Emergency Care of Acute Stroke

Katie Leonard, RN, MSN, NP
Stroke Nurse Practitioner & Coordinator
Swedish Medical Center
Denver, Colorado
Financial Disclosures

- Genentech Speakers Bureau
- EKR Speakers Bureau
- 700,000 in the US/year
- #1 Cause of Disability
- #3 Cause of Death
- Cost $56.8 Billion/year
- Only 5% of all stroke patients in the US get acute treatment
Why is stroke so difficult to treat?

- Symptoms are not recognized early
- Lack of Organized Stroke Care
- Only one approved treatment - IV tPA
  - must be given within 3 hours
  - significant risk of bleeding
- 24/7 Neurology Coverage
Use of t-PA is Still Very Low!

National treatment rates vary between 2-5% 

In 2002, Colorado state treatment rate was 2%, in 2007 increased to 8%

The best hospitals in the country are treating about 25% of all ischemic stroke patients

We can do better!!!
A Proposal

- Colorado hospitals should form **collaborative networks** to facilitate acute stroke treatment

- **Every hospital** should offer emergent evaluation and approved treatment (IV tPA)

- Patients who may benefit from advanced (intra-vascular) treatment, should have the option to:
  - Have IV tPA started locally
  - Be transferred to a Comprehensive Stroke Center ("Drip and Ship")
Stroke Care is Improving!

- Stroke care has changed with the advent and increased use of IV t-PA.
- From 1994 - 2004 the death rate from stroke declined 24%.
- If the current mortality trends hold, the American Heart Association analysts project that there may be a 34% decline in the stroke death rate when the 2010 data are released.
Stroke
Pathophysiology
Stroke = Interruption of Cerebral Blood Flow
Stroke symptoms depend on infarct location

- **Motor Cortex** (Movement)
- **Central Sulcus**
- **Sensory Cortex** (Pain, heat, and other sensations)
- **Frontal Lobe** (Judgment, foresight, and voluntary movement)
- **Broca’s Area** (Speech)
- **Frontal Lobe** (Smell)
- **Temporal Lobe** (Intellectual and emotional functions)
- **Brainstem** (Swallowing, breathing, heartbeat, wakefulness, and other involuntary functions)
- **Parietal Lobe** (Comprehension of language)
- **Temporal Lobe** (Hearing)
- **Occipital Lobe** (Primary visual area)
- **Wernicke’s Area** (Speech comprehension)
- **Cerebellum** (Coordination)
700,000 strokes annually—85% are ischemic

- Cerebral thrombosis 61%
- Cerebral embolus 24%
- Hemorrhagic stroke 12%
- Transient ischemic attack (TIA) 3%
- Intracerebral hemorrhage 9%
- Subarachnoid hemorrhage 3%

Ischemic stroke 85%
Types of Stroke

Hemorrhage
  - Intracerebral hemorrhage (ICH)
  - Subarachnoid hemorrhage (SAH)

"Thrombosis"
  - Large artery extracranial & intracranial occlusive disease
  - Small penetrating artery disease

Ischemia
  - Embolism
    - Heart
    - Intra-arterial
    - Aorta
    - Paradoxical

Systemic hypotension
TIA - Transient Ischemic Attack

Stroke Warning Sign!

- A TIA is a brief episode of cerebral ischemia.

- Average time for a TIA is 10-15 minutes

- Require immediate medical attention to prevent a possible full-blown stroke.

- All are Admitted and worked up like a stroke.

- 35% patients with a TIA will have a stroke in the next 5 years, 70% of these will occur within 2 weeks of the TIA
Neuro-Anatomy

Neuro-Vascular Anatomy
Lobes of the Brain

- Frontal lobe
- Primary motor cortex
- Central sulcus
- Primary somatosensory cortex
- Parietal lobe
- Olfactory bulb
- Temporal lobe
- Occipital lobe
- Cerebellum
- Spinal cord
Figure 10-11. Anatomic basis of middle cerebral artery syndromes.
Figure 10–10. Arterial supply of the primary motor and sensory cortex (coronal view).
Stroke Signs & Symptoms
The 5 Most Common Stroke Symptoms

- **Sudden** numbness or weakness of 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
Rapid Identification = THINK FAST!

- Facial Droop
- Arm Strength
- Speech Changes
- Time! (onset and ED!)

• Sensitivity 66%; Specificity 87%
  
Language & Speech

- **Expressive Aphasia – Non-Fluent – Left Brain**
  - Motor Problem
  - Understand but can’t get words out.
  - Frustrating!!

- **Receptive Aphasia – Fluent Aphasia – Left Brain**
  - Sensory Problem
  - Don’t understand
  - can speak but don’t make sense
  - Unaware of deficit

- **Dysarthria – Slurred Speech – Right OR Left Brain**
  - motor problem only
The Cerebellum

- Coordination
- Balance
- Equilibrium
- Ataxia
- Produces **IPSILATERAL** malfunction
Brain Stem Stroke

- Involuntary life-support functions including breathing, blood pressure, and heartbeat
- Cranial nerves
Stroke vs. Mimic

- Exact Time of Onset
- Patient has been well in the last week
- One-sided Symptoms
- Definite Focal Symptoms
- Patient able to recall exactly what he/she was doing when symptoms started

Libman et al
Acute Stroke Treatment
Stroke is an EMERGENCY!
Time is Brain
Treatment Targets

- **Strokes are Treatable!! Sometimes Reversible!!**
  - Recognize the Symptoms
  - 911 FAST!
  - Ischemics
    - Open the Blockage
    - IV tPA & Interventional procedures
    - Maximize Perfusion
  - Hemorrhages
    - Lower the BP
    - Stop the Bleeding
    - Surgery
Best Management in the ED
Includes:

- An Acute Stroke Team
  - Dedicated Physicians
    - ED
    - Neurologists
    - Radiologists
  - Neuro Nurses

- Acute Stroke Protocols
  - Stroke Alert System – page neurologist, send ICU labs, tele, go to CAT scan
Stroke history

- When was the patient last seen normal?
  - With stroke symptoms upon awakening, consider time of onset to be when the patient was last known to be symptom-free upon retiring
  - For mild impairments that subsequently worsened, consider time of onset as the time the first symptom began
  - For symptoms that completely resolved (TIA) but were followed by a second event, use time of onset of new symptoms

- Did patient experience any recent medical or neurologic events?
  - eg, surgery, trauma, hemorrhage, acute myocardial infarction (AMI), or previous stroke

- Is the patient taking any medication?
  - Especially, oral anticoagulants or antiplatelet agents
Hemorrhage or Ischemia?

- May be clinically identical

- Hemorrhage clues:
  - severe headache
  - depressed consciousness
  - nausea and vomiting
  - papilledema or pre-retinal hemorrhages
  - neck pain and stiffness
  - photophobia
STAT CT in ED:

- CT is FAST, no magnet concerns
  - Better for unstable patients.
  - Does not delay institution of therapy.

- CT is better for detection of intracranial hemorrhage.
National Institutes of Health
Stroke Scale = NIHSS

- Scale of 0-40
- The worse the deficits, the higher the number.
- Ischemic stroke pts are tested for deficits in:
  - Level of consciousness
  - Language – speaking and understanding
  - Vision, EOMs
  - Motor
  - Sensory
  - Ataxia/Coordination
- Standardizes the neuro exam and how it’s communicated, monitors trends in patient status, measures pt’s response to treatments
Tissue Plasminogen Activator

- Approved June 1996 for ischemic stroke by FDA
- 30% of patients who receive t-PA within 3 hours of sx onset are more likely to have excellent neurological recovery at 3 months than those who received placebo (Kothari, et.al., 1997)
- Paradigm shift to think of stroke like an MI or trauma
IV t-PA Decision Making

Inclusion Criteria
- Clear Neurological deficits
- Onset within 3 hours
- Age >18

Warnings
- Rapid neurologic improvement
- Very Mild stroke
- GI bleed within 14 days
- Recent Lumbar Puncture
- Recent Arterial Puncture
- BG <50 or >400

Exclusion Criteria
- ICH
- SAH
- Known AVM or aneurysm
- Prior ICH
- Active Internal Bleeding
- Major surgery within 14 d
- Pregnant
- Known Bleeding Problems (Platelets <100, PT >15, INR >1.7)
- SBP >185 or DBP >110 at time of treatment
- Within 3 months of brain surgery, head trauma, or stroke
Time is Brain

**Graph:**
- **Y-axis:** Odds Ratio for Favorable Outcome at 3 Months
- **X-axis:** Minutes From Stroke Onset to Start of Treatment

- **Lines:**
  - **Benefit for rt-PA**
  - **No benefit for rt-PA**

**Notes:**
- rt-PA = recombinant tissue plasminogen activator.
“TIME IS BRAIN”
Why is TIME so Important?

- Brain Cells & Tissue need constant oxygen (blood) to survive
- Brain Cells & Tissue Die Quickly without blood
- Brian tissue has no energy stores
- Brain tissue can not be regenerated after it dies
- Dead brain tissue bleeds easily
NIH-recommended Emergency Department response times

The “golden hour” for evaluating and treating acute stroke

door-to-needle ≤60 min

- Suspected stroke patient arrives at ED
- Initial MD evaluation including patient history, lab work initiation, and NIHSS assessment (≤10 min)
- Stroke team notified (including neurologic expertise) (≤15 min)
- CT scan initiated (≤25 min)
- CT & labs interpreted (≤45 min)
- Alteplase given if patient is eligible (≤60 min)
TPA: Dose/Administration

- 0.9 mg/kg (maximum 90 mg)
- Initial 10% as IV bolus over 1 minute
- Remaining 90% infused over 60 minutes
- Post t-PA Precautions
  - Goal SBP < 185
  - No venous or arterial punctures
  - Assess for sx of hemorrhage (decreased LOC, n/v, HA, worsened weakness)
t-PA Dosing

- Recommended dose for patients with acute stroke:
  - 0.9 mg/kg (maximum 90 mg)
  - 10% of total dose is administered as an intravenous IV bolus over 1 minute
  - The other 90% is infused immediately following the bolus over 60 minutes
- Example:
  
  \[
  \text{Pt weighs: 110 lbs} = 50 \text{ kg} \quad \text{Total dose: 45 mg (mg}=\text{ml)} \\
  \text{Bolus dose: 4.5 mg (mg}=\text{ml)} \quad \text{Infusion dose: 40.5 mg (mg}=\text{ml)}
  \]
Bolus

- Prior to t-PA try to do the following
  - Insert 3 IV’s
  - Insert a foley catheter
    - If appropriate
- Give the bolus dose over 1 minute
Infusion

- Start infusion immediately after bolus!
- Infusion over 1 hour
- Have IV Pump Ready!!
- Vital signs, neuro checks
  - Every 15 min x 2 after starting t-PA, then every 30 min x 6 hours, then every 1 hour x 16 hours.
Before and After t-PA – Watch BP

• Typical BP goals
  • SBP 120-180
  • DBP 60-100

• To treat BP, must have 2 consecutive readings, 5 minutes apart

• Use medications like labetalol and nicardipine to treat high blood pressures. Consult the physician orders for each individual patient

• If SBP less than 120 or DBP less than 60, notify neurologist
Blood Pressure Management
Ischemic Stroke

- Elevated BP is a **natural, protective, and beneficial response** during an acute ischemic stroke.
- Higher pressure helps other vessels compensate for the vessel that is blocked and possibly save surrounding tissue.
- ASA allows SBP < 220.
- Avoid Hypotension!
More on Blood Pressure Control

- Induced HTN may be necessary in certain patient populations
  - Fluid boluses may be used
  - Vasopressors may need to be started
    - Neosynephrine
    - Levophed
Three hours isn’t an absolute
Clot size, location, and consistency matter
Lytics aren’t the only option
Thrombolysis with Alteplase 3 to 4.5 Hours after Acute Ischemic Stroke

ECASS = European Cooperative Acute Stroke Study

**ECASS-3:**
19 European countries
Industry-sponsored double blind RCT 821 pts:
alteplase (418), 0.9 mg/kg, max 90mg
placebo (403)
Acute Ischemic Stroke Treatments

- **IV t-PA – “The Clot Buster”**
  - Must give within 3 hours of symptom onset
  - Sooner is better though!

- **IA = Intra-Arterial Treatment**
  - Up to 8 hours after symptom onset
  - IA t-PA
  - Clot Retriever
  - Balloon Angioplasty
  - Stent Placement
Imaging Goals in Acute Stroke “Triple CT Stroke Protocol”

1. Plain CT = Rule out hemorrhage
2. CT Perfusion = Identify ischemic brain tissue
3. CT Angiogram = Identify occluded vessels
Thank You!!

Kathryn.Leonard@HealthONECares.com

“The function of the entire body is solely to carry the brain around”

- Thomas Edison