
Minneapolis Heart Institute Foundation
GRAND ROUNDS

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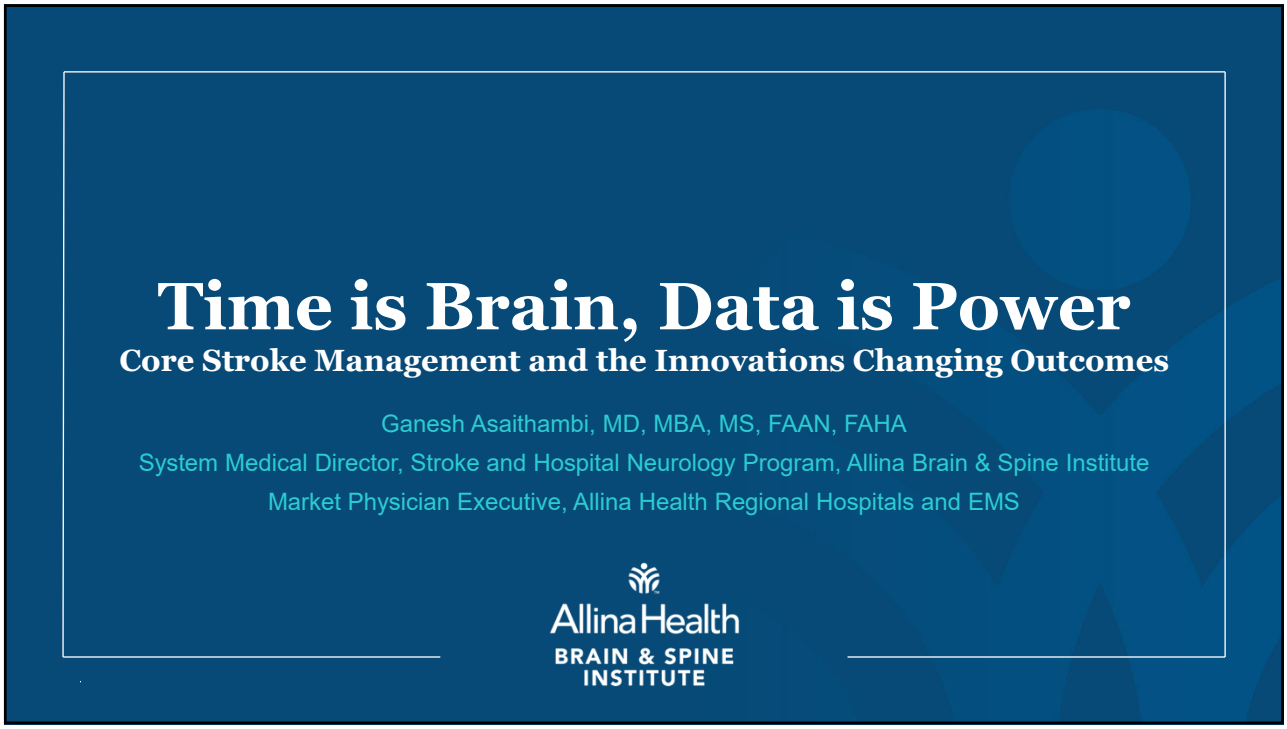
Time is Brain, Data is Power
Core Stroke Management and the Innovations Changing Outcomes
Ganesh Asaithambi, MD, MBA, MS, FAAN, FAHA
System Medical Director, Stroke and Hospital Neurology Program, Allina Brain & Spine Institute
Market Physician Executive, Allina Health Regional Hospitals and EMS
Allina Health
BRAIN & SPINE INSTITUTE

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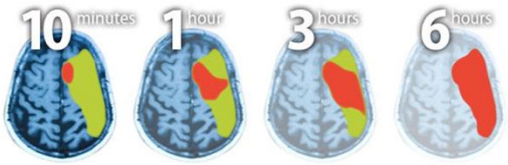
Conflicts of Interest

- No relevant financial disclosures
- Will not speak about off label use of devices or medications
- Serve on the Board of Directors for Minnesota Connect Aphasia Now

Time is brain!

Every minute 2,000,000 brain cells die during stroke.



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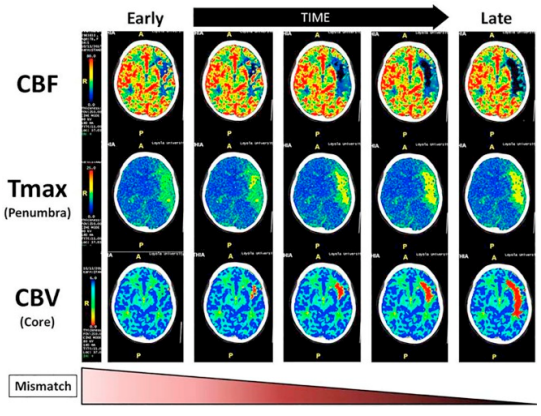
THE STAKES



Gomez CR. J Stroke Cerebrovasc Dis 2018.

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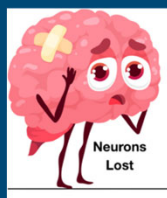

Time is Brain!

	Neurons Lost	Synapses Lost	Myelinated Fibers Lost	Accelerated Aging
Per Stroke	1.2 billion	8.3 trillion	7140 km/4470 miles	36 y
Per Hour	120 million	830 billion	714 km/447 miles	3.6 y
Per Minute	1.9 million	14 billion	12 km/7.5 miles	3.1 wk
Per Second	32 000	230 million	200 meters/218 yards	8.7 h

Ganti L. Int J Emerg Med 2025

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Objectives

- Explain how data-driven innovations have advanced stroke management
- Identify emerging technologies transforming stroke care
- Integrate new research and evolving guidelines into practical clinical decision-making

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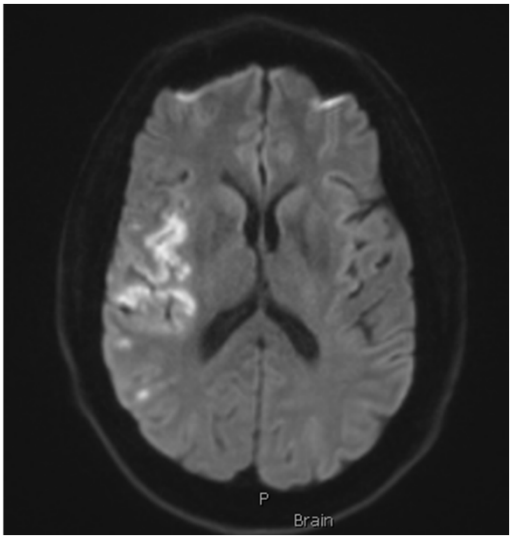
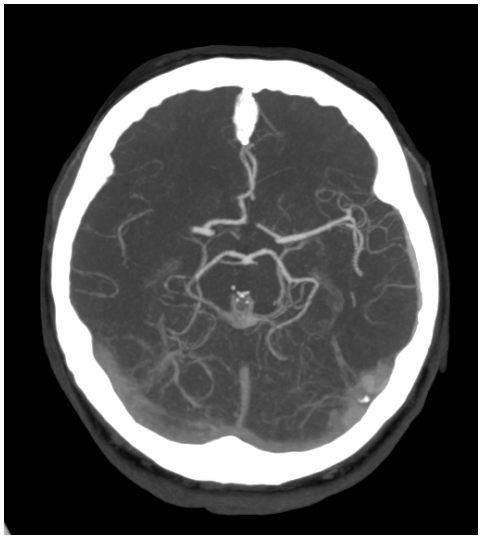
Mark's Story of 30 Minutes





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Stroke is a Systems Disease

Stroke ≠ Neurologist Problem

Stroke = System Design Opportunity

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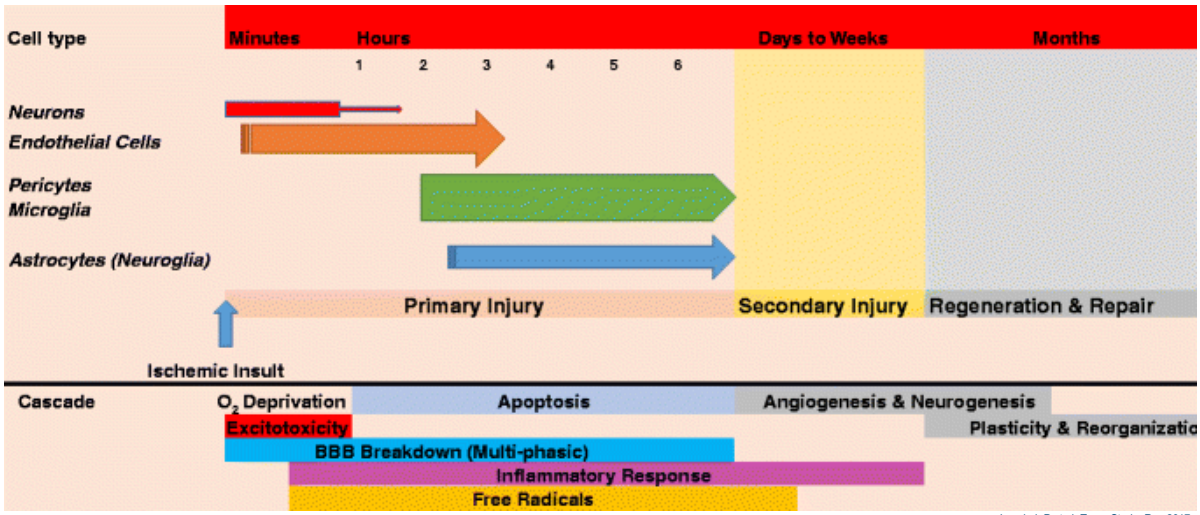
Stroke is Predictable



Lapchak P et al. Trans Stroke Res 2017.

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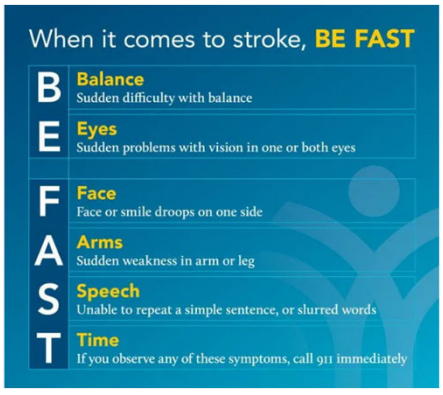
Six Decisions



- Detect
- Image
- Decide
- Reperfuse
- Stabilize
- Prevent

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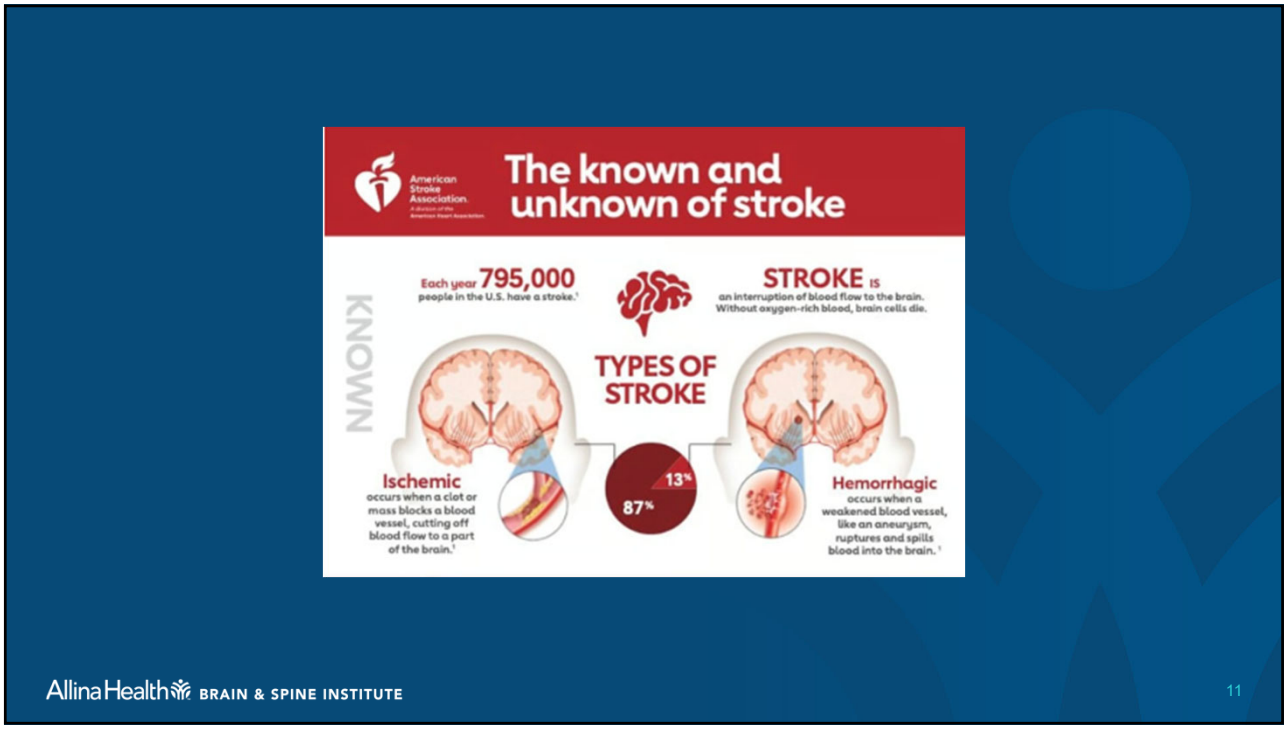
American Stroke Association
The known and unknown of stroke
KNOWN
Each year 795,000 people in the U.S. have a stroke.
STROKE IS an interruption of blood flow to the brain. Without oxygen-rich blood, brain cells die.
TYPES OF STROKE
Ischemic
occurs when a clot or mass blocks a blood vessel, cutting off blood flow to a part of the brain.
87%
13%
Hemorrhagic
occurs when a weakened blood vessel, like an aneurysm, ruptures and spills blood into the brain.
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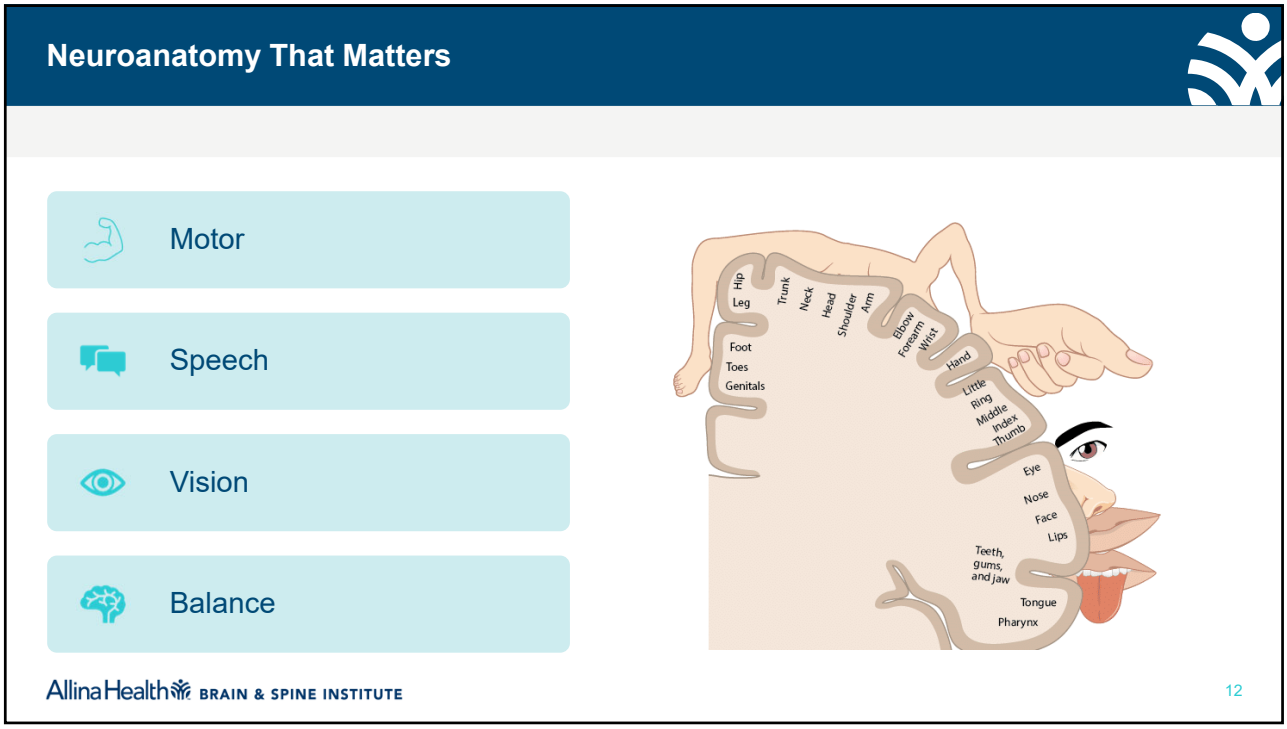
Neuroanatomy That Matters
Motor
Speech
Vision
Balance
Hip
Leg
Trunk
Neck
Head
Shoulder
Arm
Elbow
Forearm
Wrist
Hand
Little
Ring
Middle
Index
Thumb
Foot
Toes
Genitals
Eye
Nose
Face
Lips
Teeth, gums, and jaw
Tongue
Pharynx
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Detect: The Moment That Changes Everything

- VAN, FAST-ED, RACE
- Early recognition = earlier reperfusion
- Detection begins before CT

RACE

Facial Palsy	2 points
Arm Motor Function	2 points
Leg Motor Function	2 points
Gaze Palsy	1 point
Aphasia/ Agnosia	2 points

When ≥5, RACE has:
- 0.85 sensitivity
- 0.68 specificity

for identifying LVO

VAN

Arm Weakness and	*Sine qua non*
Visual Disturbance or	+/-
Aphasia or	+/-
Neglect	+/-

When yes ≥ 1+, VAN has:
- 100% sensitivity
- 90% specificity

for identifying emergent LVO

FAST-ED

Facial Palsy	1 point
Arm Weakness	2 points
Speech Changes	2 points
Eye Deviation	2 points
Denial/Neglect	2 points

When ≥3, FAST-ED has:
- 0.71 sensitivity
- 0.78 specificity

When ≥4, FAST-ED has:
- 0.61 sensitivity
- 0.89 specificity

Eng M et al. Curr Atheroscler Rep 2017.

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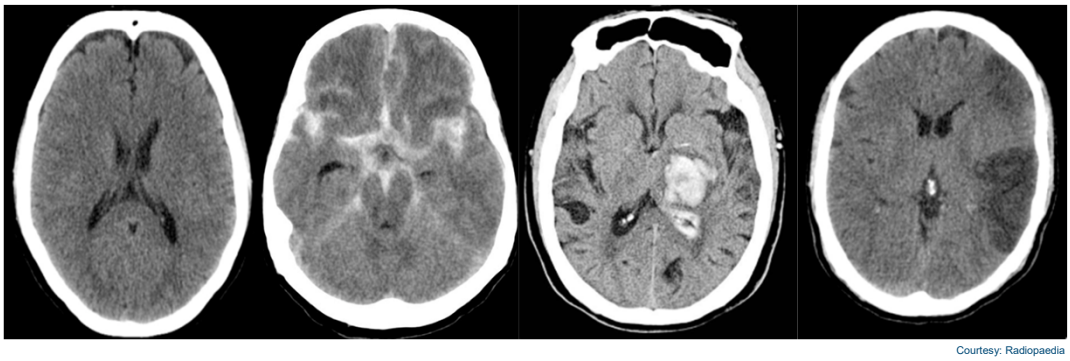
Image: CT Head



Courtesy: Radiopaedia

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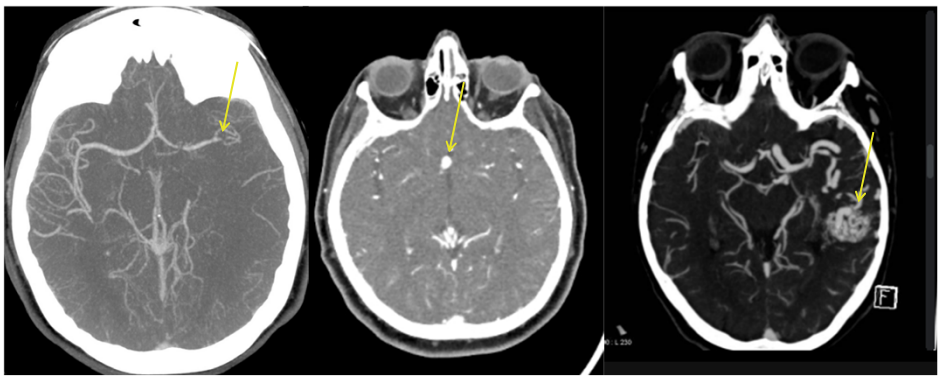
Image: CTA

Finding the Enemy



Courtesy: Radiopaedia

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CT + AI: Find the Enemy Quicker

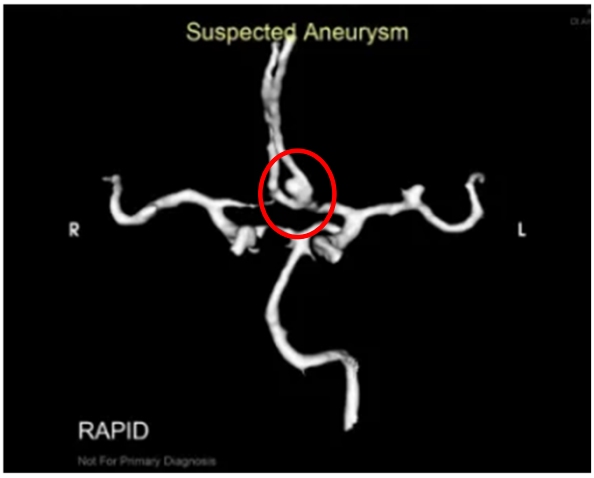

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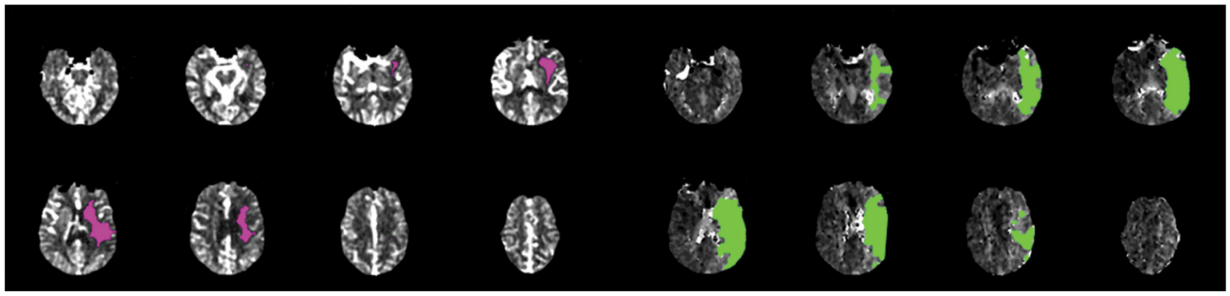
Image: CTP

Tissue over Time



Volume of Ischemic Core, 23 ml

Volume of Perfusion Lesion, 128 ml

Mismatch volume, 105 ml
Mismatch ratio, 5.6

Albers GW et al. New Engl J Med 2018.

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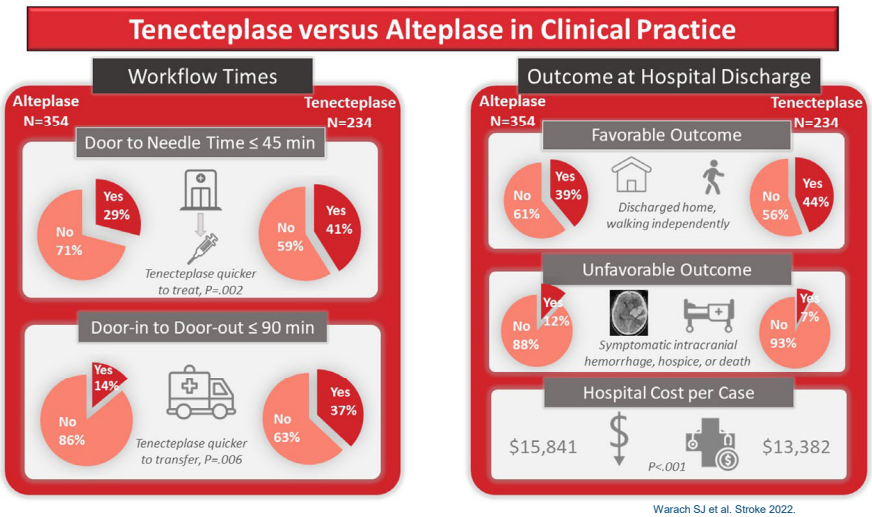
Reperfuse: IV Thrombolysis for Ischemic Stroke



Warach SJ et al. Stroke 2022.

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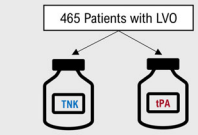
Reperfuse: IV Thrombolysis in Ischemic Stroke

Tenecteplase vs Alteplase

- Higher specificity for fibrin (14-fold)
- Greater fibrinogen preservation (10-fold)
- Reduced binding to plasminogen activator inhibitor-1 (80-fold greater resistance)
- Longer half-life
  - Administered in a single dose over 5 seconds
  - Shorter half-life alteplase is what mandates hour-long infusion
  - Gaps between bolus and infusion for alteplase
    - ≥ 5 min in 80% of patients
      - Results in substantially lower achieved serum levels and clinical effectiveness

POPULATION

- A pooled analysis of two RCTs
- Adults with occlusion of the ICA or MCA presenting within 4.5 hours of symptom onset
- Basilar artery and isolated extracranial ICA occlusions excluded



METHODS

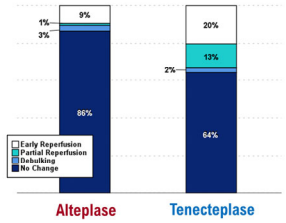
Outcomes:

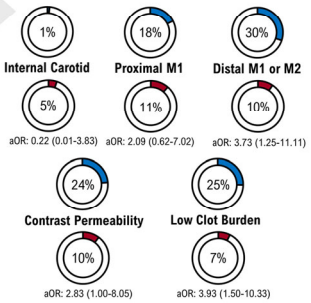
- ***Early Reperfusion*** - Absence of retrievable thrombus or >50% reperfusion on imaging assessment.

Subgroup Analysis:

- *Occlusion Site (ICA, Proximal M1, Distal M1 and M2)*
- *Contrast Permeability (Residual Flow)*
- *Clot Burden (Clot Burden Score)*

FINDINGS





Yogendrakumar V et al. Stroke 2023.

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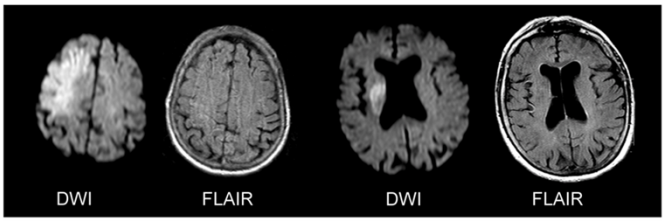
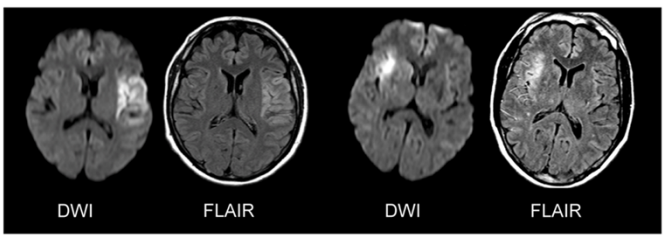
Expanding the Window to 24 Hours: IV Thrombolysis

DWI-FLAIR-mismatch



No DWI-FLAIR-mismatch



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IV Thrombolysis at Allina Health: Cost

Tenecteplase vs Alteplase

	Unweighted	95% bootstrap CI	Weighted	95% bootstrap CI
Costs in 12/2023 dollars (negative indicates saved $)				
Thrombolytic Drug Cost, Difference in Medians	-$4,136	[-$4,519, -$3,900]	-$4,141	[-$4,522, -$3,922]
Total Hospital Encounter Charges, Difference in Medians	-$7,031	[-$17,020, $4,176]	-$3,213	[-$15,031, $7,251]
Treatment effect (positive indicates benefit)				
Home Discharge, % Difference	2.85	[-7.46, 13.26]	2.44	[-8.31, 12.53]
Incremental Cost-Effectiveness Ratio				
Drug Cost Difference / Home Discharge % Difference	-$1,451	[-$11,526, $11,022]	-$1,700	[-$10,818, $11,515]
Total Charge Difference / Home Discharge % Difference	-$2,466	[-$18,297, $15,398]	-$1,319	[-$14,228, $12,968]

Asaithambi G et al. Preprint.

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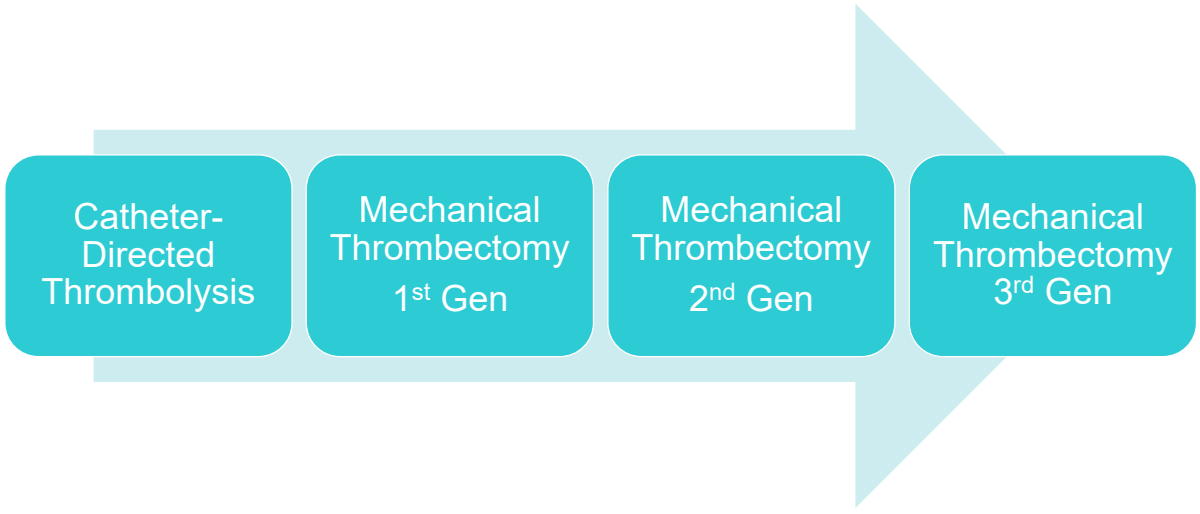
Mechanical Thrombectomy: The Modern Miracle



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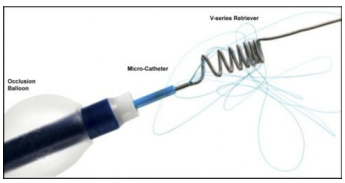

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Thrombectomy in Ischemic Stroke

Therapy	Number Needed to Treat
Thrombectomy for Ischemic Stroke	2.8
Decompressive Hemicraniectomy for Stroke	2
Defibrillation for Cardiac Arrest	2.5
Goal Directed Therapy for Sepsis	5
Thrombolysis for Ischemic Stroke ≤ 3 hours	8
Thrombolysis for Ischemic stroke 3-4.5 hours	15
Ipratropium and beta-agonist nebulizer for asthma	11
PCI for high-risk STEMI	17
Aspirin for STEMI	42
Antibiotics for rheumatic fever	53
Bariatric surgery on mortality in obesity	77

Kamal N et al. Br J Neurosurg 2018.

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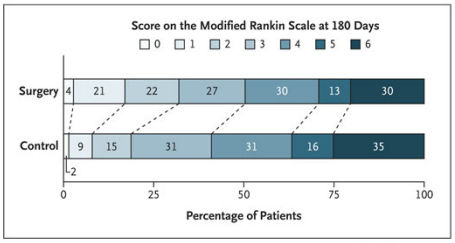
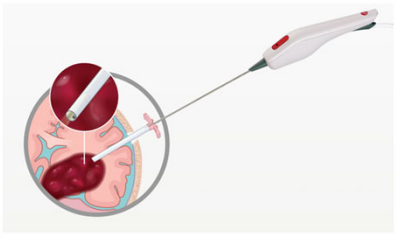
Hemorrhagic Stroke Interventions: ICH



B Ordinal mRS score at different time points

Follow-up	No. of patients Total	MM	MIS	OR (95% CI)
30 d				
Overall	195	67	128	4.23 (2.36-7.57)
Deep	136	46	90	3.88 (1.96-7.68)
Lobar	59	21	38	5.30 (1.73-16.20)
90 d				
Overall	186	66	120	1.31 (0.78-2.19)
Deep	136	49	87	1.30 (0.70-2.40)
Lobar	50	17	33	1.35 (0.50-3.51)
180 d				
Overall	172	58	114	1.29 (0.78-2.13)
Deep	125	42	83	1.28 (0.70-2.32)
Lobar	47	16	31	1.30 (0.51-3.32)

Favors MM | Favors MIS
0.5 1 10 20
OR (95% CI)



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ENRICH Investigators. New Engl J Med 2024.
MIND Investigators. JAMA 2025.

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Hemorrhagic Stroke: SAH

- Aneurysm Treatment
  - Clip
  - Coil
  - Flow diversion
    - Intra-saccular (WEB)
    - Parent vessel
- Vasospasm
  - Transcranial Doppler
  - EEG

> J Neurosurg Anesthesiol. 2025 Dec 5. doi: 10.1097/ANA.0000000000001079. Online ahead of print.

Role of Electroencephalography in the Management of Aneurysmal Subarachnoid Hemorrhage: National Inpatient Sample, 2012–2017

Ganesh Asaithambi [1], Summer L Martins [2]

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Stabilize: Lives

Poor outcome: OR 0.77 (95% CI 0.69-0.87)

Death: OR 0.76 (95% CI 0.66-0.85)

- Blood pressure monitoring
- Dysphagia screening
- Early mobilization
- Delirium prevention
- Reduce mortality

Langhorne P et al. Cochrane Database Syst Rev 2020.

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Prevention: The Long Game

- Atrial fibrillation detection
- Antithrombotic optimization
- Blood pressure control
- LDL < 70
- PFO closure in select patients

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Stabilize: Rehabilitation

- Early intensive rehabilitation improves ADLs
- SSRIs help in avoiding post-stroke depression

Stroke/Depression Status	Unadjusted OR (95% CI)	p-value	Adjusted OR (95% CI)	p-value
No Stroke/Depression	Reference			
No Stroke/No Depression	0.04 (0.03, 0.05)	<0.001	0.03 (0.03, 0.04)	<0.001
Stroke/No Depression	0.04 (0.01, 0.10)	<0.001	0.04 (0.02, 0.10)	<0.001
Stroke/Depression	1.55 (1, 2.39)	0.048	1.86 (1.21, 2.85)	0.005

Asaithambi et al. Preprint.

Vivistim

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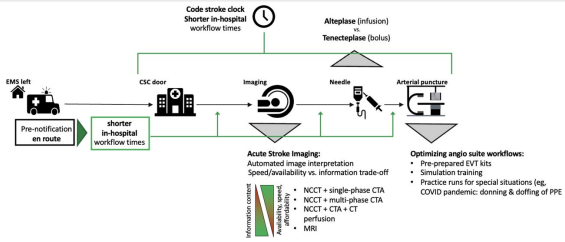
Workflows: Choreography Matters



Ospel JM et al. J Neurointervent Surg 2023.

Credit: Tom Pennington, 2013.

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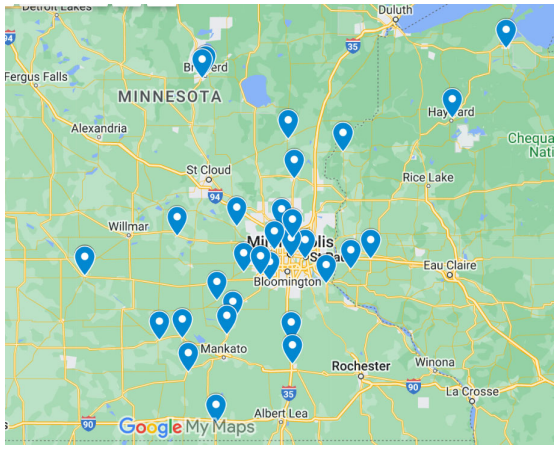
Workflows: Allina Health Stroke Program

- In 2025, 4320 patients
- Telehealth: >8000 calls
- 250 thrombectomies
- 30% received reperfusion treatment
- Decrease unnecessary transfers
- Thousands of miles saved



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The Next Frontier: Patient-Centric

- ReMEDy-2: DM199 (kallikrein)
  - Vasodilation to the microcirculation in the ischemic penumbra to avoid apoptosis
- Acupuncture in Aphasia
  - Promote brain functional reorganization in language networks
- Neuroprotection
  - ~~Targeted temperature~~
  - ~~Magnesium~~
  - ~~Nerinetide~~
  - Minocycline??
- Stem cells

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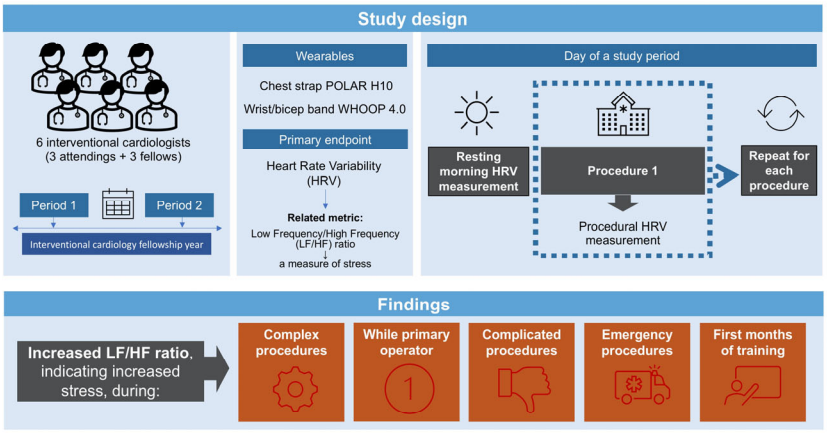
The Next Frontier: Clinician-Centric

Heart rate variability among stroke clinicians



©CCAD MHIF

Alexandrou M et al. J Invasive Cardiol 2025.

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The Next Frontier: Enterprise-Centric

Time-Driven Activity-Based Costing

- Waste 1 minute = 1.9 million neurons
- Save 1 minute = 1.8 healthy life

- We know the neuronal and functional benefit, but for every minute saved in door to needle time, how much are we saving in operational cost?

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Coming Together

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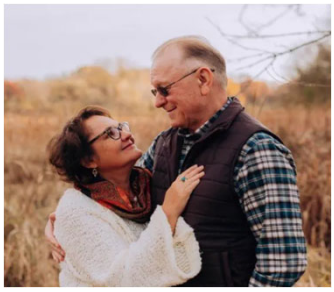

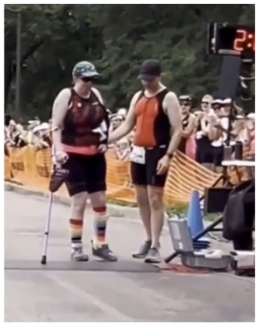

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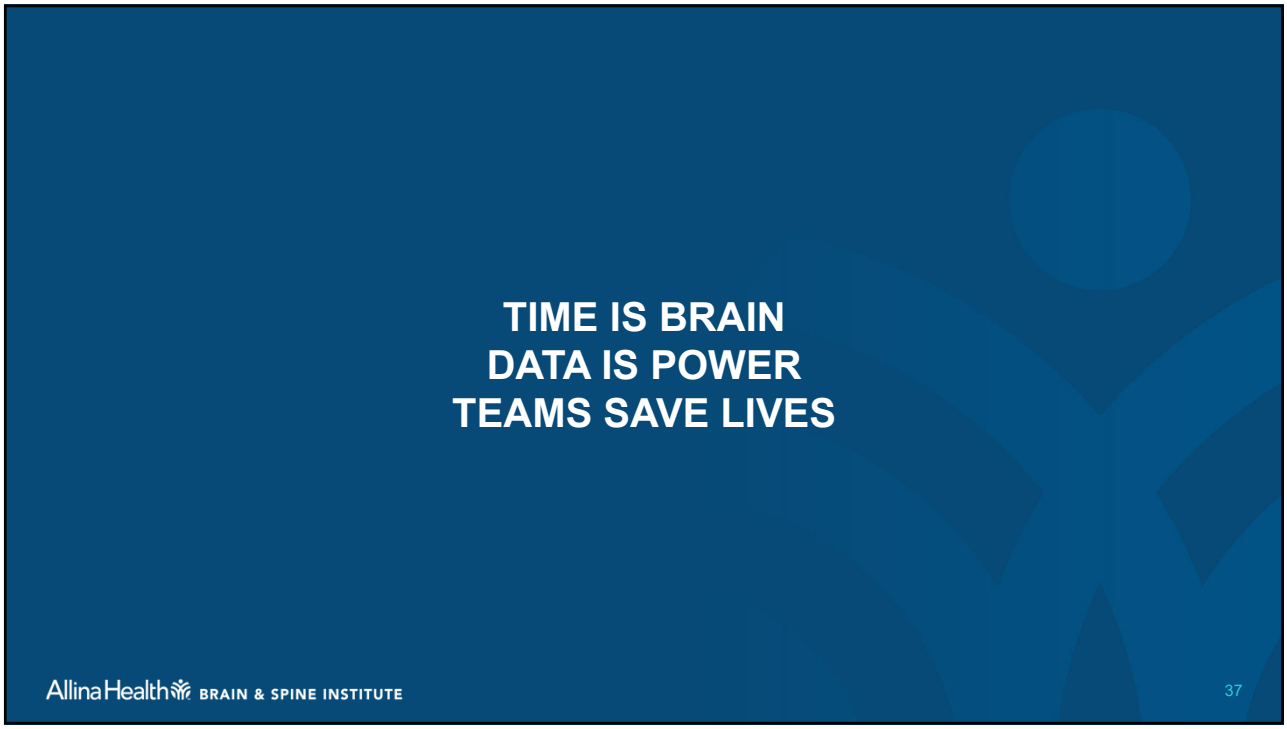
TIME IS BRAIN
DATA IS POWER
TEAMS SAVE LIVES
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