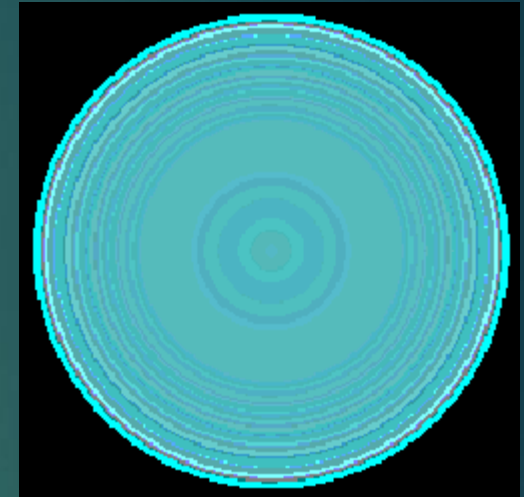




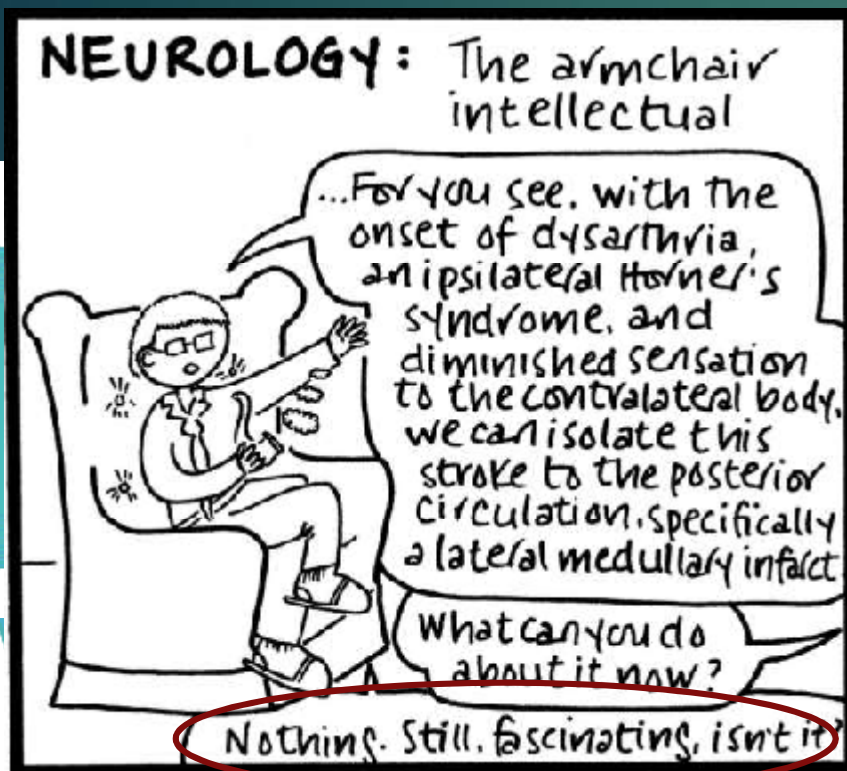
Neurointervention in management of acute stroke

MASOUD MEHRPOUR MD, MPH
INTERVENTIONAL NEUROLOGIST
ASSOCIATE PROFESSOR
IUMS

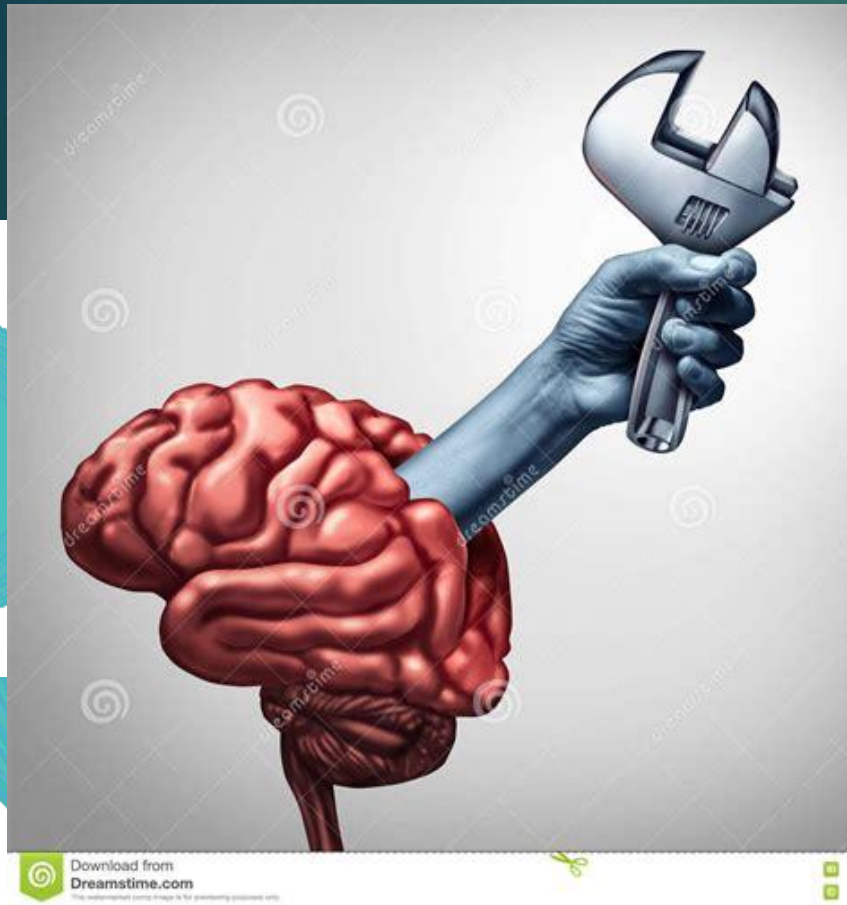
Disclosure:
none



Neurology: the armchair intellectual



Revolution in stroke



Decreasing Stroke mortality from 3rd to 5th cause of death in Europe and USA

Stroke unit

rTPA

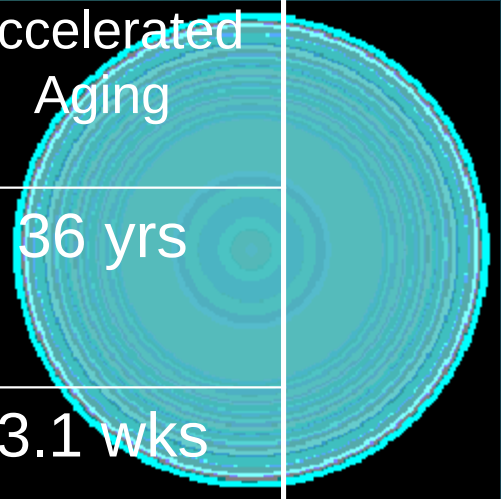
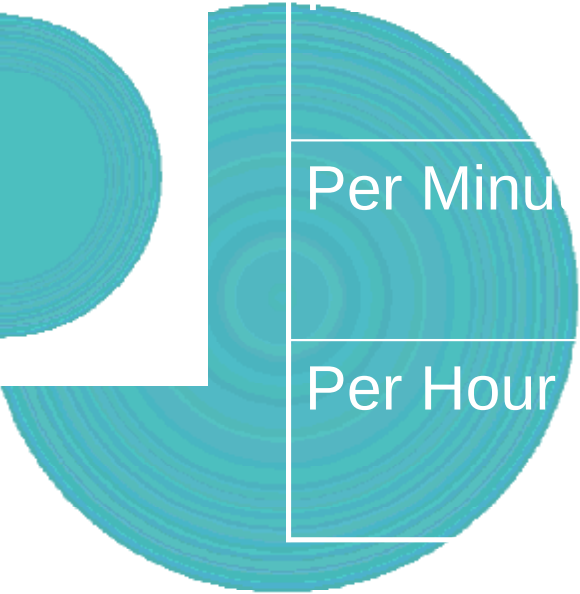
Intervention

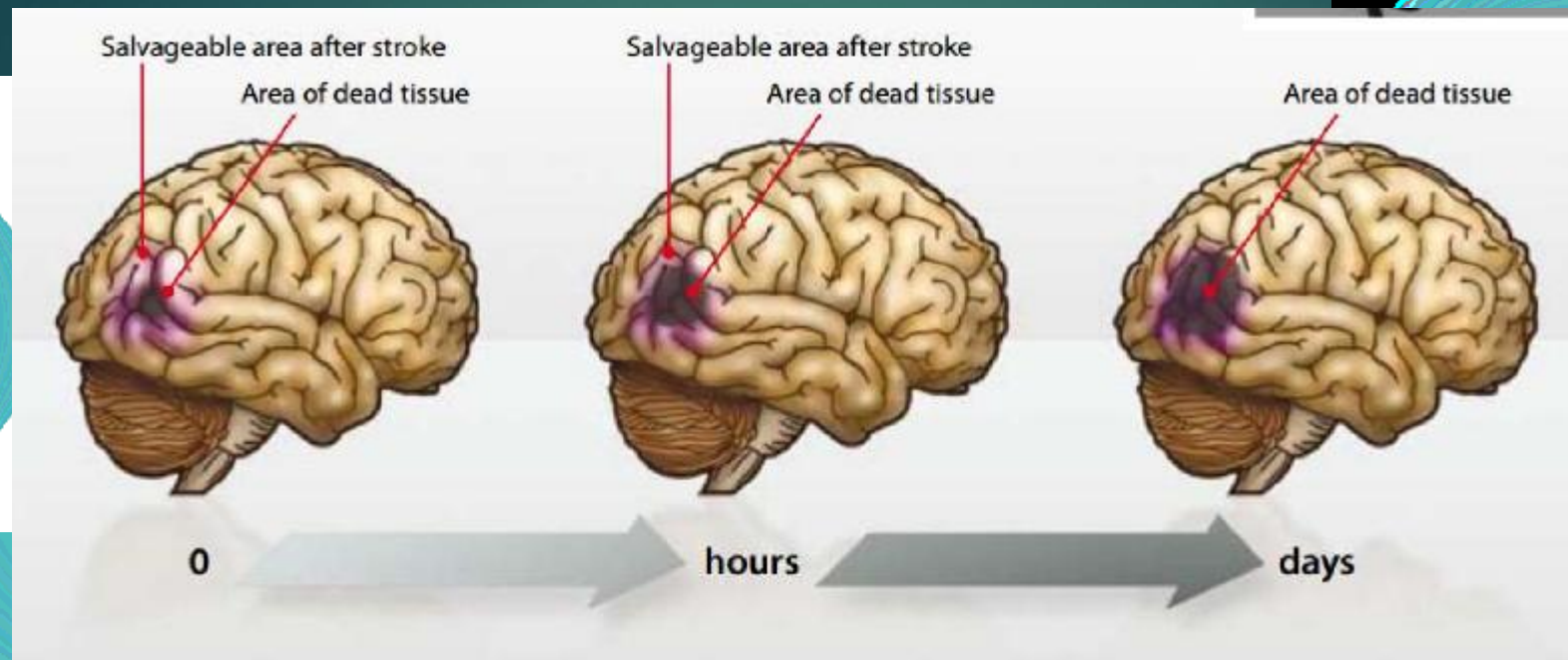


Time Is Brain !!



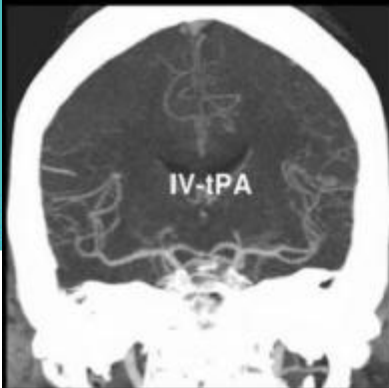
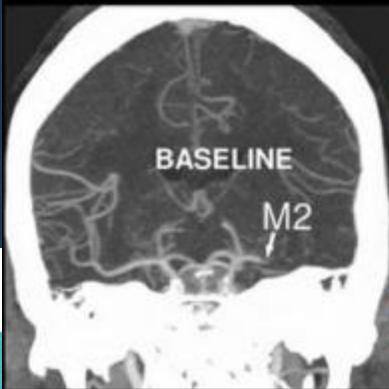
		Neurons Lost	Synapses Lost	Accelerated Aging
Per Minute	1	1.2 billion	8.3 trillion	36 yrs
	10	1.9 million	14 billion	3.1 wks
	100	120 million	830 billion	3.6 yrs





NINDS Trial

National Institute of Neurological Disorders and Stroke rt-PA Study Group



- 624 pts randomized within 3 hrs.
 - ★ Placebo
 - ★ Rt-PA 0.9 mg/kg (max 90 mg) over 1 hr.
- Neurological assessment
 - ★ TPA increased full recovery rate 21% to 34% (32% relative) at 3 months (OR=1.7 (95%CI 1.2-2.6) $p=0.008$).
 - ★ Mortality not different between groups.
 - ★ IC bleed rt-PA 6.4% vs 0.6% ($p < 0.001$).

10x

NEJM 1995;333:1581-7.



Recanalization rates:



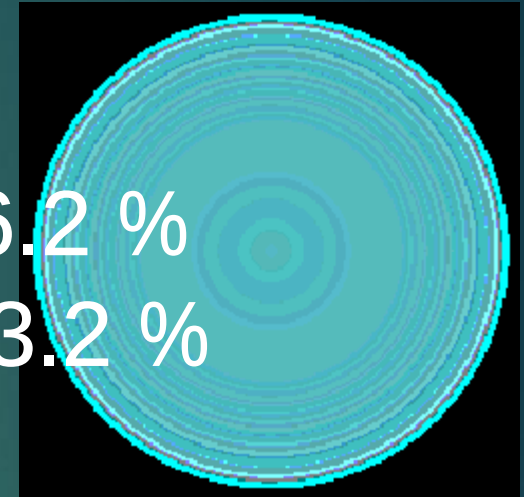
u Spontaneous: 14% to 28 %

u Intravenous thrombolysis: 46.2 %

u Intra-arterial thrombolysis: 63.2 %

u Combined IV and IA
thrombolysis: 67.5 %

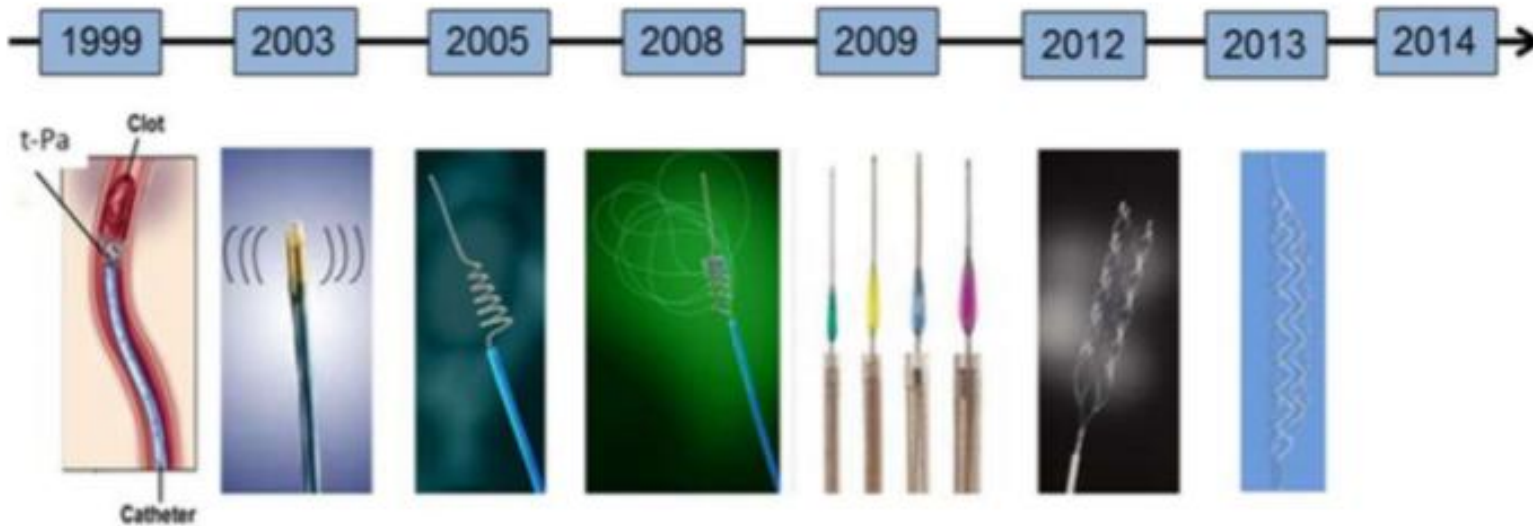
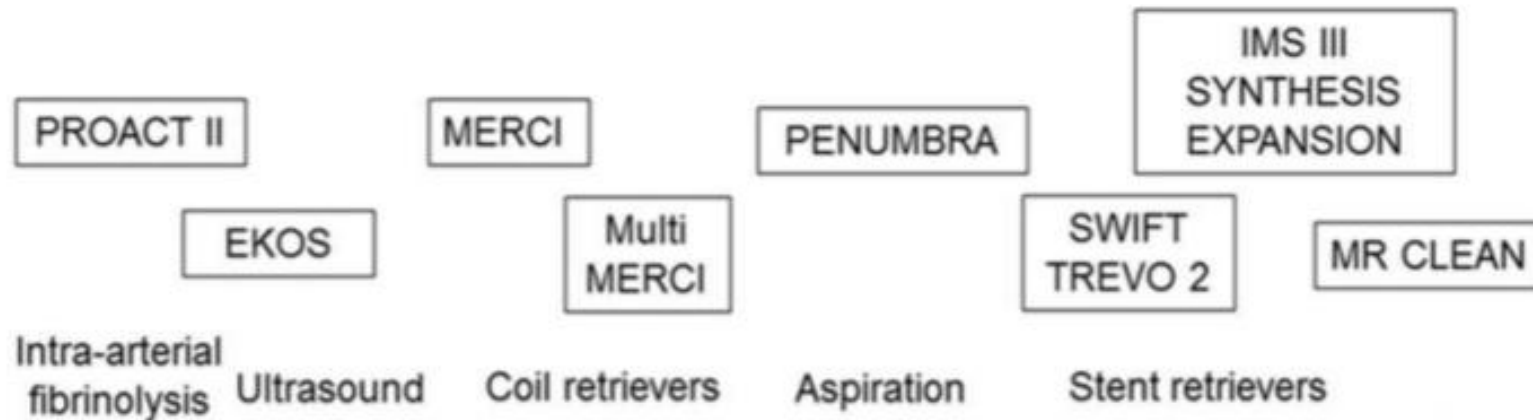
u Mechanical thrombectomy: 83.6
%



Ultrasound (TCD) enhanced IV thrombolysis

- u Meta-analysis: 6 RCT's, n = 224 and 3 nRCT's, n = 192 • High-frequency ultrasound enhanced thrombolysis versus tPA alone • Recanalization: 22% versus 17% • mRS: significantly better
- u Meta-analysis: 5 RCT's, n = 233 • Recanalization: significantly more likely • mRS: no significant difference
- u CLOTBUST trial, n = 26, part of both meta-analyses • MCA occlusion • Recanalization: 20% versus 13% • mRS: non-significant positive trend

Evolution of IAT



Recanalization / reperfusion: TICI scale

TICI: thrombolysis in cerebral infarction scale

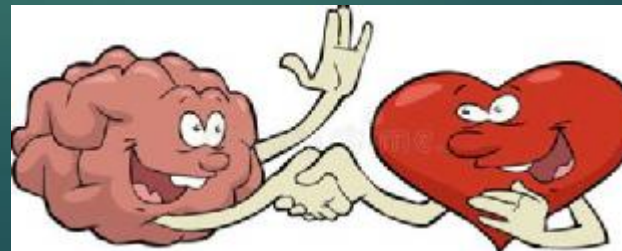
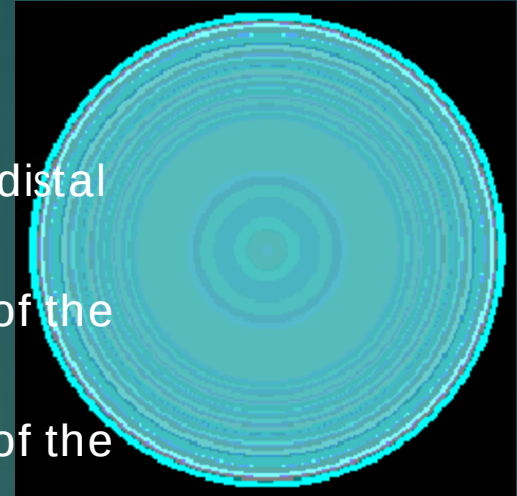
u Grade 0: no perfusion

u Grade 1: perfusion past the initial obstruction but limited distal perfusion or slow distal perfusion

u Grade 2a: perfusion of < 50% of the vascular distribution of the occluded artery

u Grade 2b: perfusion of > 50% of the vascular distribution of the occluded artery

u Grade 3: full perfusion with filling of all distal branches



EARLY TRIALS: Mechanical Thrombectomy

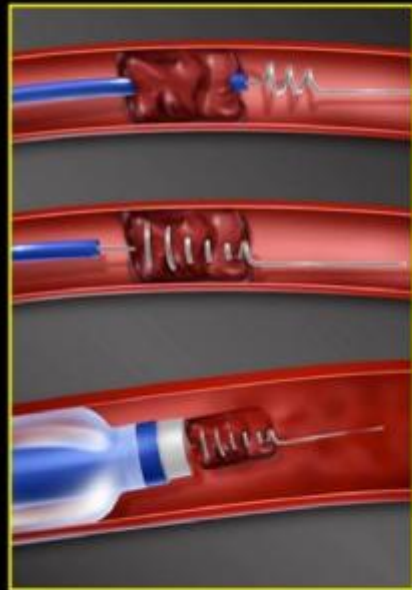
- MERCI
- MR RESCUE
- SYNTHESIS EXP
- IMS-III

- The initial trials did not demonstrate conclusive benefit for endovascular therapy, although there were promising signals.
- There seemed to be a balance between early and effective mechanical reperfusion with the risk of intracranial hemorrhage (ICH) that was related to reperfusion of nonviable brain.



IMS-III: Early Trials

Interventional Management of Stroke



Merci
Retriever

- No benefit for MT $\pm$ IV-TPA vs. IV-TPA in moderate to severe acute ischemic stroke.
- However, there were significant weaknesses.
 - ★ CTA was not required, which allowed the inclusion of patients who did not have intracranial large-vessel occlusion.
 - ★ First generation MT devices used.



PARADIGM SHIFT

- MR CLEAN
- ESCAPE
- EXTEND IA
- SWIFT PRIME
- REVASCAT

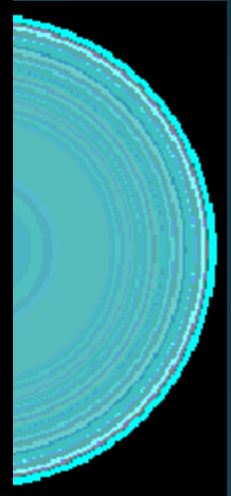
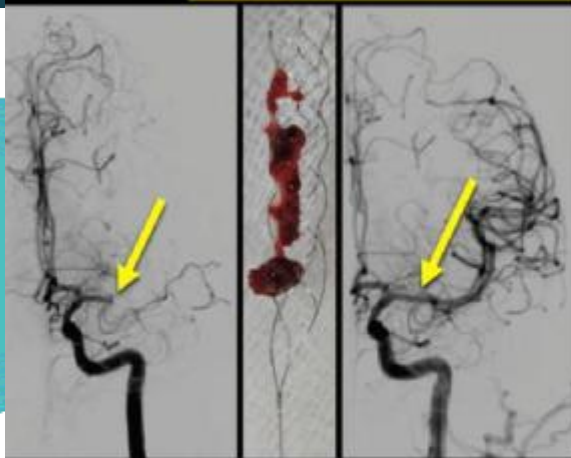
- Between December 2014 and April 2015, 5 RCTS provided compelling evidence that mechanical thrombectomy (MT) improves outcomes after acute ischemic stroke.
- MT significantly improved clinical outcome in patients with proximal intracranial occlusion of the anterior circulation compared with IV t-PA.



EVOLUTION OF STROKE Rx

The major differences between these positive endovascular trials and past trials were:

- ★ CTA to select patients with LVO.
- ★ Select viable brain (penumbra).
- ★ Stent retrievers for thrombectomy.



Endovascular Ischemic Stroke Treatment

	# Patients	Mean Age	Occlusion	Time Window	mHSS
MR CLEAN	IA – 233 Control 267	65y	Distal ICA or MCA or ACA	IA $\leq$ 6 hr	$\leq$ 2 Mean: IA 17 Control 18
ESCAPE	55 15	70-71y	Distal ICA or MCA	12 hr from onset (15.5% > 6 hr)	None at entry Mean: IA 16 Control 17
EXTEND IA	IV – 35 IV/IA – 35	IV- 70 y IV/IA – 69y	ICA or MCA (1 st or 2 nd segment)	IV < 4.5 hr IA start $\leq$ 6 hr finish $\leq$ 8 hr	None at entry Mean: IV 13 IV/IA 17
SWIFT	8 98	IV – 66y IV/IA – 65y	Distal ICA or prox MCA	IA $\leq$ 6 hr groin puncture	8-29 Mean: IV 17

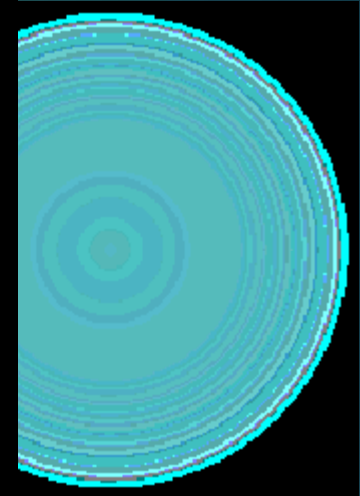
Endovascular Ischemic Stroke Treatment

	Radiology Inclusion	ASPECTS	% patients receiving iv tpa	Median time stroke onset to iv tpa
MR CLEAN	CTA/MRA Shows occlusion	No inclusion # Median 9	IA 87.1% Control 90.6%	85-87 min
ESCAPE	NCCT ASPECTS 6-10 CTA Good-good collaterals	Median 9	IA 72.7% Control 78.7%	IA 110 min Control 125 min
EXTEND IA	NCCT CTA CTP		100 %	IV 145 min IV/IA 127 min
SWIFT PRIME	CTA/MRA Shows occlusion	< 6 was exclusion	100%	IV 117 min IV/IA 110 min

Ischemic Stroke Therapy

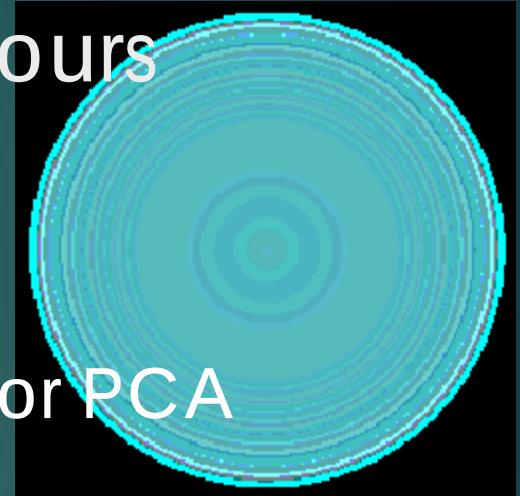
PATIENT SELECTION

- **IV Thrombolysis**
 - ≤ 4.5 hrs from onset.
 - Widely available.
 - Restricted population.
 - No bleed on CT.
 - SBP < 185 mmHg
 - DBP < 110 mmHg
 - Low bleeding risk.
- **Mechanical Thrombectomy**
 - ≤ 6 hrs from onset.
 - ASPECTS > 6 .
 - Large vessel occlusion.
 - Disabling strokes (NIHSS > 5).
 - MCA occlusion.
 - Speech impaired.
 - Vision impaired.

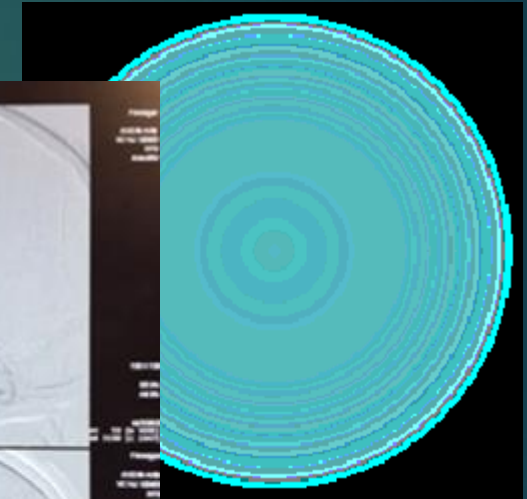


Although benefits remain uncertain, mechanical thrombectomy may be reasonable for patients within 6 hours of onset and with:

- u Large proximal occlusion of M2, M3 MCA branches
- u Large proximal occlusions of ACA, vertebral, basilar or PCA
- u Low ASPECTS scores (<6)
- u Low NIHSS scores (<6)
- u Baseline functional status with mRS >1



Top of basilar stroke

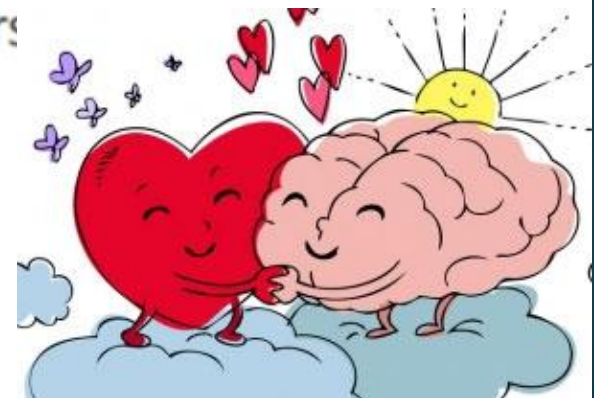


Give IV rtPA first: "Drip and Ship"

"Eligible stroke patients should receive intravenous thrombolysis while concurrently arranging endovascular thrombectomy, with neither treatment delaying the other"

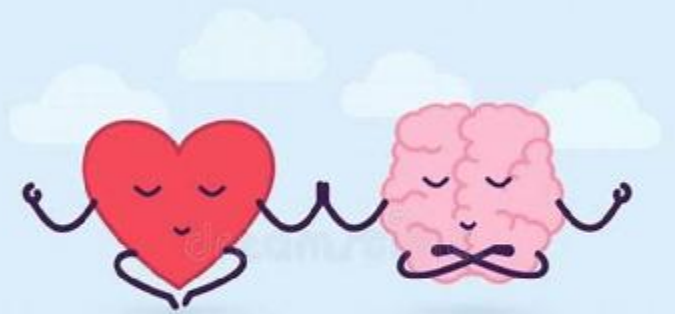
Recent EXTEND TNK: Tenecteplase might be better than alteplase as a bridging therapy (Campbell, NEJM 2018)

- Tenecteplase 0.25 mg/kg versus Alteplase within 4.5 hours
- 202 patients eligible for thrombectomy
- Higher incidence of reperfusion
- Better functional outcome

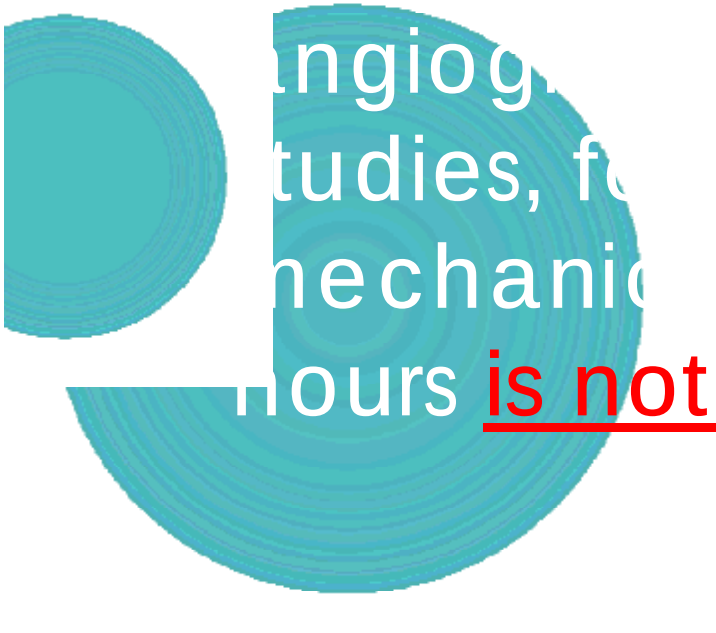


How about Cr?

- u For patients who otherwise meet criteria for endovascular treatment, it is reasonable to proceed with CTA if indicated in patients with suspected large vessel intracranial occlusion prior to obtaining a serum creatinine concentration in patients without a history of renal



BALANCE
your life



u Additional imaging beyond CT and CTA
Magnetic resonance
angiography (MRA), such as perfusion
studies, for selecting patients for
mechanical thrombectomy under 6
hours is not recommended

Next step

ORIGINAL ARTICLE

Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct

Raul G. Nogueira, M.D., Ashutosh P. Jadhav, M.D., Ph.D., Diego C. Haussen, M.D., Alain Bonafe, M.D., Ronald F. Budzik, M.D., Parita Bhutta, M.D., Dilpreet R. Yavagal, M.D., Marc Ribo, M.D., Christophe Cognard, M.D., Ricardo A. Henel, M.D., Cathy A. Sila, M.D., Ameer E. Hassan, D.O., Monica Millan, M.D., Eled I. Levy, M.D., Peter Mitchell, M.D., Michael Chen, M.D., Joey D. English, M.D., Qaiser A. Shah, M.D., Frank L. Silver, M.D., Vilur M. Pereira, M.D., Brijesh P. Mehta, M.D., Blaise W. Baxter, M.D., Michael G. Abraham, M.D., Pedro Cardona, M.D., Erol Veznedaroglu, M.D., Frank R. Halperinger, M.D., Lei Feng, M.D., Jawad F. Korman, M.D., Demetrius K. Lopes, M.D., Brian I. Jankowitz, M.D., Michael K. Frankel, M.D., Vincent Costalat, M.D., Nivav A. Vora, M.D., Albert J. Yoo, M.D., Ph.D., Amer M. Malik, M.D., Anthony J. Furlan, M.D., Marta Rubiera, M.D., Amin Aghaebrahim, M.D., Jean-Marc Olivet, M.D., Wondwossen G. Tekle, M.D., Ryan Shields, M.Sc., Todd Graves, Ph.D., Roger J. Lewis, M.D., Ph.D., Wade S. Smith, M.D., Ph.D., David S. Liebeskind, M.D., Jeffrey L. Saver, M.D., and Tudor G. Jovin, M.D., for the DAWN Trial Investigators¹

mRS 0-2 49% vs 13%
adjusted difference 33%, 95% CI 21%-44%

ORIGINAL ARTICLE

Thrombectomy for Stroke at 6 to 16 Hours with Selection by Perfusion Imaging

Gregory W. Albers, M.D., Michael P. Marks, M.D., Stephanie Kemp, B.S., Soren Christensen, Ph.D., Jenny P. Tsai, M.D., Santiago Ortega-Gutiérrez, M.D., Ryan A. McTaggart, M.D., Michel T. Torbey, M.D., May Kim-Tenser, M.D., Thabele Leslie-Mazwi, M.D., Amrou Samraj, M.D., Scott E. Kerner, M.D., Sameer A. Ansari, M.D., Ph.D., Sharon D. Yeatts, Ph.D., Scott Hamilton, Ph.D., Michael Milynash, M.D., Jeremy J. Heil, M.D., Greg Zaharchuk, M.D., Sun Kim, M.D., Janice Carruzzella, M.S.N., Yuko Y. Palesch, Ph.D., Andrew M. Demchuk, M.D., Roland Bammer, Ph.D., Philip W. Lavori, Ph.D., Joseph P. Broderick, M.D., and Maarten G. Lansberg, M.D., Ph.D. on behalf of the DEFUSE 3 Investigators²

40% of the DEFUSE 3 patients were
outside DAWN selection criteria

mRS 0-2 44.6% vs 16.7%
relative risk 2.67, 95% CI 1.60-4.48, P<0.0001

Extended time for embolectomy

- u In selected patients with AIS within 6-16 hours of last known normal who have large vessel occlusion in the anterior circulation and meet other DAWN or DEFUSE-3 eligibility criteria, mechanical thrombectomy is recommended

- u In selected patients with AIS within 16-24 hours of last known normal who have large vessel occlusion in the anterior circulation and meet other DAWN eligibility criteria, mechanical thrombectomy is reasonable

MECHANICAL THROMBECTOMY

REVISED GUIDELINES

- Patients eligible for IV Alteplase should receive it even if being considered for EVT
- Patients under consideration for EVT, observation after IV Alteplase to assess for clinical response should not be performed.

NEW GUIDELINES

- Eligible patients within 6-16 hours of LKW with LVO in anterior circulation and meet DAWN or DEFUSE 3 criteria, EVT is recommended
- Eligible patients within 6-24 hours of LKW with LVO in anterior circulation and meet other DAWN criteria, EVT is recommended

Imaging Selection for Thrombectomy 6-24hrs

In selected patients with AIS within 6-24 hours of last known normal who have large vessel occlusion in the anterior circulation, obtaining CT perfusion, diffusion weighted MRI or MRI perfusion is **recommended** to aid in patient selection for mechanical thrombectomy, but only when imaging and other eligibility criteria from RCTs showing benefit are strictly applied



Imaging Selection for Thrombectomy 6-24hrs



DWI/PWI and CTP Assessment in the Triage of Wake-Up and Late Presenting Strokes Undergoing Neurointervention (DAWN)

6-24hrs

MRI DWI or automated perfusion evaluation for core volume

Group	Age	NIHSS	Infarct
A	≥80	≥10	≤20cc
B	<80	≥10	≤30cc
C	<80	≥20	31-50cc



Endovascular Therapy Following Imaging Evaluation for Ischemic Stroke 3 (DEFUSE 3)

6-16hrs

Automated perfusion evaluation of core and mismatch volume

Age 18-90
NIHSS ≥6
Core <70cc
Mismatch ratio ≥1.8
Mismatch volume ≥15ml



Which device?

- u The use of mechanical thrombectomy rather than stent retrievers as first line devices for mechanical thrombectomy may be reasonable in some circumstances, but stent retrievers remain the first choice.

Anesthetic choice?

JAMA | Original Investigation

Effect of Conscious Sedation vs General Anesthesia on Early Neurological Improvement Among Patients With Ischemic Stroke Undergoing Endovascular Thrombectomy A Randomized Clinical Trial

Silvia Schönenberger, MD; Lorenz Uhlmann, MSc; Werner Hacke, MD, PhD; Simon Schieber, MD; Sibu Mundiyanapurath, MD; Jan C. Purrucker, MD; Simon Nagel, MD; Christina Klose; Johannes Pfaff, MD; Martin Bendszus, MD; Peter A. Ringleb, MD; Meinhard Kieser, PhD; Markus A. Möhlenbruch, MD; Julian Bösel, MD, FNCs

ORIGINAL CONTRIBUTION

General Anesthesia Versus Conscious Sedation for Endovascular Treatment of Acute Ischemic Stroke

The AnStroke Trial (Anesthesia During Stroke)

Pia Löwhagen Hendén, Alexandros Rentzos, Jan-Erik Karlsson, Lars Rosengren, Birgitta Leiram, Henrik Sundeman, Dennis Dunker, Kunigunde Schnabel, Gunnar Wikholm, Mikael Hellström, Sven-Erik Ricksten

JAMA Neurology | Original Investigation

Effect of General Anesthesia and Conscious Sedation During Endovascular Therapy on Infarct Growth and Clinical Outcomes in Acute Ischemic Stroke A Randomized Clinical Trial

Individual Decision

- It is reasonable to select anesthetic technique during endovascular therapy for AIS based on individualized assessment of patient risk factors, technical performance of the procedure, and other clinical characteristics. Further randomized trial data are needed.

Thank you for your attention

Friends Forever



BRAIN - HEART

www.shutterstock.com · 613776623