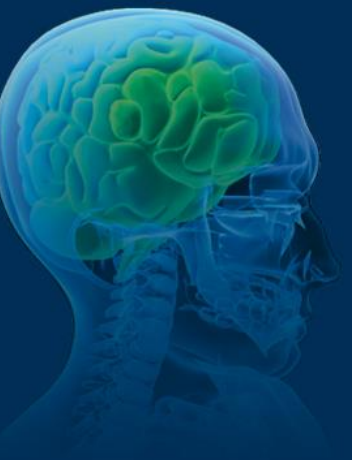
UF HEALTH SHANDS COMPREHENSIVE STROKE CENTER



Acute Stroke Management

UF Health Shands Comprehensive Stroke Center

Tiffany Sheehan, RN, SCRN
Stroke Program Coordinator

Nicolle Davis, RN, SCRN
Stroke Program Coordinator

Christina Wilson, MD, PhD
Assistant Professor of Neurology

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Acute Stroke Management

- Learning Objectives:
  - Understand the care of acute stroke patients including pathophysiology, presentation, assessment, diagnostics and treatment
  - Recognize the indications and contraindications for the use of IV t-PA
  - Understand diagnostic tools and treatment options for acute stroke
  - Demonstrate knowledge of the location and application of stroke related policies and procedures

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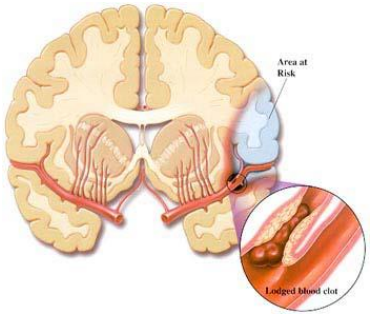
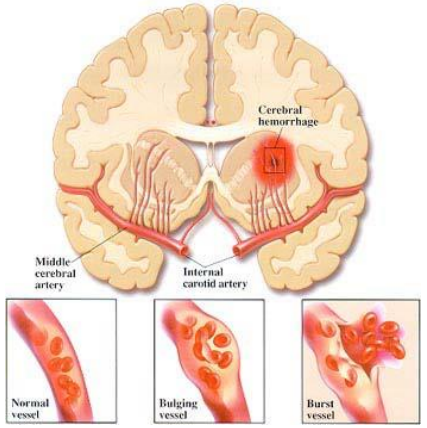
Types of Stroke

- Ischemic (87%): Impaired blood flow due to a vascular blockage



- Hemorrhagic (13%): Ruptured blood vessel
  - Intraparenchymal (10%)
  - Subarachnoid (3%)



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Types of Stroke

- Transient Ischemic Attack (TIA): Transient focal neurological deficit due to ischemia
  - Same symptoms as stroke
  - Duration less than 24 hours (usually <1 hour)
  - No evidence of permanent tissue damage on MRI
  - Heralds risk of impending stroke
    - Up to 8% risk of stroke in the next 48 hours
    - **Requires immediate medical attention**!

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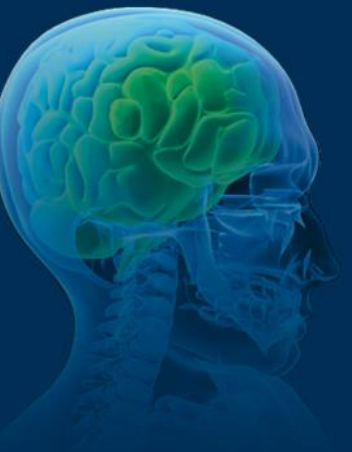

Stroke Symptoms

- Sudden Onset of one or more of the following:
  - Hemibody weakness (face, arm, leg)
  - Hemibody numbness
  - Confusion, difficulty speaking or understanding
  - Change in vision involving one or both eyes
  - Gait instability, dizziness, imbalance, loss of coordination
  - Severe headache
  - Nausea/vomiting
  - Loss of consciousness

stroke
EVERY MINUTE COUNTS, SO ACT FAST
Face drooping
Arm weakness
Speech difficulty
Time to call 911

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Stroke Risk Factors

- Non-Modifiable:
  - Age
  - Gender
  - Race/Ethnicity
  - Heredity
- Modifiable:
  - Hypertension
  - Cardiac Disease
  - Diabetes
  - Hypercholesterolemia
  - Cigarette Smoking
  - Physical Inactivity
  - Obstructive Sleep Apnea

> 90% of stroke is caused by these risk factors

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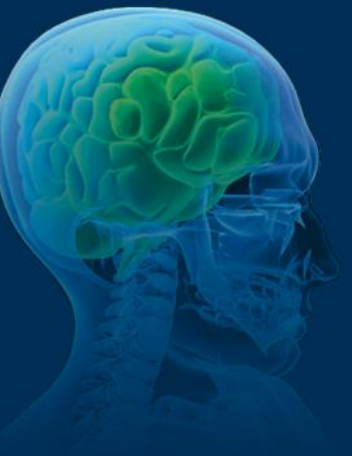

Stroke is an Emergency!

- Time is Brain!
- A reduced time to treatment of just 1 minute was associated with 1.8 extra days of healthy life, which works out to approximately one month for every 15 minutes saved!
- Timely medical intervention is crucial
- Below demonstrates the estimated pace of neuron circuitry lost during an acute ischemic stroke:

Time	Neuron Lost	Myelinated Fibers Lost	Accelerated Aging
Per second	32, 000	218 yards	8.7 hours
Per minute	1.9 million	7.5 miles	3.1 weeks
Per hour	120 million	447 miles	3.6 years
Per stroke	1.2 billion	4,470 miles	36 years

Neale, 2014; *Stroke* 2006, 37:263

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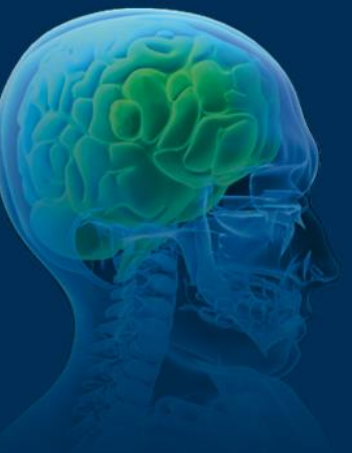
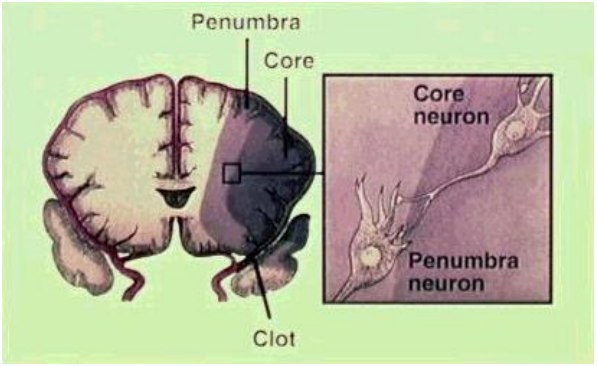


Goal: Save the Penumbra

- Infarct = area permanently damaged by lack of blood flow
- Penumbra = area of salvageable tissue surrounding it
- Damage to the penumbra may be reduced if the flow of blood and oxygen to the tissue resumes
- Fast intervention is required!



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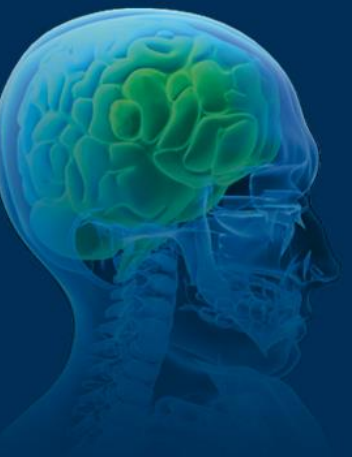
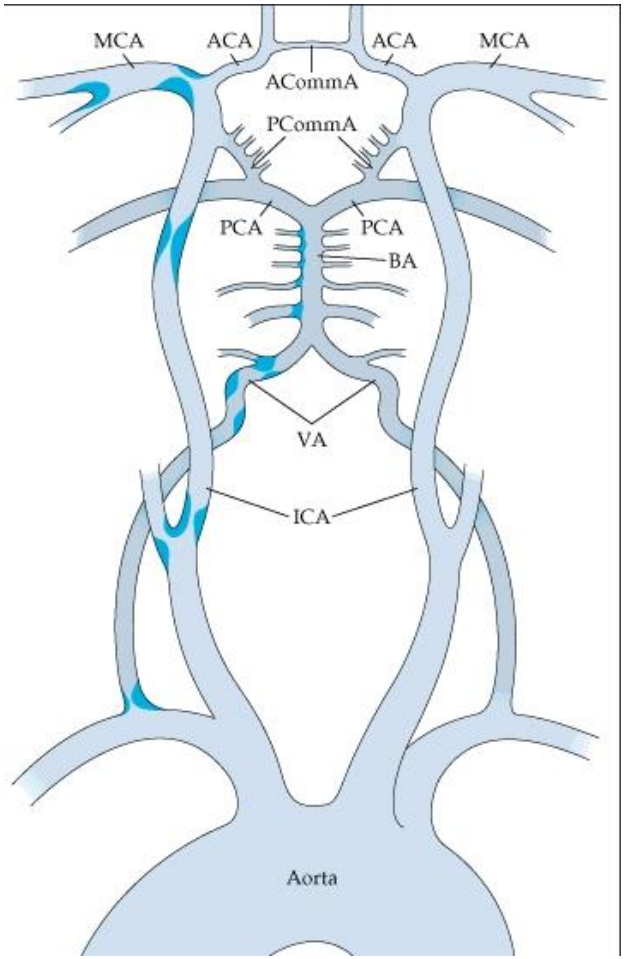
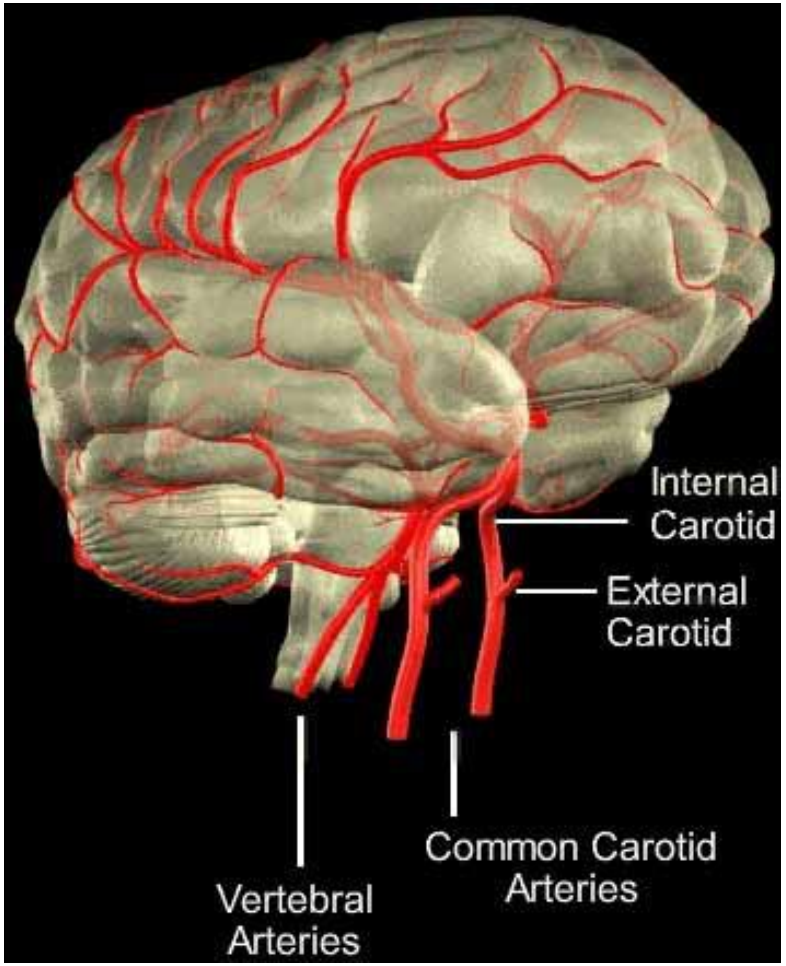


Vascular Anatomy





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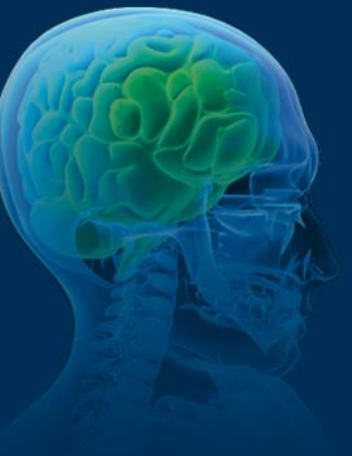
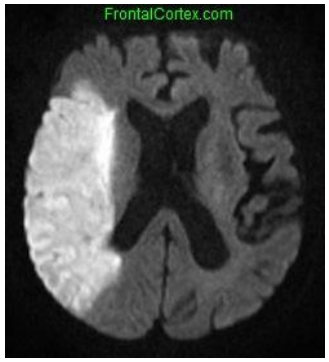


Stroke Locations



- Middle Cerebral Artery (MCA):
  - Symptoms:
    - Contralateral weakness (hemiparesis/hemiplagia), hemisensory loss of the face and arm
    - Contralateral Hemianopia
  - Right Hemisphere:
    - Neglect of left visual and sensory input
    - Spatial disorientation
    - Aprosody (lack of normal speech rhythm)
  - Left Hemisphere:
    - Aphasia and difficulty reading, writing or calculating (10% of left-handed people will have language centers in the right hemisphere)

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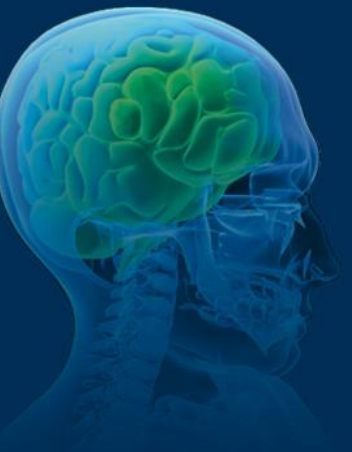
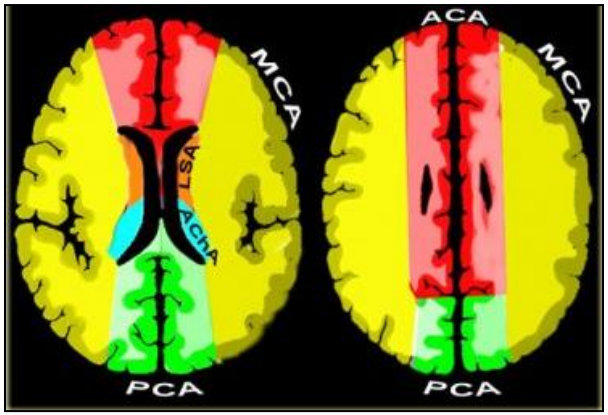
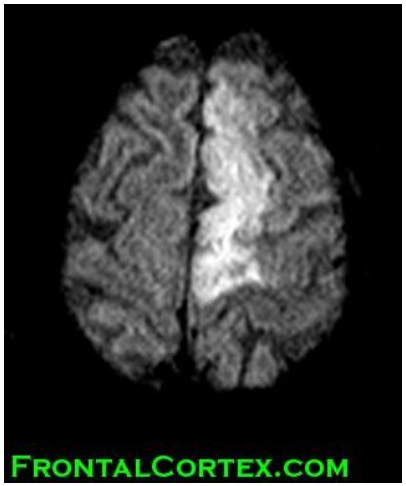


Stroke Locations

- Anterior Cerebral Artery (ACA):
  - Symptoms:
    - Contralateral weakness and sensory loss of the foot and leg
    - Mental status impairment: confusion, amnesia, preservation, personality changes such as apathy or flat effect
    - Abulia (inability to make decisions or perform voluntary acts)





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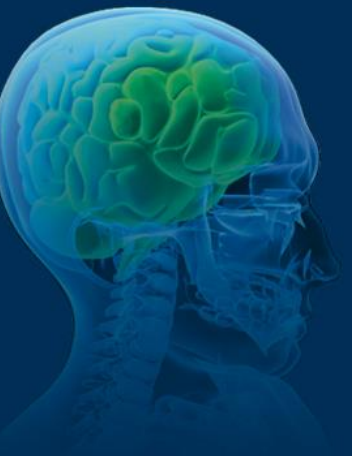
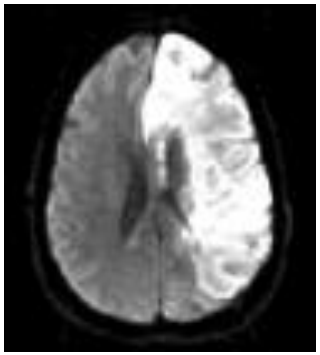
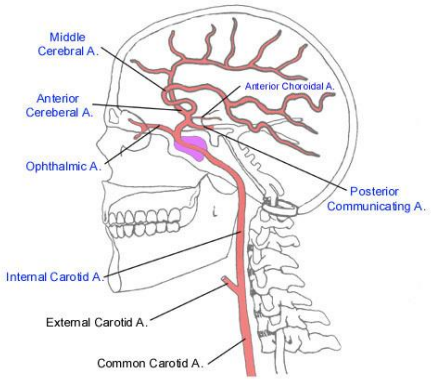


Stroke Locations

- Internal Carotid Artery (ICA):
  - Symptoms:
    - A combination of MCA & ACA territories
    - Weakness and sensory loss of the contralateral face, arm, and leg
    - Aphasia/Neglect
    - Ipsilateral episodes of visual blurring or temporary blindness (amaurosis fugax) from ophthalmic artery involvement
    - Carotid bruit
    - An extensive stroke may affect consciousness from cerebral edema and brainstem herniation





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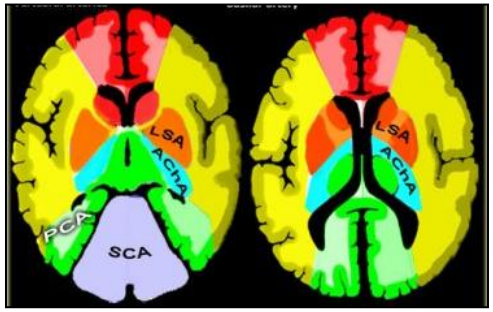
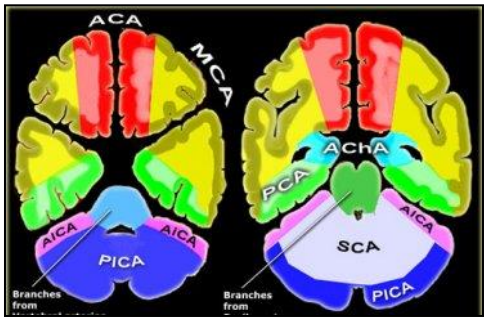
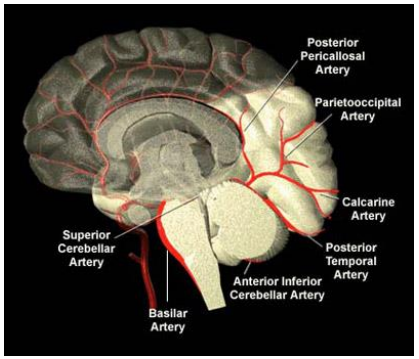
Stroke Locations

- Posterior Circulation:
  - Symptoms:
    - Contralateral hemiplegia/hemiparesis or quadriplegia/quadriparesis
    - Dysarthria
    - Ipsilateral numbness and weakness of face, “crossed signs” (brainstem cranial nerves)
    - Vertigo, nausea, dizziness, ataxic gait and clumsiness (cerebellum)
    - Diplopia, nystagmus, conjugate gaze paralysis, and opthalmoplegia (cranial nerves, ocular tracts)
    - Diminished level of consciousness (reticular activating system)







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Stroke Management

- Stroke chain of survival:
  - Detection: rapid recognition of stroke symptoms
  - Dispatch: early activation and dispatch of EMS systems by calling 911
  - Delivery: Rapid EMS identification, management and transport
  - Door: appropriate triage to stroke center
  - Data: rapid triage, evaluation, and management within the ED
  - Drug: appropriate medical management
  - Disposition: rapid admission to a stroke or critical care unit

Circulation 2010: 122;S818

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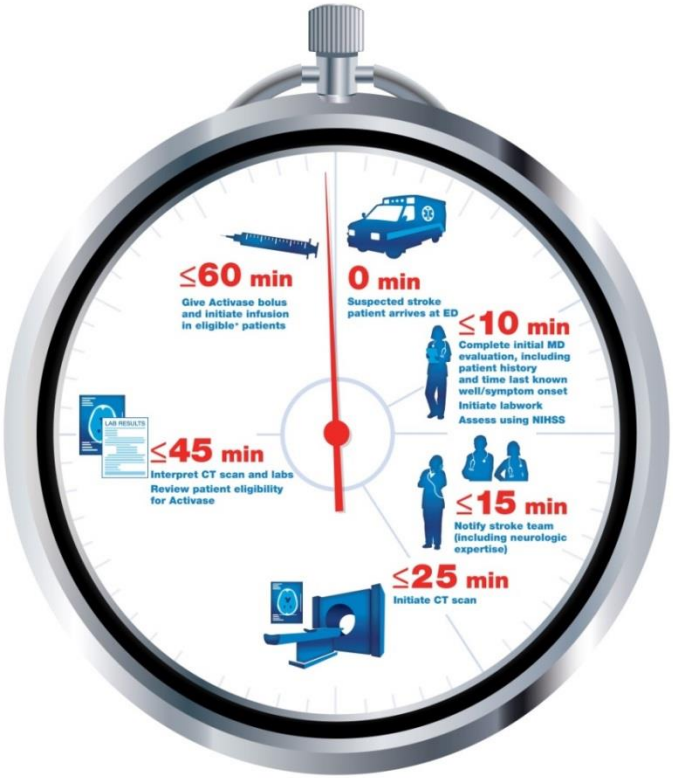
Stroke Management Timeline

Action	Time
Door to Physician	≤ 10 min
Door to Stroke Team	≤ 15 min
Door to CT Initiation	≤ 25 min
Door to CT Interpretation	≤ 45 min
Door to ECG*	≤ 45 min
Door to Chest X-Ray*	≤ 45 min
Door to IV t-PA	≤ 60 min
Door to Interventional	≤ 90 min
Door to Stroke Unit	≤ 3 hours

** If applicable*



Stroke 2013: 44:870
www.activase.com

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UF Health's Stroke Alert Process

- Policy Number **CP02.078** describes the process for notification and activation of a stroke alert for timely implementation of patient care management.

- To access UF Health's core policy and procedure for a stroke alert, use the following link:

https://my.portal.shands.ufl.edu/portal/page/portal/DEPT_CONTENT/Policies/CORE/CP02%20-%20Patient%20Care/CP02.078_.pdf

External "Stroke Alert" timeline and designated team member responsibilities

Process	0-5	10	15	20	25	30	40	45	50	55	60
EMS or Triage Notification of "Stroke Alert" patient	ShandsCalr Communication Specialists							Results less than 45" for treatment decision!			Goal: Door to Needle Administration less than 60 minutes!
Triage to designated stroke bed(s)	ED CN										
Obtain Blood glucose, assess/obtain IV access, Vitals signs, neuro assessment, weight and prepare for transport to CT scan	ED RN										
Initiate ED Stroke "Doc flowsheet"	ED RN										
ED Attending assess patient	ED Attending										
Initiate Stroke order sets	Vascular Neurology team/ ED MD										
Vascular Neurology team assess patient (initial NIHSS)	Vascular Neurology team										
Labs sent and Non Contrast CT complete	ED RN/STAT RN										
CT results interpreted	Vascular Neurology team										
Labs, Chest X-ray, and ECG resulted	ED RN/STAT RN/Radiology Staff										
Notify appropriate nursing unit/nursing coordinator of patient placement need	ED CN										
t-PA decision made (e.g. Labs, LKN,imaging, patient informed consent, t-PA inclusion/exclusion criteria)	Vascular Neurology team/ED MD										
Consult to Neurosurgery if CT positive for hemorrhagic stroke	Vascular Neurology team										
Consult to Endovascular Neurosurgeon if endovascular procedure candidate	Vascular Neurology team										
RN mixes and dual verifies bolus and infusion of t-PA when patient meeds criteria and order received	ED RN										
Prior to t-PA administration obtain baseline blood pressure and neuro assessment and document on ED Stroke "Doc flowsheet"	ED RN										
Following administration of t-PA blood pressure, HR, full neuro assessment obtained and documented on ED Stroke "Doc flowsheet" every 15 min X 2 hours, every 30min X 6 hours, every 1 hour X 16 hours	ED RN/Interventional Radiology RN (if IR case)										
Swallow Screen prior to administration of any PO medication, fluids or food (document on ED Stroke doc flowsheet)	ED RN										
Complete full neuro assessment and handoff upon transport of patient to designated bed placement (document in ED Stroke "doc flowsheet")	ED/STAT/ICU/Interventional Radiology RN										

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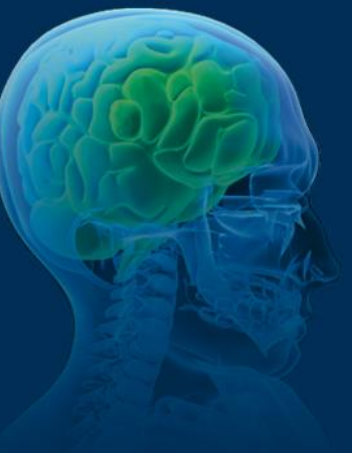

Stroke Management

- Initial ED Evaluation:
  - History: Establish/Confirm time of symptom onset or time of last known well
    - Acuity of onset
    - Prior similar symptoms
  - Physical examination
    - Clues to the diagnosis and cause?
  - Neurological examination
    - NIH Stroke Scale

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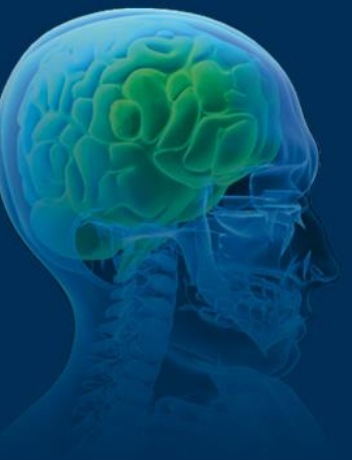

Stroke Management

- Initial ED Evaluation:
  - STAT CT Scan
    - Look for early ischemic changes
    - Rule out hemorrhage or stroke mimic
      - Clinical clues to a hemorrhage:
        - » Severe headache
        - » Nausea/Vomiting
        - » Very high BP
        - » Not reliable enough!
  - Cannot distinguish ischemic vs. hemorrhagic stroke without CT, therefore prior to scan:
    - NO Aspirin
    - NO Heparin
    - NO tPA
    - NO BP meds unless MAP > 140 mm Hg

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Stroke Management

- Initial ED Evaluation:
  - Laboratory Testing:
    - Blood glucose (result required prior to IV t-PA administration)
    - Electrolytes with renal function studies
    - CBC (Platelets)
    - Coagulation factors (PT/PTT)
    - Markers of cardiac ischemia
  - Select Patients:
    - ECG
    - Toxicology screen
    - Pregnancy Test
    - ABG
    - EEG
    - Lumbar puncture

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Stroke Management

- Laboratory testing results can introduce delay
- DO NOT DELAY IV t-PA administration pending lab results unless:
  - Clinical suspicion for bleeding abnormality/thrombocytopenia
  - Patient is taking coagulants
  - History is unknown
- Retrospective reviews have shown very low rates of unsuspected coagulopathies/thrombocytopenia

Stroke 2007;38:1639
Neurology 2009;73:1957

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Stroke Management: Ischemic

- Acute ischemic stroke treatment strategies include:
  - Reperfusion: to restore cerebral blood flow
  - Antithrombotic therapy: to prevent recurrent thromboembolism
  - Neuroprotection: to minimize the damage
  - Supportive Care

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Acute Treatment: IV t-PA

- IV t-PA Eligibly (the short version):
  - Clinical diagnosis of ischemic stroke within 4.5 hours of symptom onset
  - No stroke or head trauma in the past 3 months
  - No prior history of intracranial hemorrhage or current hemorrhage on head CT
  - No major surgery within the past 14 days
  - No GI/GU bleeding in the past 21 days
  - No lumbar puncture or arterial puncture at non-compressible sites in the past 7 days
  - BP < 185/110 (use caution if achieving this goal requires aggressive measures)
  - Platelets <100,000
  - INR <1.7
  - Special considerations:
    - Rapidly improving symptoms
    - Pregnancy
    - Seizure at onset
    - Glucose <60 or > 400

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IV t-PA within 3-4.5 hours

- Original study restricted patients that were:
  - > 80 years old
  - On anticoagulation, regardless of INR
  - History of prior stroke and diabetes
  - NIHSS >25

- The above mentioned criteria are not absolute contraindications. Treatment decisions within these groups should be individualized, with recognition of elevated risk of hemorrhage.

NEJM 2008;359:1317

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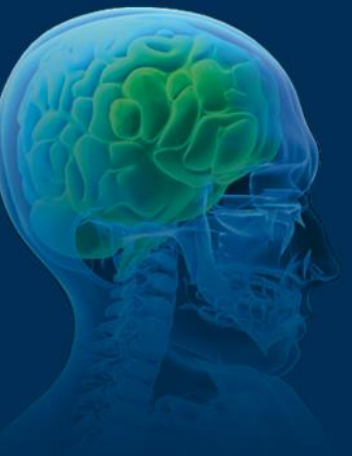
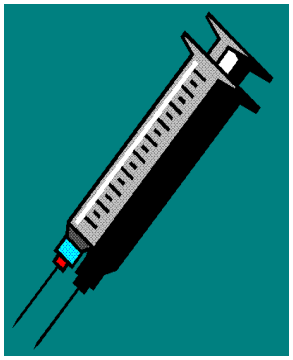


IV Stroke Therapy



- Intravenous t-PA
  - 0.9 mg/kg (MAX dose of 90 mg)
  - 10% bolus over 1 minute
  - Remainder infused over 60 minutes
  - NO Heparin, Warfarin, Aspirin, etc for 24 hours
  - Keep BP < 180/105 for the next 24 hours
  - Avoid invasive procedures for the next 24 hours
  - Admit to an Intensive Care Unit

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IV tPA: Adverse Events

- Orolingual Angioedema:
  - 1-5% of patients treated with IV tPA
  - Usually mild, transient, and contralateral to ischemic hemisphere
  - STOP infusion upon signs of reaction

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IV t-PA: Ethical Considerations

- Informed Consent?
  - IV t-PA is a FDA-approved standard of care within 3 hours of symptom onset
  - Given the risks of treatment, a discussion of risks and benefits with the patient and/or family should occur, if possible
  - UF Health prefers written consent whenever possible, however if it causing a delay in treatment, verbal consent is acceptable. If the patient is unable to provide informed consent, and the legal next of kin is unavailable, implied treatment consent verified by TWO attendings is acceptable.
  - Should not delay treatment
  - If the patient is unable to consent and family is not reachable, treatment should be based on implied consent for emergency treatment
  - Most lawsuits initiated are a result of *failure* to treat

AAN policy
Ann Emerg Med 2008;52:160
Neurol Clin 2010;28:429

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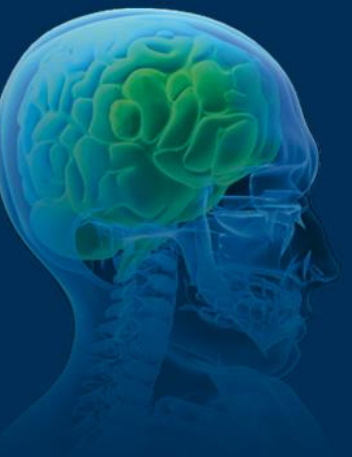

IV t-PA: Stroke Mimics

- Stroke Mimics:
  - Seizure
  - Hypoglycemia
  - Complicated migraine
  - Hypertensive encephalopathy
  - Wernicke's encephalopathy
  - CNS abscess
  - CNS tumor
  - Drug toxicities
  - Recrudescence of prior stroke
  - Psychogenic

- Attempt to identify stroke mimics prior to t-PA administration
- Best to err on the side of treatment
- Risk of hemorrhage is highest into the area of infarcted tissue
- In one series of 512 patients treated with IV t-PA:
  - 21% determined to be stroke mimics
  - None experienced hemorrhage
  - 87% were functionally independent at discharge

Neurology 2010;74:1310

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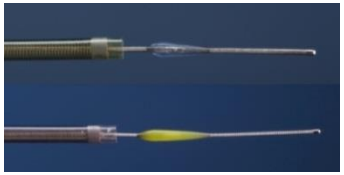
Acute Treatment: Endovascular

- Intra-arterial t-PA or mechanical clot retrieval
  - General time window is up to 6-8 hours after symptom onset
  - Window may be extended in certain circumstances
  - Techniques require accessible large vessel occlusion
  - Often used as a “rescue” therapy if IV t-PA does not recanalize vessel
  - Advantages:
    - Local effect (less systemic bleeding)
    - May be more effective for large clots than IV tPA
    - Longer window for intervention
  - Disadvantages:
    - Personnel
    - Technology
    - Time

MERCI



Penumbra

Solitaire

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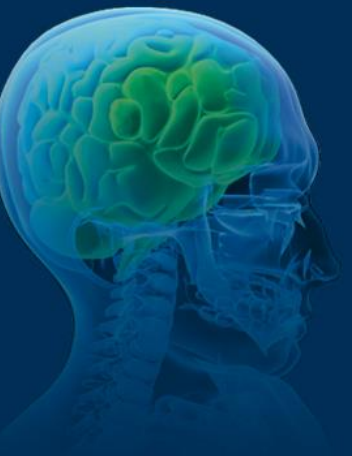
UF HEALTH SHANDS COMPREHENSIVE STROKE CENTER



Acute Treatment: Aspirin

- If not eligible for t-PA, Aspirin given acutely has been shown to improve patient outcomes

- Heparin was traditionally used in acute ischemic stroke, but repeated clinical trials have failed to demonstrate a benefit over ASA.

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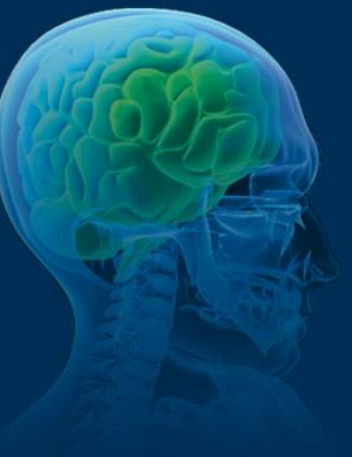

Stroke Management: Hemorrhagic

- SAH Presentation:
  - With or without focal neurological deficit
  - Common Signs and Symptoms:
    - "Worst headache of life"
    - Nausea/Vomiting
- ICH Presentation:
  - May present with any (or no) focal neurologic deficit
  - Common Signs and Symptoms:
    - Nausea/Vomiting
    - Sudden, severe headache
    - Diminished LOC
    - Elevated BP

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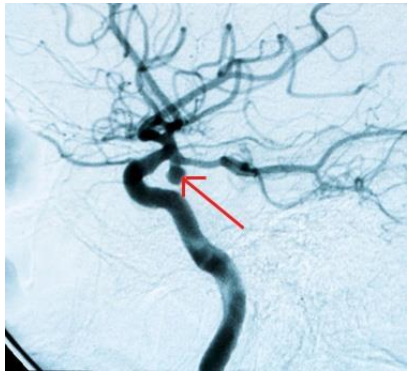
Stroke Management: Hemorrhagic

- SAH Treatment:
  - Document Hunt Hess (required for vascular neurology & neurosurgery)
  - HOB at 30 degrees
  - Intubation if patient unable to protect airway
  - Nimodipine and statin to prevent delayed ischemia
  - Labs:
    - PT/PTT/INR
    - CBC
    - BMP
  - Aggressive BP control:
    - SBP< 160, MAP<90
    - Labetalol IV or Nicardipine gtt
  - Consider Neurosurgical Consult:
    - EVD (ICP < 20mm Hg)
    - Early endovascular coiling
    - Surgical clipping
  - Long term EEG monitoring and TCD for vasospasm evaluation
  - Seizure Precautions
  - ICU monitoring
  - Supportive care



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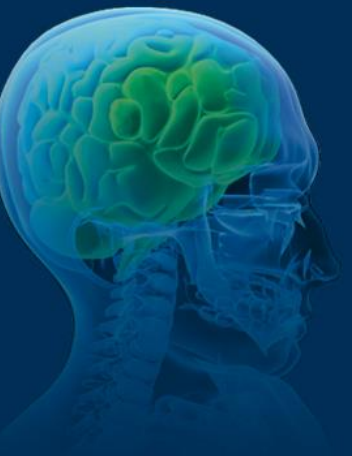

Stroke Management: Hemorrhagic

- ICH Treatment:
  - STAT Head CT, consider vascular imaging
  - HOB at 30 degrees
  - Intubation if patient unable to protect airway
  - Aggressive BP control:
    - SBP< 160, MAP<90
    - Labetalol IV or Nicardipine gtt
  - Labs:
    - INR
    - PTT
    - T&S
    - CBC
    - D-dimer
    - Fibrinogen
    - LFTs
    - UDS
  - Reverse Coagulopathy
    - For INR> 1.4, median time to procoagulant therapy should be < 90 minutes.
  - Consider Neurosurgical Consult:
    - Hematoma evacuation
    - External ventricular drain

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Stroke Order Set

- The Stroke Program has dedicated order sets for the care of stroke patients. Stroke order sets should be utilized for stroke patient management.
  - ED Specific Stroke Order Sets:
    - Adult Neurological Event- Stroke: 1600000047
    - Adult Stroke tPA:1600000054
    - Post Alteplase (tPA) Stroke Program Orders: 304000071
  - Neurology Specific Stroke Order Sets:
    - Stroke Program Alteplase (t-PA) Administration: 304000072
    - Neurology Admission Orders: 304000258

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The Joint Commission (TJC) Core Measures

UF Health is currently a TJC Primary Stroke Center, which requires 90% compliance with the following measures:

- **STK-1**: DVT prophylaxis end of day 2 (2013 compliance of 98%)
- **STK- 2:** Antithrombotics at discharge (2013 compliance of 100%)
- **STK-3**: A. Fib discharge on anticoagulation (2013 compliance of 100%)
- **STK- 4**: IV t-PA, last known well to drug <3 hours (2013 compliance of 89%)
- **STK- 5**: Antithrombotics end of day 2 (2013 compliance of 97%)
- **STK- 6:** LDL> 100 on statin medication at discharge (2013 compliance of 97%)
- **STK– 8**: Education (2013 compliance of 94%)
- **STK- 10**: Rehabilitation assessment (2013 compliance of 98%)

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TJC CSC Measures

As we move forward with TJC's Comprehensive Stroke Center certification, UF Health will be required to maintain 90% compliance with the following measures:

- **CSTK-01**: NIHSS on arrival
- **CSTK-02**: mRS at 90 days
- **CSTK-03**: Severity measurement for SAH and ICH on arrival
- **CSTK-03a**: Hunt and Hess for SAH
- **CSTK-04**: INR reversal achieved
- **CSTK-04a**: Median time to treatment with procoagulant reversal agent (goal < 90 minutes)
- **CSTK-04b**: Median time to INR reversal (goal < 24 hours)
- **CSTK-05**: Hemorrhagic complications for treated patients
- **CSTK-05a**: Hemorrhagic complications IV t-PA alone
- **CSTK-05b**: Hemorrhagic complication for IA t-PA OR mechanical thrombectomy
- **CSTK-06**: Nimodipine treatment administered
- **CSTK-07**: Median time to recanalization therapy (goal < 120 min)
- **CSTK-07a**: TICI score post treatment reperfusion grade

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UF Health's Stroke Quality Measures

- UF Health's Stroke Program reports all stroke quality measures on a monthly basis via the Stroke Committee Meeting.
- The committee reviews and discusses patient care indicators and methods for improvement to ensure best patient care.

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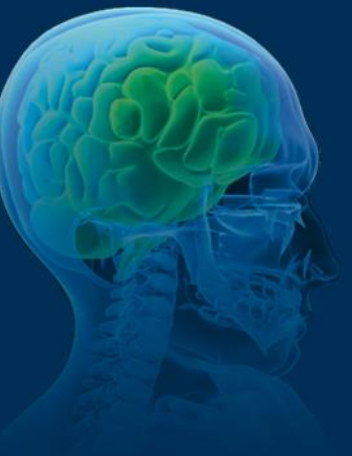

UF Health's Stroke Program Clinical Practice Guidelines

- The American Heart Association/American Stroke Association have published guidelines for the management of stroke patients. See below for links to those guidelines:
  - The early management of adults with ischemic stroke: http://stroke.ahajournals.org/content/44/3/870
  - The management of spontaneous intracerebral hemorrhage in adults: http://stroke.ahajournals.org/content/41/9/2108.full.pdf
  - The management of aneurysmal subarachnoid hemorrhage: http://stroke.ahajournals.org/content/43/6/1711
  - Implementation strategies for emergency medical services within a stroke systems of care: http://stroke.ahajournals.org/content/38/11/3097.full.pdf
  - The prevention of stroke in patients with stroke or transient ischemic attack: http://stroke.ahajournals.org/content/37/2/577.full

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