# Stroke Triage and the Modified RACE (mRACE) Score

BUREAU OF EMS

PENNSYLVANIA DEPARTMENT OF HEALTH

# Acknowledgements

Before being added as an option in the Statewide ALS Protocols, the mRACE was piloted in Western Pennsylvania.

The Bureau of EMS thanks the following for developing and pilot testing this educational program:

- Christian Martin-Gill, MD, MPH (Associate Medical Director, UPMC Prehospital Care)
- UPMC Prehospital Care Staff
- EMS West (the EMS West regional staff and many of the region's EMS agencies participated in the mRACE pilot project)

# Stroke

#4 Cause of Death

#1 Cause of adult disability

~800,000 cases per year

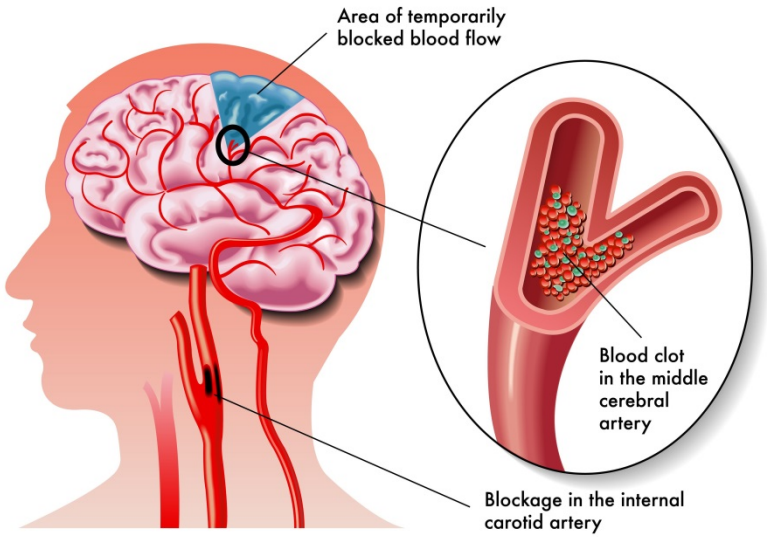
- One stroke every 40 seconds

Cost in 2010:

- 73.7 **B**illion dollars

*Stroke is a time-sensitive illness*

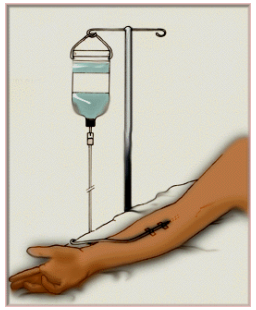
*EMS must act FAST to save brain cells and ability to function*



# History of Stroke Care

1995

- Tissue Plasminogen Activator (tPA) introduced for stroke treatment within first 3 hours (now up to a 4.5 hour window)
- Led to the development of **Primary Stroke Centers**



2015

- 5 randomized controlled trials provide strong evidence of benefit of intra-arterial therapy for select stroke patients with large vessel occlusions
- Intra-arterial therapy available at **Comprehensive Stroke Centers**

# Stroke Ready Hospital

Can perform a rapid assessment including non-contrast CT scan (to rule out intracranial bleeding)

Can consult with Neurologists (in person or telemedicine)

Can administer IV thrombolytics, when needed

Has protocols for standardized care

**Will usually transfer patients that receive IV thrombolytics**

The Joint Commission

American Heart Association

American Stroke Association

CERTIFICATION

Meets standards for

Acute Stroke Ready Hospital

# Primary Stroke Center

Can perform a rapid assessment including non-contrast CT scan (to rule out intracranial bleeding)

Can consult with Neurologists (in person or telemedicine)

Can administer IV thrombolytics, when needed

Has protocols for standardized care

**May admit patients that receive IV thrombolytics for continued stroke care**


American Heart Association
American Stroke Association
CERTIFIED
Meets standards for
Primary Stroke Center

# Comprehensive Stroke Center

*In addition to requirements for Primary Stroke Center:*

Dedicated vascular neurologists and neurosurgeons

Dedicated Neuro ICU beds 24/7

Advanced imaging capabilities (CTA, MRA)

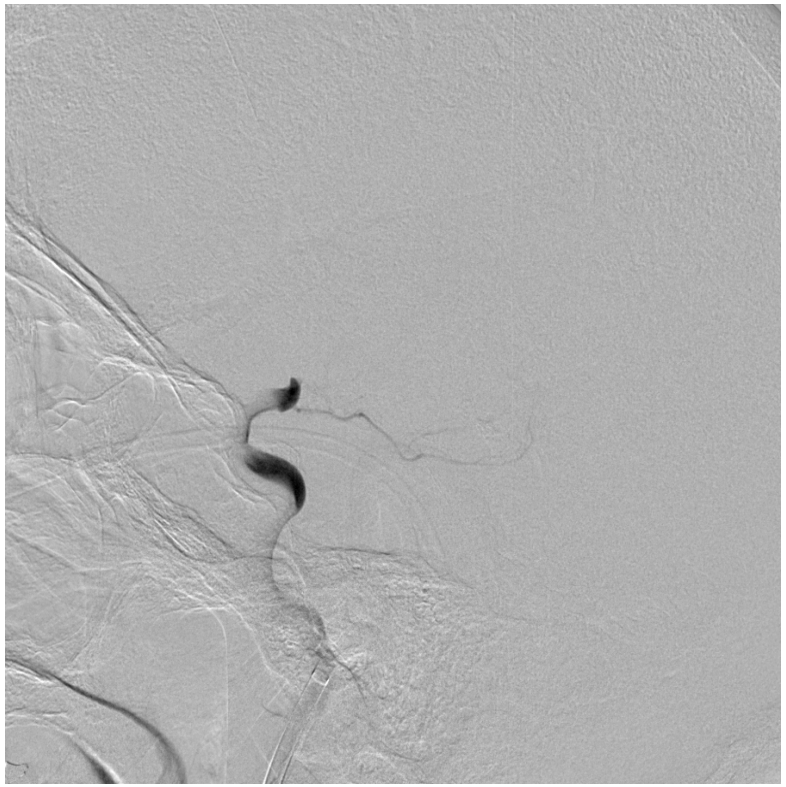
**Can perform endovascular procedures**

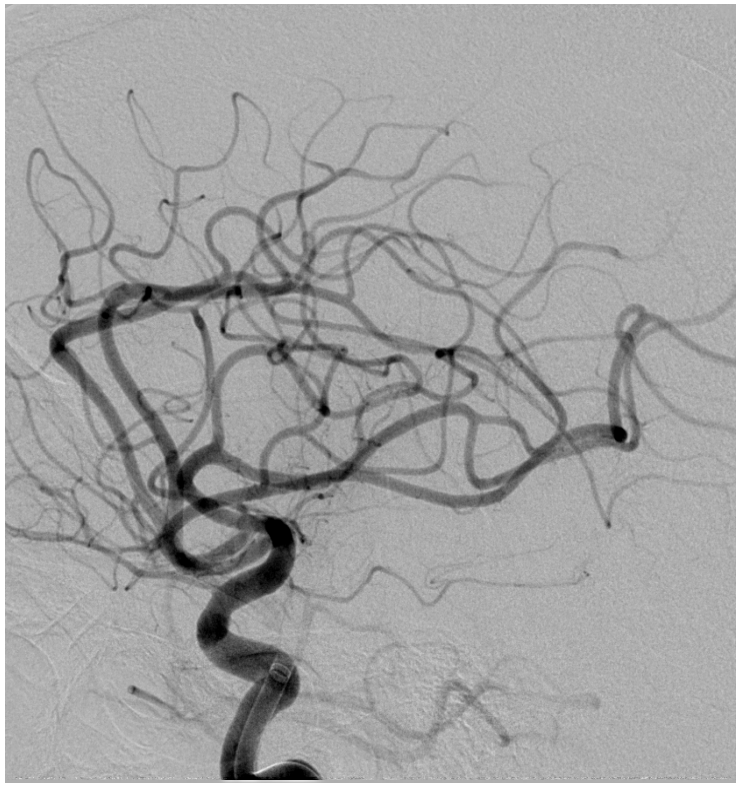
Experience in treating ischemic strokes and hemorrhages


American Heart Association
American Stroke Association
CERTIFICATION
Meets standards for
Comprehensive Stroke Center

# Intra-arterial Interventions

Use of aspiration or stent retrievers to remove blood clot from large vessels





# Large vessel occlusion (LVO)

Not all stroke patients are candidates for intra-arterial interventions

Therapy is based on advanced neuro-imaging (CTA or MRA)

Intra-arterial interventions are beneficial only for patients with large vessel occlusion

*If EMS can identify patients with high chance of large vessel occlusion, more stroke patients may be transported to a center that has a level of care that matches their needs.*

# Cincinnati Prehospital Stroke Scale (CPSS)

First published in 1997

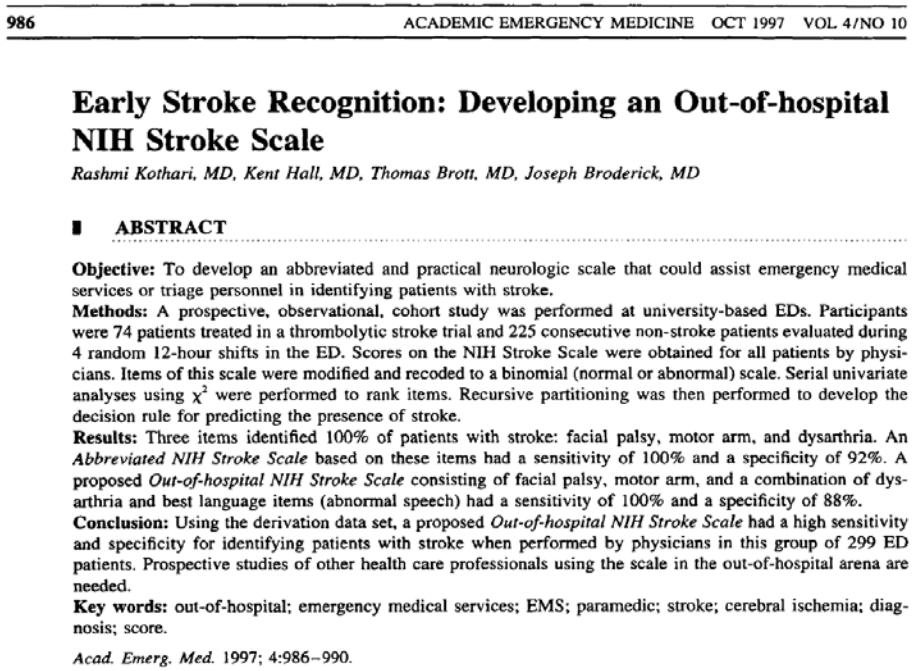
Primary stroke identification scale used in PA statewide EMS protocols

Exam:

- Facial palsy
- Arm drift
- Abnormal speech

Any positive factor suggests ~70% chance of stroke

Does not distinguish large-vessel occlusion





**Early Stroke Recognition: Developing an Out-of-hospital NIH Stroke Scale**

*Rashmi Kothari, MD, Kent Hall, MD, Thomas Brott, MD, Joseph Broderick, MD*

**ABSTRACT**

**Objective:** To develop an abbreviated and practical neurologic scale that could assist emergency medical services or triage personnel in identifying patients with stroke.
**Methods:** A prospective, observational, cohort study was performed at university-based EDs. Participants were 74 patients treated in a thrombolytic stroke trial and 225 consecutive non-stroke patients evaluated during 4 random 12-hour shifts in the ED. Scores on the NIH Stroke Scale were obtained for all patients by physicians. Items of this scale were modified and recoded to a binomial (normal or abnormal) scale. Serial univariate analyses using $\chi^2$ were performed to rank items. Recursive partitioning was then performed to develop the decision rule for predicting the presence of stroke.
**Results:** Three items identified 100% of patients with stroke: facial palsy, motor arm, and dysarthria. An *Abbreviated NIH Stroke Scale* based on these items had a sensitivity of 100% and a specificity of 92%. A proposed *Out-of-hospital NIH Stroke Scale* consisting of facial palsy, motor arm, and a combination of dysarthria and best language items (abnormal speech) had a sensitivity of 100% and a specificity of 88%.
**Conclusion:** Using the derivation data set, a proposed *Out-of-hospital NIH Stroke Scale* had a high sensitivity and specificity for identifying patients with stroke when performed by physicians in this group of 299 ED patients. Prospective studies of other health care professionals using the scale in the out-of-hospital arena are needed.
**Key words:** out-of-hospital; emergency medical services; EMS; paramedic; stroke; cerebral ischemia; diagnosis; score.

*Acad. Emerg. Med.* 1997; 4:986–990.

# RACE Scale

**Design and Validation of a Prehospital Stroke Scale to Predict Large Arterial Occlusion**
**The Rapid Arterial Occlusion Evaluation Scale**

Natalia Pérez de la Ossa, MD, PhD; David Carrera, MD; Montse Gorchs, BD; Marisol Querol, BD; Mònica Millán, MD, PhD; Meritxell Gomis, MD, PhD; Laura Dorado, MD, PhD; Elena López-Cancio, MD, PhD; María Hernández-Pérez, MD; Vicente Chicharro, MD; Xavier Escalada, MD; Xavier Jiménez, MD, PhD; Antoni Dávalos, MD, PhD

**RACE** (**R**apid **A**rterial o**C**clusion **E**valuation) **Scale**

Introduced 2014 from Barcelona, Spain

Simpler for field providers to assess than scores used in the hospital (e.g. NIH Stroke Scale)

*A modified version (the mRACE) was recently assessed in the Southwestern region of Pennsylvania as part of new regional stroke triage guidelines*

# Modified RACE Scale (mRACE)

| | | | |
|---|---|---|---|
| Speech* | Ask patient to repeat the phrase: "The sky is blue in Pennsylvania" | No numerical value | ☐ Normal Speech<br>☐ Abnormal Speech |
| Facial Palsy* | Ask patient to smile and show their teeth | • Absent (normal, symmetrical facial movement)<br>• Mild (some facial movement)<br>• Moderate to severe (little to no facial movement) | 0<br>1<br>2 |
| Arm Motor Function* | Ask patient to raise both arms, palms up, for 10 seconds | • Normal (no drift to mild drift)<br>• Moderate (able to lift arm but unable to hold for 10 secs)<br>• Severe (unable to lift either arm against gravity) | 0<br>1<br>2 |
| Leg Motor Function | Ask patient to raise each leg, one at a time, and hold for 5 seconds | • Normal (no drift to mild drift)<br>• Moderate (able to lift leg, unable to hold for 5 secs)<br>• Severe (unable to lift either leg against gravity) | 0<br>1<br>2 |
| Head & Gaze Deviation | Ask patient to move their eyes horizontally by tracking your finger and assess gaze deviation | • Absent (moves both eyes to track finger)<br>• Present (fixed or unable to shift gaze past midline) | 0<br>1 |
| Aphasia | Ask patient to follow 2 commands:<br>1. Close your eyes<br>2. Make a fist (on unaffected side) | • Performs both tasks correctly<br>• Performs 1 task correctly<br>• Performs neither task correctly | 0<br>1<br>2 |
| Agnosia | Determine if patient recognizes deficit:<br>1. Ask the patient (while pointing at affected arm): "Whose arms is this?"<br>2. Ask the patient to clap their hands | • Recognizes arm & claps or recognizes inability to clap<br>• Cannot perform one of the tasks<br>• Cannot perform either task | 0<br>1<br>2 |
| * First three items are part of Cincinnati Prehospital Stroke Scale | | TOTAL: | |

# Modified RACE Scale (mRACE)

Combined with the first step of assessing speech, can assess both a Cincinnati Prehospital Stroke Scale and the mRACE scale in 7 steps

Assesses both Aphasia and Agnosia (last two steps) regardless of laterality

- Accounts for differences between left and right-hand dominant individuals who may control language and spatial relations in different sides of their brain

Easier to perform through a single exam for all patients

| |
|---|
| Speech* |
| Facial Palsy* |
| Arm Motor Function* |
| Leg Motor Function |
| Head & Gaze Deviation |
| Aphasia |
| Agnosia |

# Modified RACE Scale (mRACE)

Prehospital Validation by 12 EMS agencies in SW PA

- Data from 2015-2017
- N=413 patients with prehospital mRACE & outcomes

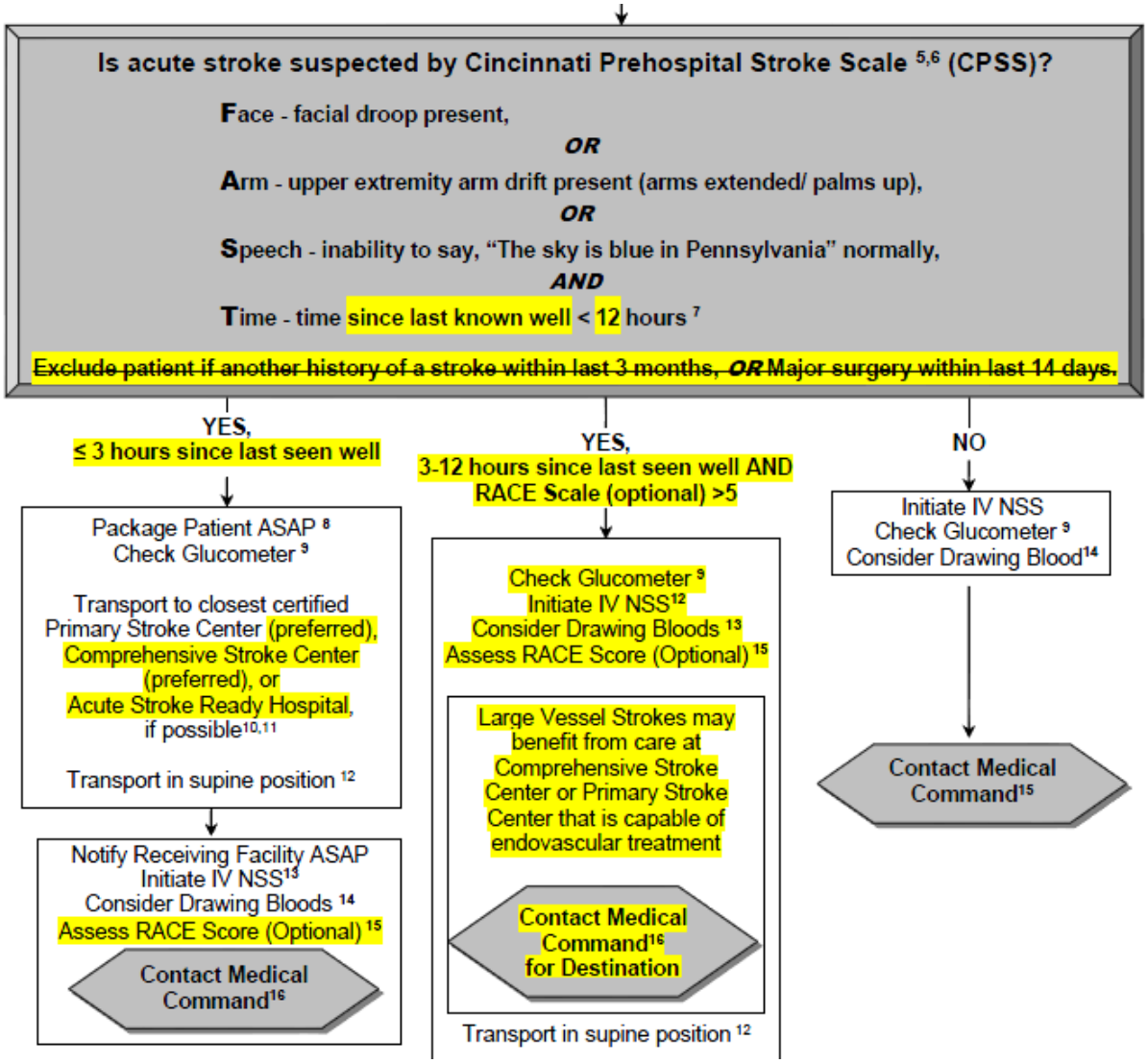
Large-vessel occlusion suspected if score = 5 or greater

- Sensitivity: 67% of patients with LVO have score ≥5
- Specificity: 70% of patients without LVO have score <5
- Similar to original RACE Scale; simpler to perform

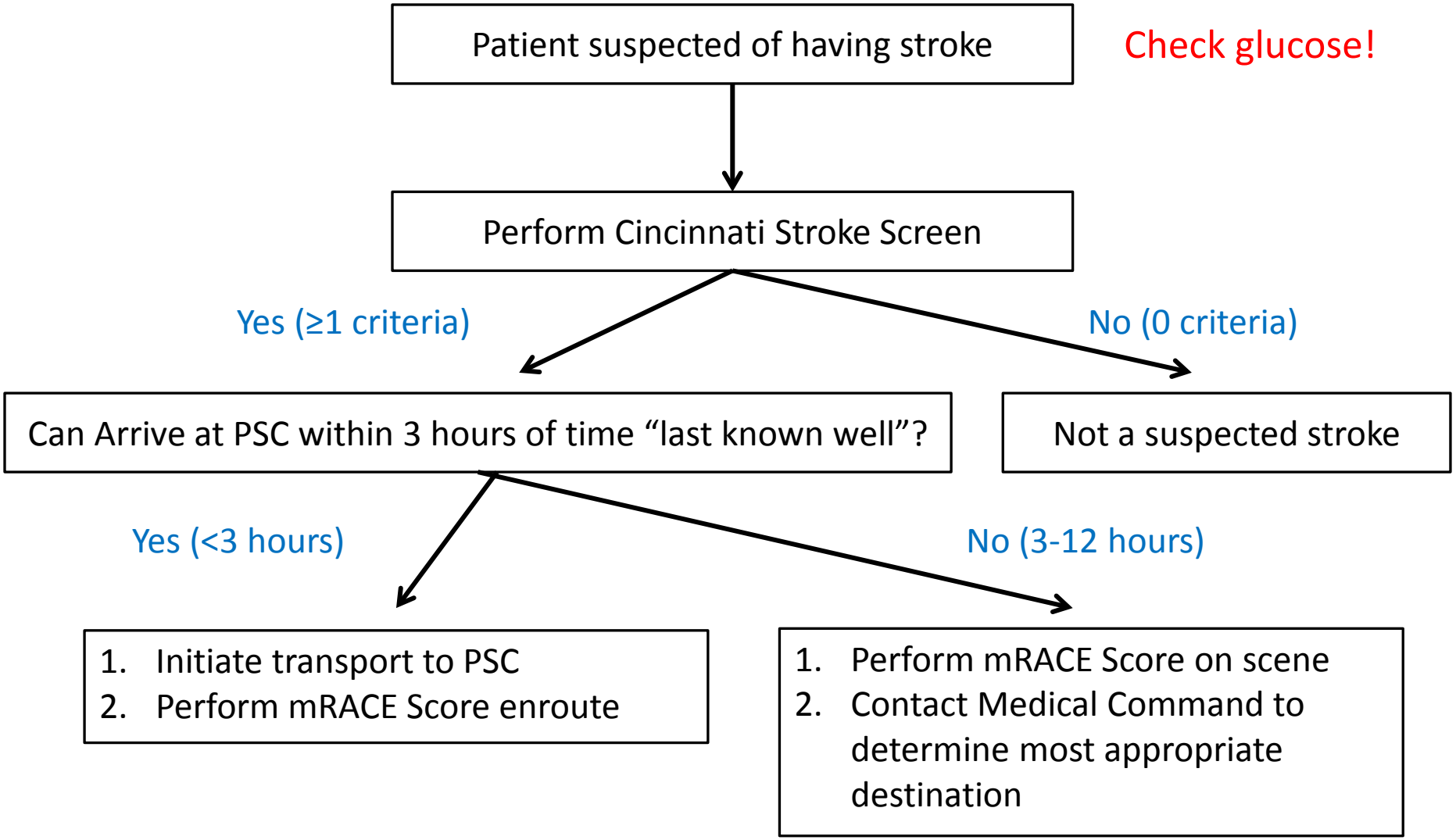
*mRACE now being incorporated as an optional protocol in Pennsylvania*

*Quality Improvement: PA stroke centers and EMS agencies are encouraged to track the accuracy of RACE scoring by EMS in identifying patients that actually have a LVO stroke*

# Pennsylvania ALS Protocol 7006: Stroke



# Stroke Triage



# Example Case 1

52-year-old male with onset of left-sided arm and leg weakness & aphasia 1 hour ago

Key findings:

- Stroke-like symptoms
- Anticipated arrival at receiving center < 3 hours from time "last known well"

*Transport to closest stroke center (Primary Stroke Center, Comprehensive Stroke Center, or Stroke Ready Hospital)*

# Example Case 2

52-year-old male with onset of left arm and leg weakness and facial palsy 4 hours ago

- Perform mRACE on scene → mRACE Scale = 6

Key Findings:

- mRACE score ≥5
- Arrival at receiving center in 3-12 hour window since last known well

*Contact Medical Command for guidance (possible bypass to a Comprehensive Stroke Center)*

# Example Case 3

52-year-old male with onset of left arm numbness and facial palsy 6 hours ago

- No weakness, aphasia, agnosia, gaze deviation or other symptoms
- Perform mRACE on scene → mRACE Scale 1

Key Findings:

- Time to arrival >3 hours since last seen well
- mRACE score <5
- Unlikely to be a large vessel occlusion

*Transport to closest stroke center (Primary Stroke Center, Comprehensive Stroke Center, or Stroke Ready Hospital)*

# Assessing the mRACE Score

AN EMS PATIENT ASSESSMENT SKILL

# Step 1 – Speech

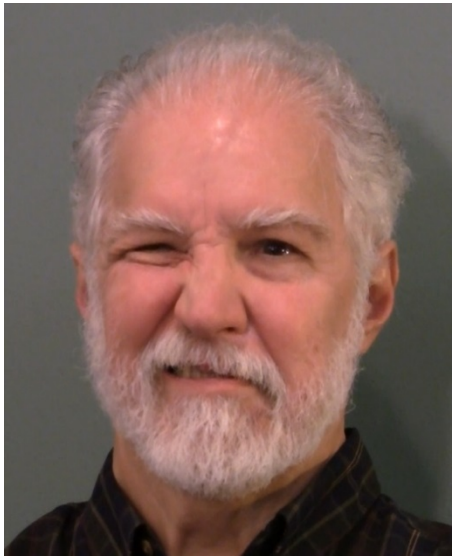
*Have the patient repeat "The sky is blue in Pennsylvania"*

| | Score |
|---|---|
| Normal (speech with correct words and no slurring) | N/A - CPSS |
| Abnormal (slurs words, says wrong words, or unable to speak) | N/A - CPSS |

# Step 2 – Facial Palsy

*Ask patient to smile / show teeth*

| | Score |
|---|---|
| Absent (symmetrical movement) | 0 |
| Mild facial palsy (slightly asymmetrical) | 1 |
| Moderate-severe facial palsy (completely asymmetrical) | 2 |



# Step 3 – Arm Motor Function

*Ask patient to raise both arms, palms up, for 10 secs*

| | Score |
|---|---|
| No or mild drift of either arm (limb held ≥10 seconds) | 0 |
| Moderate drift of either arm (limb held <10 seconds) | 1 |
| Severe weakness of either arm (no movement against gravity) | 2 |

# Step 4 – Leg Motor Function

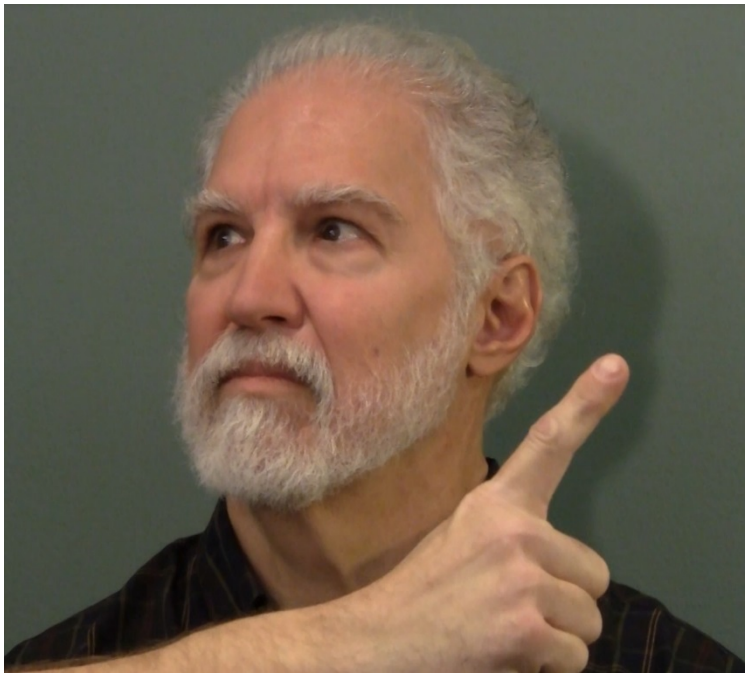
*Ask patient to raise each leg for 5 seconds*

| | Score |
|---|---|
| No or mild drift of either leg (limb held ≥5 seconds) | 0 |
| Moderate drift of either leg (limb held <5 seconds) | 1 |
| Severe weakness of either leg (no movement against gravity) | 2 |

# Step 5 – Head and Gaze Deviation

*Ask patient to keep head still & track finger with eyes*

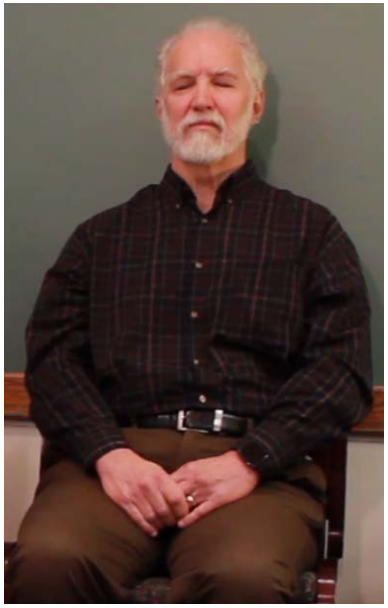
| | Score |
|---|---|
| Absent (eye movements to both sides possible and no head deviation) | 0 |
| Present (eyes and head deviation to one side) | 1 |

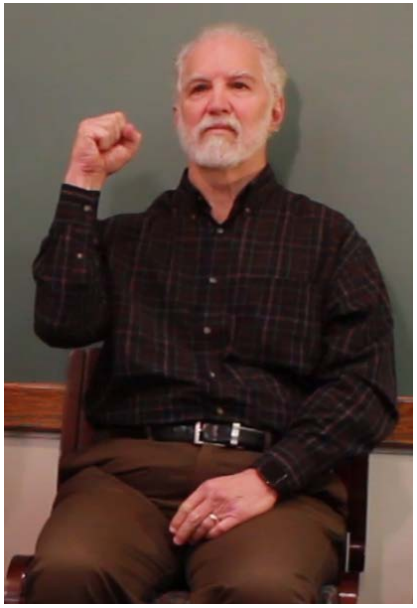


# Step 6 – Commands

*Ask patient to "close your eyes" and "make a fist with your good hand"*

| | Score |
|---|---|
| Normal (performs both tasks) | 0 |
| Moderate (performs one task) | 1 |
| Severe (performs no tasks) | 2 |





# Step 7 – Agnosia

*Ask "Whose arm is this?" & "Lift both arms and clap"*

| | Score |
|---|---|
| Normal (recognizes his/her arm and the impairment) | 0 |
| Moderate (does not recognize either his/her arm or the impairment) | 1 |
| Severe (does not recognize his/her arm nor the impairment) | 2 |

# RACE Score Example 1

# mRACE Score Example 1

| Score Element | Score | Comments |
|---|---|---|
| Speech | CPSS - (No # Score) | Normal |
| Facial Palsy | 0 | Normal |
| Arm Motor | 1 | Can lift but <10 seconds |
| Leg Motor | 1 | Can lift but <5 seconds |
| Head/Gaze Deviation | 0 | Normal |
| Commands | 0 | 2 tasks completed |
| Agnosia | 0 | Recognizes arm<br>Recognizes deficit |
| TOTAL SCORE | 2 | |

# RACE Score Example 2

# mRACE Score Example 2

| Score Element | Score | Comments |
|---|---|---|
| Speech | CPSS + (No # Score) | Abnormal |
| Facial Palsy | 0 | Normal |
| Arm Motor | 2 | Unable to move either arm against gravity |
| Leg Motor | 2 | Unable to move either leg against gravity |
| Head/Gaze Deviation | 1 | Abnormal gaze |
| Commands | 0 | 2 tasks completed |
| Agnosia | 2 | Does not recognize arm<br>Does not recognize deficit |
| TOTAL SCORE | 7 | |

Questions?

Hands-on Practice (learners will practice mRACE assessment using course scenarios, with oversight of physician course director and preceptors)