Stroke and Hyperacute Care

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Stroke Coordinator
Course Objectives

• Understand goal of a Primary Stroke Center
• List stroke risk factors
• Define embolic, thrombotic and lacunar ischemic strokes and a transient ischemic attack (TIA)
• Discuss the medical management of an ischemic stroke and understand the use of thrombolytic therapy
• Discuss the indications for surgical management of cerebrovascular disease
• Define the etiology of spontaneous intracerebral hemorrhage with sub arachnoid hemorrhage (SAH)
• Discuss diagnostic studies for strokes
What is the Impact of Stroke?

Stroke is the 4th leading cause of death in the United States

- About 750,000 Americans suffer stroke each year
- About 4 million Americans are stroke survivors
- Americans paid about $51 billion in 2003 for stroke-related medical costs
What is a Primary Stroke Center?

- Defined by BAC, ASA, and Joint Commission

- “Resources, organization and expertise” available to treat acute stroke 24/7, 365 days/year

- Acute Stroke Team must be hospital based

- Must be available to evaluate suspected stroke within 15 minutes

- Must be able to provide neuro-interventional services within 2 hours of consultation
NorthShore’s Stroke Team

- Dr. Dan Homer, Program Director

- Jim Castle, MD
- Rima Dafer, MD
- Frances Caprio, MD
- Steve Meyers, MD
- Rich Munson, MD
- Archie Ong, MD
- Nancy Doherty, APN
- Debbie Lynch, APN
- Nataliya Omelchenko, APN
- Barbara Small, MBA, RN
What is the role of the acute stroke team?

- Evaluates the patient for stroke
- Formulates a plan based on symptoms
- Is the patient a candidate for IV tPA?
- Consider intra-arterial tPA
- Consider mechanical clot extraction
- Collaborate with the healthcare team.
Initial Stroke Triage
EMS Pre-hospital

• Rapid evaluation
  - Time of symptom onset
  - Obtain glucose

Early stabilization
  - VS, cardiac monitor, SaO2>94%

Neurological Evaluation
  - Cincinnati Stroke Scale
    - Based on physical findings only
    - Observe for facial droop, arm weakness, or speech difficulties
    - Assessment mostly identifies anterior circulation ischemic stroke
Arrival to Emergency Department

• Recognize need for rapid evaluation and assessment: ABCs
  - **Goal:** Is the patient eligible for IV tPA?
  - 1.9 million neurons are lost every minute with a large vessel stroke

• Triage is high priority
  - Equivalent to a serious trauma or acute myocardial infarction
Emergently!

- **Must have CT head (non-contrast) completed**
  - within 25 minutes
  - with “read” within additional 20 minutes by neuroradiologist or neurologist. D->Read 45 minutes

- **NIHSS** is used for the **initial assessment** of patients with acute stroke

- **Obtain Blood Glucose**
## Goal Action Times

**Thrombolytic Candidates**

<table>
<thead>
<tr>
<th>Time Interval</th>
<th>Time Target</th>
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<tbody>
<tr>
<td>Door to ED Practitioner</td>
<td>10 minutes</td>
</tr>
<tr>
<td>Door to Stroke Team</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Door to CT completion</td>
<td>25 minutes</td>
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<tr>
<td>Door to CT interpretation</td>
<td>45 minutes</td>
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<tr>
<td>Door to treatment</td>
<td>60 minutes</td>
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<tr>
<td>Door to monitored bed</td>
<td>3 hours</td>
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Brain function

**Frontal Lobe:** Language, motor strip, judgment, problem solving, impulse control, reasoning, memory, personality, problem solving.

**Parietal Lobe:** Sensory perception (taste, pain, temperature), reading and arithmetic, movement, orientation, recognition and perception of stimuli.

**Temporal Lobe:** Memory, hearing, perception and recognition of auditory stimuli, and speech.

**Occipital Lobe:** Visual processing.
Start at the Top—Motor and Sensory Cortex

Motor Cortex

Sensory Cortex

Visual Cortex
The Speech Centers—Broca and Wernicke

**Broca: Expressive Aphasia**
- Know what they want to say / cannot get it out
- Struggle with reading/writing

**Wernicke—Receptive Aphasia**
- Language is meaningless
- Use random, wrong words strung together ("word salad")
What Blood Vessels Feed the Brain?

- **Aorta-> Subclavian->Common Carotids/Vertebral**

- **Common Carotids**
  - **External:** supply face/scalp
  - **Internal:** supplies the anterior part of the brain (MCA/ACA)

**Vertebral Arteries->Basilar Artery->PCA**
- Supply posterior brain, brainstem, thalamus, occipital lobe and cerebellum
CNS: Vasculature

Circle of Willis
Anterior (ACA)
Internal (ICA)
Posterior (PCA)
Basilar
Vertebral
Cranial Nerves

Brain Stem:
- Midbrain: CN III
- Pons: CN IV, V, VI, VII, VIII
- Medulla: IX, X, XI, XII

Brainstem injury/CN abnormalities
» cardiovascular system control,
» respiratory control,
» pain sensitivity control,
» alertness, and consciousness.

Thalamus: Filtering center for sensory input
What is a Stroke?

A stroke occurs when blood flow to the brain is interrupted by a blocked or burst blood vessel.
Stroke Warning Signs

- **SUDDEN** weakness or numbness of the face, arm or leg, especially on one side of the body

- **SUDDEN** confusion, trouble speaking or understanding

- **SUDDEN** trouble seeing in one or both eyes

- **SUDDEN** trouble walking, dizziness, loss of balance or coordination

- **SUDDEN**, severe headache with no known cause (for hemorrhagic stroke)
Stroke Risk Factors

- **Non Modifiable:**
  - Age
  - Sex
  - Race
  - Prior Stroke
  - Family History

- **Modifiable:**
  - Hypertension
  - Smoking
  - TIA
  - Heart Disease
  - Diabetes
  - Dyslipidemia
  - Asymptomatic Carotid Dz
TYPES of Strokes

• Ischemic Stroke (80%)
  – TIA
  – Thrombotic stroke
  – Lacunar or small subcortical stroke

• Hemorrhagic Stroke (20%)
  – Intracerebral hemorrhage
  – Subarachnoid hemorrhage
What Happens in a Ischemic Stroke?

- Death of brain cells within 3-5 minute
- Infarct Core: ischemic tissue
- Penumbra: surrounds core, less ischemia but “starving” and unable to function.
Causes of ischemic Strokes

**Thrombus 70%**
- Atherosclerosis
- Hypertension
- Hypercoagulability

**Emboli (blood clot) 30%**
- Associated with heart conditions
  - A-fib, MI, PFO
  - Less Common
  - Air, Fat, Amniotic fluid
Hemorrhagic Strokes

- Focal deficits the same as ischemic
- May include headache
  - SAH: “worst headache of my life”

Nausea and vomiting

Decreased LOC
  - Rapid LOC minutes-> hours

Neck pain
  - Nuchal rigidity, meningeal irritation
Normal vs SAH
Hemorrhagic Strokes (Incidence: 20%)

Aneurysm:
- Ballooning of a weakened region of a blood vessel.

AV malformation
- Tangle of abnormal arteries and veins.
- Arteries feed directly into the veins without a capillary bed.
- Always congenital.
What Can Happen with a Bleed?

- Too much pressure in the brain which can cause a shift.

- Herniation: shift of brain across midline

- Herniation near or into brainstem may lead to compression of the breathing center/cardiac center
Transient Ischemic Attack

- TIA is a “warning sign” that a major stroke may occur in the near future

- Treat TIA as an EMERGENCY
Anterior Cerebral Artery

Contra lateral leg weakness and sensory loss

Personality change — affect/emotions

Cognitive Impairments

Incontinence may occur
Middle Cerebral Artery

Contra lateral motor/sensory deficit
- Affects lower face, arm and hand
- Leg often spared

Left or Dominant Hemisphere
- Expressive/receptive aphasia

Right or Non Dominant Hemisphere:
- neglect or unaware of opposite side

Homonymous Hemianopsia

Gaze Palsy -> toward the injury
Middle Cerebral Artery—Vision Deficits

Eye and head deviation toward the side of infarct
Homonymous hemianopsia

quadrantanopia

hemianopsia
Middle Cerebral Artery Stroke

Day 1 - ischemia

Day 3

Day 5
Posterior Circulation Stroke

- The 5 Ds
  - Dizziness
  - Diplopia
  - Dysarthria
  - Dysphagia
  - Dystaxia
Stroke Mimics

• 6%-20% of suspected stroke pts are stroke mimics

• Stroke mimics are lower if thorough:
  – History of present illness
  – Clinical exam
  – Radiologic images
  – Laboratory information
Toxic-Metabolic

- Hypoglycemia
- Severe Hyperglycemia
- Hypo/Hyper Natremia
- Hepatic encephalopathy
- Wernicke’s encephalopathy
Seizure disorders

- Postictal Todd’s paralysis

- Hemiparesis:
  - Thought to be due to increased metabolic demand and decreased excitatory neurons at the seizure focus

- Defining factor:
  - noted seizure activity
  - Weakness that cannot be localized to one specific vascular territory
Bell’s Palsy
Migraine Headaches

• Hemiparesis:
  – Related to cortical spreading depression with activation of migraine
  – Then subsequent temporary inhibition of neurons in the same region
  – Weakness cannot be localized to one vascular territory
Neurological Degenerative Diseases

- Multiple Sclerosis
- Acute inflammatory demyelinating polyneuritis
- Optic neuritis
- Acute Myelopathy
Other Stroke Mimics

Infection

 Decompensaion of former stroke

Brain Tumor/CNS Abcess

Idiopathic intracranial hypertension
IV tPA Candidate?

- CT head (non-contrast) completed?
- NIHSS Completed?

Blood Glucose Resulted
Emergent Diagnostics

**CT (non-contrast) head:** (symptom onset <6 hours)
- First imaging for all suspected stroke pts.
- R/O blood in the brain (hemorrhagic stroke)
- Fast and Well tolerated

**CTA head and neck** (iodine contrast)
- ‘A’ refers to Angiogram or Blood Vessels
- To look for arterial stenosis, dissection, aneurysm
- Creatinine Clearance <30
Emergent Diagnostics

MRI Brain: Acute Stroke Protocol (without gad)
- Includes Diffusion, Flair, ADC, GRE
- Reliable for new ischemic changes
- NO PACEMAKERS or non-surgical METALS
- Claustrophobic: mild sedative 30 minutes prior

MRA head (without gad)
- ‘A’ refers to Angiogram or Blood Vessels
- MRA head: looks at intracranial MCA/PCA/ACA
- MRA neck: looks at extra cranial anterior/posterior circulation
NIHSS

• Designed to standardize and document reliable and valid neuro exam.

• Systematic tool designed to measure neuro deficits in the most often seen with stroke

• Allows us to:
  – Quantify our clinical exam
  – Determine if the patient’s neurological status is improving or deteriorating
  – Provide for standardization
  – Communicate patient status
NIHSS

- **NEW**: used for the initial assessment of patients with acute stroke
- ED RNs -> yearly validations to perform NIHSS
- IV tPA
  - #1,5,6: Q15 minutes x 2h, q 30 minutes x 6 h, q 1h x 16h
  - Entire NIHSS with worsening neurological changes
Use ED Stroke Order Set

- Labs need to be resulted in 45 minutes if ordered by the practitioner
  - CBC
  - Coags—PT/PTT; INR
  - BMG
  - Troponin
  - EKG
IV tPA Inclusion Criteria

- Diagnosis of ischemic stroke causing measurable neurological deficits

- Onset of symptoms < 3 hours; or onset of symptoms < 4.5 hours
  - <80 years old
  - No anticoagulation
  - NIHSS, or equal to 25
  - No DM with prior stroke

Age: 18 or older
IV tPA Exclusion Criteria

- Significant head trauma or prior stroke in previous 3 months
- Symptoms suggestive of a Subarachnoid hemorrhage
- Arterial puncture at noncompressible site in previous 7 days
- H/O previous intracranial hemorrhage
- Recent intracranial or intraspinal surgery
- Intracranial neoplasm, AVM, aneurysm
- BP > 185/110  Glucose < 50  Plts < 100,000
- Active internal bleeding
- Heparin w/in 48 hours with elevated PTT
- Anticoagulation use with INR > 1.5 or PT >15 seconds
- Current use of direct thrombin inhibitors or direct factor Xa inhib
What is tPA (Alteplase)

• “Clot Buster” A powerful enzyme that breaks down clots

• Presently, the only FDA approved treatment for ischemic strokes

• The patient must meet the inclusion criteria

• Most common side effect -> BLEEDING
tPA Administration and Dosing

- Alteplase (tPA) is in the pyxis in the ED and ICU
  - 2 glass vials, one with powder, one with 100cc sterile water
  - Mix by using transfer device, spike waster then spike powder
  - Admixture is SWIRLED until power completely diluted

Dosing for Stroke Patients  0.9mg/kg
with a maximum dose of 90mg
(REGARDLESS of BODY WEIGHT)

10% of dose over 1-2 minutes
Remainder over 1 hour
Patient to remain in ED until IV tPA completed
Angioedema

- Incidence: 1-2% of all tPA-treated stroke
- Common in Pts taking ACE inhibitors
- Usually starts near the end of tPA infusion
- No standard guidelines for management
Angioedema

- Examine tongue 20 minutes before IV tPA infusion is completed, and for 20 minutes post tPA

- Look for signs of unilateral or bilateral tongue enlargement.
Treatment

- Consider early discontinuation of tPA
- Benadryl 50mg IV
- Ranitidine 50mg IV or Famotidine 20mg IV
  
  If tongue continues to enlarge, give
- Solumedrol 80-100mg IV
- Further increase: Epi 0.1%->0.3ml sc or 0.5ml nebulizer
- Consider STAT intubation
Non-IV tPA Ischemic Strokes Treatment

- ED Stroke Order Set
- Treat BP < 220/110
  - Labetolol or Nicardipine drip
- Aspirin: 325 chewable or rectal
- Patient to remain NPO in ED
- Stroke Unit or ICU bed
Non-tPA Ischemic Stroke Patients

- Occasionally admitted to ICU following large strokes
- Monitored and treated for cerebral edema/herniation
- Hemicraniectomy-removal of skull in area of infarct to prevent shifting of brain and herniation
- Transferred to Evanston ICU->Neurosurgery
ED Care of the Hemorrhagic Stroke patient

- Patients with hemorrhagic stroke are admitted to the Intensive Care Unit from the Emergency Department. (or transferred to EH ICU from another hospital)

- **Exception:**
  - Patients with hemorrhagic stroke may be admitted to the Stroke Unit from the Emergency Department with the mutual agreement of Neurosurgery Service and Hospitalist or PCP with Teaching Service
  - Neurosurgery Service will be the admitting/primary service when the patient is admitted to the ICU.
Stroke case studies
Case Study

- Mrs. O’Donnell, 78 y/o, arrives to the ED by EMS at 11am Saturday morning.
- Cincinnati Stroke Scale results were:
  - Facial droop, arm weakness and slight slurring of speech.
- Last known time: 8am at breakfast
- Glucose is 84
- 8080 is called
Case Study

- Stroke Neurologist/APN respond

- You state: Mrs. O is a 62y/o F with h/o a-fib, on coumadin:

- What is the time frame for the initial ED assessment? Door->ED practitioner

- What next?
Case Study

• Which order set is used for suspected stroke pt?

• Why is it important to use the order set?

• What 3 things must be completed prior to IV tPA?
Case Study

• CT head shows no bleed. INR is 1.5.

• What is the cutoff value for INR?

• PMH includes breast cancer, smoker, HTN.

• Medication: coumadin 5mg/d, metoprolol
Case Study

• Patient’s BP is 195/108

• What is the cutoff BP for tPA?

• What is the first line drug recommended?
Case Study

• You administer Labetolol and BP drops to 168/102.

• Family agrees to IV tPA

• Which order set is used?
Case Study

• The weakness of her arm worsens as well as her leg 15 minutes into her infusion, as well as difficulty in arousal. What do you do?
Case Study

• She returns from CT scan more awake: CT read is stable.

• IV tPA resumed

• At the end of IV tPA you note tongue swelling.

• How do you treat?
Case Study
Case study #2

Mr. Burk is a 48 y/o right handed male that noted when he woke at 0800 and noted that his left eyebrow was higher than his right with a right facial droop.

He moved his arms and legs symmetrical.

What is your differential?
Case #2

• CT: no bleed. Last known well?

• Is the patient a candidate for IV tPA?

• Do you alert the stroke team pg 8080?

• Is this a central of peripheral lesion?
Case #2

- Central vs Peripheral disease.
  - Pain in ipsilateral ear/hearing loss
  - Check for vesicles in the external auditory canal
  - Taste test: salt/sugar
Case #2

• What is the treatment for Bell’s Palsy?
  – Prednisone 80 mg/d for 5 days, followed by a 7 day taper

• Ramsay Hunt syndrome (facial paralysis/hearing loss)
  – Caused by herpes simplex (shingles virus)
  – Acyclovir 800 mg po 5 times daily for 7 days PLUS Prednisone

• Incomplete Eye Closure
  – Ophthalmic ointment (lacri-lube) and protective eye shield at night
Thank you for being a member of our team