The Neuroscience Institute
The Jewish Hospital

MERCYHEALTH

EMS & Stroke: Why It Matters

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Outline

- Stroke types
- Pathophysiology of stroke
- Stroke signs and symptoms
- ED/Hospital treatment
- EMS impact on stroke outcomes

Stroke Types

- Acute Ischemic Stroke (AIS)
  - Acute interruption of blood supply to part of the brain
  - Up to 87% of all strokes
  - Leading cause of severe disability worldwide
  - Further classified:
    - Large vessel thrombotic
    - Small vessel thrombotic
    - Atheroembolic
    - Cardioembolic
    - Cryptogenic
      - Embolic Stroke of Undetermined Source (ESUS)

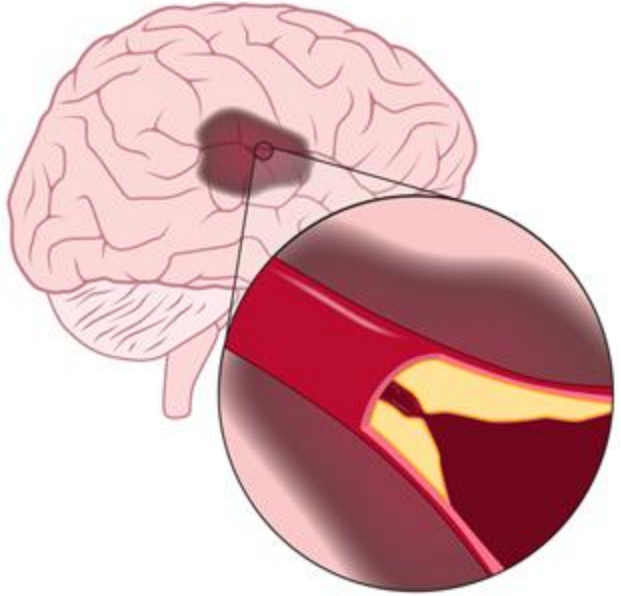


Image Source: https://imvahonshya.co.rw/sobanukirwa-indwara-ya-stroke-nuko-yakwirindwa/

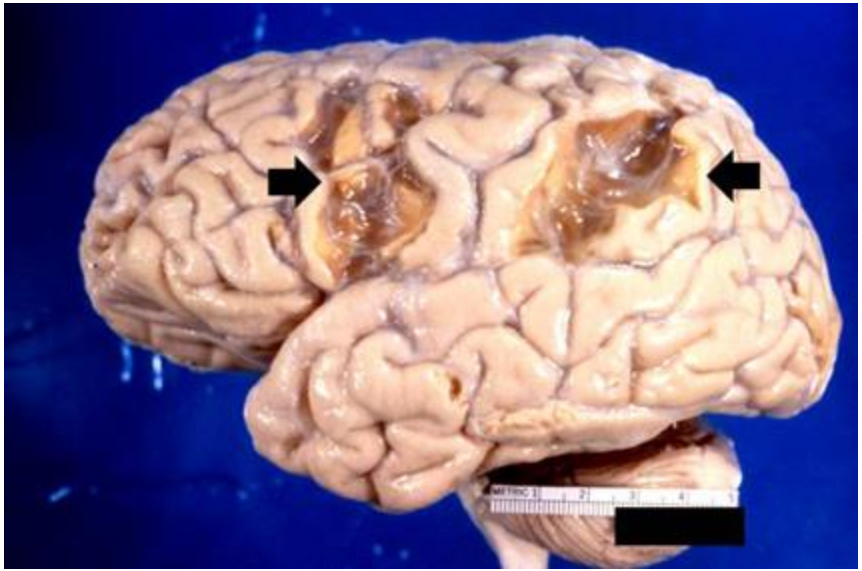


Image Sources: https://ksumsc.com/download_center/Archive/2nd/437/1.%20Neuropsychiatry%20Block/Teamwork/Pathology/5%2C6-%20Cerebrovascular%20accidents%201%20%2B%202%20pathology%20teamwork.pdf
https://www.facebook.com/mripathways/photos/httpowlyi3ro56-80-of-strokes-and-heart-attacks-are-preventable-dont-let-this-hap/745142568836527/

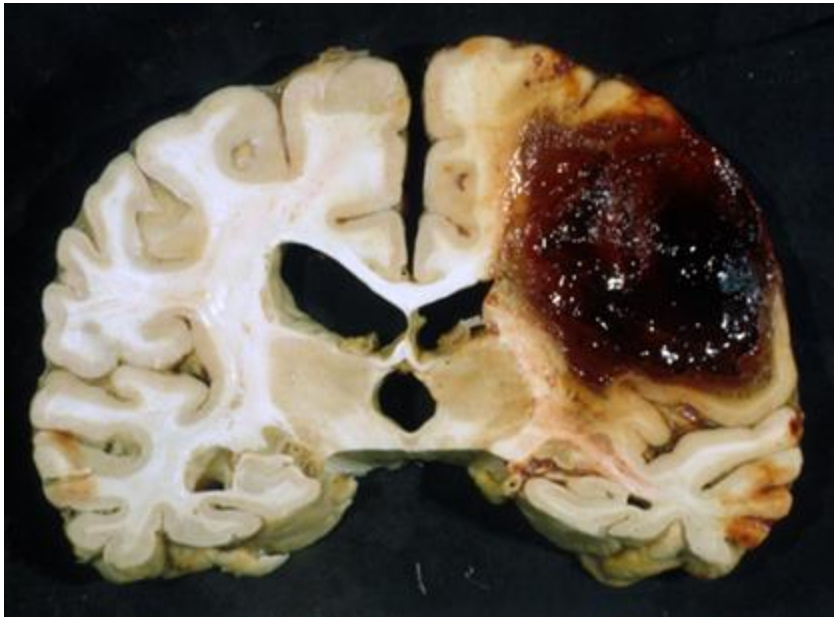
Stroke Types

- Transient Ischemic Attack
  - NOT a “mini-stroke”
  - Stroke symptoms that resolve completely within *minutes to hours*
  - They do NOT last 24 hours
  - No permanent damage (MRI negative)
  - High risk for developing acute ischemic stroke
    - 90-day stroke risk = up to 10.5%
    - Almost half occur within 2 days
  - Need a complete stroke workup to minimize further risk
    - ABCD2 Score
  - Please do NOT ignore these symptoms!

Image Source: https://www.istockphoto.com/photos/refusing-treatment

Stroke Types

- Hemorrhagic Stroke
  - Blood extravasation into brain parenchyma from ruptured vessel
  - Approximately 10% of all strokes
  - Deadliest form of acute stroke
    - Mortality rate 30-40% (compared to 5.1% for AIS receiving tPA)
  - Management is very different compared to AIS
  - Causes
    - #1 Hypertension
    - Anticoagulant medications
    - Vascular malformations
    - Cerebral amyloid angiopathy (CAA)
    - Drug use (ie, cocaine)
    - Trauma
    - Aneurysms



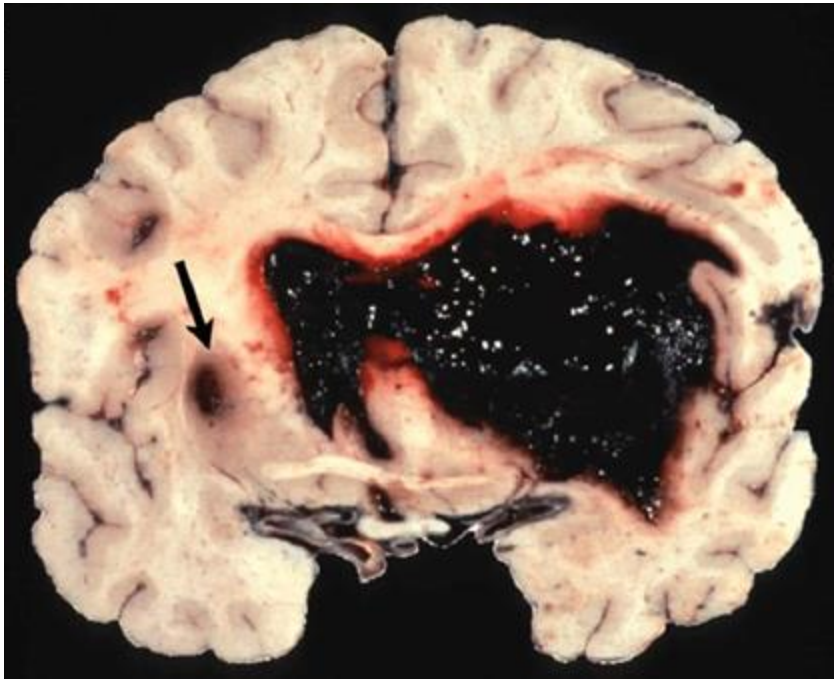


Image Sources:
https://neuropathology-web.org/chapter2/chapter2cCerebralhemorrhage.html
https://www.researchgate.net/figure/A-Asymptomatic-intracerebral-hemorrhage-arrow-localized-to-the-left-thalamus-not_fig1_7013090

Pathophysiology of Stroke

- Blood supply interrupted or completely occluded
  - Core
    - Site of primary neuronal injury
    - Cells die almost immediately
    - Non-recoverable
  - Penumbra
    - Zone around the core
    - Tissue receiving less than optimal blood flow (hypoperfused)
    - Recoverable!
    - Can be salvaged by acute intervention

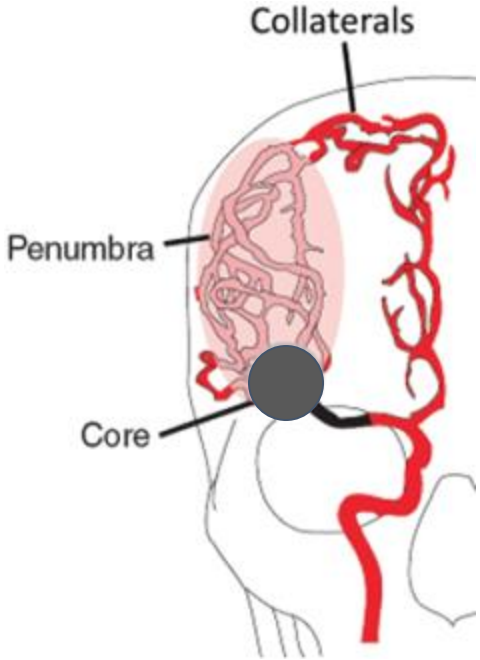


Image Source: https://www.ajnr.org/content/27/4/728/F2

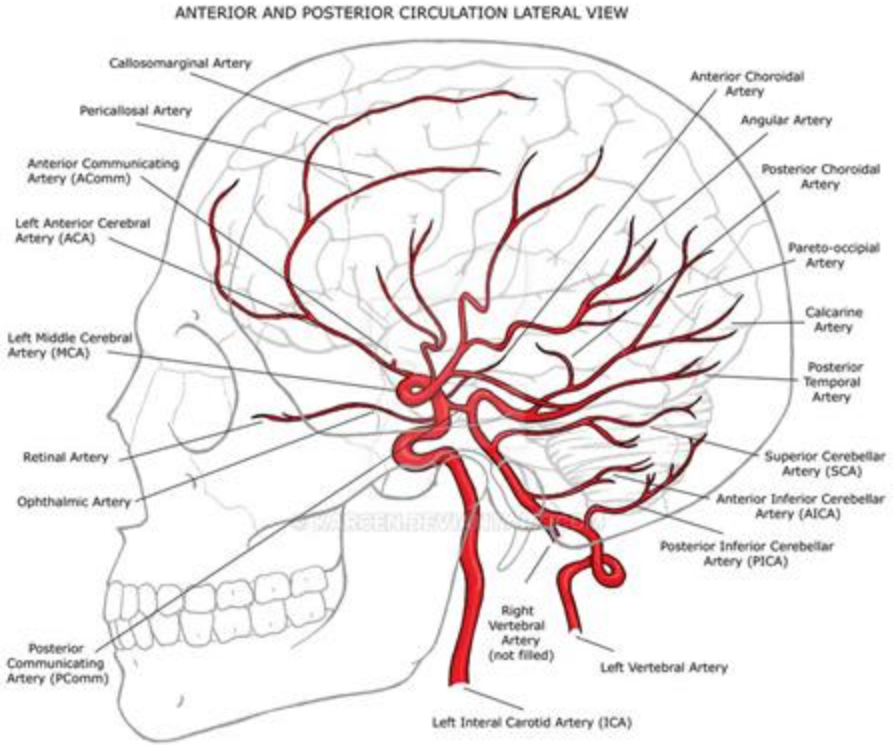
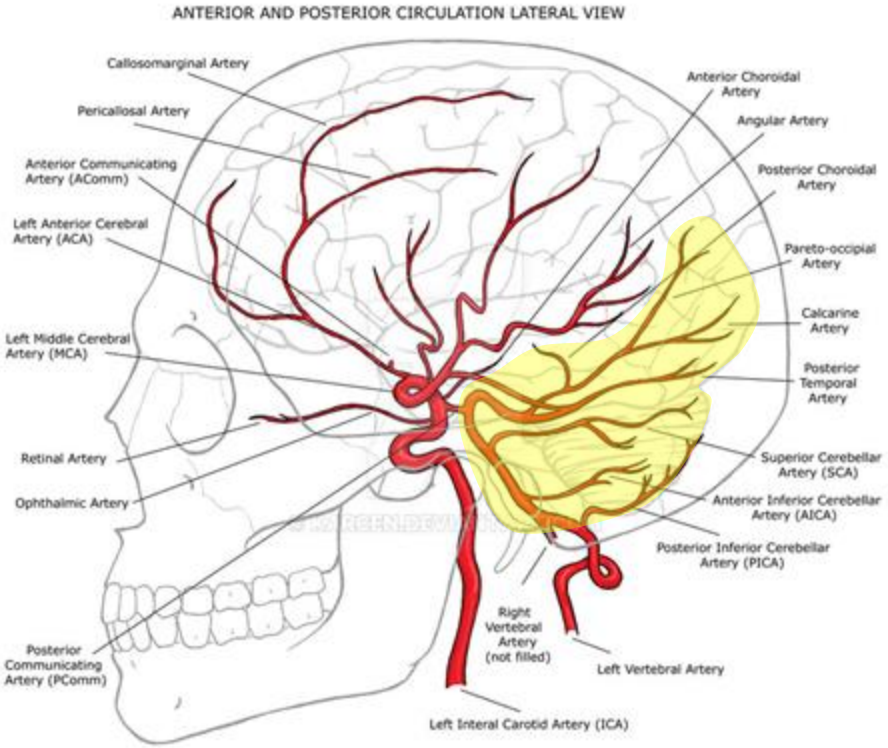
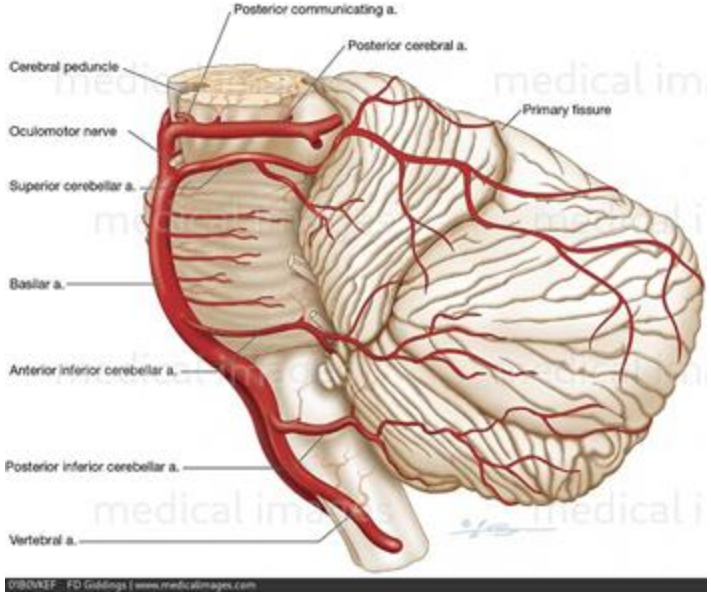


Image Source: https://www.deviantart.com/karcen/art/Cerebral-Circulation-167535443





At least 20% of stroke is in the posterior circulation

Image Sources:
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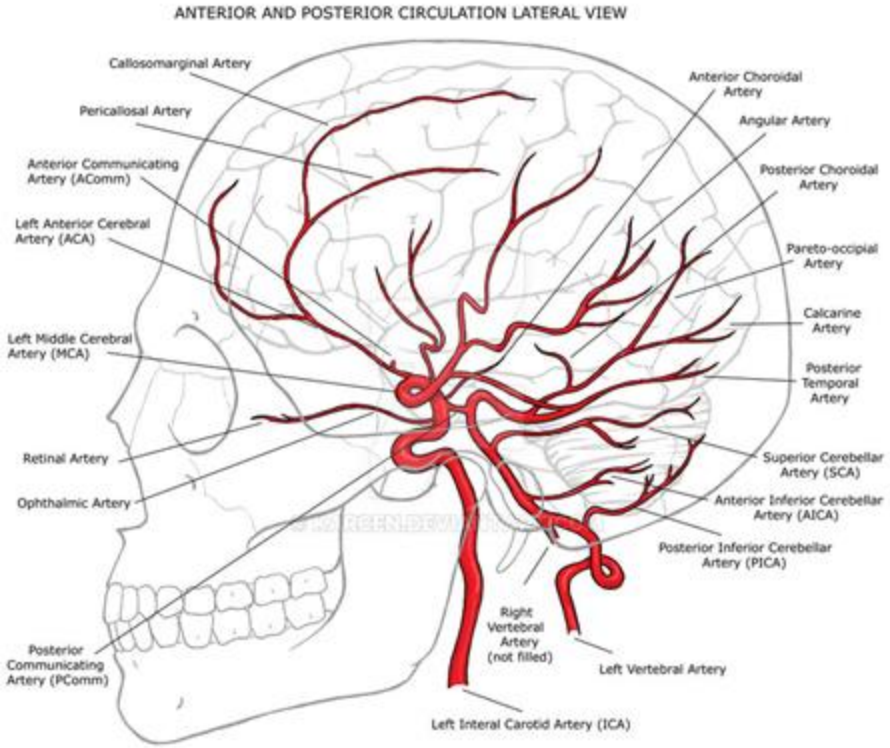
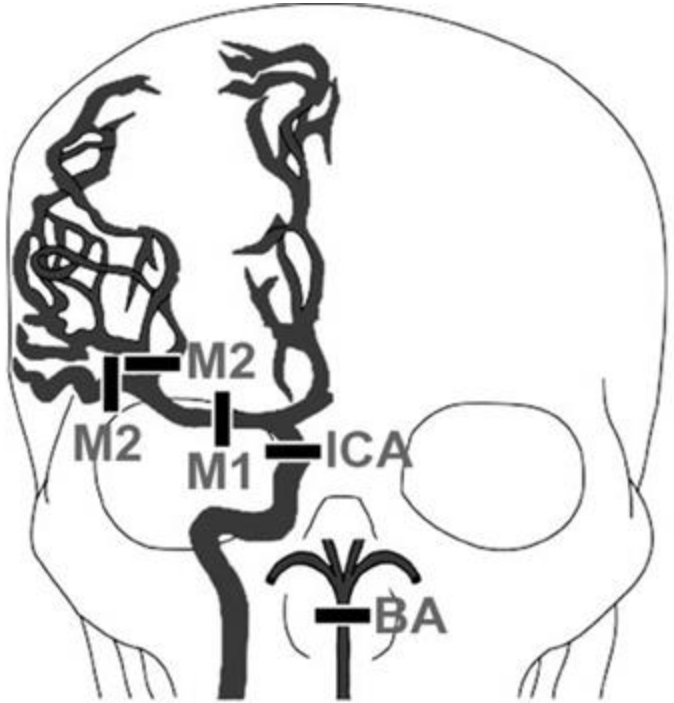
https://www.medicalimages.com





Large Vessel Occlusion (15-30% of strokes)

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https://www.researchgate.net/figure/Large-vessel-proximal-cerebral-occlusions-The-drawing-depicts-the-major-cerebral_fig1_51689398

Stroke Signs & Symptoms

Cincinnati Prehospital Stroke Scale		
Facial Droop	**Arm Drift**	**Abnormal Speech**
		*"You can't teach an old dog new tricks."*

Image Source (modified): https://thenurseszone.com/cincinnati-pre-hospital-stroke-scale/

Stroke Signs & Symptoms

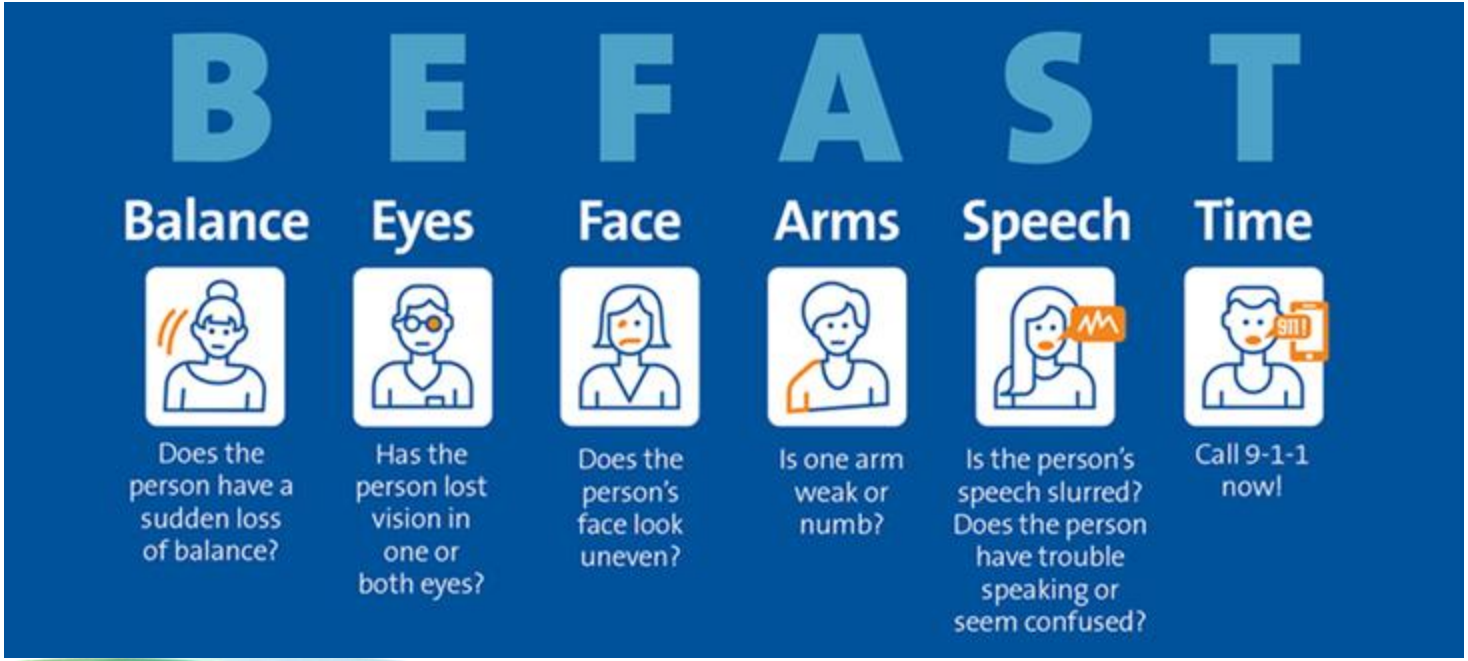
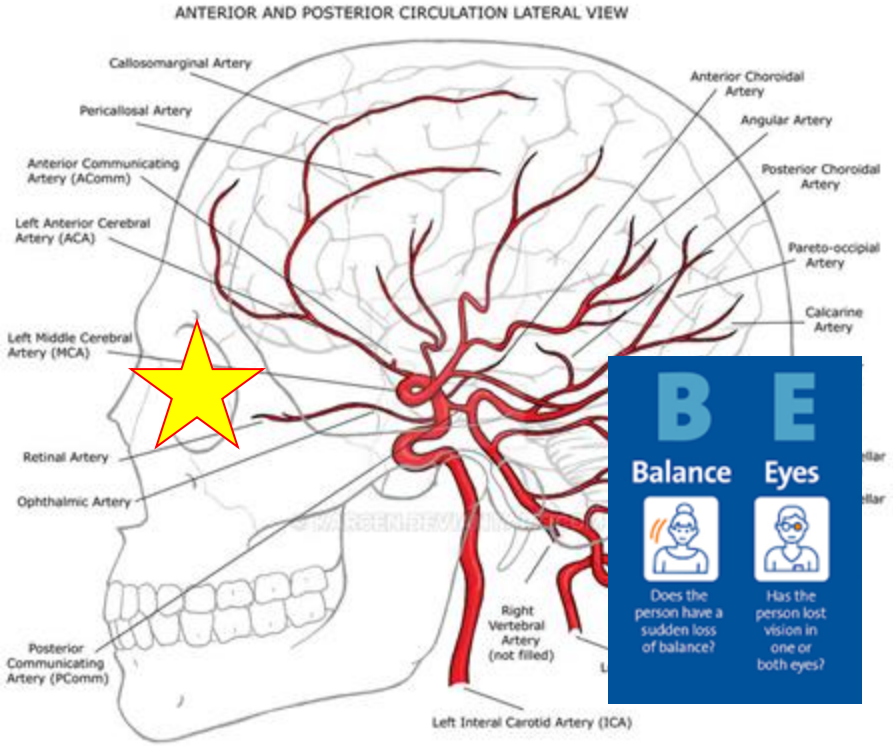


Image Source: https://neurology.duke.edu/divisions/stroke-and-vascular-neurology/about-stroke



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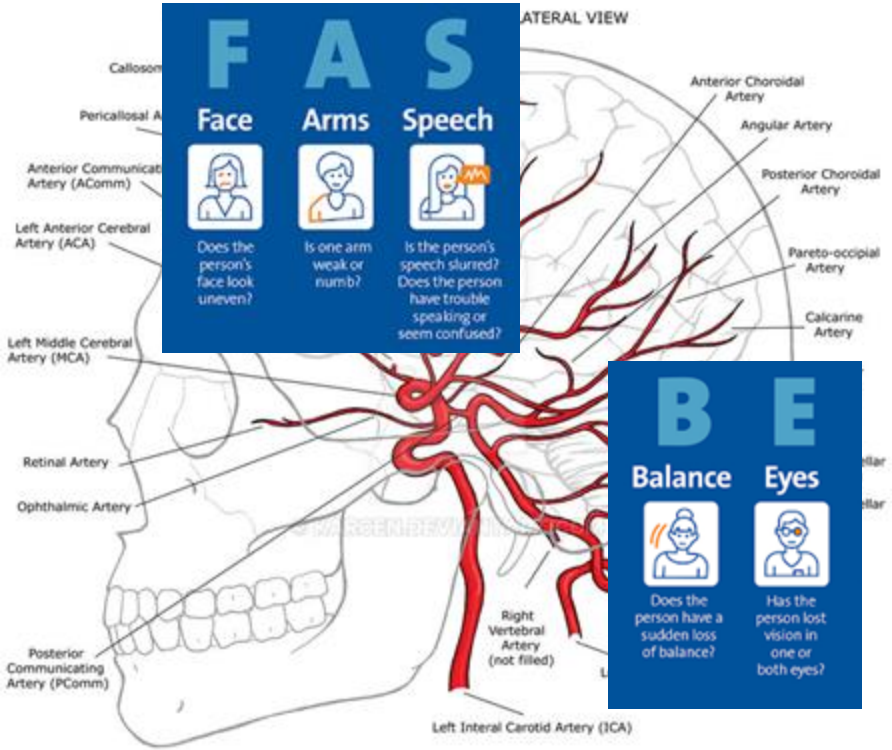


Image Source: https://www.deviantart.com/karcen/art/Cerebral-Circulation-167535443

Stroke Signs & Symptoms

Cincinnati Stroke Triage Assessment Tool — Screen for Large Occlusion Strokes

≥2 points is positive

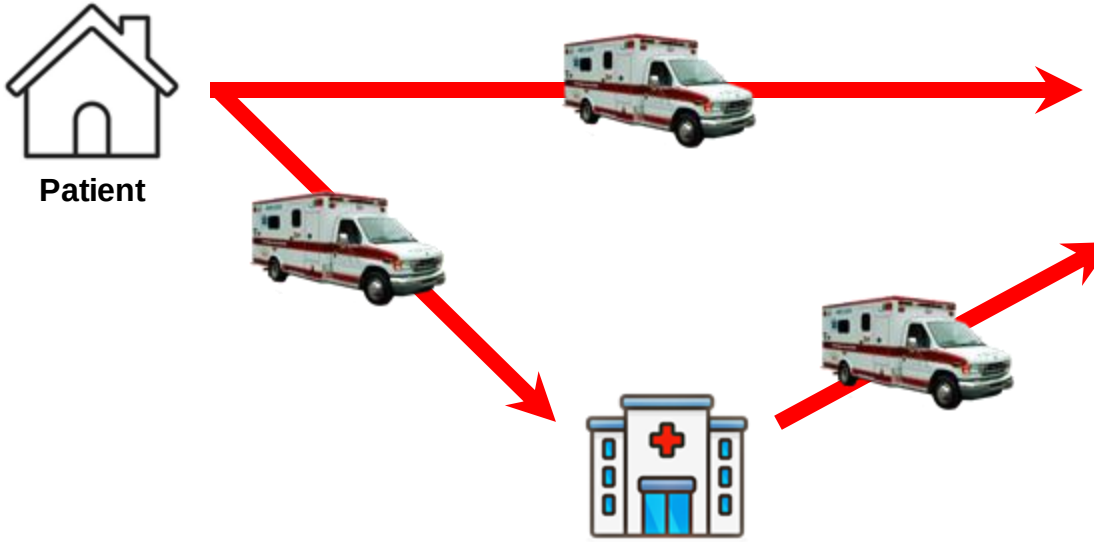
Injury	Positive if...	Value
Conjugate Gaze Deviation	Gaze is acutely impaired in one direction.	2 points
Level of Consciousness	Fails 1 or more of each of the following: • Ask age and current month • Ask to follow 2 commands: close eyes, open and close hands	1 point
Arm Weakness	When held up, one or both arms drifts down to bed within 10 seconds.	1 point

Image Source: https://www.emra.org/emresident/article/prehospital-stroke-alert

Stroke Signs & Symptoms

National Institutes of Health Stroke Scale (NIHSS) Score			
1a. Level of consciousness	0 = Alert 1 = Arouses to minor stimulation 2 = Not alert; requires repeated stimulation 3 = Unresponsive or responds only with reflex	6. Motor leg 6a. Left leg 6b. Right leg	0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity 4 = No movement
1b. Level of consciousness questions: - What is the month? - What is your age?	0 = Answers two questions correctly 1 = Answers one question correctly 2 = Answers neither question correctly	7. Limb ataxia	0 = Absent 1 = Present in one limb 2 = Present in two limbs
1c. Level of consciousness commands: - Open and close your eyes. - Open & close your hand.	0 = Performs both tasks correctly 1 = Performs one task correctly 2 = Performs neither task correctly	8. Sensory	0 = Normal; no sensory loss 1 = Mild-to-moderate sensory loss 2 = Severe to total sensory loss
2. Best gaze	0 = Normal 1 = Partial gaze palsy 2 = forced deviation	9. Best language	0 = No aphasia; normal 1 = Mild to moderate aphasia 2 = Severe aphasia 3 = Mute, global aphasia
3. Visual	0 = No visual loss 1 = Partial hemianopia 2 = Complete hemianopia 3 = Bilateral hemianopia	10. Dysarthria	0 = Normal 1 = Mild to moderate dysarthria 2 = Severe dysarthria
4. Facial palsy	0 = Normal symmetric movements 1 = Minor paralysis 2 = Partial paralysis 3 = Complete paralysis of one or both sides	11. Extinction and inattention	0 = No abnormality 1 = Visual, tactile, auditory, spatial, or personal inattention 2 = Profound hemi-inattention or extinction
5. Motor arm 5a. Left arm 5b. Right arm	0 = No drift 1 = Drift 2 = Some effort against gravity 3 = No effort against gravity, limb falls 4 = No movement	Score 1-4 = Minor Stroke Score 5-15 = Moderate Stroke Score 16-20 = Moderate to Severe Stroke Score 21-42 = Severe Stroke	

EMS Model for Acute Stroke



- Thrombectomy Capable Stroke Center
- Comprehensive Stroke Center

Mercy Jewish Hospital
University of Cincinnati
Good Sam/B North

- Primary Stroke Center
- Acute Stroke Ready Hospital

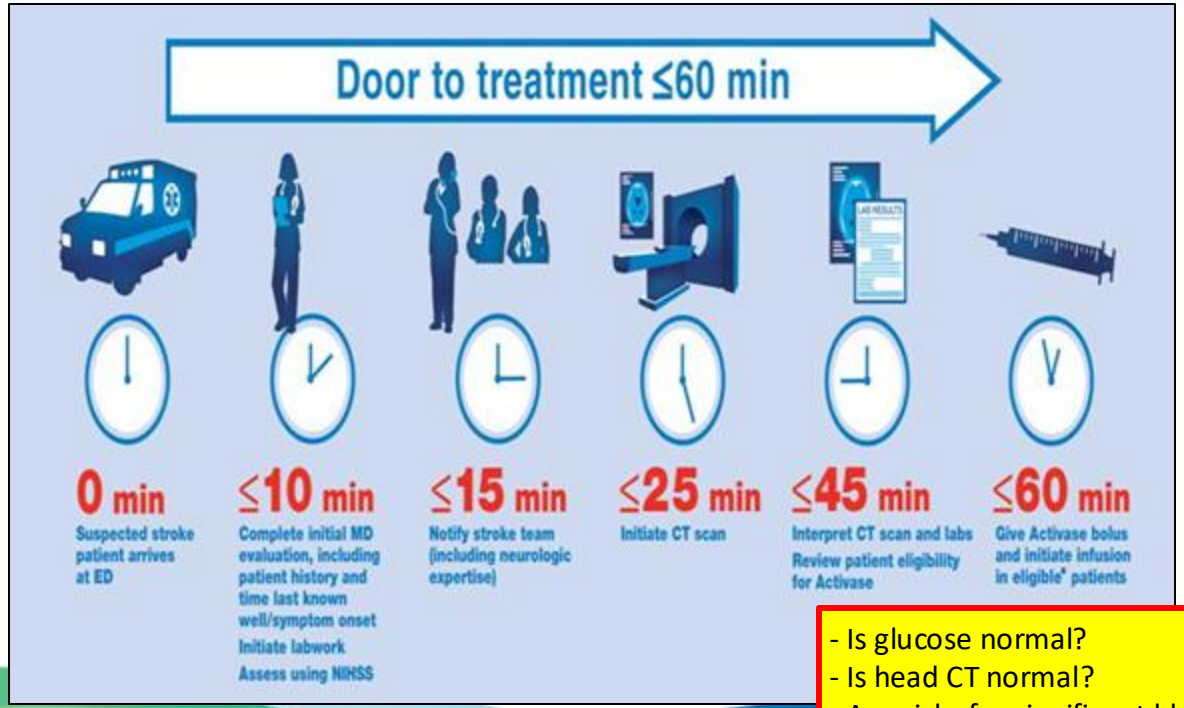
Ideal ED Timeline

Image Source: https://www.activase.com/iscstroke/golden-hour-acute-ischemic-stroke

Ideal ED Timeline

Image Sources:
https://radiopaedia.org/cases/cerebral-amyloid-angiopathy-associated-lobar-intracerebral-haemorrhage-2
https://radiologyassistant.nl/neuroradiology/brain-ischemia/imaging-in-acute-stroke

Ideal ED Timeline



- Is glucose normal?
- Is head CT normal?
- Any risks for significant bleeding?
- Age is NOT a contraindication!

Image Source: https://www.activase.com/iscstroke/golden-hour-acute-ischemic-stroke

Tenecteplase (TNK)

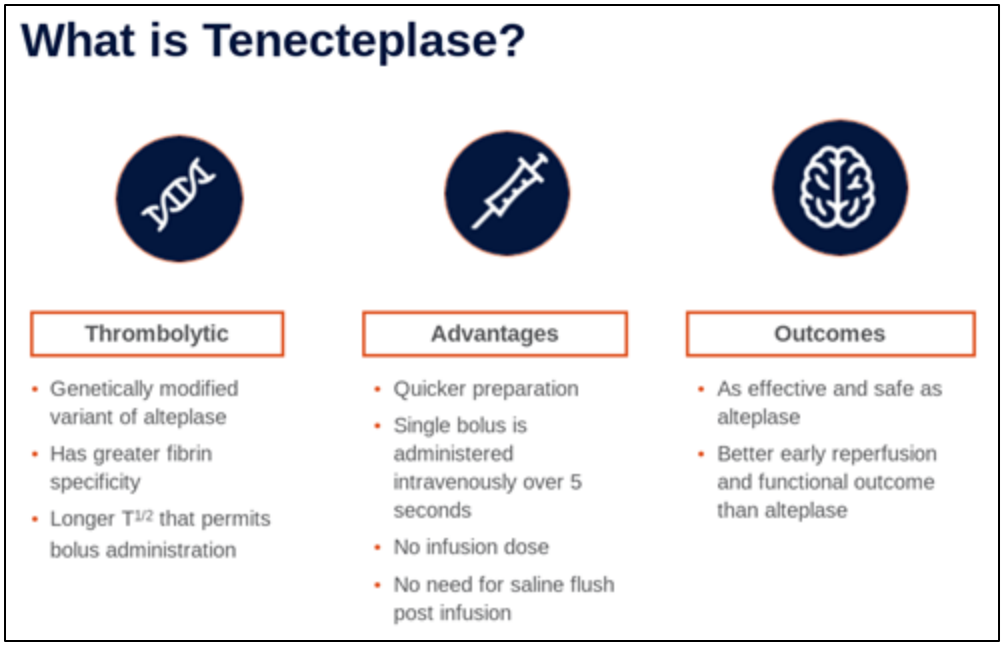
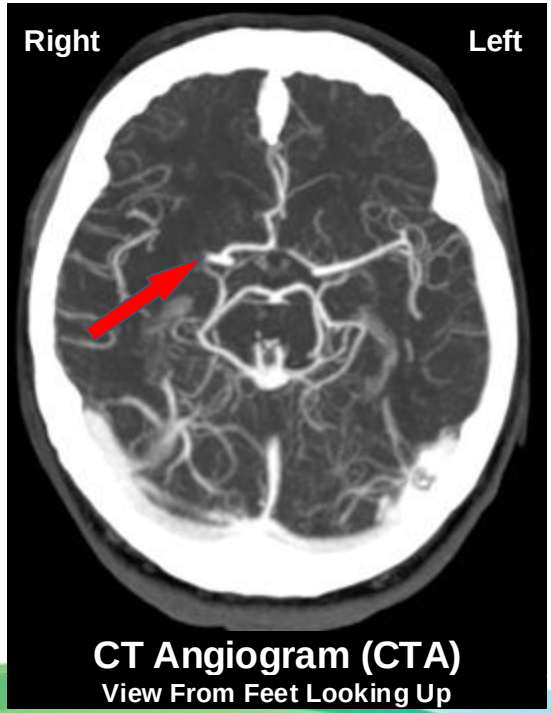


Image Source: https://www.gene.com/medical-professionals

Large Vessel Occlusion (LVO)



CT Angiogram (CTA)
View From Feet Looking Up

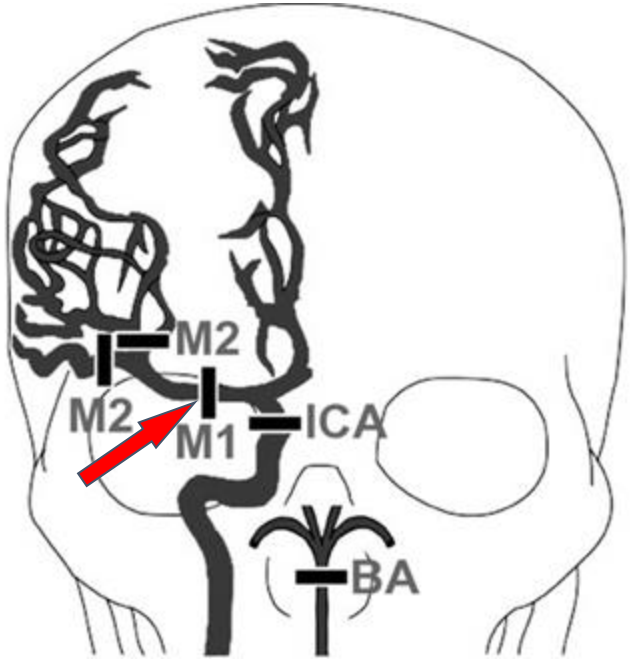
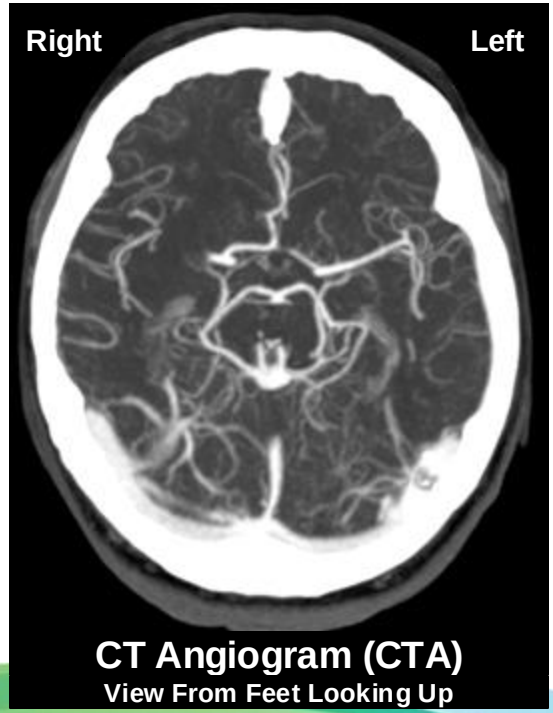


Image Sources:
https://radiopaedia.org/cases/acute-right-mca-m1-occlusion
https://www.researchgate.net/figure/Large-vessel-proximal-cerebral-occlusions-The-drawing-depicts-the-major-cerebral_fig1_51689398

Large Vessel Occlusion (LVO)



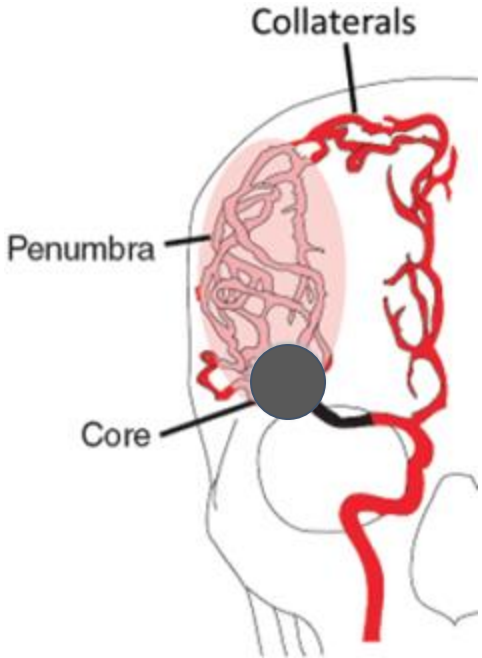
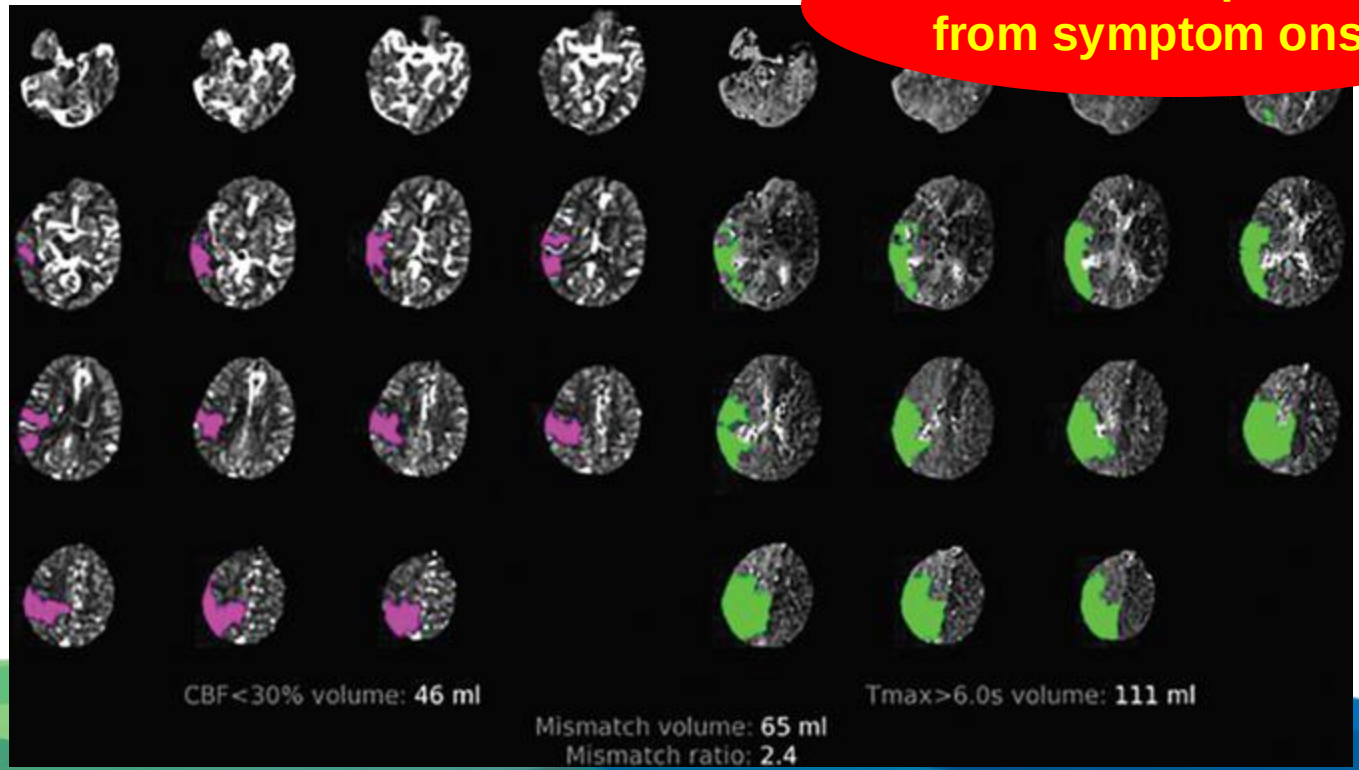


Image Sources:
https://radiopaedia.org/cases/acute-right-mca-m1-occlusion
https://www.ajnr.org/content/27/4/728/F2

CT Perfusion (CTP)

Can be done up to 24 hrs from symptom onset!



Viz.ai

Image Source: https://www.viz.ai

Thrombectomy

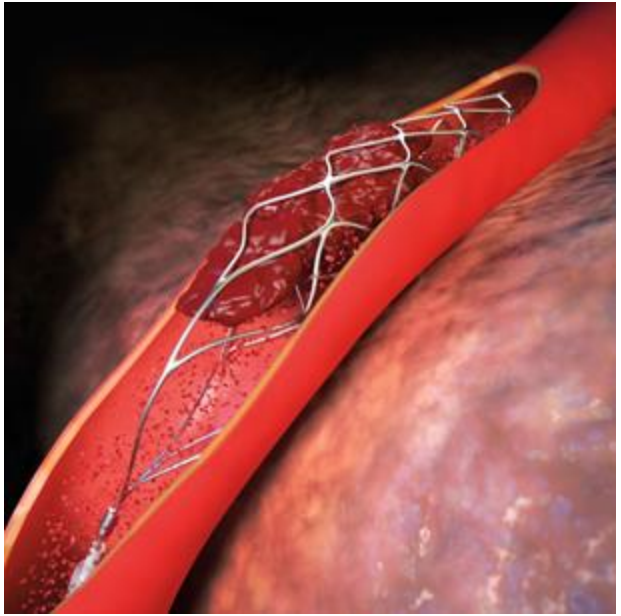
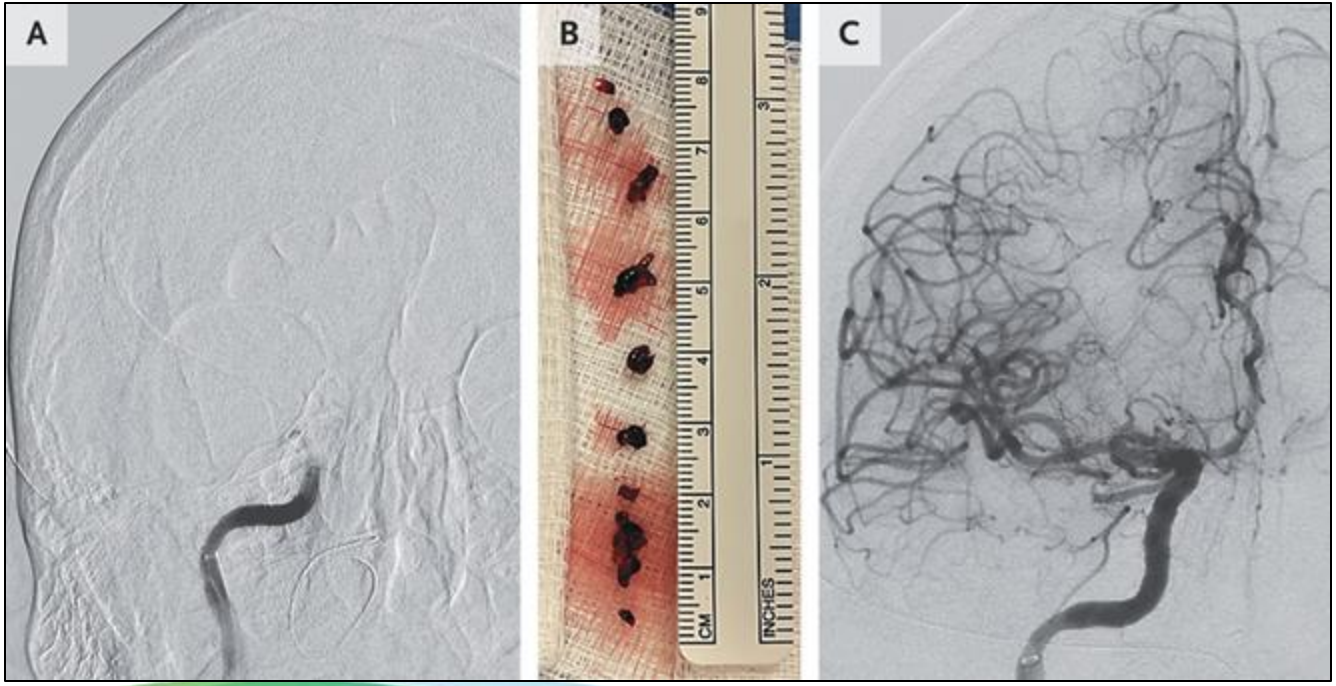


Image Sources:
https://www.heart.org/en/news/2018/05/01/guidelines-urge-new-approach-to-treating-worst-strokes
https://magazines.uthscsa.edu/mission/stents-for-strokes/

Thrombectomy



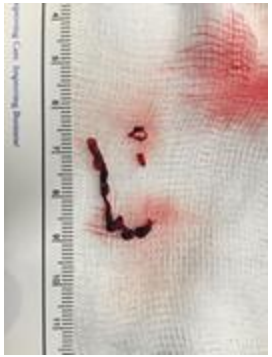


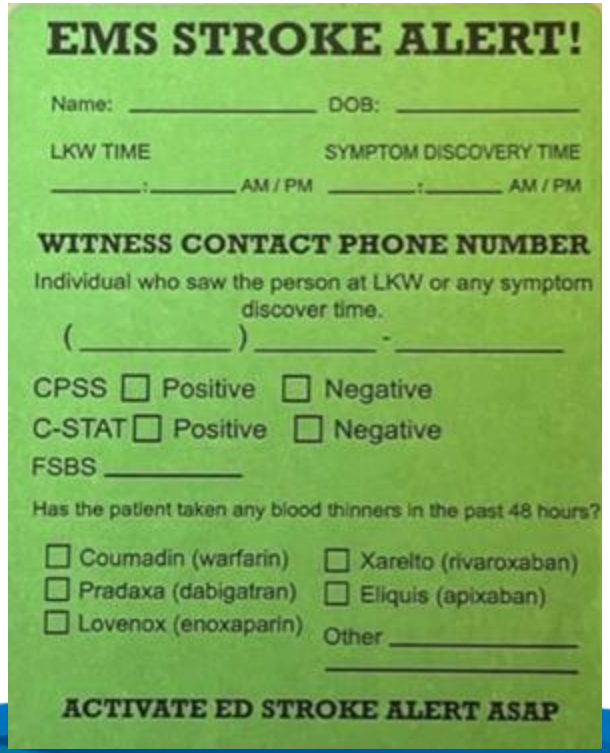
Image Sources:
https://www.nejm.org/doi/abs/10.1056/NEJMicm2116727
https://pn.bmj.com/content/17/4/252 and https://www.snis.com.au/services/acute-ischaemic-stroke/

Where EMS Can Have a HUGE Impact

Image Source: https://www.wakeahec.org/courses-and-events/73725/19th-annual-time-is-brain-advances-in-stroke-care

Where EMS Can Have a HUGE Impact

- Encourage patients to go to ED
- If you think it, say it! Pre-notify
- Last known well time
- Clear description of symptoms
  - Posterior circulation signs and symptoms
  - Avoid terms like “dizzy” or “confused”
- Baseline deficits
- Medication list
- Contact info for witnesses



EMS STROKE ALERT!

Name: _____ DOB: _____

LKW TIME _____:_____ AM / PM

SYMPTOM DISCOVERY TIME _____:_____ AM / PM

WITNESS CONTACT PHONE NUMBER

Individual who saw the person at LKW or any symptom discover time.

(_____) _____-_____

CPSS ☐ Positive ☐ Negative

C-STAT ☐ Positive ☐ Negative

FSBS _____

Has the patient taken any blood thinners in the past 48 hours?

☐ Coumadin (warfarin) ☐ Xarelto (rivaroxaban)

☐ Pradaxa (dabigatran) ☐ Eliquis (apixaban)

☐ Lovenox (enoxaparin) Other _____

ACTIVATE ED STROKE ALERT ASAP

References

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Powers, W. J., Rabinstein, A. A., Ackerson, T., Adeoye, O. M., Bambakidis, N. C., Becker, K., ... & Tirschwell, D. L. (2019). Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke: a guideline for healthcare professionals from the American Heart Association/American Stroke Association. Stroke, 50(12), e344-e418.

Powers, W. J., Rabinstein, A. A., Ackerson, T., Adeoye, O. M., Bambakidis, N. C., Becker, K., ... & Tirschwell, D. L. (2019). Guidelines for the early management of patients with acute ischemic stroke: 2019 update to the 2018 guidelines for the early management of acute ischemic stroke: data supplement 1: evidence tables. Stroke, 50(12).

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Thank You For All You Do!