doi:10.1136/neurintsurg-2017-013358

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Table 2 Outcomes of the thrombectomy group (n=60) and the control group (n=48)

Outcomes	Thrombectomy (n=60)	Control (n=48)
Successful recanalization, n (%)	45 (75%)	NA
Clinical outcome at 90 days, n (%)		
mRS ≤2	18 (30%)	1 (2.1%)
sICH	3 (5%)	3 (6.3%)
Malignant Infarction	5 (8.3%)	9 (18.8%)
Hemicraniectomy	2 (3.3%)	11 (22.9%)
Mortality	15 (25%)	23 (47.9%)

Mourand I, *et al. J NeuroIntervent Surg* 2018;**10**:5–9. doi:10.1136/neurintsurg-2017-013358

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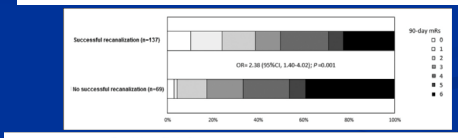
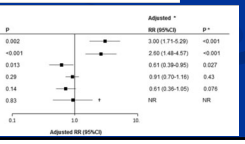
Successful Reperfusion With Mechanical Thrombectomy Is Associated With Reduced Disability and Mortality in Patients With Pretreatment Diffusion-Weighted Imaging–Alberta Stroke Program Early Computed Tomography Score ≤6

Jean-Philippe Desilles, MD; Arturo Consoli, MD; Hocine Redjem, MD; Oguzhan Coskun, MD; Gabriele Ciccio, MD; Stanislas Smajda, MD; Julien Labreuche, MST; Cristian Preda, PhD; Clara Ruiz Guerrero, MD; Jean-Pierre Decroix, MD; Georges Rodesch, MD, PhD; Mikael Mazighi, MD, PhD; Raphaël Blanc, MD; Michel Piotin, MD, PhD; Bertrand Lapergue, MD, PhD; on behalf of the ETIS (Endovascular Treatment in Ischemic Stroke) Research Investigators*



Outcomes	Successful recanalization Status: No. event/N (%)	Yes, event/N (%)	Unadjusted: RR (95%CI)	P	Adjusted *: RR (95%CI)	P *
Favorable outcome	12/69 (17.4)	53/137 (38.7)	2.22 (1.27-3.88)	0.002	3.00 (1.71-5.29)	<0.001
Early neurological improvement	12/66 (18.1)	58/127 (45.7)	2.51 (1.46-4.34)	<0.001	2.60 (1.48-4.57)	<0.001
90-day mortality	27/69 (39.1)	31/137 (22.6)	0.58 (0.38-0.89)	0.013	0.61 (0.39-0.95)	0.027
Any ICH	44/71 (62.0)	75/138 (54.4)	0.88 (0.69-1.11)	0.29	0.91 (0.70-1.16)	0.43
PH	18/71 (25.4)	23/138 (16.7)	0.66 (0.38-1.14)	0.14	0.61 (0.36-1.05)	0.076
Symptomatic ICH	10/71 (14.1)	18/138 (13.0)	0.93 (0.45-1.90)	0.83	NR	NR



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Acute Stroke With Large Ischemic Core Treated by Thrombectomy

Predictors of Good Outcome and Mortality

Pietro Panni, MD; Benjamin Gory, MD, PhD; Yu Xie, MD, PhD; Arturo Consoli, MD; Jean-Philippe Desilles, MD, PhD; Mikael Mazighi, MD, PhD; Julien Labreuche, BST; Michel Piotin, MD, PhD; Francis Turjman, MD, PhD; Omer Faruk Eker, MD, PhD; Serge Bracard, MD; René Anxionnat, MD, PhD; Sébastien Richard, MD, PhD; Gabriela Hossu, PhD; Raphael Blanc, MD, MSc; Bertrand Lapergue, MD, PhD; on behalf of the ETIS (Endovascular Treatment in Ischemic Stroke) Investigators*

Successful Recanalization strongly predicted outcome
adj OR 4.56 [1.79–11.62]; *P*=0.001

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JAMA Neurology | Original Investigation

Outcomes of Endovascular Thrombectomy vs Medical Management Alone in Patients With Large Ischemic Cores
A Secondary Analysis of the Optimizing Patient's Selection for Endovascular Treatment in Acute Ischemic Stroke (SELECT) Study

Amrou Sarraj, MD; Ameer E. Hassan, DO; Sean Savitz, MD; Clark Sitton, MD; James Grotta, MD; Peng Chen, MD; Chunyan Cai, PhD; Gary Cutter, PhD; Bita Imam, PhD; Sujan Reddy, MD; Kaushik Parsha, MD; Deep Pujara, MD; Roy Riascos, MD; Nirav Vora, MD; Michael Abraham, MD; Haris Kamal, MD; Diogo C. Haussen, MD; Andrew D. Barreto, MD; Maarten Lansberg, MD; Rishi Gupta, MD; Gregory W. Albers, MD

105 patients with large core

mRS 0-2: 31% EVT v 14% MM OR 3.27 [1.11-9.92], p=0.03

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JAMA Neurology | Original Investigation

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105 patients with large core

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RCTs are needed

70

Large Core

Triage imaging and outcome measures for large core stroke thrombectomy – a systematic review and meta-analysis

Amrou Sarraj,[1] James C Grotta,[2] Deep Kiritbhai Pujara,[1] Faris Shaker ,[1] Georgios Tsivgoulis[3,4]

Pooled Random Effect Meta-analysis of 12 studies
mRS 0-2: 25% v 7% OR 4.39 [2.53, 7.64], p<0.00001
Mortality: 23% v 33% OR 0.53 [0.40, 0.71], p<0.0001
sICH: 9% v 5% OR 1.68 [0.92, 3.09], p<0.09

Sarraj A, *et al. J NeuroIntervent Surg* 2020;**12**:1172–1179. doi:10.1136/neurintsurg-2019-015509

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Large Core

Triage imaging and outcome measures for large core stroke thrombectomy – a systematic review and meta-analysis

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RCTs are needed

Sarraj A, *et al. J NeuroIntervent Surg* 2020;**12**:1172–1179. doi:10.1136/neurintsurg-2019-015509

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Large Core

Although its benefits are uncertain, the use of mechanical thrombectomy with stent retrievers may be reasonable for patients with AIS in whom treatment can be initiated (groin puncture) within 6 hours of symptom onset and who have prestroke mRS score >1, ASPECTS <6, or NIHSS score <6, and causative occlusion of the internal carotid artery (ICA) or proximal MCA (M1).

RCTs are needed

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Thank You

Mount Sinai

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Natural History of MSS-LVO

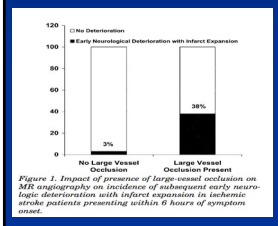

Figure 1. Impact of presence of large-vessel occlusion on MR angiography on incidence of subsequent early neurologic deterioration with infarct expansion in ischemic stroke patients presenting within 6 hours of symptom onset.

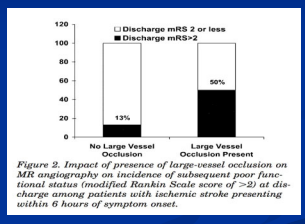

Figure 2. Impact of presence of large-vessel occlusion on MR angiography on incidence of subsequent poor functional status (modified Rankin Scale score of >2) at discharge among patients with ischemic stroke presenting within 6 hours of symptom onset.

CME **Early MRI and outcomes of untreated patients with mild or improving ischemic stroke**

V. Rajajee, MD; C. Kidwell, MD; S. Starkman, MD; B. Ovbiagele, MD; J.R. Alger, PhD; P. Villablanca, MD; F. Vinuela, MD; G. Duckwiler, MD; R. Jahan, MD; A. Fredieu, MD; S. Suzuki, MD; and J.L. Saver, MD

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