



# **Standardized Stroke Scales and Implications for Healthcare Personnel**

## **2016 ND Stroke and Cardiac Conference**

Presented by Megan Carlblom, MSN, RN, SCRNP



# Disclosures

## **CONFLICTS OF INTEREST:**

All activity planners and presenters have reported no conflicts of interest related to the presentation.

## **COMMERCIAL SUPPORT:**

No commercial support was received.

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# Objectives

- **Objective 1:** Upon completion of this session, learners should be able to recognize the Cincinnati Prehospital Stroke Scale.
- **Objective 2:** Upon completion of this session, learners should be able to identify the components of the National Institutes of Health Stroke Scale.
- **Objective 3:** Upon completion of this session, learners should know how to document a neurological exam within the North Dakota Acute Stroke Transfer Protocol
- **Objective 4:** Upon completion of this session, learners should recognize the importance of a neurological exam after treating a patient with intravenous thrombolytics.

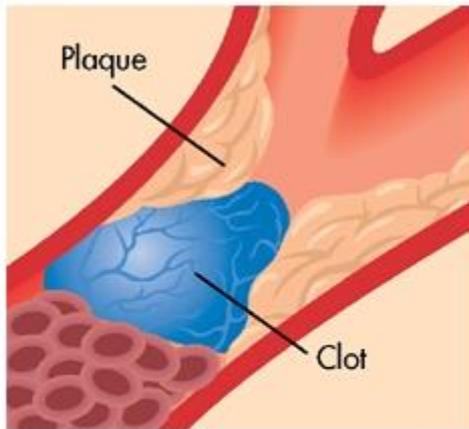


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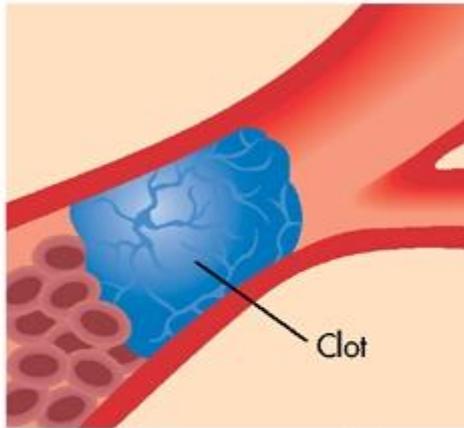
# Types of Stroke

A



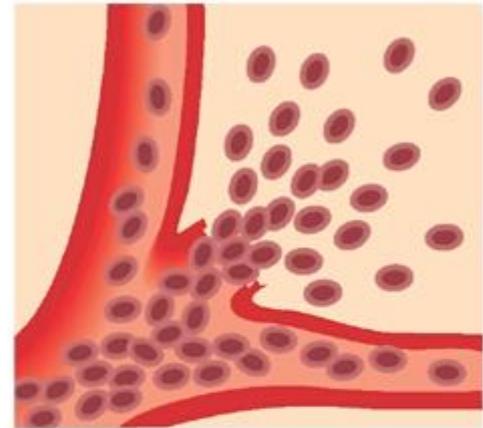
**Thrombotic stroke.** Cerebral thrombosis is a narrowing of the artery by fatty deposits called *plaque*. Plaque can cause a clot to form, which blocks the passage of blood through the artery.

B



**Embolic stroke.** An embolus is a blood clot or other debris circulating in the blood. When it reaches an artery in the brain that is too narrow to pass through, it lodges there and blocks the flow of blood.

C



**Hemorrhagic stroke.** A burst blood vessel may allow blood to seep into and damage brain tissues until clotting shuts off the leak.



# 8 D's of Stroke Care

1. Detection

4. Door

7. Drug

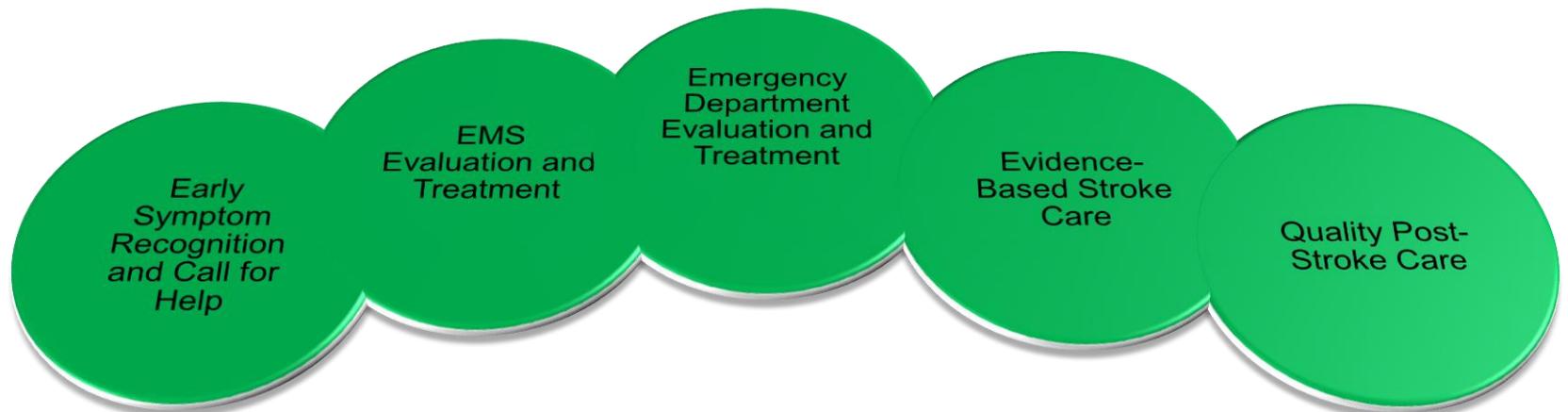
2. Dispatch

5. Data

8. Disposition

3. Delivery

6. Decision



# Detection

## STROKE WARNING SIGNS

# THINK F.A.S.T.

**FACE** Does the face look uneven?  
Ask them to smile

**ARM** Does the arm drift down?  
Ask them to raise both arms

**SPEECH** Does their speech sound strange?  
Ask them to repeat a phrase

**TIME** Every second brain cells die.  
Call 911 at any sign of stroke



# Dispatch

## AHA/ASA EMS Response Time Goals

<8 minutes to the scene, <15 minutes on-scene

<b>Dispatch Time</b>	<b>Turnout Time</b>	<b>Travel Time</b>	<b>On-Scene Time</b>
Time call is received to time EMS unit is notified to respond	From time EMS unit is notified until wheels move	Time until EMS arrives on scene	Time spent with patient before start of transport
<1 minute	<1 minute	=Time for trauma or heart attack calls	<15 minutes

# Delivery

## AHA/ASA EMS Guidelines for Management of Suspected Stroke

On Scene	In Transit
<ul style="list-style-type: none"><li>• Manage CABs: circulation, airway, breathing (O2 if needed)</li></ul>	<ul style="list-style-type: none"><li>• Rapid transport to closest facility capable of treating stroke</li></ul>
<ul style="list-style-type: none"><li>• Pre-hospital Stroke Scale</li></ul>	<ul style="list-style-type: none"><li>• Pre-notify receiving hospital</li></ul>
<ul style="list-style-type: none"><li>• Establish <b>LAST KNOWN WELL</b></li></ul>	<ul style="list-style-type: none"><li>• Check and record blood glucose to assess for hypoglycemia</li></ul>
<ul style="list-style-type: none"><li>• Brief History/Medications</li></ul>	<ul style="list-style-type: none"><li>• Check and record VS</li></ul>
<ul style="list-style-type: none"><li>• What is “The Story?”</li><li>• Family contact (phone number)</li></ul>	<ul style="list-style-type: none"><li>• Cardiac monitor</li><li>• IV access (18 in AC is preferred)</li></ul>



# Pre-hospital Stroke Scales

## 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%.



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# Determining Last Known Well

- Clarify when the person was last seen NORMAL or at baseline
- Try help identify a timeframe if they are unable to recall LKW
- Try to avoid “minutes ago”; convert to an actual time



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# Transfer of Stroke Patients

## Considerations:

- Pre-determined triage plan for EMS
- No more than 15 minute delay
- Air transport similar to trauma
- TIME OF ONSET



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# Door

## ND Acute Stroke Treatment Guidelines

Fax this packet as soon as possible to the appropriate number below with the following documents:

- Lab
- EKG
- NIHSS
- Current Medication List
- ED Records
- Any other supporting documents

## One-Call Numbers/Fax for Transfers

**Altru Health System—Grand Forks**  
 Phone: 701-780-5206 or 1-855-425-8781  
 Fax: 701-780-1097

**Essentia Health—Fargo**  
 Phone: 701-364-CALL(2255) or  
 844-865-CALL(2255)  
 Fax: 701-364-8405

**Sanford Health – Bismarck**  
 Phone: 1-855-550-1225  
 Fax: 701-323-5151

**Sanford Health—Fargo**  
 Phone: 877-647-1225  
 Fax: 701-234-7203

**CHI St. Alexius Health—Bismarck**  
 Phone: 701-530-7699 or 1-877-735-7699  
 Fax: 701-530-7005

**Trinity Health—Minot**  
 Phone: 701-857-3000 or 1-800-223-1596  
 Fax: 701-857-3260

**Reminder!  
 Please Fax  
 Documents**

## Acute Stroke Transfer Protocol

Pt Name: \_\_\_\_\_  
 DOB: \_\_\_\_/\_\_\_\_/\_\_\_\_

<p><b>A S S E S S M E N T</b></p> <p><input type="checkbox"/> BP    <input type="checkbox"/> Pulse</p> <p><input type="checkbox"/> V/S q 15 min with neuro checks</p> <p><input type="checkbox"/> Continuous Cardiac Monitoring</p> <p><input type="checkbox"/> Weight _____ kg</p> <p><input type="checkbox"/> NIHSS on arrival _____ (If Performed)</p> <p><input type="checkbox"/> Keep NPO (including meds)</p> <p>Date: _____ : _____</p> <p><b>T R I A G E</b></p> <p>ED TRIAGE TIME Date: _____ : _____</p> <p>TIME LAST SEEN WELL _____ : _____</p> <p><b>D I A G N O S T I C S</b></p> <p><input type="checkbox"/> CT Head w/o contrast</p> <p><b>CT Results:</b></p> <p><input type="checkbox"/> No acute findings</p> <p><input type="checkbox"/> Hemorrhage</p> <p><input type="checkbox"/> New Ischemic Stroke</p> <p><input type="checkbox"/> Other:</p> <p><input type="checkbox"/> Stroke Panel - CBC, Platelets, PT-INR / PTT, Chem 8 / BMP, cardiac enzymes, glucose (beside an option), Creat, Preg test (optional)</p> <p><input type="checkbox"/> 12-Lead EKG</p> <p><b>T R E A T M E N T</b></p> <p><input type="checkbox"/> If tPA candidate, institute tPA Administration Orders</p> <p><input type="checkbox"/> NPO (including meds) until Dysphagia Screen</p> <p><input type="checkbox"/> BP Protocol</p> <ul style="list-style-type: none"> <li>• Ischemic: target 185/110</li> <li>• Hemorrhagic: target 140/80</li> <li>• No sublingual Nifedipine</li> </ul> <p><input type="checkbox"/> Baseline O2 sat _____ %</p> <ul style="list-style-type: none"> <li>• O2 to keep SATs &gt;94%</li> </ul> <p><input type="checkbox"/> Acetaminophen pr for temp &gt;100.4 F</p> <p><input type="checkbox"/> Two Large-bore IV sites</p> <p><input type="checkbox"/> Normal Saline 0.9% TKO</p> <p><small>* If time allows but do not hold up transfer</small></p> <p><b>D I S P O S I T I O N</b></p> <p><input type="checkbox"/> Transfer to Tertiary Care Facility</p> <p><input type="checkbox"/> Activate EMS transfer</p> <p>Family / Contact Name &amp; Cell: _____</p> <p>ED or Primary Physician Name &amp; Number: _____</p>	<p style="text-align: center;"><b>Acute Stroke Intervention Algorithm</b></p> <pre>         graph TD             Start[Pt with signs / symptoms of stroke and symptom onset &lt; 8 hrs] --&gt; Q1{Does the facility have CT scan capabilities?}             Q1 -- Yes --&gt; Q2{Is facility able to give tPA?}             Q1 -- No --&gt; A1[Arrange for rapid transfer One-call numbers on cover of packet]             Q2 -- Yes --&gt; B1[0 - 10 min Complete Assessment and Triage Sections]             Q2 -- No --&gt; B2[10 - 25 min Complete diagnostic Section 45 min Interpretation of CT]             B1 --&gt; C1[60 min If tPA ordered, refer to tPA Administration Order set and Treatment Section. Transfer to Tertiary Care Center]             B2 --&gt; C2[If no exclusions, consider IV tPA. May consult with neurologist on call (numbers 804 page)]             B2 --&gt; C3[If CT negative for hemorrhage, refer to Inclusion / Exclusion Criteria If CT positive for hemorrhage, transfer]             C2 --&gt; C1             C3 --&gt; C1             C1 --&gt; D1[3.0 to 4.5 hr For select patients (see additional exclusion criteria) If tPA ordered, refer to tPA Administration Order set and Treatment Section. Transfer to Tertiary Care Center]             C2 --&gt; D2[Complete Disposition Section and prepare to transfer to Tertiary Care Center (send copy of this form and pertinent records)]             C3 --&gt; D2             D1 --&gt; E1[If tPA ordered, refer to tPA Administration Order set and Treatment Section. Transfer to Tertiary Care Center]             D2 --&gt; E1             E1 --&gt; F1[Pt with ischemic stroke and out of window for IV tPA may be candidates for IA tPA or mechanical embolotherapy. Contact appropriate tertiary facility for consideration.]             </pre>
<p><b>D I S P O S I T I O N</b></p> <p><b>t P A</b></p> <p><input type="checkbox"/> Onset 6x to tPA bolus &lt;3 hrs</p> <p><input type="checkbox"/> Onset 8x to tPA bolus up to 4.5 hrs in select patients (see additional criteria)</p> <p><b>C H E C K L I S T</b></p> <p><input type="checkbox"/> No hemorrhage on CT scan</p> <p><input type="checkbox"/> Thrombolytic Inclusion / Exclusion checklist completed. No exclusions for administering tPA</p> <p><input type="checkbox"/> Discussion with patient / family regarding risks/benefits/alternatives</p> <p><input type="checkbox"/> Consent obtained from patient / family who are eligible in the 3.0 to 4.5 hr window</p> <p><input type="checkbox"/> If Foley needed, insert before tPA given</p>	<p><b>I V t P A</b></p> <ul style="list-style-type: none"> <li>• 0.9 mg/Kg (max does 90 mg)</li> <li>• 10% total dose as bolus over one minute</li> <li>• Remainder over 60 minutes</li> <li>• V/S + neuro checks q 15 min during infusion, then q 15 min x 2 hr, q 30 min x 6 hr, then hourly until 24 hours after treatment</li> <li>• Maintain BP &lt;185/110</li> <li>• Repeat CT head if neuro status declines</li> <li>• No anticoag/antiplatelet for 24 hr</li> </ul>



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# NIHSS

- National Institutes of Health Stroke Scale (NIHSS)
- Since 1996 has been a standard of care in US stroke centers for ongoing neurological exam supported by ASA and Brain Attack Coalition
- Provides information useful for predicting outcomes
- Is reproducible and reliable if done consistently



# Why Use the NIHSS?

Allows healthcare personnel to:

- Express our clinical exam
- Determine changes in neurological status
  - Improvement and deterioration
- Communicate patient status



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# NIHSS and Outcomes

Score	Stroke Severity
0	No Stroke Symptoms
1-4	Minor Stroke
5-15	Moderate Stroke
16-20	Moderate to Severe Stroke
21-42	Severe Stroke



# NIHSS Guiding Principles

- No coaching; unless specified in the instructions
- Record what the patient does; not what you think the patient can do
- The most reproducible response is generally the first response



## NIH Stroke Scale

CATEGORY	SCALE DEFINITION		Date/Time	Date/Time	Date/Time
			Score	Score	Score
<b>1a. Level of Consciousness</b> (alert, drowsy, etc.)	0= Alert 1= Drowsy	2= Stuporous 3= Coma			
<b>1b. LOC Questions</b> (Month, age)	0= Answers both correctly 1= Answers one correctly	2= Answers neither correctly			
<b>1c. LOC Commands</b> (Open, close, eyes, make fist, let go)	0= Performs both correctly 1= Performs one correctly	2= Performs neither task			
<b>2. Best Gaze</b> eyes open, patient follows examiners' fingers/face)	0= Normal 1= Partial Gaze Palsy	2= Forced deviation			
<b>3. Visual</b> introduce visual stimulus (or threat) to patients visual field quadrants)	0= No visual loss 1= Partial hemianopia (blind)	2= Complete hemianopia 3= Bilateral hemianopia			
<b>4. Facial Palsy</b> (show teeth, raise eyebrows, and squeeze eyes shut)	0= Normal 1= Minor paralysis	2= Partial paralysis 3= Complete paralysis			
<b>5. Motor Arm</b> <b>5a. Left Arm</b> (Elevate extremity to 90E and score drift/movement)	0= No drift 1= Drift 2= Some effort against gravity	3= No effort against gravity 4= No movement UN= Amputation or joint fusion			
<b>5b. Right Arm</b> (Elevate extremity to 90E and score drift/movement)	0= No drift 1= Drift 2= Some effort against gravity	3= No effort against gravity 4= No movement UN= Amputation or joint fusion			
<b>6. Motor Leg</b> <b>6a. Left Leg</b> (Elevate extremity to 30E and score drift/movement)	0= No drift 1= Drift 2= Some effort against gravity	3= No effort against gravity 4= No movement UN= Amputation or joint fusion			
<b>6b. Right Leg</b> (Elevate extremity to 30E and score drift/movement)	0= No drift 1= Drift 2= Some effort against gravity	3= No effort against gravity 4= No movement UN= Amputation or joint fusion			
<b>7. Limb Ataxia</b> (Finger, nose, heel down shin)	0= Absent 1= Present in one limb	2= Present in two limbs UN= Amputation or joint fusion			
<b>8. Sensory</b> (Pinprick to face, arm [trunk] and leg—compare side to side)	0= Normal 1= Mild to moderate sensory loss	2= Severe to total sensory loss			
<b>9. Best Language</b> (Name items, describe a picture and read sentences)	0= No aphasia, normal 1= Mild to moderate aphasia	2= Severe aphasia 3= Mute, global aphasia			
<b>10. Dysarthria</b> (Evaluate speech clarity by patients repeating listed words)	0= Normal 1= Mild to moderate	2= Severe dysarthria UN=Intubated			
<b>11. Extinction and inattention</b> (Use information from prior testing to identify neglect or double simultaneous stimuli)	0= No Neglect 1= Partial Neglect	2= Profound Neglect			
			<b>Initial</b>		

# Data

## National Door to Needle Time Goals

0 min	Symptoms identified
10 min	Physician evaluation
25 min	Head CT w/o contrast; Labs sent
45 min	CT & labs results; ECG & CXR completed
60 min	IV alteplase initiated



# Ischemic Stroke Imaging

CT Scanning



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# Ischemic Stroke Imaging

MRI Scanning



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# Decision

- Type of Stroke
- Time of Onset
- Severity of Stroke
- Risk and Benefits



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# Ischemic Stroke Treatment

- Within 0 to 4.5 hours of symptom onset:
  - IV alteplase
  - Intra-arterial (IA) alteplase
  - Endovascular retrieval
- Within 6 hours of symptom onset:
  - IA alteplase
  - Endovascular retrieval
- Within 0 to 24 hours of symptom onset:
  - Endovascular retrieval (depending on the area of occlusion and extent of the infarct)



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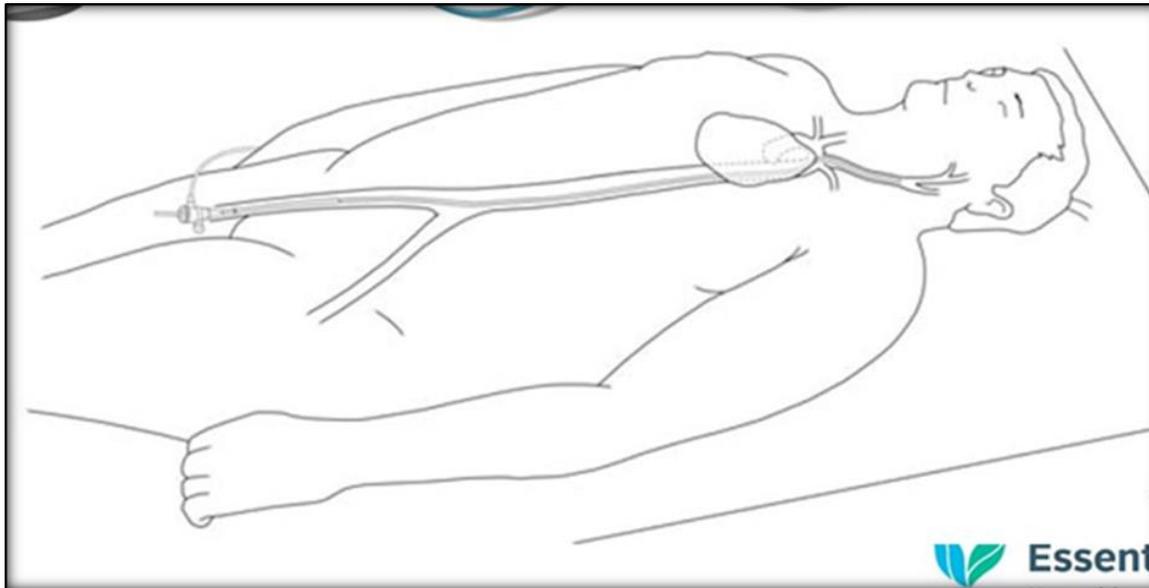
# Alteplase

- Alteplase is considered the “standard of care” for **acute ischemic stroke**
  - Research supports the use of Activase in the AHA/ASA guidelines published in 2013 and in 2007 (Class 1, Level of Evidence A recommendation)
- Alteplase is FDA approved for use in acute ischemic stroke
  - 3 hour time window (FDA approved)
  - 4.5 hour time window (not FDA approved, but supported by research and is accepted practice for appropriate candidates)



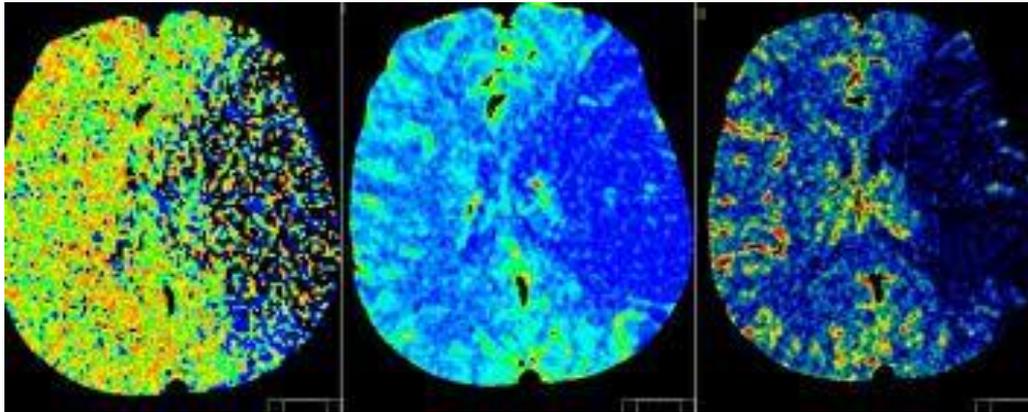
# IA Alteplase

- Can be used within 6 hours from Last Known Well
- Small vessel or large vessel occlusions
- Can be used in combination with IV alteplase and endovascular therapies

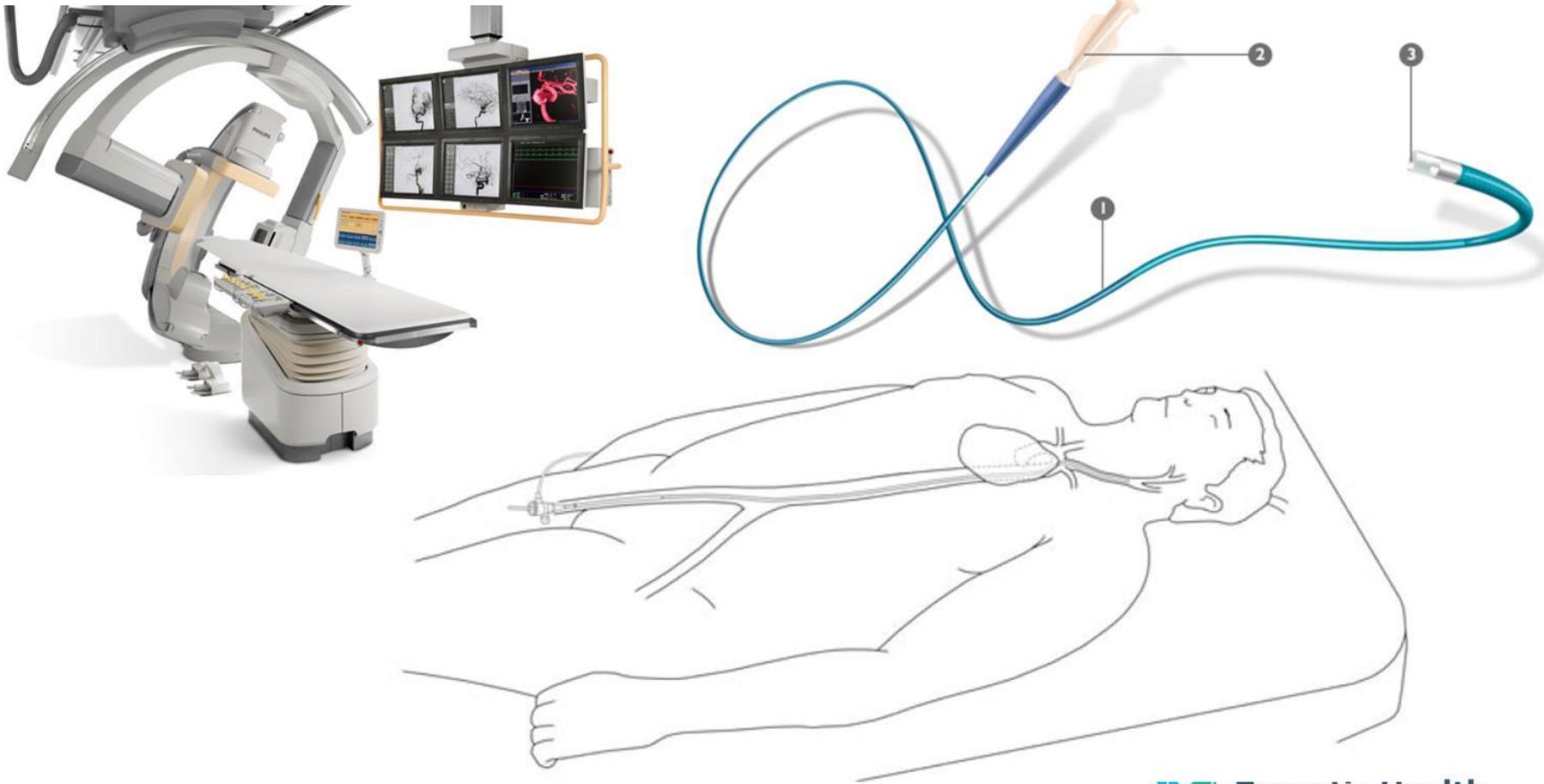


# Interventional Therapy

- Up to 6 hours after last know well (typically)
- May be done as long as 24 hours after last know well
- CT or MR-Perfusion helps to determine candidates for intervention
- Now considered to be the Standard of Care along with IV alteplase

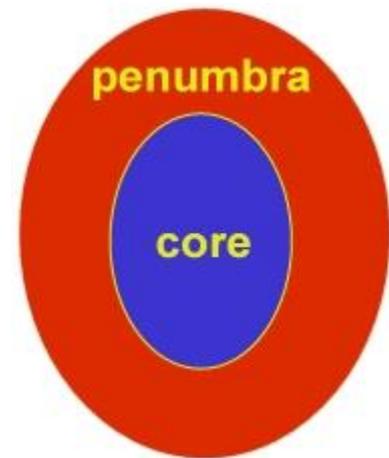
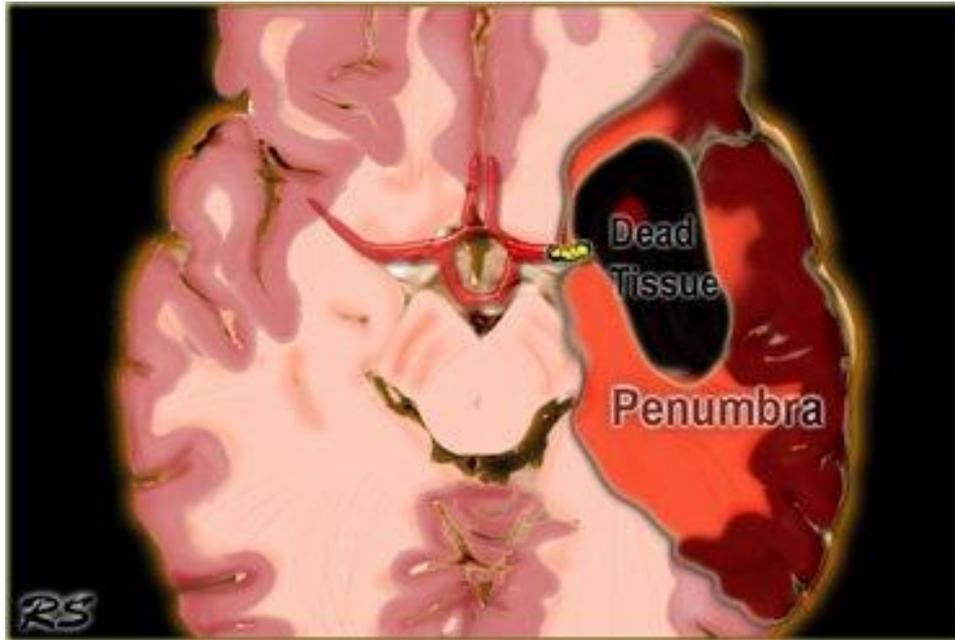


# Interventional Therapy (Endovascular)



# Ischemic Penumbra

Ischemic tissue potentially destined for infarction but not yet irreversibly injured and the target of acute therapies.



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# Drug

- Give within 0-4.5 hours of Last Known Well
- Patient must meet criteria
- Works well for small vessel strokes
- Can be helpful in large vessel strokes

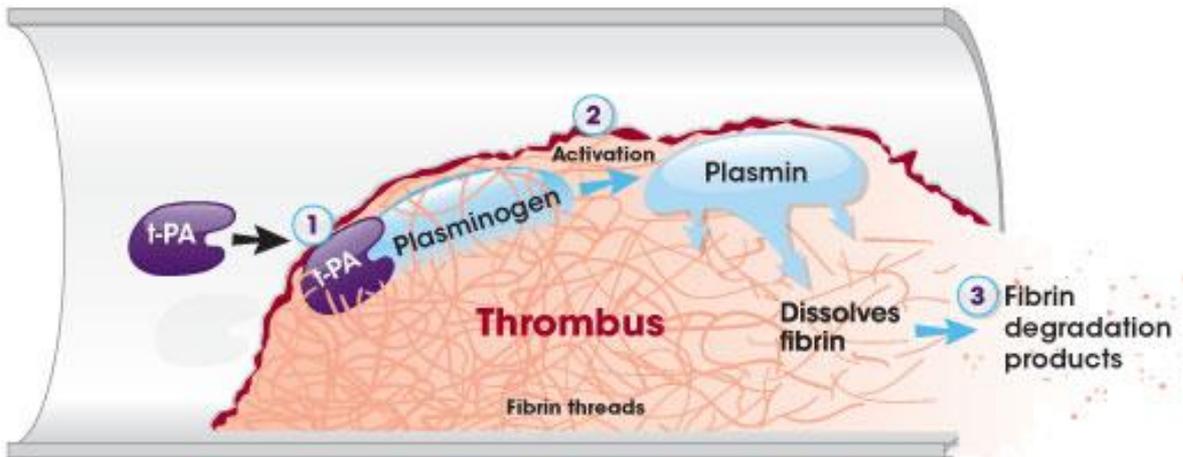
– Remember: Time is Brain!!



# tPA (tissue plasminogen activator)

- tPA is also called **Activase** or **Alteplase**
- Mechanism of action:
  - Binds to fibrin in the thrombus and converts entrapped plasminogen to plasmin, initiating local fibrinolysis

## Cathflo—a fibrin-specific\* MOA



- 1 Recombinant t-PA (alteplase) binds to fibrin in thrombus
- 2 converts entrapped plasminogen to plasmin that
- 3 initiates local fibrinolysis.

Retrieved from [www.cathflo.com](http://www.cathflo.com)



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# Alteplase Exclusion Criteria

- See alteplase Inclusion/Exclusion Criteria form
- Key exclusion criteria to consider right away:
  - Hemorrhage on CT
  - INR  $>1.7$
  - Beyond the 4.5 hour time window for any patient
  - BP  $>185/110$  despite treatment



# Monitoring

- Before bolus: Full NIHSS and baseline VS
  - During infusion: VS and abbreviated NIHSS
    - Q15” x 2 hours, then
    - Q 30” x 6 hours, then
    - Q 1 hour x 16 hours
- 

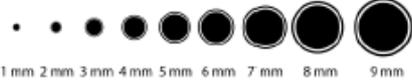
Full 24 hours of close monitoring

- Documentation is key!!



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★ To be initiated at the Critical Access Hospital and continued by EMS. Please highlight or indicate when hand off occurred.																		
	Baseline	15 min	30 min	45 min	1 hr	1.25 hr	1.5 hr	1.75 hr	2 hr	2.25 hr	2.5 hr	2.75 hr	3 hr	3.5 hr	4 hr	4.5 hr	5 hr	
<b>Date:</b>	<b>Time</b>																	
	BP																	
	P																	
	R																	
	Temp																	
	SpO2 RA/O2																	
	Pain - H/A																	
<b>Neuro Checks:</b>																		
Level of Consciousness (LOC) A=alert C=confused L=lethargic S=stuporous O=comatose																		
LOC Questions - month / age																		
LOC Commands open/close eyes - squeeze/release hands																		
Right pupil size/response																		
Left pupil size/response																		
Extraocular Movements (EOMs) normal = 0 gaze abnormal in one or both eyes = 1 eyes deviated and fixed = 2																		
Visual fields Normal - recognize finger movement in all 4 quad = N Right visual field deficit = R Left visual field deficit = L																		
Facial symmetry (+/-)																		
Motor arms R/L		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Motor Legs R/L		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Arm sensation(+/-) R/L		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Leg sensation(+/-) R/L		/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/	/
Speech No wrong words, no slurring = N Wrong words = W Slurring = S																		
RN / EMS initials:																		
<b>Motor Scale</b> 5 - normal strength (no drift) 4 - against some resistance (drift) 3 - overcomes gravity 2 - can't overcome gravity 1 - flicker of muscle 0 - no movement; flaccid		<b>Pupile Size</b> 						<b>Pupile Response</b> (+) = present (-) = absent NR = no response			<b>LOC Questions / Commands</b> "You can't teach an old dog new tricks" "No ifs ands or buts about it" 0 = answers/ obeys both correctly 1 = answers / obeys one correctly 2 = incorrect			Patient Label				

# After Giving Alteplase

- Avoid:
  - Intra-arterial catheters, NG tubes, foley placement, IV sticks for 24 hours
  - No antithrombotics/antiplatelets/anticoagulants for 24 hours (aspirin, heparin, plavix, coumadin, etc...)



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# What are You Monitoring For?

- Any new bleeding
- Any sign of hemorrhage in the brain
  - Sudden neurologic decline
  - New headache
  - Nausea/Vomiting
  - Sudden rise in BP
- Angioedema



# What to do if S/S of Bleeding?

- Stop the drug
- Notify provider immediately
- Prepare for STAT head CT
- Prepare to draw Type & Cross
- Order coag lab tests



# Is Alteplase Dangerous?

- NINDS pivotal trial: patients who received alteplase had a 6.4% risk of having an ICH vs 0.6% from placebo
  - Study done in 1995
  - Patients who received alteplase were 33% more likely to experience MINIMAL to NO disability at 3 months vs. placebo
- Time is Brain!!
  - Symptomatic ICH rates decrease as time to treatment decreases
  - Every 15 minute faster interval was associated with:
    - Fewer sICH
    - Reduced in-hospital mortality
    - More patients with independent ambulation at discharge
    - More patients discharged home



# Disposition

- Stroke Units or Intensive Care Units
- Evidence-based stroke care
- Stroke etiology



# What does the future look like...?

- Identification of Large Vessel Occlusions (LVO) in the Field
  - More significant deficits
  - Higher morbidity and mortality
- Regional Stroke Systems
  - ✓ ND and MN developing systems currently!



# Questions?



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# Thank You!

For More Information or Resources Contact:

Megan Carlblom, Stroke Program Manager  
at Essentia Health-Fargo at (701).364.4398



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# References

Cadena, R. 2013. Stroke care: a balanced approach to tPA. Retrieved from <http://epmonthly.com/article/stroke-care-a-balanced-approach-to-tpa/>

Higashida, R., et al. (2013). Interactions within stroke systems of care: A policy statement from the American Heart Association/American Stroke Association. *Stroke* (44).

Juach, E. Cucchiara, B. 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. *Circulation*. 2010. [http://circ.ahajournals.org/content/122/18\\_suppl\\_3/S818.full](http://circ.ahajournals.org/content/122/18_suppl_3/S818.full) Accessed August 2014.

Jauch, E., et al. (2013). Guidelines for the early management of patients with acute ischemic stroke: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke*. Retrieved online at <http://stroke.ahajournals.org/content/early/2013/01/31/STR.0b013e318284056a>

National Institute of Neurological Disorders and Stroke. Stroke Proceedings; Acute Care. [http://www.ninds.nih.gov/news\\_and\\_events/proceedings/stroke\\_proceedings/recs-acute.htm](http://www.ninds.nih.gov/news_and_events/proceedings/stroke_proceedings/recs-acute.htm) Accessed August 2014.

ND Acute Stroke Treatment Guidelines. [https://www.ndhealth.gov/EMS/pdfs/ND\\_Acute\\_Stroke\\_Treatment\\_Guidelines.pdf](https://www.ndhealth.gov/EMS/pdfs/ND_Acute_Stroke_Treatment_Guidelines.pdf). Accessed September 2016

Powers, W. J., et al. (2015). 2015 AHA/ASA focused update of the 2013 guidelines for the early management of patients with acute ischemic stroke regarding endovascular treatment: A guideline for healthcare professionals from the American Heart Association/American Stroke Association. *Stroke* (46), 1-46.

Smith, E., et al. (2005). Poor outcomes in patients who do not receive intravenous tissue plasminogen activator because of mild or improving ischemic stroke. *Stroke* (36), 2497-2499.



The Stroke Foundation. <http://www.thestrokefoundation.com/index.php/about-stroke/62-the-seven-d-s-of-stroke-survival> Accessed August 2014.