ACUTE STROKE AND TIA MANAGEMENT

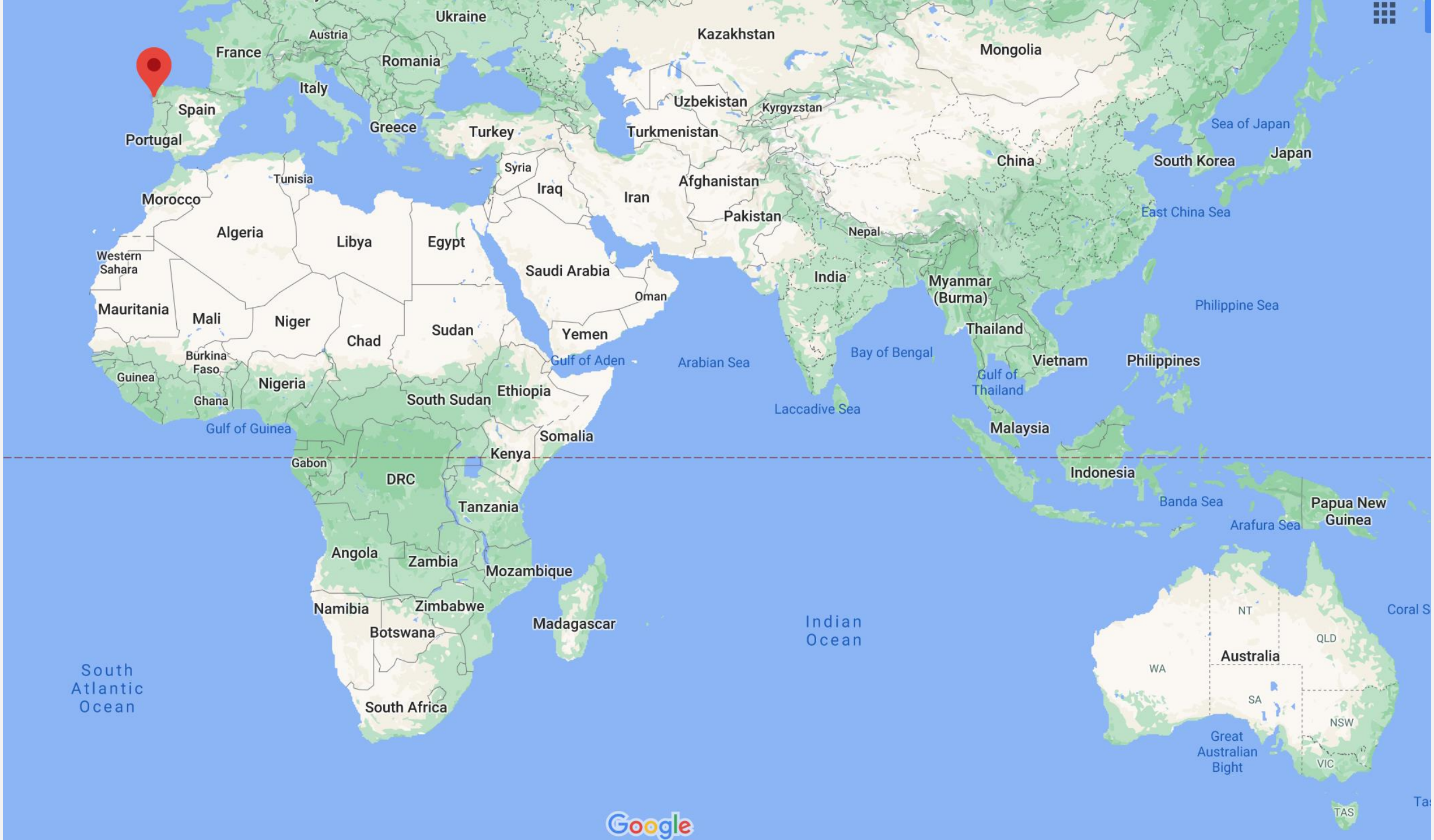
Carlos García-Esperón

John Hunter Hospital

Learning Objectives:

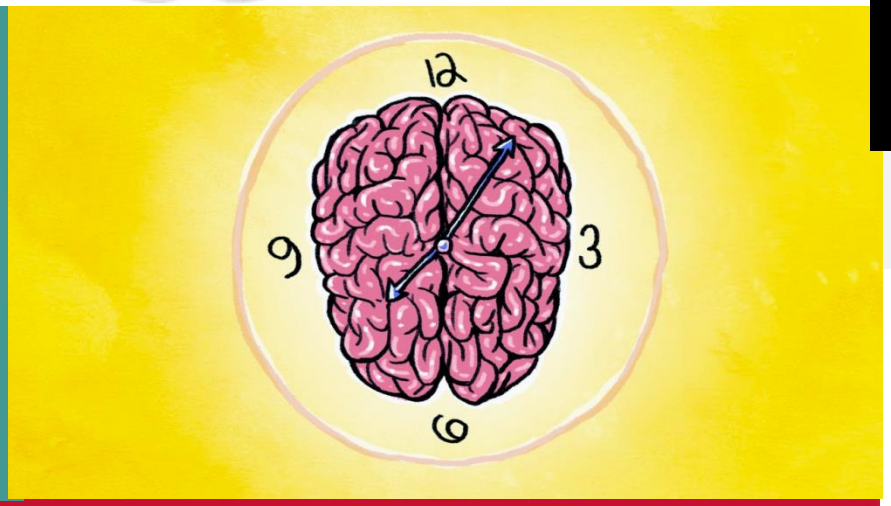
- Management of TIA/minor stroke
  - Identify red flags in Minor stroke and Transient Ischaemic Attacks (TIAs) that require urgent review reducing the subsequent risk of further stroke.
  - When to and who to refer to for urgent follow up and tests that need to be organised.
- Emergency Department acute stroke assessment and management.
  - How to assess Hyper-acute stroke patients
  - What is the Current Hyper-acute stroke treatment?
- Stroke/TIA Secondary prevention
  - What are the relevant Investigations, Medications, Follow up?

- Hyperacute stroke
- NSW telestroke / pre hospital phase
- TIA / Minor stroke management


Ukraine
Austria
France
Romania
Kazakhstan
Mongolia
Italy
Spain
Uzbekistan
Kyrgyzstan
Greece
Turkey
Turkmenistan
Sea of Japan
Portugal
China
South Korea
Japan
Syria
Tunisia
Iraq
Afghanistan
Morocco
Iran
Pakistan
East China Sea
Algeria
Libya
Egypt
Nepal
Western Sahara
Saudi Arabia
India
Myanmar (Burma)
Oman
Mauritania
Mali
Niger
Sudan
Yemen
Thailand
Philippine Sea
Chad
Gulf of Aden
Bay of Bengal
Arabian Sea
Vietnam
Philippines
Burkina Faso
Guinea
Nigeria
Gulf of Thailand
Ethiopia
South Sudan
Ghana
Laccadive Sea
Malaysia
Gulf of Guinea
Somalia
Kenya
Gabon
Indonesia
DRC
Banda Sea
Papua New Guinea
Tanzania
Arafura Sea
Angola
Zambia
Mozambique
NT
Coral S
Namibia
Zimbabwe
Madagascar
QLD
Indian Ocean
Botswana
Australia
WA
South Atlantic Ocean
SA
NSW
Great Australian Bight
South Africa
VIC
TAS
Google


WHEN YOU PRETEND
YOU PERFECTLY UNDERSTAND
NATIVE SPANISH SPEAKERS


WITH A STROKE,
TIME LOST IS BRAIN LOST.
Learn more at StrokeAssociation.org or 1-888-4-STROKE.
Ad Council
American Stroke Association.


12
3
6
9


TIME LOST
IS BRAIN LOST


TIME
IS
BRAIN
Randomise and
treat urgently

EARLY NOTIFICATION OF STROKE TEAM!

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

Saver, Stroke 2006

Total number of neurons: 85 billion

MR X.

77 years old male.

Alcohol consumption: 4-5 beers per day.

Atrial fibrillation; on Dabigatran 5 years ago. Stopped. Reason?

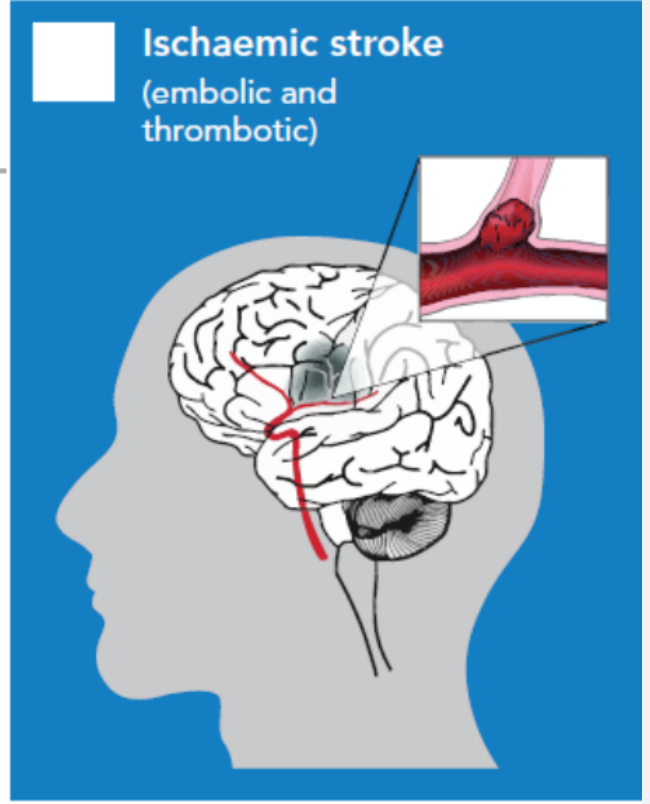
Yesterday, at 17.00, at the pub.

Headache, word finding difficulties, right side weakness.

Called ambulance 000

Arrived hospital at 18:15

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).

MR X ED ARRIVAL18:35 / SO 17:00)

Left gaze preference, right homonimous hemianopia, right central facial palsy, Right hemiparesis (A1/5 – L3/5), right hypoesthesia, mixed aphasia.

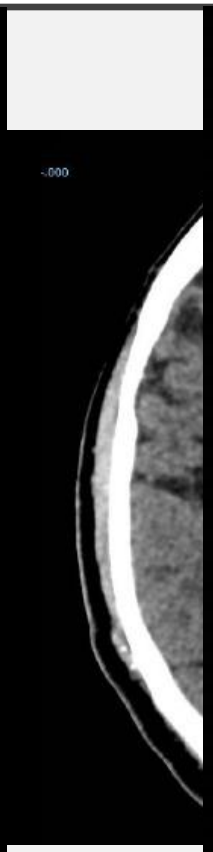
NIHSS 20

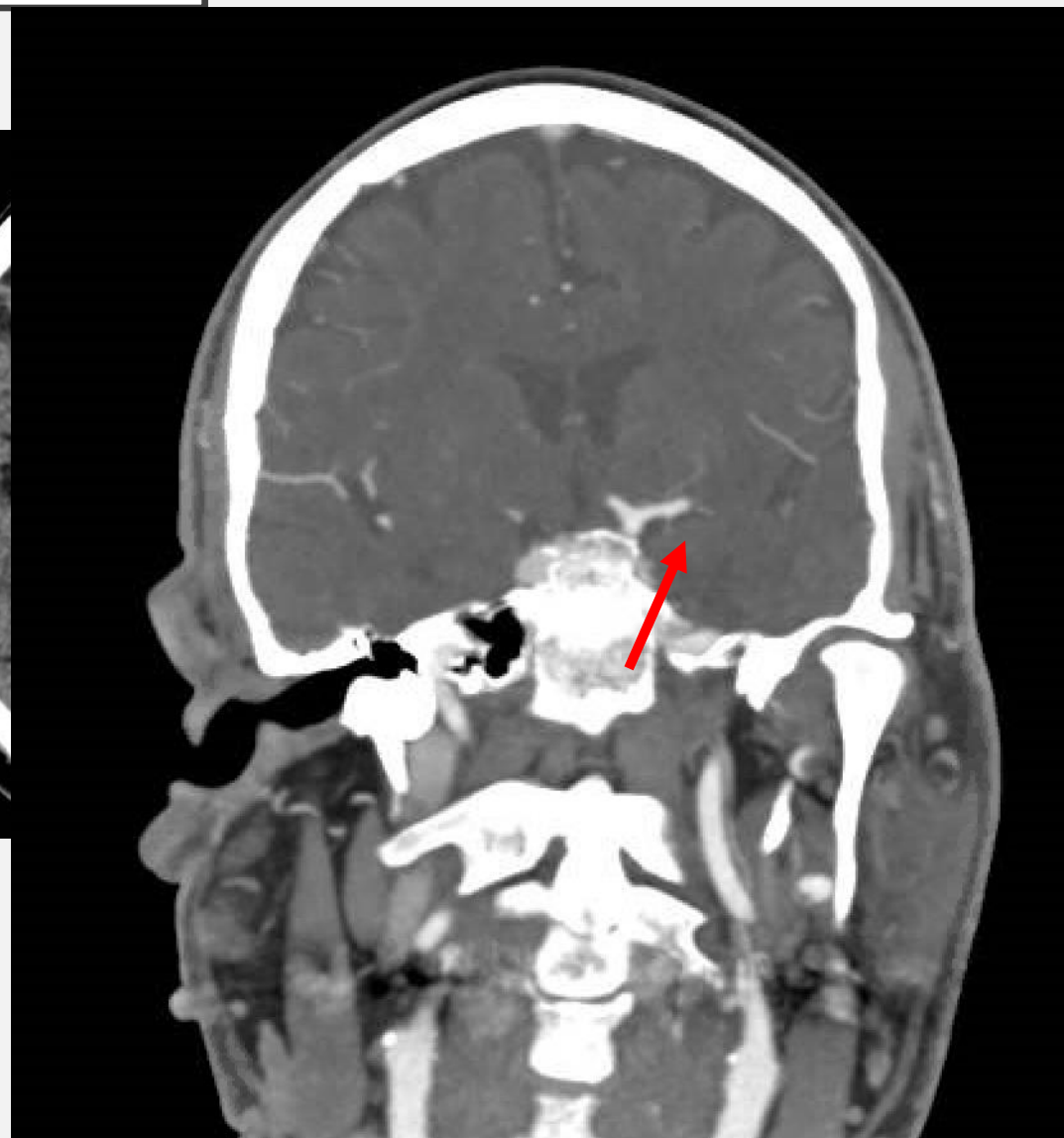
ECG, Blood tests are normal

What kind of brain imaging should be ordered?

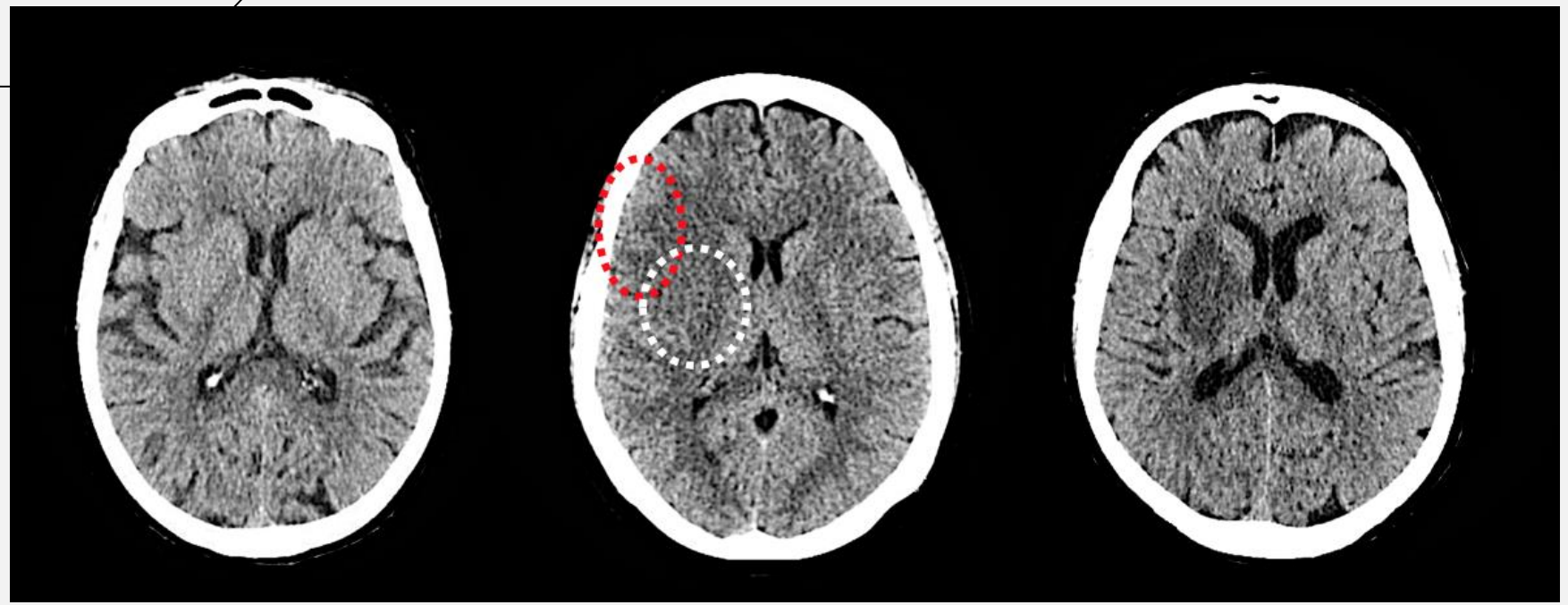
a- Brain CT
b- Brain CTA
c- Brain CTP
d- Brain MRI
e- Cerebral angiogram
f- A+B+C

BRAIN NCCT + CTA





NOT EVERYTHING IS BLACK AND WHITE

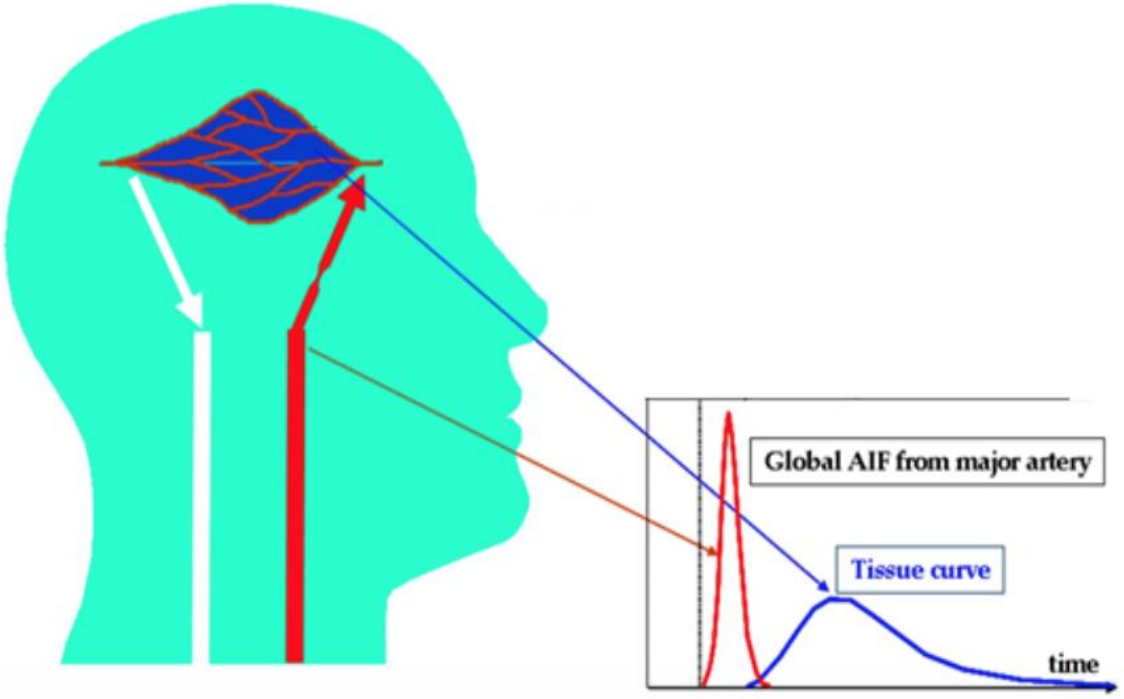


MULTIMODAL IMAGE, BRAIN CT+CTA+CTP

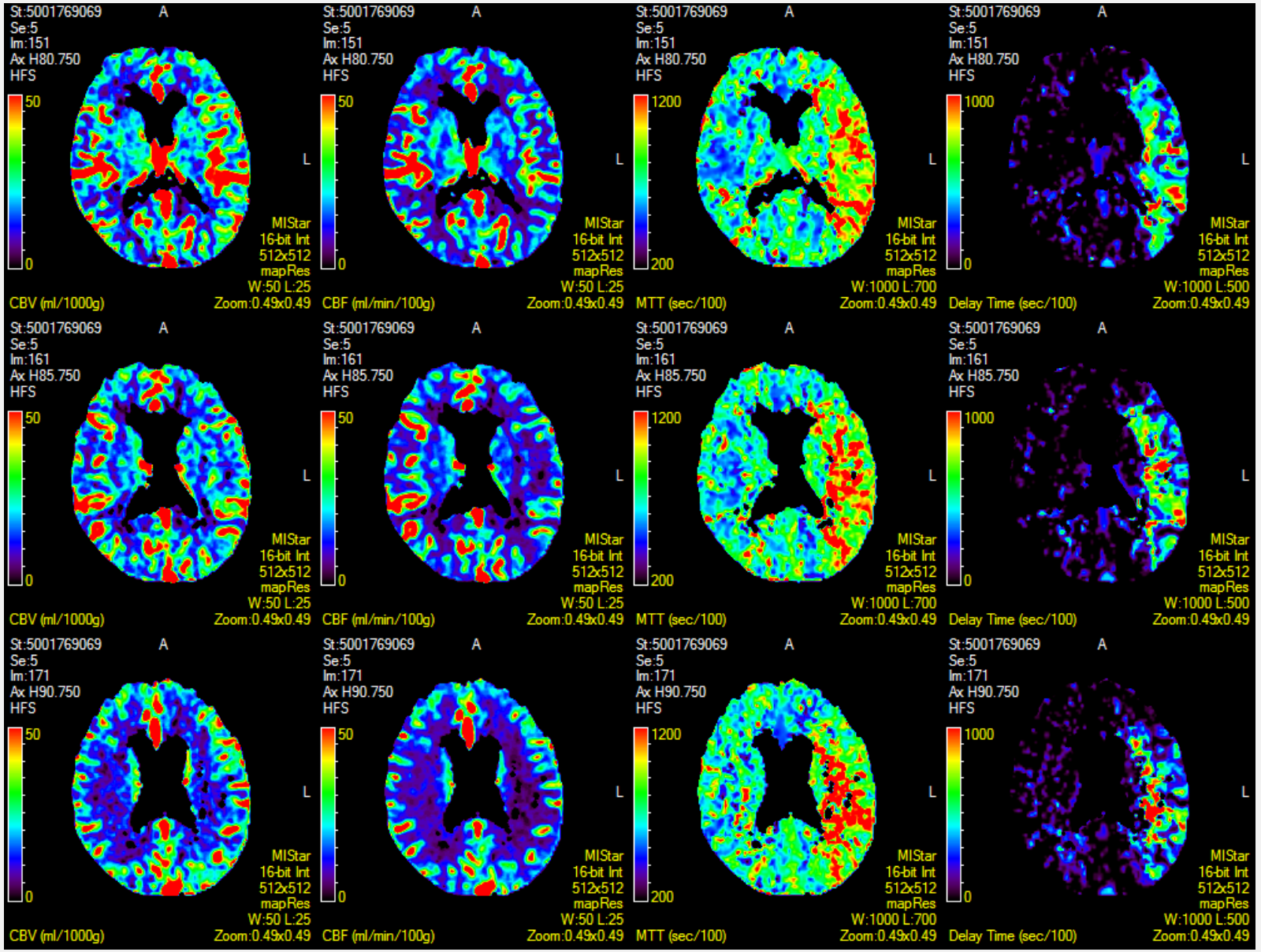
Using the contrast injection movie, we calculate
Cerebral blood flow, volume, and transit (MTT and Tmax/Delay Time)

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

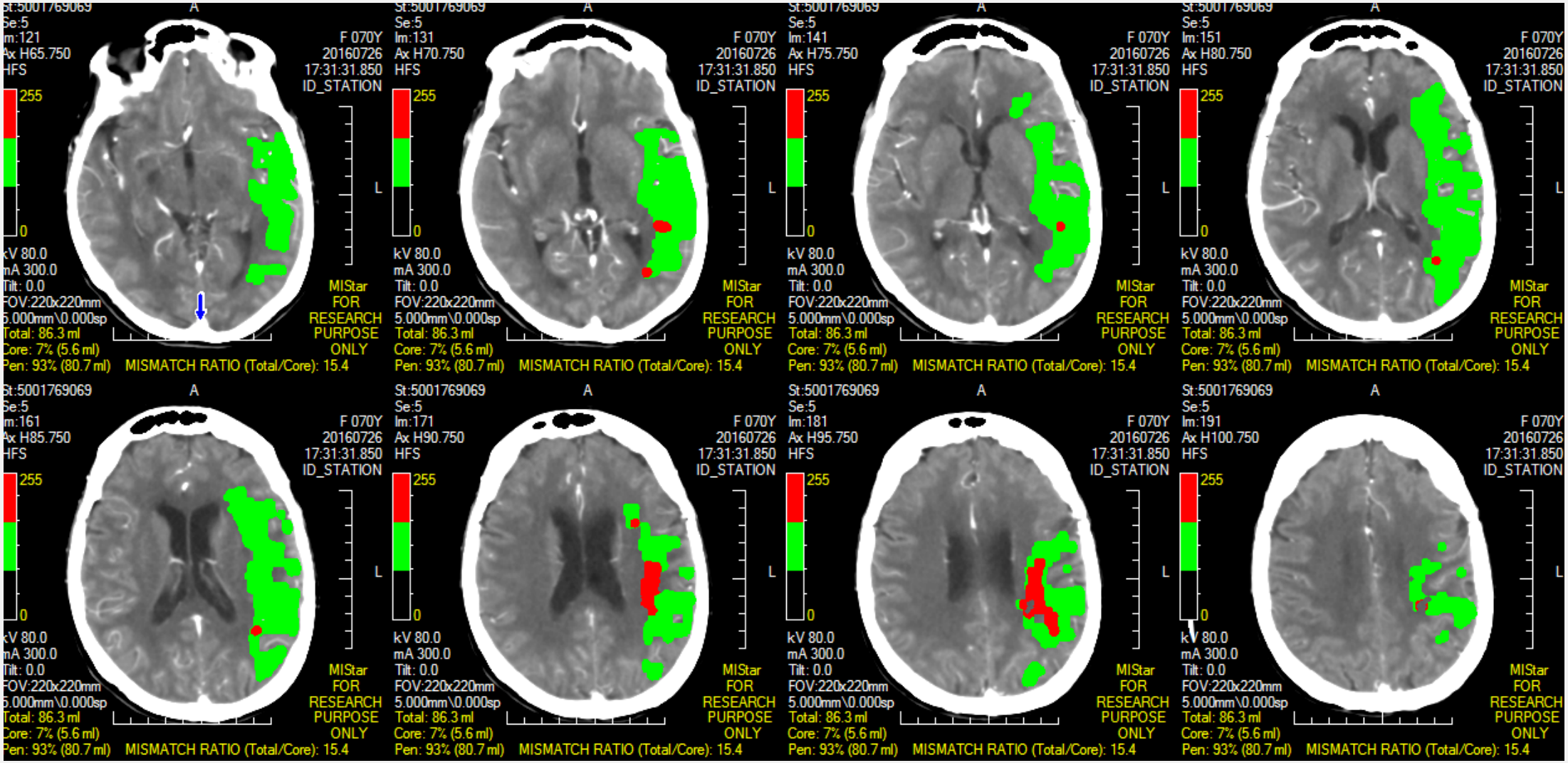
Penumbra
long DT + normal or high CBF
(maximal vasodilation)



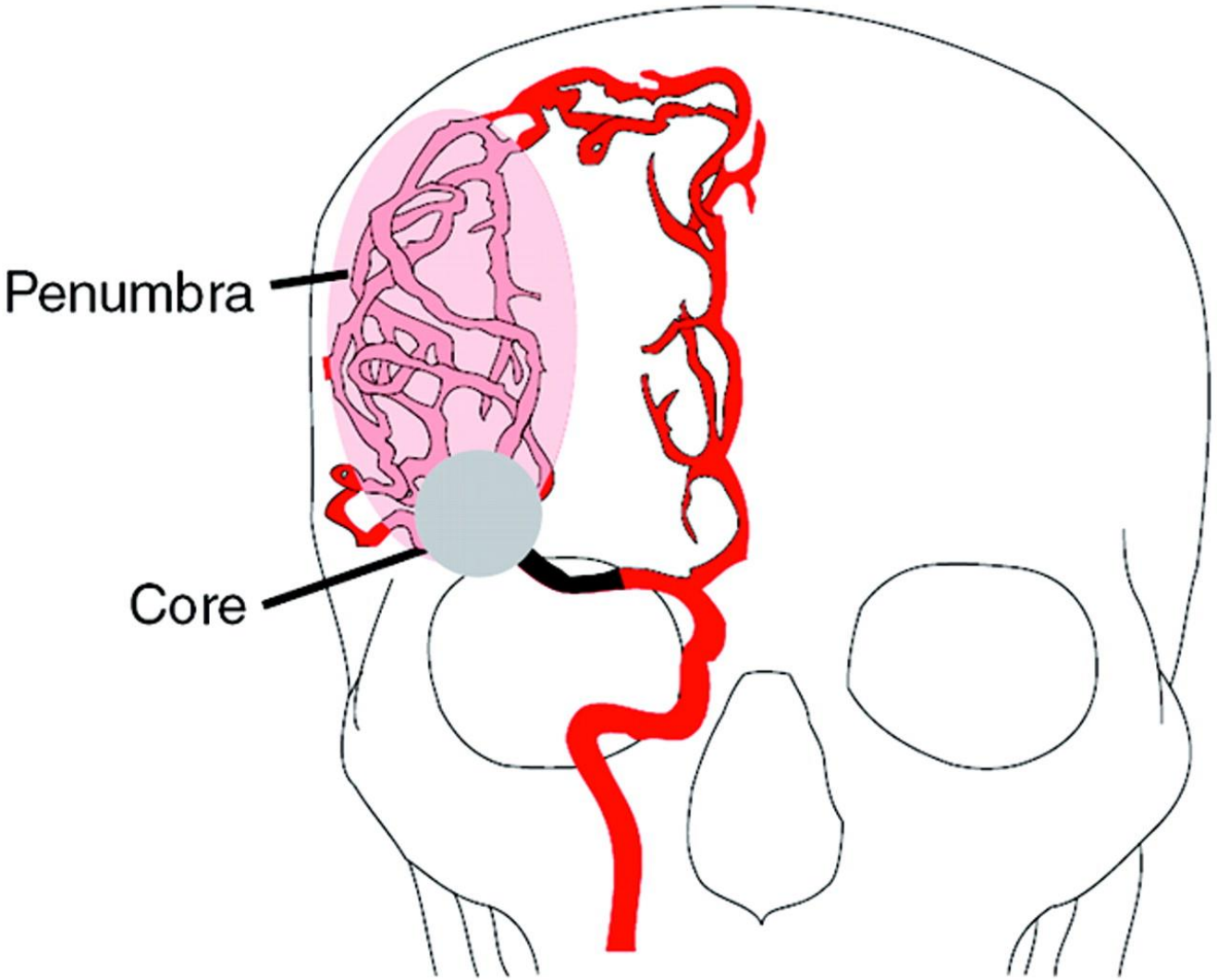
CEREBRAL BLOOD VOLUME	CEREBRAL BLOOD FLOW	MEAN TRANSIENT TIME	DELAY TIME



CT PERFUSION – CORE / PENUMBRA MAPS



HUMAN PENUMBRA



1980's

PET studies suggested penumbra exists in humans and even for long period

WORLD HAS CHANGED

WHY DO CTP BEFORE TREATMENT?

- Target mismatch (core <70 mL, penumbra >15 mL)
  - 23 times greater chance of excellent outcome compared to untreated
  - 77% reduction in mortality

- Large core volume (>70mL)
  - 48% increase of mortality and x9 symptomatic intracerebral haemorrhage

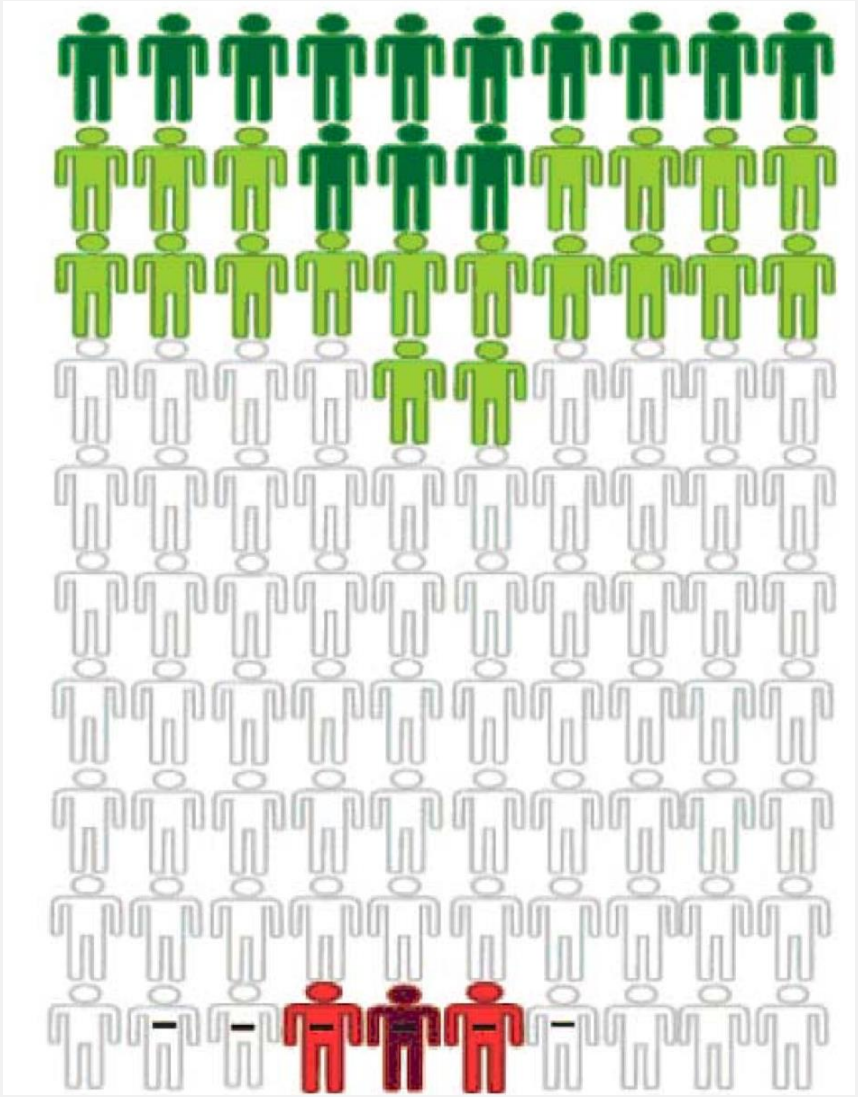
- Small perfusion lesion (<15 mL)
  - One-third of all lysis eligible strokes
  - No significant benefit from thrombolysis *(Bivard, 2018 Annals of Neurology)*

- No target mismatch
  - **16 times greater chance of poor clinical outcome** and death if treated

AND NOW, WHAT TO DO?

- A - Start Aspirin 100mg + Clopidogrel 75mg STAT
- B - Start Heparin iv.
- C - Start Alteplase (rTPA)
- D - Tenecteplase 0.25mg/kg
- E- Endovascular clot retrieval
- F - Alteplase + Endovascular clot retrieval

THROMBOLYSIS

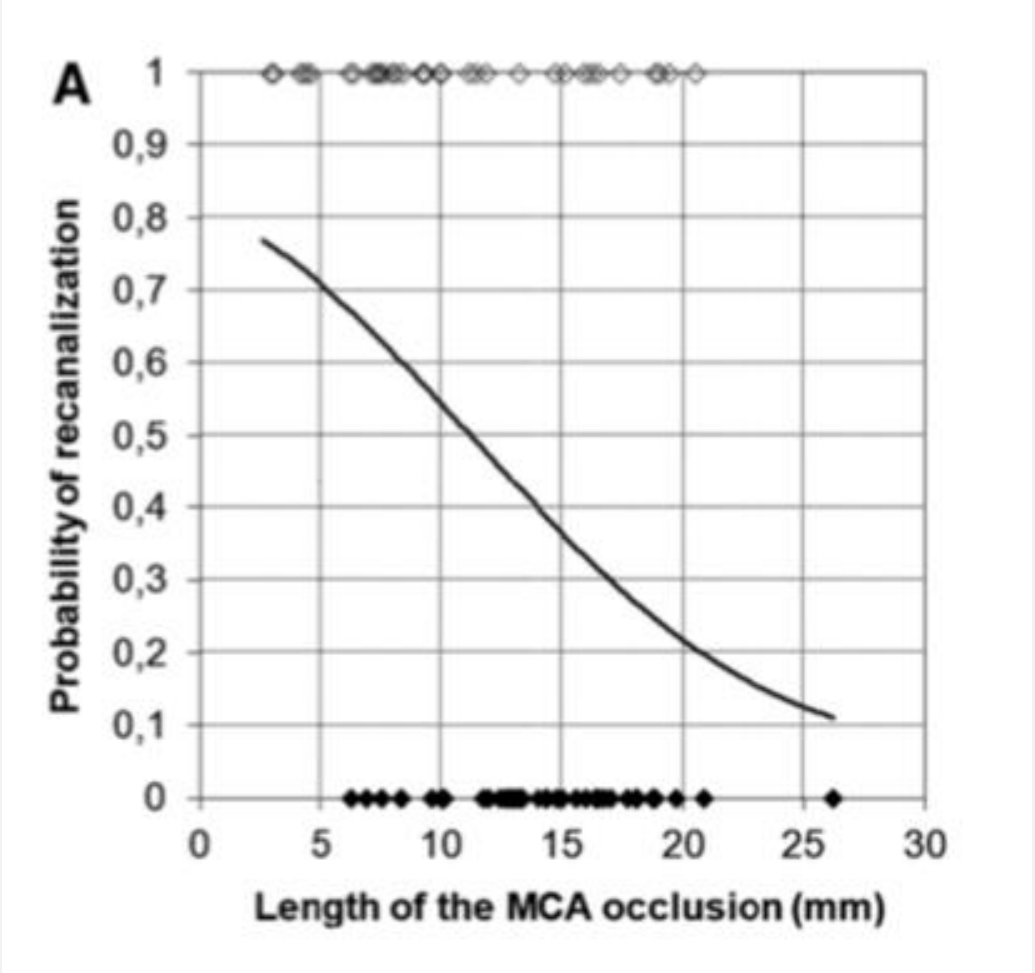


Delivered at rural hospitals of the Telestroke network
The majority of patients do not benefit
Thrombolysis is not ideal to dissolve big clots

LIMITATIONS

Not for everyone

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



Rohan et al, Stroke 2015

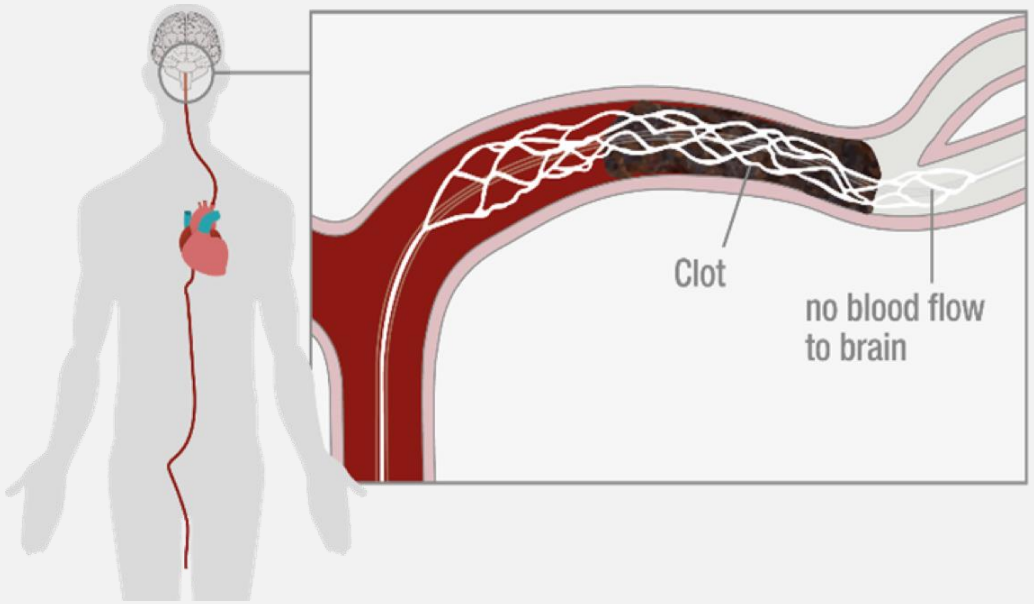
MR X AFTER TPA (18:50 - SO:17:00)

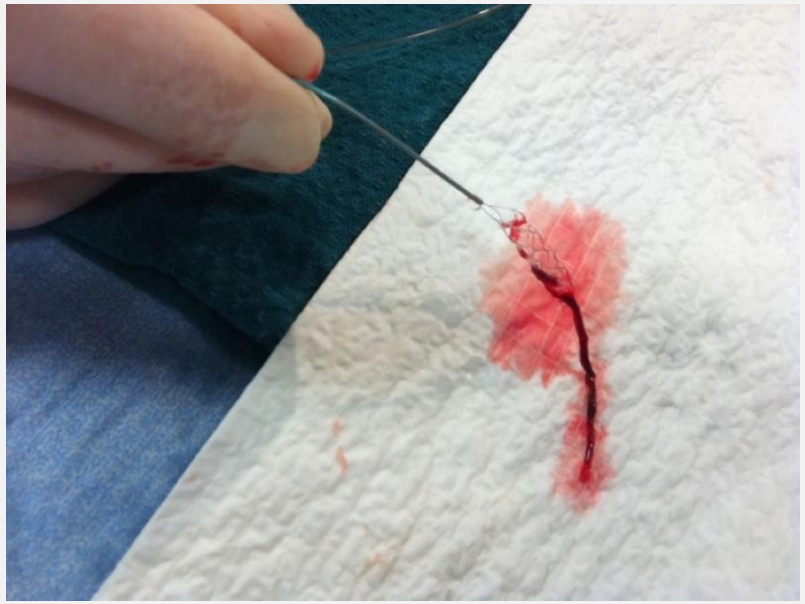
- No clinical improvement.
- Still right side weakness, mixed aphasia, and h.hemianopia.

THROMBECTOMY / ENDOVASCULAR CLOT RETRIEVAL

For patients with ischemic stroke caused by a large artery occlusion and brain tissue to save

24 hour window





OUTCOME OF THROMBECTOMY TRIALS (2015)

3 month outcome after disabling stroke

	Thrombectomy	Medical treatment
Independent	**46%**	**26.5%**
Moderate dependent	32.5%	41.1%
Bed bound/Dead	21.5%	34.4%

OUTCOME OF THROMBECTOMY TRIALS (2015)

3 month outcome after disabling stroke

	Thrombectomy	Medical treatment
Independent	**46%**	**26.5%**
Moderate dependent	32.5%	41.1%
Bed bound/Dead	21.5%	34.4%

Number need to treat = 3

CTP, IMAGING MODALITY FOR THROMBECTOMY

ORIGINAL ARTICLE

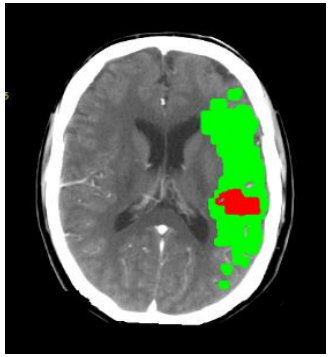
Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct

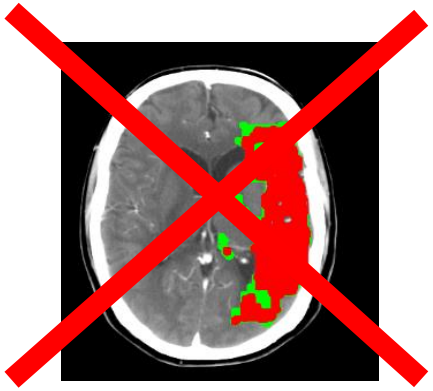
Raul G. Nogueira, M.D., Ashutosh P. Jadhav, M.D., Ph.D., Diogo C. Haussen, M.D., Alain Bonafe, M.D., Ronald F. Budzik, M.D., Parita Bhuva, M.D., Dileep R. Yavagal, M.D., Marc Ribo, M.D., Christophe Cognard, M.D., Ricardo A. Hanel, M.D., Cathy A. Sila, M.D., Ameer E. Hassan, D.O., et al., for the DAWN Trial Investigators*

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-Gutierrez, M.D., Ryan A. McTaggart, M.D., Michel T. Torbey, M.D., May Kim-Tenser, M.D., Thabele Leslie-Mazwi, M.D., Amrou Sarraj, M.D., Scott E. Kasner, M.D., et al., for the DEFUSE 3 Investigators*





CTP, IMAGING MODALITY FOR EECR

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., Diogo C. Haussen, M.D., Alain Bonafe, M.D., Ronald F. Budzik, M.D., Parita Bhuva, M.D., Dileep R. Yavagal, M.D., Marc Ribo, M.D., Christophe Cognard, M.D., Ricardo A. Hanel, M.D., Cathy A. Sila, M.D., Ameer E. Hassan, D.O., et al., for the DAWN Trial Investigators*

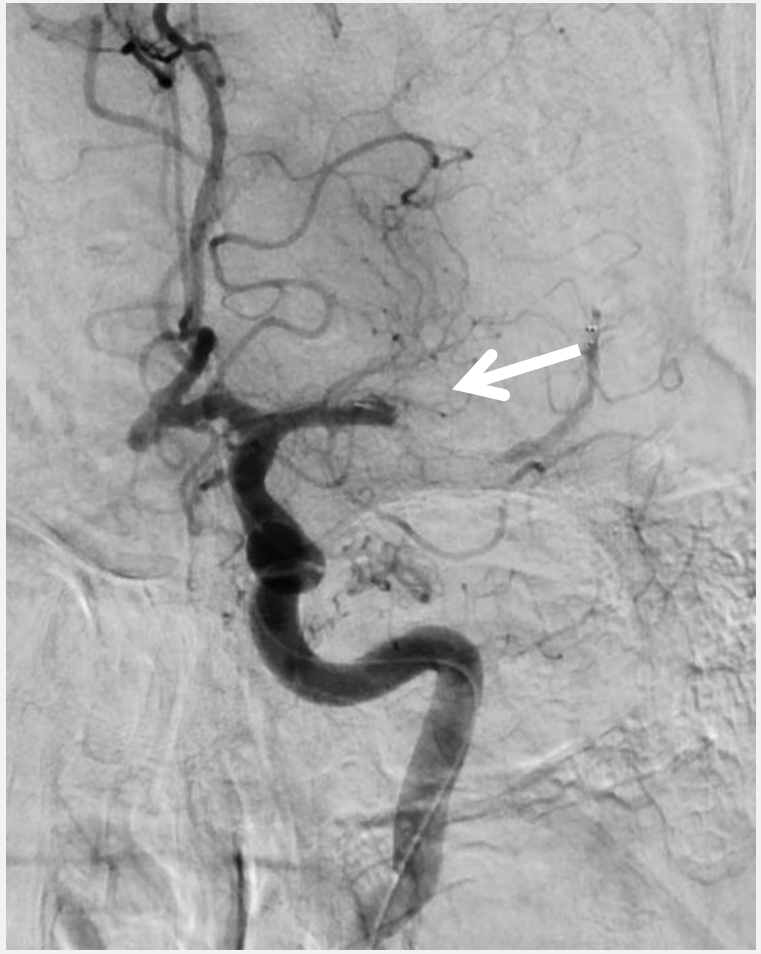
ORIGINAL ARTICLE

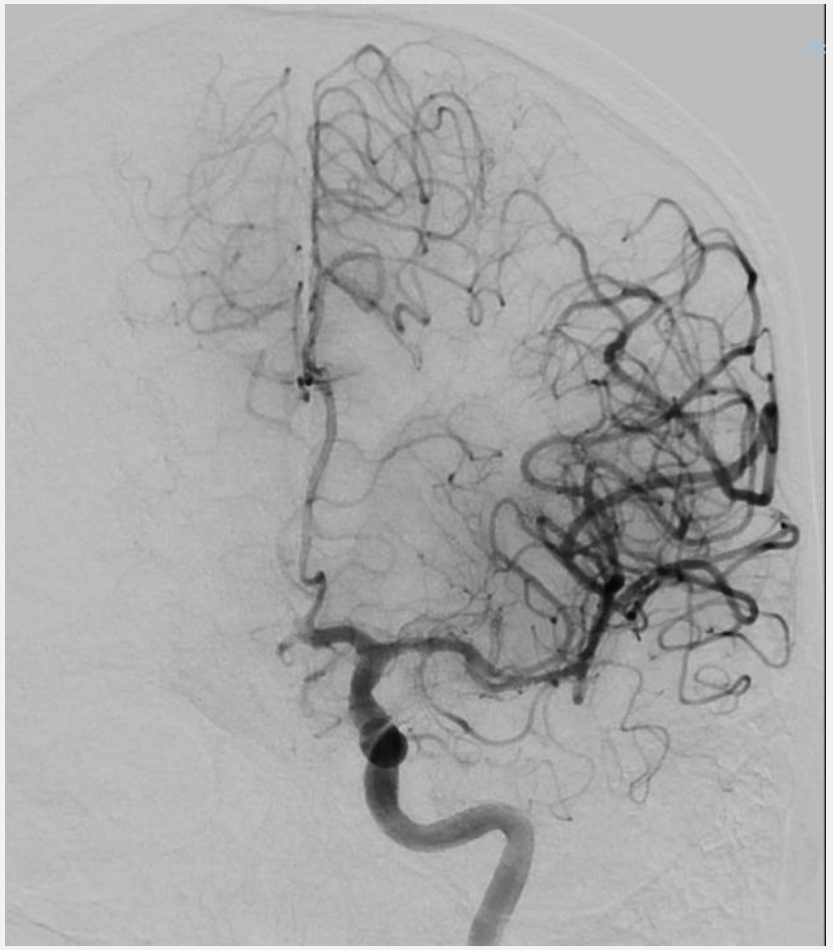
Thrombectomy for Stroke at 6 to 16 Hours with Selection by Perfusion Imaging

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-Gutierrez, M.D., Ryan A. McTaggart, M.D., Michel T. Torbey, M.D., May Kim-Tenser, M.D., Thabele Leslie-Mazwi, M.D., Amrou Sarraj, M.D., Scott E. Kasner, M.D., et al., for the DEFUSE 3 Investigators*

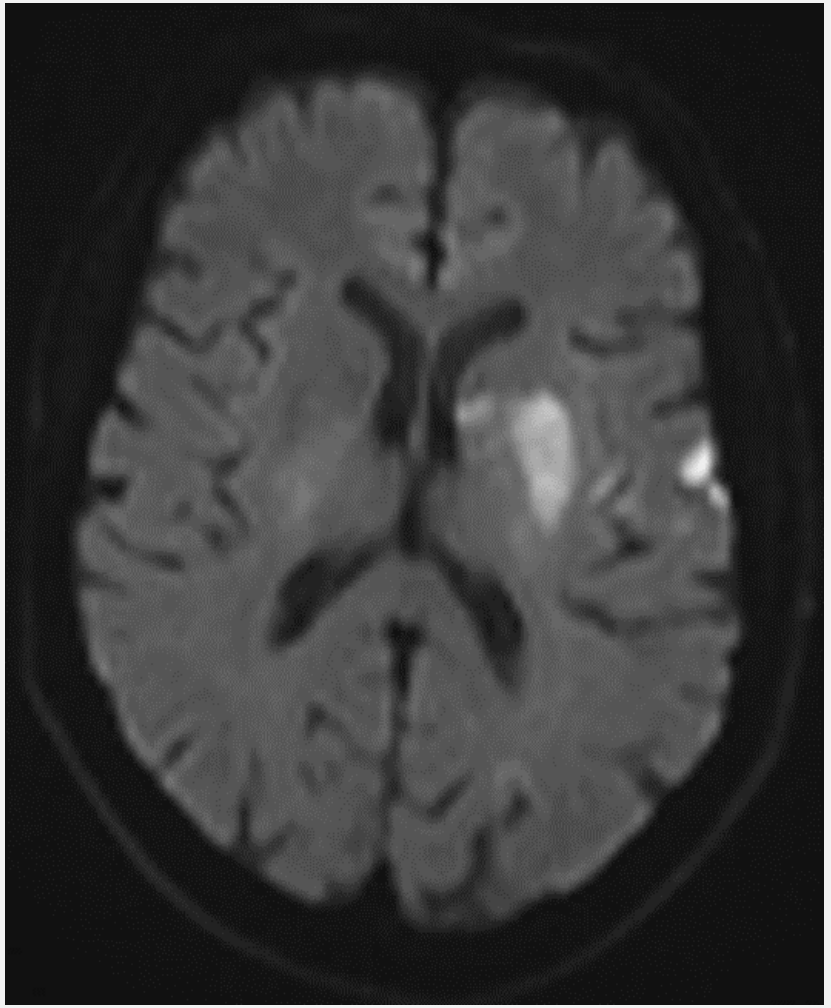
NNT= 3-4

MR X : SUCCESFUL THROMBECTOMY





F UP IMAGE



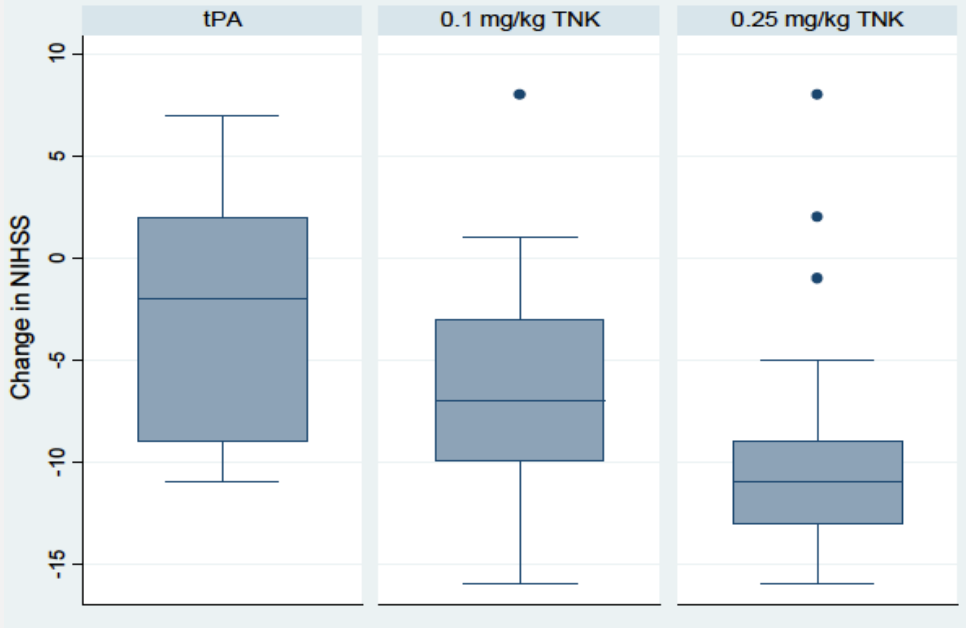
TENECTEPLASE? NOT YET

More fibrin-specific than alteplase (tPA)
More resistant to plasminogen activator inhibitor-1 than tPA
½ life longer than other lytics

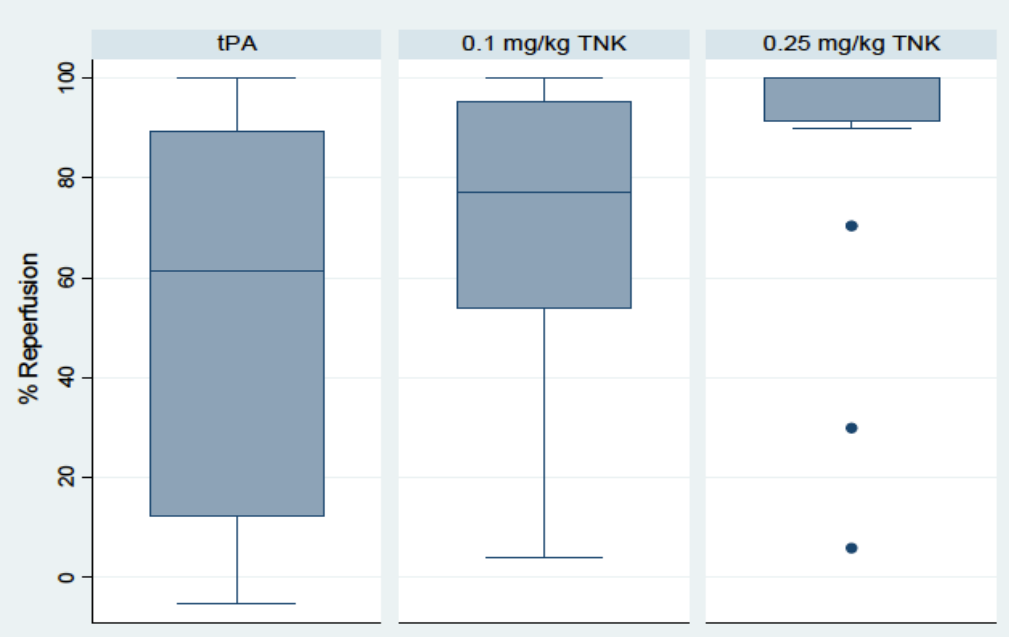
Single dose as bolus

Phase IIB TNK vs tPA (NEJM 2012)

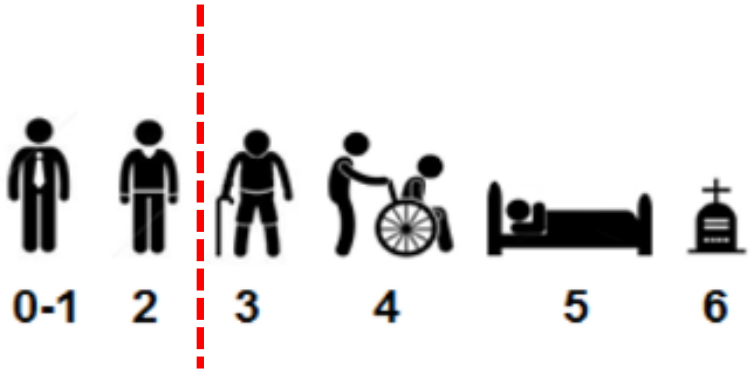
NIHSS 24 h



% Reperfusion



Results	N=221 Combined therapy "Bridging"	N=217 Primary Thrombectomy EVT alone
90-day mRS 0-2	51.6% (114/221)	56.7% (123/217)
90-day mRS shift	-	-
90-day mRS 0-1	37.6% (83/221)	39.2% (85/217)
90-day mRS 0-3	67.0% (148/221)	70.0% (152/217)



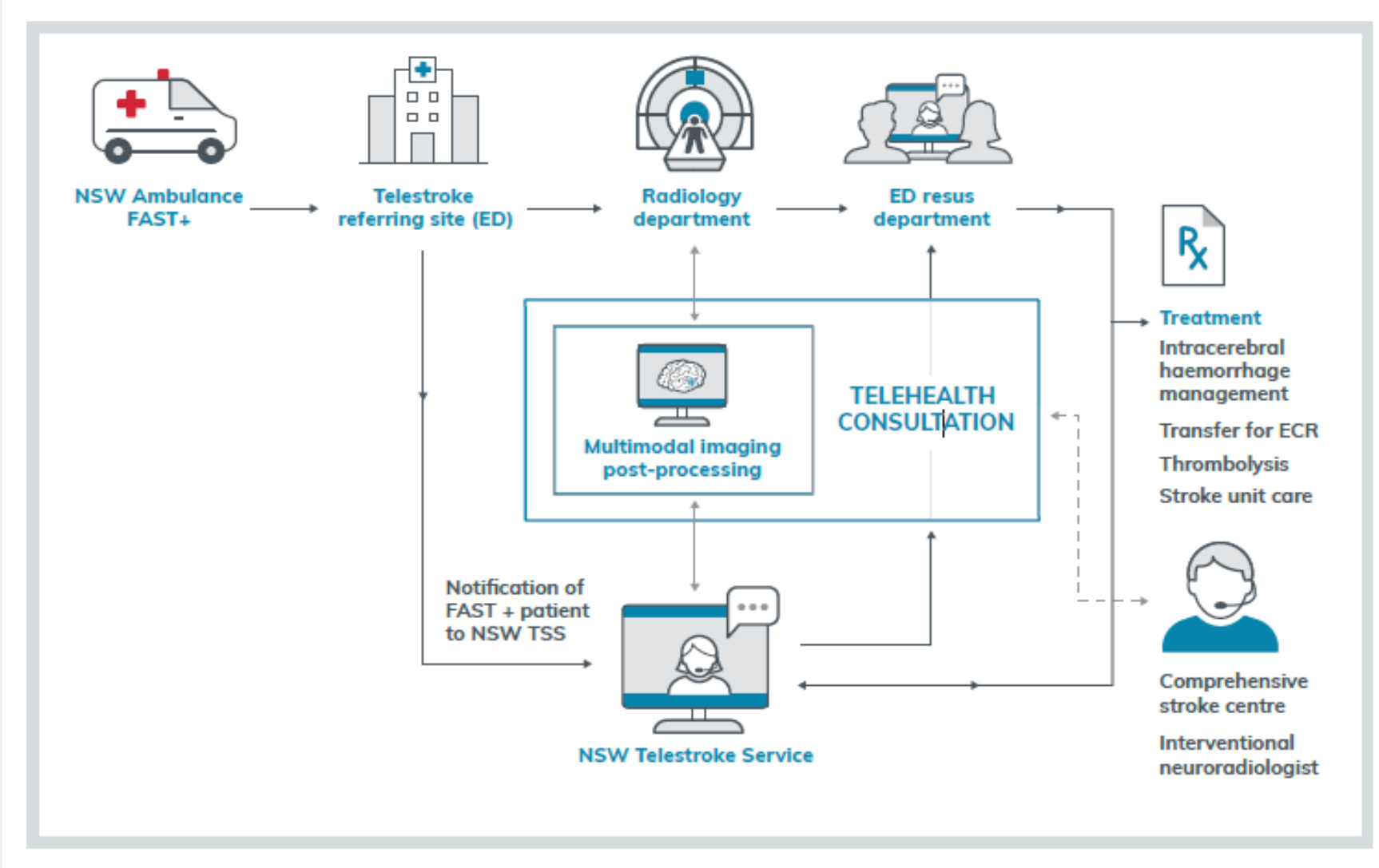
Modified Rankin Scale (mRS)

NO EVIDENCE TO SKIP TPA BEFORE THROMBECTOMY

Courtesy of NSW Telestroke network (Prof Butcher et al)

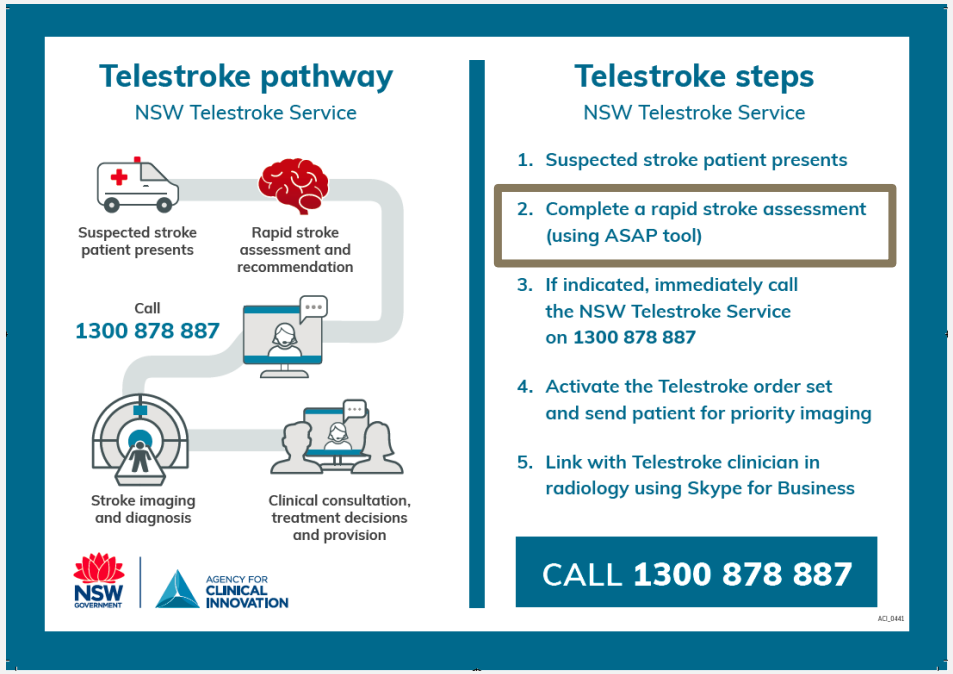
Paul Reeves
Alvin Chew

Courtesy of NSW Telestroke network (Prof Butcher et al)



Courtesy of NSW Telestroke network (Prof Butcher et al)

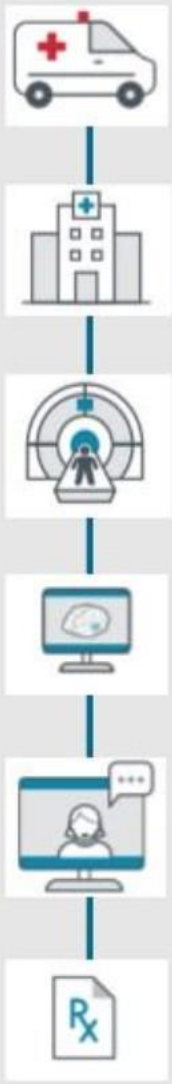
IMPLEMENTATION: EDUCATION AND TRAINING FOR STAFF



Prof Rohan Walker et al (UoN / HMRI)

Courtesy of NSW Telestroke network (Prof Butcher et al)

NSW Telestroke Service



Stroke is a leading cause of long term disability and a major cause of death in NSW.

Reperfusion interventions can limit the harm caused by acute ischaemic strokes (AIS) for some patients. The sooner the intervention is made, the greater the potential to salvage brain function.

***NSW Telestroke** is a virtual care service available 24/7. It gives regional & remote hospitals access to triage tools and specialist neurology consultants who provide rapid and expert recommendations about reperfusion.*

The service is being rolled out statewide to 23 regional hospitals.

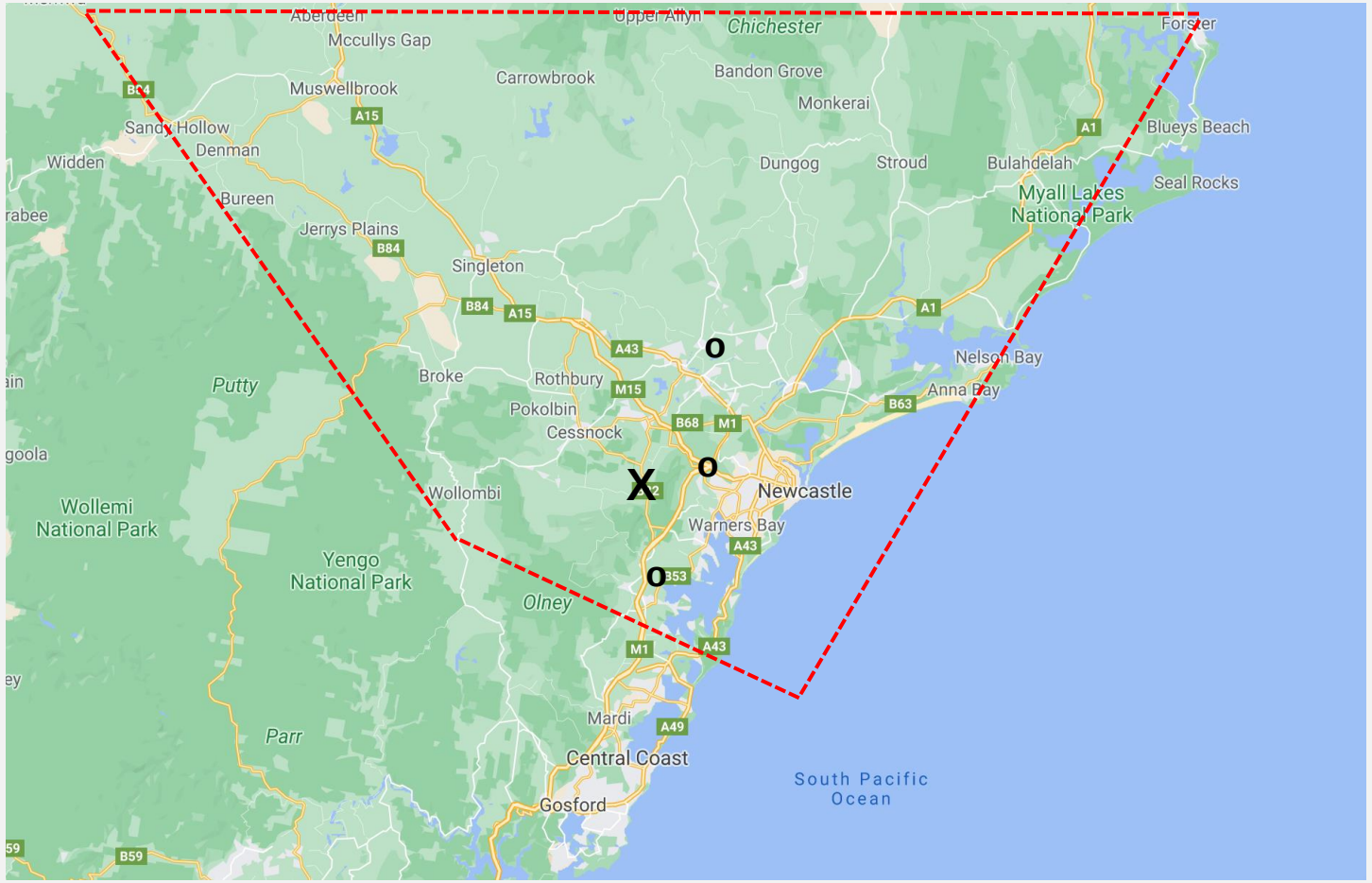
23 Live sites

2333 Telestroke cases

460 Reperfusion recommendations

Courtesy of NSW Telestroke network (Prof Butcher et al)

NSW AMBULANCE - DIRECT NEUROLOGIST CALL



HUNTER-8

Hunter 8 Item	Scoring Definition	Score on Scene	Score on Arrival
1. LOC Observations	**0** Alert (A) **1** Rousable to minor stimulation (V) **2** Rousable only to painful stimulation (P) **3** Reflex response or unrousable (U)		
2. LOC Questions Ask patient's age and current month (must be exact)	**0** Both correct **1** One correct or dysarthria, foreign language **2** Neither correct		
3. Commands – opens/close eyes, grip and release non paretic hand then other hand (1 step commands or mimic ok)	**0** Both correct (OK if impaired by weakness) **1** One correct **2** Neither correct		
4. Best Gaze – test horizontal eye movements-tracking object/face	**0** Normal **1** Partial gaze, abnormal gaze in 1 or both eyes **2** Forced eye deviation or total paresis which cannot be overcome		
5. Facial Palsy – show teeth, close eyes tight, raise eyebrows. If stuporous, check symmetry of grimace to pain	**0** Normal **1** Minor paralysis, flat nasolabial fold, asymmetrical smile **2** Partial paralysis (lower face) **3** Complete paralysis (upper & lower face)		
6. Motor Arm – arms outstretched 90° sitting or 45° (supine) for 10 seconds. Encourage best effort. Score for Left and then right arm.	**0** No drift for 10 seconds **1** Drift but does not hit bed **2** Some effort against gravity but can't sustain **3** No effort against gravity **4** No movement at all **X** Unable to assess due to amputation, fusion Explain _____	Left Right	Left Right
7. Dysarthria – read or repeat list of words (see word list below)	**0** Normal **1** Mild-mod slurred speech but intelligible **2** Unintelligible or mute **X** Intubated or mechanical barrier		
8. Extinction/Neglect – simultaneously touch patient on both hands or legs with their eyes closed. Show fingers in both visual fields	**0** Normal none detected **1** Neglect or extinction to double simultaneous stimulation in any modality (sensory, visual) OR visual/sensory loss on one side. **2** Profound neglect in both visual and sensory modalities		
Total Score		/24	/24

H8 OF 8, THRESHOLD FOR LARGE STROKES

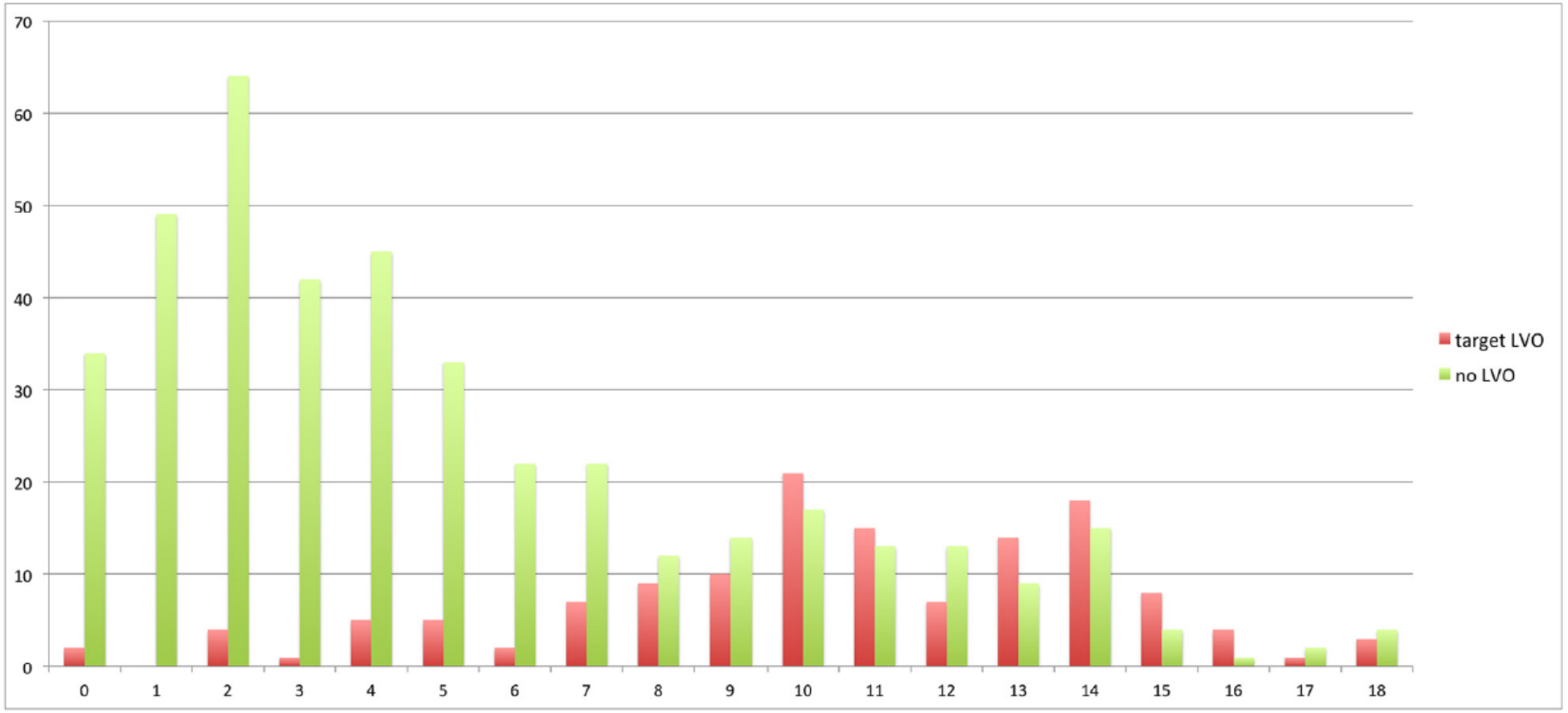
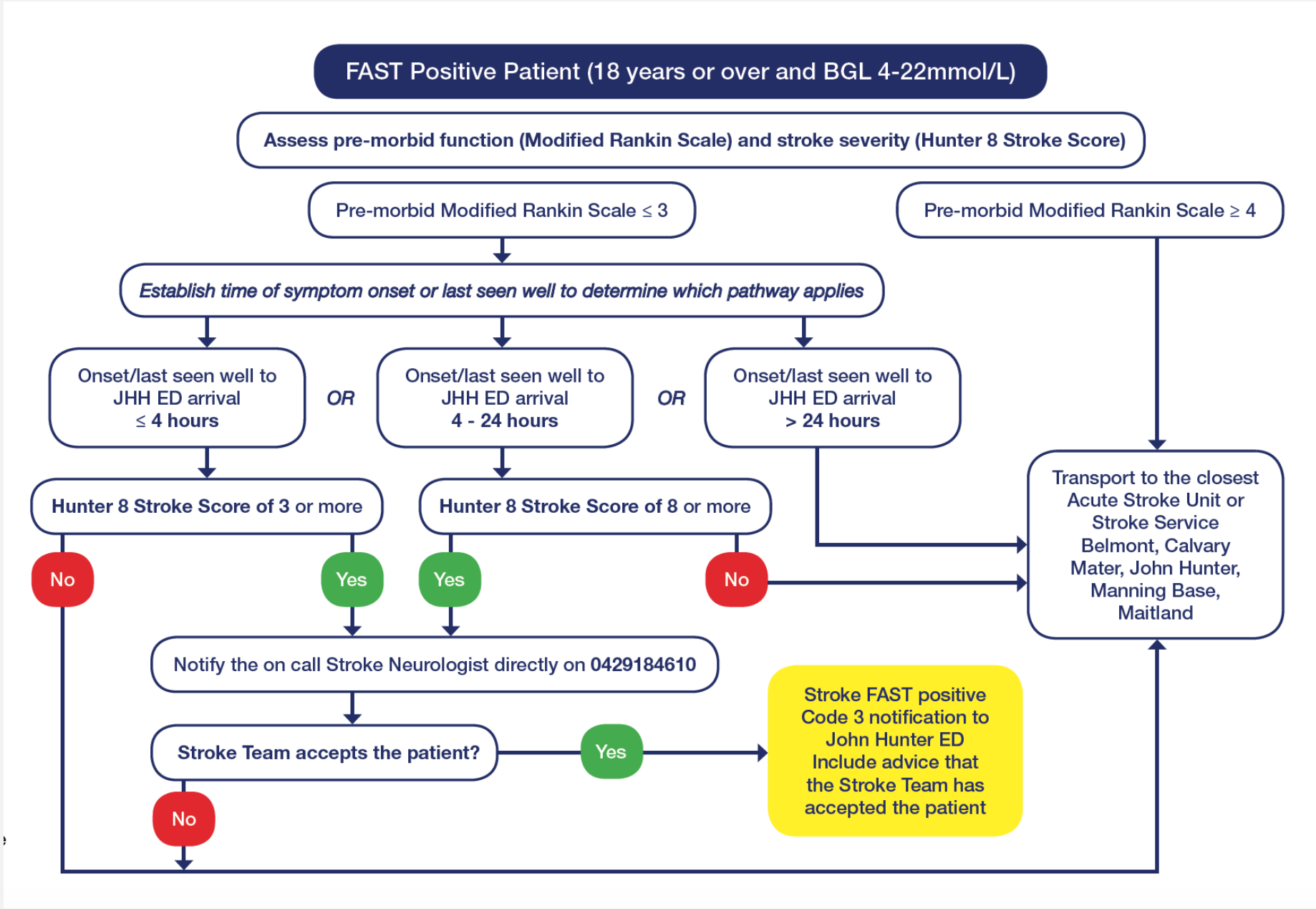


Figure 2. *Distribution of patients with a large vessel occlusion and without large vessel occlusion (y-axis) per NIHSS-8 score (x-axis). Abbreviation: NIHSS-8, National Institutes of Health Stroke Scale-8.*


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 ≤ 3
Pre-morbid Modified Rankin Scale ≥ 4
Establish time of symptom onset or last seen well to determine which pathway applies
Onset/last seen well to JHH ED arrival ≤ 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
Hunter 8 Stroke Score of 8 or more
No
Yes
Yes
No
Transport to the closest Acute Stroke Unit or Stroke Service Belmont, Calvary Mater, John Hunter, Manning Base, Maitland
Notify the on call Stroke Neurologist directly on 0429184610
Stroke Team accepts the patient?
Yes
Stroke FAST positive Code 3 notification to John Hunter ED Include advice that the Stroke Team has accepted the patient
No

TIA / MINOR STROKE MANAGEMENT

MOST OF TIA = MINOR STROKES

"Transient episode of neurologic dysfunction caused by focal brain, spinal cord, or retinal ischemia"

AHA definition now includes **Absence of Infarct on Imaging**.
Clinical definition = **No** residual symptoms at 24 hours.

TIA / minor stroke = spectrum of same disease

What brain imaging to do?

Detecting acute ischemia in NCCT after symptoms that resolve within 24 hours is low (4%)

MRI (DWI) is highly sensitive (88% sensitivity) and specific (95% specificity) for acute infarction

URGENT TREATMENT!

- **Untreated:** high short term risk for subsequent events (7-17% 90-day risk recurrent stroke)[1].

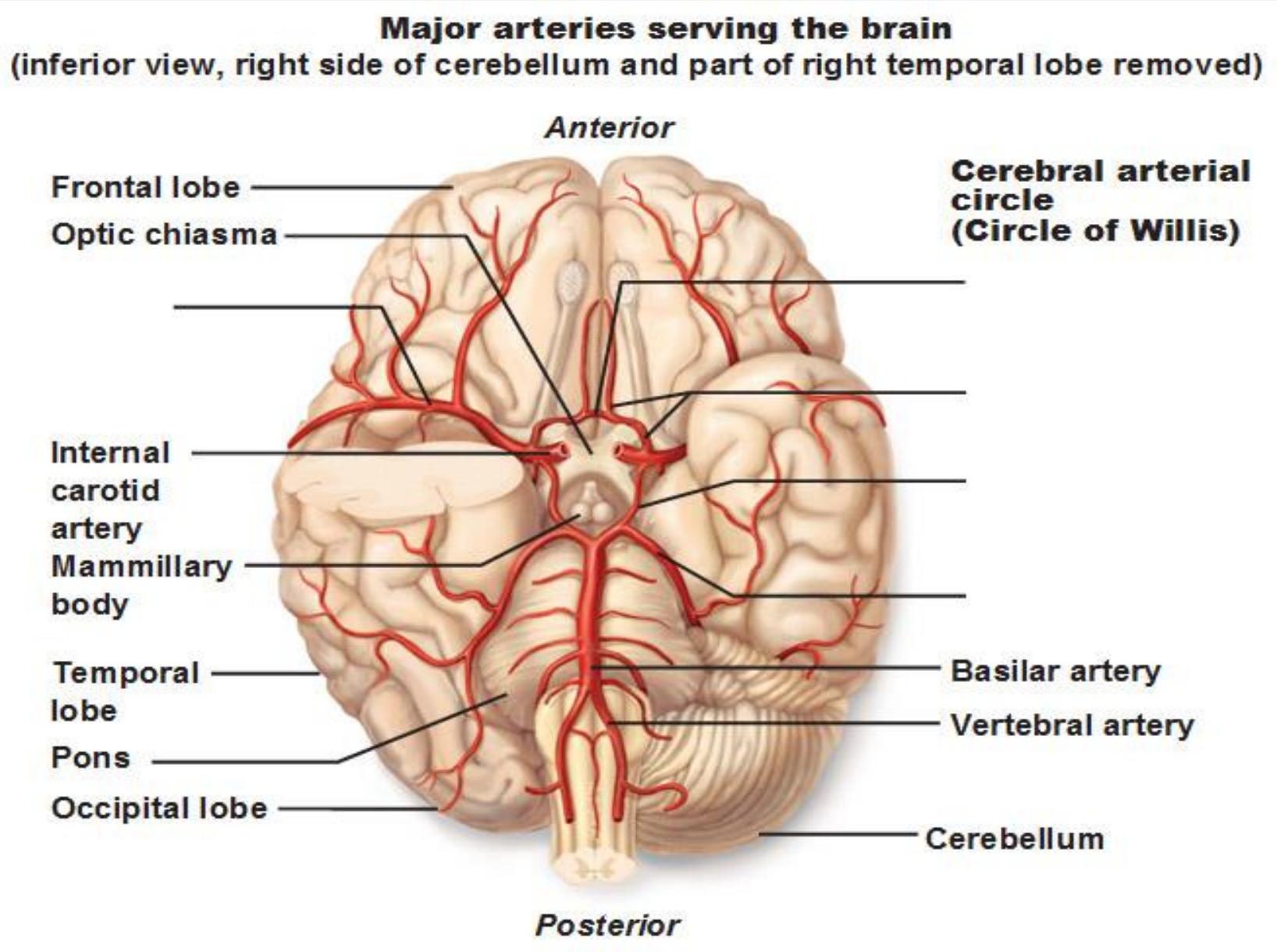
- **Treatment** – antithrombotic ± BP lowering, statin and assessment for AF and symptomatic carotid stenosis ➔ may prevent ≥ 80%.

- Early antithrombotics = majority of benefit

- **Correct Identification** is key: History (sudden onset) + Examination + Investigations

1. Rothwell et al. *Lancet* 2007

SYMPTOMS



- **Unilateral weakness** (Face-Arm-Leg)
- **Aphasia**
- **Hemianopia**
- **Unilateral numbness** (Face/Arm/Leg)

- **Isolated dysarthria**
- **Numbness 1 limb**
- **Isolated dizziness**

TIA RISK STRATIFICATION

All symptoms are not equal:

- Dysarthria, ataxia, confusion, vertigo → poor predictive value.
- Aphasia, hemiparesis → much stronger predictive value.

ABCD2 scoring system – helps stratify risk – particularly in non-specialist hands.

Addition of Imaging (MRI) → better prediction.

- Remains controversial – does not tell you about carotids

The ABCD^2 score can be used to estimate the risk of ischemic stroke in the first two days after TIA. The score is tallied as follows:	
Age:	
≥60 years	1 point
<60 years	0 points
Blood pressure elevation when first assessed after TIA:	
Systolic ≥140 mmHg **or** diastolic ≥90 mmHg	1 point
Systolic <140 mmHg **and** diastolic <90 mmHg	0 points
Clinical features:	
Unilateral weakness	2 points
Isolated speech disturbance	1 point
Other	0 points
Duration of TIA symptoms:	
≥60 minutes	2 points
10 to 59 minutes	1 point
<10 minutes	0 points
Diabetes:	
Present	1 point
Absent	0 points

EXCLUDING A STROKE

1. **It is only a TIA if the patient is completely neurologically normal:**
   - No visual field defect.
   - No sensory inattention.
   - No dysarthria.
   - No dysphasia (follows 3-step command, names low frequency words).

TIA/STROKE MIMICS

- Looks like TIA / stroke, but it is something else
- 5% - 17% of total ED presentations

Common mimics	
Seizures	
Syncope	
Functional disorders	60%
Migraine with aura	
Sepsis	
Brain tumor	
Metabolic	
BPPV	
Drugs	
Bell's palsy	
Transient global amnesia	

MORE LIKELY MIMIC

Positive symptoms

- Indicate an excess of neuronal electrical activity

- Visual: flashing lights, zig zag shapes, lines, shapes, objects
- Motor: jerking limb movements
- Onset: Progressive

Stroke / TIA - Negative symptoms – Loss of functionality

CLASSIFICATION AND MECHANISMS

ISCHEMIC
(80%)

HEMORRHAGIC
(20%)

TIA/STROKE

Subarachnoid hemorrhage

Intracerebral hemorrhage

Atherosclerotic (20%)

Cardioembolic (20%)

Lacunar (25%)

Infrequent (5%)

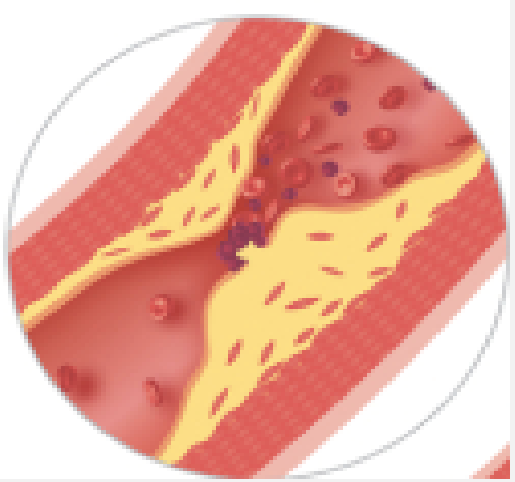
Cryptogenic (30%)

MECHANISMS AND TESTS

ATHEROSCLEROTIC

Atherosclerosis > 50% stenosis of relevant extra or intracranial artery

Most common location: Carotids



Carotid bifurcation on DSA

Can cause ischemic infarction due to:

- Local thrombosis / Embolism /Distal hypoperfusion

All patients with carotid territory stroke or TIA should have extracranial vessels assessed

Carotid US
CT Angiography / MR Angiography

CAROTID STENOSIS

Who to Treat? Controversy lessening

- Symptomatic vessels (recent TIA in the relevant territory) 70-99% stenosis ➔ revascularise.
- Asymptomatic vessels – not as strong benefit, but evidence growing (specially in >80%).

Not advocating screening, or carotid dopplers for everyone!
Vessels on the asymptomatic side detected during stroke work up may be worth treating

How?

- Carotid endarterectomy. Consider stenting in young (<70 y).

When?

- Within 2 weeks from event greater benefit

TIA ANTIPLATELET THERAPY

CHANCE Trial[1] (China) 21 days A+C:

- 5000 pts, <24h of high risk TIA or minor stroke randomised to A+C (300mg loading, then 75mg, + ASA x 21days then Clopidogrel alone to 90 d.) or Aspirin alone

- ➔ 32% relative risk reduction (3.5% ARR) of recurrent stroke at 90 days with A+C, no difference bleeding.

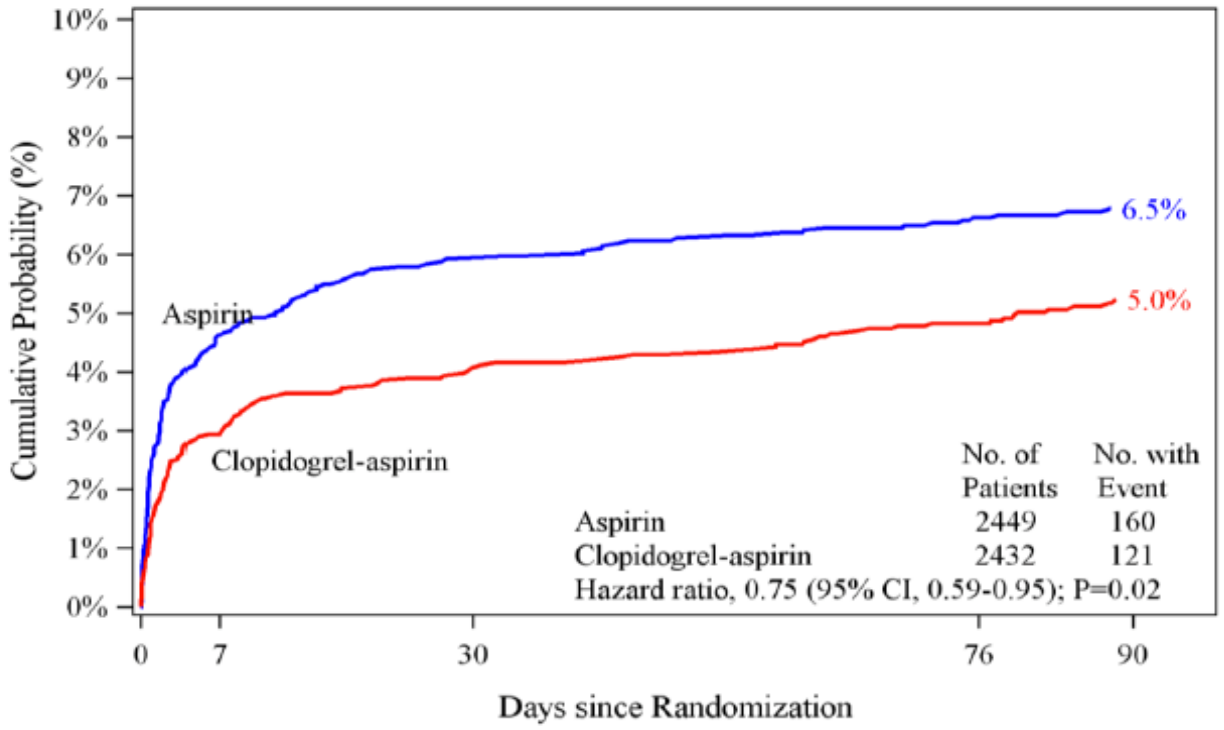
POINT Trial (US, Europe, Newcastle, other Aust) 90 days A+C:

- 1.5% absolute risk (30%RRR) reduction major ischemic events (most in 1st 3/52)
- 0.5% absolute risk increase of major haemorrhage (most in subsequent 9/52).

1. Wang et al. NEJM 2013
n.b. Ed. Commentary by G Hankey (Perth)
2. Johnston et al. NEJM 2018

POINT TRIAL

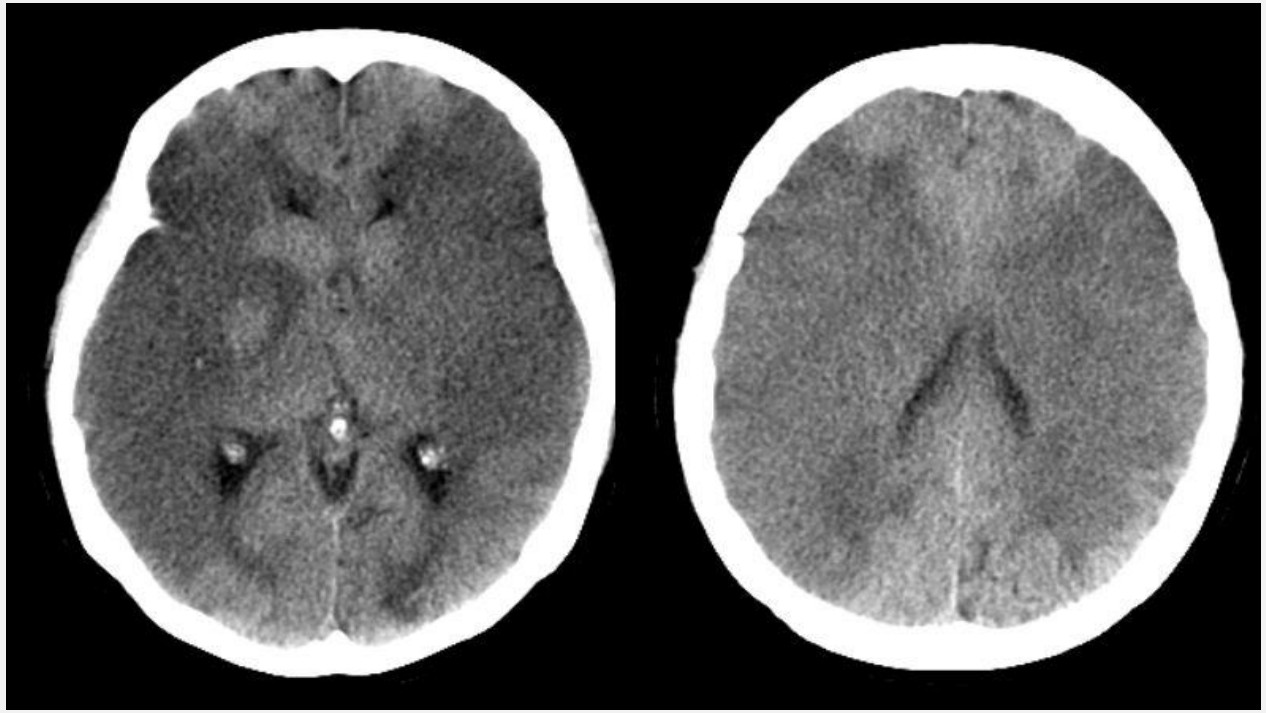
Results: Major Ischemic Events



No. at Risk					
Aspirin	2449	2269	2153	2105	1365
Clopidogrel-aspirin	2432	2279	2179	2113	1445

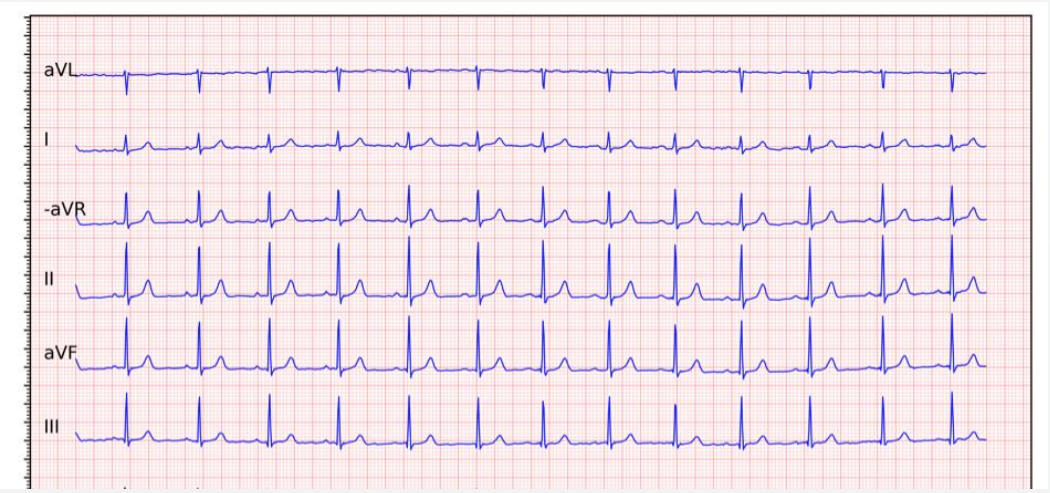
CARDIOEMBOLIC SOURCE

Different vascular territories may be affected when the source is the heart
Bilateral infarctions

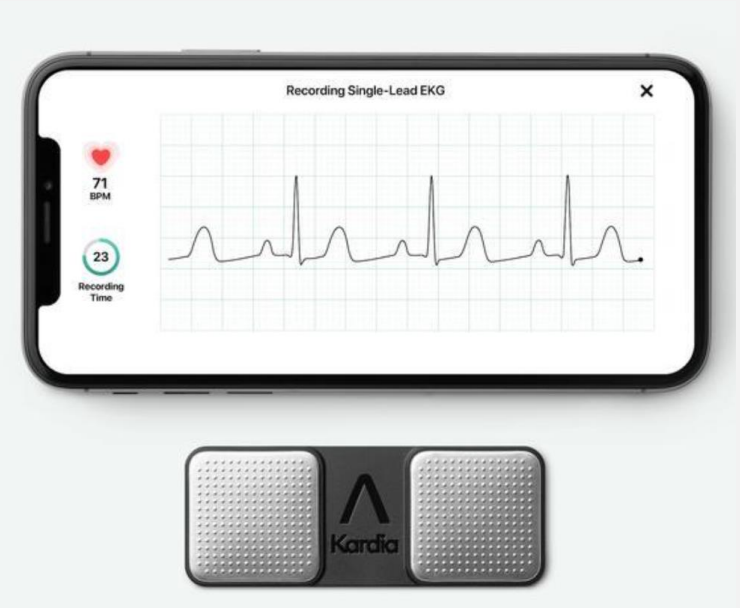


ECG – SHORT PERIOD

For high-risk stroke/TIA workup, not routine population screening



ECG / 24 h ECG telemetry



Kardia iECG (200 AUD)

Apple Watch (600 AUD)

ECG – LONG PERIOD

30-day HeartBug

Loop recorder implant

LACUNAR STROKE

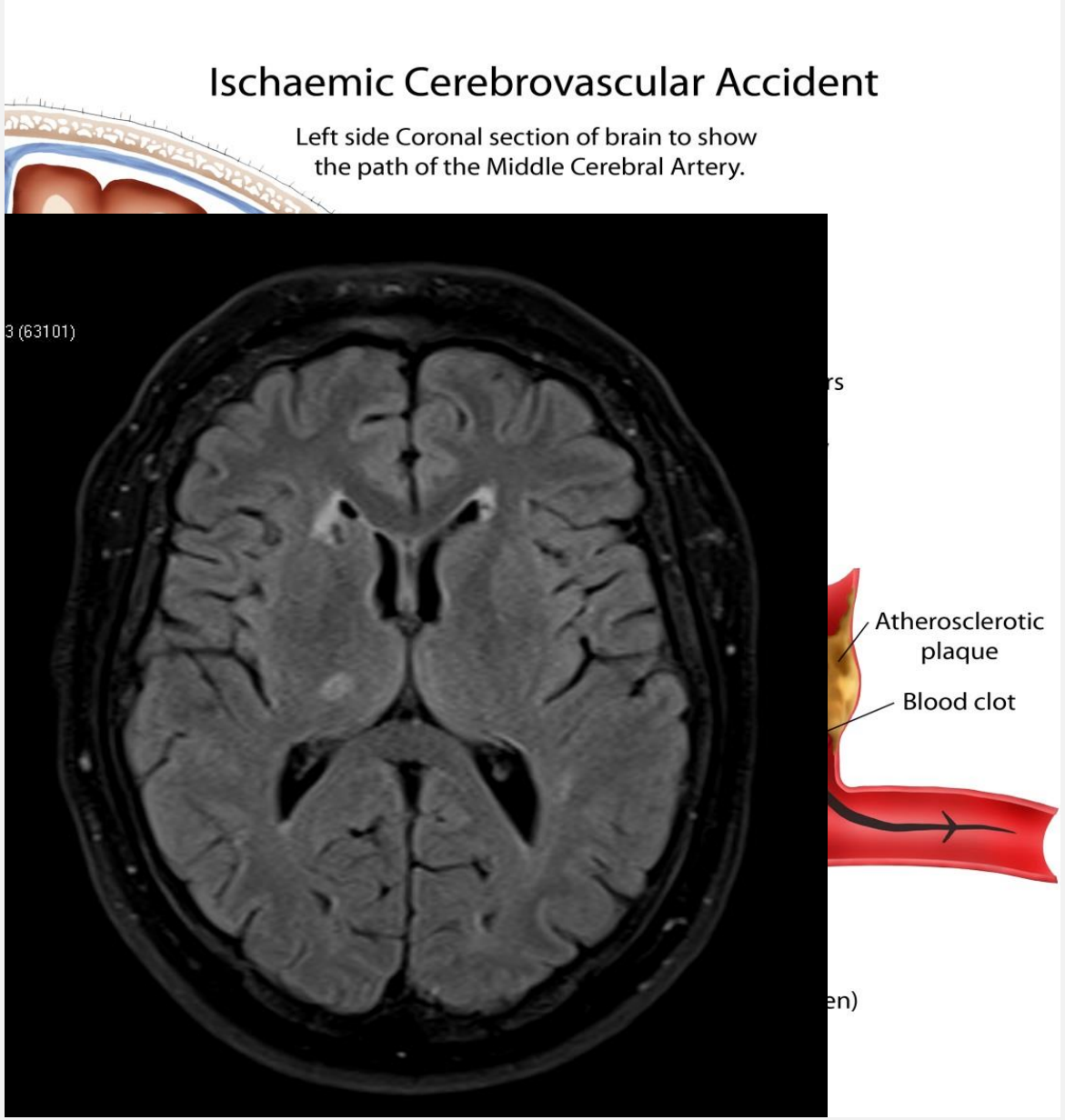
Vascular risk factors leads to hyperplasia of the wall vessel: **Lypohyalonisis**

Brainstem and basal ganglia

Always subcortical and inferior to 15 mm.

Secondary to vasc risk factors

- Smoking
- Sugar
- Hypertension
- Hypercholesterolemia



Antiplatelet therapy + Statins + Risk factor control!

PFO CLOSURE / SCREENING

PFO does not cause strokes

Incidental finding: 20-25% population

But emboli from venous circulation can by-pass lungs and cause stroke if PFO +

PFO screen indicated in young patients (<60 y old) with possible embolic (cortical) stroke/TIA and no other clear cause of the stroke/TIA.

If patient performing a Valsalva maneuver at onset might suggest PFO mechanism

Complementary test

Bubble study request in TTE

TOE

Right-left shunt by transcranial doppler

YOUNG STROKE PATIENT

Carotid / vertebral dissection

AF AND ANTICOAGULATION

- Paroxysmal, persistent and permanent AF have increased stroke risk.
  - (approx 3x RR on average – NVAF; 17x RR for AF + Valvular HD).

- Indications for DOAC – CHA_2DS_2 VASc> 1 or 2.
  - CHA_2DS_2 VASc 0 ➔ no Rx (ASA is not recommended NHF and other guidelines).

- N.b. Scoring irrelevant if prior event?:
  - Stroke risk in pts with prior stroke / TIA = 13.4%, v. 4.1% in those without[1]

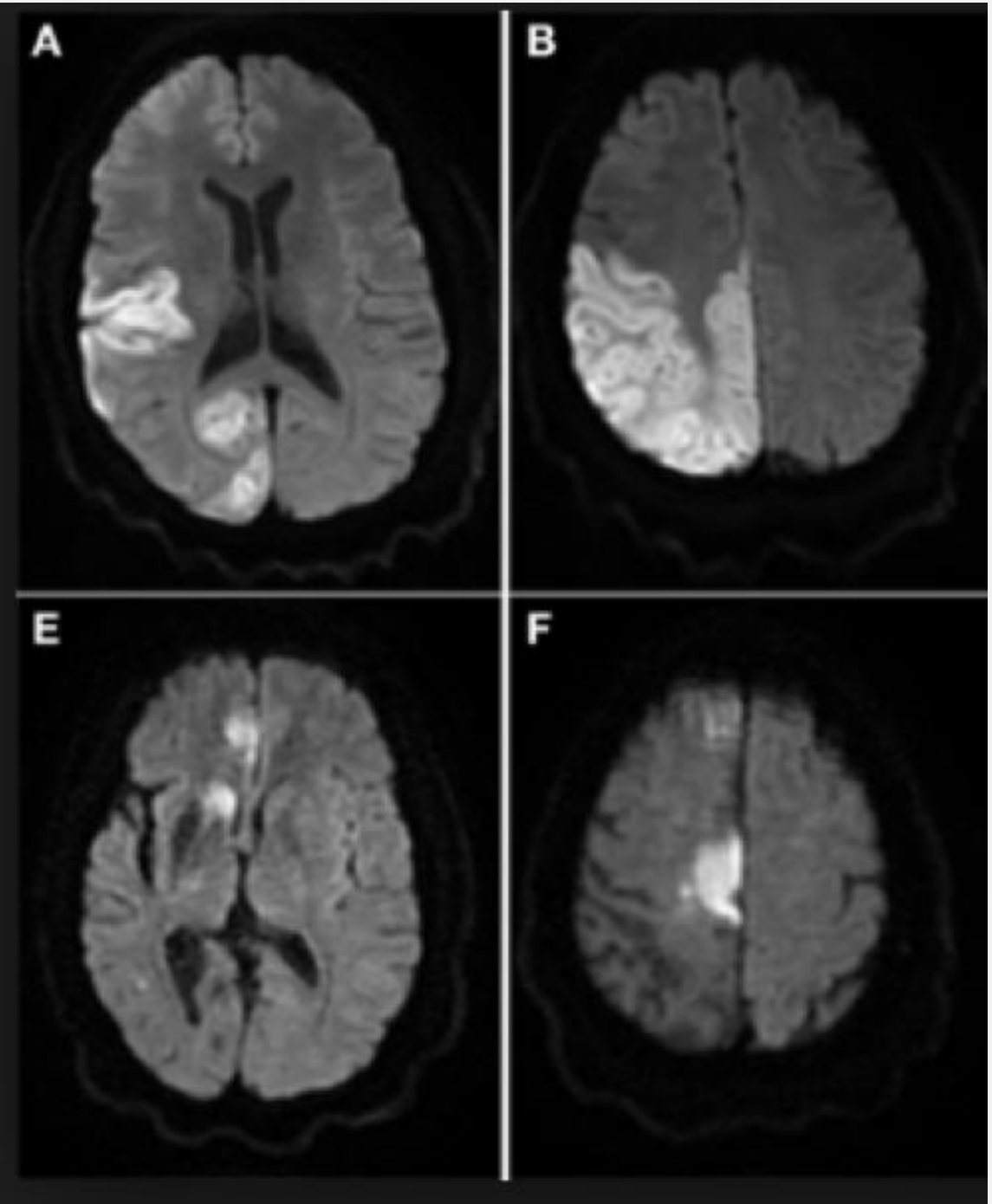
- Warfarin just indicated for mechanical valves, or severe mitral stenosis with AF.

1. Hart et al. *Ann Int Med* 2007

CRYPTOGENIC STROKE AND AF

- 20-40% ischaemic stroke are "**cryptogenic**"
- Insertable loop recorder increased detection rate for AF (>30secs) in this group from 1.4% to 8.9% after 6 months (12.4% at 12 months), with treatment implications.
- Heart-bug ECG recorder (30-day)

Sanna et al. 2014. NEJM. 370:2478-86



2 large multicenter randomized clinical trials comparing antiplatelet versus DOAC in cortical strokes *(NAVIGATE-ESUS and RESPECT-ESUS)*

Negative for secondary prevention of ischemic events
Increased haemorrhagic risk in DOAC group

Conclusion: AF needs to be captured!

REFERRAL PATHWAY

- Stroke / TIA clinic (Rapid access)
- 6 sessions per week at JHH
- Referral fax: 4921 34 88 - Addressed to Prof Neil Spratt, Dr Alvin Chew or myself

- Telestroke clinic MBH (please, flag that patient is from Manning area)
  - Weekly
  - Referral to local stroke coordinator MBH (Position TBA) / JHH

  - Maitland stroke clinic (please, flag that patient is from Maitland area)
  - Fortnightly (starting Feb 2022)
  - Referral to be sent to the JHH

If Questions?

In-hours stroke fellow at JHH
(8-5pm Monday – Friday)

SUMMARY: TIA PATHWAY

- Exclude ICH (NCCT).

- Determine mechanism:
  - Carotid Stenosis (duplex / CTA / MRA)
  - AF? ECG +/- Holter → **Anticoagulate**
  - <60 y.o. cryptogenic => PFO? (TTE agitated saline bubble study).

- If not in AF:
  - Clopidogrel 300 mg stat, + 75 mg daily.

    +

  - Aspirin 300 mg stat + 100-150 mg daily.

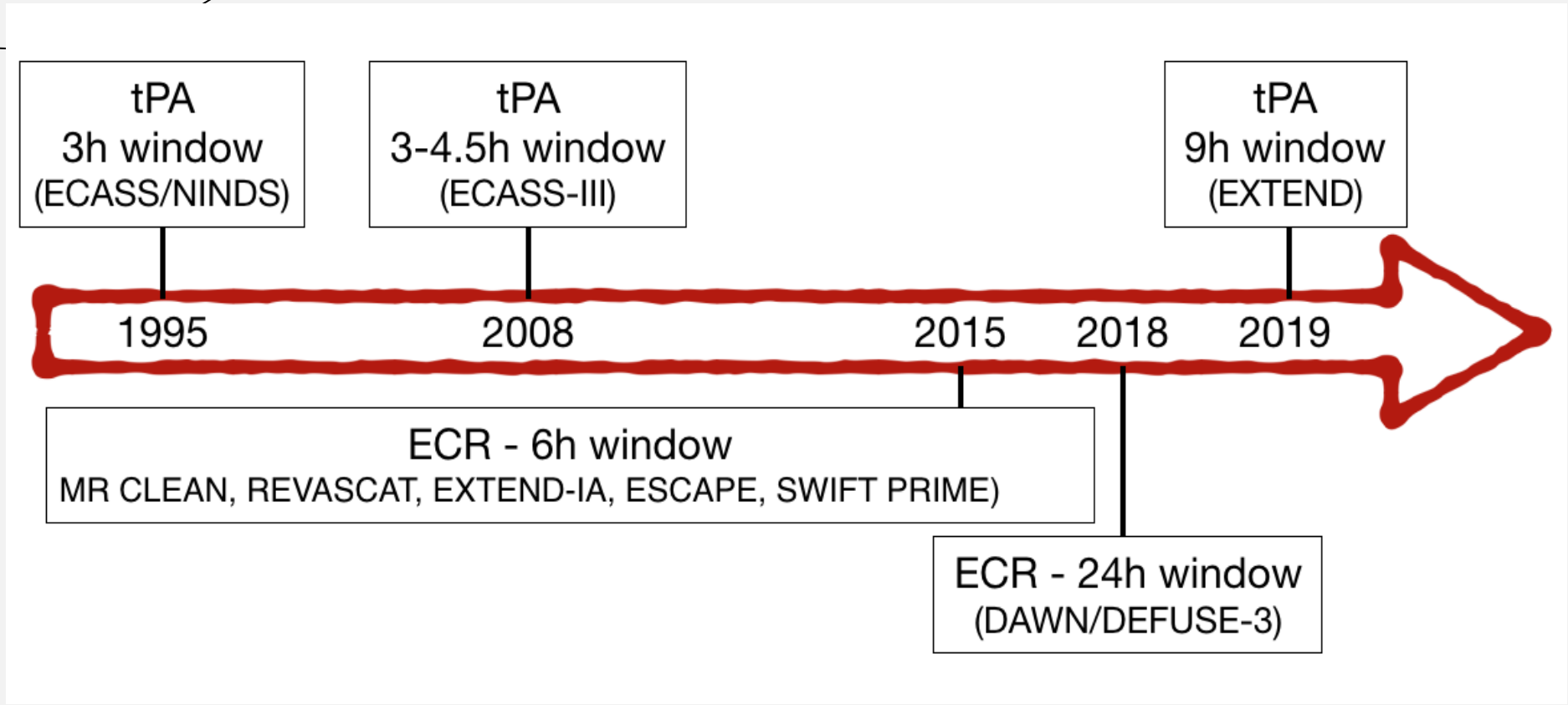
  } **X 3 weeks, then single Antiplatelet and Statins**

Referral to stroke clinic (JHH)

THANKS!

Q? carlos.garciaesperon@health.nsw.gov.au

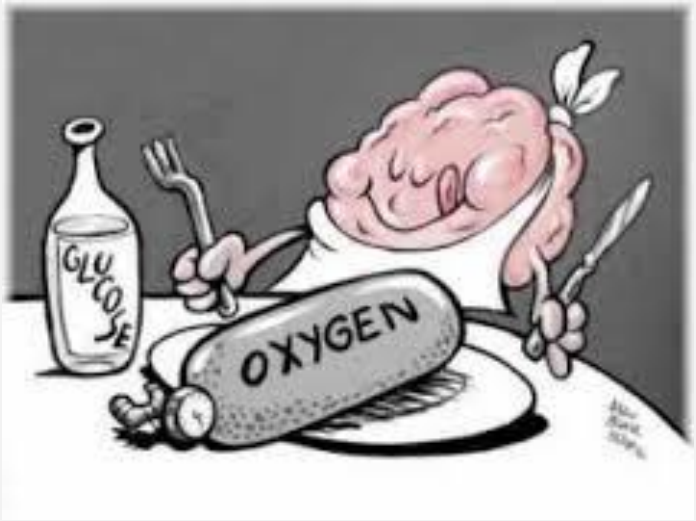
TIMELINE OF REPERFUSION THERAPIES



PHYSIOPATHOLOGY

Irreversible damage sets in as soon as

2-4 minutes after O2 and glucose deprivation



The brain receives about 20 % of the cardiac output although it is only 2 % of body weight.

The brain contains little or no energy stores of its own.

Even brief deprivation can lead to death of the affected brain tissue.

CONCLUSION AND FUTURE CHALLENGES

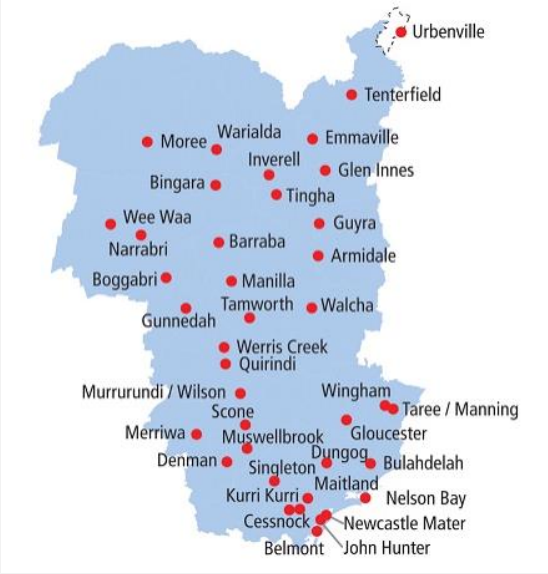
Under 60 minutes

CONCLUSION AND FUTURE CHALLENGES

PREHOSPITAL

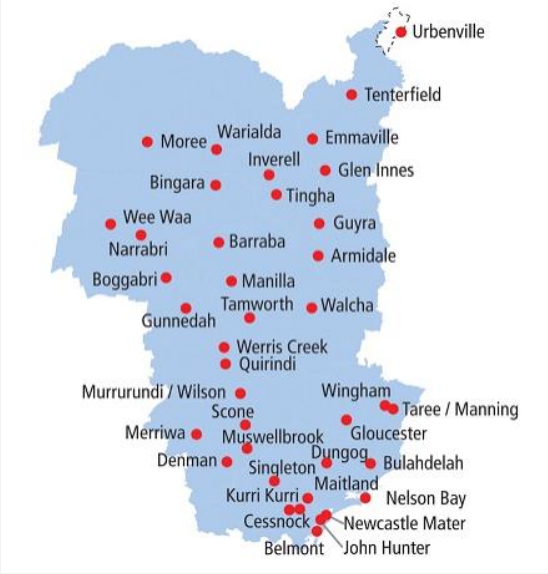
CONCLUSION AND FUTURE CHALLENGES

PREHOSPITAL



CONCLUSION AND FUTURE CHALLENGES

PREHOSPITAL



Hunter 8 pre hospital stroke scale

However, no pre hospital scale can supply the stroke neurologist
Need of video on the field

HUNTER-8

Hunter-8 ≥ 8

½ patients have a large vessel occlusion (ECR candidates) or ICH

Hunter 8 Item	Scoring Definition	Score on Scene	Score on Arrival
1. LOC Observations	**0** Alert (A) **1** Rousable to minor stimulation (V) **2** Rousable only to painful stimulation (P) **3** Reflex response or unrousable (U)		
2. LOC Questions Ask patient's age and current month (must be exact)	**0** Both correct **1** One correct or dysarthria, foreign language **2** Neither correct		
3. Commands – opens/close eyes, grip and release non paretic hand then other hand (1 step commands or mimic ok)	**0** Both correct (OK if impaired by weakness) **1** One correct **2** Neither correct		
4. Best Gaze – test horizontal eye movements-tracking object/face	**0** Normal **1** Partial gaze, abnormal gaze in 1 or both eyes **2** Forced eye deviation or total paresis which cannot be overcome		
5. Facial Palsy – show teeth, close eyes tight, raise eyebrows. If stuporous, check symmetry of grimace to pain	**0** Normal **1** Minor paralysis, flat nasolabial fold, asymmetrical smile **2** Partial paralysis (lower face) **3** Complete paralysis (upper & lower face)		
6. Motor Arm – arms outstretched 90° sitting or 45° (supine) for 10 seconds. Encourage best effort. Score for Left and then right arm.	**0** No drift for 10 seconds **1** Drift but does not hit bed **2** Some effort against gravity but can't sustain **3** No effort against gravity **4** No movement at all **X** Unable to assess due to amputation, fusion Explain _____	Left Right	Left Right
7. Dysarthria – read or repeat list of words (see word list below)	**0** Normal **1** Mild-mod slurred speech but intelligible **2** Unintelligible or mute **X** Intubated or mechanical barrier		
8. Extinction/Neglect – simultaneously touch patient on both hands or legs with their eyes closed. Show fingers in both visual fields	**0** Normal none detected **1** Neglect or extinction to double simultaneous stimulation in any modality (sensory, visual) OR visual/sensory loss on one side. **2** Profound neglect in both visual and sensory modalities		
Total Score		/24	/24

ED ACUTE ASSESSMENT: WHEN TO CALL?

- Time from onset
- Severity of symptoms: NIHSS
- Pre-morbid status – mRS / DBS

D-B-S

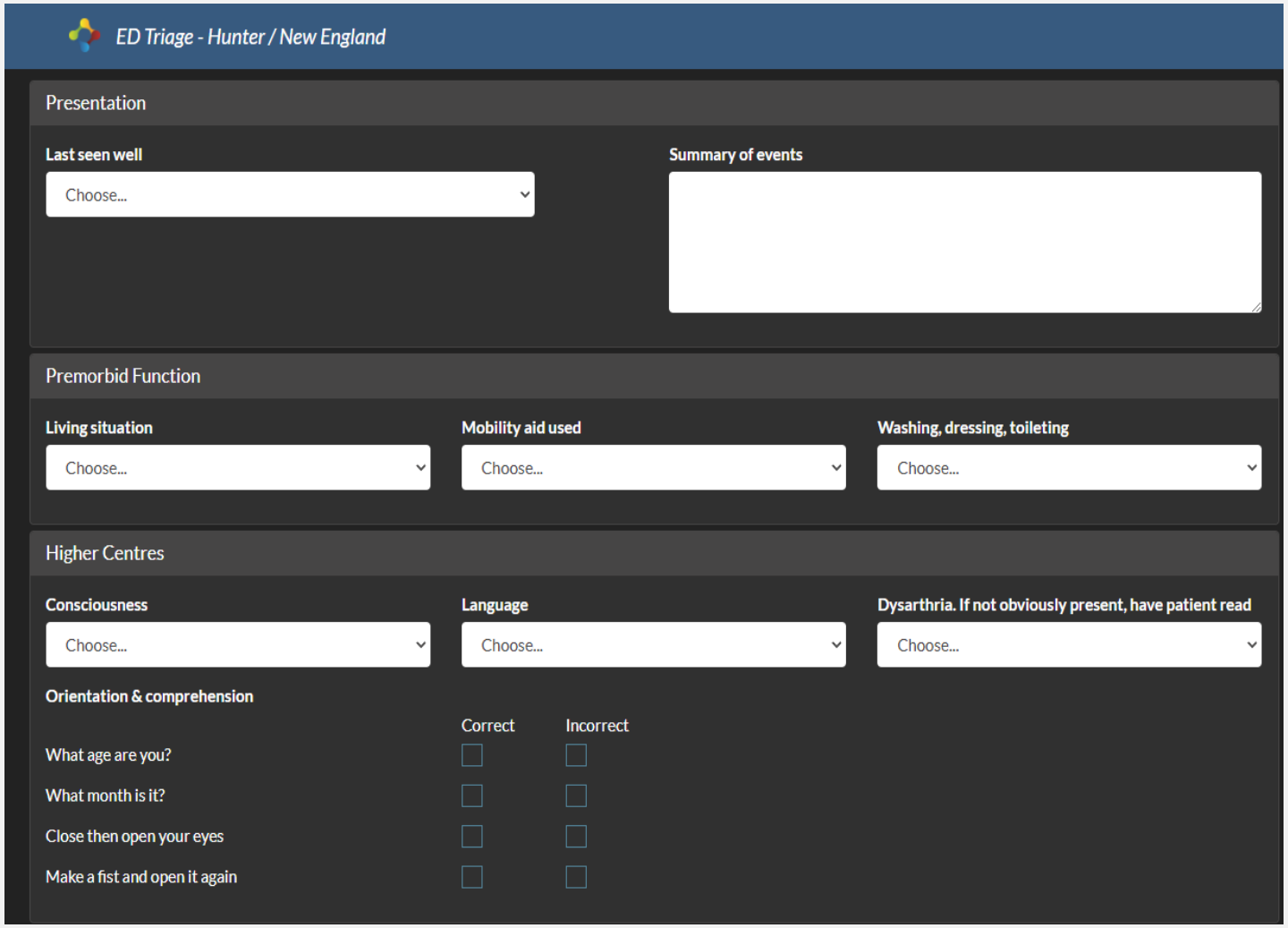
Driving /

Domestics

Banking

Shopping

STROKE TRIAGE - ROUNDS



1.4 STROKE FTE…

Population 920 370

Area 131 785 km^2

Population 211 000

Area 11 335 km^2

REFERRAL TO STROKE CLINIC - TIPS

TESTS

-NCCT is a must
-CTA ideal (specially if PMH of AMI, PVD or crescendo TIA), otherwise carotid ultrasound (GP to organize)
-MRI – patent has to pay as outpatient.. Don't write it!
-TTE and 24 h ECG telemetry if required

- Call Stroke team if doubts.

- Be realistic in the message. Follow up in 2 weeks??? It takes us 4-6 weeks most of the time
- Limited capacity - 7 stroke sessions / week – but patients from all HNE / MNC

Is it a stroke / TIA??

SECONDARY PREVENTION

- Dual antiplatelet-3 weeks then monotherapy, high dose Statin
- AF – Anticoagulation
- Avoid Aspirin + NOAC
- Warfarin is the past
- Don't forget the life style risk factors - smoking, alcohol

- **Driving**
- TIA - no driving 2 weeks (4 weeks for commercial licence)
- Minor stroke – not for 4 weeks (3 months for commercial)

REFERRAL TO STROKE/TIA CLINIC

- Urgent rapid Stroke /TIA clinic referrals to be faxed to (02) 49213488
- John Hunter Hospital neurology department
- (page 11 of ED stroke/TIA pathway)

- Non urgent -RIMS (Referral information management system)
- Fax 49236417

THANKS!

carlos.garciaesperon@health.nsw.gov.au

STROKE MIMICS

- Looks like stroke, but it is something else
- 5% - 17% of total ED presentations

Common mimics	
Seizures	
Syncope	
Conversive disorders	60%
Migraine with aura	
Sepsis	
Brain tumor	
Metabolic	
BPPV	
Drugs	
Bell's palsy	
Transient global amnesia	

John Hunter Emergency Acute Stroke Procedure

Pre-hospital Notification: NSWA to notify Stroke Fellow who will determine whether the patient is:

1) For Acute Stroke Intervention:
Meet Stroke Doctor in the ED and continue along acute intervention pathway.

2) NOT for Acute Stroke Intervention:
Triage assessment on arrival - if acute stroke is suspected from triage call stroke team / otherwise usual ED management.

For all self-presenting stroke patients / any stroke patient not screened by paramedics pre-hospital proceed directly to ED triage outlined below:

Arrival / Triage:
Stroke triage guided by the 'Stroke Triage - Rounds' triage tool (found on HNE intranet)
All acute strokes to receive an ATS category 2 (at minimum)
Determine presence of immediate life threats present (ABCD)
1) If requiring urgent resuscitation move to resus
2) If medically stable continue pathway directly to CT

IV Access:
18 gauge IVC inserted
In the case of difficult access (if > 2 attempts or >10 minutes) – transfer to resus

Facilitate CT scan:
Stroke Doctor to coordinate CT scan
Nurse escort required (appropriate skill i.e. resus level)
Ideally transfer with NSWA on stretcher (ED team to accompany NSWA)
If patient requires ongoing resuscitation transfer with ED nurse, medical officer and any equipment required

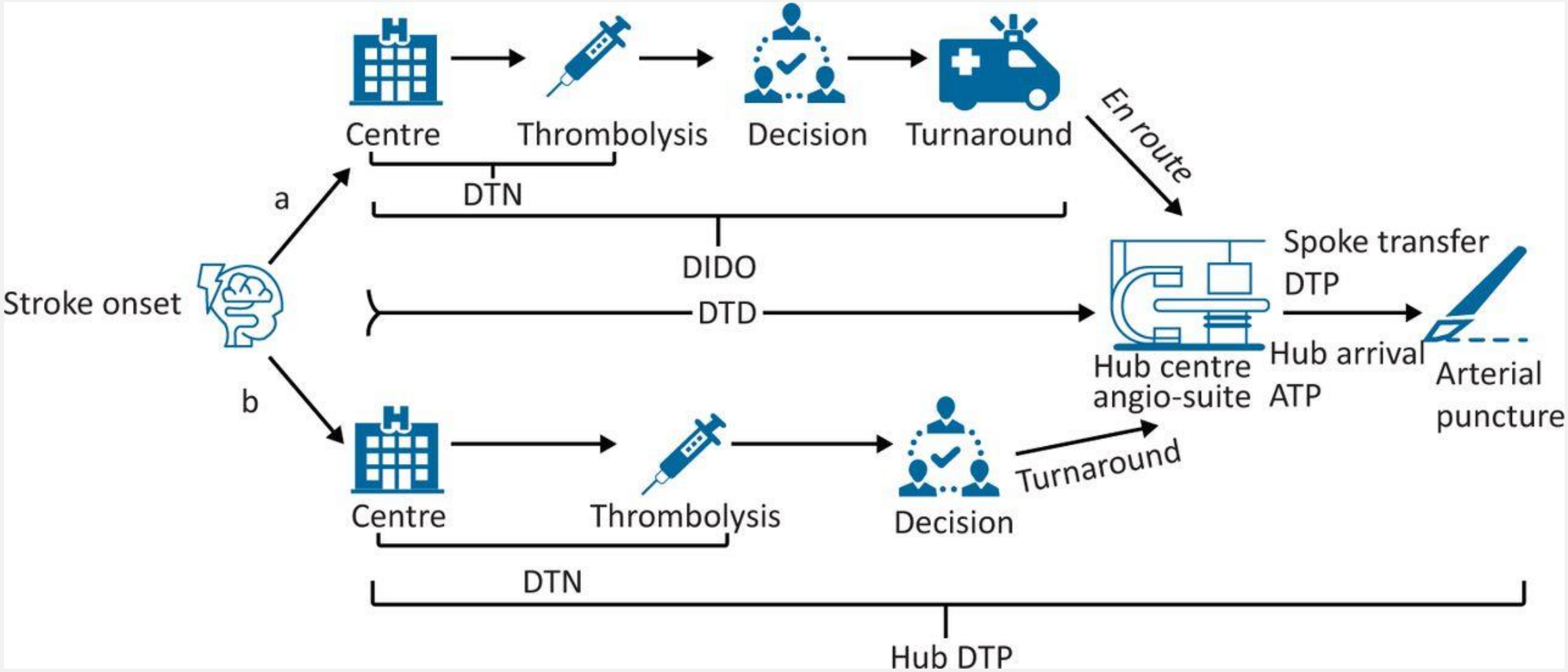
All hyper acute stroke patients return to resus (or appropriate substitute with 1:1 supervision) immediately following CT until a decision is made on the need for acute therapy

Acute Therapy Following review of the CT, the stroke team will direct care along one of the following pathways:

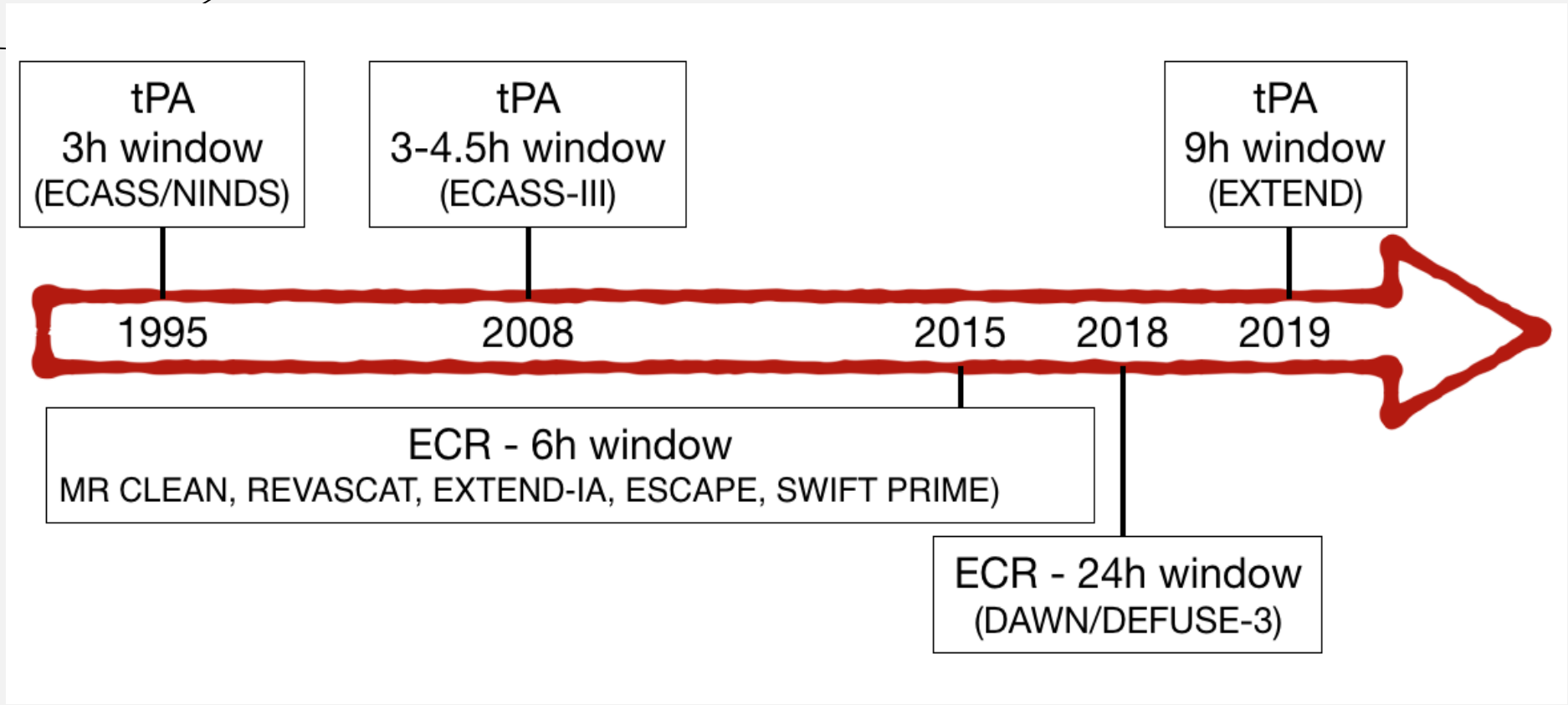
No Acute Therapy	• Continue care along the stroke pathway in a clinically appropriate area of the department.
Thrombolysis	• Monitor in a resuscitation bed • Establish 2nd point of IV access • Ensure no contraindications as per pathway (i.e. BP controlled below 185/110) • Administer Thrombolytic agent as directed by Stroke Doctor: 1. Alteplase: Confirm dose, do not shake vial while reconstituting, administer bolus dose as an IV push immediately followed by the infusion (delivered by syringe driver). 2. Tenecteplase (acute stroke research trial patients only): Confirm dose (stroke dose of 0.25mg/kg is different to cardiac dose), reconstitute medication, deliver bolus dose as an IV push. • Contact G2 in charge to inform them of thrombolysis taking place - Book an acute stroke unit bed as usual. • Continue to monitor as per Stroke pathway (must remain in the ED with 1:1 nursing for at least 2 hours post administration)
ECR (clot retrieval)	• Establish 2nd point of IV access • Change to gown and shave bilateral groin • Complete pre-op checklist • Insert urinary catheter (IDC) - *desirable* • Patient remains in the ED until confirmation is received that lab 5 is ready for the patient including the presence of the anaesthetic team.

WHY PRE HOSPITAL SCALES?

"The right patient to the right hospital"



TIMELINE OF REPERFUSION THERAPIES



UNEXPLAINED LOC

44 years old female

PMH / Anxiety on SSRI

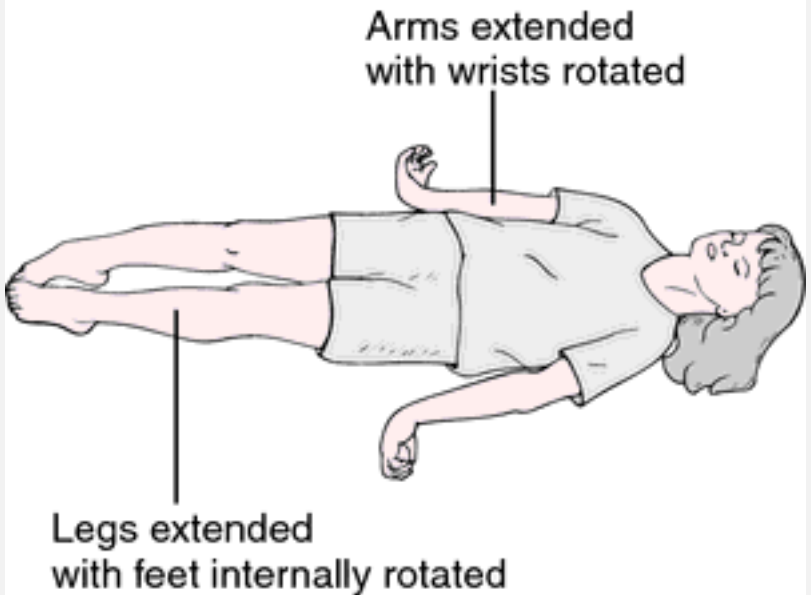
Unwell + vomiting + collapse – hit head on bathroom floor

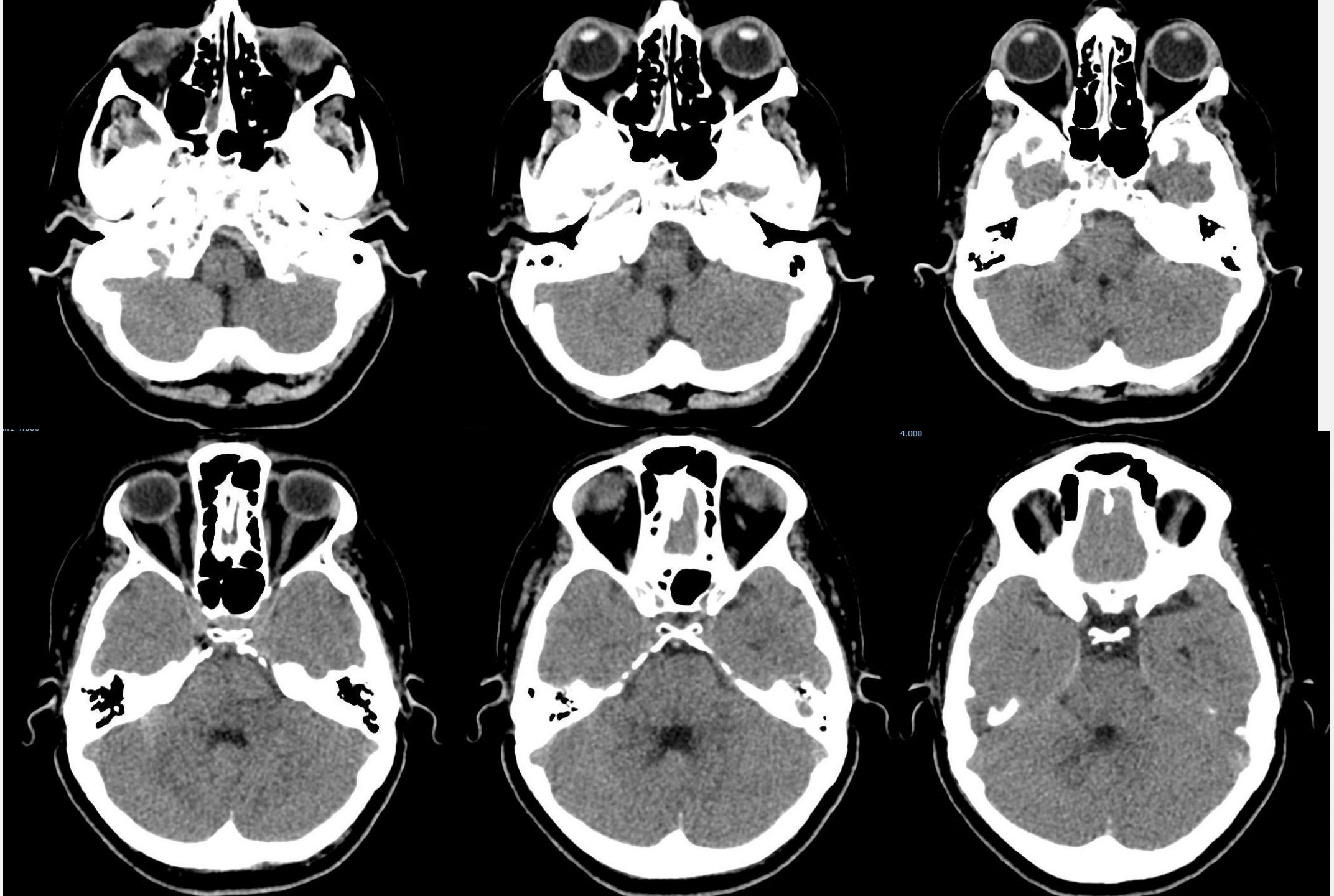
Arrival JHH (60-90 minutes since onset)

Extensor (decerebrate) posture, GCS 5 – Intubation

Bloods: Normal

37.2 C




4.000

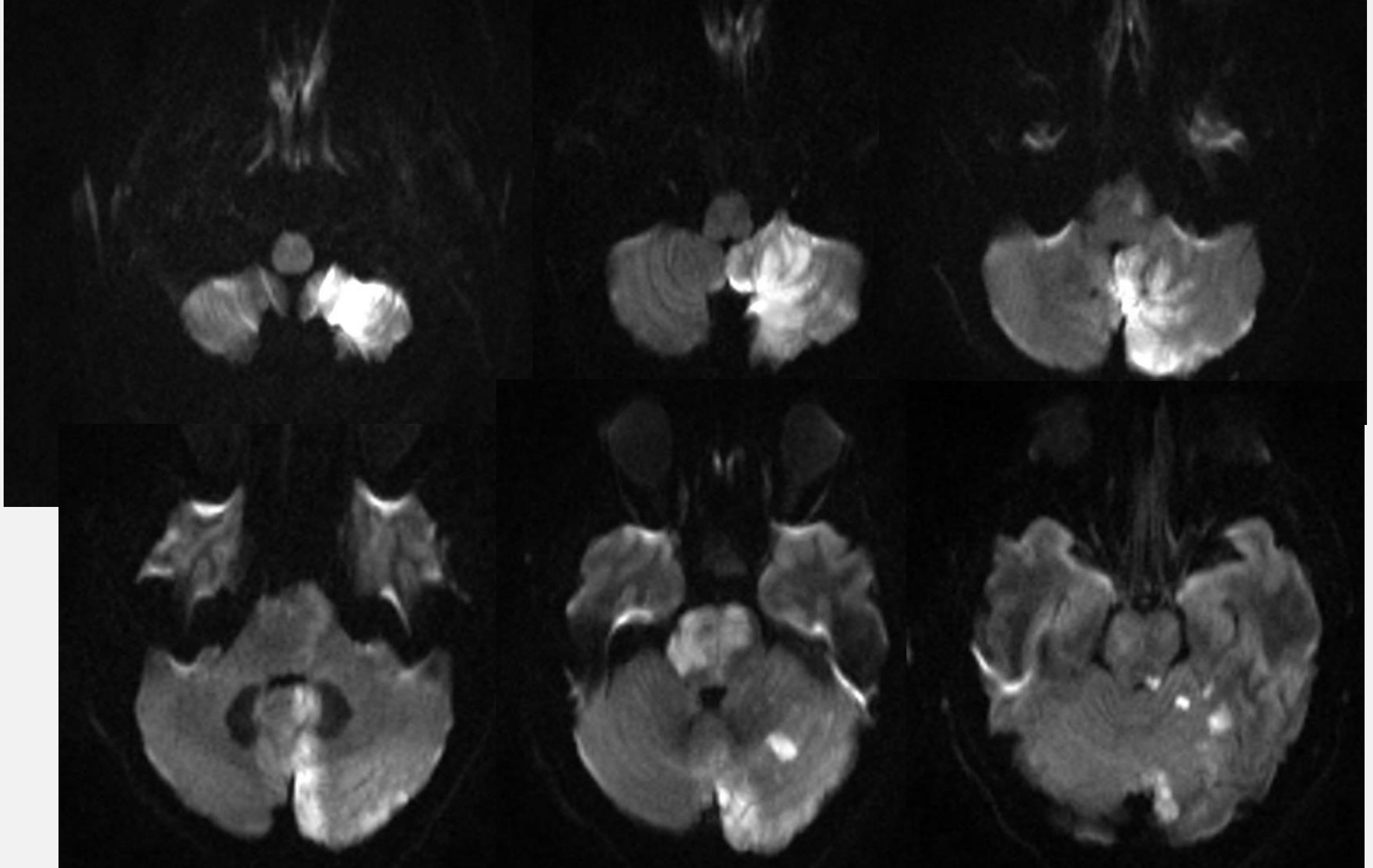
Differential diagnosis

Meningoencephalitis / seizure / drugs?

Admission in ICU

LP: Normal

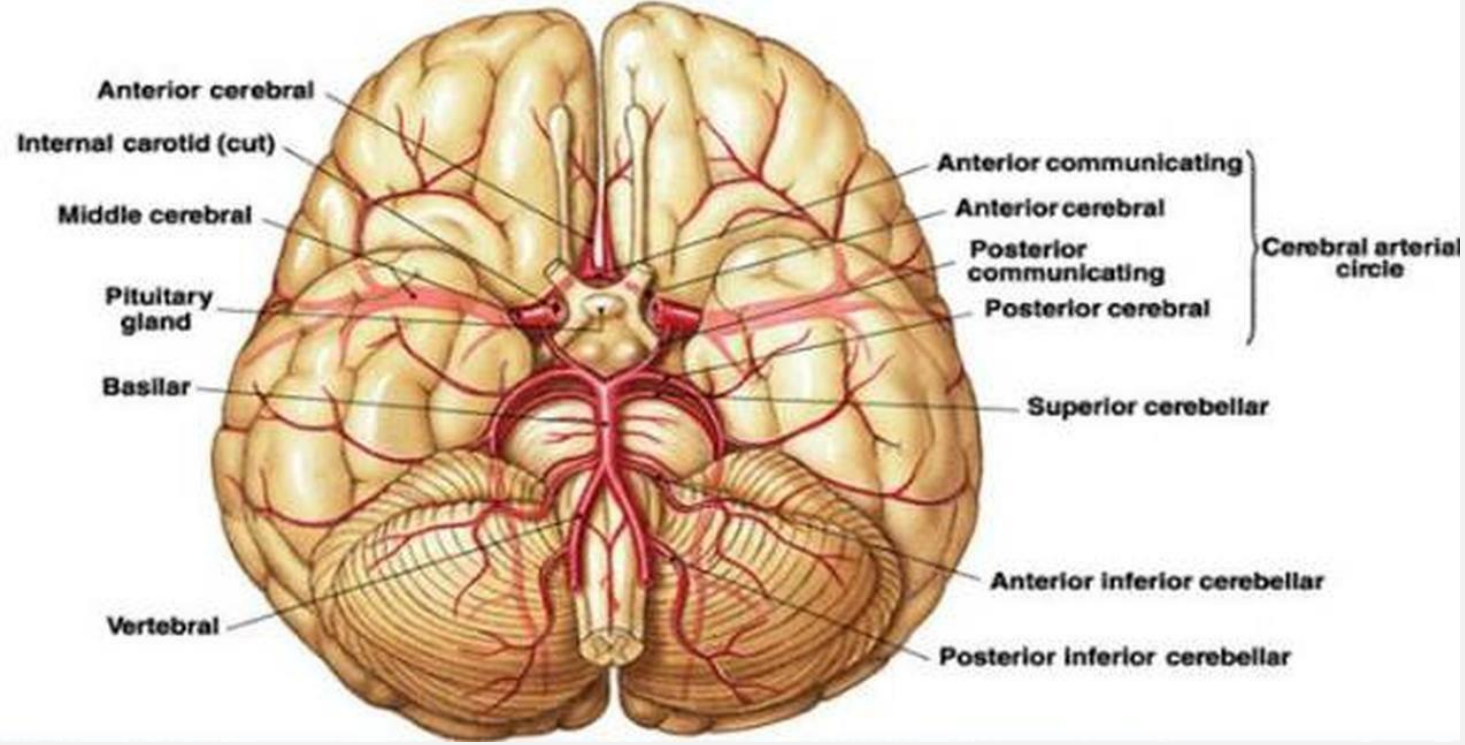
Successful extubation day after, but need to re-intubation later that day



Patient extubated 4 days since onset.

Locked-in syndrome.

Communicate with family blinking.



Prevalence
3-5% of ischemic strokes

Outcome with no treatment
70-90% mortality

SYMPTOMS
Motor deficits (hemi or tetraparesis) - 40-65% cases

Dysarthria (+++) - 30-60%

Vertigo, nausea, and vomiting - 55-70%

Visual disturbances (diplopia, hemianopia..) - 20-30%

Altered consciousness - 20-30%

MBH TELESTROKE CLINIC

- Commenced in November 2018 at MBH
- Weekly, using current resources.

- Hybrid model

- > 280 patients assessed

MBH TELE CLINIC – ANALYSIS OF 173 APPOINTMENTS

136 (78.6%) first appointments (125 attended)
37 (21.4%) follow-up
14 (8%) of the patients failed to attend

Of the 125 first appointments

106 (84.8%): stroke or TIA by the stroke neurologist
(80 ischemic strokes, 22 TIA and 4 haemorrhagic strokes).

A change in diagnosis was made by the stroke neurologist in 23 (18.4%) of the initial appointments

MBH TELE CLINIC – INTERVENTIONS

Any intervention was made by the neurologist for 102 (81.6%) of the 125 first appointments.

Medication changed for 67 (53.6%) patients

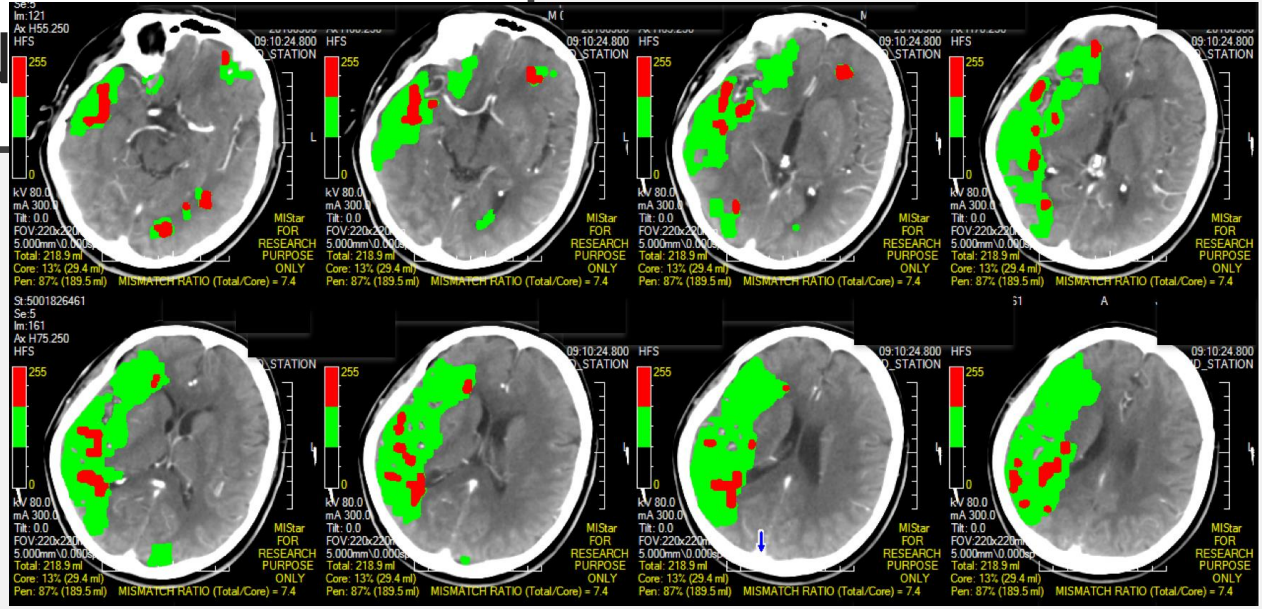
Additional investigations requested in 72 patients (57.6%)

Referral for **a stroke clinical trial** on 15 patients (12%)

Another type of intervention: 23 patients (18.4%)
Referral to another specialist, referral for a formal driving assessment…

PATIENT SELECTION

- **CT Perfusion at spoke sites**



CNS Neuroscience & Therapeutics
Open Access

Implementation of multimodal computed tomography in a telestroke network: Five-year experience

Carlos Garcia-Esperon[1,2] | Frode Soderhjelm Dinkelspiel[3] | Ferdi Miteff[1,2] | Shyam Gangadharan[1,2] | Tom Wellings[1,2] | Bill O´Brien[4] | James Evans[4] | Tom Lillicrap[1,2] | Jelle Demeestere[5] | Andrew Bivard[6] | Mark Parsons[2,6] | Chris Levi | Neil James Spratt[1,2] |

for the Northern NSW Telestroke investigators

PATIENT SEL

Implementation of multimodal computed tomography in a telestroke network: Five-year experience

N= 240

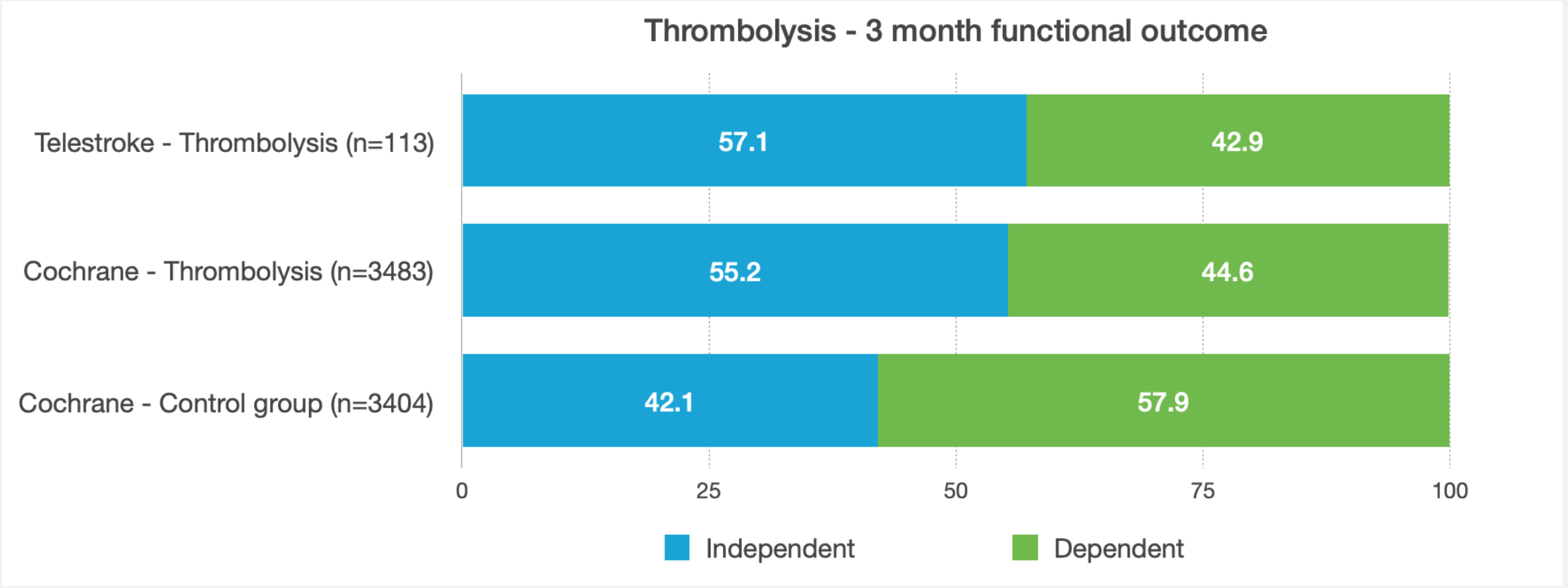
Baseline median NIHSS: 4 [2-9]

Baseline mRS 0-2: 92%

Visible vessel occlusion: 35%

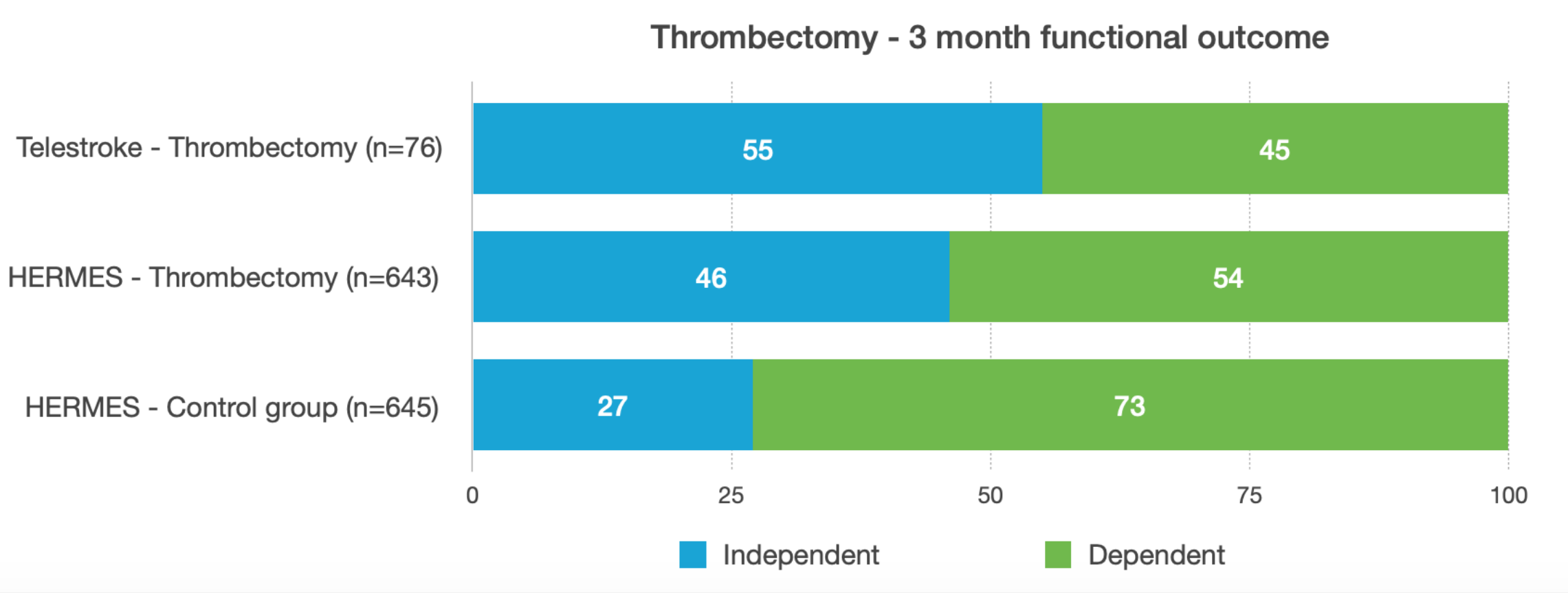
Large vessel occlusion: 18%

PATIENT SELECTION

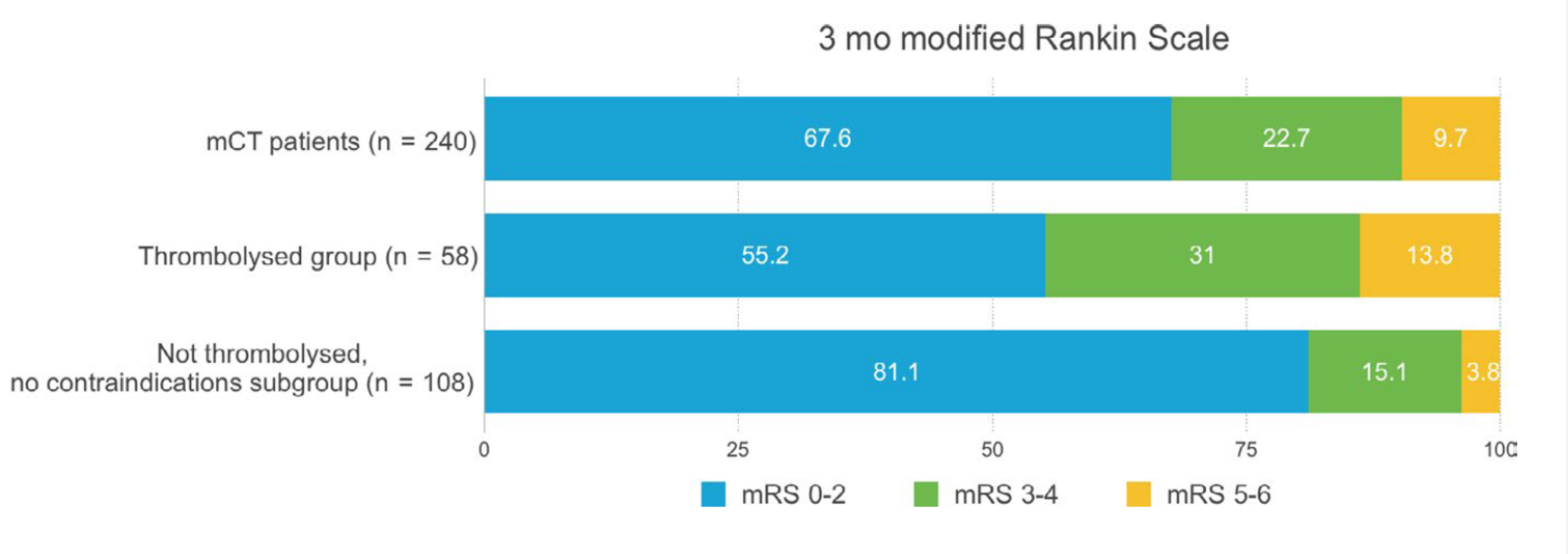


sICH 1.7 % - Currently 0.8%

PATIENT SELECTION



PATIENT SELECTION



sICH 1.7 % - Currently 0.8%

PATIENT SELECTION

- *Same core / penumbra thresholds than used at hub site?*
  - Yes, but need of careful interpretation of CTP – Not just core/penumbra volumes
  - Hypoperfusion Intensity Ratio[1,2] (Tmax>10/Tmax>6) or DT-based ratio[3], useful for tissue survival

- *Repeat imaging at arrival?*
  - Average transfer takes 4-6 hours
  - Not routinely - Unless unexpected delays or clinical deterioration/improvement
  - Our single centre experience *(unpublished)* suggests safety / low futile thrombectomy rate

- *Who should be transported?*
  - EVT candidates
  - Haemorrhages
  - At risk of malignant MCA
  - Endarterectomy

[1] Olivot et al, Stroke (2014)
[2] Guenego et al, Annals of Neurology (2018)
[3] Lin et al, Stroke (2020)

TRANSPORT MODALITY

- *Expensive* (In Australia paid by government)

- *Understand the resources*
  - Limited transport availability, high demand

- *The in-theory fastest is not the real-life fastest*
  - Helicopter would require round trip (sometimes not possible on a single tank of gas)
  - Lack of helipad in all the rural sites at hospital, need to transport to the airport.
  - <u>Know the area. Know the resources</u>

TRANSPORT MODA

Air vs. Road Decision for Endovascular Clot Retrieval in a Rural Telestroke Network

frontiers in Neurology

Shyam Gangadharan[1], Thomas Lillicrap[2], Ferdinand Miteff[1,2], Pablo Garcia-Bermejo[1], Thomas Wellings[1], Billy O'Brien[3], James Evans[3], Khaled Alanati[1], Christopher Levi[1,2], Mark W. Parsons[2,4], Andrew Bivard[2,4], Carlos Garcia-Esperon[1,2†] and Neil J. Spratt[1,2†] for the Northern NSW Telestroke Investigators*

62 patients (20 road transfers / 42 air transfers)
Median spoke-door-to-hub-door was 308min - 68% spent at rural (DIDO 214min - IQR, 171–247]

DIDO was longer for air transfers than road (p = 0.004), median 87min greater decision-to-departure

The distance at which the extra speed of an aircraft made up for the delays involved in booking an aircraft was 299 km (185 miles) from the comprehensive stroke centre.

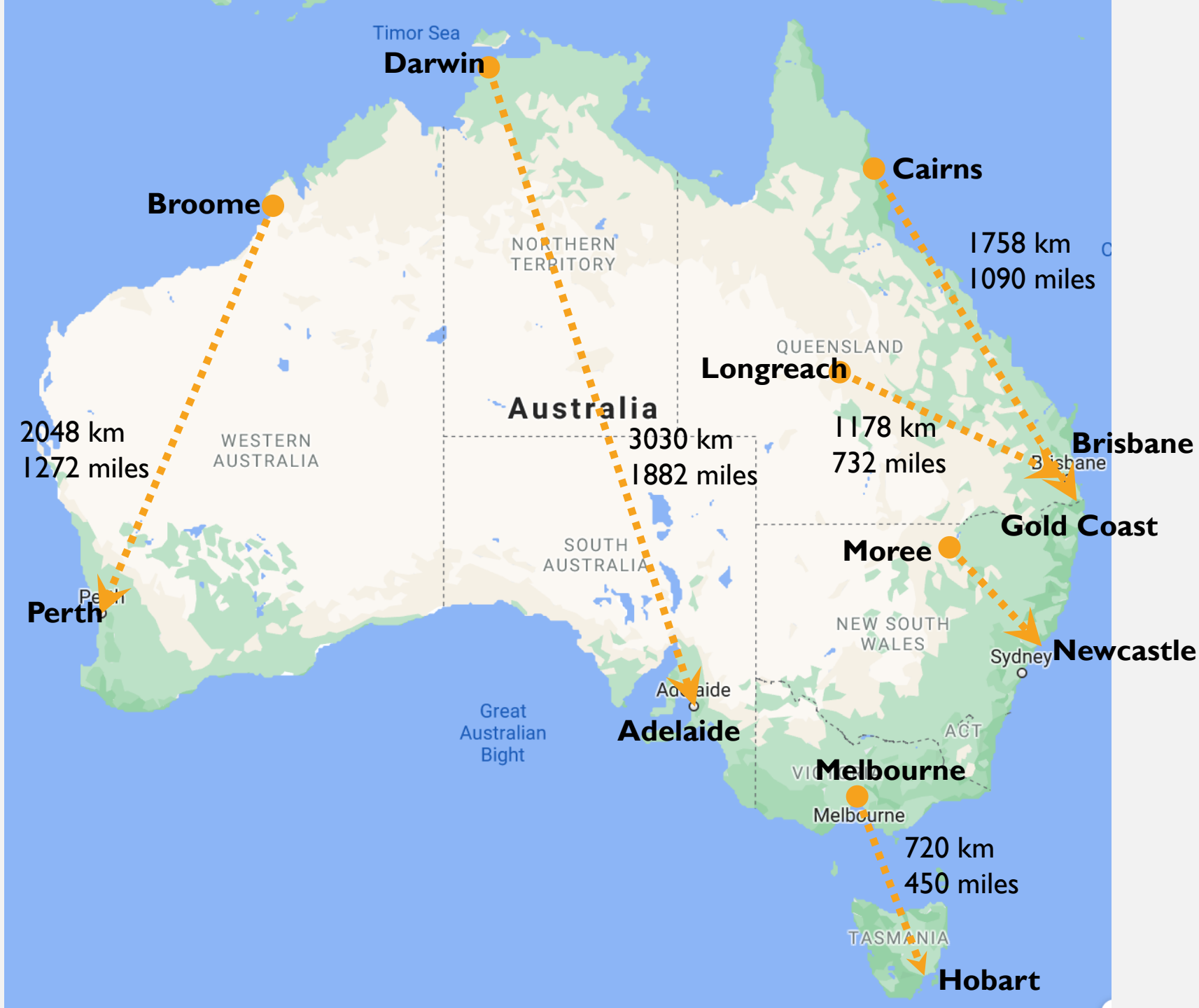
FORGOTTEN FACTORS

- *Emotional impact on family*
  - Some families unable to visit their relatives during admission (socio-economic factors)
  - 20% mortality in LVO

- *Staff and patient safety*
  - Lights and sirens?

- *Spoke sites / Ambulance services*
  - Understand their resources
  - Provide feedback to the team
  - Know them and get them to know you

- *Weather*


Timor Sea
Darwin
Broome
Cairns
NORTHERN TERRITORY
1758 km
1090 miles
QUEENSLAND
Longreach
Australia
3030 km
1882 miles
1178 km
732 miles
Brisbane
2048 km
1272 miles
WESTERN AUSTRALIA
Gold Coast
SOUTH AUSTRALIA
Moree
Perth
NEW SOUTH WALES
Sydney
Newcastle
Great Australian Bight
Adelaide
ACT
Melbourne
Melbourne
720 km
450 miles
TASMANIA
Hobart

IMPOSSIBLE IS NOTHING

76-year-old man

Medical history/
Heart failure
AF on DOAC

Collapsed in Darwin at 5 am
Initial assessment: Dysarthria and right-side ataxia.

Fluctuation of symptoms.

Slide courtesy of: Kleinig TJ, Cervera A , Scroop R

IMPOSSIBLE IS NOTHING

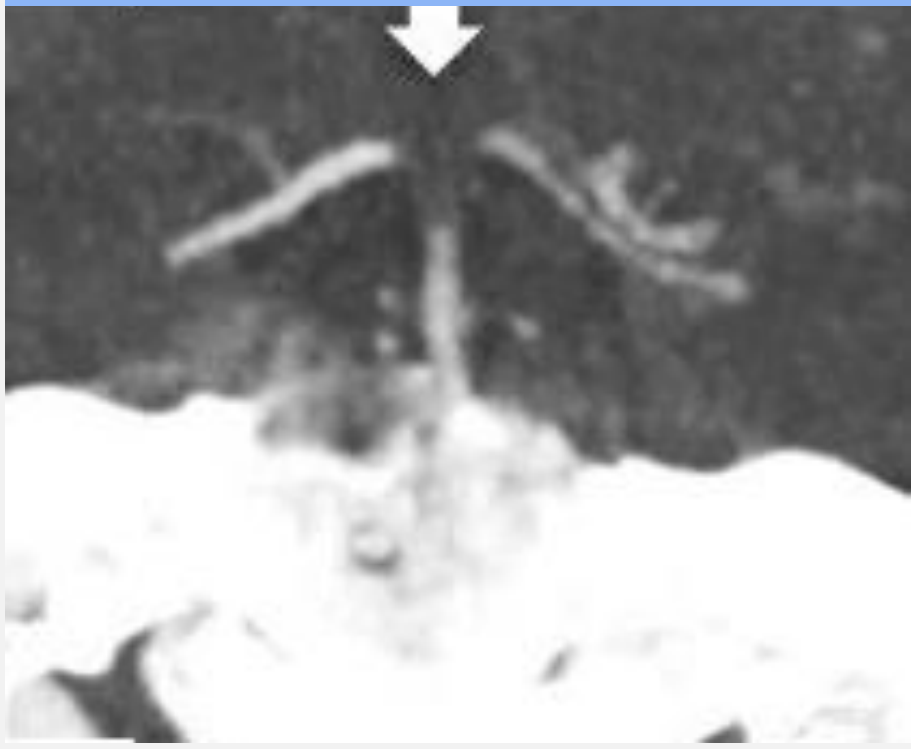
76-year-old man

Medical history/
Heart failure
AF on DOAC

Collapsed in Darwin at 5 am
Initial assessment: Dysarthria and right-side ataxia.

Fluctuation of symptoms.

CTA – Top of basilar occlusion



Slide courtesy of: Kleinig TJ, Cervera A , Scroop R

IMPOSSIBLE IS NOTHING

76-year-old man

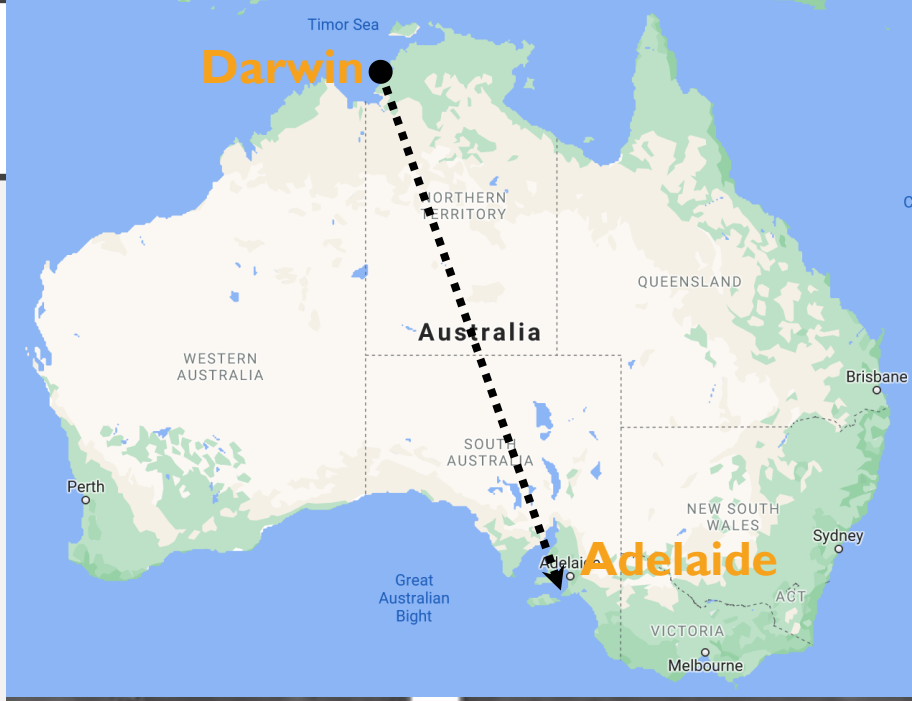
Medical history/
Heart failure
AF on DOAC

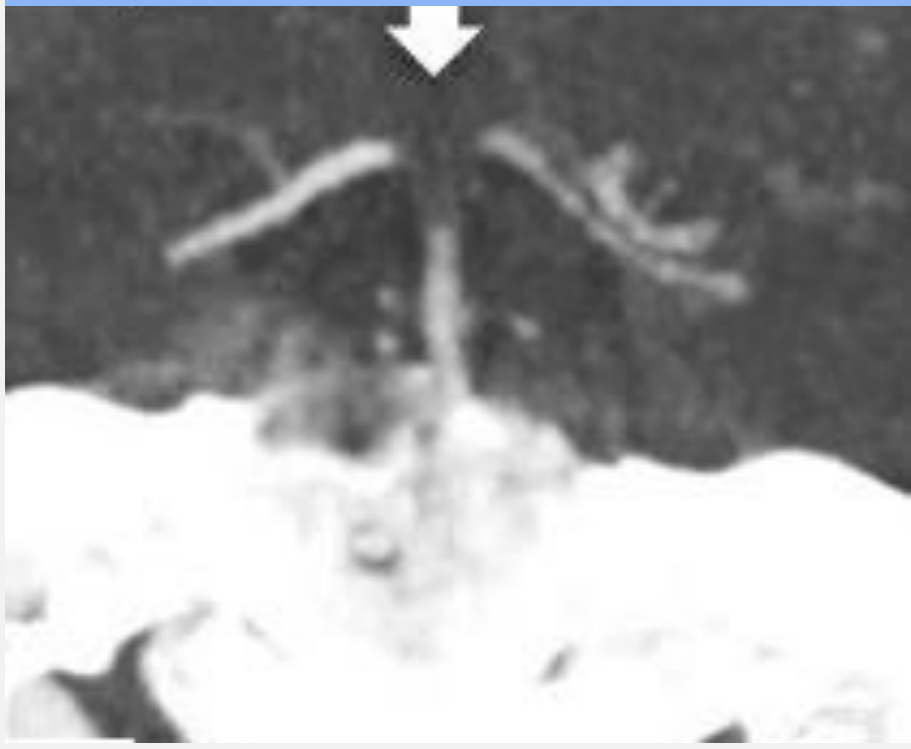
Collapsed in Darwin at 5 am
Initial assessment: Dysarthria and right-side ataxia.

Fluctuation of symptoms.

CTA – Top of basilar occlusion

Contact Royal Adelaide Hospital (3000km)
Patient transferred via aeromedical jet retrieval.





Slide courtesy of: Kleinig TJ, Cervera A , Scroop R

IMPOSSIBLE IS NOTHING

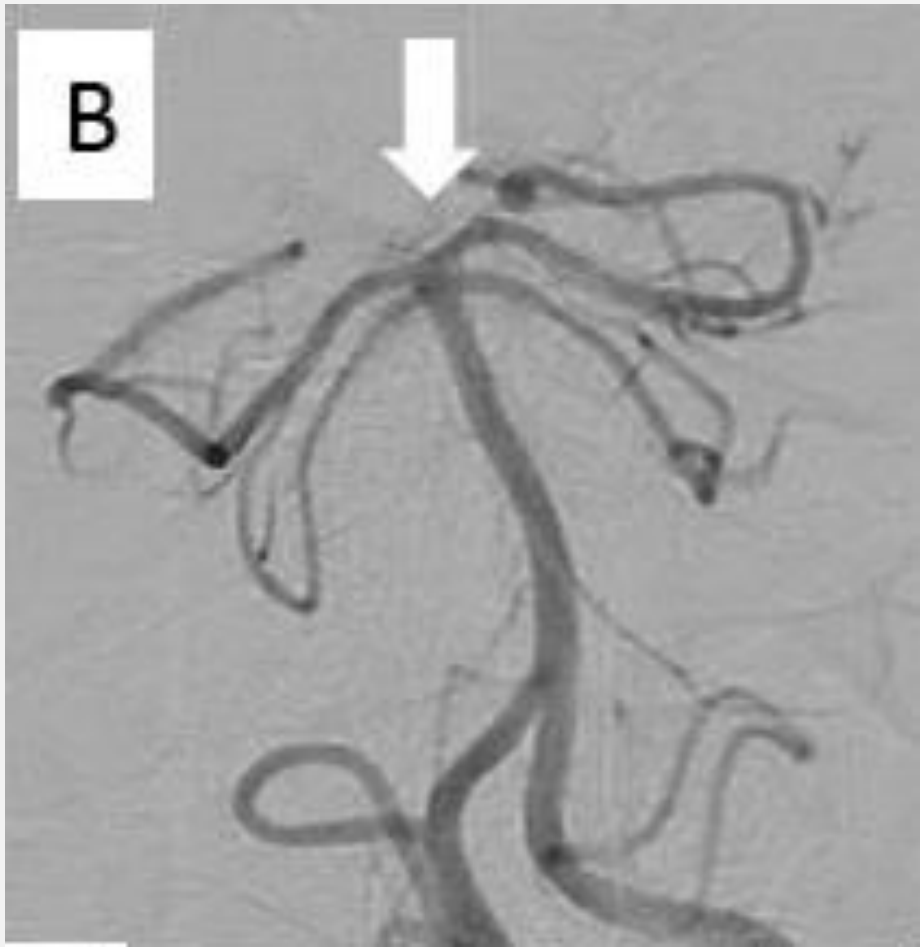
In Adelaide

Initial examination (23:30 - 18.5 h from onset):
Right facial droop and mild gait unsteadiness

CTA: persistent distal basilar occlusion
Post-CTA (00:15), worsening of dysarthria and right hemiparesis

EVT: Full reperfusion at 01:05 (23 h from onset)

Day after: NIHSS 0.



Slide courtesy of: Kleinig TJ, Cervera A , Scroop R

CONCLUSIONS

- Spend time in rural sites, know the ED and retrieval teams
- Multimodal CT and imaging access is crucial in patient selection
- Use your imagination, each geographical area is different = different needs
- Extended time-window (CTP guided) = theoretical access to thrombectomy to almost everyone in the world.
    - **Almost everyone is 8 h flight from a thrombectomy centre!**

PFO CLOSURE / SCREENING

PFO does not cause strokes

Incidental finding: 20-25% population

But emboli from venous circulation can by-pass lungs and cause stroke if PFO +

PFO screen indicated in young patients (<60 y old) with possible embolic (cortical) stroke/TIA and no other clear cause of the stroke/TIA.

If patient performing a Valsalva maneuver at onset might suggest PFO mechanism

Complementary test

Bubble study request in TTE

TOE

Right-left shunt by transcranial doppler

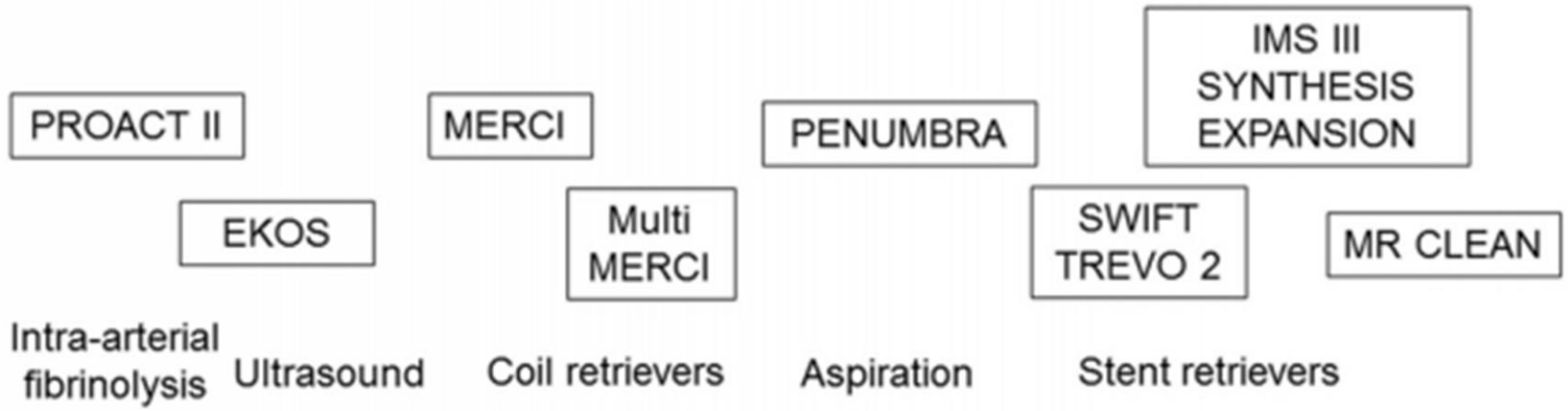
WHAT IS NEW

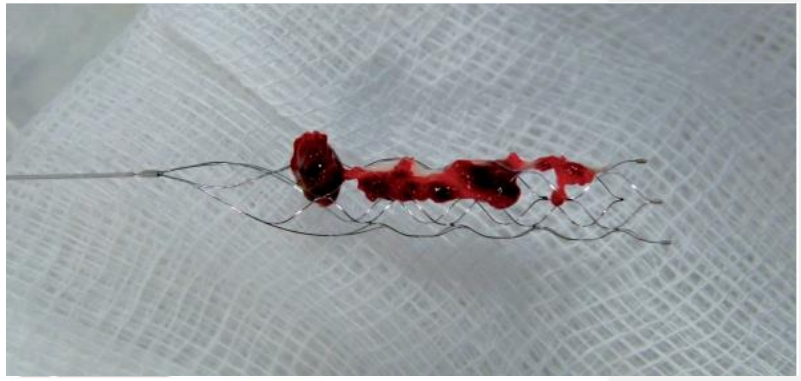
- tPA pre LVO , needed.

WE KNOW

ASA
AUSTRALASIAN
STROKE ACADEMY

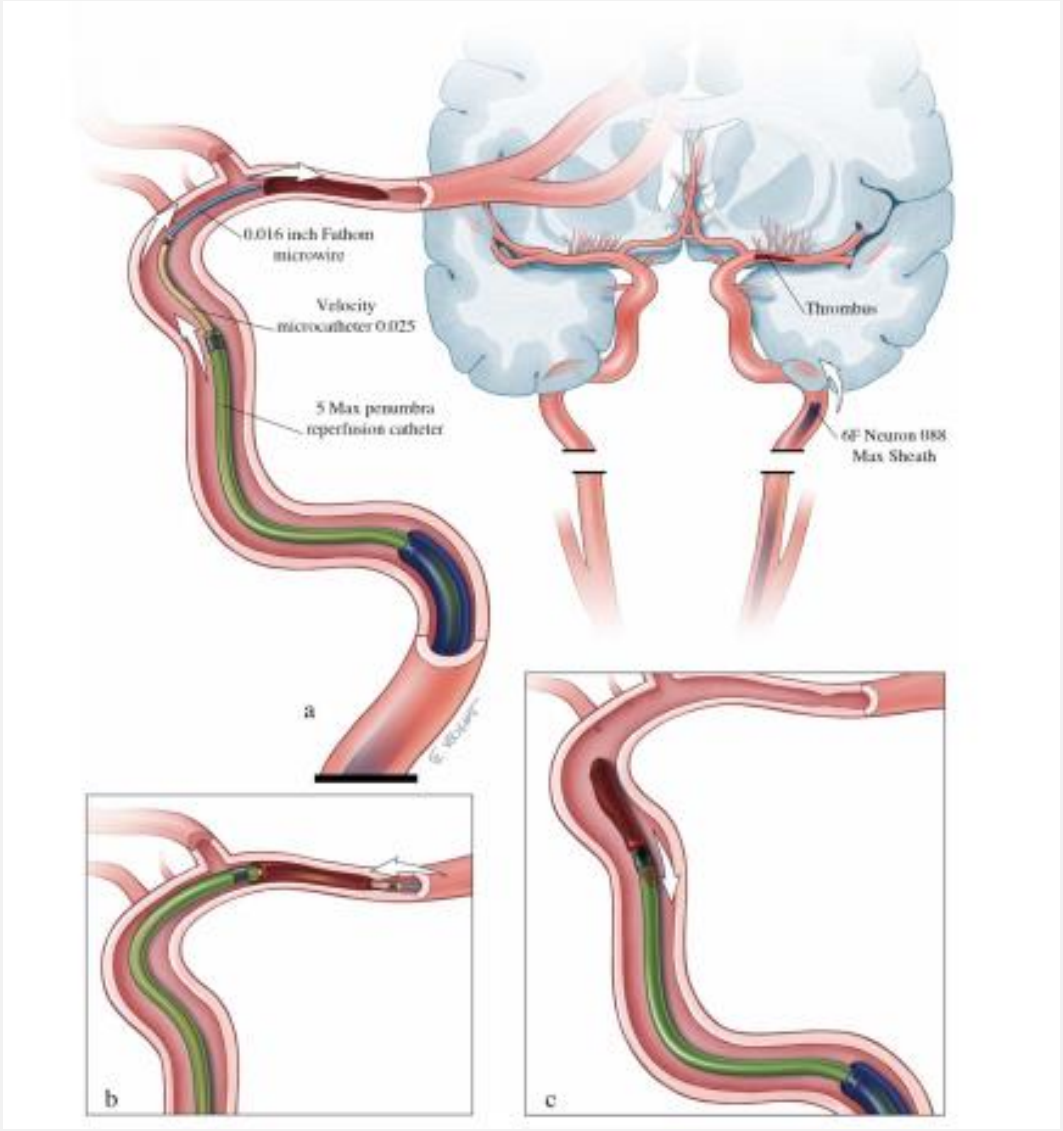
STENT RETRIEVERS / ASPIRATION



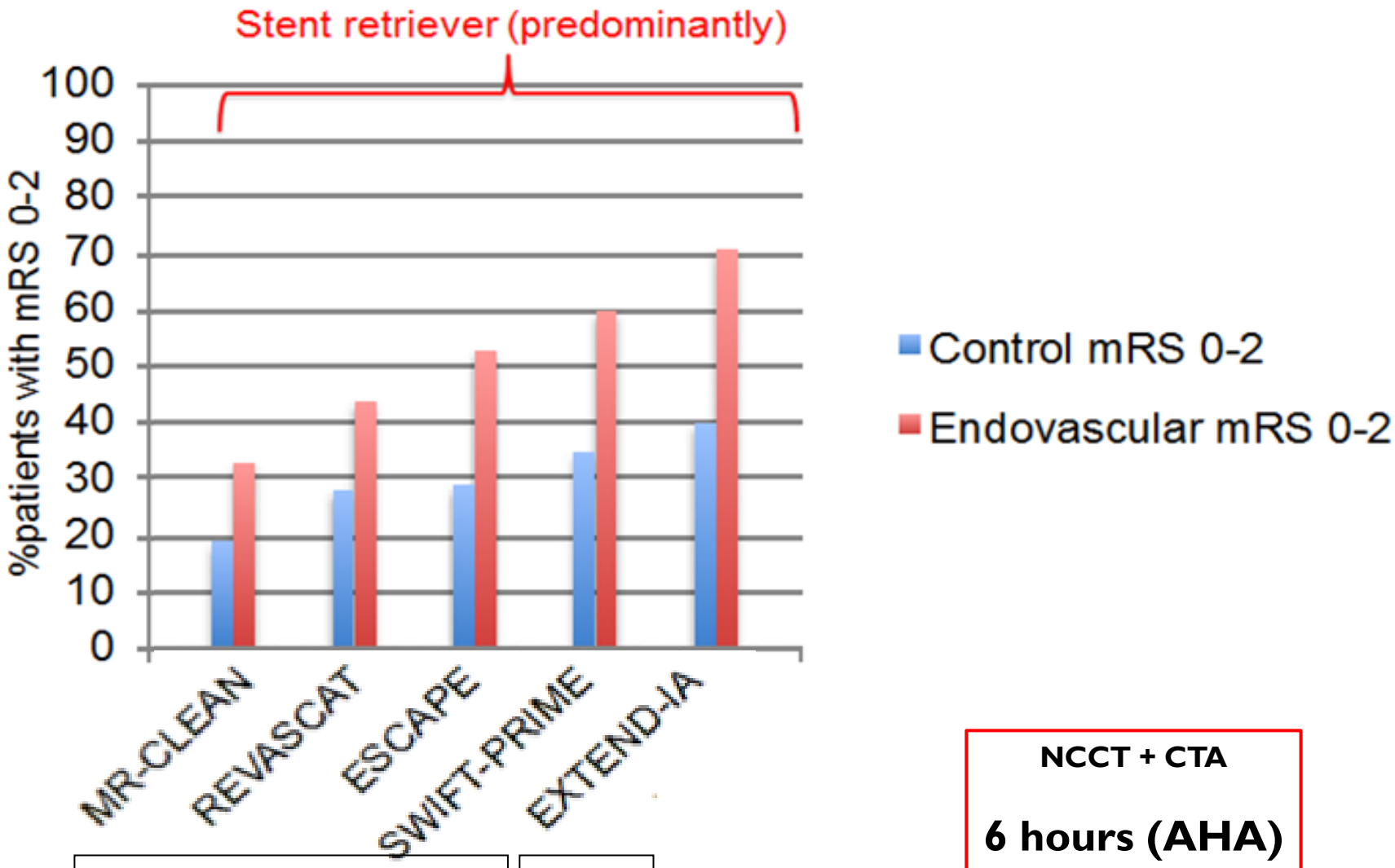


Solitaire
Trevo

STENT RETRIEVERS / ASPIRATION



TIME WINDOW



Brain NCCT + CTA | **CTP**

NCCT + CTA

6 hours (AHA)

CTP, IMAGING MODALITY FOR THROMBECTOMY

ORIGINAL ARTICLE

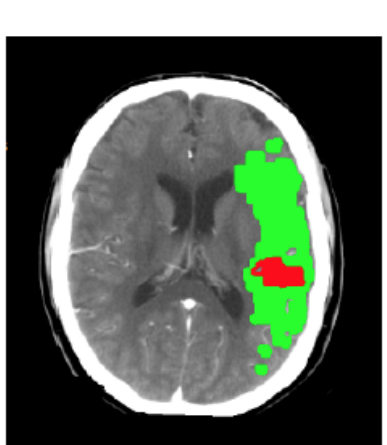
Thrombectomy 6 to 24 Hours after Stroke with a Mismatch between Deficit and Infarct

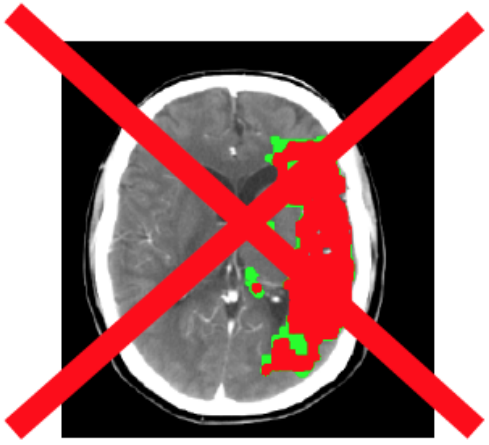
Raul G. Nogueira, M.D., Ashutosh P. Jadhav, M.D., Ph.D., Diogo C. Haussen, M.D., Alain Bonafe, M.D., Ronald F. Budzik, M.D., Parita Bhuva, M.D., Dileep R. Yavagal, M.D., Marc Ribo, M.D., Christophe Cognard, M.D., Ricardo A. Hanel, M.D., Cathy A. Sila, M.D., Ameer E. Hassan, D.O., et al., for the DAWN Trial Investigators*

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-Gutierrez, M.D., Ryan A. McTaggart, M.D., Michel T. Torbey, M.D., May Kim-Tenser, M.D., Thabele Leslie-Mazwi, M.D., Amrou Sarraj, M.D., Scott E. Kasner, M.D., et al., for the DEFUSE 3 Investigators*





CTP, IMAGING MODALITY FOR ECR

ASA
AUSTRALASIAN
STROKE ACADEMY

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., Diogo C. Haussen, M.D., Alain Bonafe, M.D., Ronald F. Budzik, M.D., Parita Bhuva, M.D., Dileep R. Yavagal, M.D., Marc Ribo, M.D., Christophe Cognard, M.D., Ricardo A. Hanel, M.D., Cathy A. Sila, M.D., Ameer E. Hassan, D.O., et al., for the DAWN Trial Investigators*

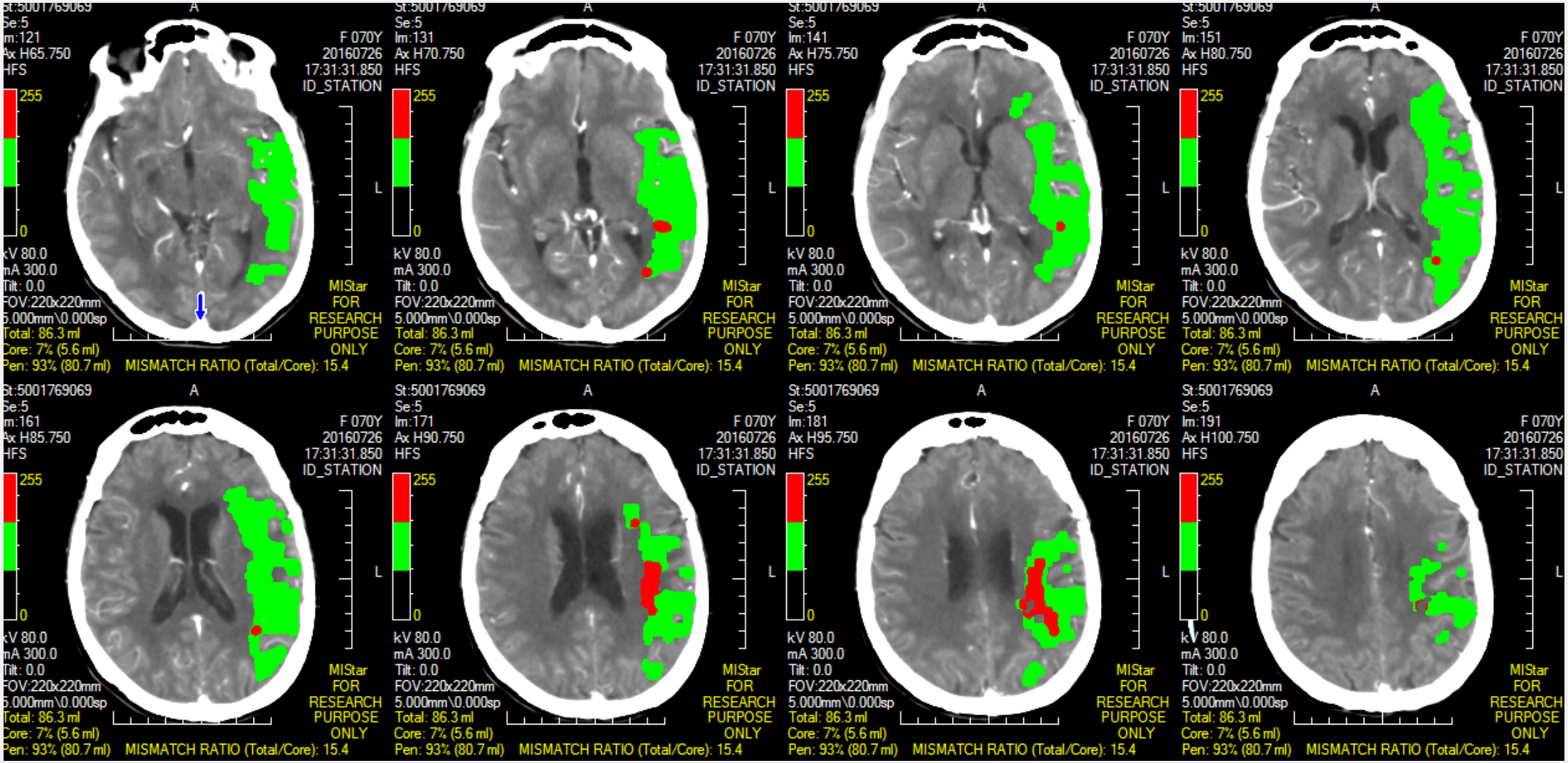
ORIGINAL ARTICLE

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-Gutierrez, M.D., Ryan A. McTaggart, M.D., Michel T. Torbey, M.D., May Kim-Tenser, M.D., Thabele Leslie-Mazwi, M.D., Amrou Sarraj, M.D., Scott E. Kasner, M.D., et al., for the DEFUSE 3 Investigators*

NNT = 3-4

CT PERFUSION – CORE / PENUMBRA MAPS



WORLD HAS CHANGED

EMBOLIC STROKE OF UNDETERMINED SOURCE TRIALS

RE-SPECT ESUS

enrolment completed in December 2017 after randomization of 5,390 patients

1:1 randomization, double-blinded

- **dabigatran 150 mg twice daily**
- **aspirin 100 mg once daily**

primary endpoint: time to first recurrent stroke (ischemic, hemorrhagic, or unspecified)

NAVIGATE ESUS

terminated in October 2017 due to futility for the primary endpoint after enrolment of 7,214 patients

1:1 randomization, double-blinded

- **rivaroxaban 15 mg once daily**
- **aspirin 100 mg once daily**

primary endpoint: time to first recurrent stroke (ischemic, hemorrhagic, or unspecified), magnetic resonance imaging-positive transient ischemic attack, or systemic embolism

ATTICUS

active, up to 600 patients with embolic stroke of undetermined source and additional risk factors for subclinical atrial fibrillation; continuous or daily ECG monitoring

1:1 randomization, open-label

- **apixaban 5 mg twice daily**
- **aspirin 100 mg once daily**

primary endpoint: new ischemic lesions on magnetic resonance imaging after 12 months

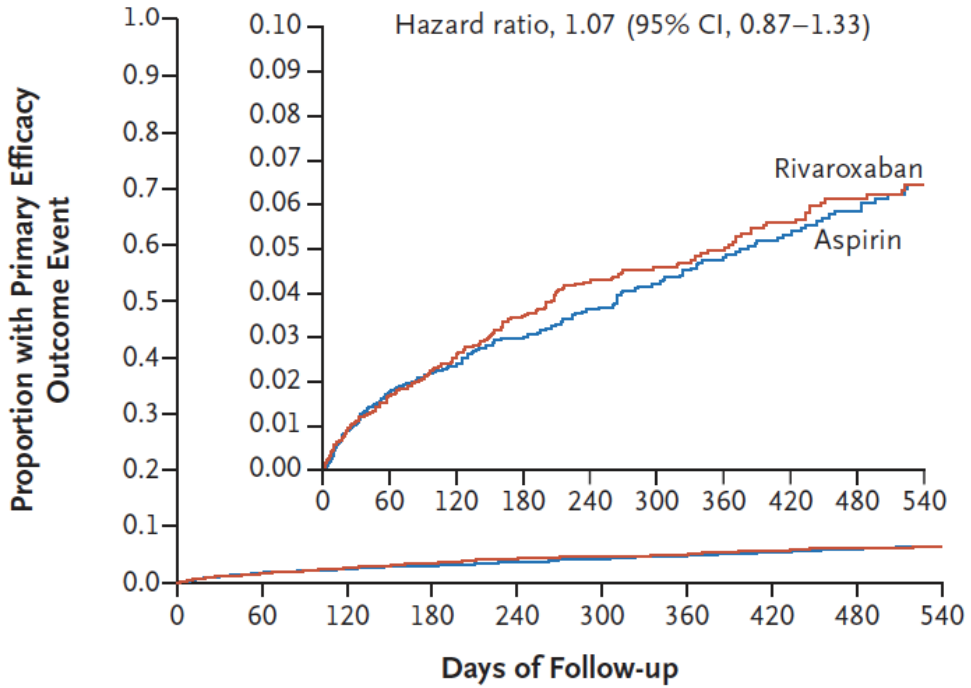
The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Rivaroxaban for Stroke Prevention after Embolic Stroke of Undetermined Source

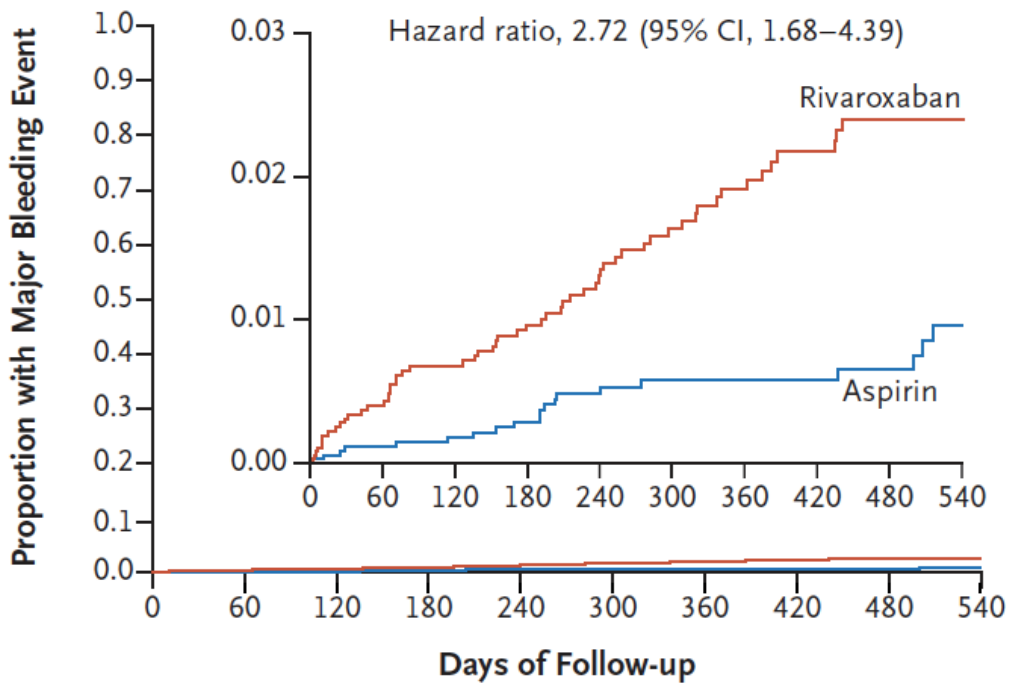
N Engl J Med 2018;378:2191-201.
DOI: 10.1056/NEJMoa1802686

A Kaplan–Meier Curves for Time to Event in the Primary Efficacy Outcome



No. at Risk										
Rivaroxaban	3609	3211	2854	2525	2156	1874	1584	1306	1046	786
Aspirin	3604	3205	2858	2531	2166	1880	1579	1319	1036	779

B Kaplan–Meier Curves for Time to Major Bleeding Event



No. at Risk										
Rivaroxaban	3609	3249	2906	2582	2206	1911	1615	1342	1071	807
Aspirin	3604	3254	2918	2597	2231	1939	1637	1371	1083	822