Ischemic Stroke Diagnosis and Medical Management

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Stroke Epidemiology

- Nearly 800,000 Americans suffer stroke annually
- Fourth leading cause of death in North America
- Leading cause of permanent disability in adults
- 20-30% fatality rate
- Annual cost in US > $70 billion
Overview of Acute Stroke Treatment

Stroke?

Ischemic

IV tPA Candidate?

Interventional Candidate?

Hemorrhagic

ICH Requiring Emergent Intervention?

Aneurysmal SAH candidate for early coiling/clipping?

Minutes - Hours

Hours - Days

ICH = intracerebral hemorrhage
SAH = subarachnoid hemorrhage
Outline

• Stroke subtypes and pathogenesis/mechanisms
• Acute stroke diagnosis
• Hyperacute management
  – tPA
  – Interventional therapy
• General inpatient management
• Secondary stroke prevention
Stroke/TIA Mimickers

- Seizure
- Migraine
- Hypoglycemia
- Bell’s Palsy
- Vestibulopathies
- Tumor
- Multiple sclerosis
- Encephalitis
- Intracranial (e.g., subdural or epidural) hematoma
- Intoxication or other encephalopathy
- Conversion disorder
Stroke Intervention Strategies

Improve perfusion  ↔  Neuroprotection
t-PA in Acute Ischemic Stroke

• **Major inclusion criteria**
  – Ischemic stroke within 4.5 hours of onset
  – Measurable neurological deficit
  – Age 18+
  – BP $\leq$ 185/110

• **Dose**
  – 0.9 mg/kg (max. 90 mg) as a 10% bolus over 1 min and the remainder over 60 min

Jauch et al. *Stroke* 2013;44
t-PA For Acute Stroke
Contraindications

- Suspected SAH
- Recent significant head trauma (3 mos) or stroke (3 mos)
- Recent intracranial or intraspinal surgery
- History of intracranial hemorrhage
- Heparin w/in 48 hrs and elevated PTT
- INR > 1.7
- PLT count <100,000
- Direct thrombin inhibitor or direct factor Xa inhibitor within 2 days
- Glucose < 50mg/dL
- Intracranial neoplasm, AVM or aneurysm
- Uncontrolled hypertension (>185/110)
- Multilobar hypodensity on CT (> 1/3 hemisphere)
- Active internal bleeding
- Arterial puncture at non-compressible site in previous 7 days
- Relative exclusion criteria
  - Only mild or rapidly improving symptoms
  - Seizure with postictal impairment
  - Pregnancy
  - Major surgery or serious trauma within previous 14 days
  - Recent GI or GU bleed (within 21 days)
  - Recent MI (within 3 mos)

Jauch et al. *Stroke* 2013;44
Selected, Updated tPA Guidelines
(Class IIb; LOE C)

• Treatment of patients with non-disabling symptoms w/in 3 hours may be considered
• Treatment of moderate to severe stroke in pregnancy may be considered
• Treatment of carefully selected patients who have undergone major surgery w/in 14 days may be considered
• Treatment of selected patients with recent trauma (<14 days) may be carefully considered
• Treatment of patients with aneurysms <10mm is reasonable
• Treatment of patients with severe stroke and unruptured AVM may be considered

Demaerschalk et al. Stroke 2016
Stroke Endovascular Therapy
Selected 2015 Endovascular Guidelines

• Criteria for endovascular therapy with a stent retriever (Class I; Level of Evidence A)
  – Prestroke mRS score 0 to 1
  – Receiving tPA within 4.5 hrs
  – Causative occlusion of ICA or proximal MCA (M1)
  – ≥18 yrs of age
  – NIHSS ≥ 6
  – ASPECTS ≥ 6
  – Treatment initiated within 6 hrs of symptom onset

• Effectiveness of treatment beyond 6 hrs is uncertain (Class IIb; Level of Evidence C)

Powers et al. Stroke 2015
Selected 2015 Endovascular Guidelines

- Endovascular therapy within 6 hrs in carefully selected patients with contraindications to tPA is reasonable; inadequate data to determine efficacy \((\text{Class IIb; Level of Evidence C})\)

- Treatment within 6 hours of patients with M2 or M3, ACA, VA, basilar, or PCA is reasonable although benefits uncertain \((\text{Class IIb; Level of Evidence C})\)
Endovascular Therapy

• Unresolved questions
  – Efficacy without tPA/beyond 6 hours?
  – Best imaging selection?
Endovascular Therapy

• Unresolved questions
  – Efficacy without tPA/beyond 6 hours?
  – Best imaging selection?
Acute Ischemic Stroke
General Supportive Care and Treatment

- Use of standardized ordersets recommended
- Volume
  - NS
- Glucose
  - Treat hypoglycemia of < 60 mg/dL
  - Treat hyperglycemia to 140-180 mg/dL range
- Temperature
  - Treat temp > 38°C
- Oxygenation
  - Keep $O_2$ sat >94%

Jauch et al. *Stroke* 2013;44
Acute Ischemic Stroke
General Supportive Care and Treatment

• Swallow eval prior to po intake
• DVT prophylaxis
  – SC anticoagulants
  – Intermittent compression devices +/- ASA in those who cannot receive anticoagulants
• Cardiac Monitoring for at least 24 hours
• Early mobilization
• Continue statin or evaluate for initiation
• Evaluate for rehabilitation
• Blood pressure

Jauch et al. Stroke 2013;44
Cerebral Autoregulation

Normal

Ischemia
Blood Pressure in Acute Stroke
Treatment Thresholds in 1\textsuperscript{st} 24 hrs

- **Ischemic**
  - No t-PA
    - 220/120
    - Lower SBP 15%
  - + t-PA
    - 180/105

- **ICH**
  - Presenting SBP 150-220
    - Target 140 SBP
  - Presenting SBP > 200
    - Aggressive reduction with continuous IV infusion

Jauch et al. *Stroke* 2013;44
Hemphill et al. *Stroke* 2015;46
Acute Ischemic Stroke
Antithrombotic Therapy

• Aspirin (initial dose 325mg) within 24 to 48 hours after stroke onset is recommended
• Anticoagulation (except sc for DVT prophylaxis) not recommended

Jauch et al. *Stroke* 2013;44
Stroke Mechanisms

- Large vessel atherothromboembolism
- Small vessel disease
- Cardioembolism
- Cryptogenic/Embolic Stroke of Undetermined Source (ESUS)
- Other (e.g., dissection, prothrombotic state, drugs of abuse etc)
CRYSTAL - AF

• 441 patients with cryptogenic stroke
• All received ≥24 hrs standard cardiac monitoring within 90 days of stroke
• Half tracked with implanted monitor (*Reveal XT*, Medtronic)
CRYSTAL –AF
Time to First Detection of AF

Detection of Atrial Fibrillation by 36 Months

Hazard ratio, 8.8 (95% CI, 3.5–22.2)
P < 0.001 by log-rank test

No. at Risk

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Secondary Stroke Prevention

• Address modifiable risk factors
  – Behavioral
    ○ Exercise 30 min at least 2-3 days/week
    ○ Smoking cessation
    ○ Weight management
    ○ Limit alcohol
  – Medical
    ○ BP control; ACE or ARB if DM
    ○ High-potency statin (atorvastatin, rosuvastatin)
    ○ DM control
    ○ Screen for OSA
    ○ Insulin resistance (pioglitazone)

• Antithrombotic therapy
  – Anticoagulation if high-risk cardioembolic source, otherwise antiplatelet

• Intervention
  – Endarterectomy (vs stenting) candidate?
    ○ 50-99%

• Cardiac monitoring
  – Consider for ESUS
Recap

• Stroke subtypes and pathogenesis/mechanisms
• Acute stroke diagnosis/stroke mimickers
• Hyperacute management
  – tPA
  – Interventional therapy
• General inpatient management
• Secondary stroke prevention