Emergency Department Management of Acute Ischemic Stroke

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Acute Ischemic Stroke
The “Eight D’s” of ED management

- Prehospital Management
  - Detection
  - Dispatch
  - Delivery
- Emergency Department Management
  - Door
  - Data
  - Decision
- Emergent Therapeutic Options
  - Drug
  - Device

Prehospital Care: General Principles

- Successful stroke treatment is built on the principle of “time=brain.”
- Patients that arrive to the hospital outside of their therapeutic window have no effective emergent treatment options.
- Public education efforts are needed to advance awareness of the signs and symptoms of stroke.
- The public must understand that stroke=911!

Prehospital Management: EMS Care

SUMMARY

- Identify the possibility of an ongoing stroke.
- Establish a concrete time of onset if at all possible-use all available resources.
- Complete prehospital assessment including CPHSS, Blood Glucose Check.
- Notify appropriate receiving hospital as soon as possible.
- Run emergency traffic if onset within 6 hours.

Emergency Department Management: Door

- Successful triage must include a dependable method of recognition of stroke symptoms, especially in non EMS patients!
- On arrival, the acute stroke patient is placed in a high acuity area and given the same triage priority as an unstable patient.
- Once the airway, breathing, and circulation are assessed, the most appropriate first step in management is-

Emergency Department Management: Door

- Vitals, IV access, and confirmation of blood glucose are performed immediately.
- An accurate focused history and physical exam are quickly performed by the ED team.
- Time of symptom onset is a critical component of the history.
The Rapid ED Neurologic Exam

- Rapid focused neurological exam identifies deficits—should include 6 essential components of neurological function (Mental Status, Cranial Nerves, Motor Exam, Sensory Exam, Reflexes, Coordination)
- The NIH Stroke Scale may be used as a tool for rapid neurological assessment and quantification of neurological deficits

Emergency Department Management: Door

- The Head CT Scan serves as a critical fork in the road for stroke care.
- Emergency Department personnel must streamline acute stroke patients into the head CT scanner as soon as possible and all unnecessary delays must be avoided!
  - Multimodal CT imaging may influence decision making, when available (more later!)

NINDS Time Targets

- Door to doctor: 10 minutes
- Door to CT completion: 25 minutes
- Door to CT interpretation: 45 minutes
- Door to decision/treatment: 60 minutes

HOW?

NINDS Trial Design

- Two part double-blinded study with 624 acute stroke patients randomized to IV t-PA or placebo
- Favorable outcome defined as normal or near normal at 90 days using four outcome measures: NIHSS, Glasgow Outcome Scale, Modified Rankin Scale, Barthel Index
- Primary analysis based on global synthesis of the four measures of favorable outcome

NINDS Trial

- NINDS Trial analysis concluded that there was a statistically significant difference in favorable outcome for t-PA treated patients
- Much controversy followed in the wake of the NINDS Trial
- FDA approval for the use of IV t-PA for acute ischemic stroke followed closely behind the publication of the study
- Many criticisms followed as well
NINDS Validation

- In response to criticisms, the NINDS released its data set from the 1995 Trial for independent review.
- 2003: Independent Panel performs review addressing major criticisms and validates NINDS Trial analysis.
- Statistically significant clinical benefit confirmed (Odds Ratio For Favorable Outcome=2.1, 95% CI= 1.5-2.9)

*Stroke (2004;35:2418-2424)*

Methods

- Original individual patient data were pooled from 6 randomized controlled trials
- 2775 Patients
- Over 300 Hospitals
- 18 Countries
- Median age 68 years
- Median Baseline NIHSSS 11

Results

- Median onset-to-time treatment=243 minutes
- Of the 928 (33%) treated within 3 hours, one-third were from studies other than NINDS
- Symptomatic ICH rate=5.9%
- Adjusted Odds Ratios for Favorable Outcome:

<table>
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<tr>
<th>TIME</th>
<th>ODDS RATIO</th>
<th>95% CI</th>
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<td>0-90</td>
<td>2.8</td>
<td>1.8-4.5</td>
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<tr>
<td>271-360</td>
<td>1.2</td>
<td>0.9-1.5</td>
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Additional Safety Data: Graham GD. *Stroke* 2003

- 2003 Meta-analysis of 15 studies (n=2639)
- Median NIHSS=14
- Studies excluded:
  - n<15
  - Treatment window >3 hours
  - Unreported symptomatic ICH rates
  - Special population limitations
- Overall symptomatic ICH rate=5.2%
Emergency Department Management: Decision

- First, review the history and be certain that time of onset is concrete.
- If there is any doubt, thrombolytic therapy is contraindicated.
- The window for FDA Approved IV t-PA treatment is 3 hours from symptom onset.***

Thrombolytic Therapy for Acute Ischemic Stroke: Indications

- Acute Ischemic Stroke within 3 hours of symptom onset*** (More soon)
- Age greater than 18 years old

Thrombolytics for Ischemic Stroke: Contraindications

- Evidence of ICH
- Suspicion of SAH
- Recent stroke, intracranial surgery, or serious CHI within 3 months.
- Major surgery or severe trauma within 14 days
- History of ICH
- Intracranial neoplasm, AVM, or aneurysm
- Noncompressible arterial puncture or LP within 7 days
- Major symptoms improving or minor stroke symptoms (NIHSS<4???)
- Uncontrolled HTN at time of treatment***
- Seizure at stroke onset
- Active internal bleeding
- INR >1.7, PT>15 sec, Platelet Ct. <100,000
- Heparinization within 48 hours preceding stroke and elevated aPTT at presentation

Emergency Department Management: Decision

Secondly, the differential diagnosis of acute ischemic stroke should be reviewed.

- Hypoglycemia
- Hyperglycemia
- Complicated Migraine
- Todd’s Paralysis
- Intracranial Hemorrhage
- Hypertensive Encephalopathy
- Trauma
- Neoplasms/Mass lesion
- Encephalitis/Meningitis
- Hyponatremia
- Uremia
- Toxicological
- Psychiatric
- Bell’s Palsy
- Arterial Dissection

Once the working diagnosis of acute ischemic stroke is confirmed and inclusion/exclusion criteria have been reviewed, careful discussion with the patient and family takes place. Several important points are emphasized…
NINDS Trial Reported Benefit

- With IV-tPA treatment, there is a 30% greater chance of improved clinical outcome.

NINDS Trial Symptomatic ICH Rate
t-PA Treatment vs. Non-Treatment

<table>
<thead>
<tr>
<th>Symptomatic ICH Rate (%)</th>
<th>Treatment Group</th>
<th>Non-Treatment Group</th>
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<td>0.0%</td>
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**Graham et al: 5.2% Symptomatic ICH Rate**

NINDS Trial 30 Day Mortality	
t-PA Treatment vs. Non-Treatment

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**Graham et al: 5.2% Symptomatic ICH Rate**

Individual Patient’s Risk/Benefit Profile Reviewed

- Worse outcome regardless of treatment associated with:
  - Diabetes Mellitus
  - Advanced Age
  - Uncontrolled Hypertension
  - Higher NIHSS scores
  - CT findings of edema, hypodensity, or dense MCA
- Increased risk of hemorrhage associated with:
  - Significant findings on head CT scan
  - Treatment beyond 3 hour window
  - NIHSS>20
  - Post treatment elevations in blood pressure

Emergency Department Management: Drug

- The total dose of IV-tPA is 0.9mg/kg (90mg max)
- 10% of total dose is given IVP over 1-2 min
- 90% remaining dose is given as IV infusion over one hour
- Excess IV-tPA from vials is discarded to avoid accidental overdose.

Post-Treatment Considerations

- After IV-tPA is given, the patient is admitted to an ICU/Stroke Unit setting with skilled nursing available.
- If such a setting is unavailable, immediate transfer should be considered.
- Neurologic exams are performed every 30 minutes X six hrs. then every hr. X 16 hrs.
- Blood pressure is closely monitored and treated aggressively to maintain strict parameters.
Post Treatment Considerations

- The stroke team’s worst scenario: the post treatment headache...

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Post Treatment Considerations

- If post treatment hemorrhage is suspected
  - Immediate discontinuation of rt-PA
  - Emergent Head CT
  - Obtain blood for PT, PTT, Fibrinogen, T&C
  - Prepare platelets, cryoprecipitate
  - Consider Factor VIIa
  - Obtain appropriate surgical consultation.

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ED Management: Critical Actions

- Triage the patient with appropriate urgency
- Obtain fingerstick blood glucose
- Activate Stroke Team in timely fashion
- Emergently obtain CT imaging
- Set the stage for treatment decisions

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The Future

- As we speak, multiple new therapies are under investigation.
- One very promising new therapy currently in some use is intra-arterial thrombolytic treatment.
- Skilled interventional neuroradiologists use a tiny catheter to identify obstructing lesions and deliver thrombolytics at the site of the clot.
- This is practice is widely employed, but not yet FDA approved.

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The Future

- Ultrasound aided thrombolysis
- New mechanical techniques and new toys for the angiography suite are constantly being developed.

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Extending the Window???
Additional Considerations
- Age > 80 years
- History of prior stroke and diabetes
- Any anticoagulant use prior to presentation
- NIHSS > 25
- CT findings involving >1/3 MCA territory

At the Frontier: Multimodal Imaging
CT Angiography/CT Perfusion Studies

Clinical Implications???
- Opens opportunities for patients previously excluded under standard protocols.
- Potential to increase likelihood of appropriate treatment selection.
- Potential to increase patient safety by identifying patients more likely to hemorrhage.
- Ongoing studies will determine if the promise of these modalities will be fulfilled.

The Future
- Widespread educational efforts are needed at the public, prehospital, and hospital level.
- Well designed code stroke protocols and guidelines must be established at the prehospital, ED, and inpatient arenas.
- Well integrated stroke teams are needed with cooperation between the departments of Neurology, Radiology, Neurosurgery, Nursing, and Emergency Medicine.

Summary
- BE PREPARED!
- Triage the Patient with Urgency
- Rule out Hypoglycemia and get CT quickly
- Come to a decision with patient and family
- Administer thrombolytics early!
- Admit the patient to appropriate care unit
- Educate the public, your hospital, and your Emergency Department team!
- Consider “the future” today…