Stroke Thrombectomy: Current Indications and Results

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Surgical Co-Director Comprehensive Stroke Center

Beth Israel Deaconess Medical Center

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HARVARD MEDICAL SCHOOL TEACHING HOSPITAL

Disclosures:

Consultant:

Medtronic

Stryker

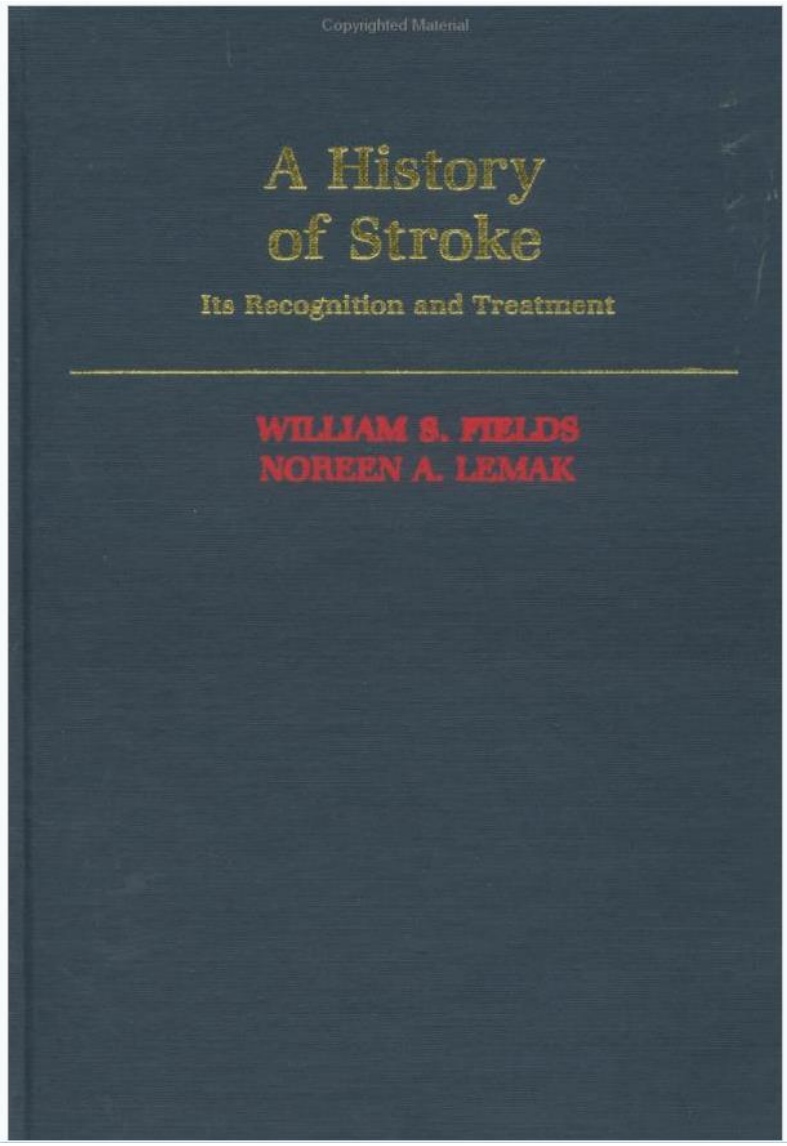
Cerenovus

Avail

Pipeline proctor > 100 cases

Major Challenges

- Less than 10% of stroke victims receive treatment
- Challenges include:
  - public awareness,
  - emergency medical services
  - access to medical care and equipment
- Slow progress in scientific achievements and treatments



CONTENTS

History of Treatment Options

- Historically, stroke treatment centered on rehabilitation and later on prevention
- Only since 1990s systematic studies and efforts aimed at revascularization and 'clot-busting'
- Since 1990s i.v. tPA has become standard of care and aim of stroke treatment from rehab to revascularization

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J. H. Olsen and Others
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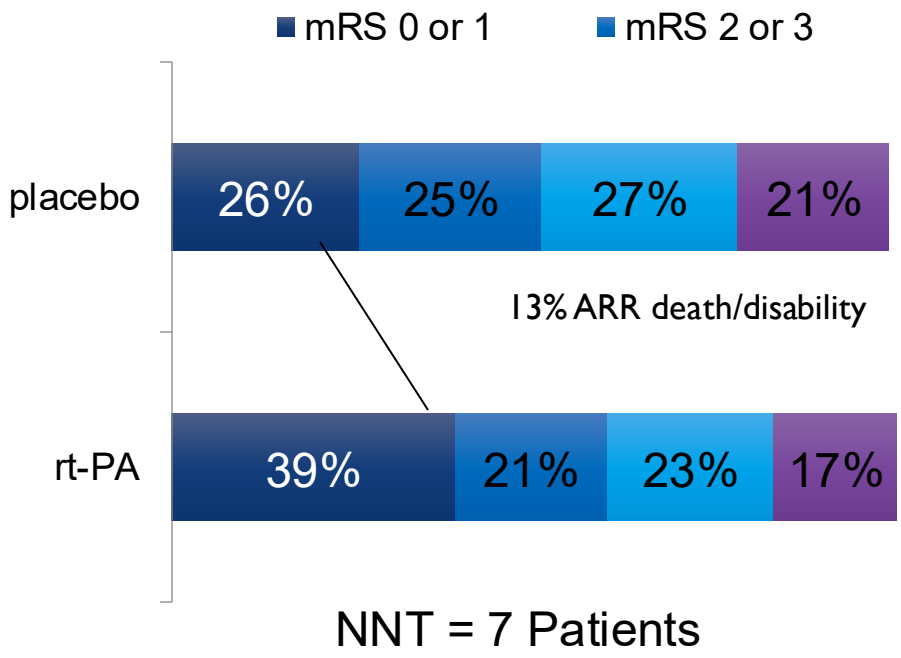
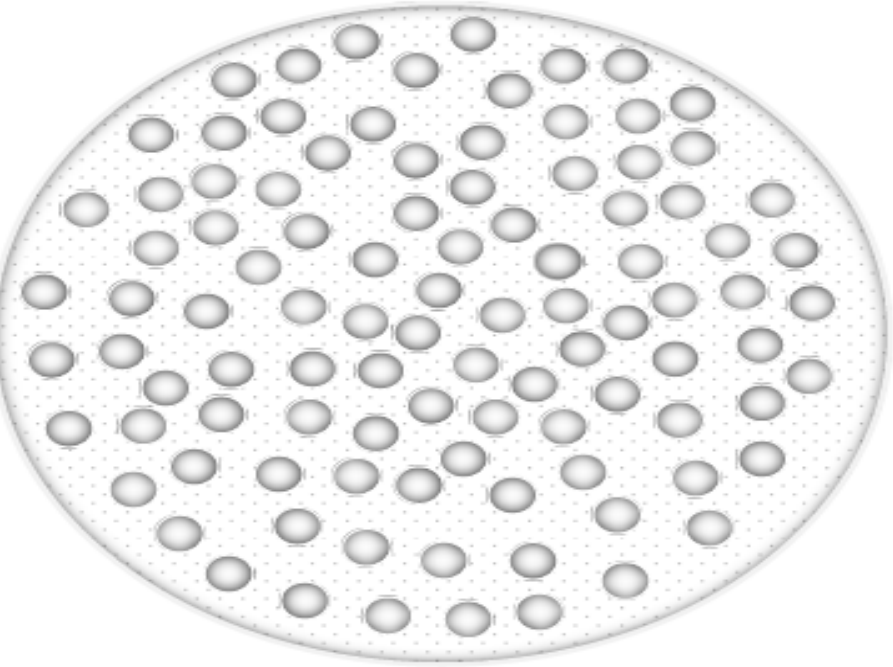
Amiodarone in Congestive Heart Failure



NNT = 7 Patients

What does all this mean for a typical group of 100 stroke patients?



Suppose that 25 would have had a good stroke outcome (mRS 0-1) <u>without</u> rt-PA and 6 would have died within the first week

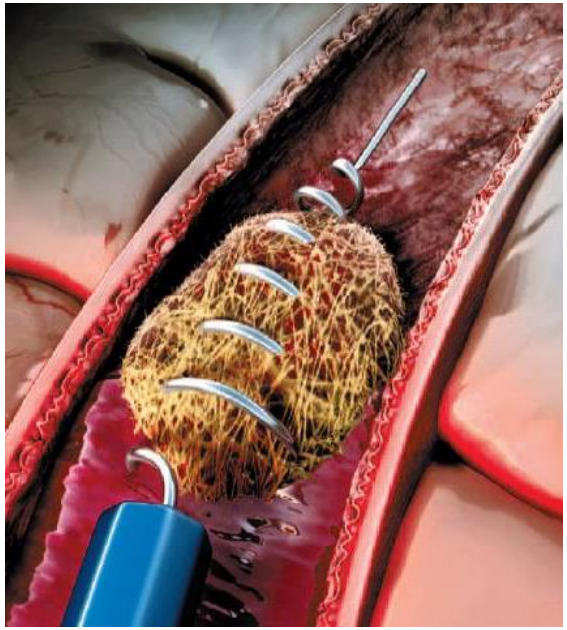
If they had all been given rt-PA within 3 hours…

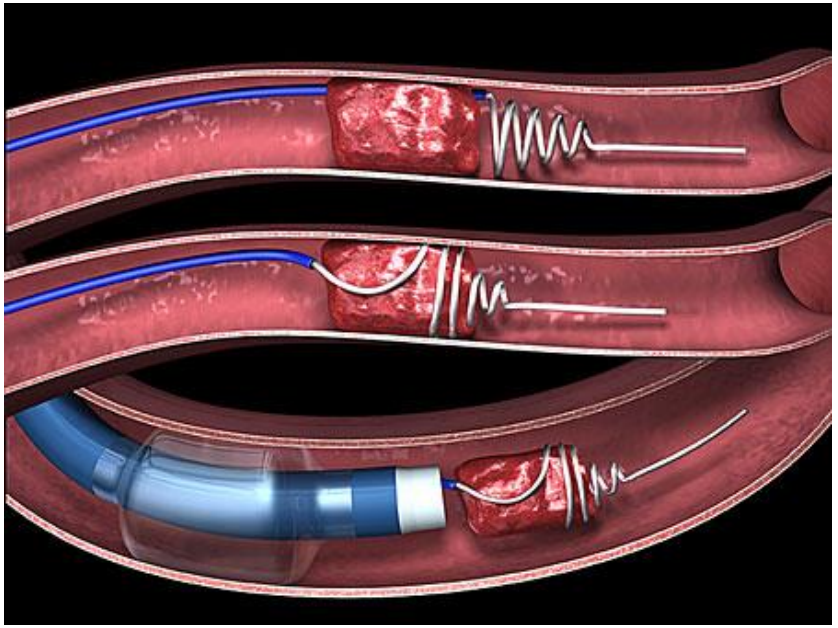
…the number recovering rises to about 35
…but 2 extra would die from ICH within 7 days

1

8

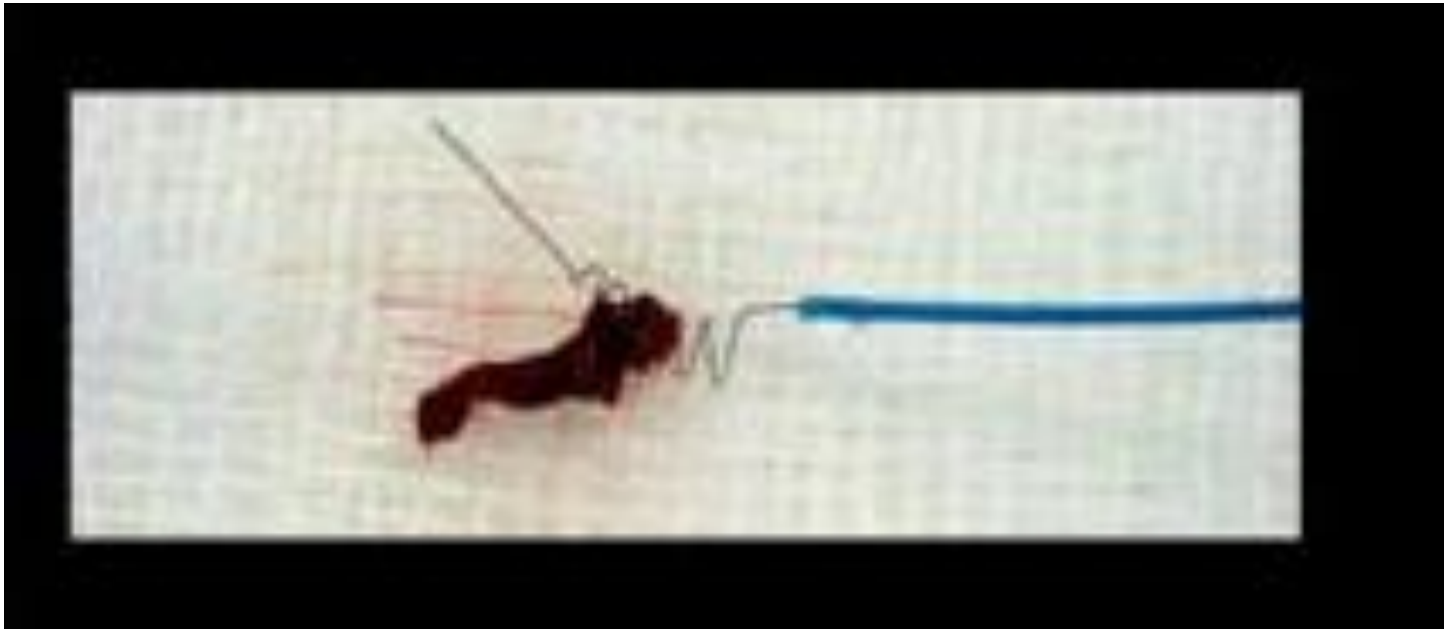
Emberson J, on behalf of the Stroke Thrombolysis Trialists' Lancet 2014





Smith WS, et al. Safety and efficacy of mechanical embolectomy in acute ischemic stroke: Results of the MERCI trial. *Stroke.* 2005; 36: 1432–1438.

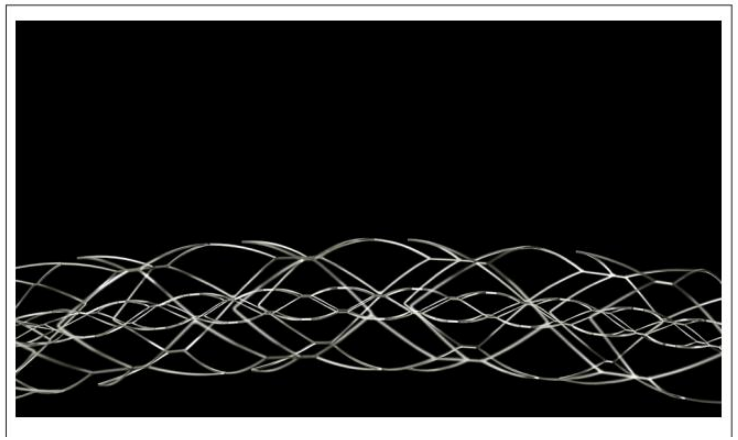
MERCI



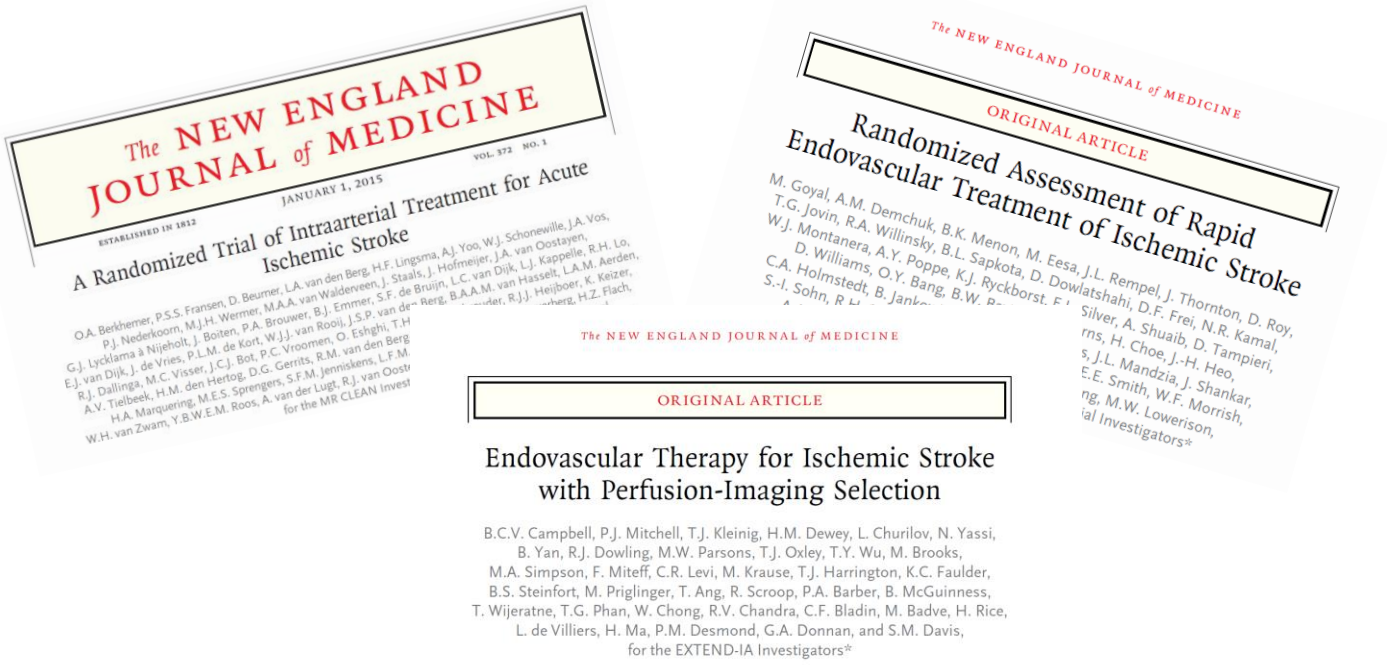
Smith WS, et al. Safety and efficacy of mechanical embolectomy in acute ischemic stroke: Results of the MERCI trial. *Stroke*. 2005; 36: 1432–1438.

MODERN STROKE TRIALS 2015

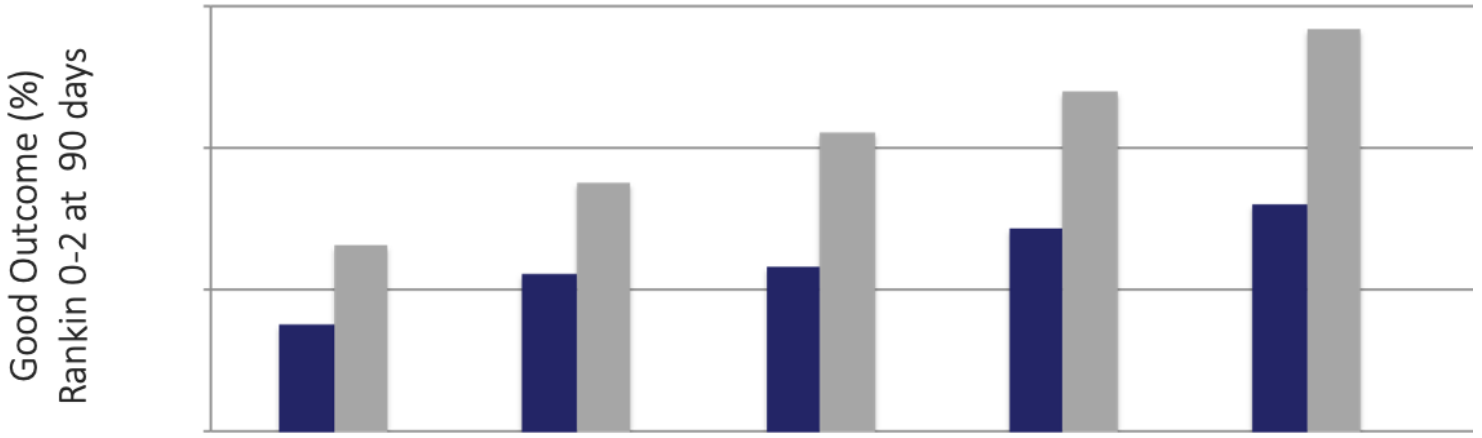
- 11 years to improve device design and ultimately prove efficacy



Game changing trials in 2015

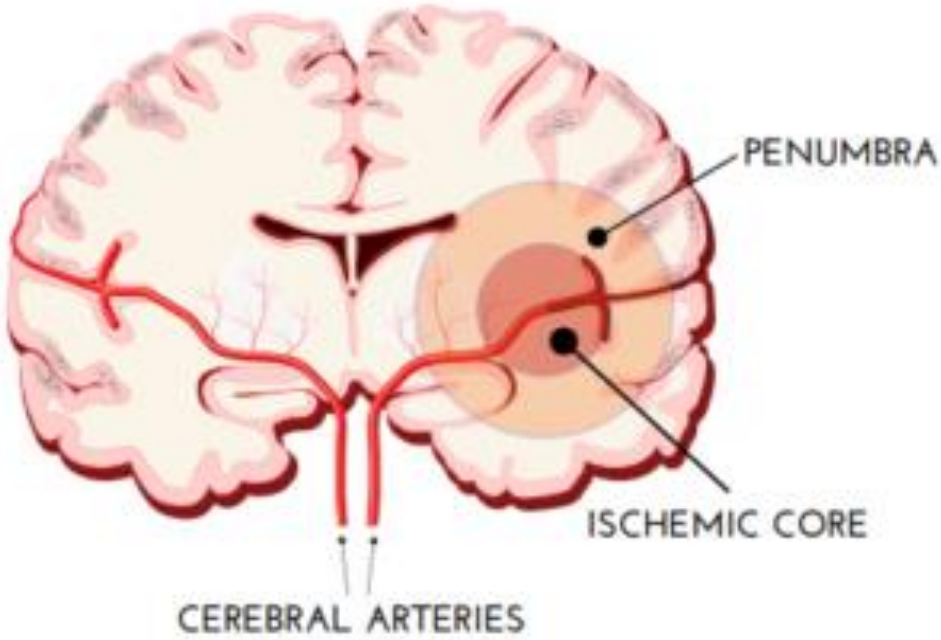


Randomized Clinical Trials 2015

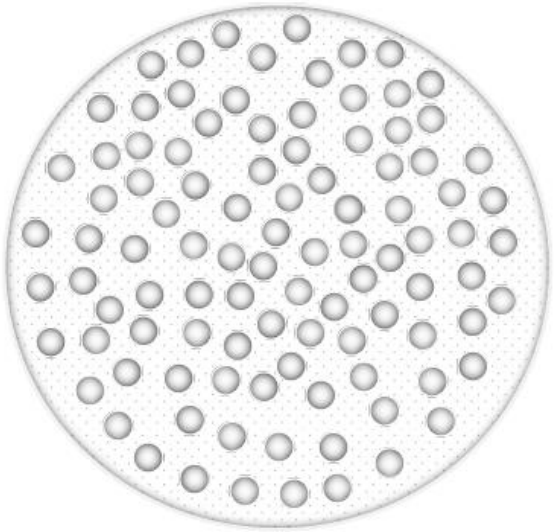


	MR CLEAN	REVASCAT	ESCAPE	SWIFT PRIME	EXTEND-IA
	P<0.5	P<0.05	P<0.001	P<0.001	P<0.01
Endo-vascular	33%	44%	53%	60%	71%
Control	19%	28%	29%	36%	40%


30 min
2 hrs
12 hrs
Infarct core
Penumbra
Myheart.net


PENUMBRA
ISCHEMIC CORE
CEREBRAL ARTERIES

What does all this mean for a typical group of 100 stroke patients



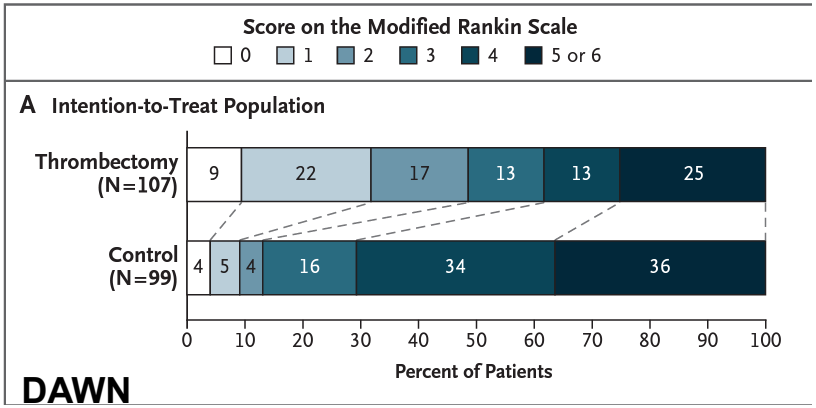
Suppose that 35 patients would have had a good stroke outcome (mRS 0 to 2) at 3 months and 12 would have died after receiving IVT

If they have been given endovascular treatment…

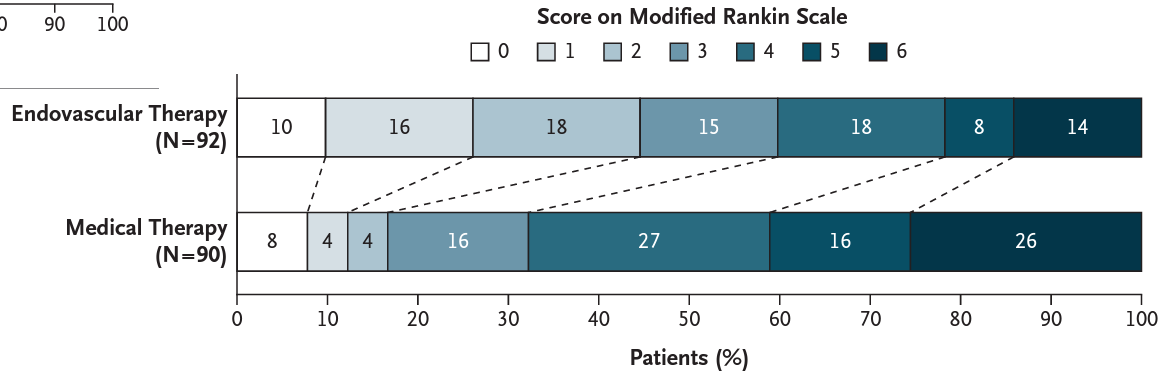
… the number recovering rises to 60…

… 3 less patients would die within 3 months

Extending the Time Window: 6- 24 hours

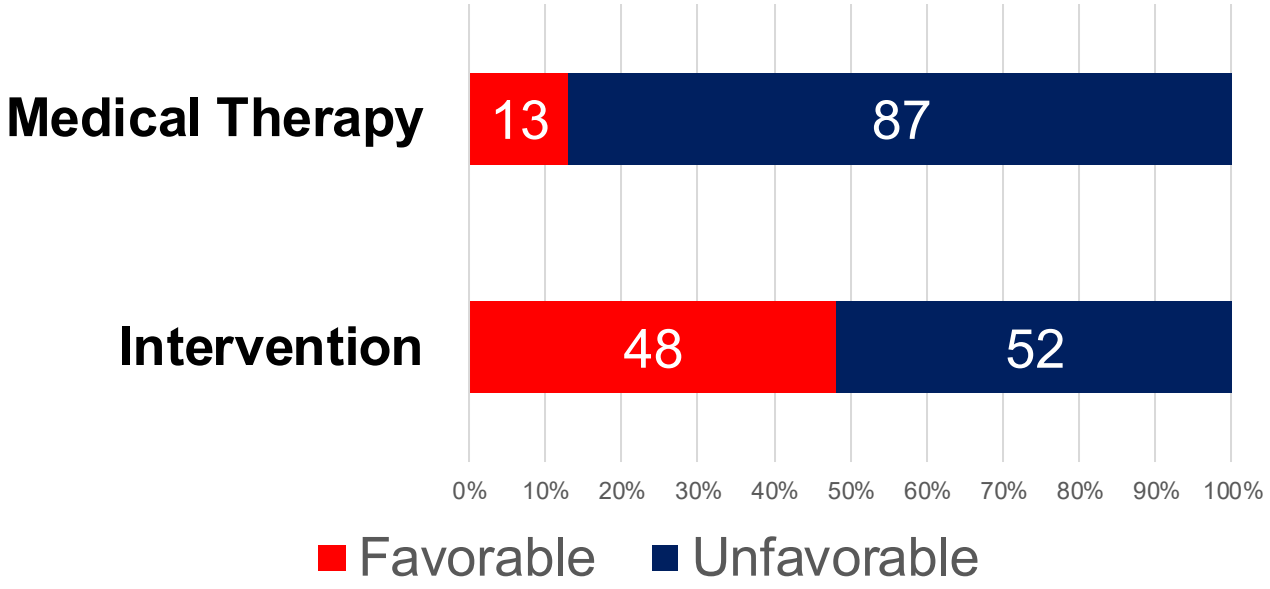


DAWN



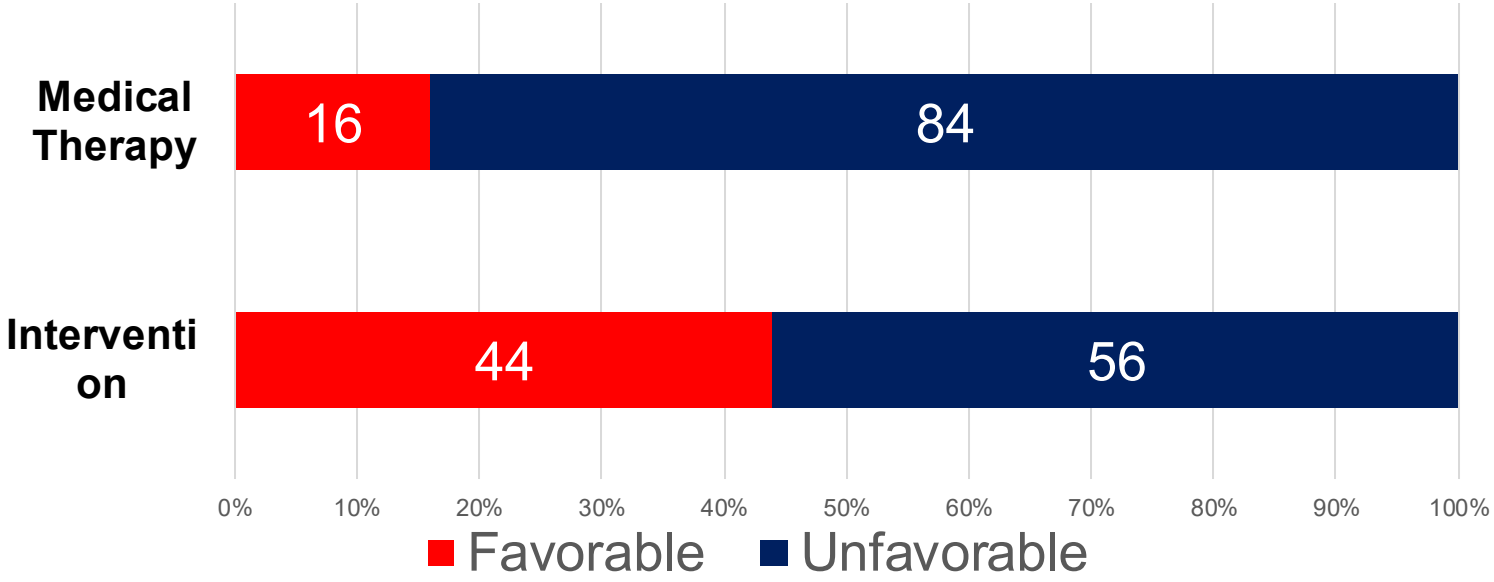
DEFUSE-3

DAWN TRIAL: 6- 24 hour window



Nogueira RG et. al; DAWN Trial Investigators. Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct. N Engl J Med. 2018 Jan 4;378(1):11-21. doi: 10.1056/NEJMoa1706442. Epub 2017 Nov 11. PMID: 29129157.

DEFUSE-3 TRIAL: 6- 18 hour window



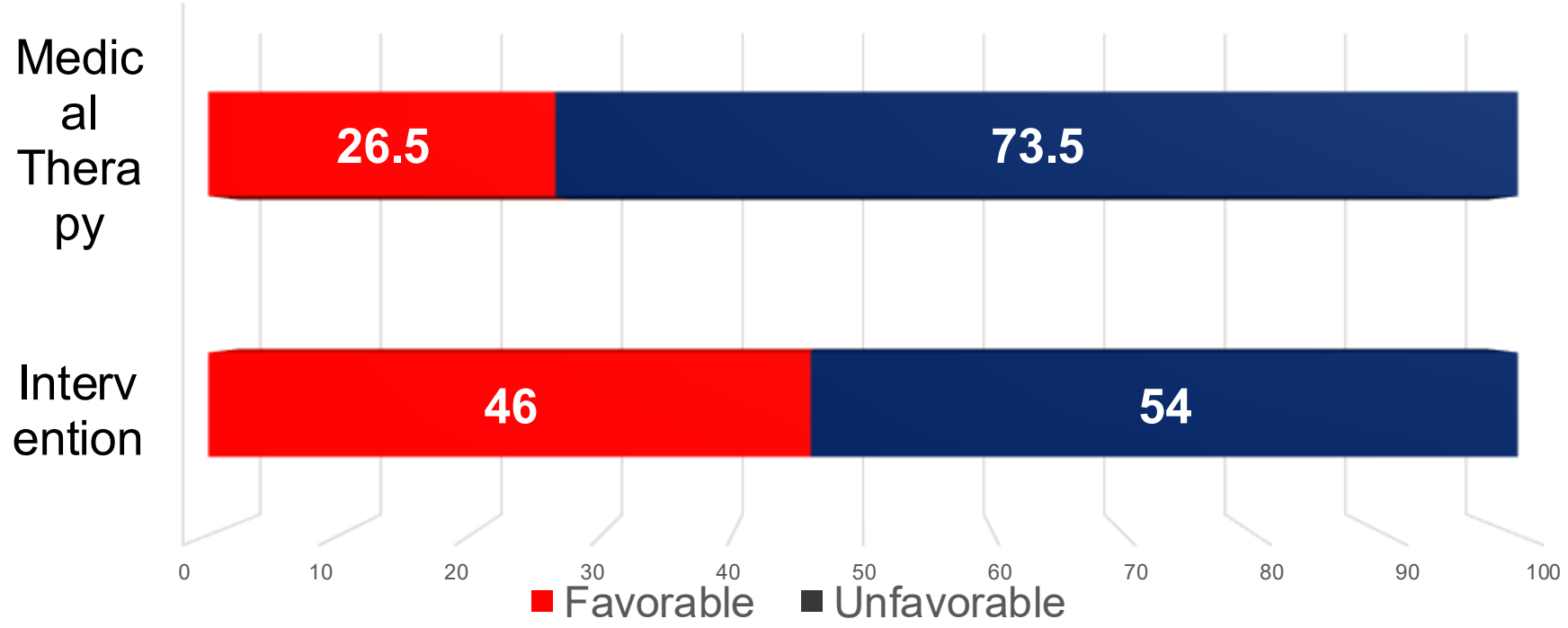
Endovascular thrombectomy after large-vessel ischaemic stroke: a meta-analysis of individual patient data from five randomised trials

Mayank Goyal, Bijoy K Menon, Wim H van Zwam, Diederik W J Dippel, Peter J Mitchell, Andrew M Demchuk, Antoni Dávalos, Charles B L M Majoie, Aad van der Lugt, Maria A de Miquel, Geoffrey A Donnan, Yvo B W E M Roos, Alain Bonafe, Reza Jahan, Hans-Christoph Diener, Lucie A van den Berg, Elad I Levy, Olvert A Berkhemer, Vitor M Pereira, Jeremy Rempel, Mònica Millán, Stephen M Davis, Daniel Roy, John Thornton, Luis San Román, Marc Ribó, Debbie Beumer, Bruce Stouch, Scott Brown, Bruce C V Campbell, Robert J van Oostenbrugge, Jeffrey L Saver, Michael D Hill, Tudor G Jovin, for the HERMES collaborators

www.thelancet.com Vol 387 April 23, 2016

Goyal M, et. al HERMES collaborators. 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. doi: 10.1016/S0140-6736(16)00163-X. Epub 2016 Feb 18. PMID: 26898852.

Overall Study Population



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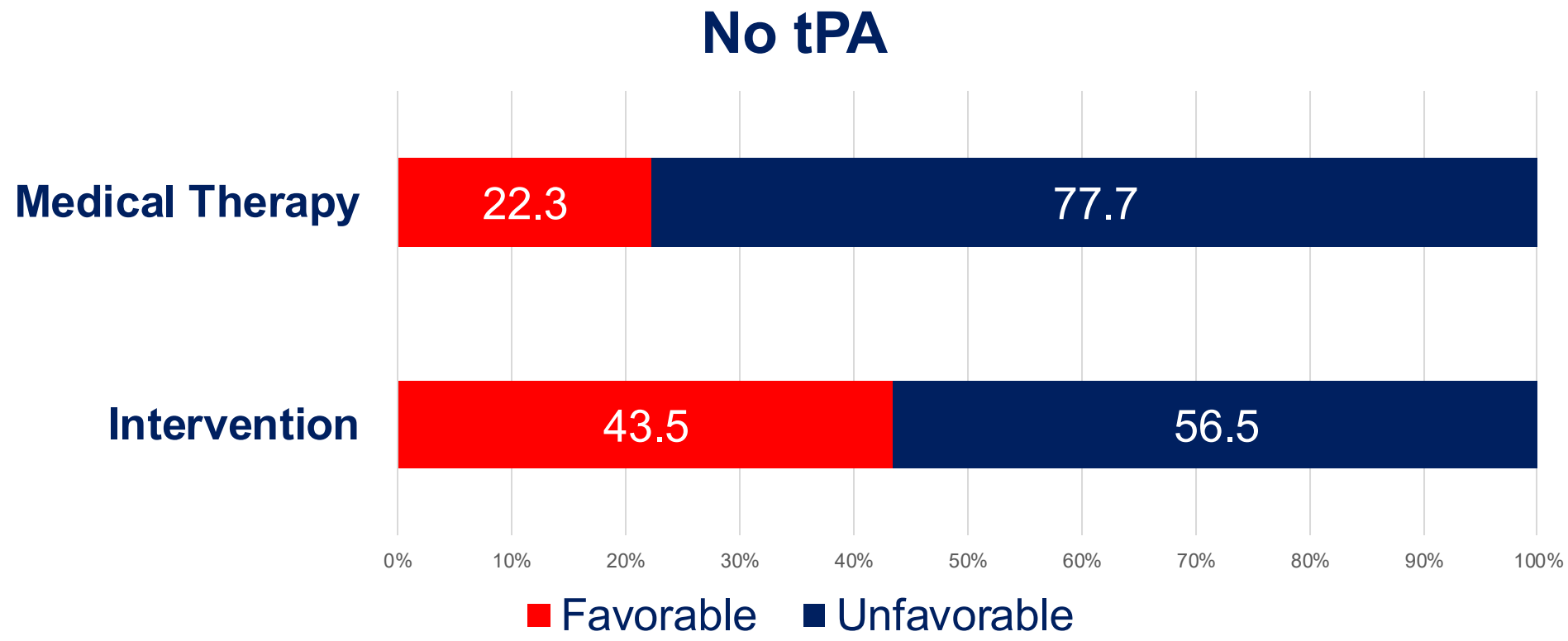

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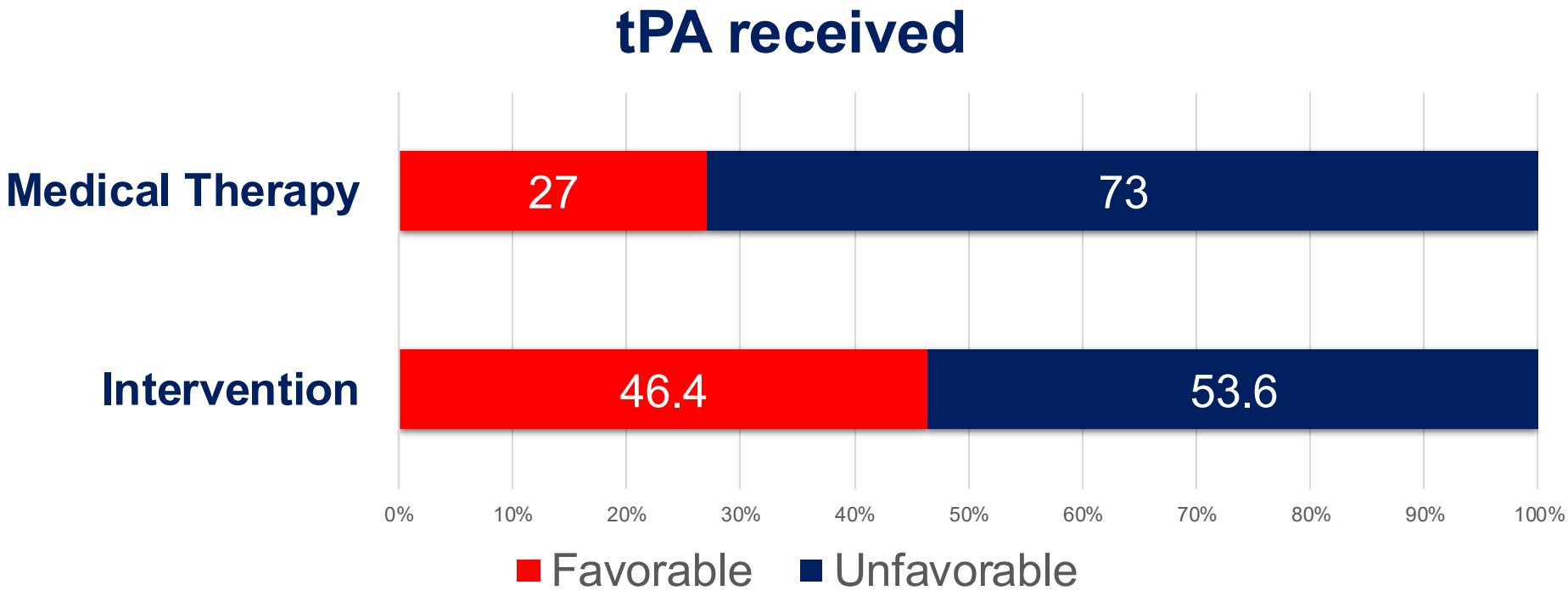

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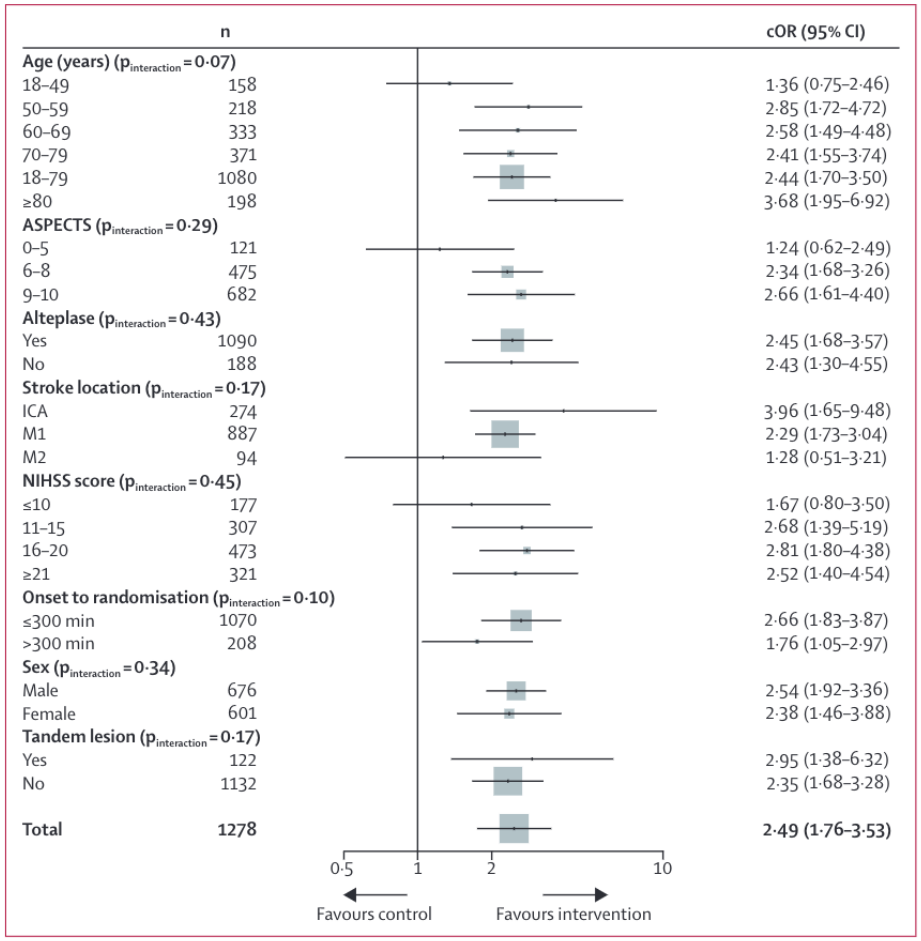

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Number Needed to Treat

In order to have one additional patient be independent at 90 days

MR CLEAN

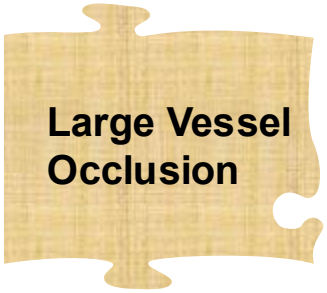
ESCAPE

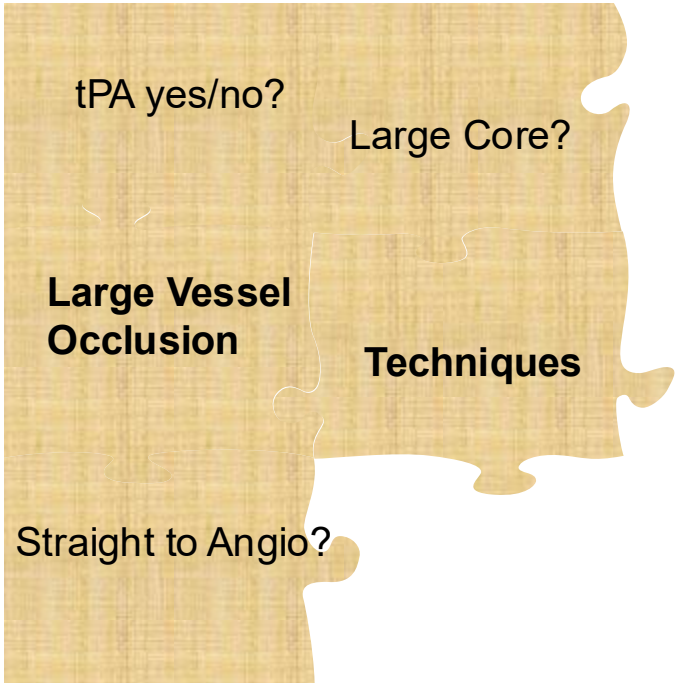
EXTEND-IA

SWIFT PRIME

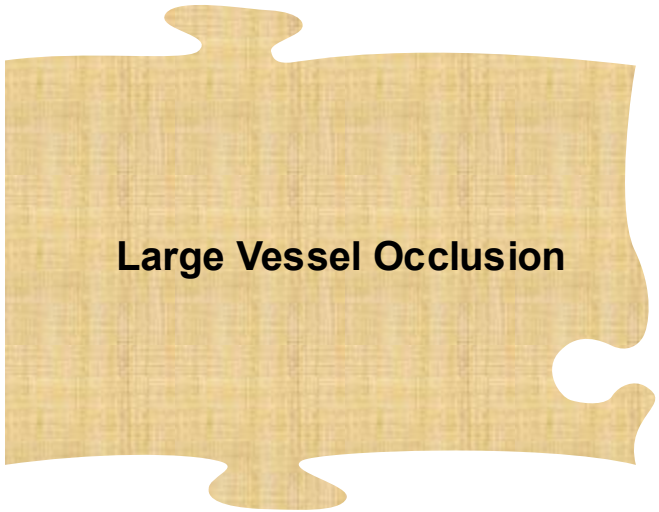
PRIMARY PCI VS. THROMBOLYSIS FOR STEMI: PREVENTION OF DEATH/MI/

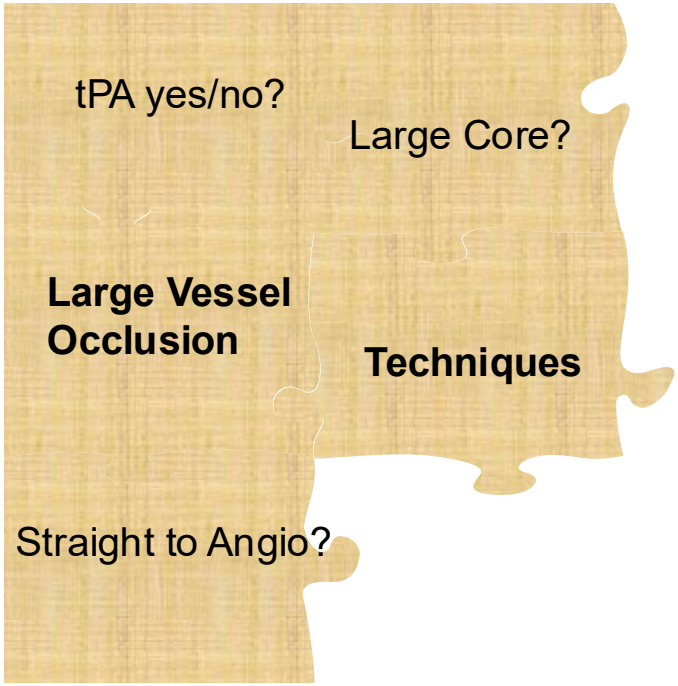
Three Burning Questions




tPA yes/no?
Large Core?
Large Vessel Occlusion
Techniques
Straight to Angio?

Three Burning Questions




tPA yes/no?
Large Core?
Large Vessel Occlusion
Techniques
Straight to Angio?

JAMA | Original Investigation

Effect of Mechanical Thrombectomy Without vs With Intravenous Thrombolysis on Functional Outcome Among Patients With Acute Ischemic Stroke

The SKIP Randomized Clinical Trial

Kentaro Suzuki, MD, PhD; Yuji Matsumaru, MD, PhD; Masataka Takeuchi, MD; Masafumi Morimoto, MD, PhD; Ryuzaburo Kanazawa, MD, PhD; Yohei Takayama, MD; Yuki Kamiya, MD, PhD; Keigo Shigeta, MD, PhD; Seiji Okubo, MD, PhD; Mikito Hayakawa, MD; Norihiro Ishii, MD, PhD; Yorio Koguchi, MD, PhD; Tomoji Takigawa, MD, PhD; Masato Inoue, MD, PhD; Hiromichi Naito, MD; Takahiro Ota, MD, PhD; Teruyuki Hirano, MD, PhD; Noriyuki Kato, MD, PhD; Toshihiro Ueda, MD, PhD; Yasuyuki Iguchi, MD, PhD; Kazunori Akaji, MD, PhD; Wataro Tsuruta, MD, PhD; Kazunori Miki, MD, PhD; Shigeru Fujimoto, MD, PhD; Tetsuhiro Higashida, MD, PhD; Mitsuhiro Iwasaki, MD; Junya Aoki, MD, PhD; Yasuhiro Nishiyama, MD, PhD; Toshiaki Otsuka, MD, PhD; Kazumi Kimura, MD, PhD; for the SKIP Study Investigators

JAMA January 19, 2021 Volume 325, Number 3

Beth Israel Deaconess Medical Center

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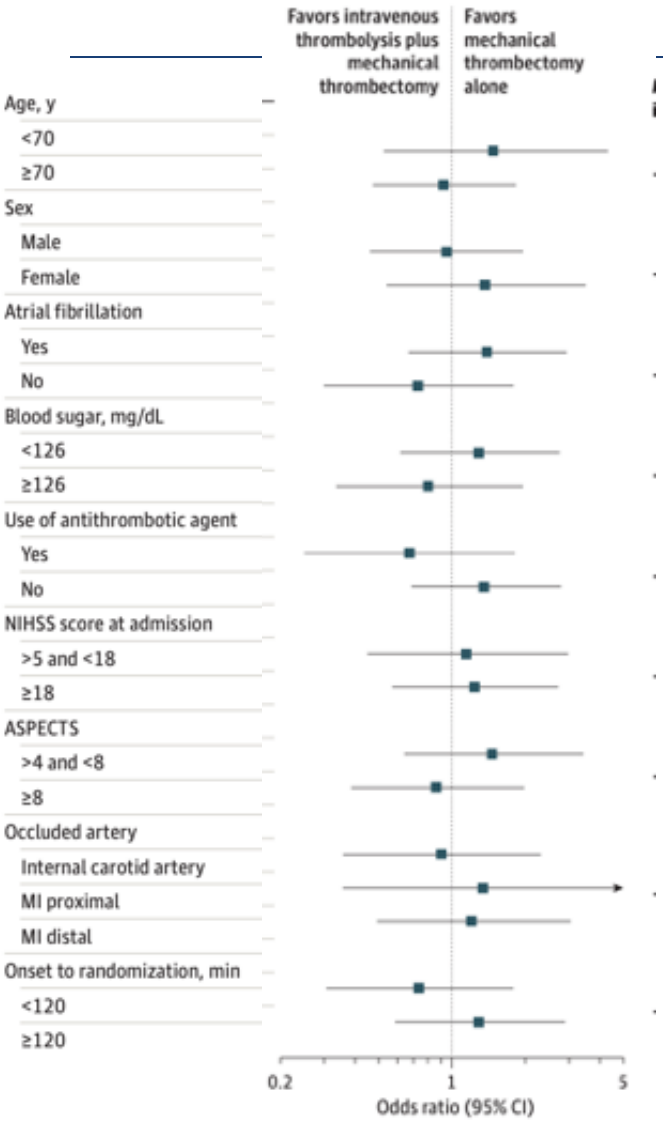
Randomized clinical trial of 204 patients

A favorable functional outcome **59.4% of patients with mechanical thrombectomy alone** and in **57.3% of those randomized to combined intravenous thrombolysis plus mechanical thrombectomy** (odds ratio, 1.09 [95% confidence limit below the noninferiority margin of 0.74]).

The findings **failed** to demonstrate **noninferiority** of mechanical thrombectomy alone but also did not allow a conclusion of **inferiority**.

Suzuki K, et al. The randomized study of endovascular therapy with versus without intravenous tissue plasminogen activator in acute stroke with ICA and M1 occlusion (SKIP study). Int J Stroke. 2019 Oct;14(7):752-755. doi: 10.1177/1747493019840932. Epub 2019 Mar 29. PMID:



	MT alone	MT + tPA	P value
Any hemorrhage at 36 hrs	34%	51%	0.2
Symptomatic hemorrhage (NINDS criteria)	8%	12%	.48

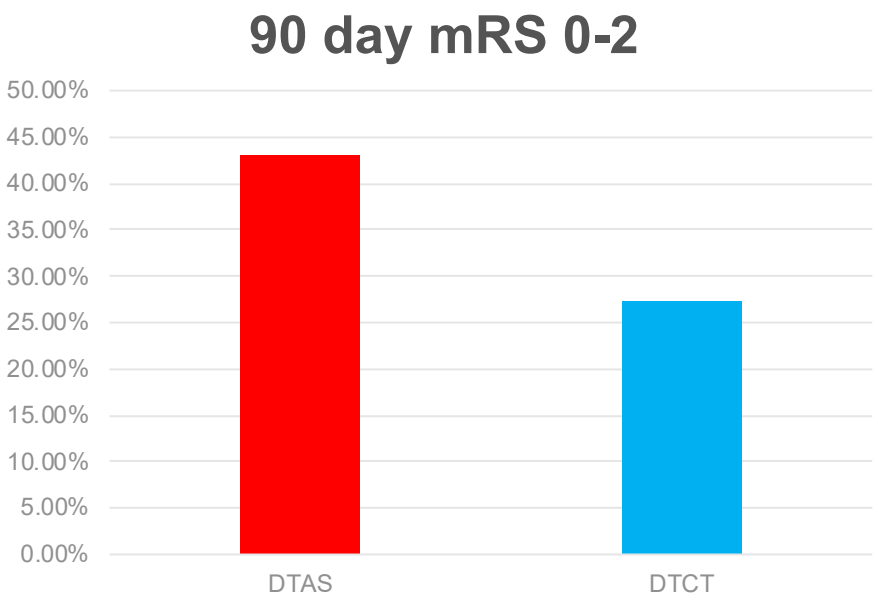
JAMA Neurology | Original Investigation

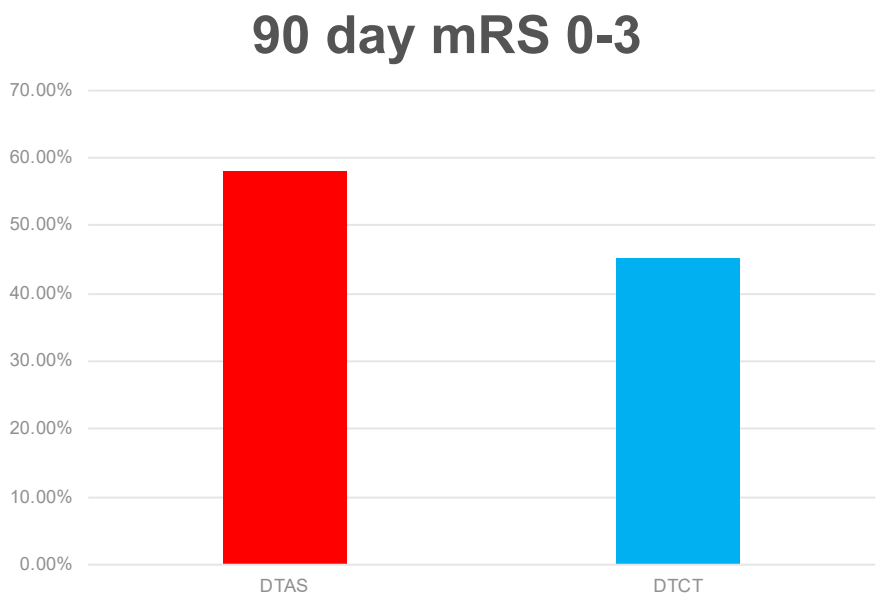
Direct to Angiography Suite Without Stopping for Computed Tomography Imaging for Patients With Acute Stroke
A Randomized Clinical Trial

Manuel Requena, PhD; Marta Olivé-Gadea, MD; Marian Muchada, PhD; David Hernández, MD; Marta Rubiera, PhD; Sandra Boned, PhD; Carlos Piñana, MD; Matías Deck, MD; Álvaro García-Tornel, MD; Humberto Díaz-Silva, MD; Noelia Rodriguez-Villatoro, PhD; Jesús Juega, MD; David Rodriguez-Luna, PhD; Jorge Pagola, PhD; Carlos Molina, PhD; Alejandro Tomasello, MD; Marc Ribo, MD, PhD

JAMA Neurology September 2021 Volume 78, Number 9

Requena M et. al. Direct to Angiography Suite Without Stopping for Computed Tomography Imaging for Patients With Acute Stroke: A Randomized Clinical Trial. JAMA Neurol. 2021 Sep 1;78(9):1099-1107. doi: 10.1001/jamaneurol.2021.2385. PMID: 34338742; PMCID: PMC8329790.


90 day mRS 0-2
50.00%
45.00%
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
DTAS
DTCT


90 day mRS 0-3
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
DTAS
DTCT

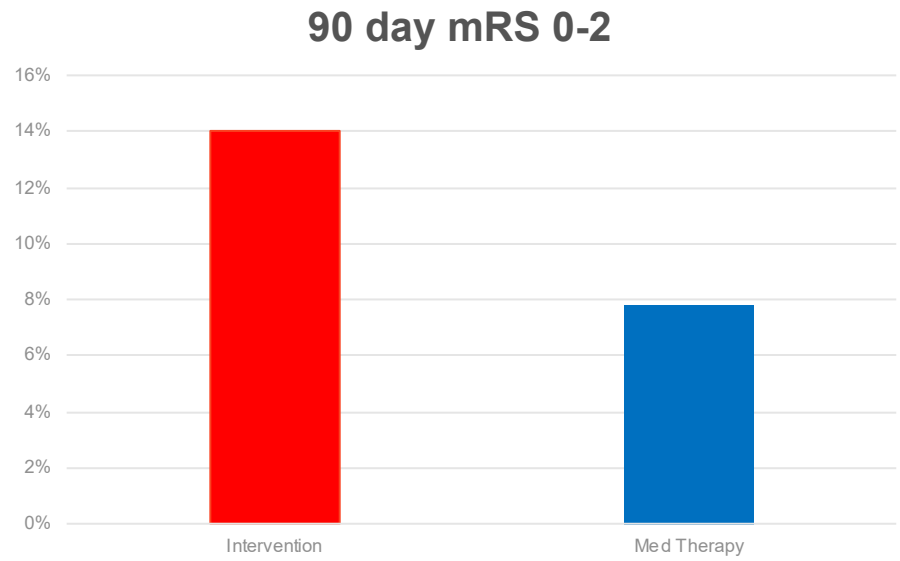
The NEW ENGLAND JOURNAL of MEDICINE

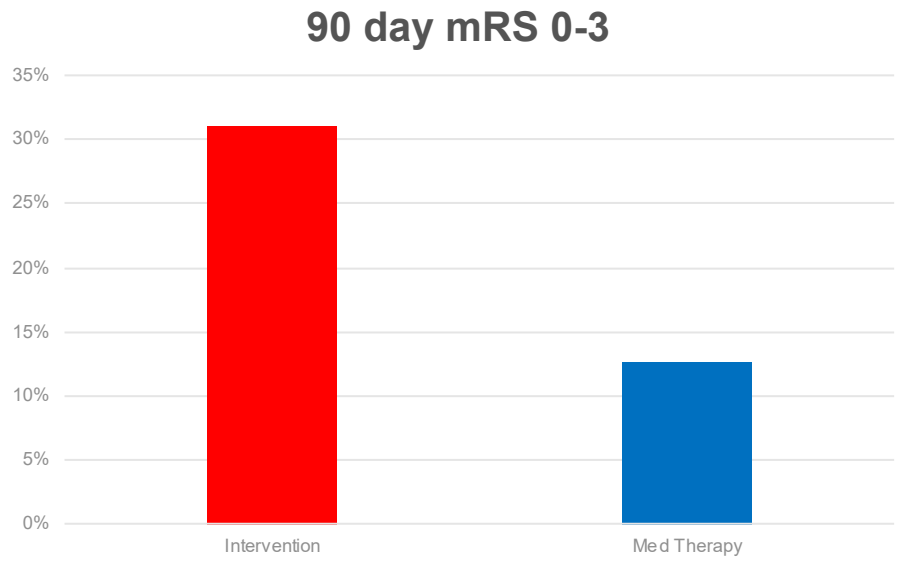
ESTABLISHED IN 1812 APRIL 7, 2022 VOL. 386 NO. 14

Endovascular Therapy for Acute Stroke with a Large Ischemic Region

S. Yoshimura, N. Sakai, H. Yamagami, K. Uchida, M. Beppu, K. Toyoda, Y. Matsumaru, Y. Matsumoto, K. Kimura, M. Takeuchi, Y. Yazawa, N. Kimura, K. Shigeta, H. Imamura, I. Suzuki, Y. Enomoto, S. Tokunaga, K. Morita, F. Sakakibara, N. Kinjo, T. Saito, R. Ishikura, M. Inoue, and T. Morimoto

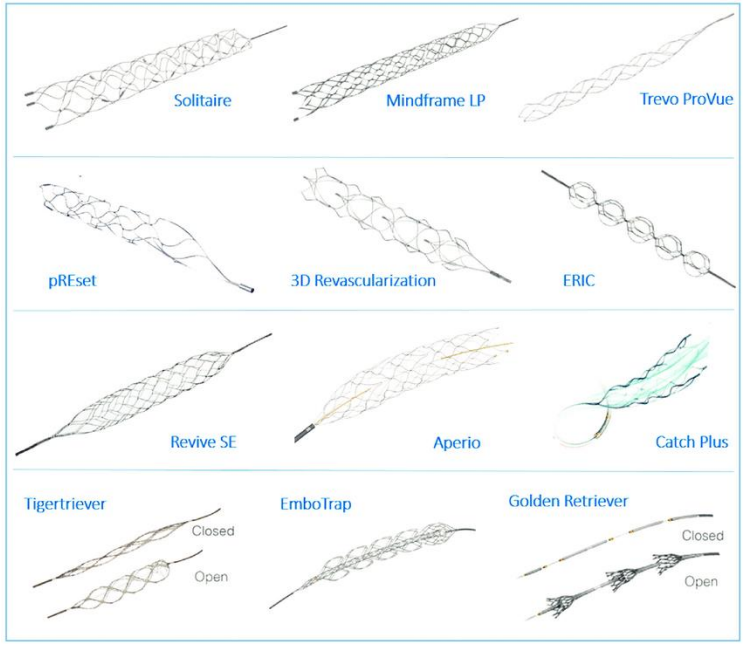
Yoshimura S, et. al. Endovascular Therapy for Acute Stroke with a Large Ischemic Region. N Engl J Med. 2022 Apr 7;386(14):1303-1313. doi: 10.1056/NEJMoa2118191. Epub 2022 Feb 9. PMID: 35138767.

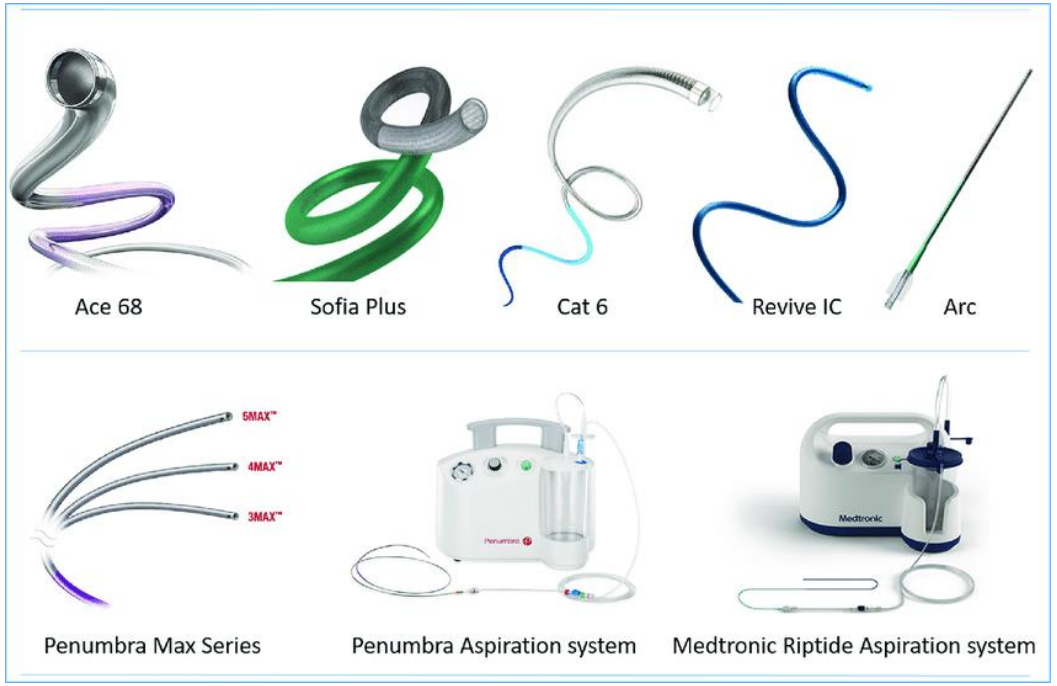




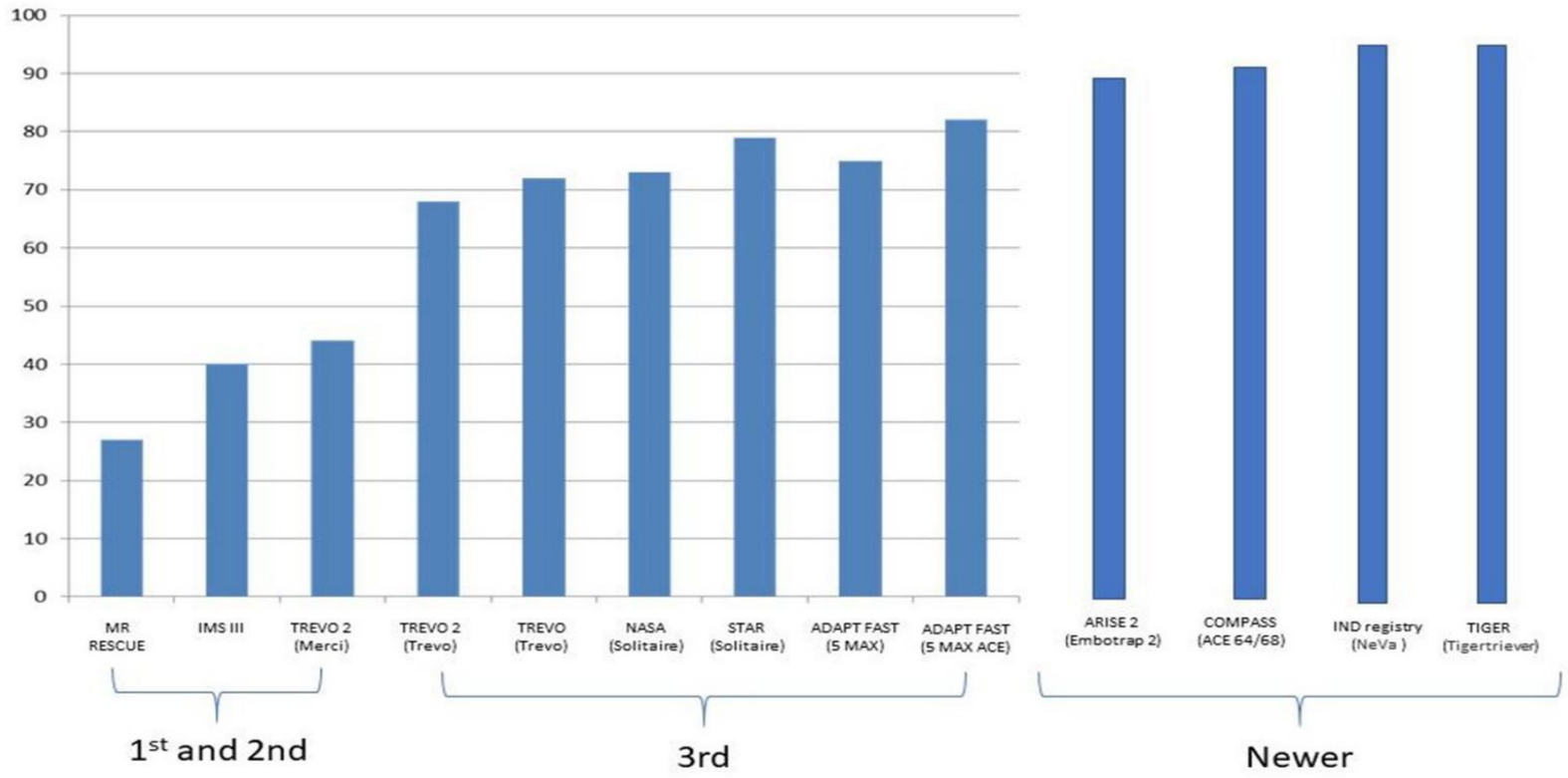
Yoshimura S, et. al. Endovascular Therapy for Acute Stroke with a Large Ischemic Region. N Engl J Med. 2022 Apr 7;386(14):1303-1313. doi: 10.1056/NEJMoa2118191. Epub 2022 Feb 9. PMID: 35138767.

Main Advances: Novel Tools



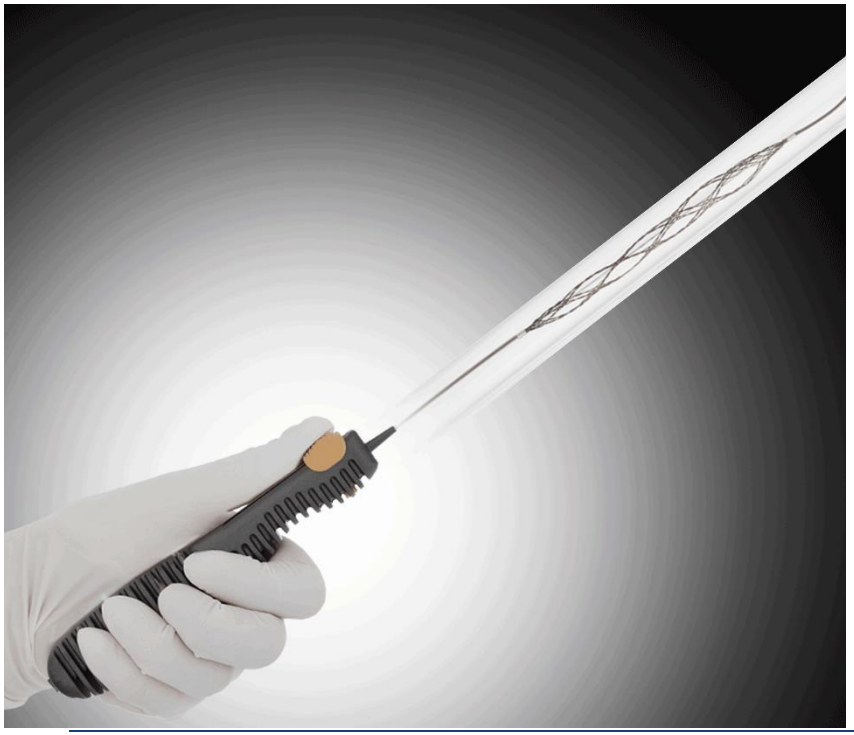


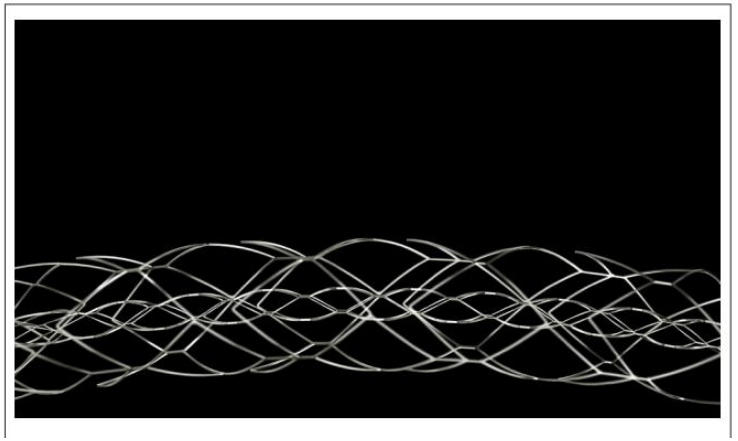
First pass effect: The New Outcome

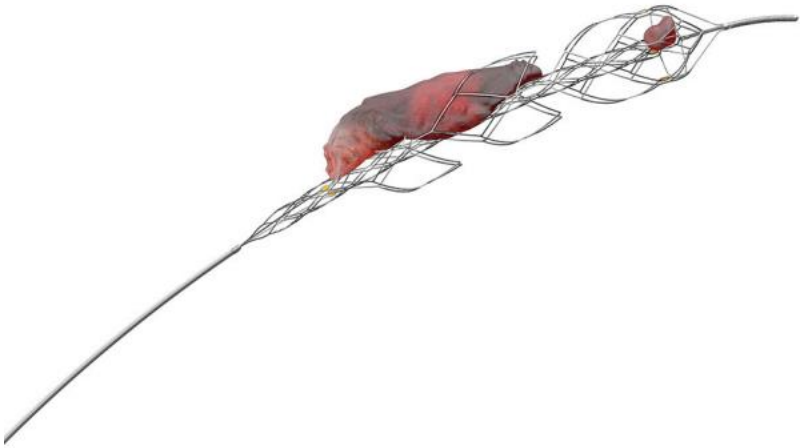


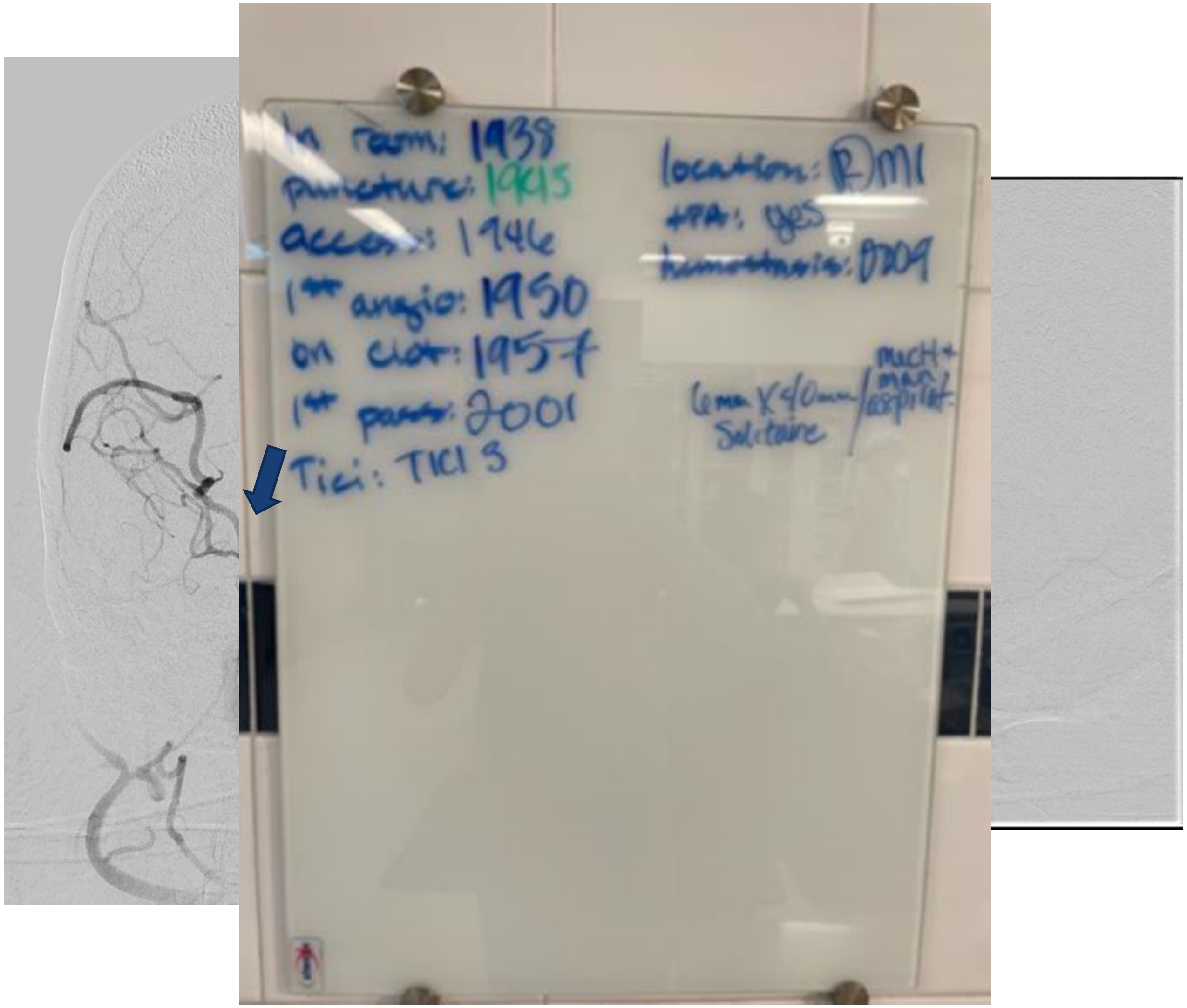
Yeo L et. al.. Evidence-Based Updates to Thrombectomy: Targets, New Techniques, and Devices. Front Neurol. 2021 Sep 9;12:712527. doi: 10.3389/fneur.2021.712527. PMID: 34566856; PMCID: PMC8459011.

Main Advances: Novel Tools

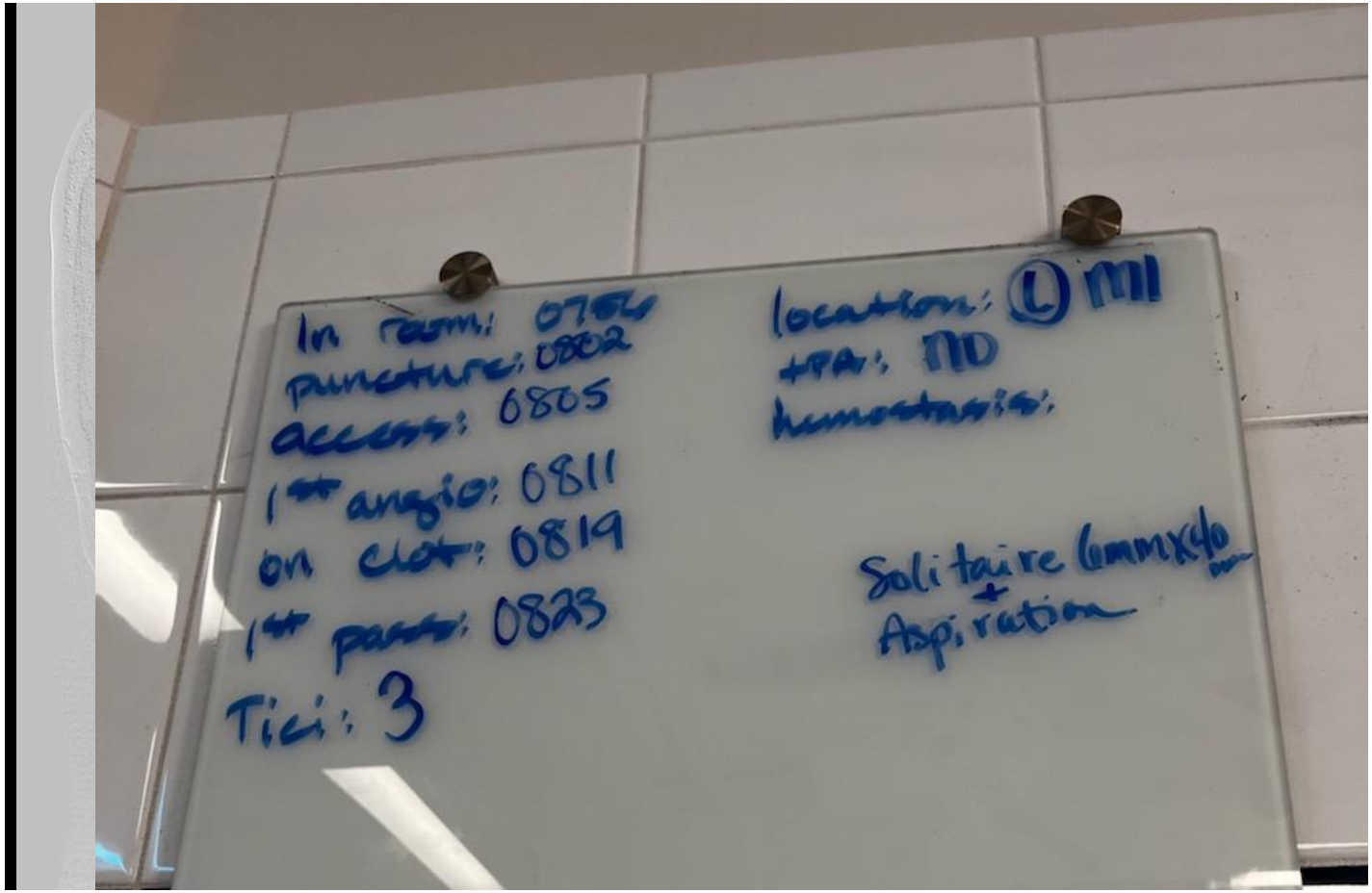








In room: 1938
puncture: 1945
access: 1946
1st angio: 1950
on clot: 1957
1st pass: 2001
Tici: TICI 3
location: (R) M1
tPA: yes
6mm X 40mm Solitaire


In room: 0750
puncture: 0802
access: 0805
1st angio: 0811
on clot: 0819
1st pass: 0823
Tici: 3
location: L M1
tPA: no
hemostasis:
Solitaire 6mmx40
+
Aspiration

Conclusion

- **Stroke** has become a **surgical** disease to a large degree
- **Indications** are constantly **expanding** in terms of time window, core volume and mismatch ratio, including distal branches
- **Device advances** are continuously improving technical aspects resulting in improved first-pass effects
- Questions remain regarding: skip tPA, medium vessel occlusions, largs cores
- Next big **frontiers**: AI, expanding stroke networks, straight to angio, training

THANK YOU

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