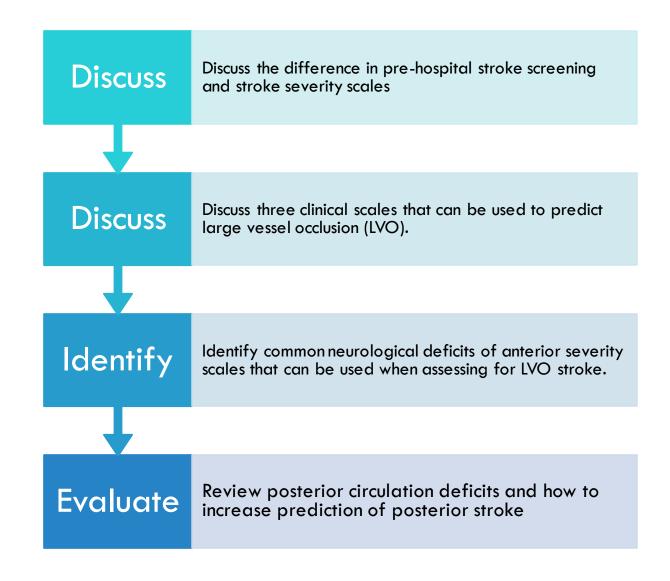# PREHOSPITAL STROKE ASSESSMENT TOOLS AND BENEFITS

Debbie Summers MSN, RN, AHCNS-BC, CNRN, SCRN

Saint Luke's Marion Bloch Neuroscience Research

OBJECTIVES

Discuss — Discuss the difference in pre-hospital stroke screening and stroke severity scales

Discuss — Discuss three clinical scales that can be used to predict large vessel occlusion (LVO).

Identify — Identify common neurological deficits of anterior severity scales that can be used when assessing for LVO stroke.

Evaluate — Review posterior circulation deficits and how to increase prediction of posterior stroke

FASTER STROKE TREATMENT IS BETTER TREATMENT

Patients treated within 60 minutes experience improved outcomes, including lower in-hospital mortality and reduced long-term disability
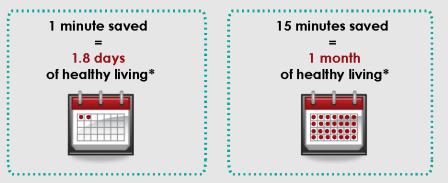
GC Fonarow et al. JAMA. 2014;311(16):1632-1640
Saver et al. JAMA. 2013;309(23):2480-8

Save a Minute, Save a Day[1]

Did you Know?
Quicker treatment for stroke adds healthy days to your life.

1 minute saved
=
1.8 days
of healthy living*

15 minutes saved
=
1 month
of healthy living*

Learn how to recognize a stroke.
If you think you are having a stroke, call 9-1-1 immediately!

SPOT A STROKE

F A S T

FACE DROOPING   ARM WEAKNESS   SPEECH DIFFICULTY   TIME TO CALL 911

Stroke Warning Signs and Symptoms

* Ischemic stroke
1 AHA Stroke Journal – Meretoja, March 2014

American Heart Association | American Stroke Association

Together to End Stroke™

@2014 American Heart Association/American Stroke Association

DEFINITIONS

SENSITIVITY

• Sensitivity also called the true positive predictive rate (PPR) measures the proportion of actual positives that are correctly identified. Refers to a test's ability to designate an individual with disease as positive. A highly sensitive test means that there are few false negative results, and thus fewer cases of disease are missed.

SPECIFICITY

• Specificity also called the true negative predictive rate (NPR) measures the proportion of actual negatives that are correctly identified. The percentage of healthy people who are correctly identified as not having the condition. Specificity avoids false positives

PRE-HOSPITAL STROKE SCALES

Name	Location	PPV	NPV (Range)
Cincinnati Prehospital Stroke Scale (CPSS) – (Face, Arm, Speech) 1997	Cincinnati, USA	72%v - 1/3 findings 85% - if 3/3 findings	(57-96)
FAST – (Face, ARM, Speech, Time) 1998	Newcastle, UK	(73-98) - Range	(45-98) - Range
LA Prehospital Stroke Scale (LAPSS) 2000 (Hx of seizure, age ≥ 45, pre-stroke baseline, BG 60-400, asymmetry-unilateral weakness)	Los Angeles, USA	91	97

PPV = Positive Predictive Value
NPV = Negative Predictive Value

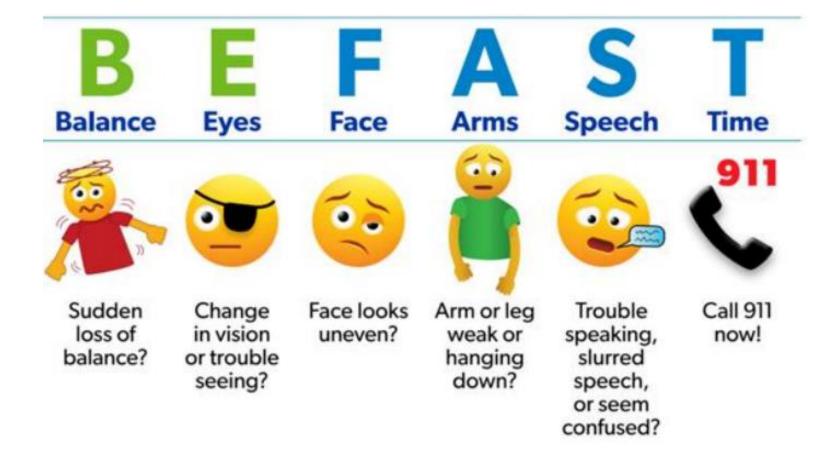# LOS ANGELES PREHOSPTIAL STROKE SCREEN (LAPSS)

Kidwell CS, Starkman S, Eckstein M, Weems K, Saver JL. "Identifying stroke in the field. Prospective validation of the Los Angeles prehospital stroke screen (LAPSS)." Stroke 2000 Jan;31(1):71-6

Screening criteria

1. Age over 45 years
2. No prior history of seizure disorder
3. New onset of neurological symptoms in last 24 hours
4. Patient was ambulatory at baseline (prior to event)
5. Blood glucose between 60 and 400

Exam criteria

	Normal
Facial smile/grimace	___
Grip	___
Arm weakness	___

6. Based on exam, patient has only unilateral weakness

If **YES** (or unknown) to all items above, LAPSS screening criteria met.

If LAPSS criteria for stroke met, call receiving hospital with "code strok

BE-FAST (BALANCE, EYES, FACE, ARM, SPEECH, TIME)

BEFAST- REVIEW

- FAST identified 69% to 90% of strokes but missed up to 40% of those with posterior circulation events. *Int J Stroke. 2013;8:E3.*

- Rates improved with the addition of visual symptoms and limb ataxia, but ataxia can be difficulty to identify. *J Neurol Neurosurg Psychiatry. 2012;83:228–229.*

- Some educational programs have used the mnemonic BE-FAST, adding a "B" for balance and an "E" for eyes, but supportive data are limited.

- A Systematic Review and Meta-Analysis Comparing FAST and BEFAST in Acute Stroke Patients
  - 9 studies – 6151 participants analyzed
  - Sensitivity of FAST was 0.77, specificity was 0.60
  - Sensitivity of BEFAST was 0.68, specificity was 0.85
  - Conclusions: Our findings indicated that FAST and BEFAST might be useful in the diagnosis of acute ischemic stroke. The diagnostic value of BEFAST in acute ischemic stroke was higher than in FAST; thus, it might have an important role in the fast recognition of acute ischemic stroke. *Front. Neurol., 28 January 2022*

STROKE SEVERITY SCALE

- Refers to a numerical scale used to determine the severity of the neurologic deficits once a stroke is suspected in order to identify patients with severe symptoms due to LVO that may benefit from EVT.
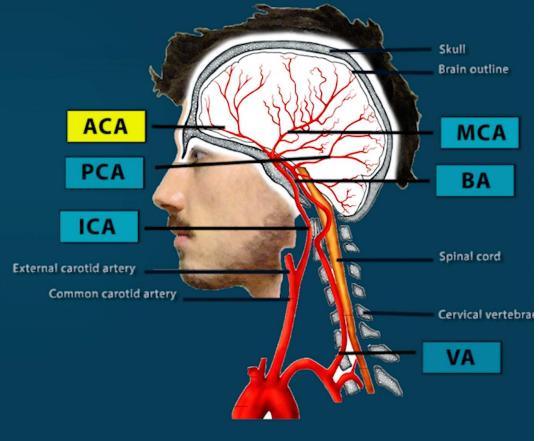
- There are several available tools, and no single tool has been shown to be superior. Each EMS region should choose a single screening tool and severity tool for use across all EMS providers.

- Why you can't have a perfect scale:
  - Up to 29% of patient with baseline of NIHSS = 0 had a proximal occlusion on CTA
  - Most scales are subsets of NIHSS scores
  - Patients with ICH, post seizure paralysis, hyperglycemia in the field can have high NIHSS
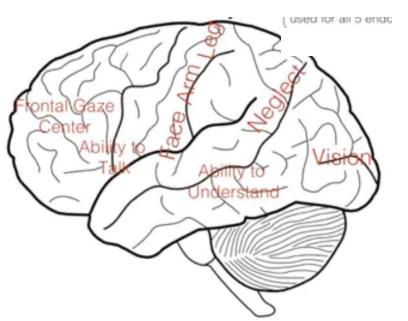
Large Vessel Occlusion (LVO)

- **Occlusion of any primary arteries of the brain**

  - **ICA:** Internal carotid arteries

  - **MCA:** Middle cerebral arteries

  - **ACA:** Anterior cerebral arteries

  - **BA:** Basilar artery

  - **PCA:** Posterior cerebral arteries

ANATOMICAL CORRELATION TO DEFICIT

CORTICAL SIGNS

- Conjugate eye deviation - large infarcts
- Aphasia and neglect alone with out motor symptoms - highly sensitive markers for LVO (sensitivity 0.91) and EVT (sensitivity 0.90)
- In combination with hemiparesis leads to a higher sensitivity (0.97)
- Neglect symptoms alone achieve the highest PPV for LVO

PREDICTING EMERGENT LARGE VESSEL OCCLUSION (ELVO) STROKES

Instrument	Findings	Reference
Simple 3-item Stroke Scale • LOC (0-2) • Gaze (0-2) • Motor function (0-2)	Score of > 4 predicted proximal LVO (Carotid T-segment or M1 segment occlusion of MCA) 80% Specificity 62% Sensitivity PPV – 21% NPV – 95%	Stroke. 2005; 36: 773-776
LA Motor Scale (LAMS) • Facial droop (0-1) • Arm drift (0-2) • Grip strength (0-2)	Score ≥ 4 ↑ by 7-fold that a stroke patient harbors a LVO 93% Specificity 38% Sensitivity PPB – 28% NPV – 95%	Stroke. 2008; 39: 2264-2267
NIHSS	Time dependent; anterior circulation ≥ 9 points within 3 hours ≥ 7points within 3-6 hours Poor PPV for patients with posterior circulation strokes	Stroke. 2013; 44: 1153-1157 CCM Journal. 2016;44(6):e336-e343
Rapid Arterial oCclusion Evaluation Scale (RACE) • Facial palsy (0-2) • Arm motor function (0-2) • Leg motor function (0-2) • Gaze (0-1) • Aphasia or Agnosia (0-2)	Score ≥ 5 Specificity = 0.68 Sensitivity = 0.85 PPV = 0.42 NPV = 0.94	Stroke. 2014; 45: 87-91

PREDICTING EMERGENT LARGE VESSEL OCCLUSION (ELVO) STROKES

Instrument	Findings	Reference
LEGS • **L**eg strength • **E**yes/visual fields • **G**aze • **S**peech/language	NIHSS ≥ 10 correlate well with LVO LEGS score of ≥ 4 correlate well with NIHSS > 10	Stroke. 2014; 45: ATMP59
CPSSS – Cincinnati Prehospital Stroke Severity Score – **CSTAT** • Conjugate gaze deviation (2 points) • Incorrect answers of a least one of two LOC questions (1 point) • Cannot hold arm up for 10 seconds (1 point)	73% specific in identifying 89% sensitive NIHSS ≥ 15	Stroke. 2015; 46: 1508-1512
VAN • **V**ision • **A**phasia • **N**eglect	Specificity 90% Sensitivity 100% PPV – 74% NPV 100%	J Neurointerventional Surg. 2016;0:1-5 DOI:10.1136/neurintsurg -2015-012131
PASS – **Prehospital Acute Stroke Severity** • LOC (month/age) • Gaze palsy/deviation • Arm weakness	PASS score ≥ 2 had median NIHSS =17; PASS score < 2 had median NIHSS = 6	Stroke. 2016; 47: 00.00. DOI. 10.1161/STROKEAHA.1 15.012482

F.A.S.T
(To rule out a stroke)

FACE
-Is the face weak or drooping on one side?
-Ask the person to smile.

ARMS
-Is one arm weak or numb?
-Ask them to lift their arms; Does one arm drift downwards?

SPEECH
-Are they slurring their speech? Ask the person to repeat a simple sentence. Do they repeat it correctly?

TIME
-Time is important! How much time has passed?
-Call 9-1-1 IMMEDIATELY!

The Los Angeles Motor Scale LAMS (Stroke severity)

Facial Droop	
Absent	0
Present	1
Arm Drift	
Absent	0
Drifts down	1
Falls rapidly	2
Grip Strength	
Normal	0
Weak grip	1
No grip	2

Total score: (0-5)
Score of 4-5 is possible ELVO

Nazliel B. Stroke. 2008 Aug; 39(8): 2264–2267.

EMS TRANSPORT CRITERIA SHOULD BE SEVERITY AS WELL AS TIME BASED

1 or 2 points to the highest center within 15 minutes (likely a minor stroke and probably not a candidate for more aggressive therapy)

3-5 points, or any patient who is drowsy or has impaired consciousness goes to CSC (larger stroke that benefits from higher level of care)

Grotta et al., Stroke. 2013; 44:555-557

NIHSS – PREDICTING LVO

Validated across a variety of environments and providers

Gives data about severity and potentially location

NIHSS ≥ 6 identifies patients who should receive endovascular therapy

(Class I, LOE A)

Can be utilized in selected Prehospital Providers

May be too complicated for generalized use

Limited assessment of posterior strokes - Unsteady gait, dizziness, or diplopia

2015 Stroke Endovascular Update

RAPID ARTERIAL OCCLUSION EVALUATION - RACE

1. Aim to develop and validate a simple prehospital stroke scale to predict the presence of large vessel occlusion (LVO) in patients with acute stroke

2. Designed based on elements of the NIHSS
   - Focuses on facial palsy, extremity motor function, head and gaze deviation, and aphasia or agnosia.

3. Thought to be simpler to assess by field providers than a full NIHSS

4. Scale - range is 0-9 points
   - RACE scale score >5 points is associated with detection of a LVO
   - RACE has as a sensitivity of 85% and specificity of 68%

Pérez de la Ossa et al., 2014 Jan;45(1):87-91

RACE

Aphasia (Right Hemiparesis)
Evaluate if obeys
1. Close your eyes
2. Make a fist
Agnosia (Left Hemiparesis)
1. Ask the patient while showing him or her the paretic arm "Whose arm is this and evaluate
2. Can you lift both arms and clap

Table 1. RACE Scale (Table view)

Item	RACE Score	NIHSS Score Equivalence
Facial palsy		
Absent	0	0
Mild	1	1
Moderate to severe	2	2–3
Arm motor function		
Normal to mild	0	0–1
Moderate	1	2
Severe	2	3–4
Leg motor function		
Normal to mild	0	0–1
Moderate	1	2
Severe	2	3–4
Head and gaze deviation		
Absent	0	0
Present	1	1–2
Aphasia[*] (if right hemiparesis)		
Performs both tasks correctly	0	0
Performs 1 task correctly	1	1
Performs neither tasks	2	2
Agnosia[†] (if left hemiparesis)		
Patient recognizes his/her arm and the impairment	0	0
Does not recognized his/her arm or the impairment	1	1
Does not recognize his/her arm nor the impairment	2	2
Score total	0–9	

Pérez de la Ossa et al., 2014 Jan;45(1):87-91

CINCINNATI PREHOSPITAL STROKE SEVERITY SCALE (CPSSS)

1. First published in 1997
   - Identifies facial paresis, arm drift, and abnormal speech.
   - 80% of stroke patients will exhibit one or more of these symptoms.
   - Does not identify posterior circulation strokes
   - Strength: Quick and easy for EMS to use

2. Score ranges from 0 to 4
   - 2 points: Conjugate gaze deviation
   - 1 point: Incorrectly answers at least one of LOC (age or current month) and does not follow at least one or two commands (close eyes, open and close hand
   - 1 point: Cannot hold arm (R or L) up for 10 seconds before arm falls to bed

3. Score ≥2 was 89% sensitivity and 73% specificity in identifying NIHSS ≥15.

Katz et al., Stroke. Jun;46(6):1508-12

Cincinnati Stroke Triage Assessment Tool – CSTAT

Li et al; *Prehosp Emerg Care*. 2020;24(4):500-504.

FIELD ASSESSMENT STROKE TRIAGE FOR EMERGENCY DESTINATION – FAST -ED

Three distinct groups for the likelihood of LVOS:
0-1: < 15%
2-3: ~ 30%
4-9: > 60% or higher

Lima et al. 2016;47(8):1997-2002
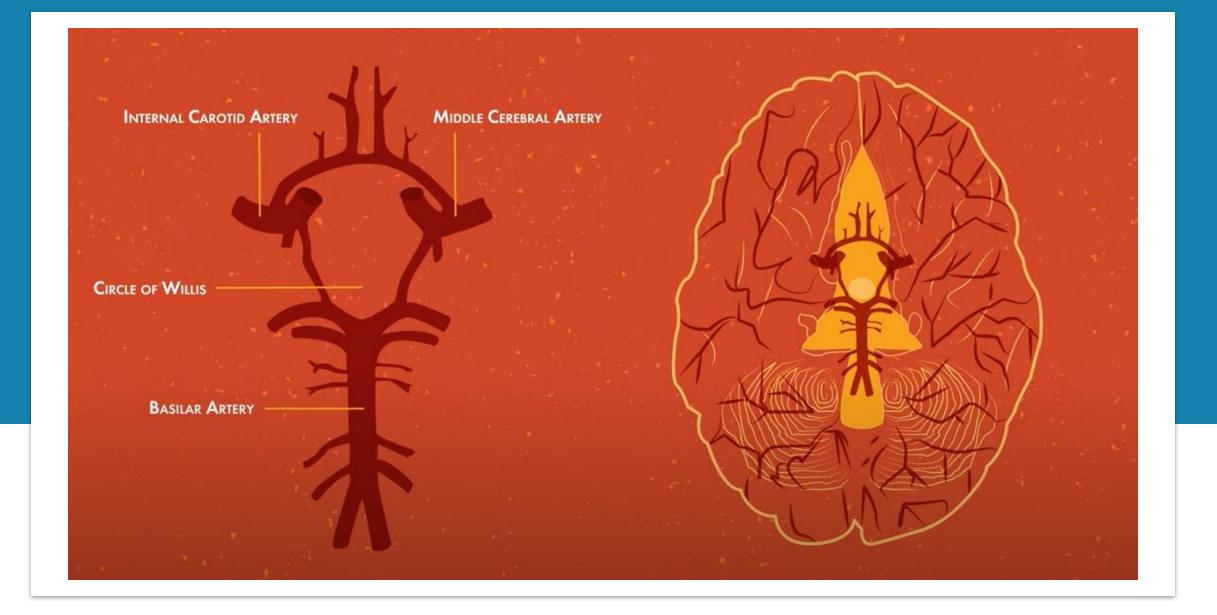

ANY POSITIVE *BE FAST* FINDINGS?
Are their symptoms indicative of a large vessel stroke? ↓

Score (Circle)

Ask if the patient is on any anticoagulant medications, such as:
- Coumadin/Warfarin
- Xarelto/Rivaroxaban
- Pradaxa/Dabigatran
- Savaysa/Edoxaban
- Eliquis/Apixaban
- Heparin/Enoxaparin
- Any other anticoagulants? (please list):

Time anticoagulant last taken:

		Score
F	**Facial Palsy** (ask the patient to show their teeth or smile) • Both sides of the face move equally or not at all • One side of the face droops or is clearly asymmetric	Score: 0 1
A	**Arm Weakness** (with eyes closed, ask patient to hold arms out with their palms up and hold them there for 10 seconds) • Both arms remain up for > seconds or slowly move down equally • Patient can raise arms but one arm drifts down in < 10 seconds • One or both arms fall rapidly, can't be lifted, or no movement occurs at all	Score: 0 1 2
S	**Speech Changes** *Expressive Aphasia* - ask the patient to name 3 common items • Names 2 to 3 items correctly • Names 0 to 1 item correctly *Receptive Aphasia* - ask the patient to perform a simple command (Example: "show me two fingers") • Normal - patient can follow the simple command • Unable to follow the simple command	Score: 0 1 0 1
T	**Time** • What time did the symptoms start? ⟶ • What time was the patient last known well (last appear normal)?	___:___ ___:___
E	**Eye Deviation** • No deviation; eyes move equally to both sides • Patient has clear difficulty when looking to one side (left or right) • Eyes are deviated to one side and do not move to the other side	Score: 0 1 2
D	**Denial/Neglect** *Denial* - show the patient their affected arm and ask, "Do you feel weakness in this arm?" • Patient **recognizes** the weakness in their weak arm • Patient **does NOT recognize** the weakness in their weak arm *Neglect* - show the patient their affected arm and ask, "Whose arm is this?" • Patient **recognizes** their weak arm • Patient **does NOT recognize** their weak arm	Score: 0 1 0 1

Large vessel occlusion assessment tools: VAN

So... what is VAN?

Weakness PLUS...

V Vision
A Aphasia
N Neglect

Teleb et al. J Neurointerv Surg. 2016

VISUAL, APHASIA, NEGLECT- VAN

Positive patients had 100% sensitivity, 90% specificity, (PPV) 74% and NPV 100% for detecting LVO

Stroke VAN

How weak is the patient? Raise both arms up	☐ Mild (minor drift)
	☐ Moderate (severe drift—touches or nearly touches ground)
	☐ Severe (flaccid or no antigravity)
	☐ Patient shows no weakness. Patient is VAN negative

(exceptions are confused or comatose patients with dizziness, focal findings, or no reason for their altered mental status then basilar artery thrombus must be considered; CTA is warranted)

Visual disturbance	☐ Field cut (which side) (4 quadrants)
	☐ Double vision (ask patient to look to right then left; evaluate for uneven eyes)
	☐ Blind new onset
	☐ None
Aphasia	☐ Expressive (inability to speak or paraphasic errors); do not count slurring of words (repeat and name 2 objects)
	☐ Receptive (not understanding or following commands) (close eyes, make fist)
	☐ Mixed
	☐ None
Neglect	☐ Forced gaze or inability to track to one side
	☐ Unable to feel both sides at the same time, or unable to identify own arm
	☐ Ignoring one side
	☐ None

FANG-D – DEVELOPED BY SAINT LUKE'S

F – Field cut – (PCA)

A – Aphasia – (L MCA)

N – Neglect – (R MCA)

G – Gaze Preference – (MCA, looks at stroke)

D – Dense Hemiparesis – (NIH ≥ 3 in any limb

Credit on development to
Dr. Karin Old, Dr. Naveed
Akhtar, and Angie Hawkins

Prospective study completed Department of Emergency Medical Center, Charlotte North Carolina. Study completed in the small hospital ED to help ED physicians in making transport decisions.
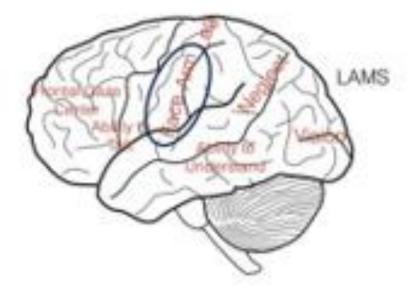
- Sensitivity of 91% - this exceeded RACE, FAST-ED and CPSS screening
- Specificity of 35%
- Substantial inter-rater reliability
- Limitations – missing data and how would it compare to out of hospital (field) screening and needs further validation

Hoglund et al *JACEP Open*. 2020; 1: 908– 917.

LIMITATIONS
LAMS

Pure Motor - No Vision Assessment

Los Angeles Motor Scale (LAMS)[22]		
Face	0	Both sides move normally
	1	One side is weak or flaccid
Arm	0	Both sides move normally
	1	One side is weak
	2	One side is flaccid/doesn't move
Grip	0	Both sides move normally
	1	One side is weak
	2	One side is flaccid/doesn't move
Total		0–5

LIMITATIONS
CINCINNATI PREHOSPITAL STROKE SEVERITY SCORE

CPSSS

Score ranges from 0 to 4

- 2 points: Conjugate gaze deviation
- 1 point: Incorrectly answers at least one of LOC (age or current month) and does not follow at least one or two commands (close eyes, open and close hand
- 1 point: Cannot hold arm (R or L) up for 10 seconds before arm falls to bed

No Vision Assessment

LIMITATIONS VAN

Only assesses arm weakness

Vision – field cut, blind
Aphasia – receptive or expressive
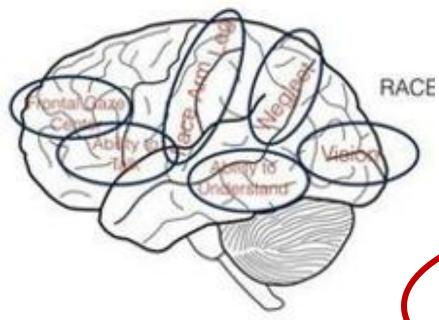**N**eglect – forced gaze, sensory neglect

LIMITATIONS RACE

Table 1. RACE Scale (Table view)

Item	RACE Score	NIHSS Score Equivalence
Facial palsy		
Absent	0	0
Mild	1	1
Moderate to severe	2	2–3
Arm motor function		
Normal to mild	0	0–1
Moderate	1	2
Severe	2	3–4
Leg motor function		
Normal to mild	0	0–1
Moderate	1	2
Severe	2	3–4
Head and gaze deviation		
Absent	0	0
Present	1	1–2
Aphasia [*] (if right hemiparesis)		
Performs both tasks correctly	0	0
Performs 1 task correctly	1	1
Performs neither tasks	2	2
Agnosia [†] (if left hemiparesis)		
Patient recognizes his/her arm and the impairment	0	0
Does not recognized his/her arm or the impairment	1	1
Does not recognize his/her arm nor the impairment	2	2
Score total	0–9	

POSTERIOR STROKE CIRCULATION SYMPTOMS CHALLENGING

- Inaccurate localization occurs if rely on clinical neurologic deficits alone

- Crossed signs PLUS contralateral hemiplegia/hemianesthesia are specific- point to brainstem involvement

| Crossed sensory deficits: medulla | Crossed motor deficits: medulla, pons, and midbrain |

- Disturbed consciousness in NOT highly specific for posterior circulation stroke

ADAM'S SCALE OF POSTERIOR STROKE (ASPOS)

Goal to develop a tool to assess and predict posterior strokes (20-40% of all ischemic strokes)

All other severity scales primarily assess anterior circulation

Posterior signs – LOC, gait/truncal ataxia, vertical gaze palsy, nystagmus, and bulbar signs (swallowing)

Adam's Scale of Posterior Stroke (ASPOS).

Item	Score
Reactivity	0. conscious
	1. somnolence, confusion
	2. sopor
	3. coma
Eyes	0. normal eye movement and visual fields
	1. nystagmus, double vision, hemianopia
	2. eye movement disturbances
	3. oftalmoplegia, cortical blindness
Pharynx	0. normal swallowing, no dysarthria
	1. mild dysarthria
	2. moderate dysarthria, choking on liquids
	3. anarthria, choking on solid foods, nosogastric tube
Strength	0. without motor deficit of limbs or face
	1. mild motor deficit of limbs or face
	2. moderate/severe motor deficit of limbs or face
	3. limb paralysis
Balance	0. Romberg's attempt negative, normal gait

Wisniewsji et alBrain Sciences, 2021:*11*(4).

EXPANDED NIHSS (E-NIHSS) 4

Olivata et al. Journal of Stroke and Cerebrovascular

2016 Dec;25(12):2953-2957.

Comparison: Item 4

Horizontal eye movements

- 0 = normal
- 1 = partial gaze palsy (gaze is abnormal in 1 or both eyes, but forced deviation or total gaze paresis is not present)
- 2 = forced deviation or total gaze (paresis not overcome by the oculocephalic maneuver)

Horizontal *and vertical* eye movements

- 0 = normal
- 1 = partial gaze palsy (gaze is abnormal in 1 or both eyes, but forced deviation or total gaze paresis is not present)
- 1 = nystagmus and/or Horner's syndrome
- 2 = forced deviation or total gaze (paresis not overcome by the oculocephalic maneuver

EXPANDED NIHSS (E-NIHSS) 6

Comparison: Item 6

Facial palsy

- 0 = normal
- 1 = minor paralysis (flattened nasolabial fold, asymmetry on smiling)
- 2 = partial paralysis (total or near-total paralysis of the lower face)
- 3 = complete paralysis of 1 or both sides (absence of facial movement in the upper and lower parts of the face)

Facial, hypoglossal and glossopharyngeal palsy

- 0 = normal
- 1 = minor paralysis (flattened nasolabial fold, asymmetry on smiling)
- 2 = partial paralysis (total or near-total paralysis of the lower face)
- 3 = complete paralysis of 1 or both sides (absence of facial movement in the upper and lower parts of the face)
- 3 = deficit of IX nerve (soft palate paralysis)
- 3 = deficit of XII nerve

EXPANDED NIHSS (E-NIHSS) 11

Comparison: Item 11

Limb ataxia

- 0 = absent or untestable
- 1 = present in 1 limb
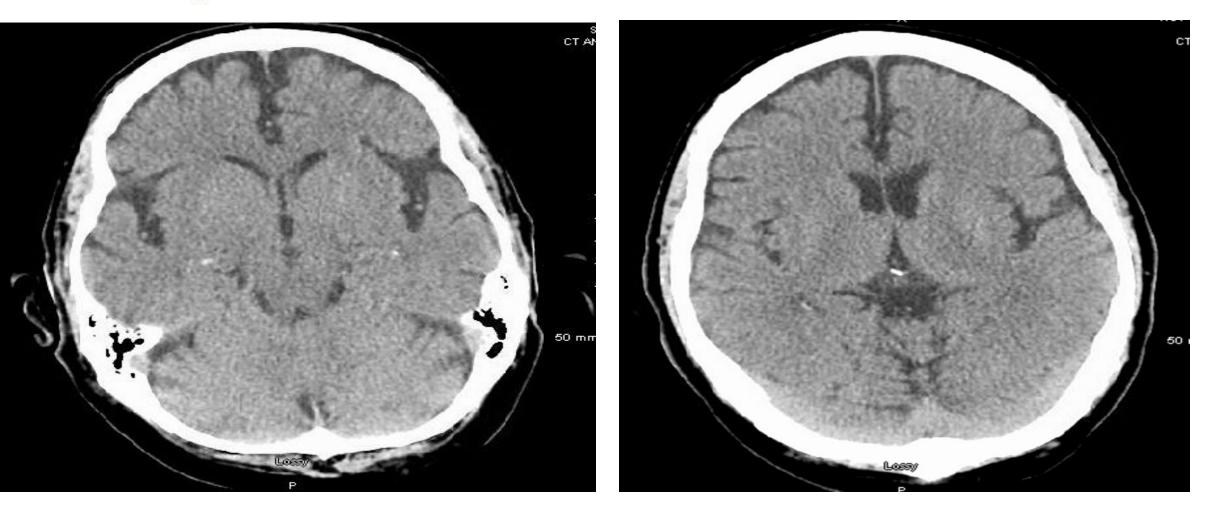- 2 = present in 2 limbs

Limb *and trunk ataxia*

- 0 = absent or untestable
- 1 = present in 1 limb
- 1 = imbalance in Romberg position
- 2 = present in 2 limbs
- 2 = trunk ataxia or retro- or lateropulsion

CASE STUDY 1

- 67-year-old right-handed male

- Sudden onset right arm weakness while eating breakfast at 6:30 wife immediately called 911

- Transported to the local PSC hospital

- IV alteplase administered at 07:45

- Notified CSC and asked to accept patient as a drip and ship
  - No formal LVO scale completed

- Arrival to CSC 09:15, NIH 6 on arrival - since was 6 notified INR team of possible intervention and a CTA/CTP head and completed
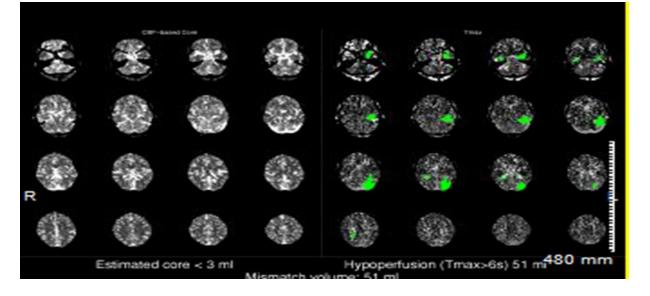
CASE STUDY 1 INITIAL CT HEAD

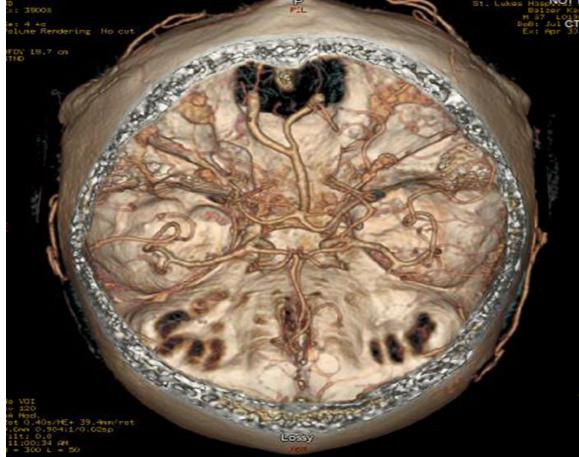Initial Head Non-Contrast CT at PSC hospital
Negative – no acute infarct

NATIONAL INSTITUTES OF HEALTH STROKE SCALE

	CATEGORY	SCORE	
1A	Level Of Consciousness	0	
1B	Level Of Consciousness Questions	0	
1C	Level Of Consciousness Commands	0	
2	Best Gaze	0	
3	Visual fields	1	
4	Facial palsy (paresis)	1	Face weak (1)
5A	Motor—Left arm	0	
5B	Motor—Right arm	1	Arm weak but no flaccid (0)
6A	Motor—Left leg	0	
6B	Motor—Right leg	1	
7	Limb Ataxia	0	
8	Sensory	1	
9	Best Language	1	
10	Dysarthria (articulation of words)	0	
11	Extinction	0	
	Score	6	

Los Angeles Motor Scale (LAMS)[22]

	Score	Description	
Face	0	Both sides move normally	1
	1	One side is weak or flaccid	
Arm	0	Both sides move normally	1
	1	One side is weak	
	2	One side is flaccid/doesn't move	
Grip	0	Both sides move normally	1
	1	One side is weak	
	2	One side is flaccid/doesn't move	
Total	0–5	Grip with both hands SCORE – 1 Score ≥ 4 ↑ by 7-fold that a stroke patient has a LVO	

CASE STUDY 1
CTA – CTP HEAD

Small core infarction and moderate area of penumbra within the left temporal occipital region consistent with a distal left PCA P3/P4 branch occlusion.

The left P1 and P2 segments are patent, and the definite site of arterial occlusion is not visualized by CT angiography.

CASE STUDY 1

No large vessel occlusion established

Notified ICU of patient – handoff report provided

Patient admitted to ICU for follow up status/post IV Alteplase care

Cincinnati Prehospital Stroke Severity Scale (CPSSS)

Conjugate gaze deviation = 2

Level of Consciousness = 1

Incorrectly answers at least one of the following:
    How old are you?
    What month is it?

    AND

Does not follow at least one of two commands:
    Close your eyes.
    Open and close your hand (non-paretic)

Motor = 1
Cannot hold arm (right, left or both) for up to 10 s before arm falls onto bed.

LVO is likely if score ≥ 2

Score 1

Rapid Arterial oCclusion Evaluation (RACE)

Facial palsy - weakness on one side of face with smile.
    Absent = 0
    Mild (some facial movement) = 1
    Moderate to severe (little to no facial movement) = 2

Arm motor function - the same test as Cincinnati and Los Angeles scales.
    Normal to mild = 0
    Moderate (able to lift arm, but unable to hold it for 10 seconds) = 1
    Severe (unable to raise arm) = 2

Leg motor function - ask the patient to lift each leg.
    Normal to mild (able to lift leg and hold for five seconds) = 0
    Moderate (able to lift, but unable to hold for five seconds) = 1
    Severe (unable to lift one leg off of bed at all) = 2

Head and gaze deviation - if the patient's head or eyes are towards one side, ask them to look towards the other side.
    Absent = 0
    Present (unable shift gaze past midline) = 1

If a right-side deficit is found, check for aphasia (inability to say or hear words correctly). Ask the patient to close their eyes and make a fist.
    Performs both tasks correctly = 0
    Performs 1 task correctly = 1
    Performs neither task = 2

If a left-side deficit is found, check for agnosia (an inability to process sensory information). Touch their arm and ask "whose arm is this?" Then ask them to raise both hands and clap.
    Patient recognizes his/her arm = 0
    Does not recognize his/her arm or the impairment = 1
    Does not recognize his/her arm nor the impairment = 2

LVO is likely if the cumulative score is above 5.

Score 3

Field Assessment Stroke Triage for Emergency Destination (FAST-ED)

Facial palsy - weakness on one side of face with smile.
    Absent or minor paralysis = 0
    Partial or complete paralysis = 1

Arm weakness
    No drift= 0
    Drift or some effort against gravity = 1
    No effort against gravity or no movement = 2

Speech changes
    Absent = 0
    Mild to moderate = 1
    Severe, global aphasia or mute = 2

Eye deviation
    Absent = 0
    Partial = 1
    Forced deviation = 2

Denial/Neglect
    Absent = 0
    Extinction to bilateral simultaneous stimulation in only one sensory modality = 1
    Does not recognize own hand or only orients to one side of the body = 2

LVO is likely if FAST-ED ≥ 4.

Score 3

CASE STUDY 2

- 58-year-old male awoke at 6:00 and was at work by 7:00. Co-workers had witnessed patient and seemed normal that AM

- Found sitting on a pallet at 9:00 and when co-worker attempted to find out what was wrong – co-worker questioned patient and speech was gibberish, he noted left sided facial droop and arm weakness.

- 911 called and transported to nearby PSC since it was 3 hours and 45 minutes since last known well – since it was unwitnessed

- Co-worker notified wife

CASE STUDY 2

Arrival to PSC at 9:45 – last known well was at 6:00 AM

Time of onset 9:15 PM

NIH stroke score – 13 at PSC hospital

- Stat CT Head negative
- Glucose 98
- No warfarin

NATIONAL INSTITUTES OF HEALTH STROKE SCALE

	CATEGORY	SCORE
1A	Level Of Consciousness	0
1B	Level Of Consciousness Questions	1
1C	Level Of Consciousness Commands	0
2	Best Gaze	1
3	Visual fields	1
4	Facial palsy (paresis)	2
5A	Motor—Left arm	3
5B	Motor—Right arm	0
6A	Motor—Left leg	1
6B	Motor—Right leg	0
7	Limb Ataxia	0
8	Sensory	2
9	Best Language	0
10	Dysarthria (articulation of words)	1
11	Extinction	1
	Score	13

Cincinnati Prehospital Stroke Severity Scale (CPSSS)

Conjugate gaze deviation = 2

Level of Consciousness = 1

Incorrectly answers at least one of the following:
- How old are you?
- What month is it?

AND

Does not follow at least one of two commands:
- Close your eyes.
- Open and close your hand (non-paretic)

Motor = 1
Cannot hold arm (right, left or both) for up to 10 s before arm falls onto bed.

LVO is likely if score ≥ 2

Score 4

Rapid Arterial oCclusion Evaluation (RACE)

Facial palsy - weakness on one side of face with smile.
- Absent = 0
- Mild (some facial movement) = 1
- Moderate to severe (little to no facial movement) = 2

Arm motor function - the same test as Cincinnati and Los Angeles scales.
- Normal to mild = 0
- Moderate (able to lift arm, but unable to hold it for 10 seconds) = 1
- Severe (unable to raise arm) = 2

Leg motor function - ask the patient to lift each leg.
- Normal to mild (able to lift leg and hold for five seconds) = 0
- Moderate (able to lift, but unable to hold for five seconds) = 1
- Severe (unable to lift one leg off of bed at all) = 2

Head and gaze deviation - if the patient's head or eyes are towards one side, ask them to look towards the other side.
- Absent = 0
- Present (unable shift gaze past midline) = 1

If a right-side deficit is found, check for aphasia (inability to say or hear words correctly). Ask the patient to close their eyes and make a fist.
- Performs both tasks correctly = 0
- Performs 1 task correctly = 1
- Performs neither task = 2

If a left-side deficit is found, check for agnosia (an inability to process sensory information). Touch their arm and ask "whose arm is this?" Then ask them to raise both hands and clap.
- Patient recognizes his/her arm = 0
- Does not recognize his/her arm or the impairment = 1
- Does not recognize his/her arm nor the impairment = 2

LVO is likely if the cumulative score is above 5.

Score 6

Field Assessment Stroke Triage for Emergency Destination (FAST-ED)

Facial palsy - weakness on one side of face with smile.
- Absent or minor paralysis = 0
- Partial or complete paralysis = 1

Arm weakness
- No drift= 0
- Drift or some effort against gravity = 1
- No effort against gravity or no movement = 2

Speech changes
- Absent = 0
- Mild to moderate = 1
- Severe, global aphasia or mute = 2

Eye deviation
- Absent = 0
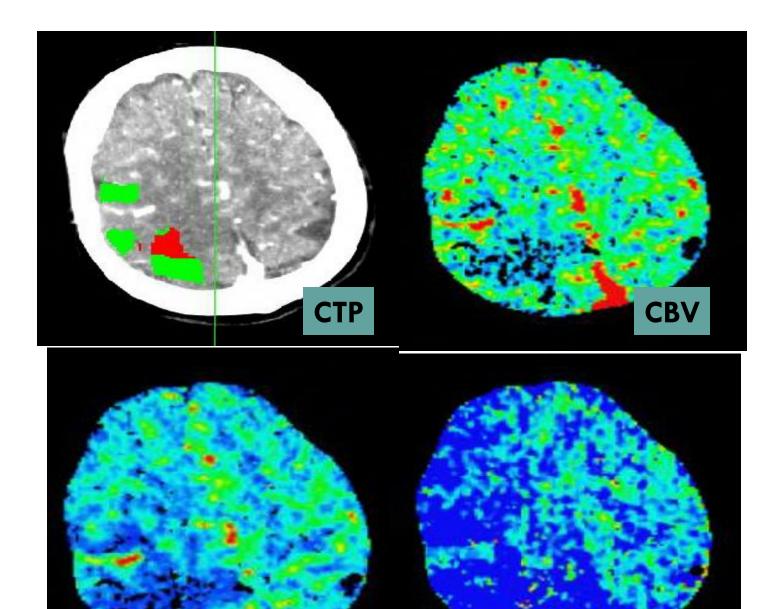- Partial = 1
- Forced deviation = 2

Denial/Neglect
- Absent = 0
- Extinction to bilateral simultaneous stimulation in only one sensory modality = 1
- Does not recognize own hand or only orients to one side of the body = 2
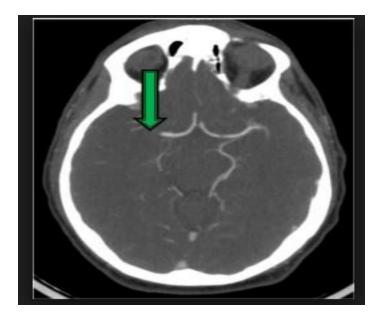
LVO is likely if FAST-ED ≥ 4.

Score 5

CASE STUDY 2

- IV Alteplase administered at urban PSC – without endovascular ability – NIH remained 13 and there was a high suspicion of LVO

- PSC notified CSC of transport and ETA

- CSC – notified stroke team and endovascular team of suspected LVO

- Upon arrival
  - NIHSS – 16
  - CTA and CTP completed

CT Perfusion CT Angio

CTP

CBV

CBF

MTT

CASE STUDY 3

- 63-year-old right-handed male

- Time of onset 10:00 pm when went to bed

- Patient did not show up to work – notified daughter at 0700 and she went to house and found father in bed with stroke symptoms (dysarthria, left hemiplegia and right gaze preference)

- 0911 called at 07:30 patient outside the IV alteplase window

- EMS completed a LVO assessment - highly suspicious of LVO

- EMS notified small hospital – determined to call for helicopter and take to CSC.

- CSC notified Acute stroke team and interventional team.

- Upon arrival
  - NIH 16
  - Acute stroke work-up
  - Stat CT

	CATEGORY	SCORE
1A	Level Of Consciousness	0
1B	Level Of Consciousness Questions	1
1C	Level Of Consciousness Commands	0
2	Best Gaze	2
3	Visual fields	2
4	Facial palsy (paresis)	2
5A	Motor—Left arm	2
5B	Motor—Right arm	0
6A	Motor—Left leg	2
6B	Motor—Right leg	0
7	Limb Ataxia	0
8	Sensory	2
9	Best Language	0
10	Dysarthria (articulation of words)	1
11	Extinction	2
	Score	16

Rapid Arterial oCclusion Evaluation (RACE)

Facial palsy - weakness on one side of face with smile.
Absent = 0
Mild (some facial movement) = 1
Moderate to severe (little to no facial movement) = 2

Arm motor function - the same test as Cincinnati and Los Angeles scales.
Normal to mild = 0
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If a left-side deficit is found, check for agnosia (an inability to process sensory information). Touch their arm and ask "whose arm is this?" Then ask them to raise both hands and clap.
Patient recognizes his/her arm = 0
Does not recognize his/her arm or the impairment = 1
Does not recognize his/her arm nor the impairment = 2

LVO is likely if the cumulative score is above 5.

Score 7

CASE STUDY 3 - INITIAL CT HEAD — NEGATIVE — OLD LACUNAR ON THE RIGHT
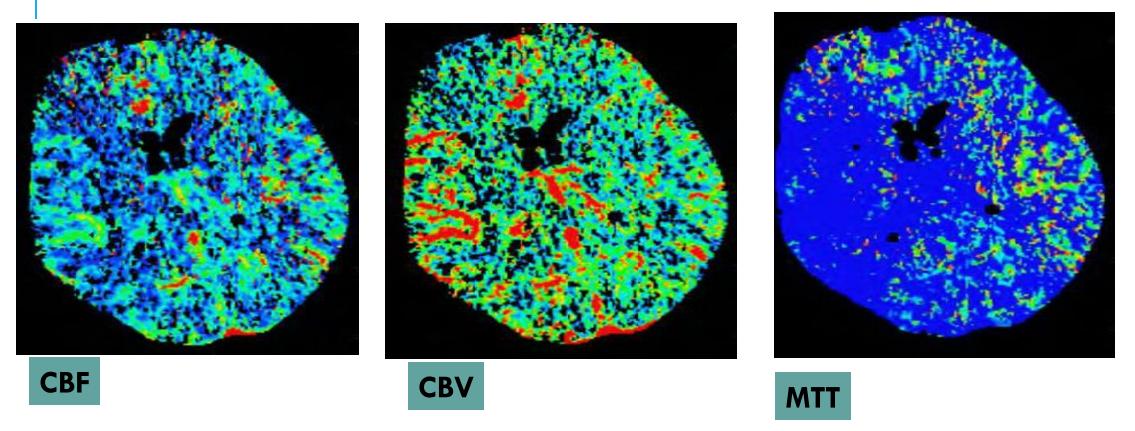
Not a candidate for IV alteplase

CASE STUDY 3 – CTA

Right M1 MCA Occlusion

CASE STUDY 3 – CTP

CBF

CBV

MTT

Changes of the anterior medial temporal and insular cortices, findings indicative of acute infarct.
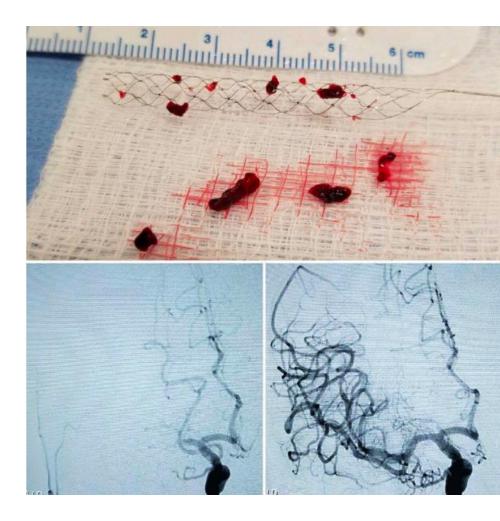
Large mismatched perfusion defect with penumbra.

CASE STUDY 3

CTA/CTP showed LVO

Intervention team at bedside
- Evaluating patient
- Intervention recommended
- Family/patient education

Taken to intervention - handoff report to endovascular team and ICU

Rural Acute Stroke (RAS) Measures

Time to Intravenous Thrombolytic Therapy ≤ 60 minutes

★ Door-In/Door-Out Time at First Hospital Prior to Transfer for Acute Therapy ≤ 90 Minutes

National Institutes of Health Stroke Scale (NIHSS) Reported

★ Door to CT ≤ 25 Minutes

Dysphagia Screen

★ Documentation of Last Known Well or Time of Discovery of Stroke Symptoms

IV Thrombolytic Therapy Arrive by 3.5 Hours Treat by 4.5 Hours

★ EMS Pre-notification

★ Non-Contrast Brain CT or MRI Interpreted Within 45 Minutes of Arrival

★ Telestroke Consultation Done

★ *Measure new to recognition measure set; previously existed as reporting measure*

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THANK YOU
Always Questions
Not Always Answers

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