Objectives

- History of Stroke.
- Cost of Stroke in the U.S.
- Anatomy of the Brain.
- Identification of Stroke in the Prehospital setting.
- Stroke Scales.
- Treatment
Apoplexy

- Identified as early as 2,400 years ago when Hippocrates recognized and described signs of stroke.

- In 1620, Dr. Johann J. Wepfer suggested that Apoplexy could be caused by bleeding or blockage in the brain.²

- Most progress has been seen over the last two decades.²
Cost of Stroke

- Total cost of stroke to the United States: estimated at about $43 billion / year
- Direct cost for medical care and therapy: estimated at about $28 billion / year
- Indirect cost from lost productivity and other factors: estimated at about $15 million / year
- Average cost of care for a patient up to 90 days after a stroke: $15,000*
- For 10% of patients, cost of care for the first 90 days after a stroke: $35,000*
- Percentage of direct cost of care for the first 90 days*:
  - initial hospitalization = 43%
  - rehabilitation = 16%
  - physician cost = 14%
  - hospital readmission = 14%
  - medications and other expenses = 13%
The Brain
The Brain

- Divided into 3 functional parts:
  - Cerebrum
  - Cerebellum
  - Brain Stem
Cerebrum

• Divided into left and right hemispheres.

• Injury to the left cerebral hemisphere produces sensory and motor deficits on the right side, and vice versa.

• Over 95% of people have dominance for speech and language in the left hemisphere. Thus, a left hemisphere stroke will be more likely to produce aphasia and other language deficits.
Cerebrum

5 lobes within the Cerebrum

- **Frontal:** Muscle control, motor skills and cognitive function
  - Brocca’s Area

- **Parietal:** Sensation of touch, pain, and pressure

- **Temporal:** Auditory, language, memory
  - Wernicke’s Area

- **Occipital:** Visual

- **Insula:** Interpersonal experience, consciousness, self-awareness.
  - Food poisoning anyone? Scared of heights?
Cerebellum

• Second largest part controlling balance, coordination and further control of movement.

• A stroke involving the cerebellum may result in a lack of coordination, clumsiness, shaking, or other muscular difficulties.
Brainstem

- Control of automatic functions such as respiration, heart rate, blood pressure, wakefulness, arousal, and attention.

- Brainstem strokes can be serious or even fatal. People who survive may be left with severe impairments or remain in a vegetative state.
Brain Vasculature
Brain Vasculature

- Blood is supplied to the brain via the right and left common carotid arteries and left and right vertebral arteries.

- The common carotid arteries are divided into external and internal carotid arteries.

- The vertebrobasilar arteries supply blood to the posterior part of the cerebrum, part of the cerebellum, and brain stem.
Brian Vasculature

- Any decrease in blood flow through the carotid arteries can result in weakness, numbness or paralysis opposite to the occlusion.
- Decrease in blood flow through the vertebral arteries can result in serious impairments.
Brain Vasculature:
Circle of Willis
Brain Vasculature: Circle of Willis

- Connection of the carotid and vertebrobasilar arteries.
- Located at the base of the brain.
- The anterior cerebral artery (ACA), the middle cerebral artery (MCA) and the posterior cerebral artery (PCA) arise from here and feed other parts of the brain.
- Occlusion to the arteries within the Circle of Willis can be temporarily overcome as a result of collateral circulation.
Brain Vasculature

- Anterior Cerebral Artery:
  - Supplies the frontal lobes.

- Middle Cerebral Arteries
  - Largest branch of the internal carotid
  - Supplies portion of the frontal lobe and the lateral surfaces of the temporal and parietal lobes
  - The most often occluded during Stroke.
Brain vasculature

- **Posterior Cerebral Arteries**
  - Supply the temporal and occipital lobes.
  - Infarction usually occurs secondary to an emboli from the lower segments of the vertebrobasilar arteries or heart.

- **Lenticulostriate Arteries**
  - Small and deep penetrating arteries stemming from the MCA.
  - Occlusions to these vessels are known as lacunar strokes which account for approximate 20% of all strokes.
  - Most often in patients with history of chronic hypertension.
Got kicked out of the hospital. Apparently, the sign "Stroke Patients Here" meant something completely different.
Stroke Recognition in the Prehospital Setting.
In a perfect world, you and I probably wouldn’t exist, so let’s not hope for one

Ze Frank

PICTUREQUOTES.com
In a Perfect World

* Family/Bystanders recognize signs and symptoms and 911 is called.
* Dispatcher recognizes the Stroke symptoms
* EMS arrives on scene FAST!!!
* Stroke is recognized by EMS
  - LKWT
* Transport to SRC or CSC.
<table>
<thead>
<tr>
<th>METRIC</th>
<th>POPULATION</th>
<th>GOALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of EMS patients triage to an ASRH, PSC, CSC</td>
<td>Patients call EMS via 911</td>
<td>Improve presentation times to a stroke center, increase use of IV tPA</td>
</tr>
<tr>
<td>% of IV tpa treated with DTN time ≤ 60 min</td>
<td>Patients eligible for IV tPA</td>
<td>Improve use of IV tPA</td>
</tr>
<tr>
<td>Median time to acute reversal of INR in ICH or SAH</td>
<td>ICH/SAH patients with INR &gt; 1.4</td>
<td>Reduce time to reversal</td>
</tr>
<tr>
<td>Median time to establish telemedicine link</td>
<td>Patients at non-stroke center</td>
<td>Improve efficiency of telemedicine care and expedite stabilization and transfer</td>
</tr>
<tr>
<td>Median time from ED arrival to second hospital arrival among transferred patients</td>
<td>Patients at remote facilities transferred to PSC or CSC</td>
<td>Reduce transportation times</td>
</tr>
</tbody>
</table>
Stoke Recognition in the Prehospital Setting

• A retrospective study conducted between September 2009 and December 2012 found that EMS correctly recognized 57.6% of stroke cases.

• Correctly recognized cases had a shorter door-to-physician time (4 vs 11 min, p<.001) and shorter door-to-CT time (23 vs 48 min, p<.001)\(^1\)
Stroke-STEMI-Trauma
Stroke Recognition in the Prehospital Setting

- Achieved through the use of Stroke Scales.
- Currently Stroke Scales use include:
  - National Institute of Health Stroke Scale (NIHSS)
  - Cincinnati Prehospital Stroke Scale (CPSS)
  - Face Arms Speech Test (FAST)
  - Los Angeles Prehospital Stroke Screen (LAPSS)
  - Miami Emergency Neurological Deficit (MENDS)
  - Los Angeles Motor Scale (LAMS)
  - Rapid Arterial Occlusion Evaluation (RACE)
Wait there are more….  

- Melbourne Ambulance Stroke Screen (MASS)  
- Ontario Prehospital Stroke Screen Tool (OPSS)  
- Medic Prehospital Assessment for Code Stroke (MedPACS)  
- Recognition of Stroke in the ER (ROSIER)  
- Modified NIH Stroke Scale
SAY WHAT NOW?
A retrospective study conducted between September 2009 and December 2012 found that EMS correctly recognized 57.6% of stroke cases.

Correctly recognized cases had a shorter door-to-physician time (4 vs 11 min, p<.001) and shorter door-to-CT time (23 vs 48 min, p<.001)\(^1\)
Stroke Scales

• Why so many scales?
• The challenge then becomes simplicity, sensitivity, and specificity.
• Let’s not forget TIME…
**Stroke Scales: NIHSS**

- Prehospital and Emergency Stroke Scales are derived from NIHSS.
- The NIHSS is a 15-item neurologic examination stroke scale used to evaluate the effect of acute cerebral infarction on the levels of consciousness, language, neglect, visual-field loss, extraocular movement, motor strength, ataxia, dysarthria, and sensory loss.
- A trained observer rates the patient’s ability to answer questions and perform activities. Ratings for each item are scored with 3 to 5 grades with 0 as normal, and there is an allowance for untestable items.
- The single patient assessment requires up to 10 minutes to complete.
<table>
<thead>
<tr>
<th>Score</th>
<th>Stroke Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No Stroke Symptoms</td>
</tr>
<tr>
<td>1-4</td>
<td>Minor Stroke</td>
</tr>
<tr>
<td>5-15</td>
<td>Moderate Stroke</td>
</tr>
<tr>
<td>16-20</td>
<td>Moderate to Severe Stroke</td>
</tr>
<tr>
<td>21-42</td>
<td>Severe Stroke</td>
</tr>
</tbody>
</table>

### National Institute of Health Stroke Scale (NIHSS)

**1A Level of consciousness**
- 0: alert
- 1: drowsy
- 2: obtunded
- 3: coma/ unresponsive

**1B Orientation questions (two)**
- 0: answers both correctly
- 1: answers one correctly
- 2: answers neither correctly

**1C Response to commands (two)**
- 0: performs both tasks correctly
- 1: performs one task correctly
- 2: performs neither

**2 Gaze**
- 0: normal horizontal movements
- 1: partial gaze palsy
- 2: complete gaze palsy

**3 Visual fields**
- 0: no visual field defect
- 1: partial hemianopia
- 2: complete hemianopia
- 3: bilateral hemianopia

**4 Facial movements**
- 0: normal
- 1: minor facial weakness
- 2: partial facial weakness
- 3: complete unilateral palsy

**5 Motor function (arm)**
- 0: no drift
- 1: drift before 10 seconds
- 2: falls before 10 seconds
- 3: no effort against gravity
- 4: no movement a: left, b: right

**6 Motor function (leg)**
- 0: no drift
- 1: drift before 5 seconds
- 2: falls before 5 seconds
- 3: no effort against gravity
- 4: no movement a: left, b: right

**7 Limb ataxia**
- 0: no ataxia
- 1: ataxia in one limb
- 2: ataxia in two limbs

**8 Sensory**
- 0: no sensory loss
- 1: mild sensory loss
- 2: severe sensory loss

**9 Language**
- 0: normal
- 1: mild aphasia
- 2: severe aphasia
- 3: mute or global aphasia

**10 Articulation**
- 0: normal
- 1: mild dysarthria
- 2: severe dysarthria

**11 Extinction or inattention**
- 0: absent
- 1: mild (loss of 1 sensory modality)
- 2: severe (loss of 2 sensory modalities)
Stroke Scales: CPSS

- Developed in 1997 at the University of Cincinnati for prehospital use.
- Derived from the NIHSS.
- Identification of stroke through three signs.
- A patient positive for 1 of the 3 signs has a 72% probability of an ischemic stroke and 85% probability of an acute stroke if all signs are positive.\(^3\)
- Easy to conduct and takes less than 1 minute.
- Does not assess stroke severity and it is unable to measure posterior circulation strokes.
Cincinnati Prehospital Stroke Scale

**Facial Droop**
*Instruction:* Ask patient to smile
- **Normal:** Both sides of face move equally
- **Abnormal:** One side of face does not move as well

**Arm Drift**
*Instruction:* Ask patient to close eyes and extend both arms straight out for 10 seconds
- **Normal:** Both arms move the same or not at all
- **Abnormal:** One arm does not move or drifts down

**Speech**
*Instruction:* Ask patient to say “You can’t teach an old dog new tricks.”
- **Normal:** Patient says correct words without slurring
- **Abnormal:** Patient slurs words, says wrong words, or is unable to speak

Stroke Scales: LAPSS

- Longer and widely used scale for early identification.
- It is a 9-item stroke scale with a positive predictive value of 86% and a negative predictive value of 97% following a 1-hour training as found by prospective study conducted by UCLA.
- Takes < 3 minutes to perform.
- Does not assess stroke severity.
# LOS ANGELES PREHOSPITAL STROKE SCREEN (LAPSS)

**Patient Name:**

**Rater Name:**

**Date:**

<table>
<thead>
<tr>
<th>Screening Criteria</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Age over 45 years</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. No prior history of stroke disorder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. New onset of neurologic symptoms within last 24 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Patient was ambulatory at baseline (prior to event)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Blood glucose between 60 and 400</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Exam: Look for obvious asymmetry</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Normal</strong></td>
<td><strong>Right</strong></td>
</tr>
<tr>
<td></td>
<td>Facial smile / grimace:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Drop</td>
</tr>
<tr>
<td></td>
<td>Grip:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>No Grip</td>
</tr>
<tr>
<td></td>
<td>Arm weakness:</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Based on exam, patient has only unilateral (and not bilateral) weakness: Yes [ ] No [ ]

10. If Yes (or unknown) to all items above LAPSS screening criteria met: Yes [ ] No [ ]

11. If LAPSS criteria for stroke met, call receiving hospital with “CODE STROKE”, if not then return to the appropriate treatment protocol. (Note: the patient may still be experiencing a stroke if even if LAPSS criteria are not met.)
Stroke Scales: FAST

- FAST was developed in the UK in 1998.
- Derived from the Cincinnati Prehospital Stroke Scale (CPSS) and the Los Angeles Prehospital Stroke Screen (LAPSS).
- Emphasis is placed on a simple test that complements existing assessments. (Facial weakness, Arm weakness, Speech disturbances)
- Can be used by non-medical trained personnel and has been used for community education to better understand the signs of stroke.
- Does not assess stroke severity.
Recognise STROKE Think F.A.S.T.

If you see any of these symptoms
Act FAST call 000
The Miami Emergency Neurologic Deficit (MEND) is an easy-to-learn, easy-to-use checklist that provides key information which incorporates the three components of the Cincinnati Prehospital Stroke Scale (CPSS) as well as additional components from the NIH Stroke Scale (NIHSS).

Has not been “truly” validated for the prehospital care.
Correlation of the Miami Emergency Neurological Deficit (MEND) Exam performed in the field by paramedics with an abnormal NIHSS and final diagnosis of stroke for patients airlifted from the scene

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1University of Miami Gorden Center for Research in Medical Education, Miami, FL, United States; 2Monroe County Fire Rescue, Monroe County, FL, United States

Introduction
- Early recognition and rapid transport to a stroke center by prehospital providers are essential in the care of stroke patients.
- We trained prehospital providers to perform the Miami Emergency Neurological Deficit (MEND) exam as part of an 8-hour comprehensive course, Advanced Stroke Life Support (ASLS®).
- The MEND exam incorporates all three components of the Cincinnati Prehospital Stroke Scale (CPSS) (speech, drop, drift) and eight additional components from the NIHSS:
  - Level of consciousness
  - Gaze
  - Orientation
  - Leg motion strength
  - Command
  - Limb ataxia
  - Visual fields
  - Sensation
- The MEND can provide an expanded baseline exam in the prehospital setting without delaying scene times.
- Additionally, the exam can be used as an initial evaluation tool by nurses and for subsequent exams in the ED, ICU or floor.

Methods
- All prehospital providers from three fire rescue departments in Monroe County participated in the 8-hour ASLS® course and stroke protocol training.
- We trained a total of 169 first responders (66 EMS, 46 EMT2s, 5 RNs).
- The prehospital providers conducted the CPSS on scene, and if abnormal, placed the helicopter team on standby.
- Providers then performed the MEND exam and relayed findings to the stroke neurologist at the receiving facility.
- Patients meeting air transport criteria (Fig. 1) were flown from the scene to the receiving hospital.
- We conducted a retrospective review of the MEND exam performed by the prehospital providers.
- We then correlated these results to the same components of the initial NIHSS performed by the neurologist at the receiving hospital.
- Additionally, we reviewed the final discharge diagnosis to determine whether the patient had a stroke or TIA versus other diagnoses.

Results
- From September 2009 to June 2011, 51 airlifted patients met the criteria for undergoing both a MEND exam and the NIHSS.
- There were 32 males (63%) and 19 females (37%), with a median age of 67 years (46-88 years).
- The MEND exam performed on scene by paramedics correlated with the initial NIHSS performed in the hospital by the stroke team in 46 of the 51 (90.2%) patients. Details of the five patients whose exams did not correlate are provided in Fig. 4.
- The average NIHSS score was 9 with a range from 0 to 30.
- A total of 49 patients (79.8%) were diagnosed with stroke (37) or TIA (11). Of the 37 strokes, 32 were ischemic (80.5%) and 5 hemorrhagic (13.5%).
- The 11 patients who were not diagnosed with TIA or stroke had several different conditions including seizure (in settings of old L MCA hemorrhage and Bell's Palsy), hypertensive crisis, viral encephalitis, and complex migraines. Notably, seven of these patients had NIHSS scores that correlated with paramedic findings on the MEND exam on scene. Therefore, the paramedics were correct in activating the stroke alert protocol in these patients.

Conclusion
- The MEND exam completed on scene by paramedics correlated well with the same components on the initial NIHSS performed by the neurologist at the receiving hospital.
- The MEND exam is a valuable tool when assessing stroke patients in the field and determining the need for air transport.

Figure 1: Stroke screening and examination criteria.

Figure 2: Comparison of the NIHSS and MEND exam.

Figure 3: Air transport criteria for potential stroke patients.

Figure 4: Details of cases where NIHSS did not correlate.
Stroke Scales: Large Vessel Occlusions

- Large-vessel occlusion (LVO) is estimated to account for up to 40% of all acute ischemic strokes\(^4\).
- Associated with poor outcome.
- Have the opportunity to make the biggest impact as treatment window for LVO is longer.
- Rapid identification of LVO is key.
- “Time is Brain”
I think there may be a CT in my backpack.....
LAMS is a brief 3-item stroke severity assessment derived from the LAPSS.

Quantitatively characterizes stroke severity in the field and predicts functional outcomes with accuracy comparable to NIHSS.

Constructed by assigning point values to LAPSS items.

LAMS ≥4 showed sensitivity 81%, specificity 89%, and overall accuracy 85% for predicting LVO.

Has been validated for the prehospital by Kim, et al in 2017.

Appropriate training can be achieved in 1-3 hours.
<table>
<thead>
<tr>
<th>LAMS</th>
<th>Score the Affected Side</th>
<th>Description</th>
<th>Corresponding NIHSS score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial Droop</td>
<td>0 Absent</td>
<td>No facial asymmetry. Normal.</td>
<td>Facial Palsy 0-1</td>
</tr>
<tr>
<td></td>
<td>1 Present</td>
<td>Partial or complete lower facial droop</td>
<td>Facial Palsy 2-3</td>
</tr>
<tr>
<td>Arm Drift</td>
<td>0 Absent</td>
<td>No drift. Normal.</td>
<td>Motor Arm 0 (Normal)</td>
</tr>
<tr>
<td></td>
<td>1 Drifts down</td>
<td>Drifts down but does not hit the bed within 10 sec.</td>
<td>Motor Arm 1 (drift)</td>
</tr>
<tr>
<td></td>
<td>2 Falls rapidly</td>
<td>Arm cannot be held up against gravity and falls to the bed within 10 sec.</td>
<td>Motor Arm 2-4</td>
</tr>
<tr>
<td>Grip Strength</td>
<td>0 Normal</td>
<td>Normal.</td>
<td>No NIHSS for this. Scored 0 if admission neuro exam rated grip strength as 5 (normal)</td>
</tr>
<tr>
<td></td>
<td>1 Weak grip</td>
<td>Weak but some movement</td>
<td>Admission neuro exam rated grip strength as 4 (weak), 3 (some movement against gravity), or 2(some movement, but not against gravity)</td>
</tr>
<tr>
<td></td>
<td>2 No Grip</td>
<td>No movement. Muscle contraction be seen but without movement.</td>
<td>Neuro exam rated grip strength as 1 (muscle contraction but no movement) or 0 (no muscle contraction)</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>A score ≥ 4 is highly predicted of large artery occlusion</td>
</tr>
</tbody>
</table>
Stroke Scales: RACE

- Simple and rapid neurological scale designed to detect acute stroke patients with a high probability of having a Large Vessel Occlusion (LVO)
- A simplification of National Institute of Health Stroke Scale (NIHS)
- RACE derived from only those items within NIHSS with a higher ability to predict LVO.
- A score \( \geq 5 \) indicates the possibility of LVO with a sensitivity of 85% and Specificity of 69%
- Revalidated by Carrera, et al in 2018.\(^6\)
- Training is free and available through racescale.org. Additionally, RACE Scale App is available for free for Android and IOS.
## R.A.C.E Stroke Scale

**Rapid Arterial Occlusion Evaluation Scale**

<table>
<thead>
<tr>
<th>Item</th>
<th>Instruction</th>
<th>Score</th>
<th>NIHSS Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facial palsy</td>
<td>Ask patient to smile</td>
<td>Absent = 0</td>
<td>0-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mild = 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate to severe = 2</td>
<td></td>
</tr>
<tr>
<td>Arm motor function</td>
<td>Extend patient's arm 90 degrees if sitting, 45 if supine</td>
<td>Normal to mild = 0</td>
<td>0-4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate = 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe = 2</td>
<td></td>
</tr>
<tr>
<td>Leg motor function</td>
<td>Extend patient's leg 30 degrees in supine position</td>
<td>Normal to mild = 0</td>
<td>0-4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate = 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe = 2</td>
<td></td>
</tr>
<tr>
<td>Head &amp; gaze deviation</td>
<td>Observe deviation to one side</td>
<td>Absent = 0</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Present = 1</td>
<td></td>
</tr>
<tr>
<td>Aphasia (right side)</td>
<td>Ask patient to close their eyes and make a fist</td>
<td>Normal = 0</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate = 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe = 2</td>
<td></td>
</tr>
<tr>
<td>Agnosia (left side)</td>
<td>Ask patient to recognize familiar objects</td>
<td>Normal = 0</td>
<td>0-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Moderate = 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Severe = 2</td>
<td></td>
</tr>
</tbody>
</table>

Patient RACE scale total: 6
Before I came here I was confused about this subject. Having listened to your lecture I am still confused. But on a higher level.

(Enrico Fermi)
Stroke Scales: Which one to use?

- There doesn’t seem to be a right answer at the moment.
- Consistency and understanding is key.
  - Stroke care is dependent on identification and time, a single "perfect scale" is not the answer.
- Stroke Scales when used consistently throughout a system can expedite the DTP, DTN, and transfer to a CSC and EVT.
Treatment of Stroke
Prehospital Care

- ABCs
  - Aspiration Risk
  - O2 sats > 94%
  - BP, EKG
- Trauma?
- Blood glucose
- Infection
- LKWT
- IV
Stroke Treatment

★ Geared towards early identification.
★ Oxygenation: Maintaining adequate oxygenation is imperative during periods of acute cerebral ischemia.⁸

- Supplemental oxygen should be given when evidence of hypoxia is present (ABG/Pulse Ox)

★ Antihypertensives: Severe hypertension is a contraindication for thrombolytic therapy.⁸

- Antihypertensives should be withheld unless systolic Bp > 220 or diastolic >120
- When attempting to lower BP it should be done cautiously.
Stroke Treatment

血glucose should be maintained below 180mg/dL.⁸

Increased body temperature in the presence of acute ischemic stroke has been associated with poor outcomes.⁸

Treatment with acute reperfusion therapy depends on the degree and duration of the ischemia.⁷

Treatment with IV-tPA within 3 hours (can be extended to 4.5 hours) of onset of symptoms without significant increase in risk of significant bleeding.⁸
Stroke Treatment

* Endovascular Treatment
  - Initiated with the development of Mechanical Embolus Removal in Cerebral Ischemia (MERCI) retriever.
  - The Penumbra Stroke System, which works by debulking the thrombus in the presence of constant aspiration.
  - Currently:
    - 53% of patients treated with EVT after 12-hours from onset had a positive outcome.\(^6\)
    - EVT has been shown to be safe and effective in two recent multicenter-randomized trials for mechanical thrombectomy initiated 16-hours from imaging and 24-hours from onset of symptoms.\(^6\)
QUESTIONS?

Still confused?
Thank you
Mario Vargas
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