

# The Prehospital **VAN** Stroke Assessment

Prehospital evaluation  
for large vessel occlusions

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As the Clinical Coordinator for UMC EMS' licensed continuing education program, Chad oversees and teaches both in-house education and community outreach programs to EMS providers. He is a co-author to several research posters presented across the state and nation, generating interest and helping other EMS services advance their treatment protocols based on UMC EMS' experiences. Chad also directs the UMC EMS Outreach CE program that offers free, approved online continuing education to EMS providers in Texas and NREMT recertification candidates throughout the United States.

Closer to home, he and his team of educators teach the American College of Surgeons' "Stop the Bleed" campaign to schools, organizations, and communities across Lubbock and the South Plains. Away from home, Chad represents EMS at the Governor's EMS and Trauma Advisory Council (GETAC). In addition, he has conveyed the concerns of many prehospital providers by testifying to the United States Sentencing Commission in Washington D.C. about the difficulties faced by synthetic cannabinoid use by the public. He continues to speak to students, parents, and the general public about these dangers that may be lurking within their own homes.



# DISCLOSURES

## **FINANCIAL DISCLOSURE:**

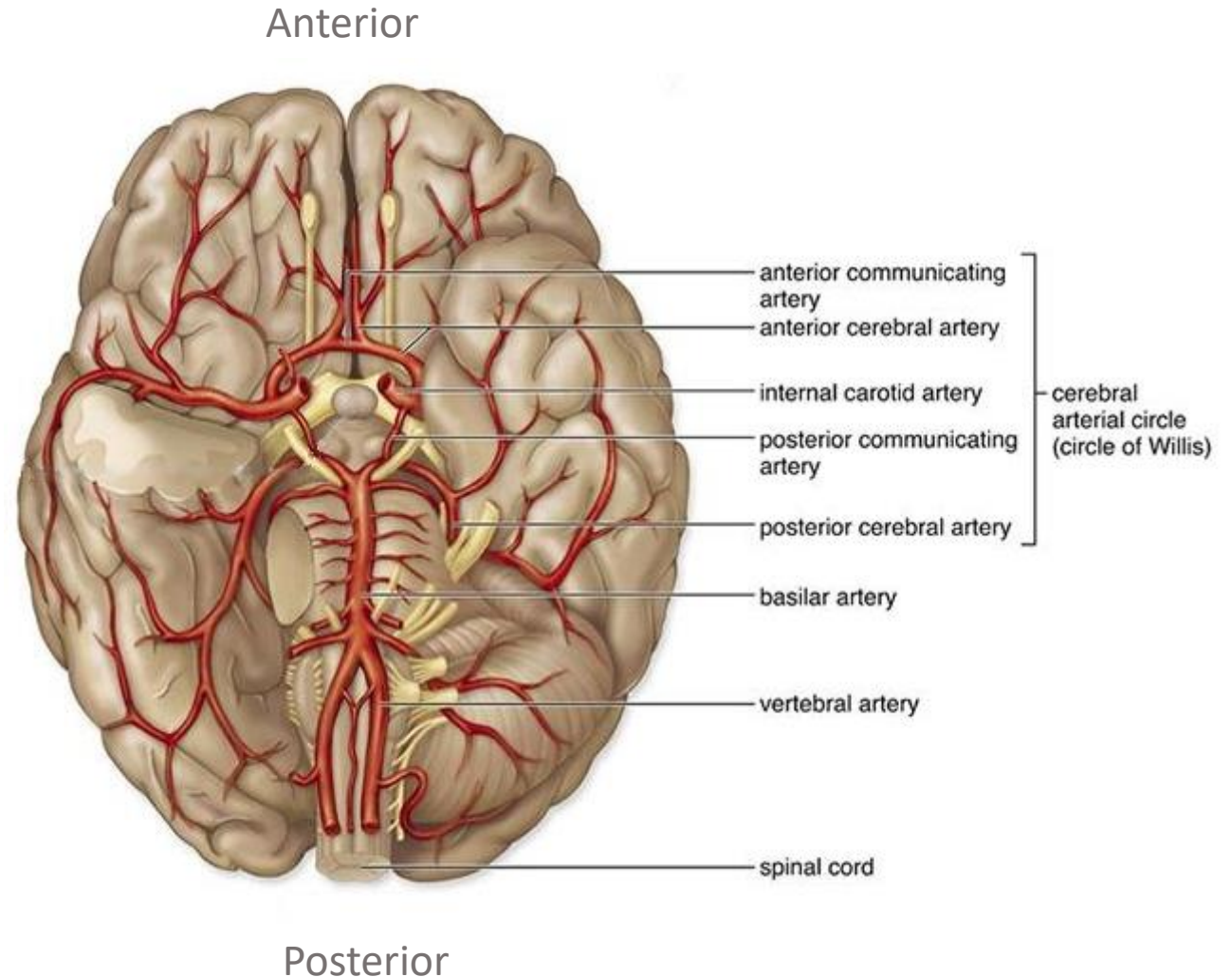
No financial relationships to disclose

## **UNLABELED/UNAPPROVED USES DISCLOSURE:**

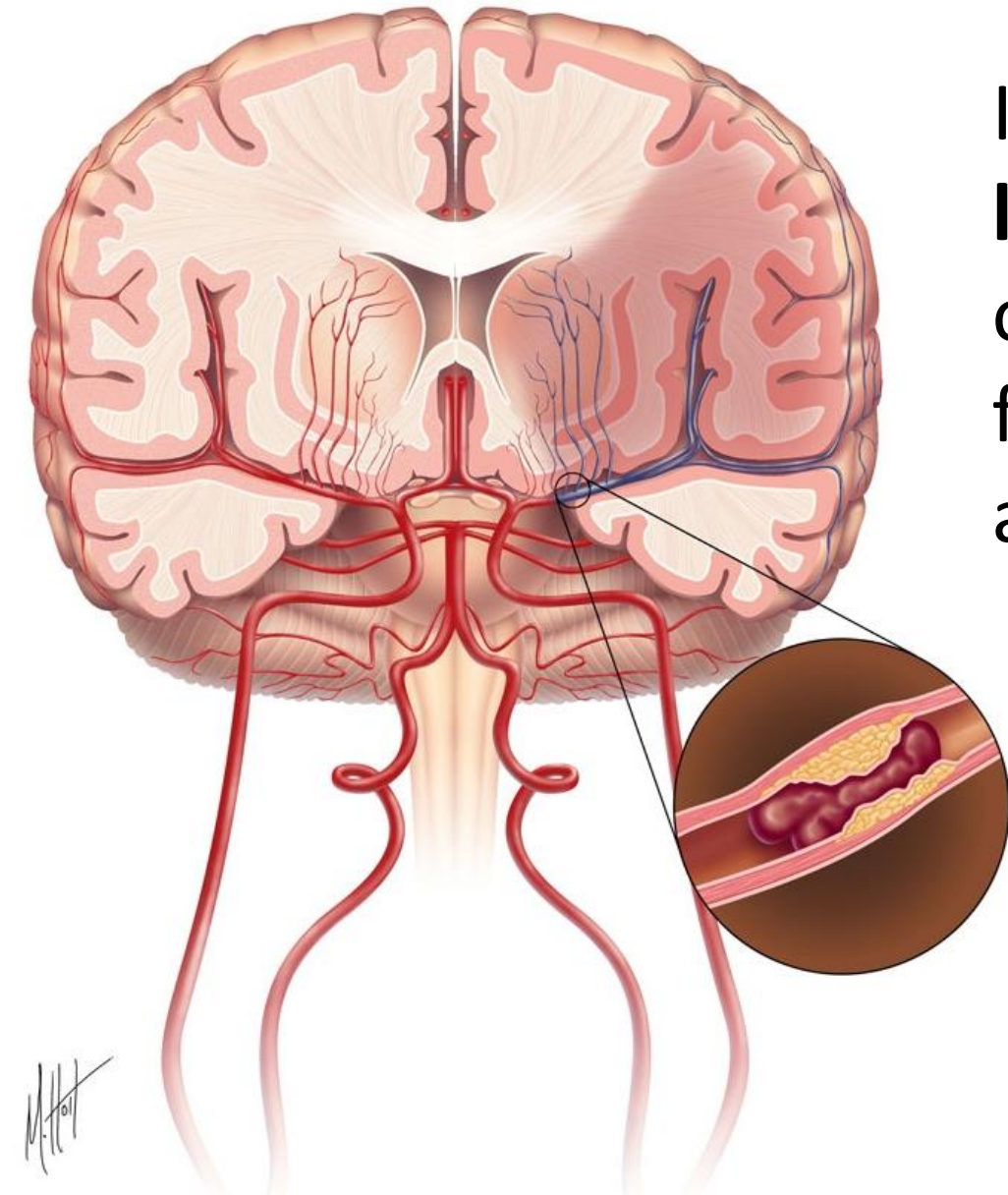
None to disclose

# A review of large cerebral vessel occlusions

The cerebral arteries are similar any other arterial network in the body: A few large vessels branch out from the base and feed the many smaller diameter vessels winding throughout the brain.



# A review of large cerebral vessel occlusions



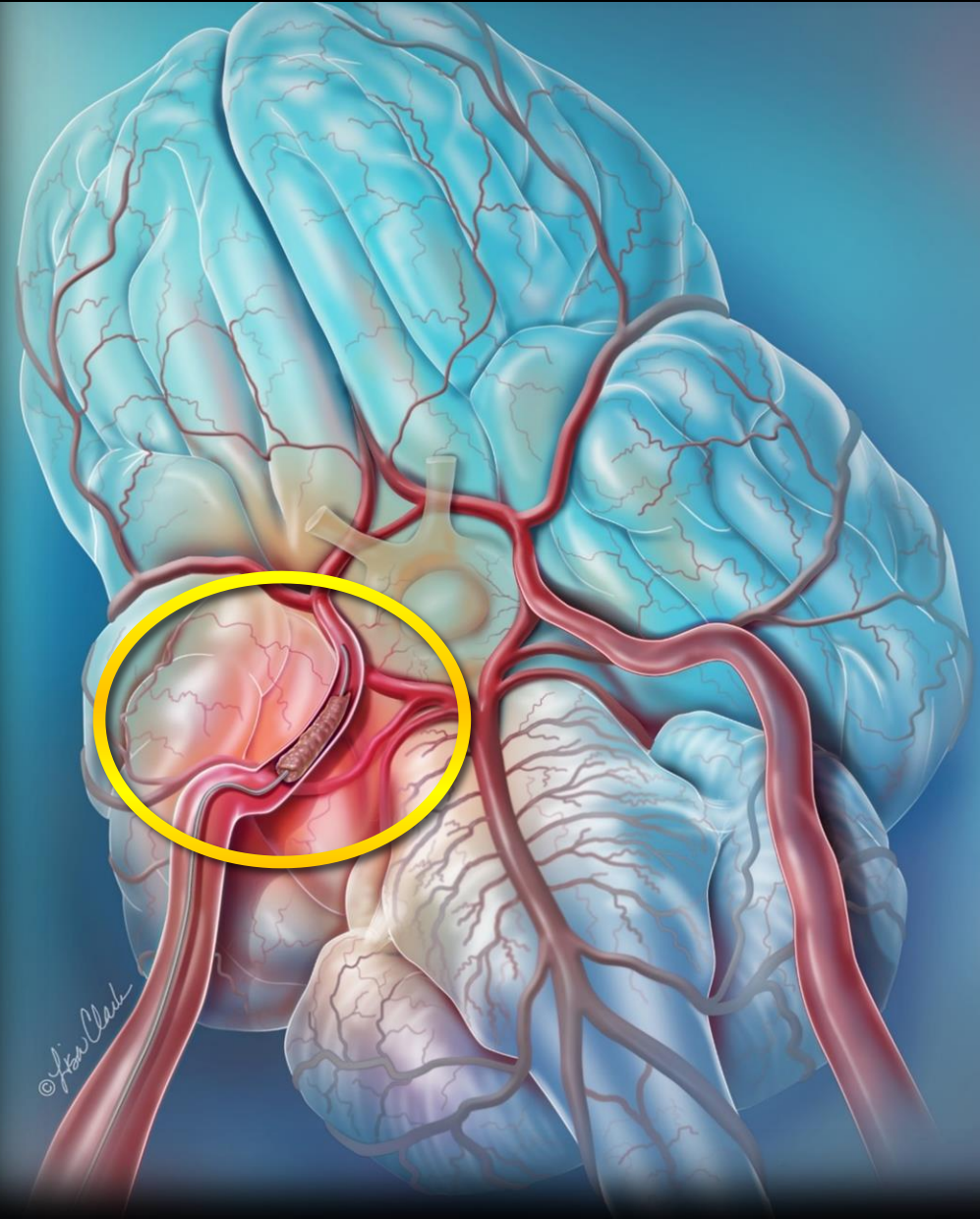
If a thrombus occludes blood flow in a **large** cerebral vessel for a significant length of time, it can cause severe, permanent functional damage. This can drastically affect the patient's quality of life.

But we can avert this fate by treating soon enough and with appropriate interventions, **reducing the risk of permanent disability or death.**<sup>1-5</sup>

# Treatment of large vessel occlusions

One treatment pathway for large vessel clot extraction starts with a controlled IV infusion of tPA to help begin the thrombus-breakdown process, which is then followed with mechanical or aspiration thrombectomy.

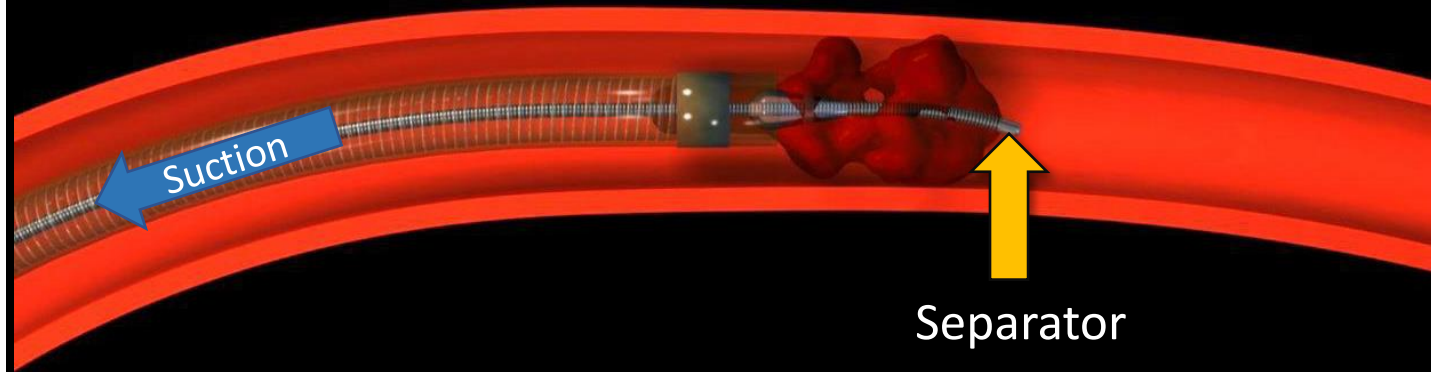
Both thrombectomy techniques introduce a catheter into the cerebral artery and physically remove the clot, facilitated by suction.



# Treatment of large vessel occlusions

One local stroke center uses the Penumbra<sup>®</sup> system with ACE catheters.

The catheter is threaded into the cerebral artery via femoral access. The “separator” wire residing within the catheter is pushed in and out of the clot to break it into smaller pieces. The clot pieces are then drawn out of the vessel and into the catheter with suction.

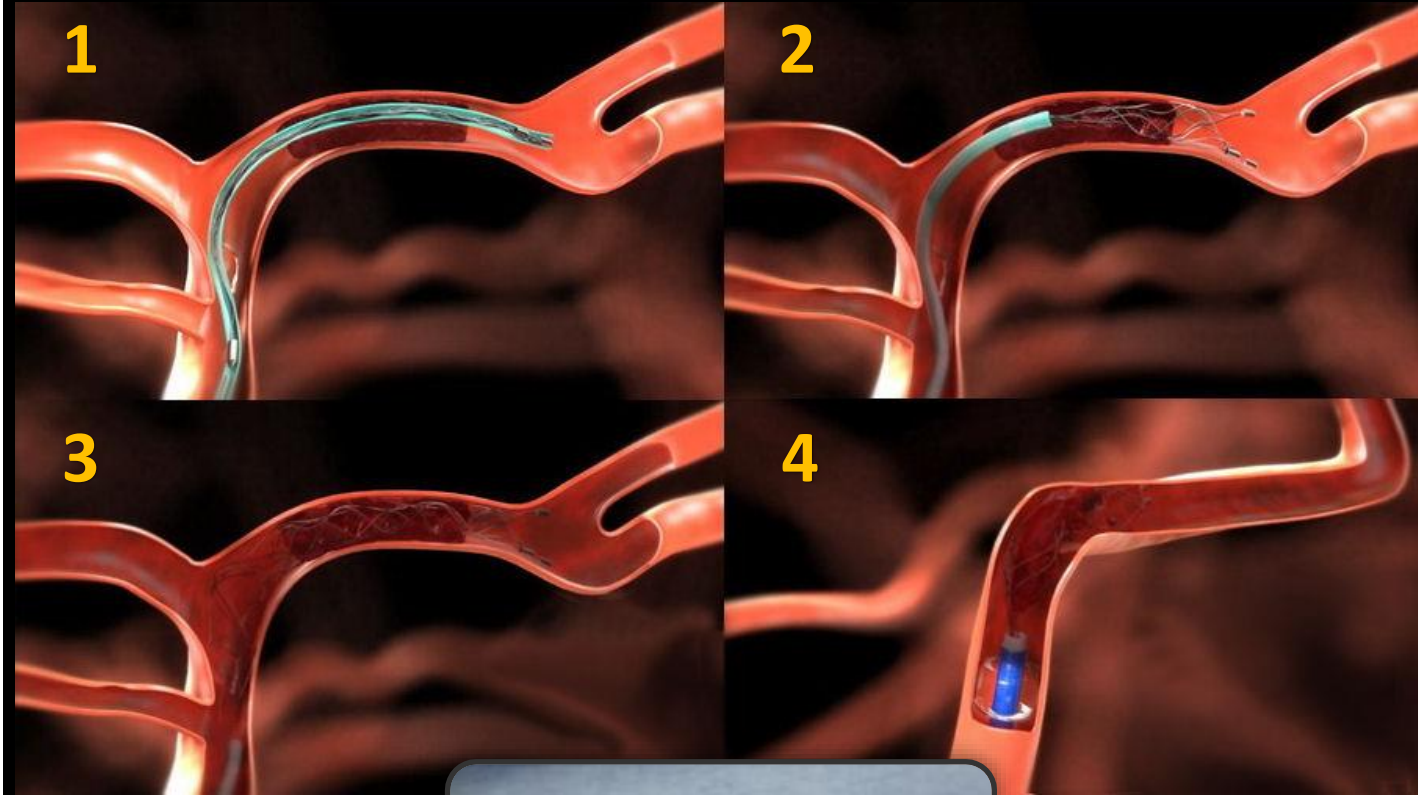


Penumbra<sup>®</sup> system using a separator and catheter aspiration for clot retrieval

# Treatment of large vessel occlusions

The mechanical stent retrieval devices used by our local stroke centers include the Solitaire™ revascularization device and the Trevo XP Provue® system.

Basically, the device is threaded through the cerebral artery and the closed stent is then introduced through the clot. The stent expands, reperfusion the vessel, and the clot is dragged back into the catheter with suction assistance.



Mechanical stent retrieval device



## New hospital notification alerts

EMS now uses the VAN stroke scale to recognize the potential for a large vessel occlusion. This allows for early, specific emergency center notification for mobilization of appropriate teams and resources.

The emergency center is now notified of both a Cincinnati Stroke Scale assessment and a “**positive VAN**” alert, if the patient meets the criteria.



# Large vessel occlusion assessment tools: VAN

## So... what is VAN?



Before explaining the VAN assessment procedure, take a look at the some of the current stroke assessment scales. See why this one was selected over the other prehospital stroke scale options.

# The National Institute of Health Stroke Scale (NIHSS)

The NIHSS is used in the hospital setting to determine the severity of stroke signs and to help guide stroke therapy decisions.

It is an 11 item patient assessment with a maximum score of 42. A score of zero suggests no deficits.

1 to 4: Minor stroke  
 5 to 15: Moderate stroke  
 16 to 20: Moderate to severe stroke  
 21 to 42: Severe stroke

Instructions	Scale Definition	Score
<b>1a. Level of Consciousness:</b> Choose a response even if a full evaluation is prevented by ET tube, language, trauma, etc.	0 = Alert; keenly responsive. 1 = Arousable by minor stimulation to obey, answer, or respond. 2 = Requires repeated stimulation to attend, or is obtunded and requires strong or painful stimulation to make movements. 3 = Responds only with reflex responses or totally unresponsive.	_____
<b>1b. LOC Questions:</b> Ask the month and his/her age. The answer must be correct - there is no partial credit for being close. Do not "help" the patient.	0 = Answers both questions correctly. 1 = Answers one question correctly (or dysarthria, intubated, foreign lang.) 2 = Answers neither question correctly.	_____
<b>1c. LOC Commands:</b> Ask to open and close eyes and to grip and release the non-paretic hand. Substitute another one step command if the hands cannot be used. Task can be demonstrated and then scored.	0 = Performs both tasks correctly (ok if impaired by weakness). 1 = Performs one task correctly. 2 = Performs neither task correctly.	_____
<b>2. Best Gaze:</b> Horizontal EOM tested by voluntary or oculocephalic maneuver (Doll's).	0 = Normal. 1 = Partial gaze palsy. Abnormal gaze in one or both eyes. 2 = Forced deviation or total gaze paresis not overcome by the oculocephalic maneuver (Doll's).	_____
<b>3. Visual:</b> Visual fields (upper and lower quadrants) are tested by confrontation, using finger counting or visual threat as appropriate. Patient must be encouraged, but if they look at.	0 = No visual loss. 1 = Partial hemianopia, quadrantanopia, extinction. 2 = Complete hemianopia. 3 = Bilateral hemianopia (blind including cortical blindness)	_____
<b>4. Facial Palsy:</b> Ask, or use pantomime to have show teeth, raise eyebrows and close eyes. Score symmetry of grimace in response to noxious stimuli in the poorly responsive or non-comprehending patient.	0 = Normal symmetrical movement. 1 = Minor paralysis (flattened nasolabial fold, asymmetry on smiling). 2 = Partial paralysis (total or near total paralysis of lower face). 3 = Complete paralysis-1 or both sides (no facial movement upper/lower face)	_____
<b>5. Motor Arm:</b> Extend the arms (palms down) 90 degrees (if sitting) or 45 degrees (if supine) and the leg 30 degrees (always tested supine). Drift is scored if the arm falls before 10 seconds. Can encourage using voice and pantomime.	0 = No drift for 10 seconds. 1 = Drift but does not hit bed or other support. 2 = Some effort against gravity, but can't maintain-falls to bed. 3 = No effort against gravity, limb falls. 4 = No movement. X = Amputation, joint fusion explain:	_____
	<b>5a. Left Arm</b> <b>5b. Right Arm</b>	_____
<b>6. Motor Leg:</b> Leg extended 30 degrees (always test supine). Drift is scored if falls before 5 seconds. Can encourage using voice and pantomime.	0 = No drift, leg holds position for full 5 seconds. 1 = Drift but does not hit bed. 2 = Some effort against gravity, but can't maintain-falls to bed. 3 = No effort against gravity, leg falls to bed immediately. 4 = No movement. X = Amputation, joint fusion explain:	_____
	<b>6a. Left Leg</b> <b>6b. Right Leg</b>	_____

# NIHSS is not quite prehospital friendly.

But, the NIHSS is not a rapid test, so becomes a problem for the prehospital setting. The Cincinnati Prehospital Stroke Severity Scale (CPSSS) was developed as a three item scale based on the NIHSS. It was found to be very useful in the prehospital setting, with particular sensitivity towards anterior circulation strokes.<sup>6</sup>

## Benefits:

- Rapid
- Easy to remember
- No calculations

### Cincinnati Pre-hospital Stroke Scale

1. **FACIAL DROOP:** Have patient show teeth or smile.



**Normal:**  
both sides  
of the face  
move equally



**Abnormal:**  
one side of  
face does not  
move as well  
as the other  
side

2. **ARM DRIFT:** Patient closes eyes & holds both arms out for 10 sec.



**Normal:**  
both arms  
move the  
same or both  
arms do not  
move at all



**Abnormal:**  
one arm does  
not move or  
drifts down  
compared to  
the other

3. **ABNORMAL SPEECH:** Have the patient say "you can't teach an old dog new tricks."

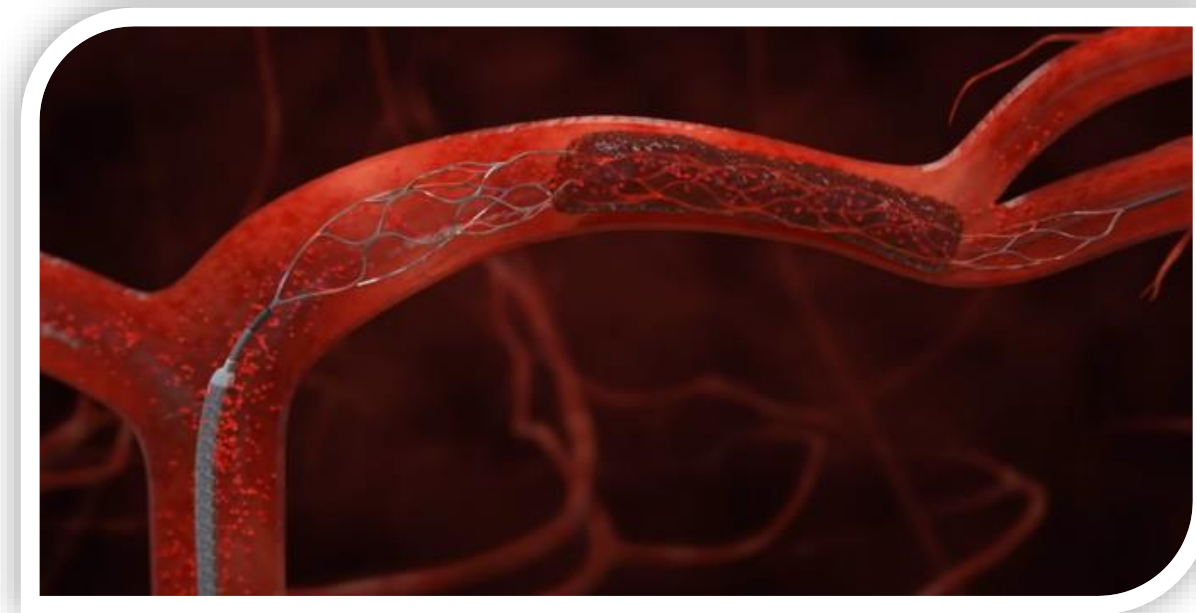
**Normal:** patient uses correct words with no slurring    **Abnormal:** patient slurs words, uses the wrong words, or is unable to speak

**INTERPRETATION:** If any 1 of these 3 signs is abnormal, the probability of a stroke is 72%.

## But medicine is always looking to improve...

**But, the Cincinnati Stroke Scale doesn't specifically target large vessel occlusions...** it recognizes *generalized* stroke signs.

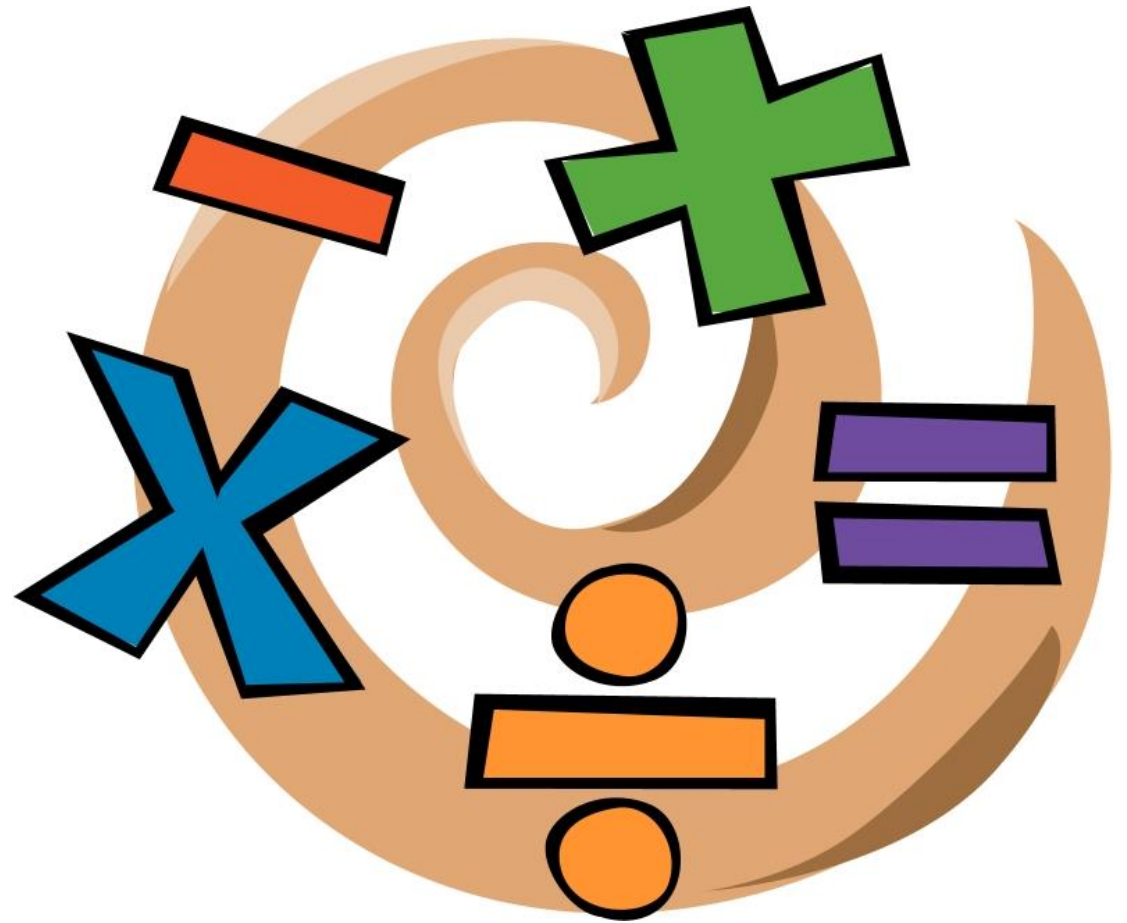
Over the years, several prehospital stroke scales have been researched, designed, and tested clinically. The latest ones focus on large vessel occlusion, since the newest treatment options have produced great functional outcomes for these patients.



## Lots of stroke scales out there. Some are complex.

Some of these other stroke scales still require adding up scores, others take some extra time to assess, and a few don't offer an easy way to remember the assessment points.

Checklists and score boxes are not ideal solutions for the prehospital environment.



# Looking at a few of the stroke assessment tools out there:

<b>Acronym:</b>	<b>Stroke Assessment Tools:</b>
<b>3I-SS</b>	Three Item Stroke Scale
<b>CPSSS</b>	Cincinnati Prehospital Stroke Severity Score
<b>FAST-ED</b>	Field Assessment Stroke Triage for Emergency Destination
<b>Hemiparesis</b>	Assessment for unilateral paralysis
<b>LAMS</b>	Los Angeles Motor Scale
<b>LEGS</b>	Texas Stroke Intervention Prehospital Stroke Severity Scale
<b>RACES</b>	Rapid Arterial Occlusion Evaluation Scale
<b>VAN</b>	Vision, Aphasia, and Neglect

**And of course, the emergency department standard for stroke assessment scores:**

<b>NIHSS</b>	National Institute of Health Stroke Scale
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# What do the different stroke scales assess?

**MOTOR FUNCTION AREA:** Initiation of voluntary muscle use. Is a component of **ALL** stroke scales.<sup>7,8</sup>

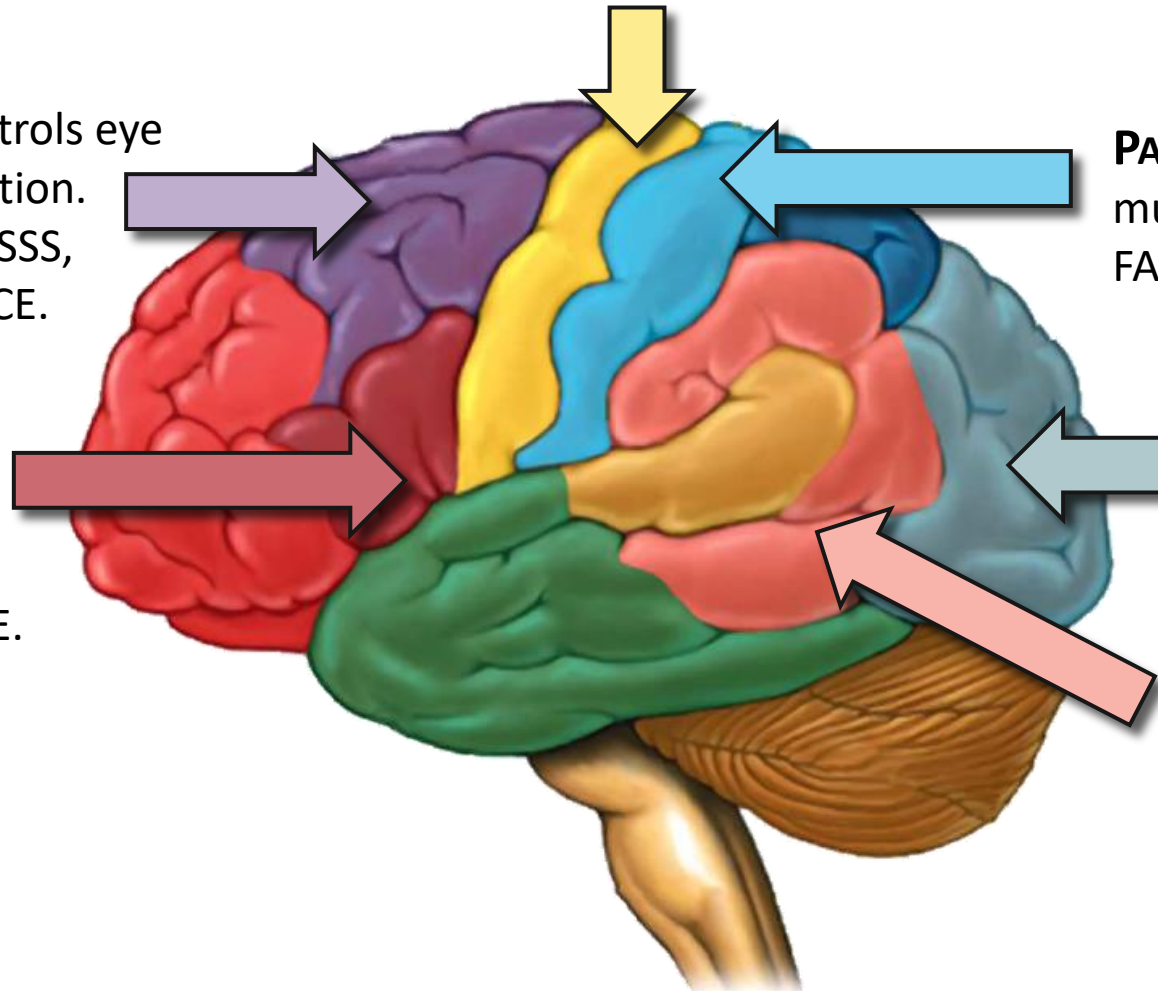
**CEREBRAL CORTEX:** Controls eye movement and orientation. Used by **VAN**, 3I-SS, CPSSS, FAST-ED, LEGS, and RACE.

**BROCA'S AREA:** Muscle control area for speech. Used by **VAN**, CPSSS, FAST-ED, LEGS, and RACE.

**PARIETAL LOBE:** Sensation from muscles and skin. Used by **VAN**, FAST-ED, and RACE.

**OCCIPITAL LOBE:** Sight, image perception/recognition. Used by **VAN**, LEGS, and RACE.

**WERNICKE'S AREA:** Written and spoken language comprehension. Used by **VAN**, CPSSS, LEGS, and RACE.

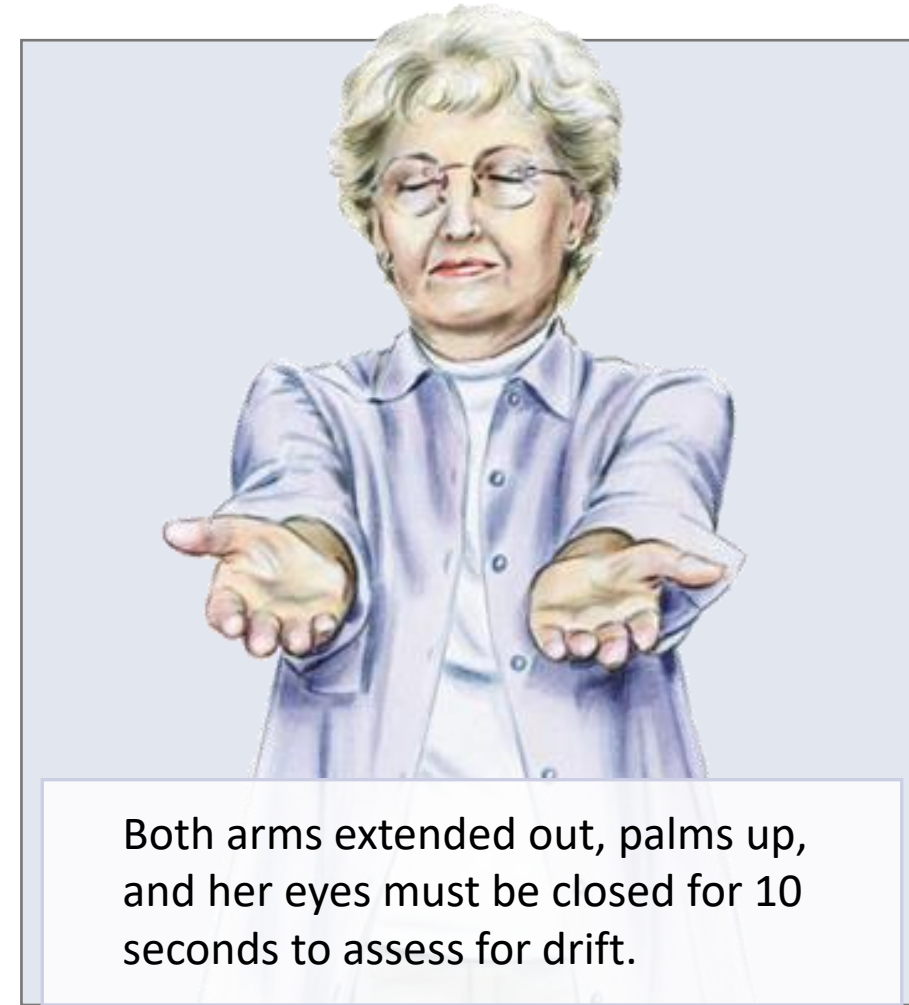




# Assessing the patient using VAN

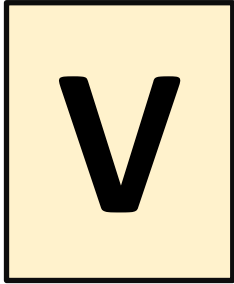
The VAN scale was selected as our large vessel occlusion determination scale because it's rapid (*30 seconds*), no math, no checklists, and:

- **The first assessment involves motor function, just like the Cincinnati Stroke Scale.** If the patient has no arm drift, paralysis, or unilateral weakness, the test is over. This rapidly triages out a group of patients since a large vessel occlusion affects motor function.
- **If arm drift is present, you'll move on to the VAN portion of the assessment...**



Both arms extended out, palms up, and her eyes must be closed for 10 seconds to assess for drift.

# The VAN Assessment Procedure



**Visual Disturbance.** Does the patient report double-vision, field cut, or loss of vision? Is it difficult for her to see your fingers clearly in a visual quadrant? If “Yes”, the test is done at this point and she’s “VAN positive”. If not, move to the next test.

Two examples of field cut (*hemianopsia*) below, where a portion of the patient’s vision is blurred or blinded. It’s helpful to learn which side is affected and report that to the receiving staff.



*Or...*

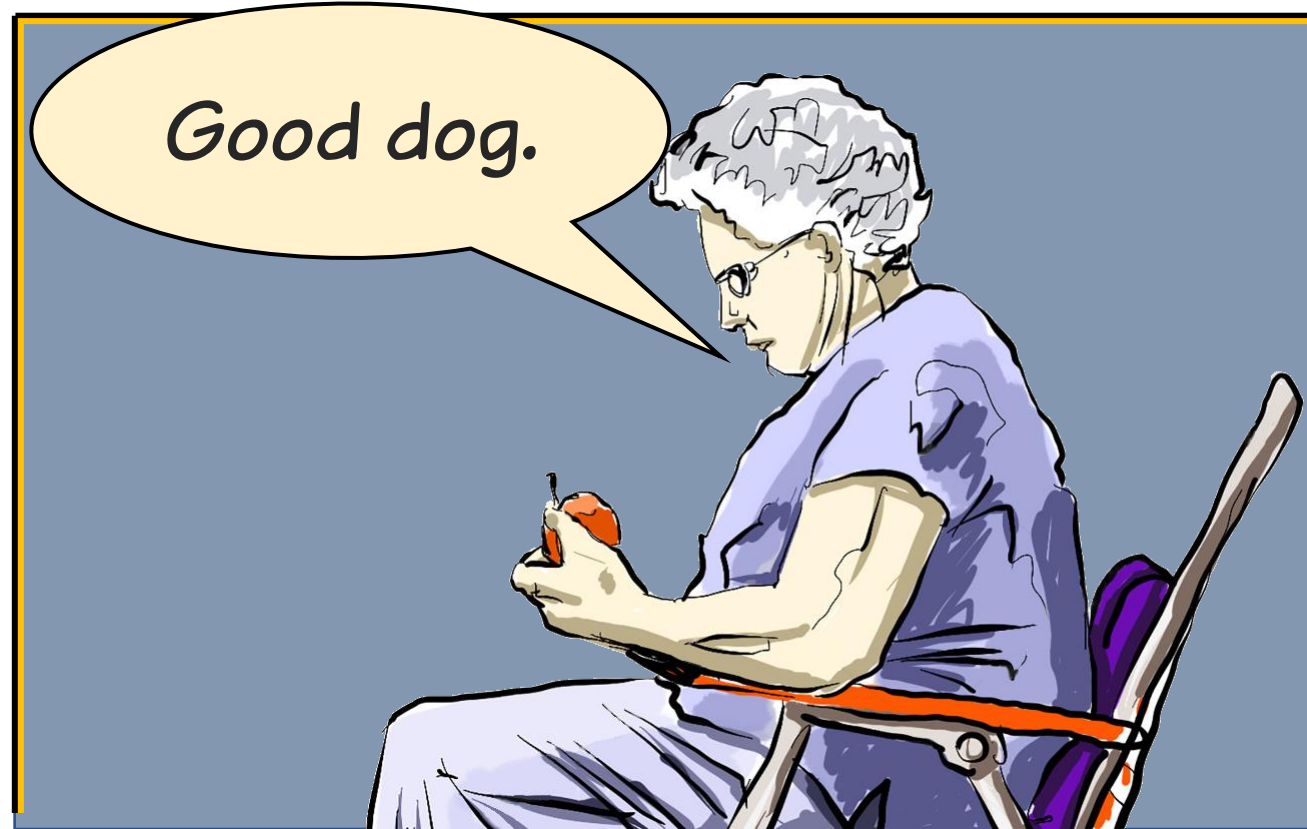


# The VAN Assessment Procedure

A

**Aphasia.** Any difficulty forming words? Can she repeat a short sentence? Can she recognize two objects correctly? Follows simple commands (*and there's no language barrier present*)?

Do not count slurred speech or baseline aphasia as a positive sign... this could be a smaller vessel occlusion or from another cause. If any of the listed aphasia criteria are met, the test is done at this point and she's "VAN positive". If not, move on to the next test.

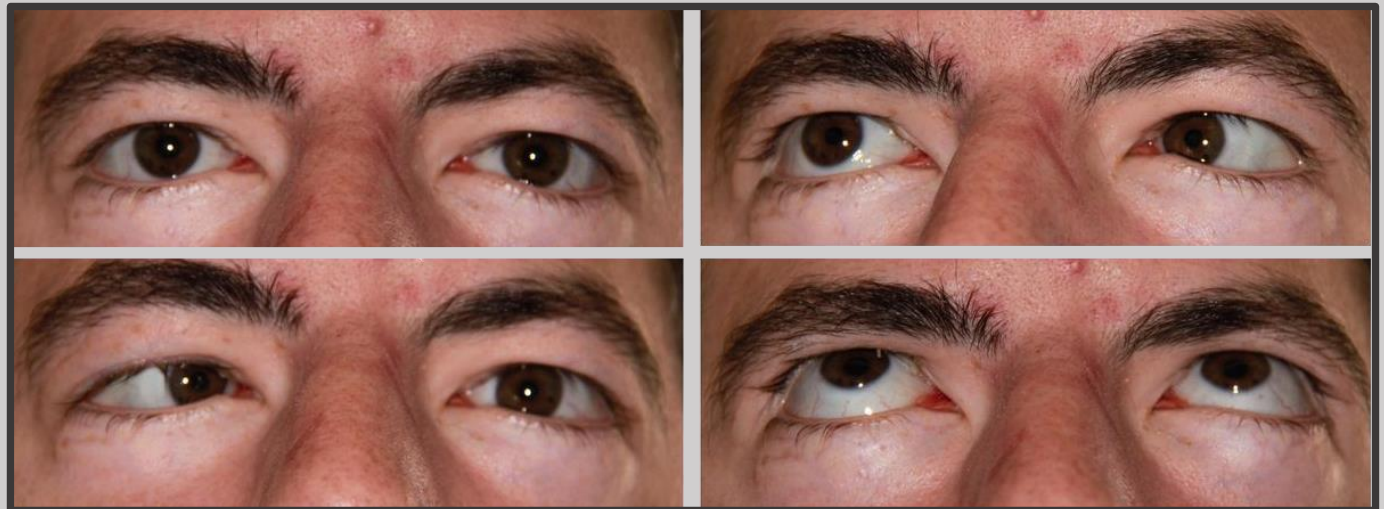


# The VAN Assessment Procedure

**N**

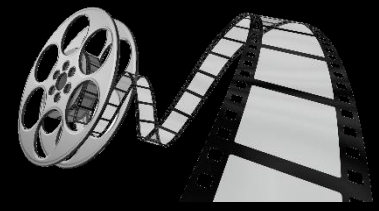
**Neglect.** Neglect refers to the patient's senses and gaze. Does the patient present with an acute "forced gaze"/conjugate gaze palsy? Are her eyes unable to track your pen to one side? Ask her to close her eyes: Is she unable to feel sensation to an arm or leg when one or both are stimulated? If "Yes" to any of these, she is "VAN positive". If not, her VAN assessment is negative for a large vessel occlusion.

It's important to assess for all directions of tracking, as eye deviation may be noticeable in one direction only.



# Video of the VAN assessment

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# How accurate is the VAN stroke scale?

The VAN stroke assessment is new and hasn't been validated in a large, multicenter study yet. However, early results from one emergency department's stroke activations offers promising results:

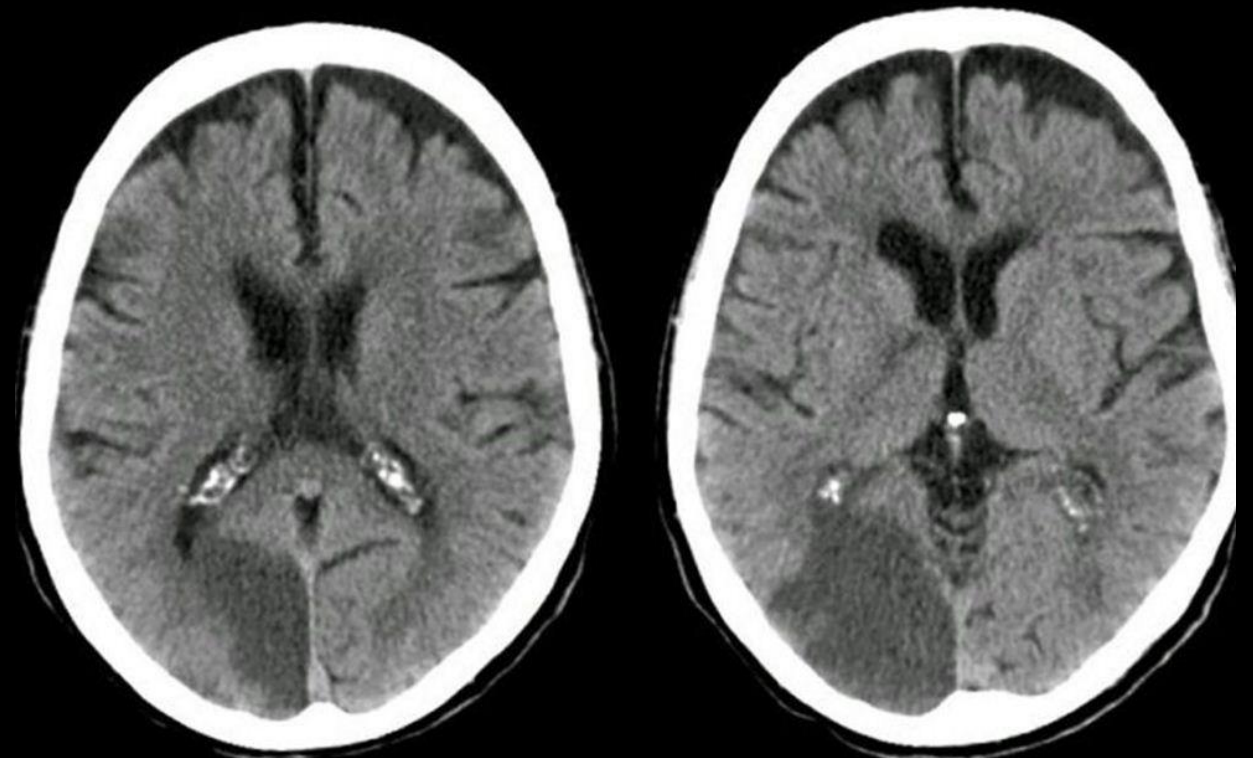
## Results from a single center VAN pilot study<sup>8</sup>

Total number of patients who were stroke activations:	62
Of those 62 patients, how many were VAN positive on assessment?	19
Of those 19 patients, how many had a large vessel occlusion (LVO)?	14
Note: All 14 of those LVO patients were VAN positive in this study.	100% sensitivity
There were 5 false-positives ( <i>patients who were VAN+, but not having a LVO stroke</i> ).	90% specificity
<b>The VAN assessment did not miss any LVO strokes.</b>	No false negatives

# Protocol revision for EMS

EMS: **Both** the Cincinnati Stroke Scale and the VAN assessment need to be performed for any suspected stroke patient. However, this is easy to do since both share two elements: **Arm drift** and a **speech assessment**.

Keep in mind that computed tomography (*“the head CT”*) still remains as the **gold standard** for stroke diagnosis.



# Stroke (suspected)

## History

- Previous CVA or TIA
- Previous cardiac / vascular surgery
- Associated diseases: diabetes, hypertension, CAD
- Atrial fibrillation
- Medications (anticoagulants)
- History of trauma

## Signs and Symptoms

- Altered mental status
- Weakness / paralysis
- Blindness or other sensory loss
- Aphasia / dysarthria
- Syncope
- Vertigo / dizziness
- Vomiting
- Headache
- Seizures
- Respiratory pattern change
- Hypertension / hypotension

## Differential


- See Altered Mental Status protocol
- TIA (transient ischemic attack)
- Seizure
- Todd's paralysis
- Hypoglycemia
- Stroke:
  - Thrombotic or embolic (~85% of cases)
  - Hemorrhagic (~15% of cases)
- Tumor
- Trauma
- Dialysis / renal Failure

Perform the Cincinnati Stroke Screen and the VAN Stroke Screen (Criteria are available in the Pearls)

One or both of the prehospital stroke screens consistent with an acute stroke?

Yes

No

Exit to  Appropriate Protocol

Time of onset or the last time patient appeared normal is definitely less than 6 hours, regardless of patient's hospital choice?


Yes

No



Transport based on: **STROKE**  
 Keep scene time ≤ 10 minutes. Immediate notification of facility. If the patient is VAN positive, alert the hospital to this finding as well.  
 Transport the patient with the head of the bed elevated about 30 degrees.

Try to obtain a phone number from a family member or other appropriate person on scene who would be able to provide information to the ED physician or RN.  
 This information can expedite the patient's treatment for stroke in the hospital.

- B** Blood glucose analysis procedure
- Oxygen (nasal cannula minimum)
- Cardiac monitor
- 12-lead ECG procedure
- I** IV and blood draw procedures

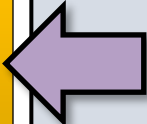
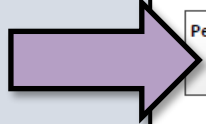
Diabetic Protocol (if indicated) 

To accommodate the intravenous contrast for specialized CT scans, the IV catheter should be no smaller than an 18 gauge unless the patient's vasculature prevents large bore access.  
 A blood draw during transport can expedite patient care at the hospital.

 Notify Destination or Contact Medical Control 

If a Code Stroke has been called and symptoms begin to improve, contact the receiving facility to cancel the Code Stroke activation.

This box now lists that both the Cincinnati Stroke Screen and VAN stroke screen should be performed.



The hospital should be alerted to any positive VAN assessments.



# The VAN Stroke Assessment isn't just for EMS

## Where else can the VAN scale be used?

- Emergency Center Triage
- Hospital ICUs, step-down units, anywhere a patient occupies a bed or a seat and suddenly develops acute stroke-like signs and symptoms.



# “Wake Up” Strokes

A **“wake-up stroke”** occurs when a patient awakens with stroke-like symptoms that were not present before falling asleep. They remain a mystery, but are likely the result of circadian changes in coagulability, serum catecholamine levels, and autonomic tone.<sup>9</sup>

**They account for roughly  
1 in 5 acute ischemic strokes<sup>9</sup>.**



# The Future for “Wake Up” Stroke Patients

There are ongoing endovascular stroke trials that will allow for enrollment of patients with an unknown time of symptom onset.

In one trial using the Trevo<sup>®</sup> stent retriever, the time window for treatment is 6 to 24 hours after symptom onset or last seen well, respectively. The trial started in 2014 with a completion date expected in 2017.<sup>10</sup>

**Questions?**



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