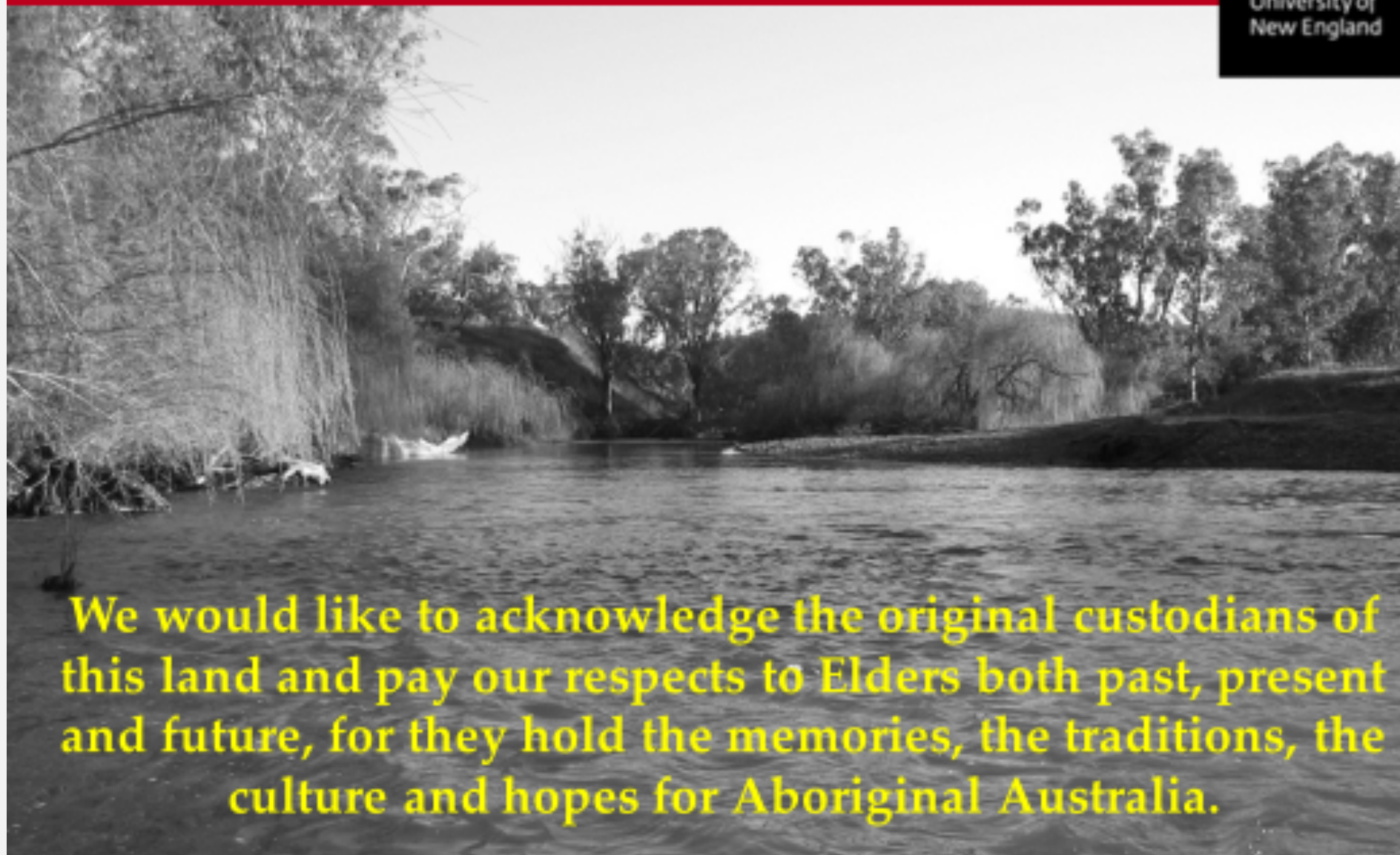


# STROKE UPDATE

- New imaging techniques
- Thrombolysis
- Ambulance bypass

Carlos Garcia-Esperon

# Acknowledgment of Country



We would like to acknowledge the original custodians of this land and pay our respects to Elders both past, present and future, for they hold the memories, the traditions, the culture and hopes for Aboriginal Australia.

## Estimated Pace of Neural Circuitry Loss in Typical Large Vessel, Supratentorial Acute Ischemic Stroke

	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

Total number of neurons: 85 billion

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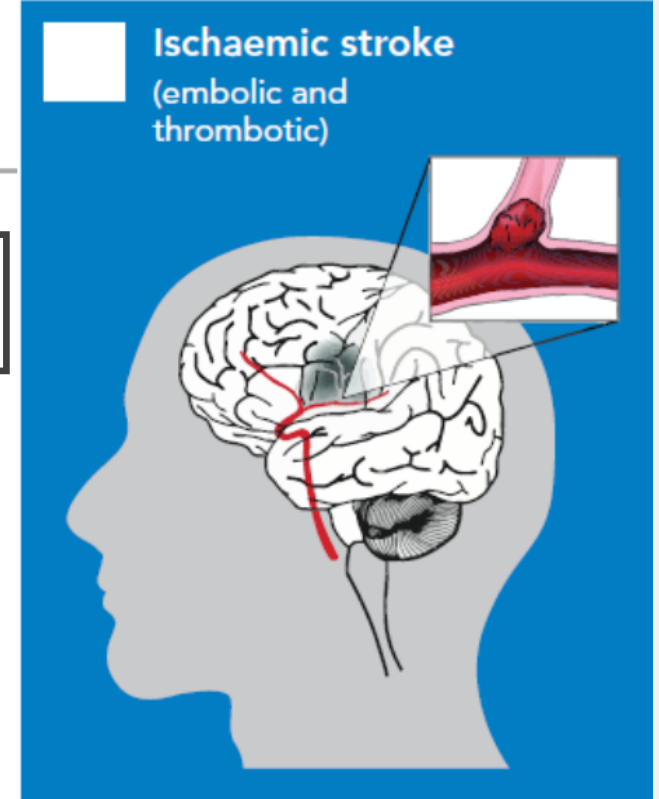
**1 IN 6 AUSTRALIANS WILL SUFFER A STROKE**

Stroke is one of the leading causes of disability in Australia  
50,000 new strokes each year in Australia

An ischemic stroke occurs when a brain artery is occluded

If the artery remains blocked for more than a few minutes, the neurons die

The goal for both of these treatment strategies is early reperfusion  
(dissolving or removing the clot).



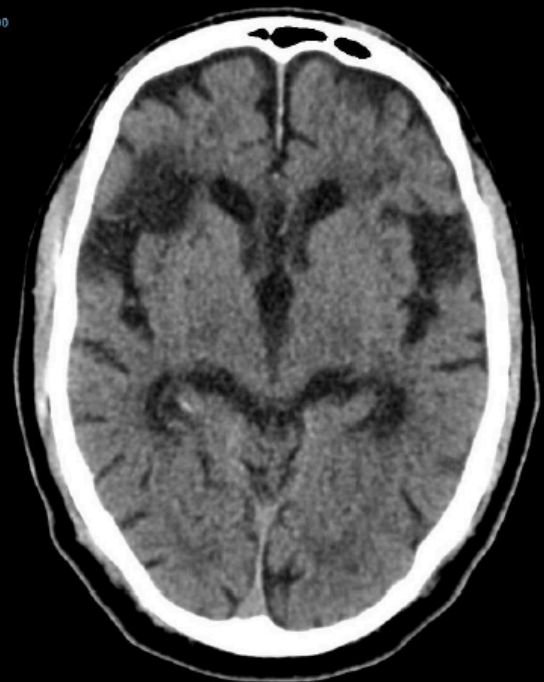
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Axial 1 4.000



100  
Axial 1 4.000



100



100



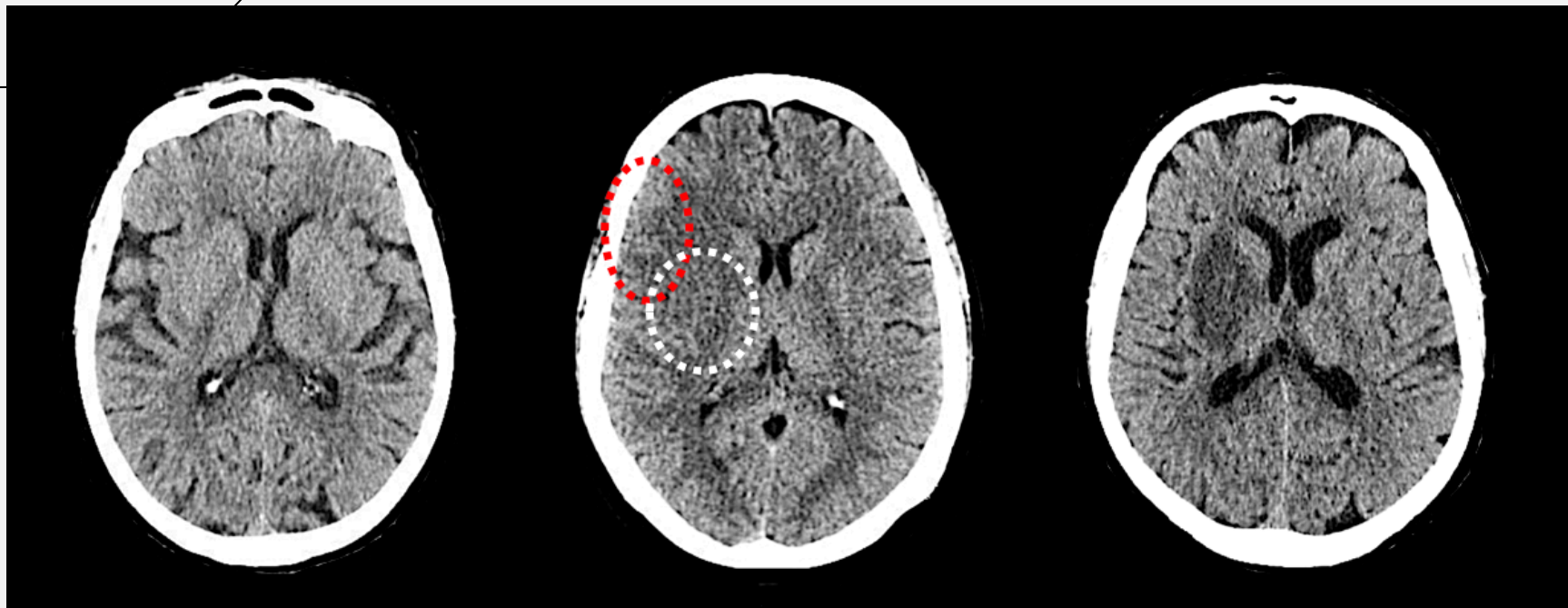
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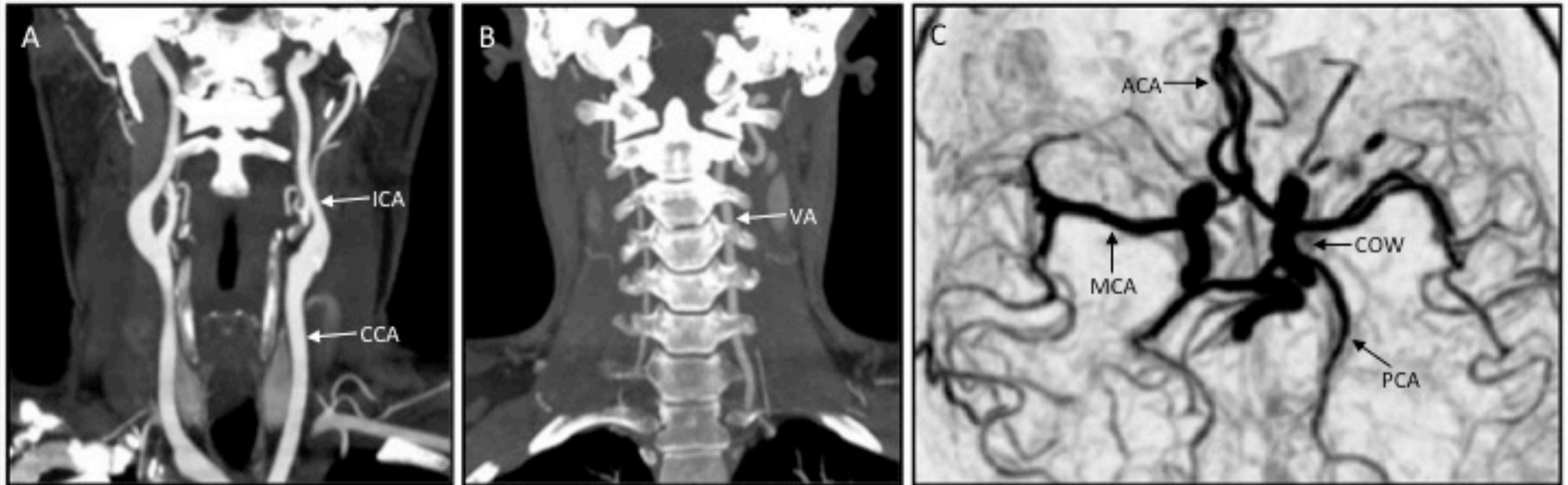
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**NOT  
EVERYTHING  
IS BLACK  
AND WHITE**



# CT ANGIOGRAPHY



# MULTIMODAL IMAGE, BRAIN CT+CTA+CTP

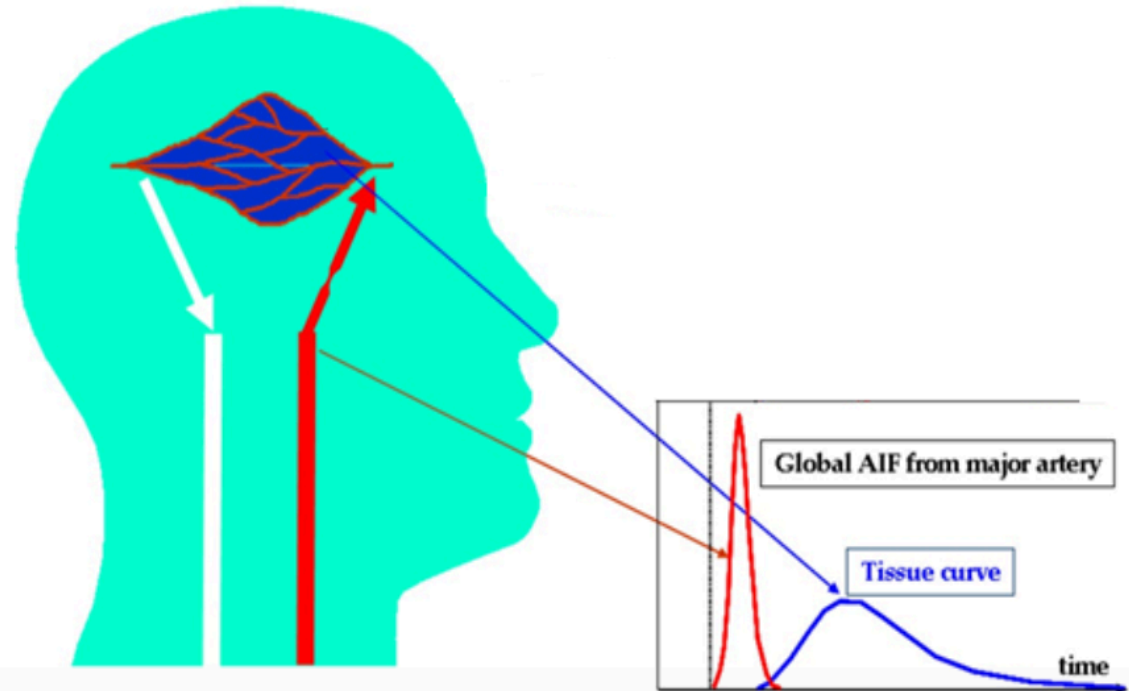
Using the contrast injection movie, we calculate  
Cerebral blood flow, volume, and transit (MTT and Tmax/Delay Time)

## Core

long DT+ low CBF  
(no blood enters the region of the infarct)

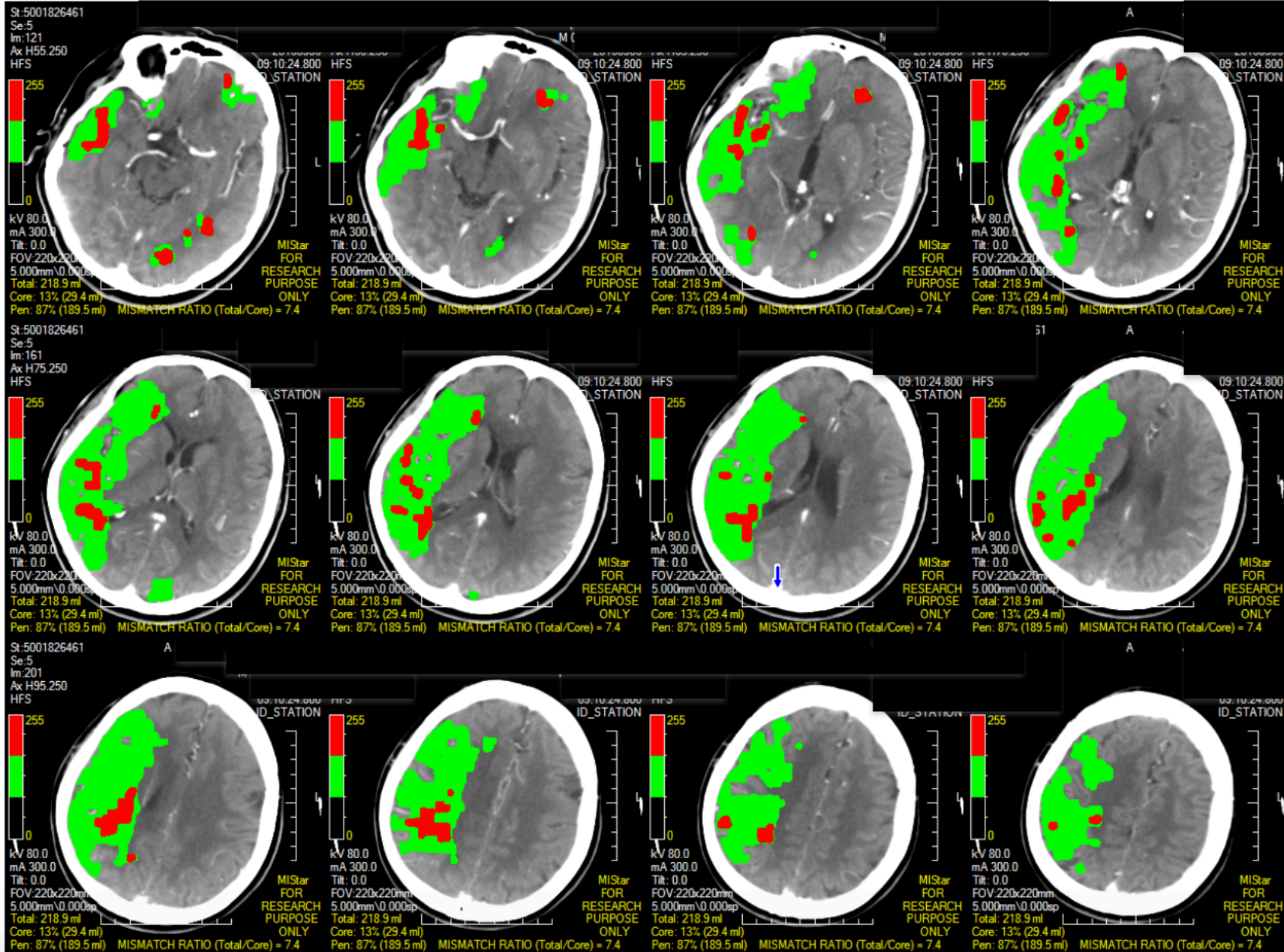
## Penumbra

long DT + normal or high CBF  
(maximal vasodilation)

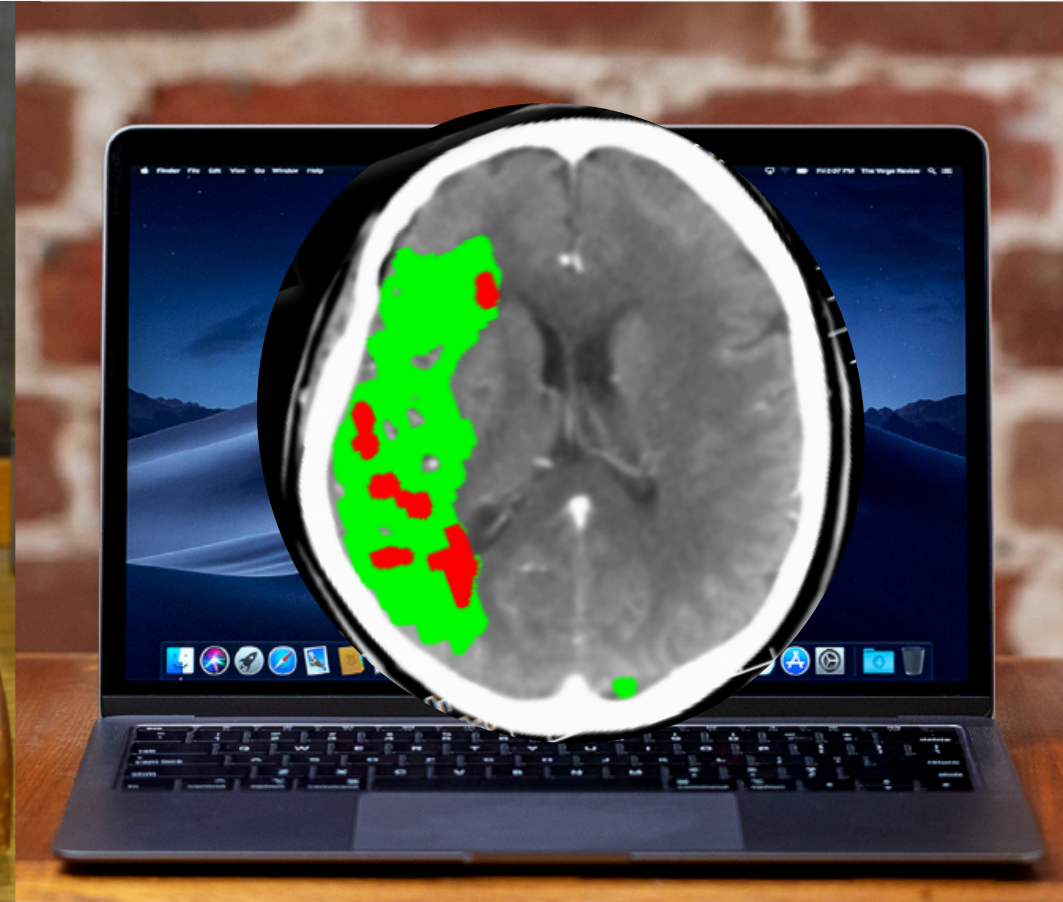
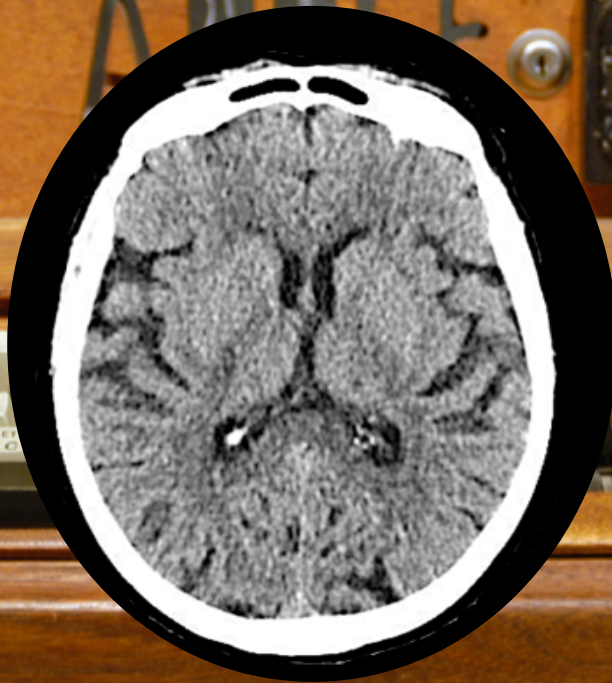




# CT PERFUSION, CORE PENUMBRA MAPS



WORLD HAS CHANGED



# THROMBOLYSIS

## Alteplase (rt-PA)

Recombinant tissue plasminogen activator

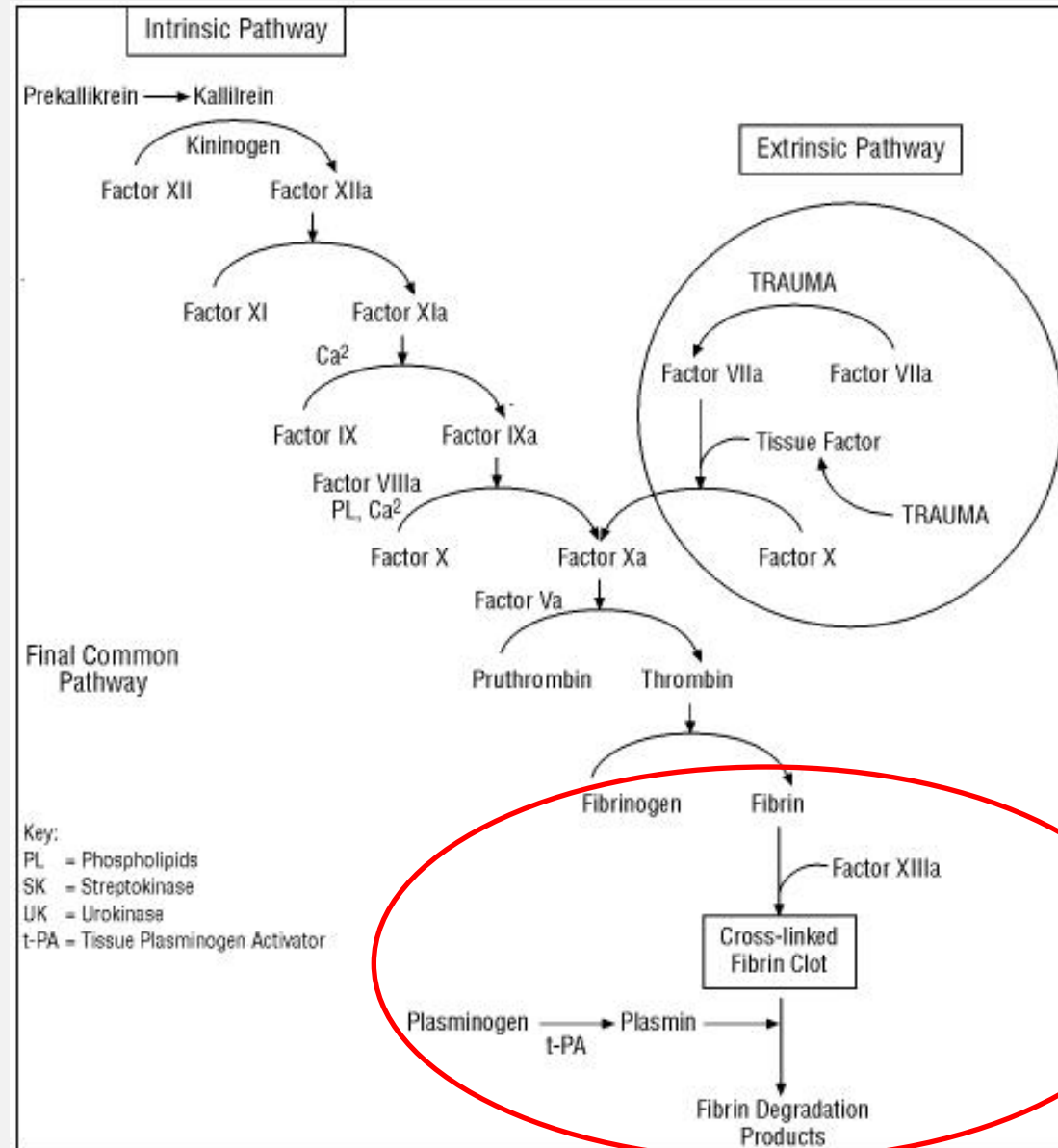
Therapeutic half-life: 4-5 min

Dose:

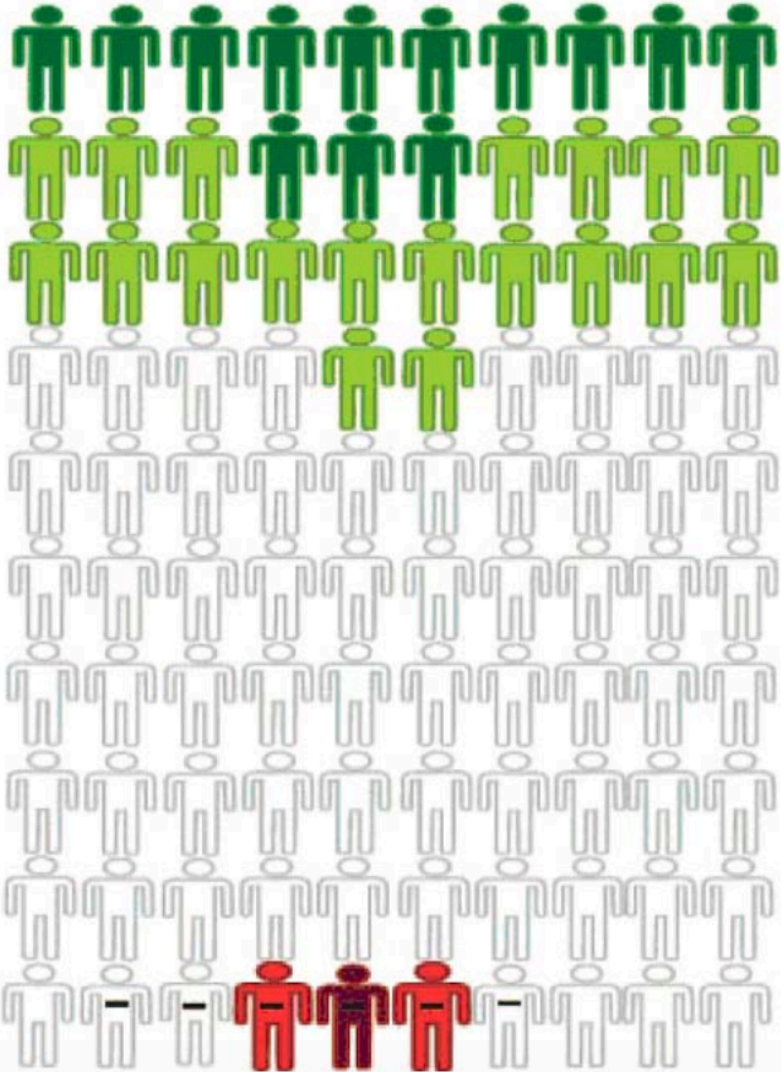
0.9mg/kg, capped at 90mg

10% IV bolus

90% 1 hour infusion



# THROMBOLYSIS



Changes in final outcome as a result of treatment:

- Dark green: Normal or nearly normal
- Light green: Better
- White: No major change
- Red: Worse
- Dark red: Severely disabled or dead

Early course:

- White circle: No early worsening with brain bleeding
- White circle with a horizontal line: Early worsening with brain bleeding

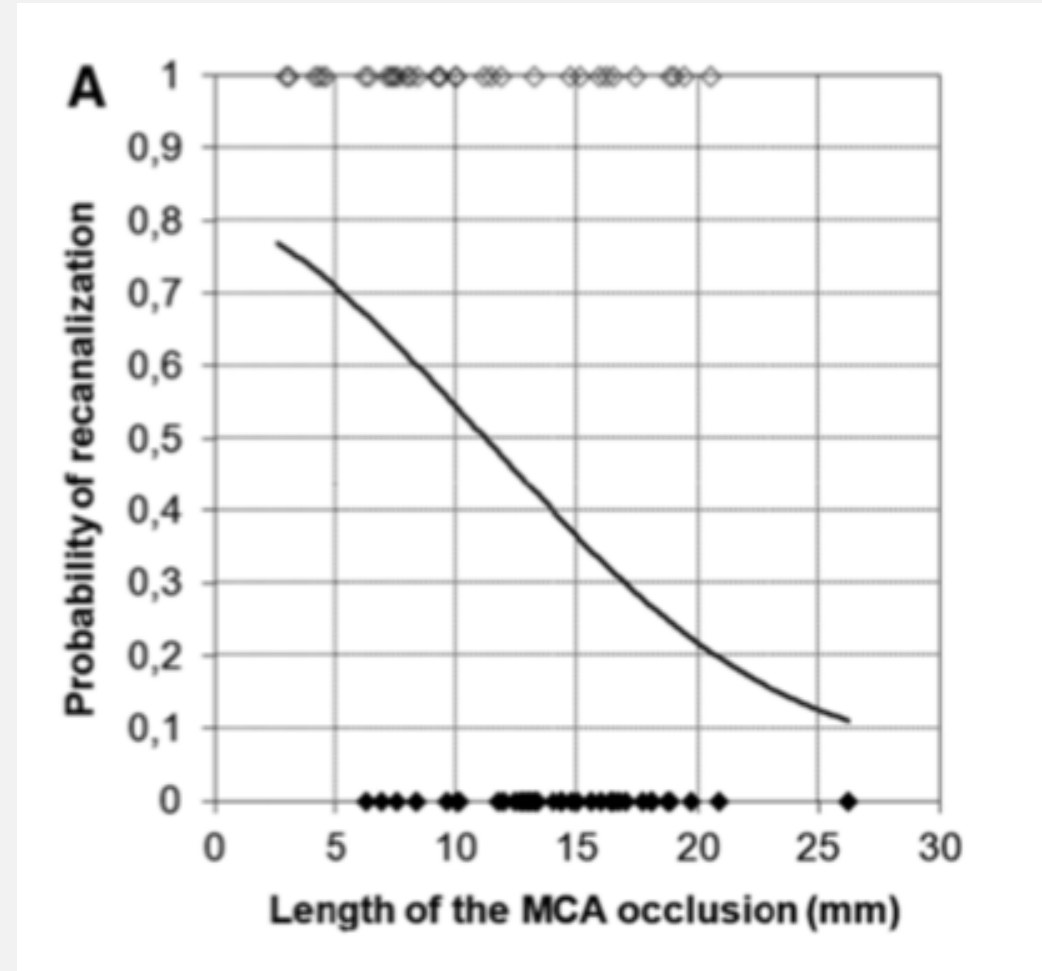
The majority do **not** benefit.

rtPA is not an ideal thrombolytic drug and does not open up big clots

# LIMITATIONS

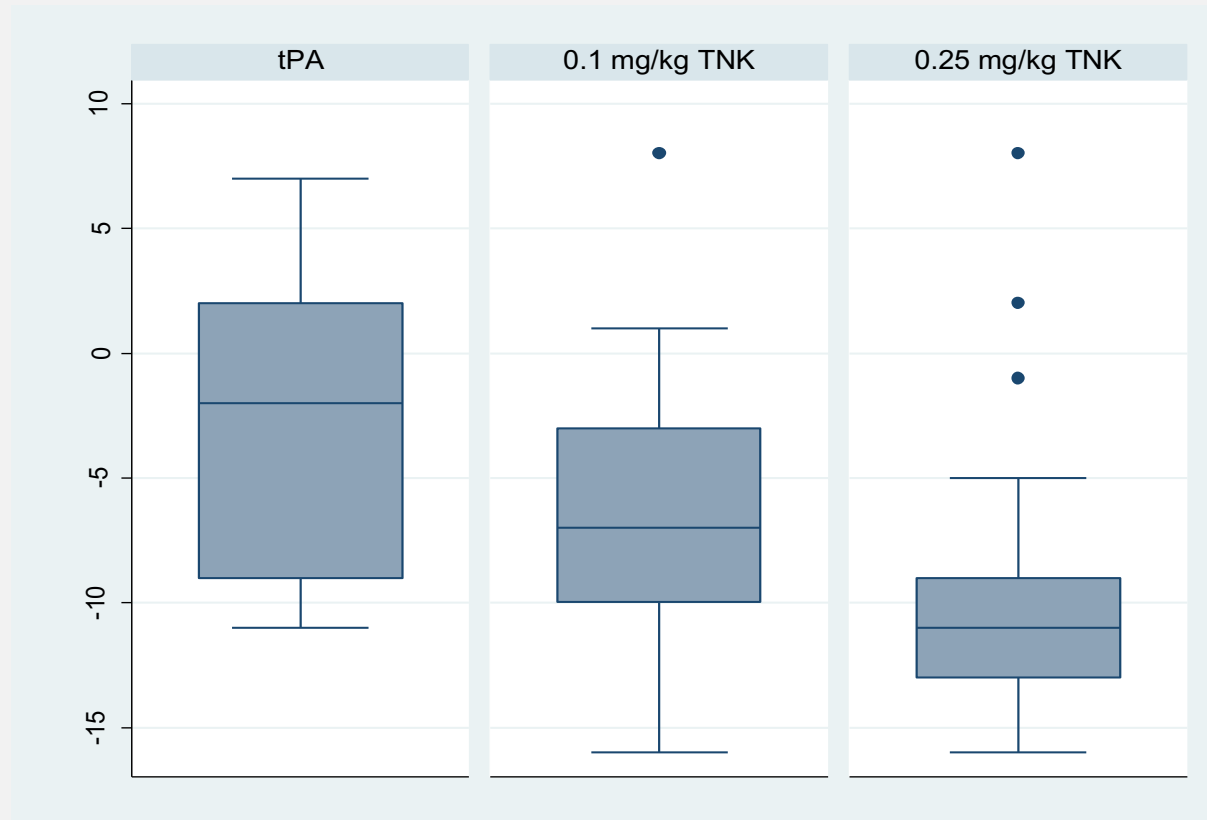
## Not for everyone

- Patients on Warfarin (if INR >1.7)
- Patients on NOAC (and compliant)
- Recent surgery (2 weeks)
- Pregnancy
- ...



# “NEW” THROMBOLYTICS: TENECTEPLASE

Distribution of change in severity of stroke (NIHSS) 24 h after treatment



Limited to clinical trials :TASTE (tPA vs TNK)

# CTP, IMAGING MODALITY FOR THROMBOLYSIS

*The* NEW ENGLAND  
JOURNAL *of* MEDICINE

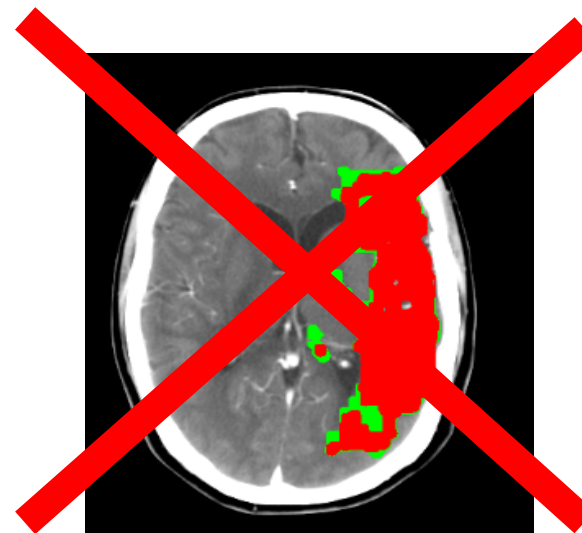
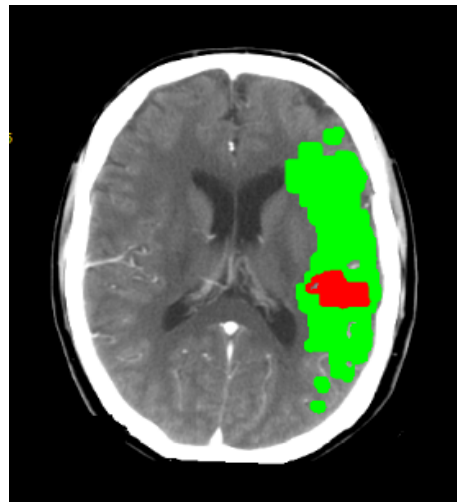
ESTABLISHED IN 1812

MAY 9, 2019

VOL. 380 NO. 19

## Thrombolysis Guided by Perfusion Imaging up to 9 Hours after Onset of Stroke

H. Ma, B.C.V. Campbell, M.W. Parsons, L. Churilov, C.R. Levi, C. Hsu, T.J. Kleinig, T. Wijeratne, S. Curtze, H.M. Dewey, F. Miteff, C.-H. Tsai, J.-T. Lee, T.G. Phan, N. Mahant, M.-C. Sun, M. Krause, J. Sturm, R. Grimley, C.-H. Chen, C.-J. Hu, A.A. Wong, D. Field, Y. Sun, P.A. Barber, A. Sabet, J. Jannes, J.-S. Jeng, B. Clissold, R. Markus, C.-H. Lin, L.-M. Lien, C.F. Bladin, S. Christensen, N. Yassi, G. Sharma, A. Bivard, P.M. Desmond, B. Yan, P.J. Mitchell, V. Thijs, L. Carey, A. Meretoja, S.M. Davis, and G.A. Donnan, for the EXTEND Investigators\*



# CTP, IMAGING MODALITY FOR THROMBOLYSIS

*The* **NEW ENGLAND**  
**JOURNAL** *of* **MEDICINE**

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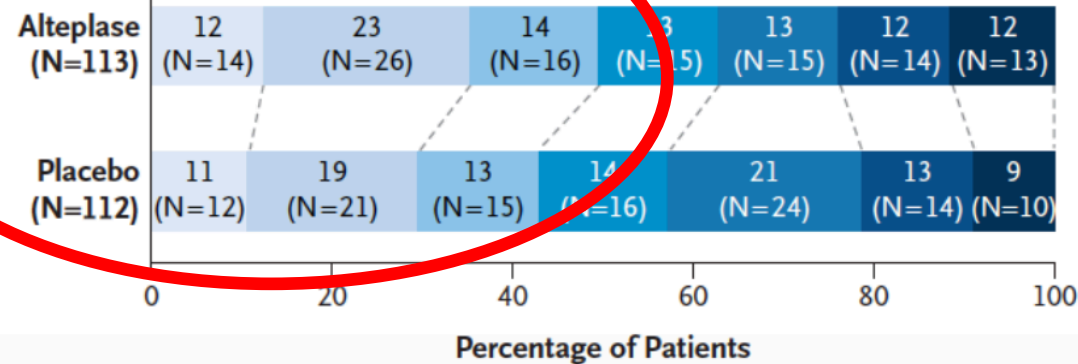
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No increased hemorrhagic  
transformation after thrombolysis  
compared to placebo





1981

***Stroke***

*A Journal of Cerebral Circulation*

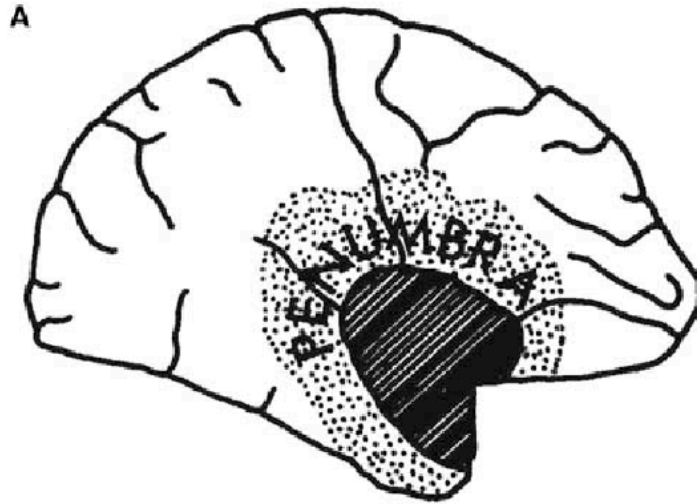
NOVEMBER-DECEMBER 1981  
VOL. 12 NO. 6

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Editorial

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Thresholds in Cerebral Ischemia — The Ischemic  
Penumbra



# PENUMBRA

1981

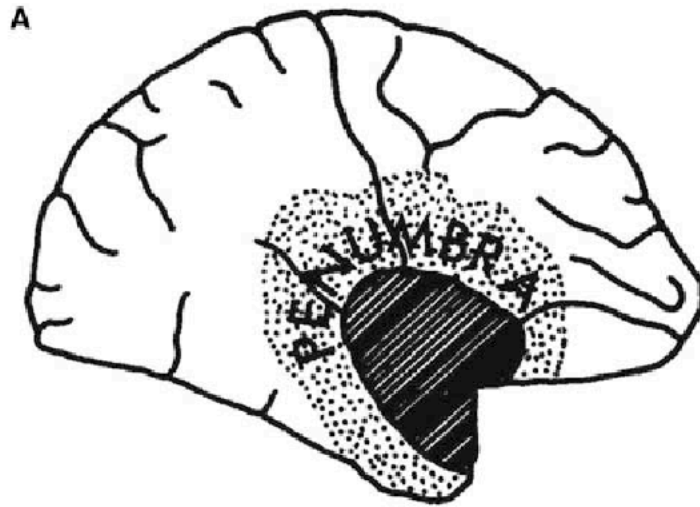
***Stroke***

*A Journal of Cerebral Circulation*

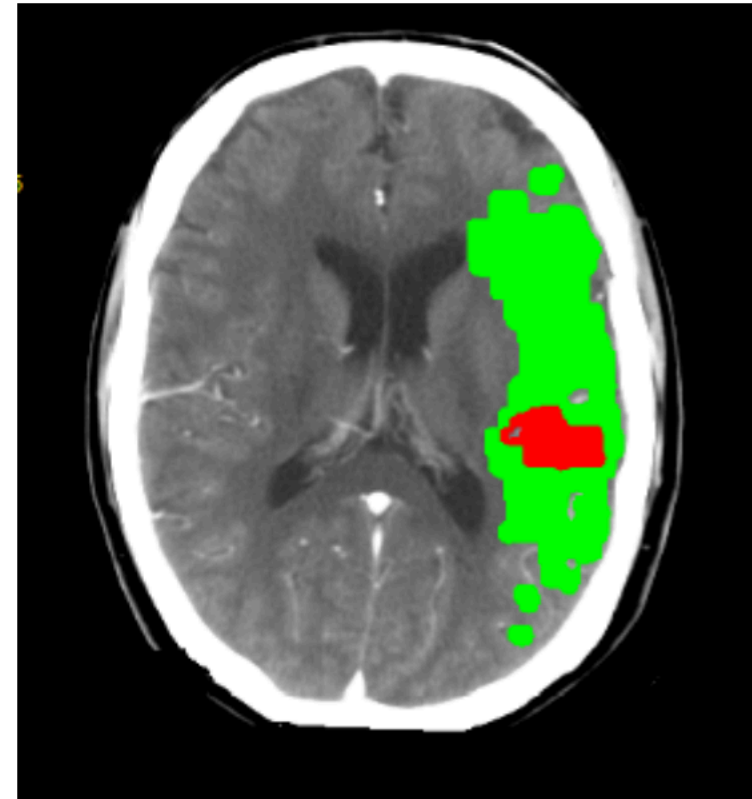
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Editorial

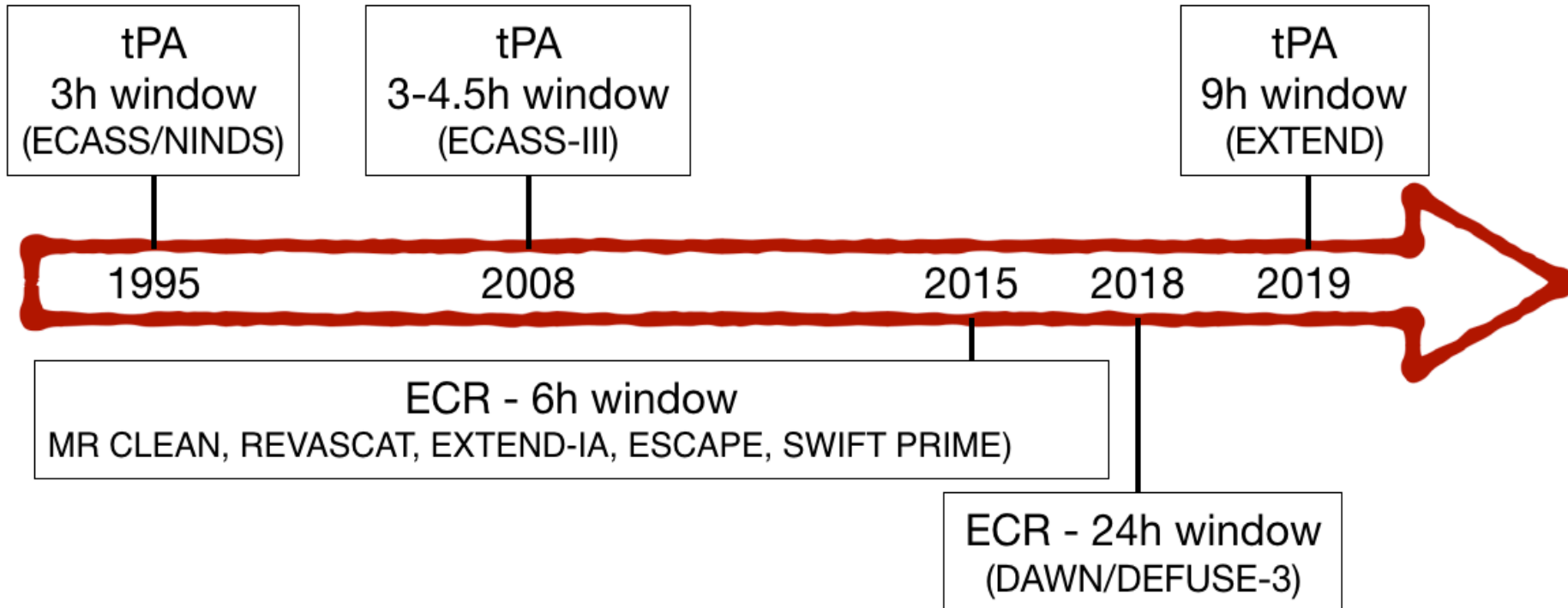
Thresholds in Cerebral Ischemia — The Ischemic  
Penumbra



Early 2000



**TIMELINE OF  
REPERFUSION  
THERAPIES**



WHEN SHOULD I REFER A PATIENT TO ED?  
AMBULANCE BYPASS

# HUNTER 8

Shortened version of NIHSS

1. LOC Observations	<ul style="list-style-type: none"> <li>0 Alert (A)</li> <li>1 Rousable to minor stimulation (V)</li> <li>2 Rousable only to painful stimulation (P)</li> <li>3 Reflex response or unrousable (U)</li> </ul>
2. LOC Questions Ask patient's age and current month (must be exact)	<ul style="list-style-type: none"> <li>0 Both correct</li> <li>1 One correct or dysarthria, foreign language</li> <li>2 Neither correct</li> </ul>
3. Commands – opens/close eyes, grip and release non paretic hand then other hand (1 step commands or mimic ok)	<ul style="list-style-type: none"> <li>0 Both correct (OK if impaired by weakness)</li> <li>1 One correct</li> <li>2 Neither correct</li> </ul>
4. Best Gaze – test horizontal eye movements-tracking object/face	<ul style="list-style-type: none"> <li>0 Normal</li> <li>1 Partial gaze, abnormal gaze in 1 or both eyes</li> <li>2 Forced eye deviation or total paresis which cannot be overcome</li> </ul>
5. Facial Palsy – show teeth, close eyes tight, raise eyebrows. If stuporous, check symmetry of grimace to pain	<ul style="list-style-type: none"> <li>0 Normal</li> <li>1 Minor paralysis, flat nasolabial fold, asymmetrical smile</li> <li>2 Partial paralysis (lower face)</li> <li>3 Complete paralysis (upper &amp; lower face)</li> </ul>
6. Motor Arm – arms outstretched 90° sitting or 45° (supine) for 10 seconds. Encourage best effort.  Score for Left and then right arm.	<ul style="list-style-type: none"> <li>0 No drift for 10 seconds</li> <li>1 Drift but does not hit bed</li> <li>2 Some effort against gravity but can't sustain</li> <li>3 No effort against gravity</li> <li>4 No movement at all</li> <li>X Unable to assess due to amputation, fusion Explain _____</li> </ul>
7. Dysarthria – read or repeat list of words (see word list below)	<ul style="list-style-type: none"> <li>0 Normal</li> <li>1 Mild-mod slurred speech but intelligible</li> <li>2 Unintelligible or mute</li> <li>X Intubated or mechanical barrier</li> </ul>
8. Extinction/Neglect – simultaneously touch patient on both hands or legs with their eyes closed.  Show fingers in both visual fields	<ul style="list-style-type: none"> <li>0 Normal none detected</li> <li>1 Neglect or extinction to double simultaneous stimulation in any modality (sensory, visual) OR visual/sensory loss on one side.</li> <li>2 Profound neglect in both visual and sensory modalities</li> </ul>
<b>Total Score</b>	

# H8 OF 8, THRESHOLD FOR LARGE VESSEL STROKES



**Figure 2.** Distribution of patients with a large vessel occlusion and without large vessel occlusion (y-axis) per NIHSS-8 score (x-axis). Abbreviation: NIHSS-8, National Institutes of Health Stroke Scale-8.

# FAST Positive Patient (18 years or over and BGL 4-22mmol/L)

Assess pre-morbid function (Modified Rankin Scale) and stroke severity (Hunter 8 Stroke Score)

Pre-morbid Modified Rankin Scale  $\leq 3$

Pre-morbid Modified Rankin Scale  $\geq 4$

Establish time of symptom onset or last seen well to determine which pathway applies

Onset/last seen well to JHH ED arrival  $\leq 4$  hours

OR

Onset/last seen well to JHH ED arrival 4 - 24 hours

OR

Onset/last seen well to JHH ED arrival  $> 24$  hours

Hunter 8 Stroke Score of 3 or more

No

Yes

Yes

Hunter 8 Stroke Score of 8 or more

No

Notify the on call Stroke Neurologist directly on 0429184610

Stroke Team accepts the patient?

Yes

No

Stroke FAST positive Code 3 notification to John Hunter ED  
Include advice that the Stroke Team has accepted the patient

Transport to the closest Acute Stroke Unit or Stroke Service Belmont, Calvary Mater, John Hunter, Manning Base, Maitland

**Hunter 8**  
(170 first cases)

**91 cases  $H8 < 8$**

**79 cases  $H8 \geq 8$**

9 bleeds

8 Large vessel occlusions

**9% large vessel occlusions**  
**19% bleeds + large vessel occlusions**

15 bleeds

26 large vessel occlusions = Clot retrieval

**33% large vessel occlusions**  
**52% bleeds + large vessel occlusions**



# WHICH PATIENTS SHOULD BE REFERED TO ED?

- Large strokes will consult ED / Ambulance
- Thrombolysis window (4.5 hours)
- Crescendo TIA
- **John Hunter Hospital Stroke Fellow (8am-5pm Monday/Friday) - Switch JHH**

THANKS!

[Carlos.garciaesperon@health.nsw.gov.au](mailto:Carlos.garciaesperon@health.nsw.gov.au)