

Hyperacute and Acute Stroke

Reconnecting over Stroke: A Primary Care Update

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Stroke Network of Southeastern Ontario

June 25, 2024

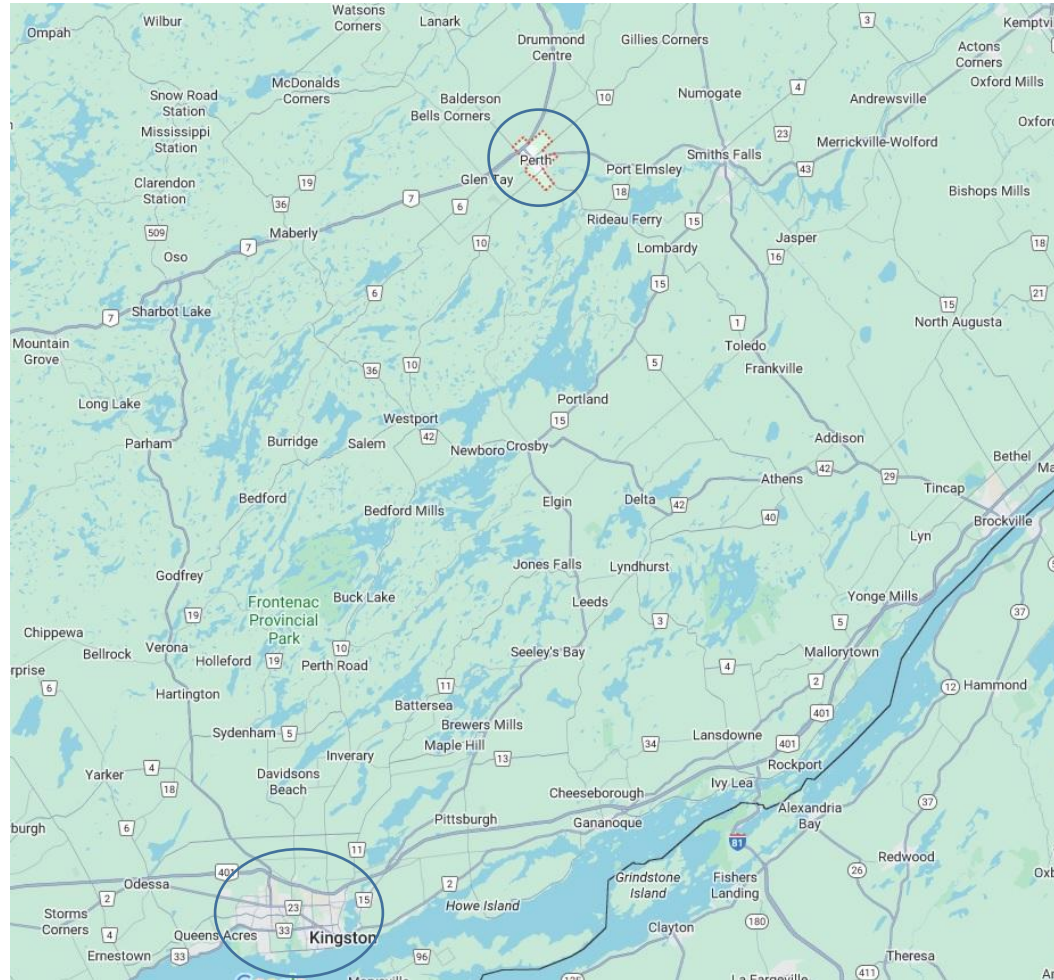
Disclosures

- I have no commercial conflicts or disclosures
- I have not received payment of any kind for this presentation

Objectives

- Review management and evidence for hyperacute stroke care
- Gain an understanding of the challenges of hyperacute stroke care in our region

- 65 y.o. witnessed sudden-onset aphasia at 7am, right arm weakness, able to walk
- Family member drove patient to ER in Perth



TRIAGE TOOLS for Acute Stroke <24 hours

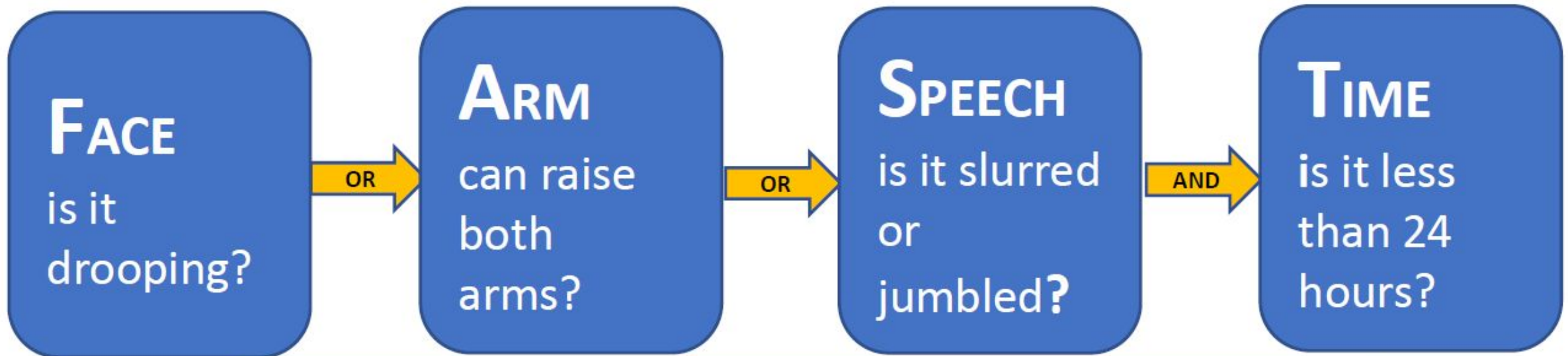
Adapted from Toronto Stroke Network & Ambulance Clinical Triage for Acute Stroke Treatment” Zhao et al. Stroke 2018;49:945-951

STROKE NETWORK
of Southeastern Ontario

Kingston Health
Sciences Centre

Centre des sciences de
la santé de Kingston

FAST Stroke Screen:



- ✓ One or more symptoms from Face, Arm, Speech **AND**
- ✓ LAST SEEN NORMAL <24 hours

IF ≤ 6 hours, Call Switchboard to Activate Acute Stroke Protocol
IF 6 -24 hours, Complete **ACT-FAST**

ACT-FAST Stroke Screen:

“ARM” (one-sided arm weakness)

Position both arms at 45° from horizontal with elbows straight

POSITIVE TEST : One arm falls completely within 10 seconds

For patients that are uncooperative or cannot follow commands:

POSITIVE TEST:

Witness minimal or no movements in one arm & movements in other arm

Proceed if Positive

If **RIGHT** ARM is weak

If **LEFT** ARM is weak

“CHAT” (Severe language deficit)

POSITIVE TEST: Mute, speaking incomprehensible, or unable to follow simple commands

“TAP” (gaze & shoulder tap)

Stand on patient’s weak side

POSITIVE TEST : Consistent eye gaze away from weak side

Otherwise

Tap shoulder & call name

POSITIVE TEST : Does not quickly turn head & eyes to you

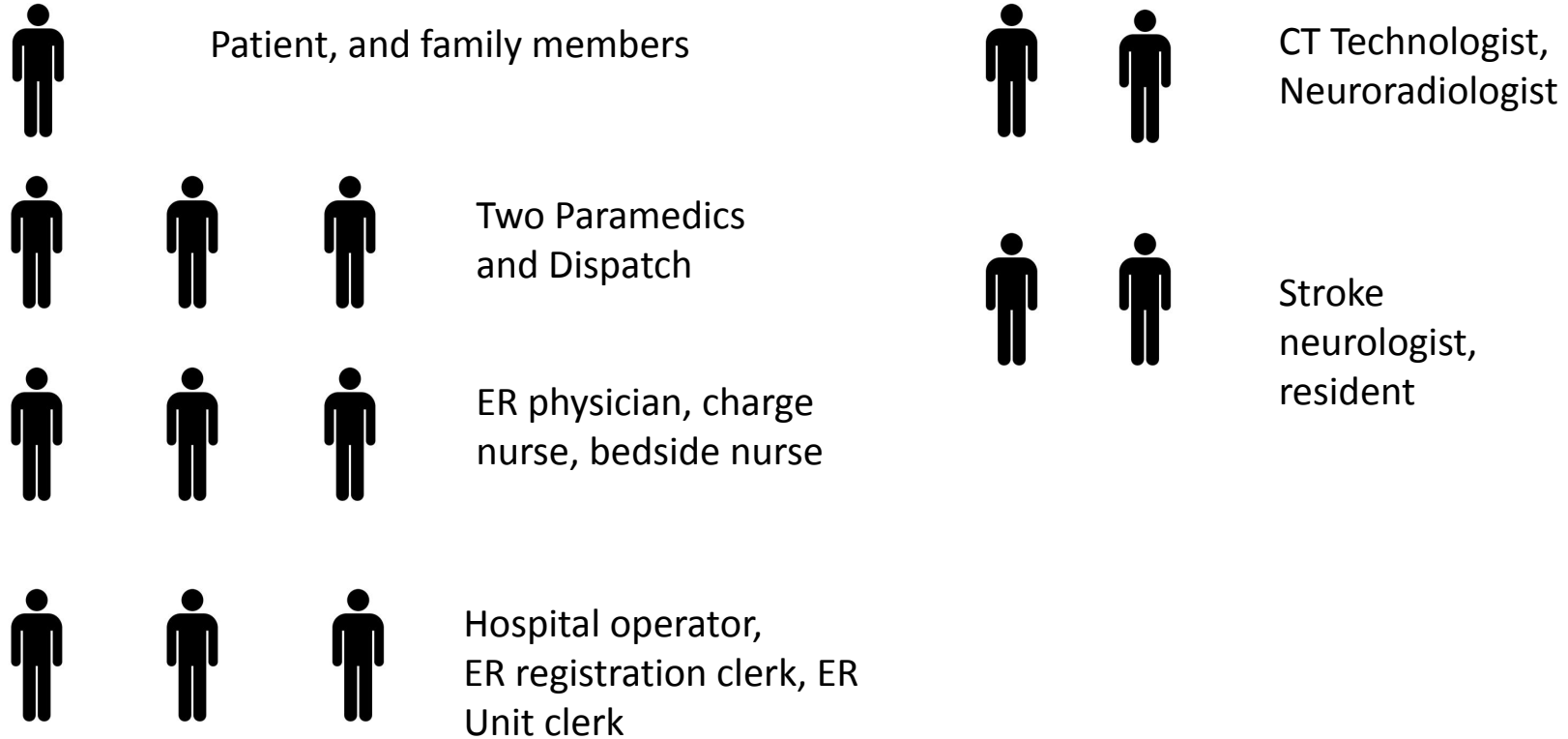
Proceed if Positive

Call Switchboard to Activate Acute Stroke Protocol

- 8am Acute Stroke Protocol activated, to Kingston for possible thrombolysis and EVT
- Stroke neurologist and team are notified and waiting for the patient who arrives 9:45am



How many people are notified during the first 10 minutes of hyperacute stroke care?



Hyperacute stroke care kind of looks like this...





Every minute of stroke results in the loss of...

- **2 million neurons**
 - **12 km myelinated fibre**
 - **14 billion synapses**
 - **4 to 7 days of lifespan**
-
- For every hour of ischemia, the brain loses as many neurons as it does over 3.6 years of normal life
 - For every minute saved in treating with thrombolysis, the patient gains an extra 1.8 days of life and one less day of disability in the first 90 days¹
 - For every minute saved in treating with EVT, the patient gains an extra week of life²

¹Meretoja et al. Stroke. 2014;45:1053–1058. ²Meretoja et al. Neurology 2017; 88 (22) 2123-2127.

Time is Brain

Reduced
in-hospital
mortality
(OR, 0.96; 95% CI,
0.95-0.98; P < .001)

Reduced
symptomatic
intracranial
hemorrhage (OR,
0.96; 95% CI,
0.95-0.98; P < .001)

Increased
achievement of
independent
ambulation at
discharge (OR,
1.04; 95% CI,
1.03-1.05; P < .001)

Increased
discharge to
home (OR, 1.03;
95% CI, 1.02-1.04;
P < .001).

- Patient immediately brought to CT
- Non contrast head CT, multiphase CTA, and CT perfusion scan was performed.



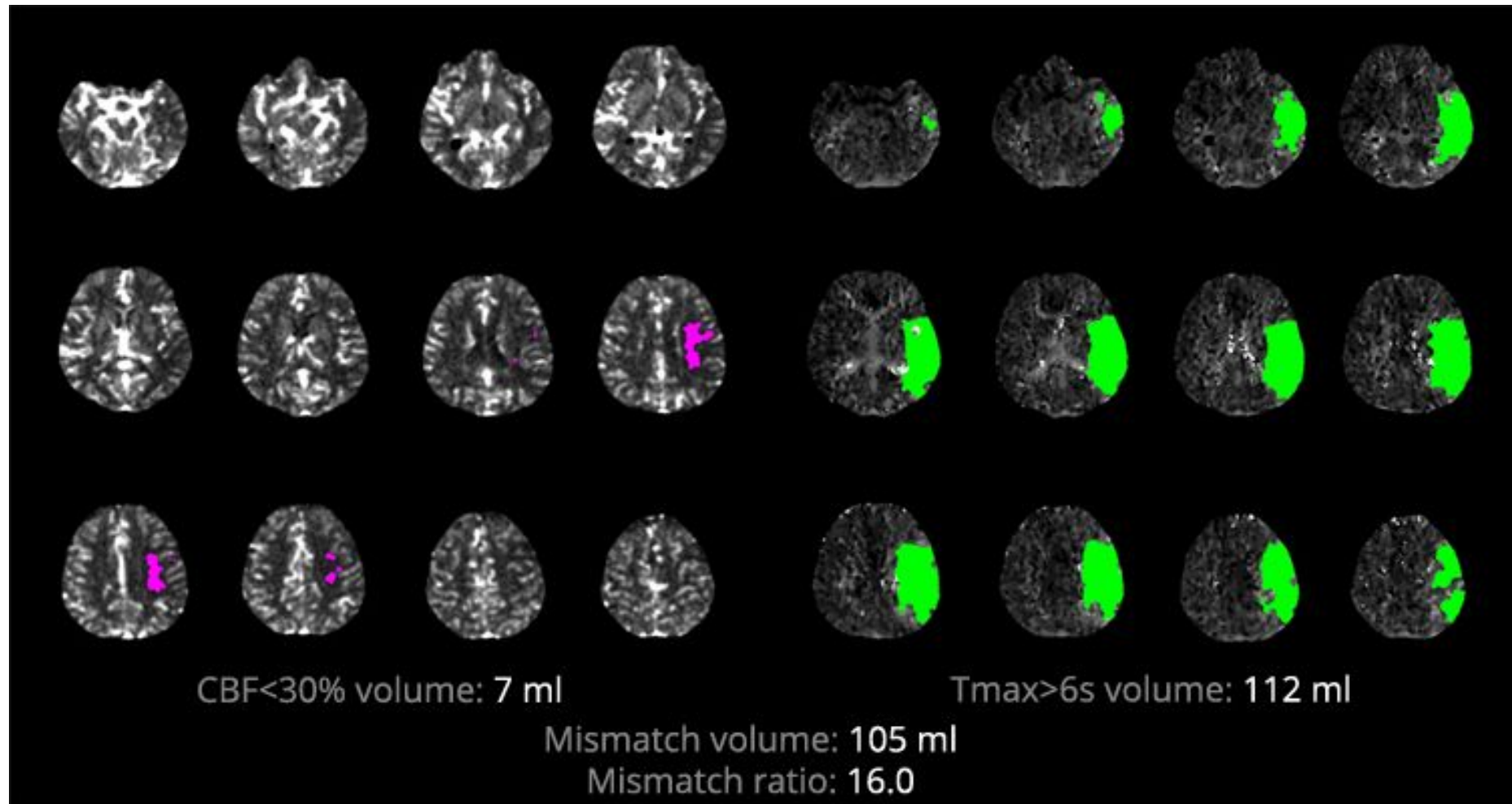


CT head showed subtle signs of acute ischemic stroke in the left hemisphere



**CT angiogram
showed the
absence of blood
flow in one
segment of the
left middle
cerebral artery**

CT perfusion scan showed the area of brain already infarcted (pink) and the area of brain that is at risk but can be salvaged (green)



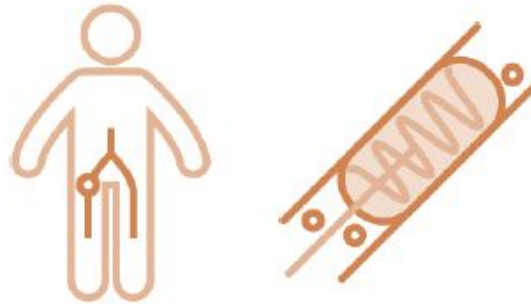
Treatments for Acute Ischemic Stroke

Thrombolysis with either tPA or TNK



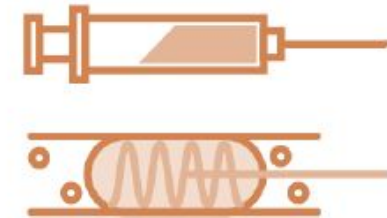
- Thrombolytic agent administered intravenously that dissolves the clot (clot buster)
- tPA must be delivered within 4.5 hours of stroke symptom onset
- **TNK is now replacing tPA because it's as effective and easier to administer**

Endovascular thrombectomy (EVT)



- Mechanical removal of a clot using a catheter and stent
- EVT is ideally performed within 6 hours of stroke symptom onset. However, this time window may be extended to 24 hours for a select group of patients

EVT and thrombolysis



- A patient can receive both tPA and EVT
- Can also receive both TNK and EVT

Intravenous tenecteplase compared with alteplase for acute ischaemic stroke in Canada (AcT): a pragmatic, multicentre, open-label, registry-linked, randomised, controlled, non-inferiority trial



Bijoy K Menon, Brian H Buck, Nishita Singh, Yan Deschaintre, Mohammed A Almekhlafi, Shelagh B Coutts, Sibi Thirunavukkarasu, Houman Khosravani, Ramana Appireddy, Francois Moreau, Gord Gubitz, Aleksander Tkach, Luciana Catanese, Dar Dowlathshahi, George Medvedev, Jennifer Mandzia, Aleksandra Pikula, Jai Shankar, Heather Williams, Thalia S Field, Alejandro Manosalva, Muzaffar Siddiqui, Atif Zafar, Oje Imoukhuede, Gary Hunter, Andrew M Demchuk, Sachin Mishra, Laura C Gioia, Shirin Jalini, Caroline Cayer, Stephen Phillips, Elsadig Elamin, Ashkan Shoamanesh, Suresh Subramaniam, Mahesh Kate, Gregory Jacquin, Marie-Christine Camden, Faysal Benali, Ibrahim Alhabli, Fouzi Bala, MacKenzie Horn, Grant Stotts, Michael D Hill, David J Gladstone, Alexandre Poppe, Arshia Sehgal, Qiao Zhang, Brendan Cord Lethebe, Craig Doram, Ayoola Ademola, Michel Shamy, Carol Kenney, Tolulope T Sajobi, Richard H Swartz, for the AcT Trial Investigators

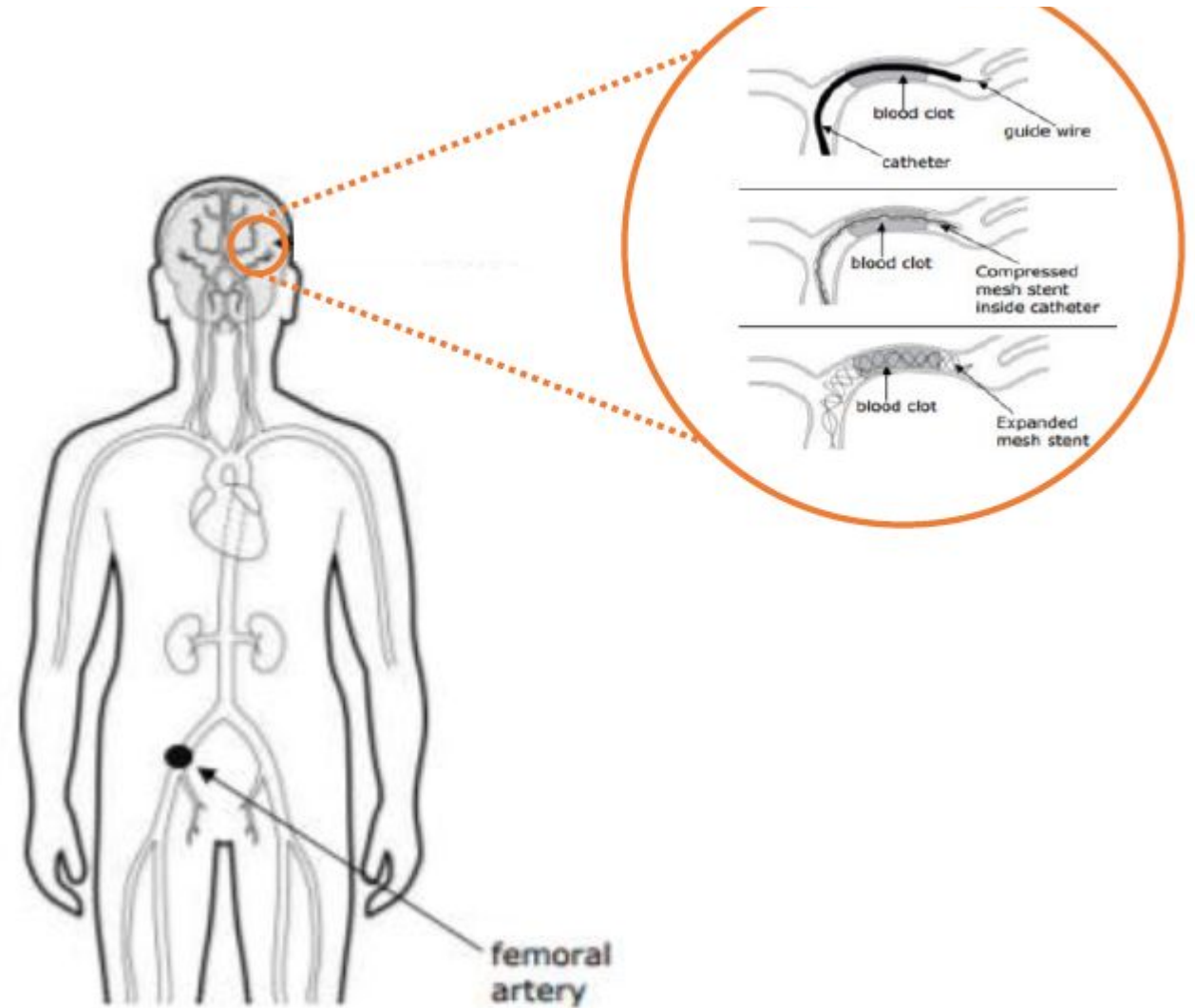
www.thelancet.com Published online June 29, 2022 [https://doi.org/10.1016/S0140-6736\(22\)01054-6](https://doi.org/10.1016/S0140-6736(22)01054-6)

Box 5A Time Windows for Reperfusion in Acute Ischemic Stroke

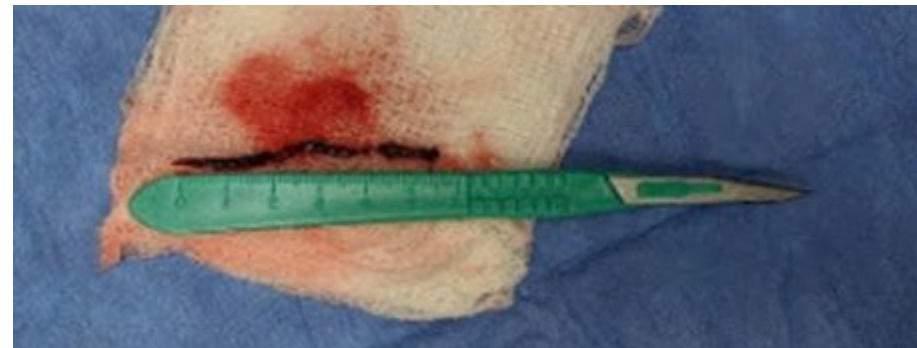
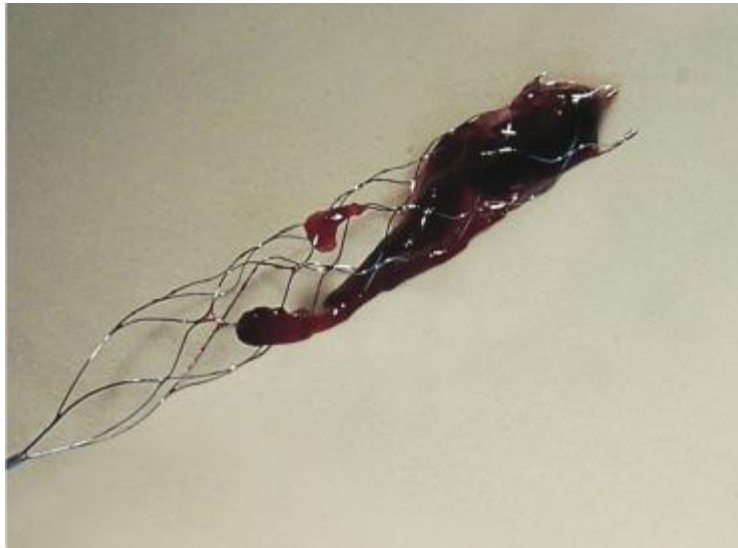
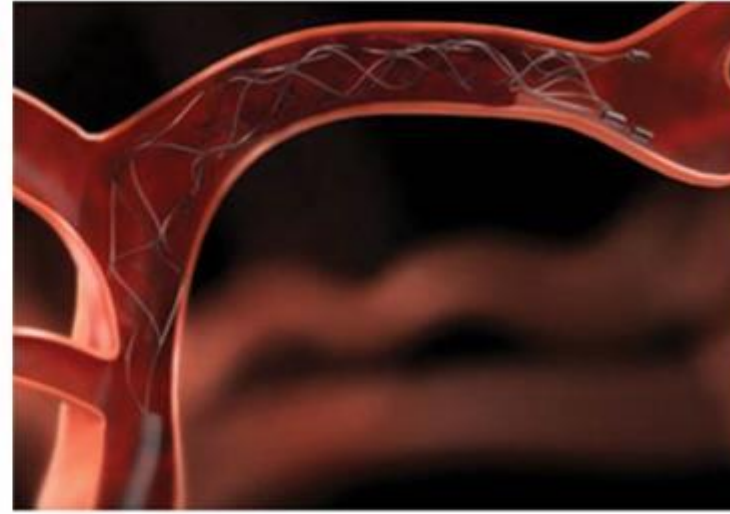
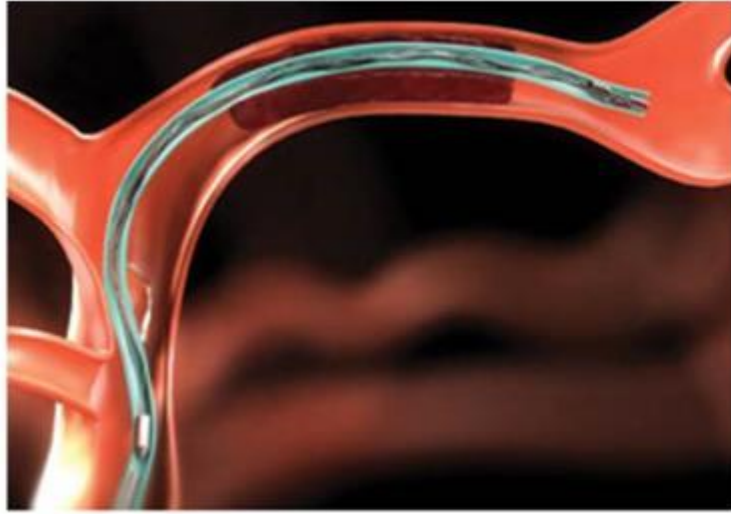
Available treatments	Time from stroke onset or last known well	Population	Notes and criteria
Screening for stroke signs and symptoms	Within 24 hours	All patients showing signs of acute disabling stroke	
Intravenous thrombolysis	0 to 4.5 hours	All patients showing signs of acute disabling stroke	Based on CT/CTA
	4.5 to 6 hours	Select patients showing signs of acute disabling stroke	Requires advanced imaging for tissue-based decision-making
	6 to 9 hours	Select patients - in discussion with a stroke expert	Requires advanced imaging for tissue-based decision-making

EVT is now a critical aspect of acute stroke care

- There are a limited number of sites in Ontario that can perform EVT
- Fortunately, Kingston is one of them



EVT with retrievable stent



Five major clinical trials in 2015 brought us EVT

Five RCTs in 2015 changed the way we approach hyperacute stroke, showing that EVT was superior to IV tPA:

MR CLEAN

EXTEND IA

ESCAPE

REVASCAT

SWIFT PRIME

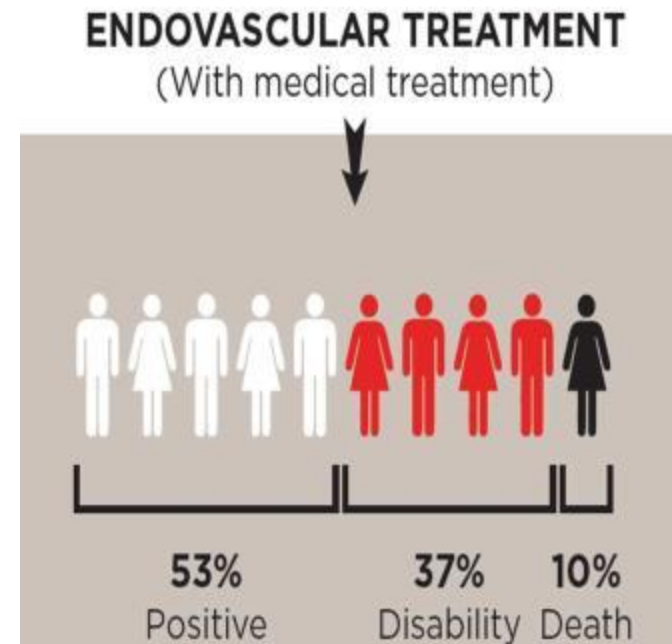
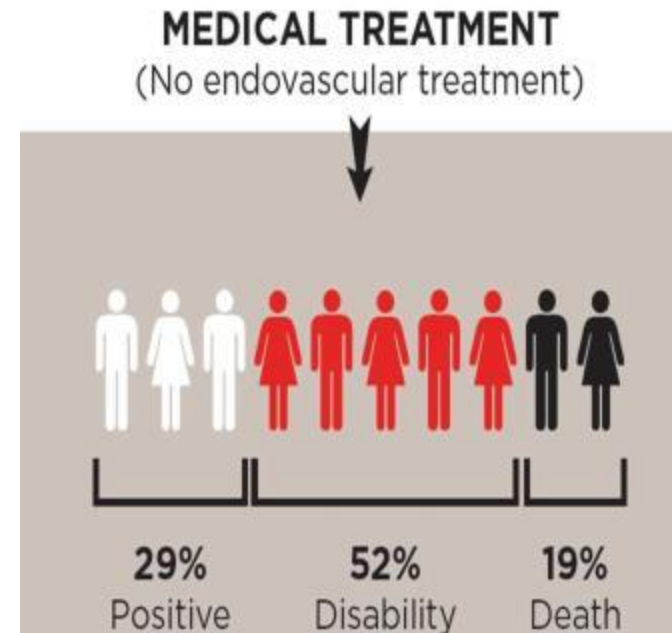
ORIGINAL ARTICLE

Randomized Assessment of Rapid Endovascular Treatment of Ischemic Stroke

M. Goyal, A.M. Demchuk, B.K. Menon, M. Eesa, J.L. Rempel, J. Thornton, D. Roy, T.G. Jovin, R.A. Willinsky, B.L. Sapkota, D. Dowlathshahi, D.F. Frei, N.R. Kamal, W.J. Montanera, A.Y. Poppe, K.J. Ryckborst, F.L. Silver, A. Shuaib, D. Tampieri, D. Williams, O.Y. Bang, B.W. Baxter, P.A. Burns, H. Choe, J.-H. Heo, C.A. Holmstedt, B. Jankowitz, M. Kelly, G. Linares, J.L. Mandzia, J. Shankar, S.-I. Sohn, R.H. Swartz, P.A. Barber, S.B. Coutts, E.E. Smith, W.F. Morrish, A. Weill, S. Subramaniam, A.P. Mitha, J.H. Wong, M.W. Lowerison, T.T. Sajobi, and M.D. Hill for the ESCAPE Trial Investigators*

Benefits of EVT

- ARR = 23.7%
- NNT = 4 (to live independently)
- Risk of ICH = 3%





LEFT





LEFT

The First Day after Thrombolysis and EVT

- Patients are admitted to a Critical Care Unit for monitoring
 - Vitals q1h, including neurovitals, and supportive care
 - NPO
 - Dysphagia is common in the immediate post-stroke period and can be difficult to detect
 - Angioedema after thrombolysis in about 1%
 - Treated with diphenhydramine, ranitidine, hydrocortisone
 - Very, very rarely requires intubation
 - Antithrombotic medications are held until follow up CT head at ~24 hours rules out hemorrhagic transformation
 - **Update family on ongoing care and prognosis**

Outcome

- Patient had persistent aphasia and right hemiparesis after TNK and EVT, but much milder
- Transferred to Brockville General Hospital Acute Stroke Unit
- At home within one month, aphasia much improved, walking on own without walking aids

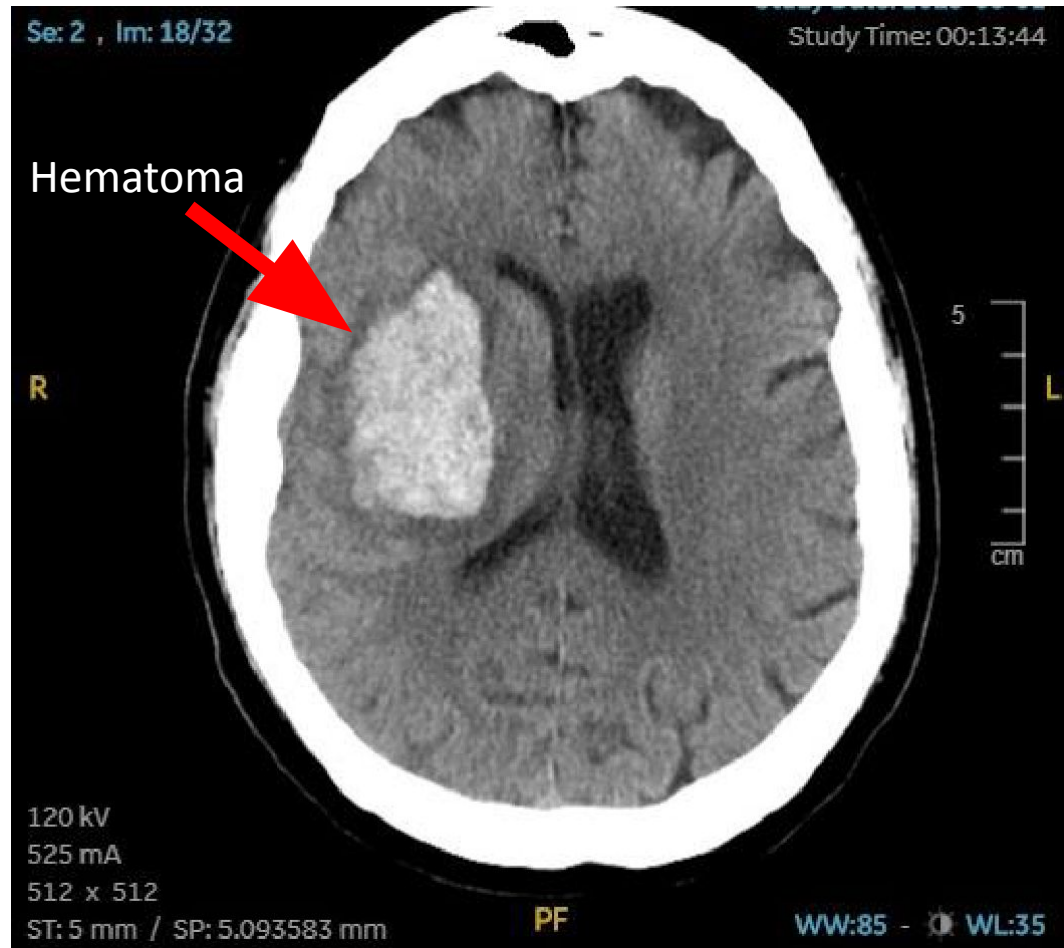
Hyperacute Hemorrhagic Stroke

- The clinical presentation of intracerebral hemorrhage (ICH) can be very similar to ischemic stroke
- CT imaging is the most important diagnostic tool for ICH diagnosis
- MRI can also play a role in the assessment of ICH etiology

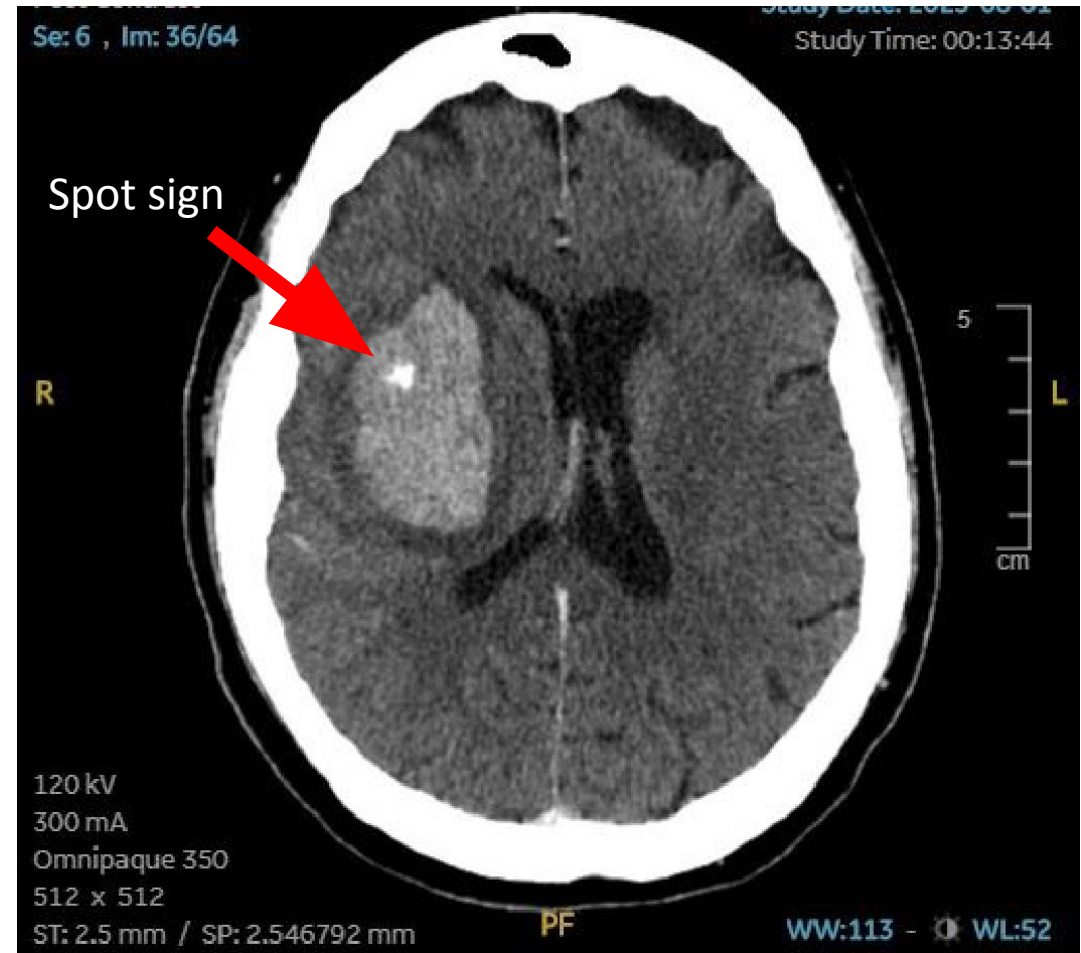
A recent ICH case in a 65F with atrial fibrillation and hypertension

- Acute onset mild headache and left side weakness
- Can speak and understand well but is unaware of any weakness
- Blood pressure: 210/113
- She is taking apixaban for atrial fibrillation

CT scan



Non-contrast scan



Contrast-enhanced scan

ICH Management

- This ICH is due to two things: hypertension and anticoagulation
1. Ensure airway is protected if patient has impaired consciousness
 2. Reverse anticoagulation:
 1. Prothrombin complex concentrate, 25-50 mg/kg, usual dose 2000 units (max dose 3000 units)
 2. Tranexamic acid 1g IV bolus, then 1g over 8 hrs
 3. If the patient is taking dabigatran, the specific reversal agent is idarucizumab
 4. Andexanet alfa (Ondexxya) now approved for reversing rivaroxaban and apixaban

ICH Management, continued

3. Maintain systolic BP < 140 mm Hg

1. We have known for many years that the higher the sBP, the worse the outcome in ICH
2. There were two clinical trials of BP lowering in ICH:
INTERACT2 (N Engl J Med 2013; 368:2355-2365), and
ATACH2 (N Engl J Med 2016; 375:1033-1043)
3. Although neither showed that targeting sBP < 140 mm Hg was better than targeting 160 mm Hg, it was shown that targeting sBP < 140 mm Hg was safe
4. IV labetalol is commonly used to lower blood pressure quickly
5. IV hydralazine can also be used

ICH Management, continued

4. Maintain temperature ≤ 37.5 °C with acetaminophen

5. Maintain strict glucose control (6.1 to 7.8 mmol/L in non-diabetic patients and 7.8 to 10.0 mmol/L in diabetic patients)

INTERACT3 Trial: Ma et al. Lancet 2023; 402: 27–40

- International, multicenter, blinded endpoint pragmatic trial comparing “Care Bundle” (3221 pts) vs usual care (3815 pts)
 - Brazil, China, India, Mexico, Nigeria, Pakistan, Peru, Sri Lanka, Viet Nam, Chile
 - BP target < 140 mmHg
 - Strict glucose control
 - Antipyrexia treatment
 - Rapid reversal of warfarin
- mRS 0-3 at 3 months: “Care Bundle” 65% vs usual care 59.7%

Prognosis in ICH can be difficult to assess

- Mortality is high for ICH, with 30% dying within one month
- *But one commonly used ICH assessment tool may lead to excess mortality:*

Severity assessment in maximally treated
ICH patients

Neurology® 2017;89:423-431

The ICH score

- Often used to predict ICH outcome
- Based on clinical practices from over 20 years ago

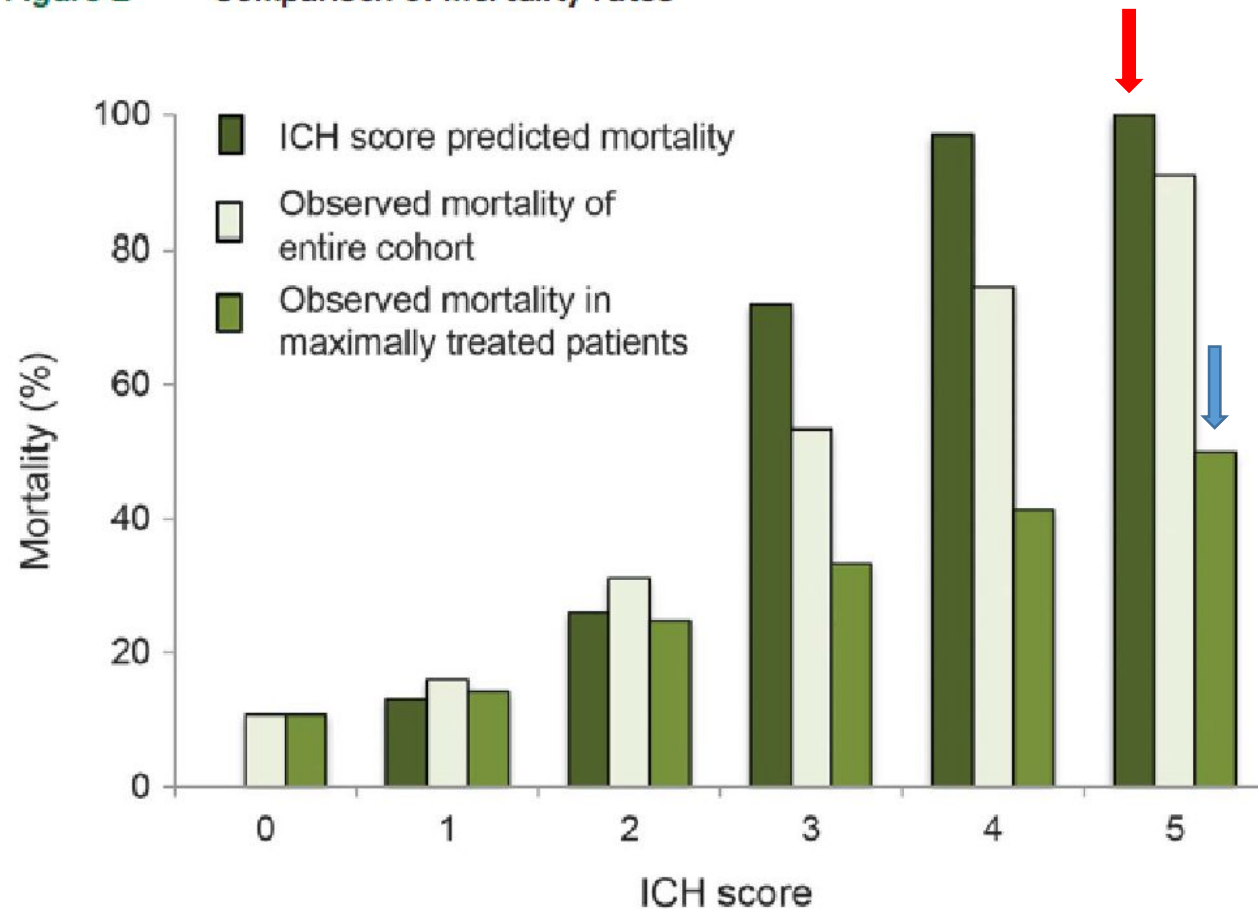
Component	ICH Score Points
GCS score	
3-4	2
5-12	1
13-15	0
ICH volume (cm ³)	
≥ 30	1
< 30	0
IVH	
Yes	1
No	0
Infratentorial origin of ICH	
Yes	1
No	0
Age (year)	
≥ 80	1
< 80	0
Total ICH Score	0-6

The GCS score refers to the GCS score at initial presentation (or after resuscitation); ICH volume, volume on initial CT calculated using the ABC/2 method; IVH, presence of any IVH on the initial CT.

GCS, Glasgow coma scale; ICH, intracerebral hemorrhage; CT, computed tomography; IVH, intraventricular hemorrhage.

Adapted from Hemphill JC 3rd, Bonovich DC, Besmertis L, Manley GT, Johnston SC. The ICH score: a simple, reliable grading scale for intracerebral hemorrhage. *Stroke* 2001 ;32:891-897.

Figure 1 Comparison of mortality rates



Observed short-term mortality rate in the entire intracerebral hemorrhage (ICH) cohort (n = 583) and in maximally treated patients (n = 471) in contrast to predicted short-term mortality rate by the ICH score.

Summary

- For hyperacute ischemic stroke, time is critical
- Treatment options include thrombolysis with TNK and endovascular thrombectomy (EVT)
 - For every minute of delay in treatment there is substantial loss of neurons, glia, and lifespan
 - Treatment window for thrombolysis is evolving beyond 4.5 hours
- For intracerebral hemorrhage, CT imaging remains the key diagnostic tool
- Treatment of ICH is focused on BP management, reversal of coagulopathy, antipyrexia and strict glucose control
- Prognosis of ICH is often unclear in the acute phase and overreliance of the ICH score should be avoided