



PeaceHealth

The Spirit of Health

**Interhospital Transfers of the
Acute Stroke Patient
EMS Grand Rounds:
February 21, 2018**

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Objectives

- Know the basic pathophysiology of acute stroke subtypes
- Understand the time sensitive nature of acute stroke
- Review inter-hospital transfer guidelines to mediate transport risks
- Explain the new ASA stroke guidelines
- Explore new proposals for triage and stroke systems of care

Stroke Definitions:

- Stroke = Acute disruption of blood flow to the brain leading to focal neurologic deficits
- TIA (transient ischemic attack) =acute disruption of blood flow of the brain leading to focal neurological symptoms last less than 24 hours (MOST CONSIDER TIA when less than ONE HOUR duration)

Acute Stroke

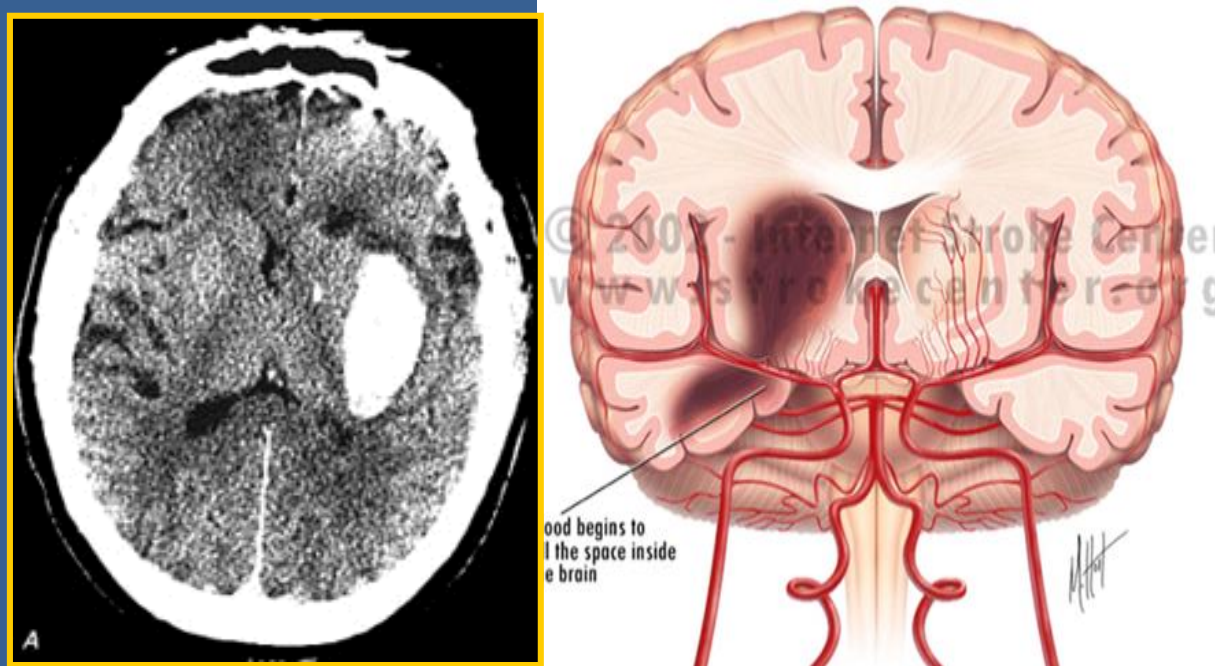
(What do you see?)

- Deficits:
 - Unilateral (though not always) weakness
 - Unilateral sensory deficit
 - Visual deficits (blindness, gaze palsy, double)
 - Speech (slurred – a motor dysfunction)
 - Language (aphasia – damage to the brain's speech center)
 - Ataxia (lack of coordinated movement)
 - Cognitive impairment
- Like real estate—Location, Location, Location

Cerebrovascular Disease: Pathogenesis

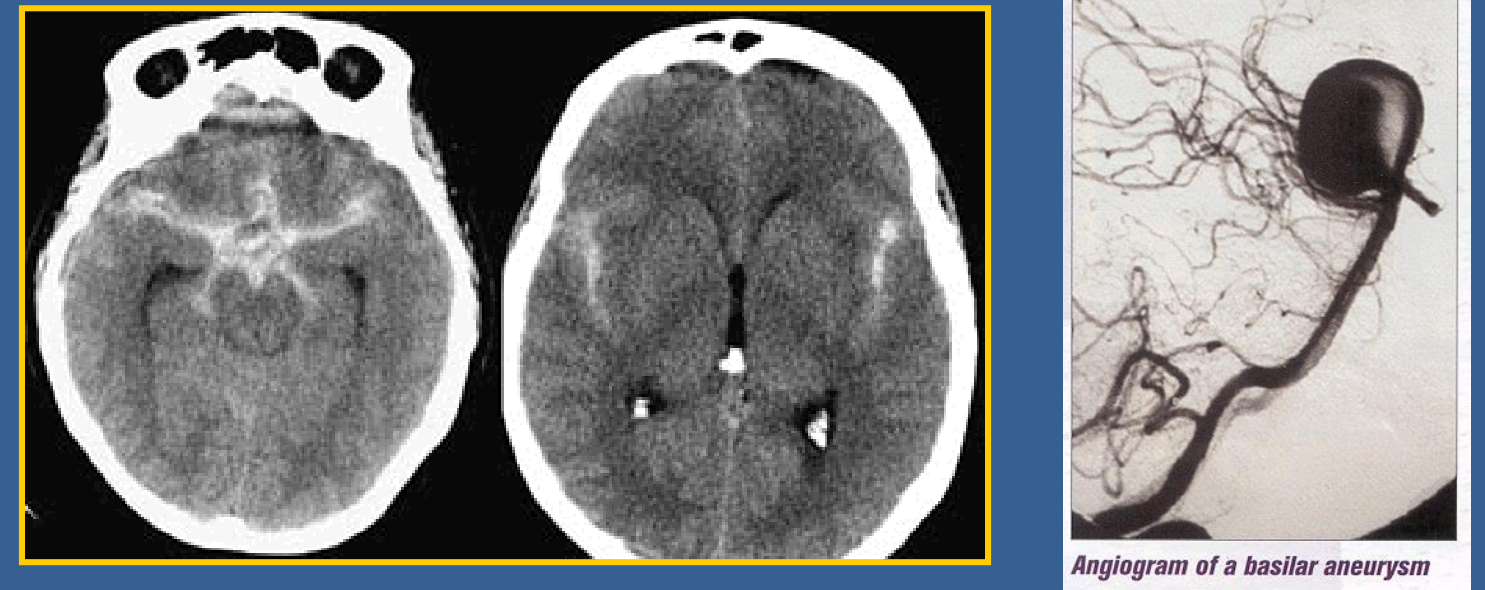
Hemorrhagic Stroke (17%)

Intracerebral Hemorrhage (59%)



Clinical Presentation
similar to ischemic stroke

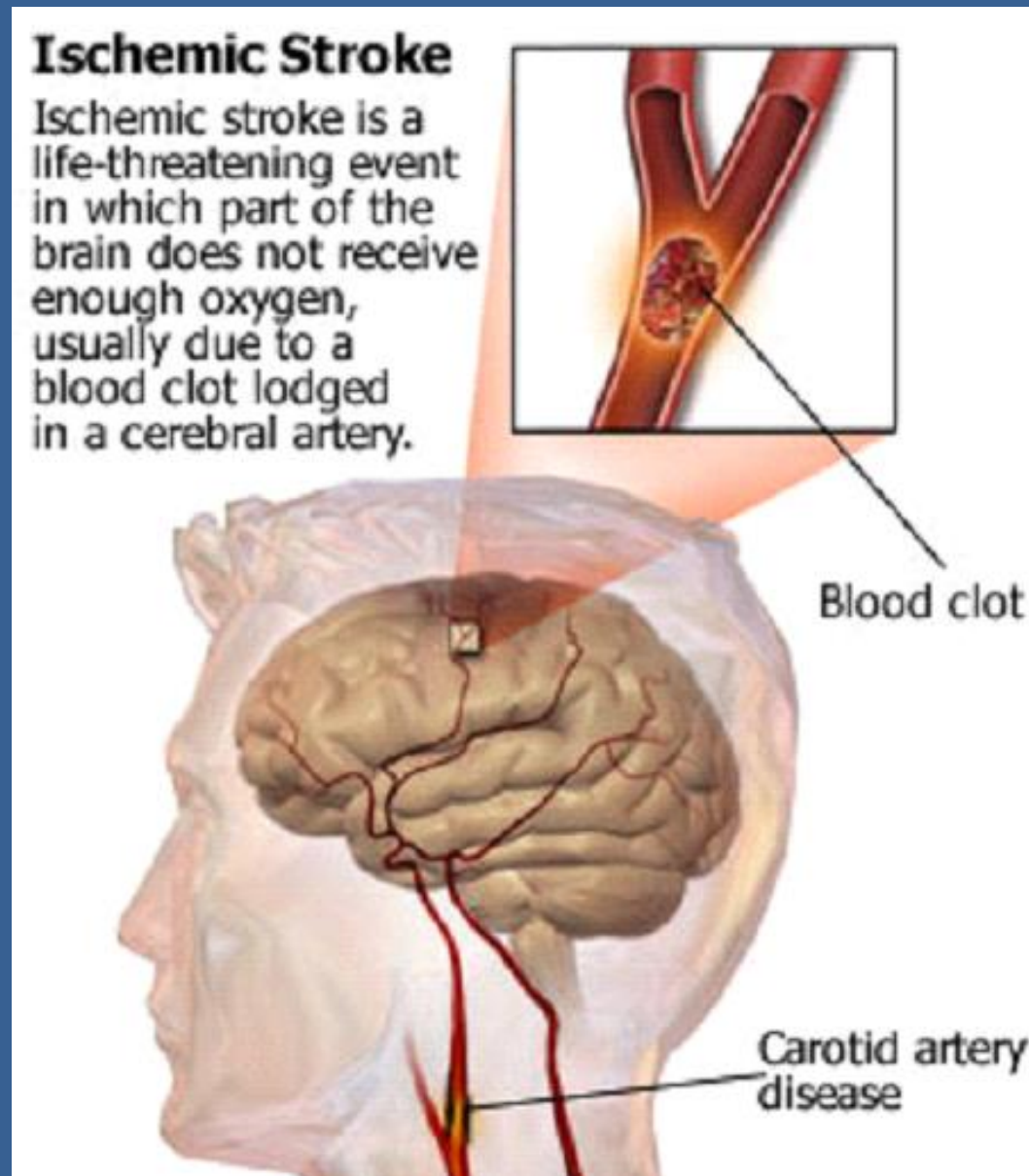
Subarachnoid Hemorrhage (41%)



Clinical Presentation
"WORSE HEADACHE OF MY LIFE"

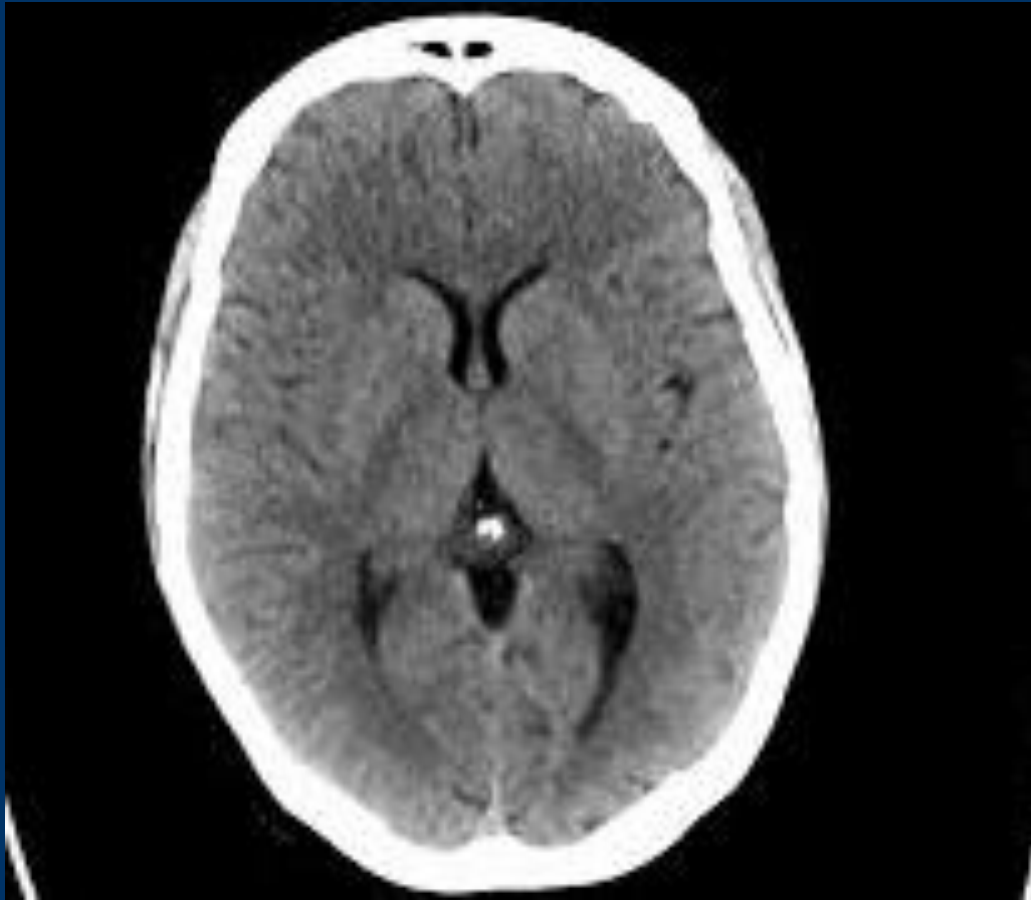
Cerebrovascular Disease: Pathogenesis

Ischemic Stroke: 83%

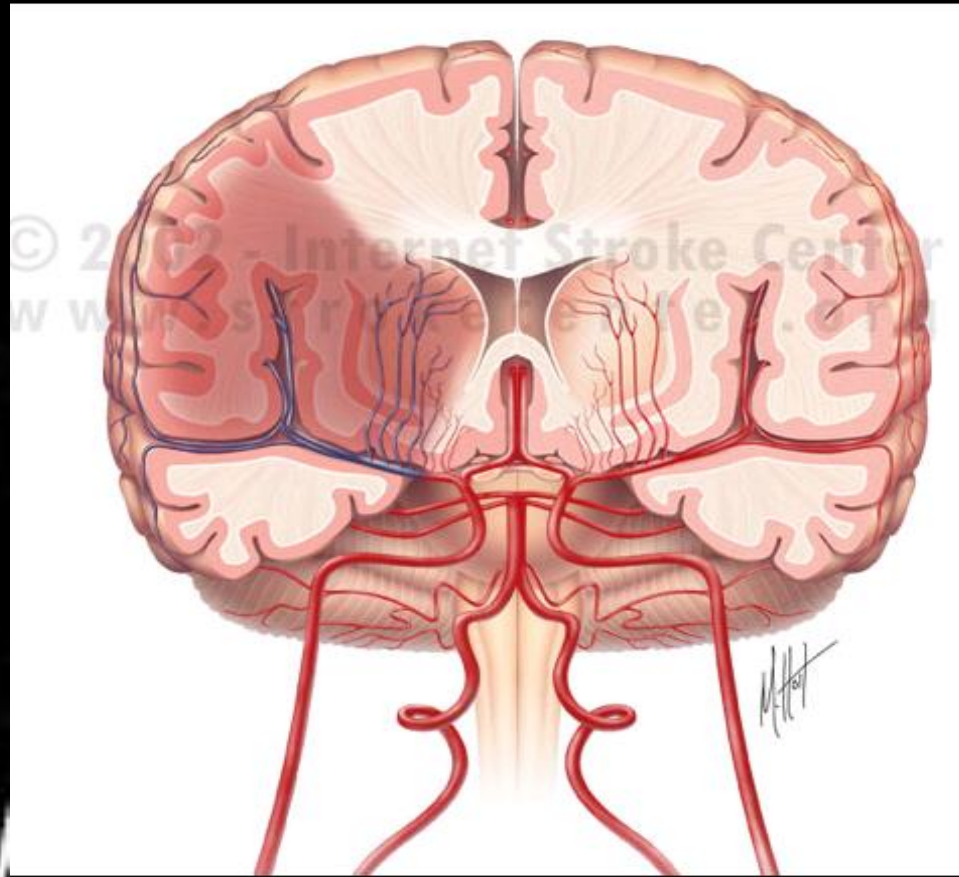


Types of Strokes

Large artery territory



CT scan initially normal



CT scan shows changes after 6 hours

Types of Strokes

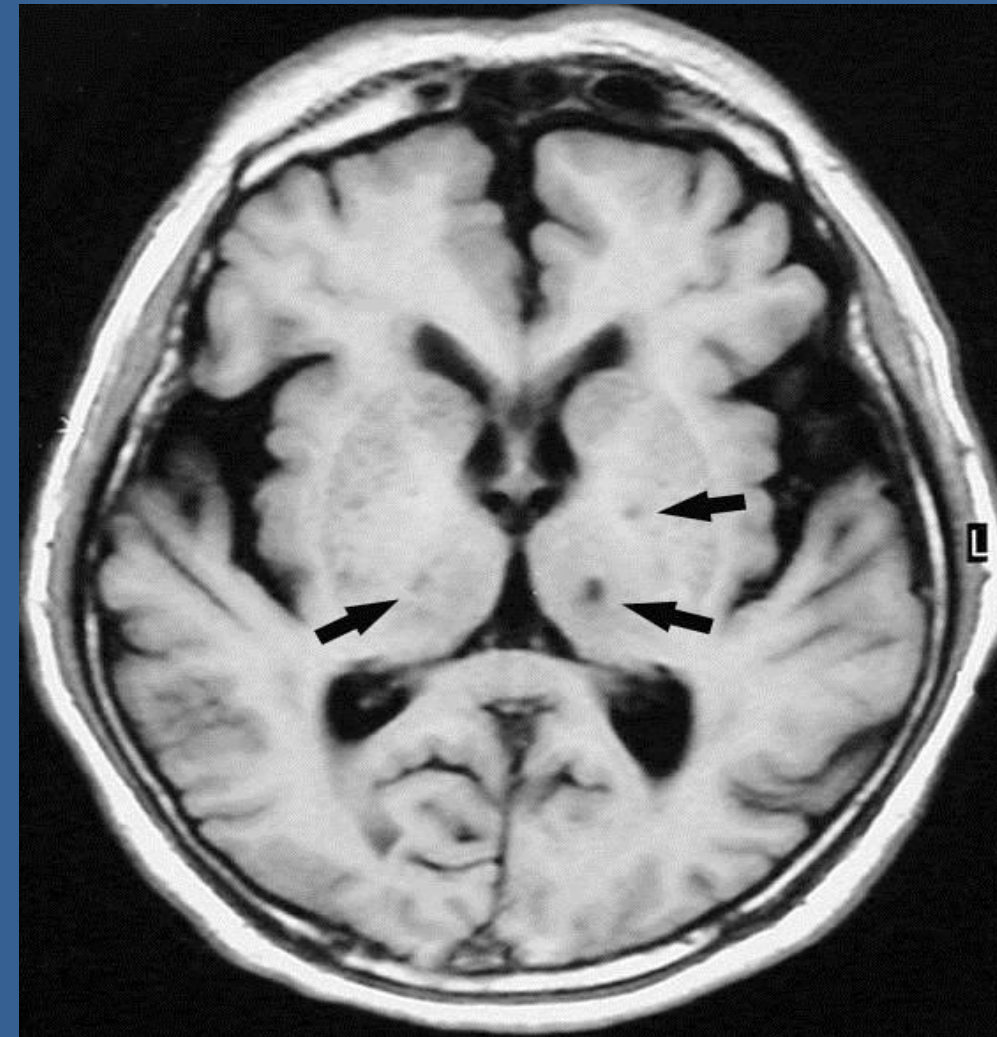
(Middle Cerebral Artery – MCA)

- The most common artery occluded in AIS—can be proximal or from carotid circulation.
- Features:
 - Motor/Sensory Deficit: face, arm, leg
 - Speech deficit – dysarthria (slurred speech)
 - Language deficit – if in dominant hemisphere
 - Gaze palsy – eyes directed towards side of AIS
 - Blindness – visual field cut (homonymous hemianopsia)



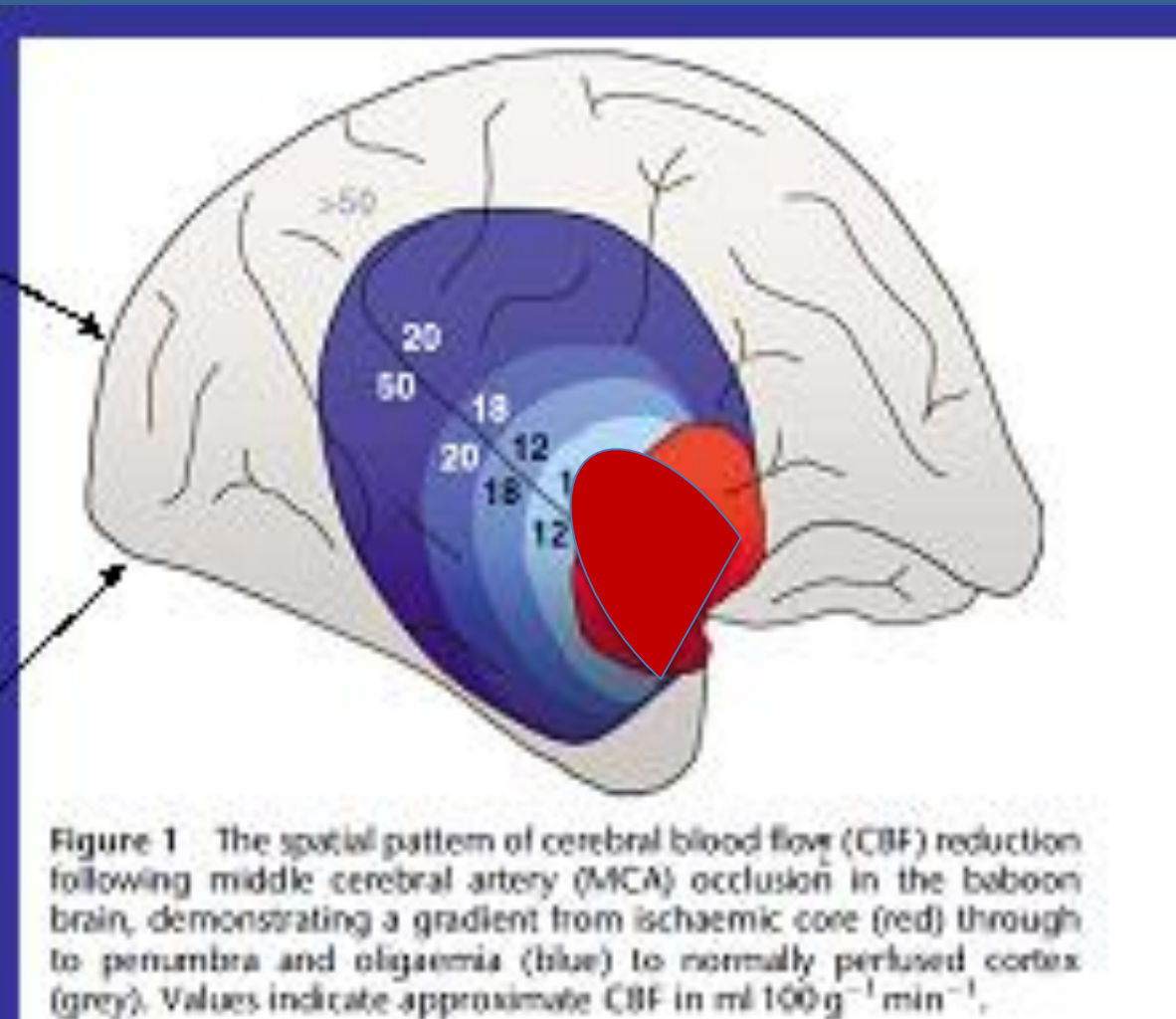
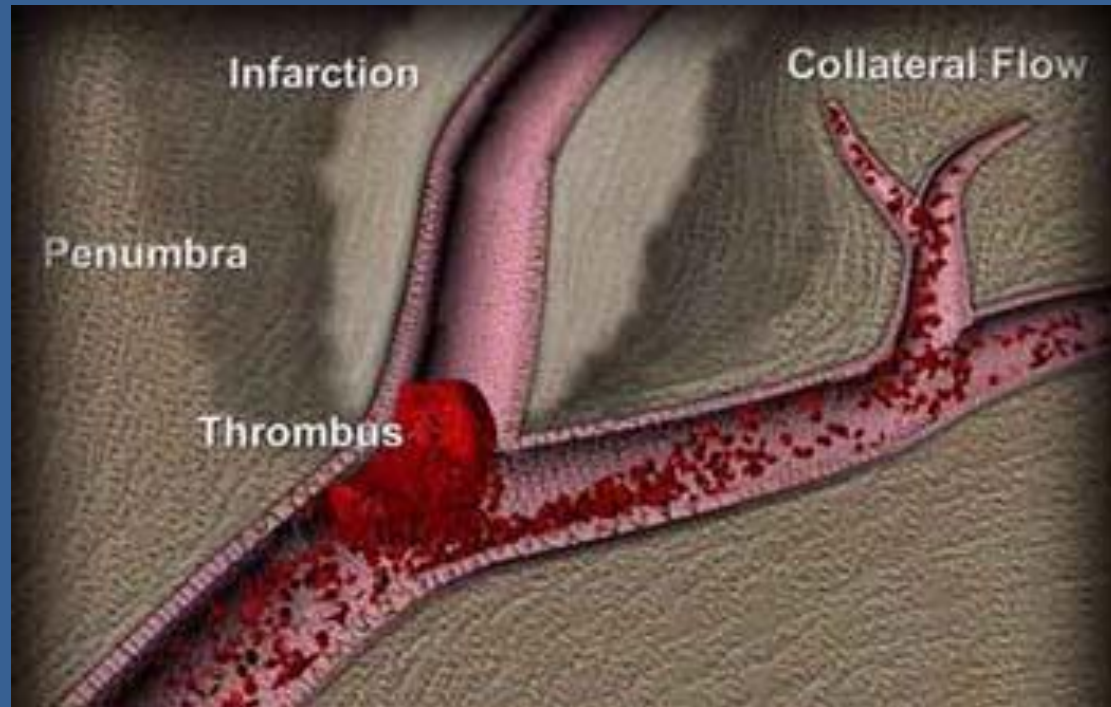
Lacunar Strokes

- These strokes are ischemic in nature.
 - Occurs in the small penetrating arteries of the brain.
 - Presentation – affects the arm, leg, and face, equal to all areas.



PENUMBRA

(That tissue surrounding the infarct that is salvageable, but at risk.)





Early EMS Notification of Possible Stroke Patient

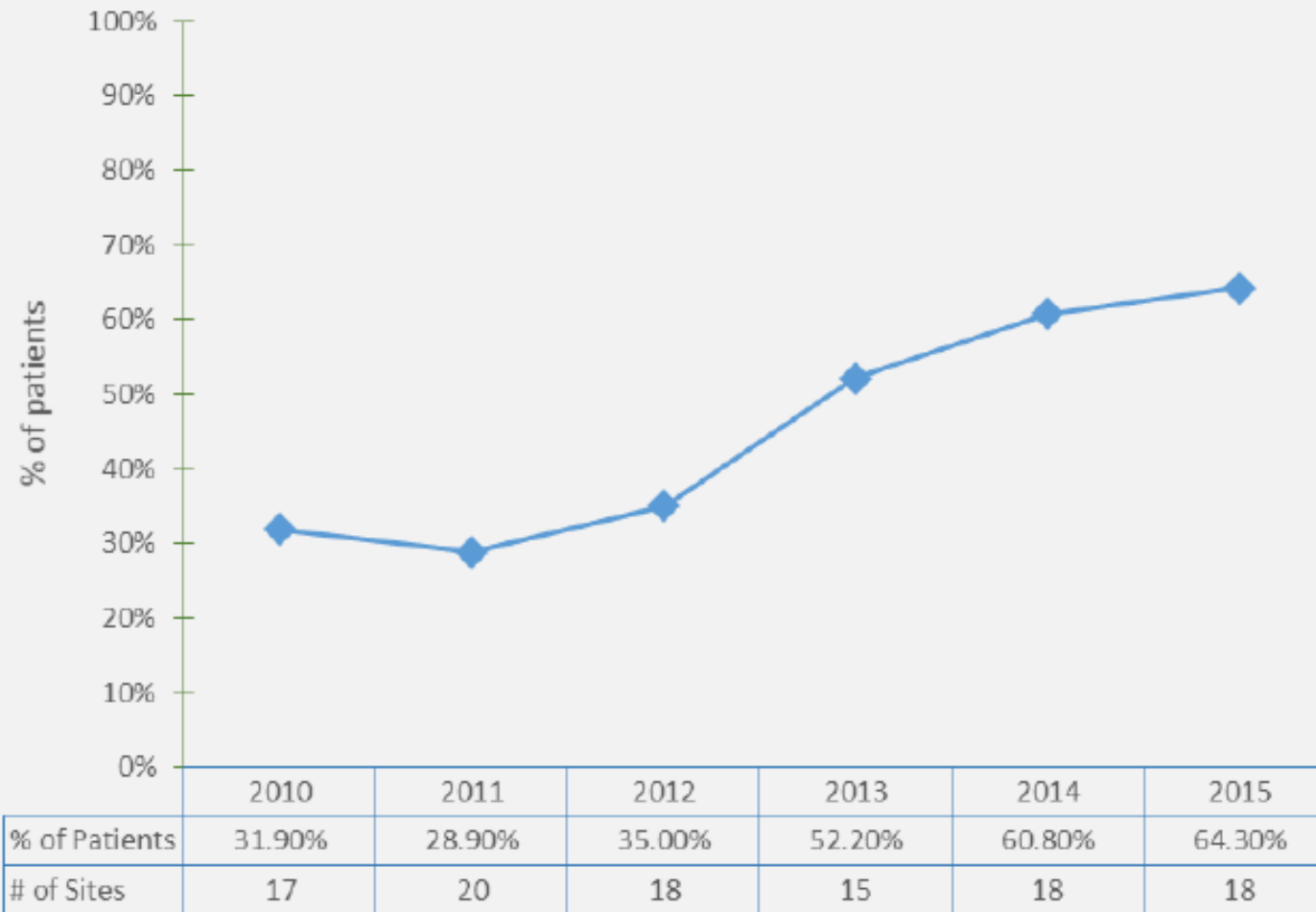
FAST/Cincinnati Stroke Scale to assess a patient for stroke:

- Facial droop
- Arm drift
- Speech
- Time Sensitive



HOW ARE WE DOING?

Pre-notification
2010-2015



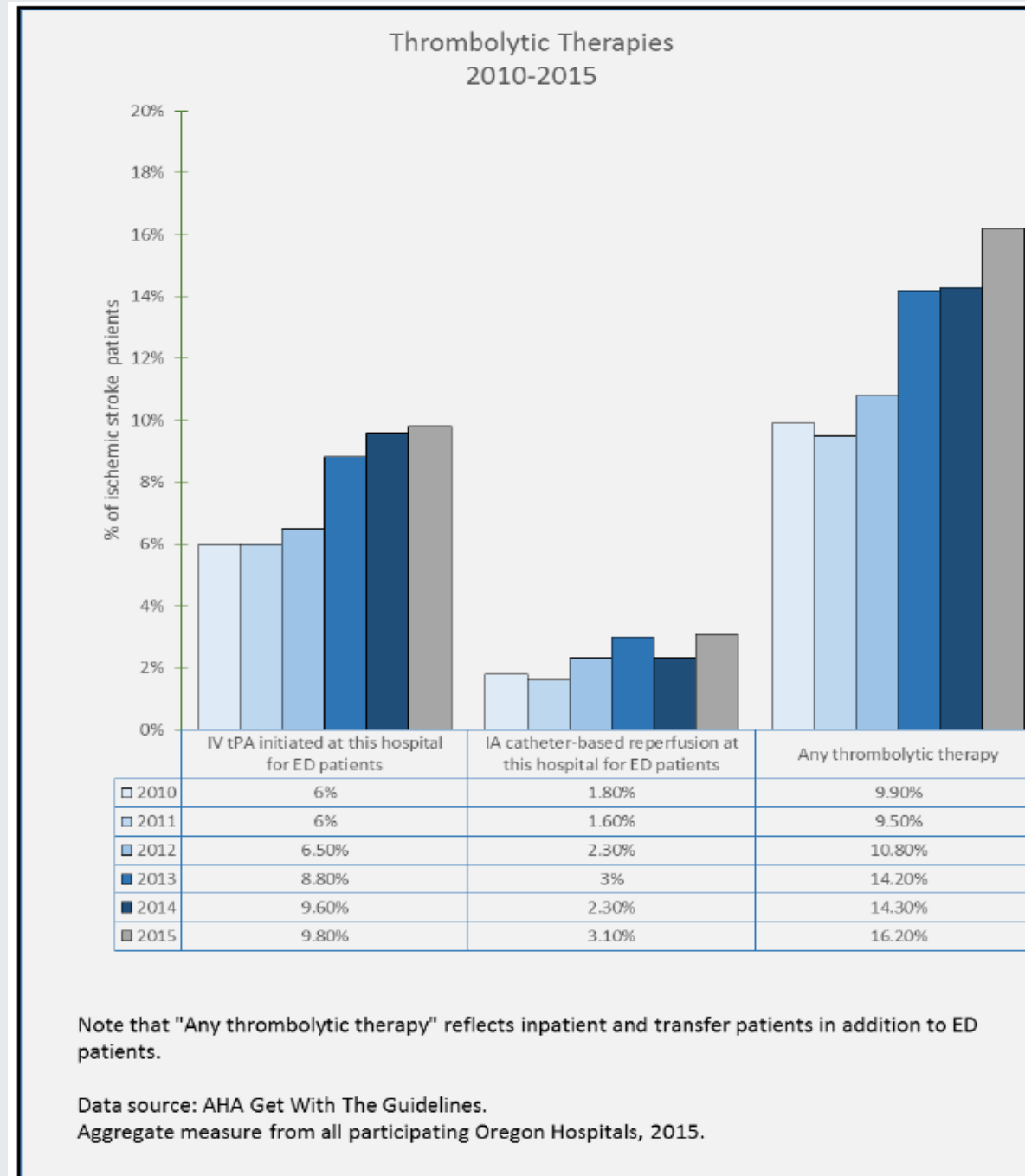
Percent of stroke cases of advanced notification by EMS for patients transported by EMS from scene.

Data source: AHA Get With the Guidelines.

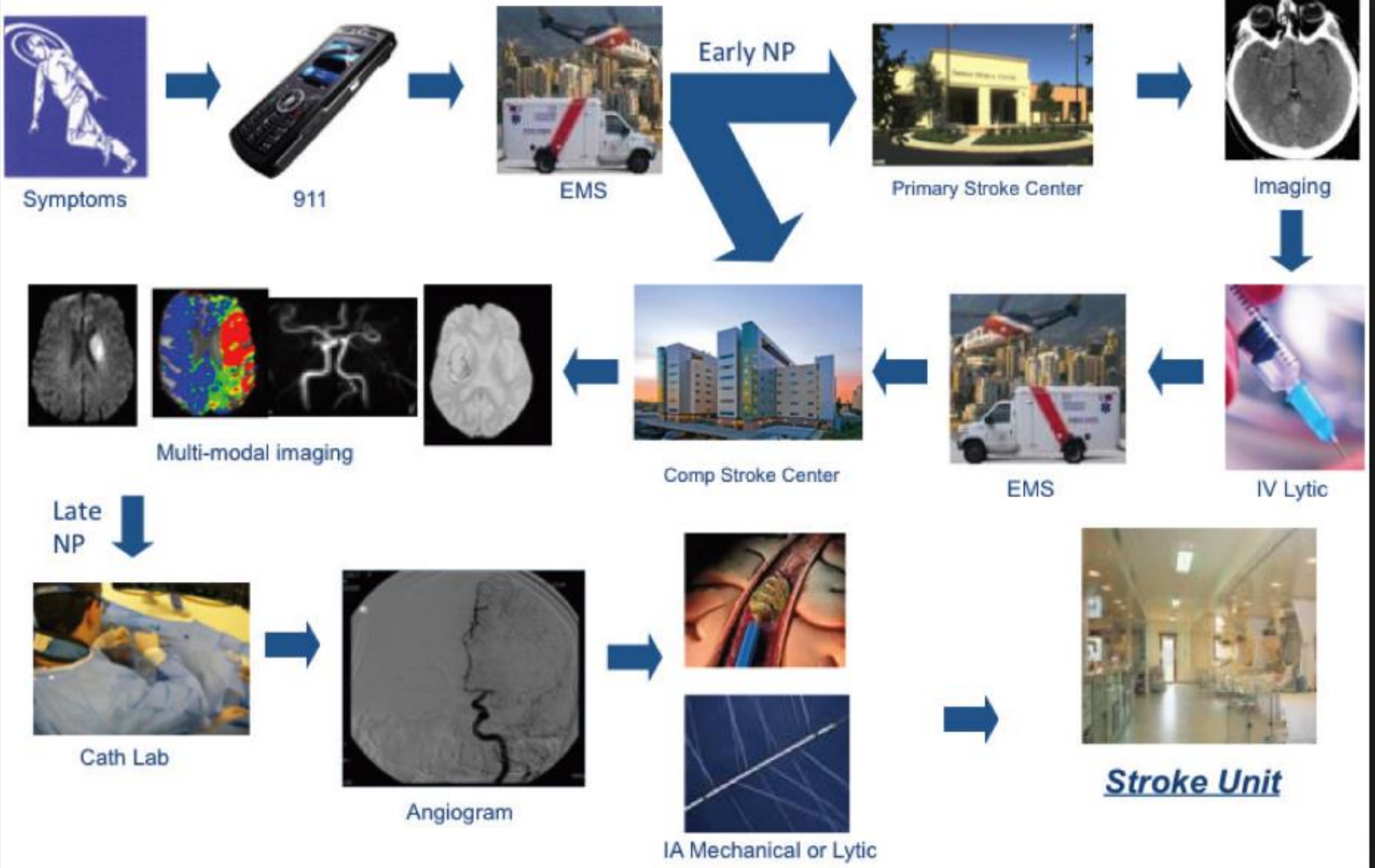
Aggregate measure from all participating Oregon hospitals.

OREGON 2010-2015

Percentage of Ischemic Stroke Patients Receiving any Reperfusion Therapy



RAPID ADVANCEMENT IN STROKE CARE



INTERHOSPITAL TRANSFER- “DRIP AND SHIP”

Rapid Initial Report and Assessment

- Age, name, DOB, pertinent past history
- Neurological deficits (NIHSS if available)
- Last Seen Well (witnessed or non-witness onset)
- IV Access (≥ 20 gauge) at least one above the wrist
- VS
- Family contact cell number

ACTIVASE- tPA (1mg/ml)

Ischemic stroke dose- 0.9mg/kg iv

First 10% given as bolus over 1 minute, the remainder over 60 minutes
(maximum dose 90mg)



TPA

TOTAL DOSE: 72 mg

BOLUS DOSE: 7.2 mg

INFUSION DOSE: 64.8 mg

AMOUNT DISGARDED: 28 mg



TPA infusions- Do and Don'ts

- Avoid transferring pumps but if necessary take care to minimize drug loss and minimize infusion interruptions
- When pump alarms to signify infusion complete
- WATCH for the drip chamber to empty, to confirm tPA bag is empty
- Remove tPA bag(or bottle) and hang 50mL normal saline at same rate as tPA.

Note: There is still tPA in the tubing that needs to be infused.



Table 5. Options to Treat Arterial Hypertension in Patients With AIS Who Are Candidates for Acute Reperfusion Therapy*

Class IIb, LOE C-E0
Patient otherwise eligible for acute reperfusion therapy except that BP is >185/110 mm Hg:
Labetalol 10–20 mg IV over 1–2 min, may repeat 1 time; or
Nicardipine 5 mg/h IV, titrate up by 2.5 mg/h every 5–15 min, maximum 15 mg/h; when desired BP reached, adjust to maintain proper BP limits; or
Clevidipine 1–2 mg/h IV, titrate by doubling the dose every 2–5 min until desired BP reached; maximum 21 mg/h
Other agents (eg, hydralazine, enalaprilat) may also be considered
If BP is not maintained ≤185/110 mm Hg, do not administer alteplase
Management of BP during and after alteplase or other acute reperfusion therapy to maintain BP ≤180/105 mm Hg:
Monitor BP every 15 min for 2 h from the start of alteplase therapy, then every 30 min for 6 h, and then every hour for 16 h
If systolic BP >180–230 mm Hg or diastolic BP >105–120 mm Hg:
Labetalol 10 mg IV followed by continuous IV infusion 2–8 mg/min; or
Nicardipine 5 mg/h IV, titrate up to desired effect by 2.5 mg/h every 5–15 min, maximum 15 mg/h; or
Clevidipine 1–2 mg/h IV, titrate by doubling the dose every 2–5 min until desired BP reached; maximum 21 mg/h
If BP not controlled or diastolic BP >140 mm Hg, consider IV sodium nitroprusside

AIS indicates acute ischemic stroke; BP, blood pressure; IV, intravenous; and LOE, Level of Evidence.

*Different treatment options may be appropriate in patients who have comorbid conditions that may benefit from acute reductions in BP such as acute coronary event, acute heart failure, aortic dissection, or preeclampsia/eclampsia.

Data derived from Jauch et al.¹

3.2. Blood Pressure	COR	LOE	New, Revised, or Unchanged
1. Hypotension and hypovolemia should be corrected to maintain systemic perfusion levels necessary to support organ function.	I	C-E0	New recommendation.

Case #1

- 72 year old woman present to her local hospital with aphasia and mild right sided weakness onset 0700.
- In ED, BP 220/110. Head CT was normal. CTA showed a left middle cerebral artery thrombus. She was started on a nicardipine drip to control her BP. IV tpa was started at 0915.
- Upon request, you arrive at 0930 to transfer the patient to the closest endovascular center.

En Route

- VS: BP 110/50 P 100, R 12, sat 100%
- Neuro exam: Awake, alert, calm but globally aphasic (can't speak or follow commands), but now the right arm is completely paralyzed

Next Step?

- Stop Nicardipine- Allow BP to rise (but not over 180/105)
- Call receiving hospital with changes and await additional instructions

INTERHOSPITAL TRANSFER “DRIP AND SHIP” Complications En Route

1. Secondary Hemorrhage
2. Allergic reaction
3. BP and/or exam fluctuations
4. Aspiration



Signs of secondary intracranial hemorrhage

1. Sudden Severe headache
2. New onset vomiting
3. Sudden decline in neurological condition
4. Sudden spike in BP

- Secure Airway
- Stop vomiting
- Control BP
- Call Receiving facility

Table 8. Management of Symptomatic Intracranial Bleeding Occurring Within 24 Hours After Administration of IV Alteplase for Treatment of AIS

Class IIb, LOE C-EO
Stop alteplase infusion
CBC, PT (INR), aPTT, fibrinogen level, and type and cross-match
Emergent nonenhanced head CT
Cryoprecipitate (includes factor VIII): 10 U infused over 10–30 min (onset in 1 h, peaks in 12 h); administer additional dose for fibrinogen level of <200 mg/dL
Tranexamic acid 1000 mg IV infused over 10 min OR ε-aminocaproic acid 4–5 g over 1 h, followed by 1 g IV until bleeding is controlled (peak onset in 3 h)
Hematology and neurosurgery consultations
Supportive therapy, including BP management, ICP, CPP, MAP, temperature, and glucose control

AIS indicates acute ischemic stroke; aPTT, activated partial thromboplastin time; BP, blood pressure; CBC, complete blood count; CPP, cerebral perfusion pressure; CT, computed tomography; ICP, intracranial pressure; INR, international normalized ratio; IV, intravenous; LOE, Level of Evidence; MAP, mean arterial pressure; and PT, prothrombin time.

Sources: Sloan et al,¹⁴⁹ Mahaffey et al,¹⁵⁰ Goldstein et al,¹⁵¹ French et al,¹⁵² Yaghi et al,^{153–155} Stone et al,¹⁵⁶ and Frontera et al.¹⁵⁷



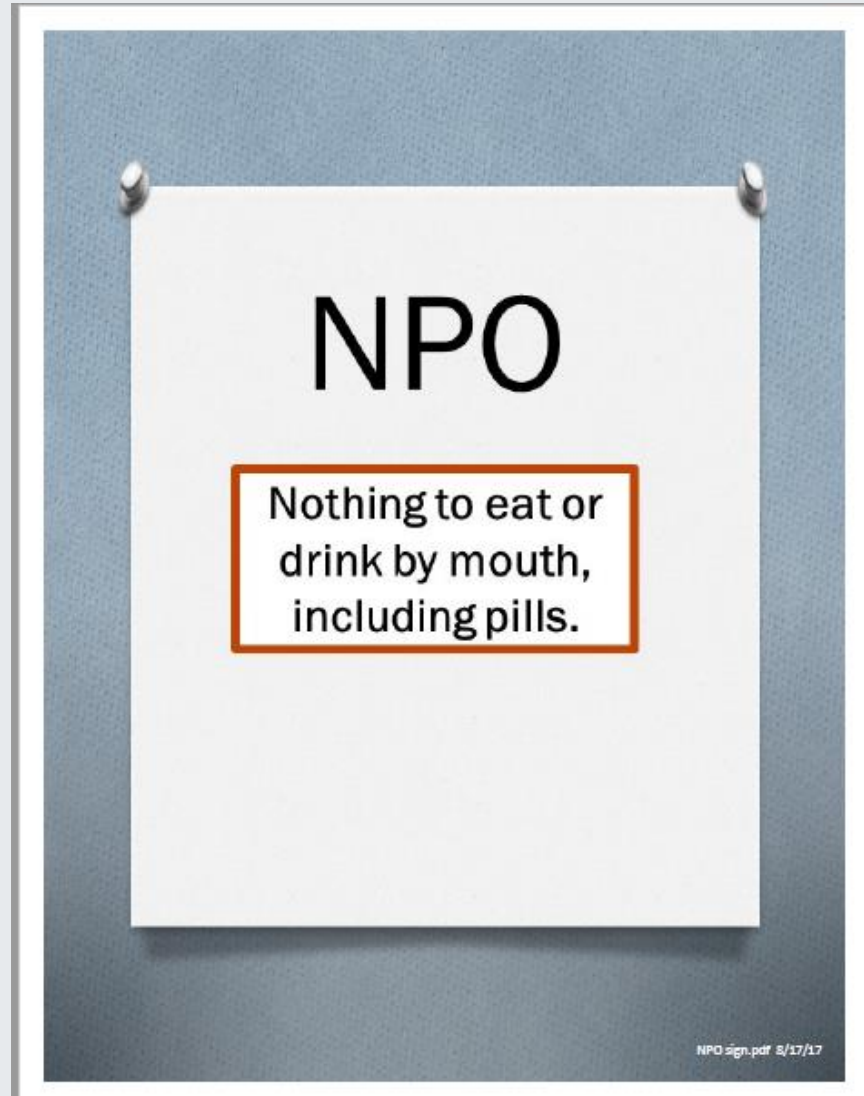
Table 9. Management of Orolingual Angioedema Associated With IV Alteplase Administration for AIS

Class IIb, LOE C-E0
Maintain airway
Endotracheal intubation may not be necessary if edema is limited to anterior tongue and lips.
Edema involving larynx, palate, floor of mouth, or oropharynx with rapid progression (within 30 min) poses higher risk of requiring intubation.
Awake fiberoptic intubation is optimal. Nasal-tracheal intubation may be required but poses risk of epistaxis post-IV alteplase. Cricothyroidotomy is rarely needed and also problematic after IV alteplase.
Discontinue IV alteplase infusion and hold ACEIs
Administer IV methylprednisolone 125 mg
Administer IV diphenhydramine 50 mg
Administer ranitidine 50 mg IV or famotidine 20 mg IV
If there is further increase in angioedema, administer epinephrine (0.1%) 0.3 mL subcutaneously or by nebulizer 0.5 mL
Icatibant, a selective bradykinin B ₂ receptor antagonist, 3 mL (30 mg) subcutaneously in abdominal area; additional injection of 30 mg may be administered at intervals of 6 h not to exceed total of 3 injections in 24 h; and plasma-derived C1 esterase inhibitor (20 IU/kg) has been successfully used in hereditary angioedema and ACEI-related angioedema
Supportive care

ACEI indicates angiotensin-converting enzyme inhibitor; AIS, acute ischemic stroke; IV, intravenous; and LOE, Level of Evidence.

Sources: Foster-Goldman and McCarthy,¹⁵⁸ Gorski and Schmidt,¹⁵⁹ Lewis,¹⁶⁰ Lin et al,¹⁶¹ Correia et al,¹⁶² O'Carroll and Aguilar,¹⁶³ Myslimi et al,¹⁶⁴ and Pahs

Prevent Aspiration



Most frequent errors

- NO family contact obtained
- Failure to verify total and remaining dose
- Lost tpa in tubing
- Long tpa interruptions
- Lack of BP checks
- Lack of Neuro checks
- Failure to maintain BP within parameters
- Failure to call ahead with status changes

Case # 2

32 year old previously healthy man presents to her local hospital with sudden severe headache without a history of trauma. Initially his BP is elevated 240/120. Head CT reveals a “head bleed”. He has severe headache but GCS is 14 and he is neurologically intact. He received one dose of Labetolol 20mg iv and his BP drops to 160/80. You are transferring a higher level of care to a hospital 2 hours away

What kind of head bleed?

Intracerebral hemorrhage (ICH)

Focal symptoms, risk for seizure, hydrocephalus or worsening neurological symptoms

Maintain BP < 150/ 90, q 5 BP until stable than 15 min

Subarachnoid hemorrhage (SAH)-

Usually non-focal, severe headache and meningismus

Maintain BP < 160/90, q 5 BP until stable then 15 min

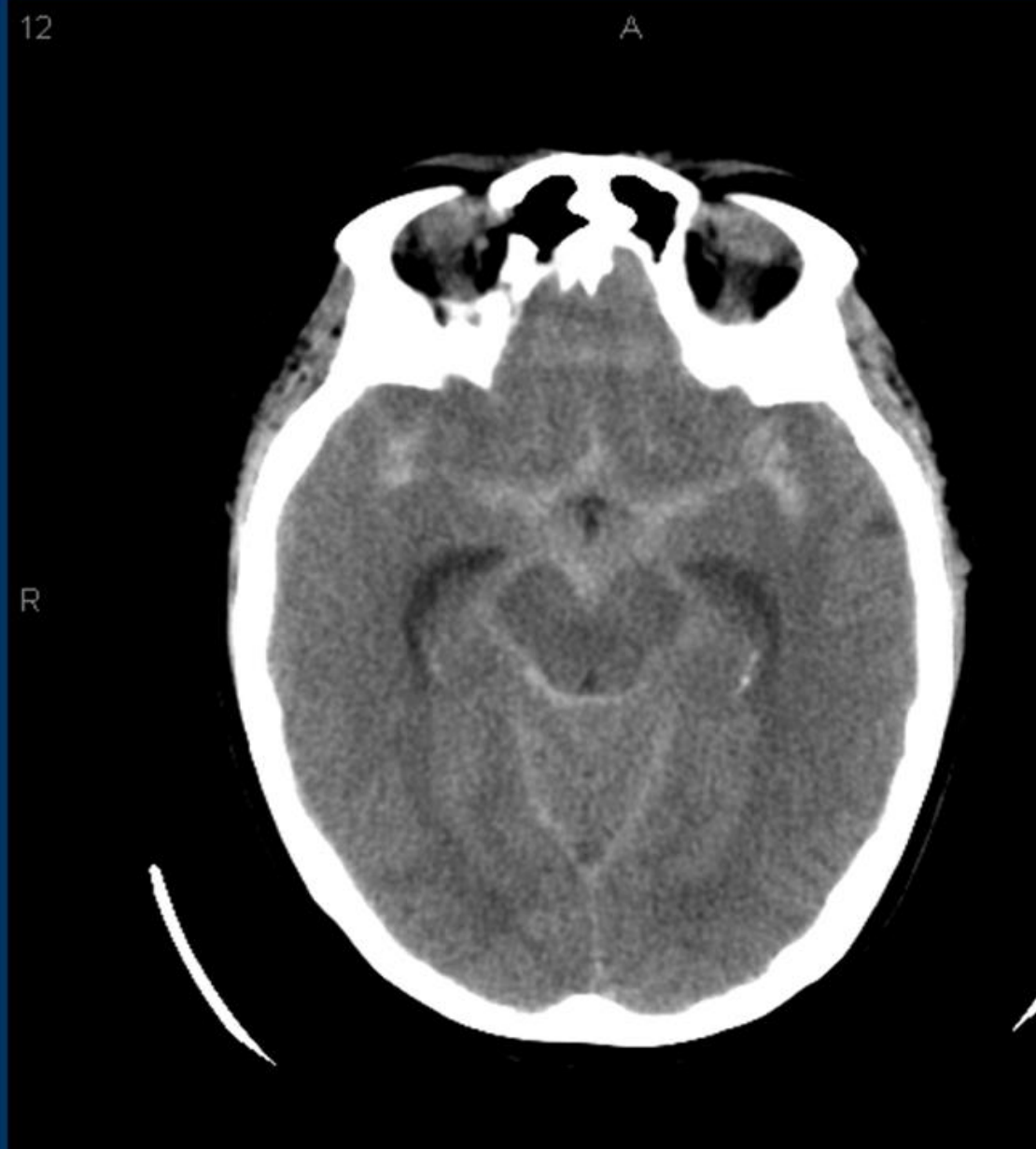
Pain control, low stimulation, avoid Valsalva and vomiting

Re-bleeding (aneurysm rupture) risk is high with poor outcomes

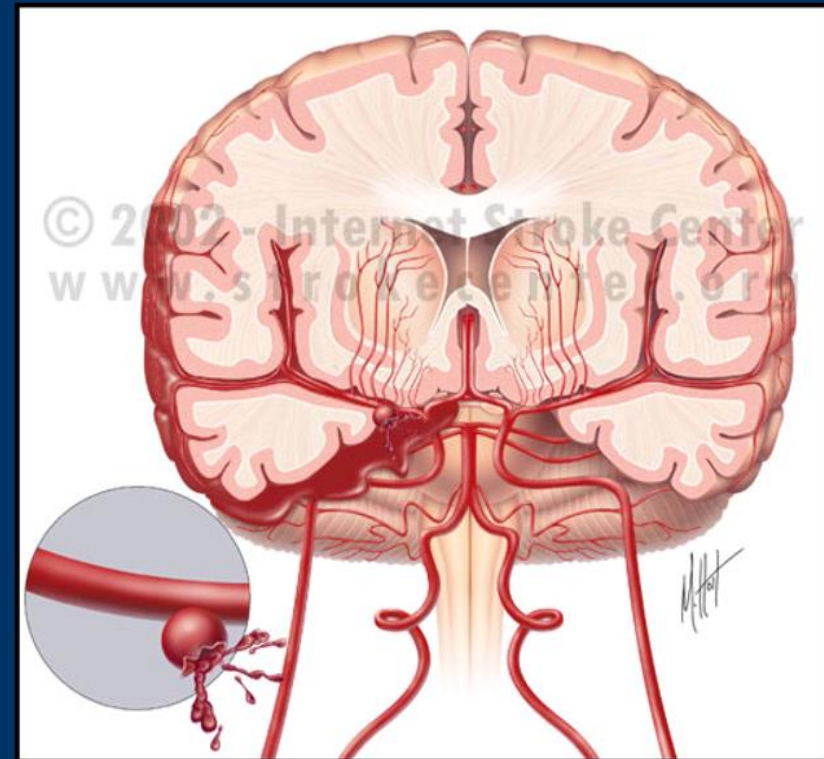
Subdural Hematoma or Other traumatic hemorrhage

Covered under head trauma guidelines

Classic “Star Pattern” of Subarachnoid Hemorrhage

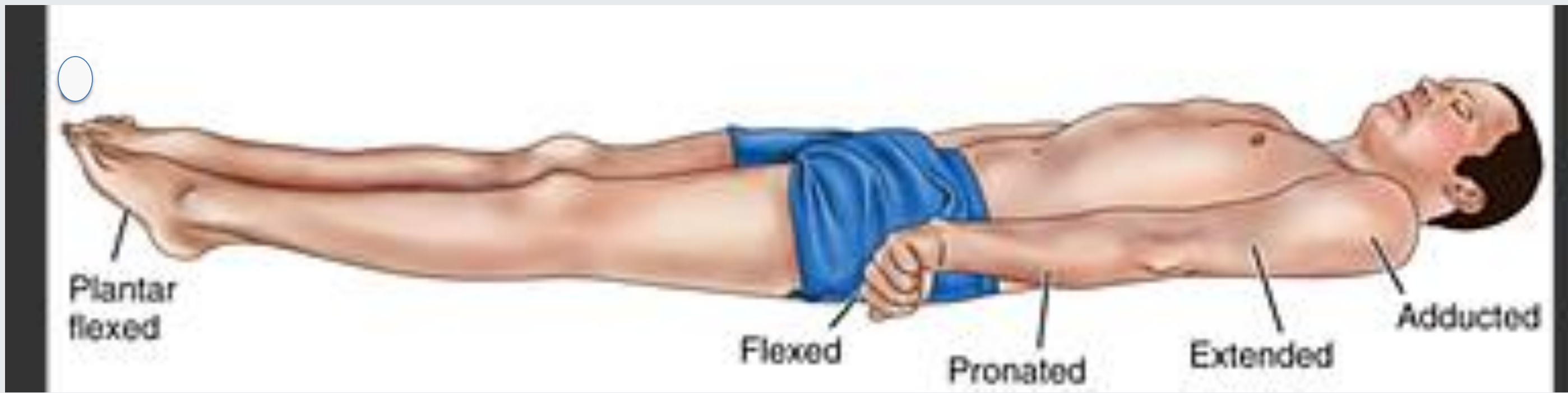


Aneurysmal bleed



En Route

- VS: BP 175/ 95 P100
 - ? BP Goal (for SAH <140/90)
- Neuro examination- Sleepy but arouses quickly, is oriented flows commands and moves all 4 extremities
- Then....
- Suddenly he begins vomiting profusely

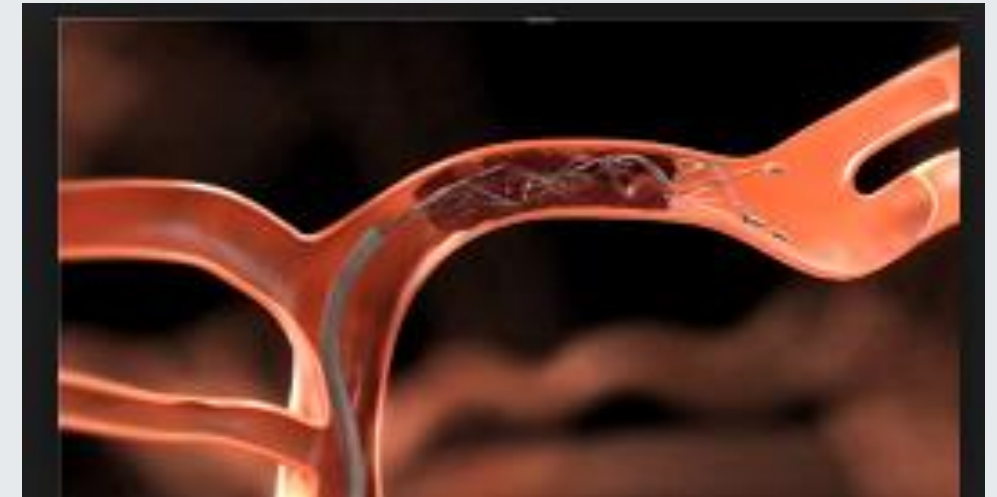
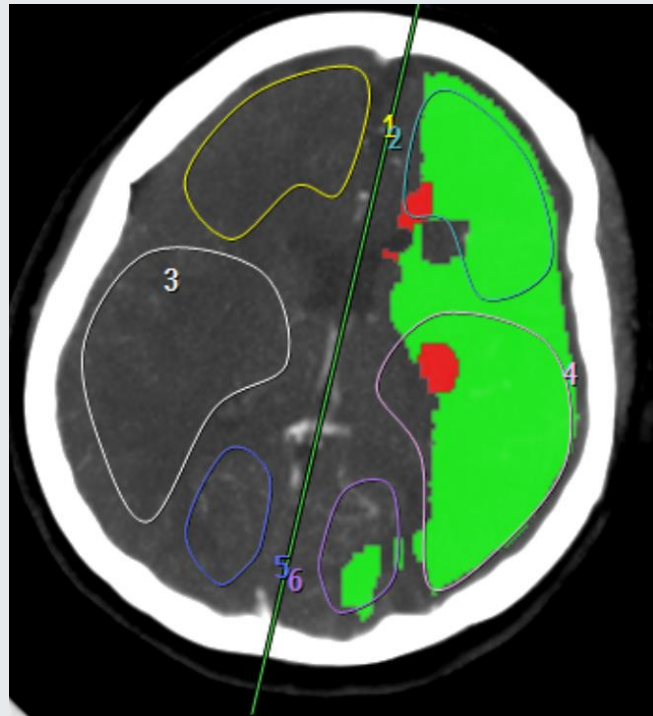


Emergent stabilization

- ABCs
- Rapid Sequence intubation
- CALL receiving facility with change
 - BP control
 - Vomiting control
 - Seizure Control
 - Mannitol



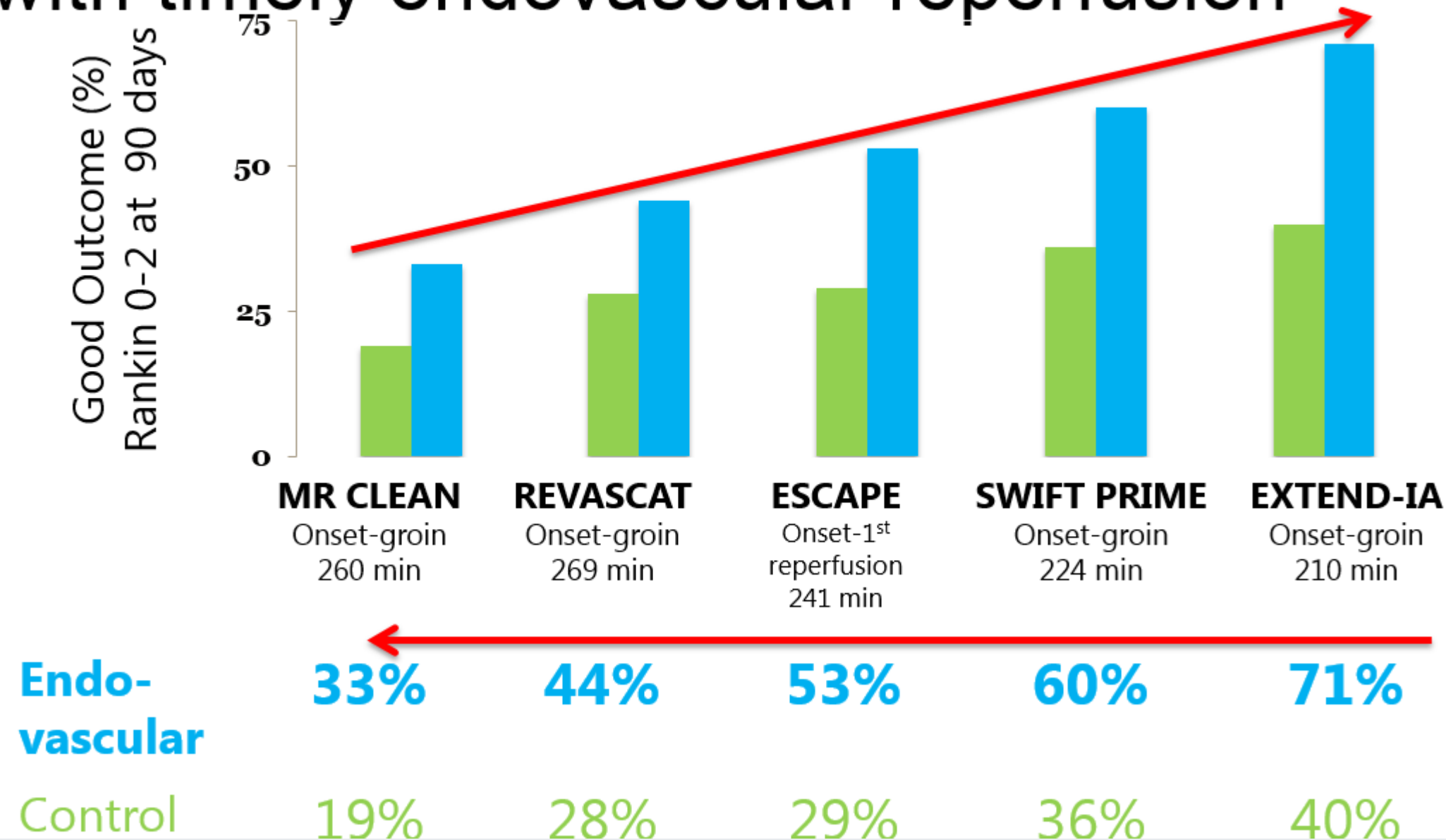
ELVO ↔ STEMI





LAST SEEN WELL < 6 hours

Patients with LVO have better outcomes with timely endovascular reperfusion

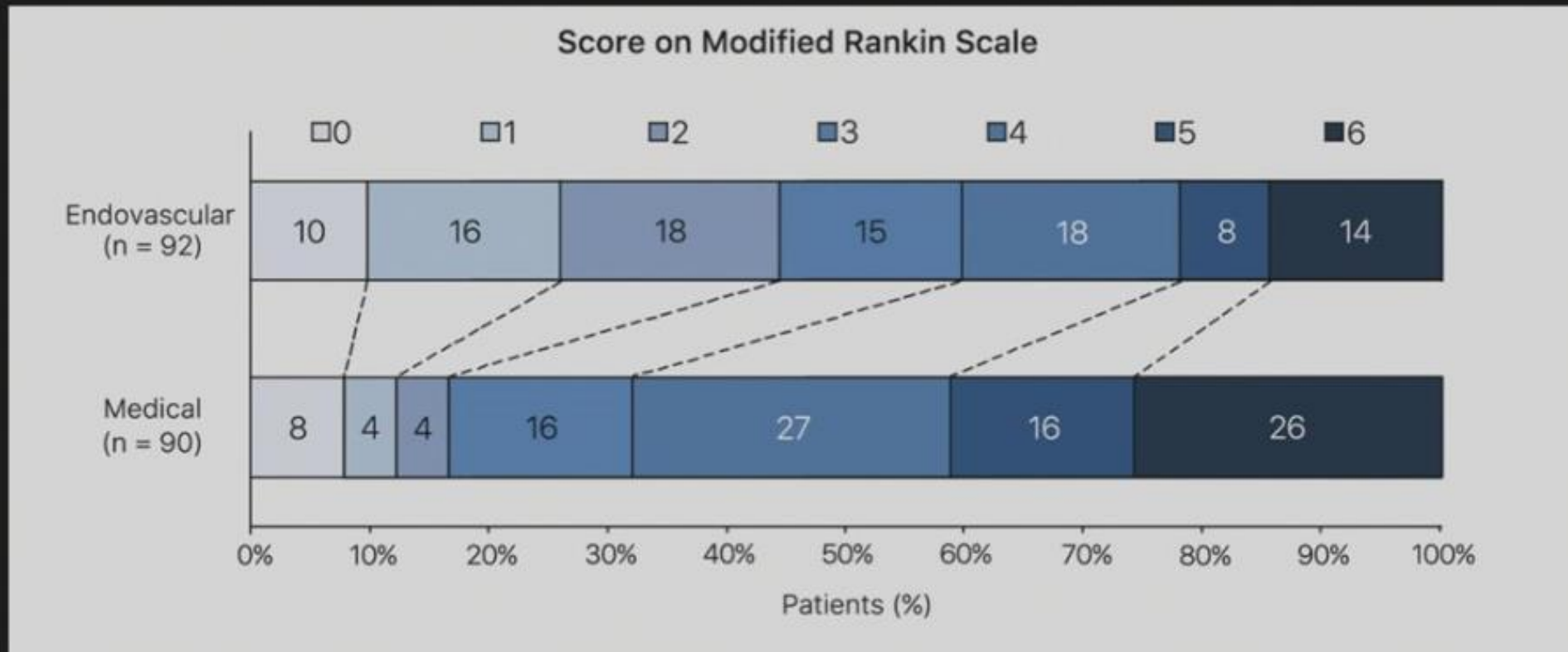




DAWN Versus DEFUSE-3 Eligibility

	DAWN	DEFUSE-3
Upper Age Limit	None	90 years
NIHSS	10+	6+
Pre-Stroke Disability	mRS 0-1	mRS 0-2
Time	6 to 24 hours	6 to 16 hours
Advanced Imaging Selection	Core <u>CIM (Clinical Imaging Mismatch)</u> ≥ 80 years old if core ≤20 cc < 80 years old: <ul style="list-style-type: none">• NIHSS 10-19: ≤30 cc core• NIHSS ≥20: 31-50 cc	Core and Penumbra <u>TMM (Target Mismatch)</u> Core <70 ml Mismatch ≥1.8 Mismatch volume ≥15 ml

Results: Primary Outcome



Odds ratio: 2.8 (1.6 - 4.7) P<0.0001
 Adjusted odds ratio: 3.4 (2.0 - 5.8) P=0.0004
 Number needed to treat: 2



AHA/ASA Guideline

2018 Guidelines for the Early Management of Patients With Acute Ischemic Stroke

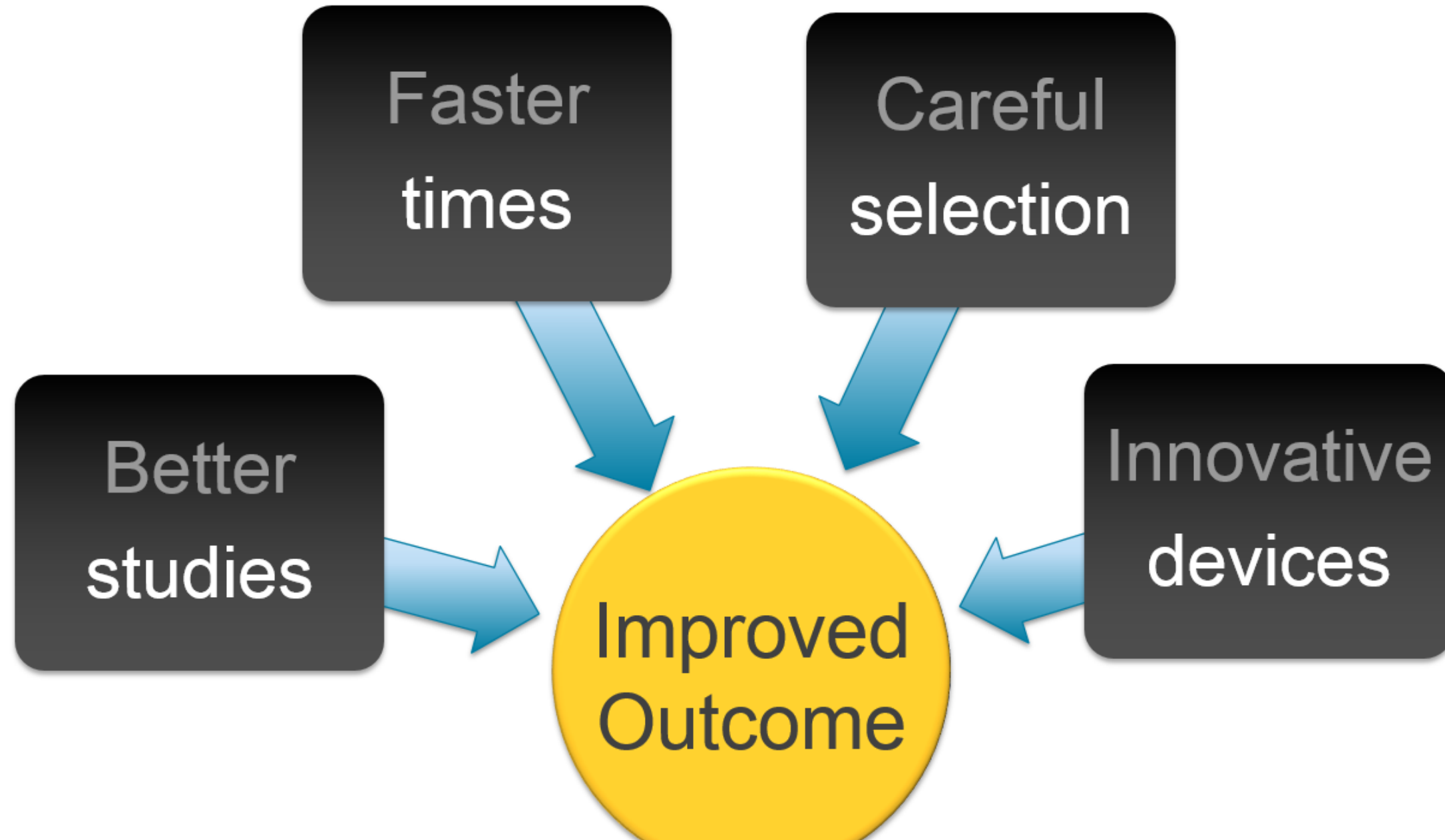
A Guideline for Healthcare Professionals From the American Heart Association/American Stroke Association

Reviewed for evidence-based integrity and endorsed by the American Association of Neurological Surgeons and Congress of Neurological Surgeons

Endorsed by the Society for Academic Emergency Medicine

3.7. Mechanical Thrombectomy (Continued)	COR	LOE	New, Revised, or Unchanged
7. In selected patients with AIS <input type="text" value="within 6-24"/> of last known normal who have LVO in the anterior circulation and meet other DAWN or DEFUSE 3 eligibility criteria, mechanical thrombectomy is recommended.	I	A	New recommendation.
8. In selected patients with AIS within 6 to 24 hours of last known normal who have LVO in the anterior circulation and meet other DAWN or DEFUSE 3 eligibility criteria, mechanical thrombectomy is recommended.	IIa	B-R	New recommendation.

Renewed Focus on Work Flow

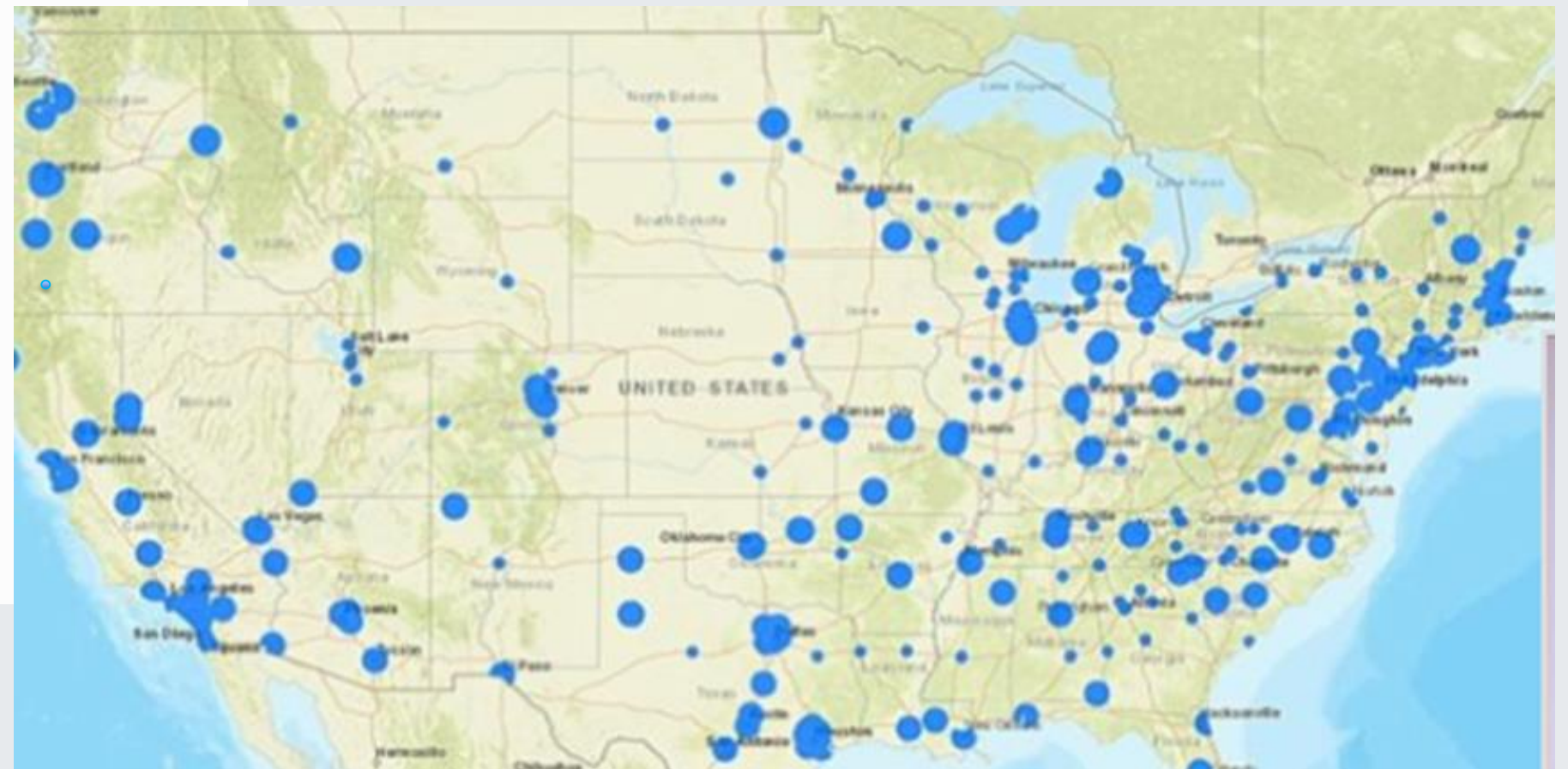


US Stroke Centers and Endovascular Treatment Centers

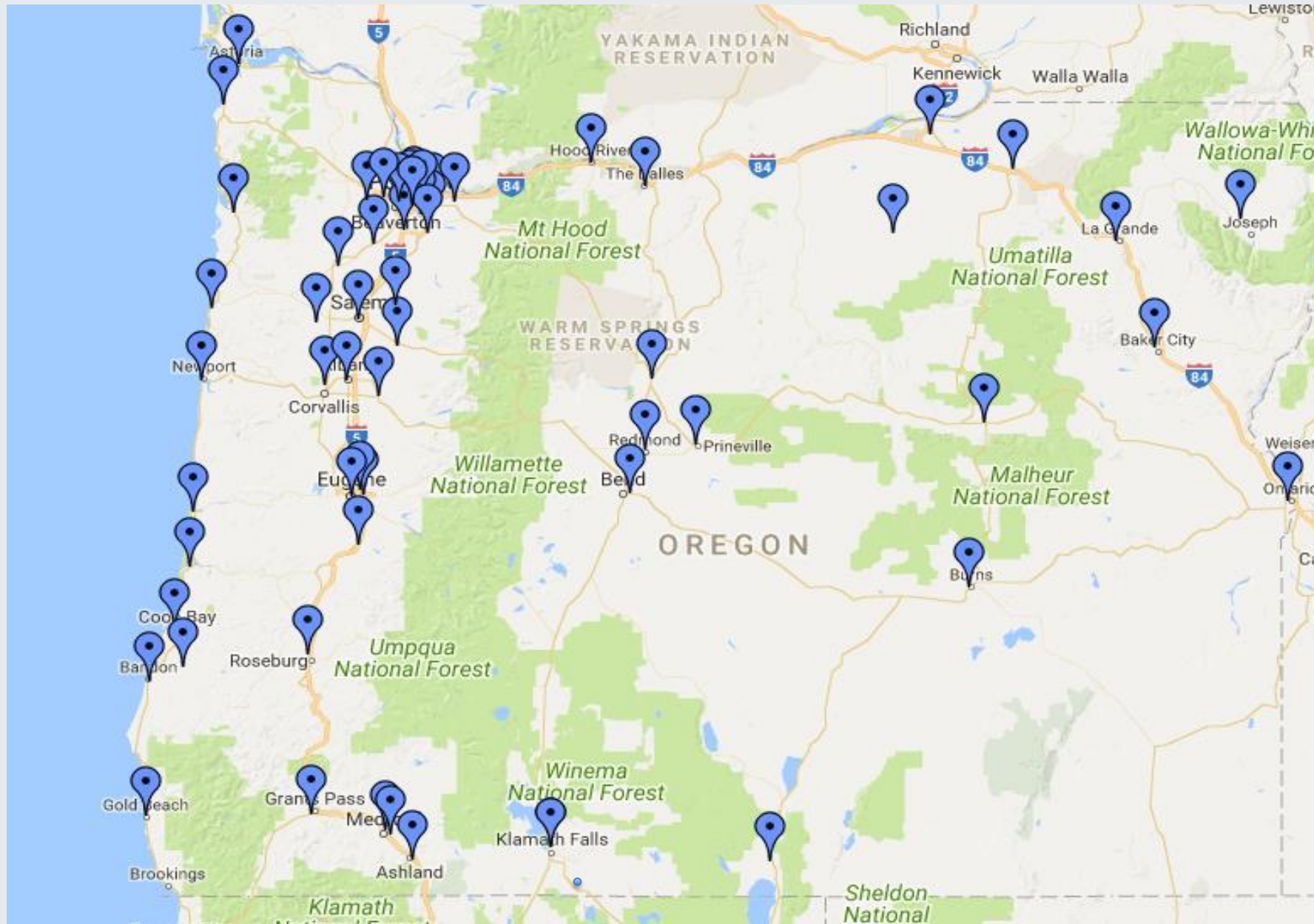
- 1645 stroke centers
 - 1068: non-EVT
 - **577: EVT** capable
 - 2016 Medicare updates volumes now indicate **797**

- Ground access:
 - 30 minutes: 137 million/44%
 - 60 minutes: 195 million/63%
 - 90 minutes: 234 million/76%

- Air access:
 - 30 minutes: 172 million/56%
 - 60 minutes: 268 million/87%
 - 90 minutes: 296 million/96%



Oregon Hospitals



Endovascular Treatment Centers

Portland Metro

Kaiser Sunnyside

Legacy Emanuel

Legacy Meridian Park

OHSU

PeaceHealth SW- Vancouver WA

Providence Portland

Providence St Vincent

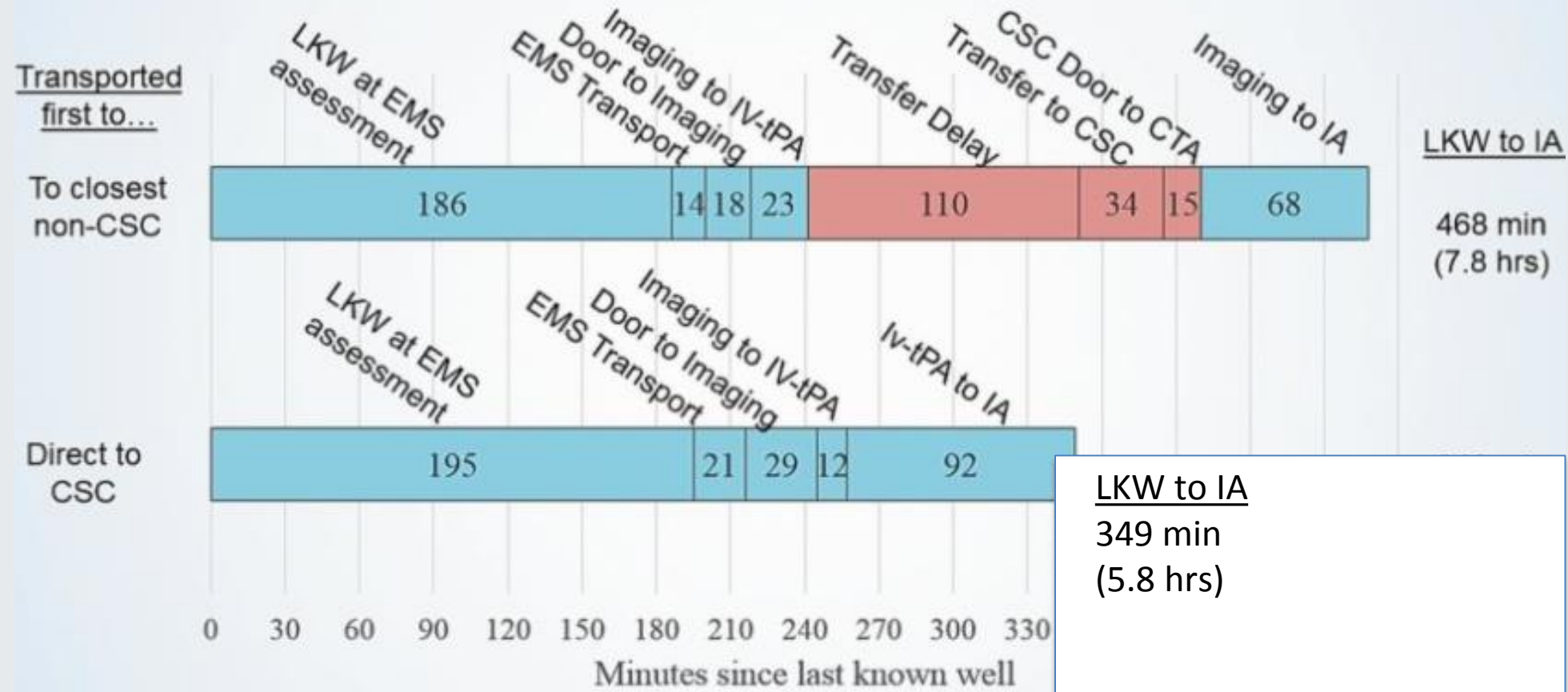
Central and Southern Oregon

PeaceHealth Riverbend- Springfield

Providence Medford

St Charles- Bend

Average time intervals of patients LKW < 6 hours EMS arrival



Time Interval data estimated using: Saver et al. JAMA. 2016 Sep 27;316(12):1279-81

STROKE SEVERITY SCALES

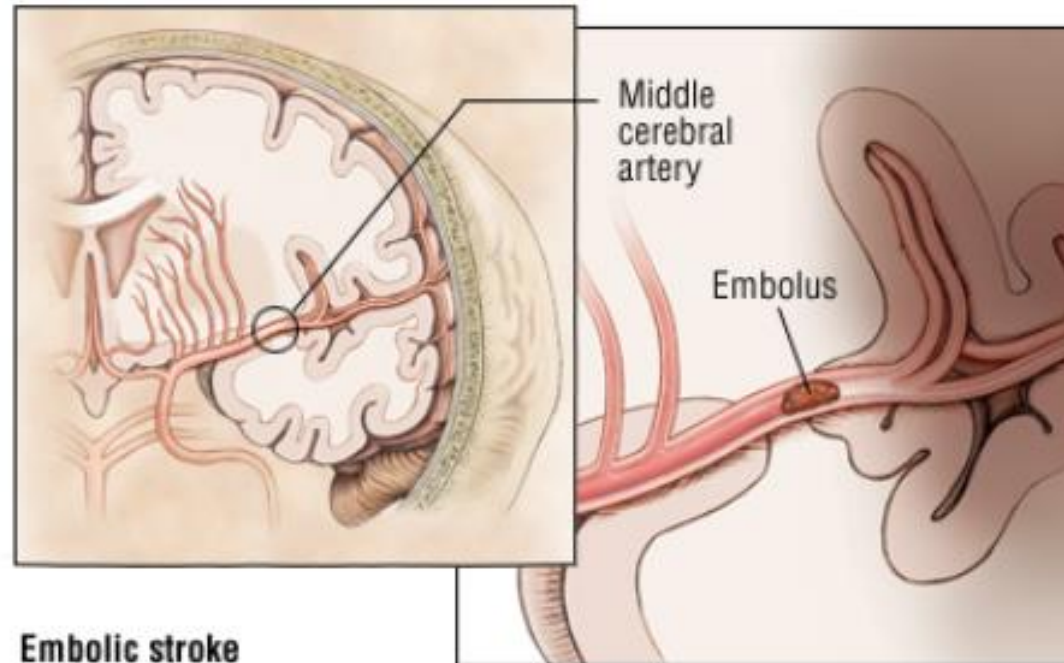
- **RAPID ARTERIAL OCCLUSION EVALUATION [RACE]**
- **LOS ANGELES MOTOR SCALE [LAMS]**
- FIELD ASSESSMENT STROKE TRIAGE FOR EMERGENCY DESTINATION [FAST-ED]
- PREHOSPITAL ACUTE STROKE SEVERITY SCALE [PASS], AND
- **CINCINNATI PREHOSPITAL STROKE SEVERITY SCALE [CPSSS]) = CSTAT**
- MARIA PREHOSPITAL STROKE SCALE (MPSS)
- RECOGNITION OF STROKE IN THE EMERGENCY ROOM (ROSIER)
- 3-ITEM STROKE SCALE (3I-SS)
- VAN
- SHORTENED VERSIONS OF THE NIHSS (SNIHSS-1, SNIHSS-5, AND SNIHSS-8)
- G-FAST
- MELBOURNE AMBULANCE STROKE SCREEN (MASS)
- MEDIC PREHOSPITAL ASSESSMENT FOR CODE STROKE (MED PACS)
- ONTARIO PREHOSPITAL STROKE SCREENING (OPSS)

At this time, there is insufficient evidence to recommend one scale over the other, or a specific threshold of additional travel time for which bypass of a PSC or ASRH is justifiable.

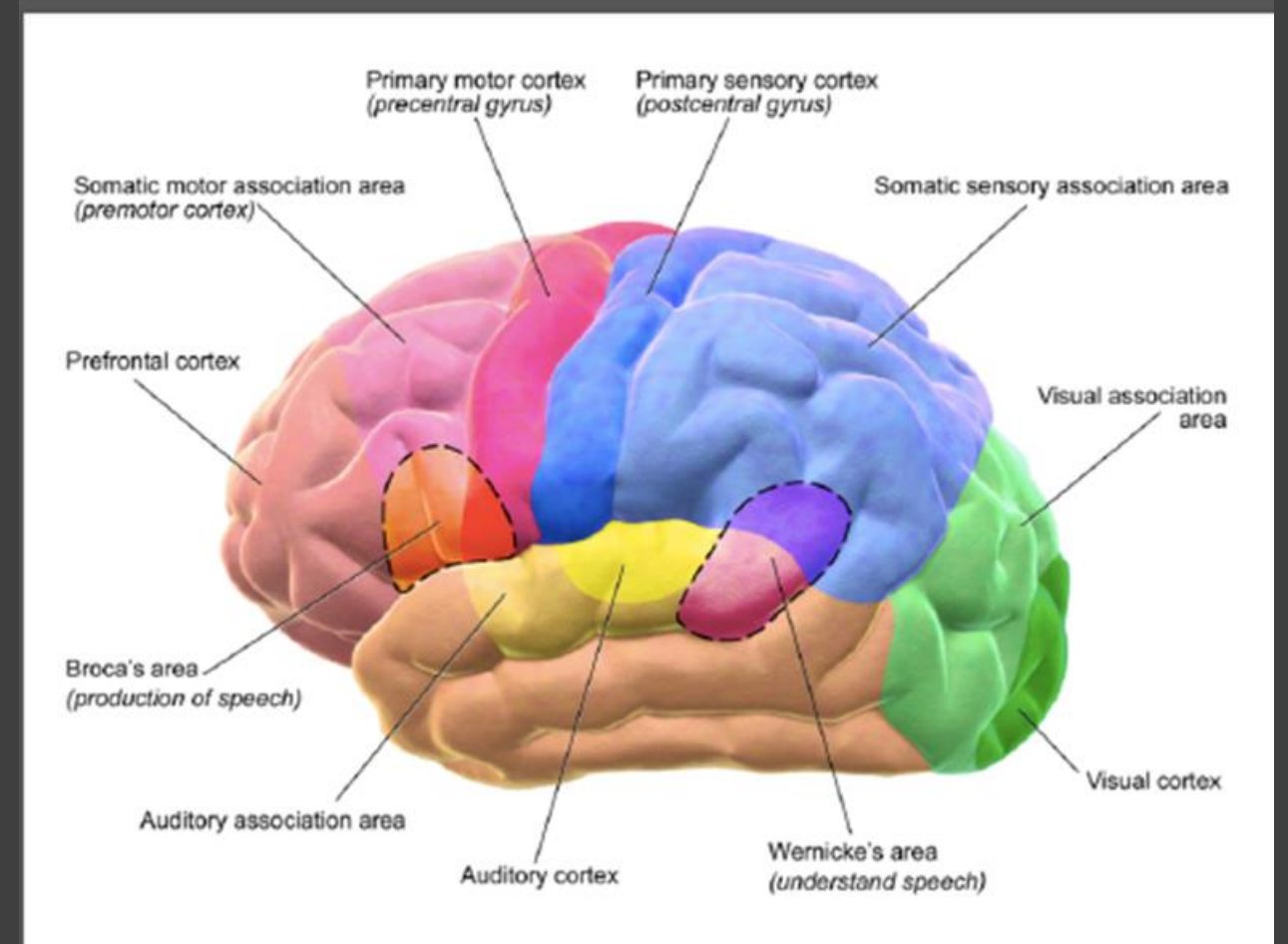




Cortical Signs



Embolic stroke

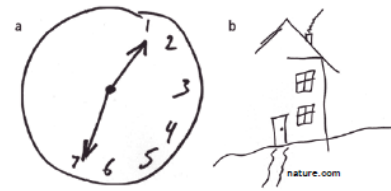


What is an ELVO?
EMERGENT LARGE ARTERY OCCLUSION

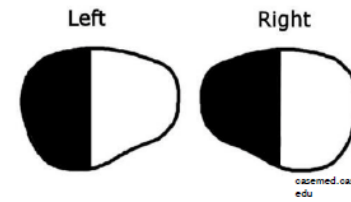
• Aphasia



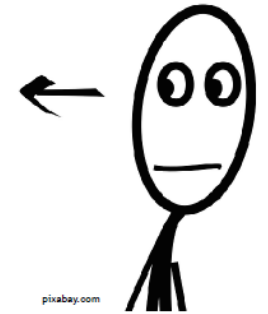
• Neglect



• Visual field cut



• Gaze palsy



Cortical Findings

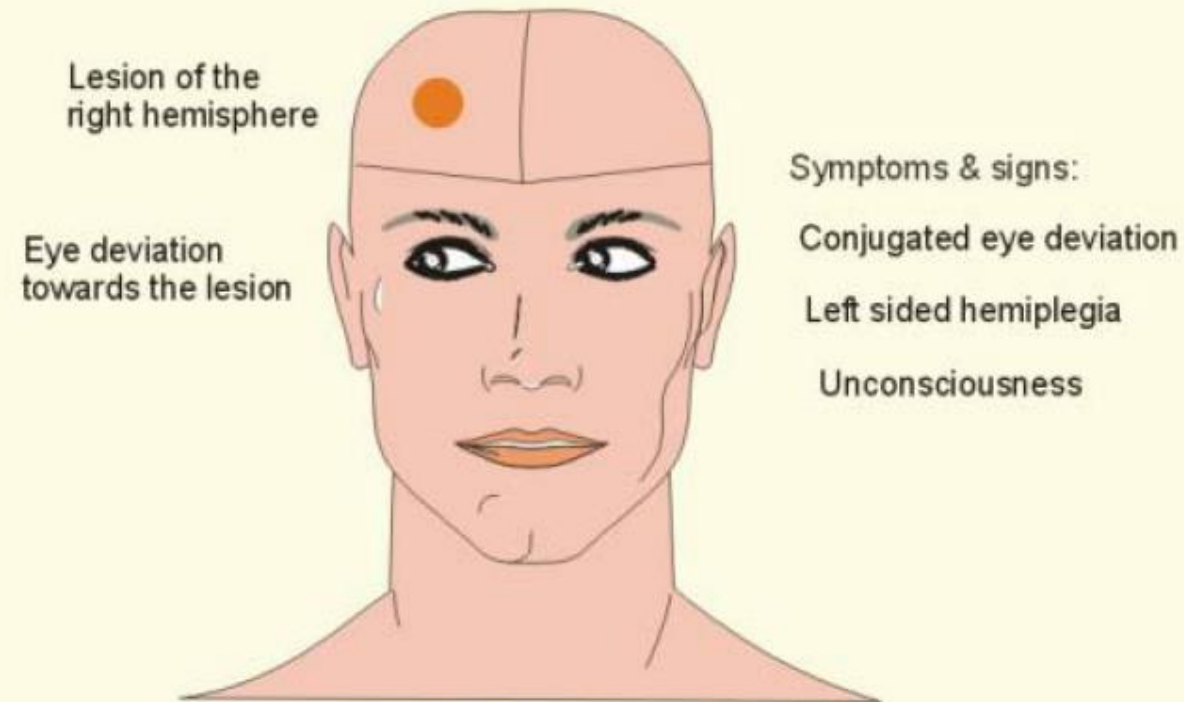
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C-STAT – CINCINNATI STROKE TRIAGE ASSESSMENT TOOL

	Points	
Gaze Preference – Deviation of eyes away from side of weakness, toward side of stroke.		
Absent	0	
Present	2	
Arm Weakness - Cannot hold up arm(s) for 10 seconds		
Absent	0	
Present	1	
Level of Consciousness - Incorrectly answers at least one of two LOC questions AND does not follow at least one of two commands.		
Absent	0	
Present	1	

***** POSITIVE C-STAT SCORE IS ≥ 2 *****

Thrombo-embolic Lesion
of The Right Middle Cerebral Artery



WHY NOT JUST TRANSFER

ALL STROKES TO ENDOVASCULAR TREATMENT CENTER?

- Iv tpa remains the mainstay for most ischemic strokes
- LVO make up ~10 % of all acute stroke
- Many tertiary stroke center have capacity issues
- Our ability to predict LVO using in-the-field scales is limited
- Long transport times could exclude some patient from getting iv tpa

ANSWER?

**DEVELOP LOCAL
AND REGIONAL
TRIAGE
PROTOCOLS**

PORTLAND METRO

PPSS - PORTLAND PREHOSPITAL STROKE SCREEN			
1. Age over 45 years	Yes	No	
2. No prior history of seizure disorder	Yes	No	Unknown
3. New onset of neurologic symptoms in last 24 hours	Yes	No	Unknown
4. Patient was ambulatory at baseline (prior to event)	Yes	No	Unknown
5. CBG between 60 & 400	Yes	No	
Neurological examination	Normal	Abnormal	
FACIAL SMILE/GRIMACE (ask patient to smile/show teeth) <u>Normal:</u> both sides of face move equally well <u>Abnormal:</u> one side of face does not move as well as the other	Yes	Right	Left
ARM DRIFT (patient closes eyes and hold both arms out palms up) <u>Normal:</u> both arms move the same or do not move at all <u>Abnormal:</u> one arm does not move or drifts down compared to other	Yes	Right	Left
HAND GRIP (have patient squeeze both hands simultaneously) <u>Normal:</u> equal grip strength <u>Abnormal:</u> unequal grip strength	Yes	Right	Left
SPEECH (have patient repeat "You can't teach an old dog new tricks") <u>Normal:</u> no difficulty in repeating <u>Abnormal:</u> patient has difficulty finding words, speaks in long meaningless sentences, and/or cannot understand or follow simple verbal instructions	Yes		
If questions 1 – 5 are all answered "Yes" or "Unknown" and at least 1 of the 4 neurological examination findings are abnormal the patient is considered to have a POSITIVE screen. Continue to C-STAT evaluation.			

Treatment:

- A. Start Oxygen per *Airway Management* protocol.
- B. Monitor vital signs and oxygen saturation.
- C. Check CBG and treat per *Altered Mental Status and Coma* protocol.
- D. Complete **Portland Prehospital Stroke Screen**.
- E. If PPSS is positive, perform C-STAT evaluation.
- F. If PPSS and C-STAT is positive, transport to nearest Intervention Stroke Center if it does NOT add more than 20 minutes of transport time. If the difference is greater than 20 minutes, transport to nearest Primary Stroke Center.
- G. If PPSS is positive and C-STAT is negative, transport to nearest Primary Stroke Center.
- H. Establish IV access (16-18 gauge in proximal site if possible).
- I. Transport patient in supine position with < 15 degree head elevation if tolerated.
- J. Document serial neurologic examinations.

C-STAT – CINCINNATI STROKE TRIAGE ASSESSMENT TOOL

	POINTS	DEFINITION
GAZE		Condition where both eyes move differently to each other.
Absent	0	
Present	2	
ARM WEAKNESS		Cannot hold up arm(s) for 10 seconds.
Absent	0	
Present	1	
LEVEL OF CONSCIOUSNESS		Incorrectly answers at least one of two LOC questions <u>AND</u> does not follow at least one of two commands.
Absent	0	
Present	1	
*** C-STAT positive is defined as a score ≥ 2 ***		

Specific Precautions:

- A. Do not treat hypertension or administer aspirin.
- B. Acute interventions, if indicated, generally must begin within 4.5 hours of symptom onset. All potential stroke patients should go to an appropriate stroke center.

Case # 3

13:10 79 y/o healthy woman while walking with her husband had a witnessed collapsed with left hemiplegia and rightward gaze deviation

1311 911 activated

1318 EMS arrives – Primary survey and VS ok

Cincinnati stroke scale is positive

? CSTAT

? Where to transport

Case # 3

WILL PATIENT ARRIVE at EVT center within 2 hours from LSW?

13:24 Medical air transport contacted

13:25 Patient loaded in ambulance and began driving to rendezvous location (high school football field)

13:47 Rendezvoused with helicopter

1404 Lift-Off

14:25 Helipad Arrival at EVT center ED

14:34 ED arrival

NIHSS 19

Cortical signs:

Right-sided eye deviation

Left-sided hemiplegia

Neglect

Left-sided visual field cut

1442 CT: Hyperdense MCA

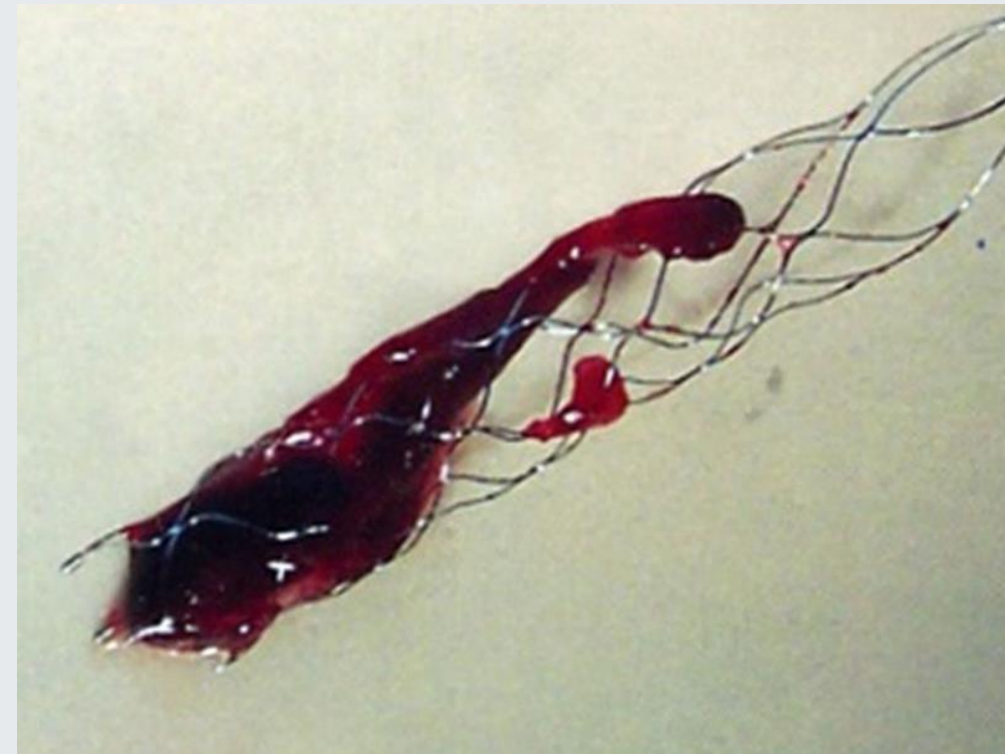
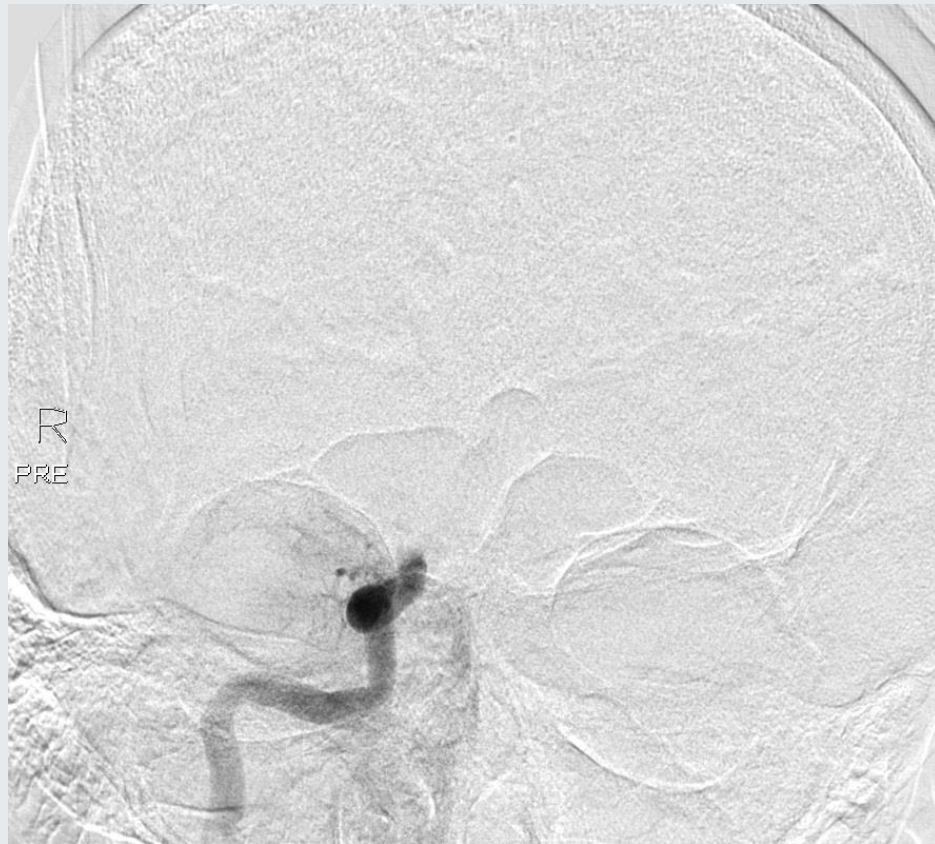
1443 CT Angiography: Right ICA/MCA occlusion

14:57 IV tPA (Door to Needle: 23 minutes; Onset to Needle Time 1 hour 47 minutes)

14:49 ELVO Alert initiated

Case # 3

- 15:08 Cath Lab arrival
- 15:10 Groin puncture (door to groin: 36 minutes)
- Right ICA terminus occlusion



- Second pass revascularization 1536



Case # 3

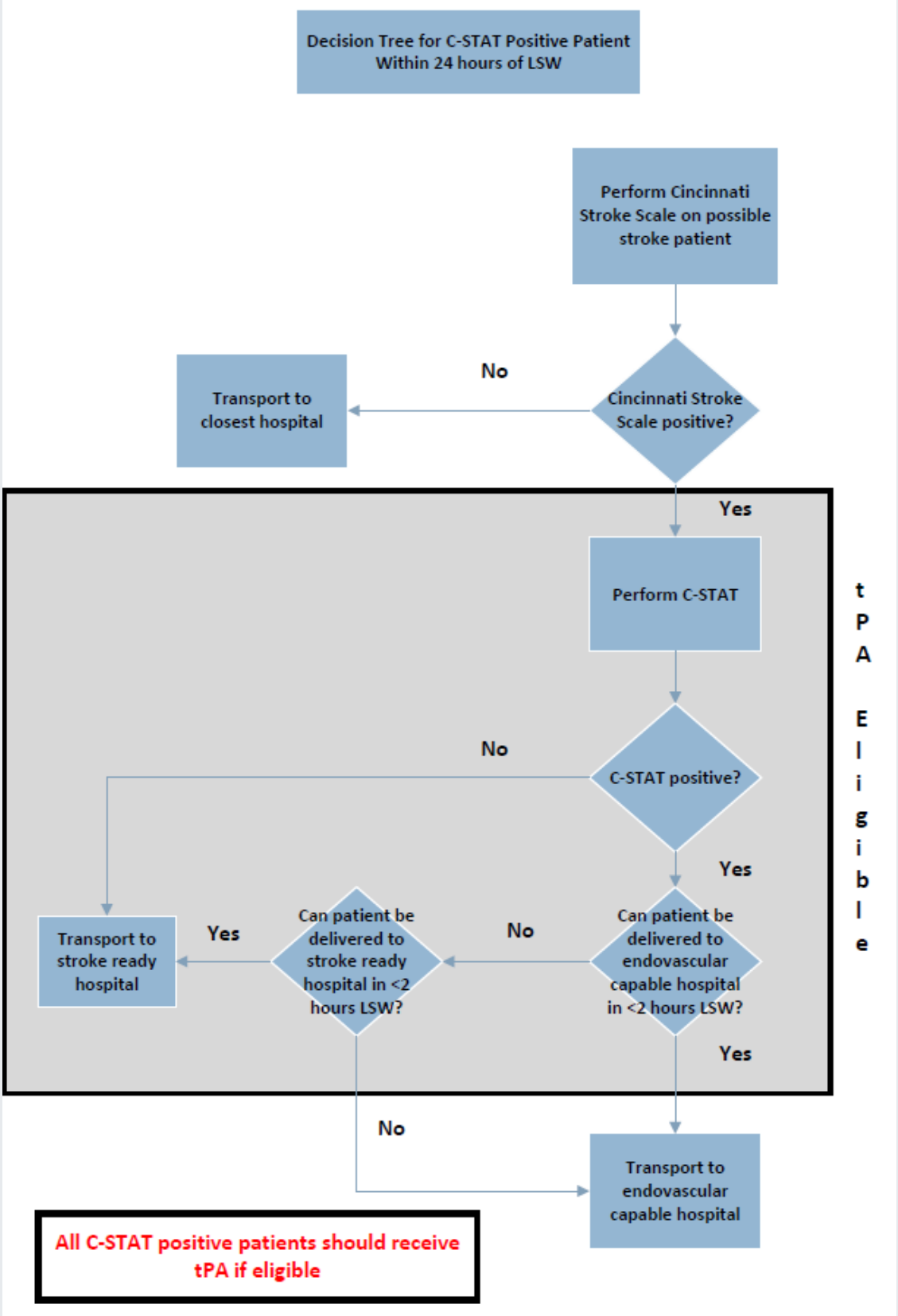


- LSW to revascularization (2 hours and 26 minutes)

Discharged home day 3 with mild residual neglect

Acute ischemic strokes patient who are C-STAT positive and up to **24 hours** from LSW should be treated as a Code 3.

All C-STAT positive patients should receive IV tPA if eligible.





ACUTE STROKE CHAIN OF SURVIVAL

Patient has sudden stroke symptoms

911 dispatch
EMS transport

Stroke Ready Hospital

ED assess
Head CT

Iv tpa initiated

Transport to EVT Center

CTA/CTP

To Cath lab
Mechanical thrombectomy



Poor communication, inefficiencies, travel delays



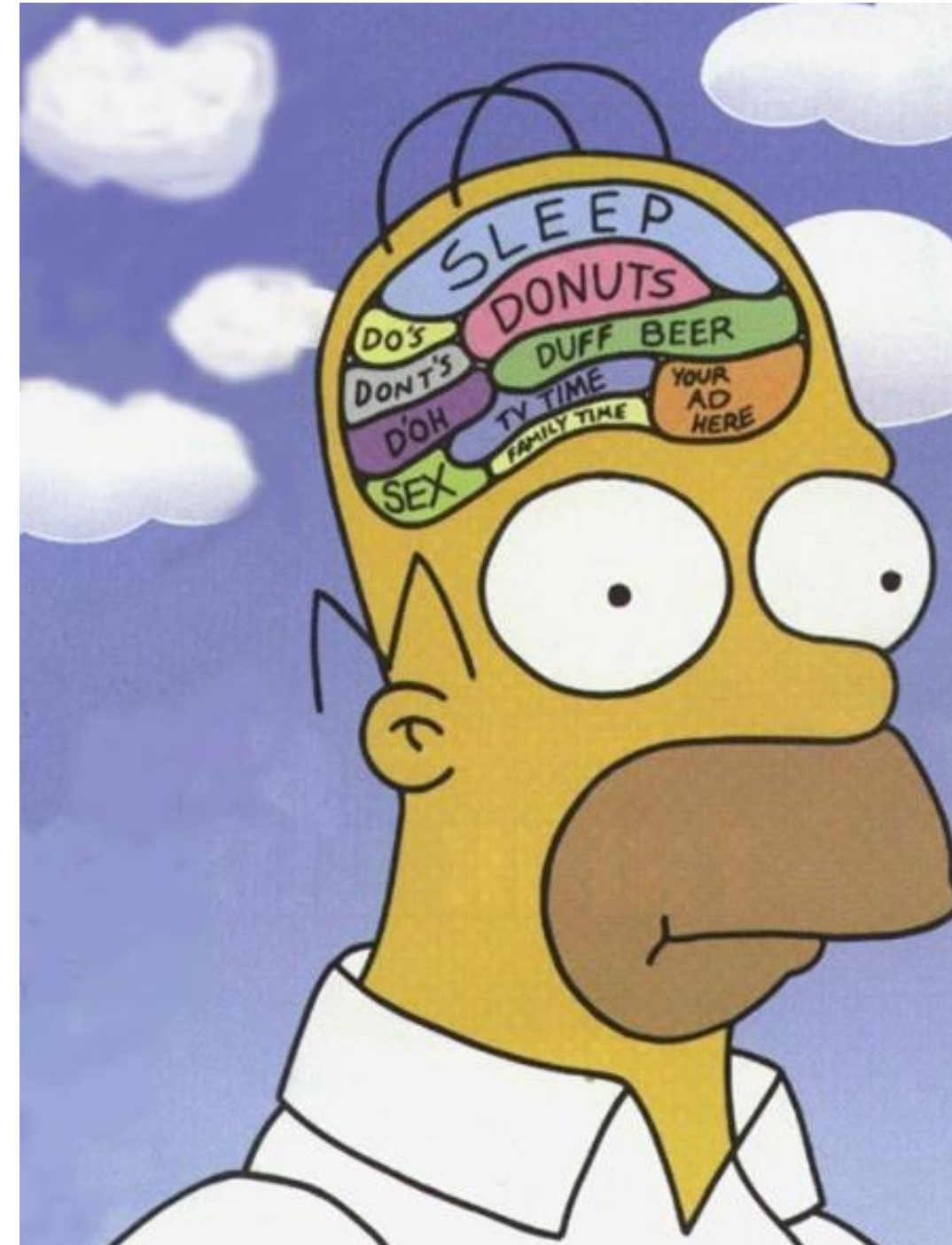
Time

1 hr

2 hrs

3 hrs

TIME IS BRAIN



Questions

- Elaine Skalabrin, MD-Stroke Program Medical Director
- Diane Soik, NP, MSN,ANP- Stroke Program Manager

RESOURCES ONLINE:

- <https://www.peacehealth.org/RBstroke>
- <https://www.peacehealth.org/EMSstroke>

Next EMS Grand Rounds

Wednesday, March 21, 2018 from

1100-1200

Trauma Update-TXA, Whole blood
in EMS, tourniquets, Stop-the-bleed

Free sign up at

www.peacehealth.org/egr

Thanks for
Attending



The American Heart Association/American Stroke Association recognizes this hospital for achieving 85% or higher compliance with all Get With The Guidelines®-Stroke Achievement Measures and 75% or higher compliance with five or more Get With The Guidelines®-Stroke Quality Measures for two or more consecutive years and achieving Thrombolytic Therapy \leq 60 minutes 75% and \leq 45 minutes 50% or more of applicable acute ischemic stroke patients to improve quality of patient care and outcomes.