Acute Stroke for the Generalist
Early management fundamentals when resources are low

Preston Seaberg, M.D.
Learning Objectives

• Evaluate a person with suspected stroke
• List ideal management steps for acute stroke
• Create a stroke management plan based on available resources
• Identify strategies to reduce risk of recurrent stroke
Acute Stroke: Definition

Sudden focal or global neurologic deficit due to dysfunction in brain, retina or spinal cord caused by vascular disruption, resulting in infarction
What is a “Focal” Neurologic Deficit?

- “Focal” = one area of central nervous system
  - e.g. retina ➔ monocular blindness
  - e.g. dominant temporal lobe ➔ aphasia
- The challenge? One area of the central nervous system can do quite a lot
  - e.g. lateral medullary syndrome
    - Ipsilateral facial sensory loss
    - Contralateral torso sensory loss
    - Dysphagia, dysphonia, absent gag reflex
    - Vertigo, nystagmus, nausea
    - Ataxia, dysmetria, dysdiadochokinesia
What Does Stroke Look Like?

- Weakness
- Numbness
- “Clumsiness”
- Imbalance
- Vision loss
- Dysphagia
- Dysarthria
- Aphasia
- Hoarseness
- Headache
- Loss of hearing
- Inattention
- Change in behavior
- Amnesia
- Facial droop
- Headache
- Vertigo
- Nausea
- Decreased level of consciousness
Can Stroke Type be Predicted without Imaging?

• In short, no
• Certain things may be suggestive in the right context
• The more common the problem, the more predictive
  • Should be noted that the coming numbers weren’t necessarily derived from patients in your population
It’s 2016, and a patient is diagnosed with stroke. If the patient is in a coma...

<table>
<thead>
<tr>
<th>History/Exam Item</th>
<th>Pooled LR+</th>
<th>Pooled LR-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior transient ischemic attack</td>
<td>0.34</td>
<td>1.2</td>
</tr>
<tr>
<td>Seizures</td>
<td>4.7</td>
<td>0.93</td>
</tr>
<tr>
<td>Vomiting</td>
<td>3</td>
<td>0.73</td>
</tr>
<tr>
<td>Headache</td>
<td>2.9</td>
<td>0.66</td>
</tr>
<tr>
<td>Coma</td>
<td>6.2</td>
<td></td>
</tr>
<tr>
<td>Drowsy</td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Alert</td>
<td>0.35</td>
<td></td>
</tr>
<tr>
<td>Neck stiffness</td>
<td>5.0</td>
<td>0.83</td>
</tr>
</tbody>
</table>

LR+ of 6.2 → 31% chance of hemorrhagic stroke if in US, 53% chance of hemorrhagic stroke if in China

Key point: even in countries with high baseline risk of hemorrhagic stroke, history/exam cannot predict stroke type
Types of Acute Stroke, Globally

- Ischemic: 70%
- Intracerebral hemorrhage: 23%
- Subarachnoid hemorrhage: 7%
Acute Ischemic Stroke: Causes

- Large artery atherosclerosis
  - Infarct only in territory of diseased artery
- Cardioembolism
  - Known source > simultaneous infarcts in multiple vascular territories
- Small vessel occlusion (lacune)
- Stroke of other determined etiology
  - E.g. hypercoagulable state, dissection
- Stroke of undetermined etiology
Intracerebral Hemorrhage

Causes

• Hypertension
• Trauma
• Bleeding disorder
• Amyloid angiopathy
• Vascular malformations

Suggestive symptoms

• Headache, depressed level of consciousness
Subarachnoid Hemorrhage

Causes

- Rupture of arterial aneurysm
- Bleeding vascular malformation
- Trauma

Suggestive symptoms

- “Thunderclap” headache
- Depressed level of consciousness
Shared Risk Factors

- Hypertension
- Cigarette smoking
- High alcohol intake

Diabetes, hyperlipidemia linked to ischemic stroke but not to hemorrhagic stroke
Physical Exam in Suspected Stroke
Standardized Stroke Assessment

• National Institutes of Health Stroke Scale (NIHSS)
• 11 items (plus some sub-items)
  • Level of consciousness
  • Eye movements
  • Visual fields
  • Strength of face, arms and legs
  • Limb coordination (absence of ataxia)
  • Sensation to pinprick
  • Speech and articulation
NIHSS In Action

https://www.youtube.com/watch?v=wzjWAJgGjTw

See separate PDF for copy of NIHSS
Where does the NIHSS Fall Down?

• Posterior circulation
  • Possible symptoms: headache, nausea, vertigo
  • Signs: truncal ataxia

• Speech testing not necessarily standard in other languages

• If patient cannot read, articulation domain must be tested differently
Key Principles in Stroke Management

• First things first
  • Airway
  • Breathing
  • Circulation

• Then systematic assessment
  • History
  • Structured physical exam
  • Exclusion of mimics (e.g. hypoglycemia)

• Then optimal management
  • Cause-dependent and -independent
Ideal Acute Stroke Management

Patient taken by ambulance to nearby facility with
- CT scanner, MRI and experienced radiologist
- Neurologist and vascular neurosurgeon
- Cerebral reperfusion capability
- Dedicated stroke unit/team

In much of the world, not widely available
Acute Ischemic Stroke: Ideal Management

- Step 1: optimize airway, breathing, circulation
- Step 2: standardized assessment
- Step 3: noncontrast CT head, capillary glucose
- Step 4: systemic fibrinolytic agent, if candidate
- Step 5: endovascular therapy, if candidate
- Step 6: aspirin within 48 hr (+ 21 d clopidogrel if not cardioembolic)
  - Initially 160-300 mg (per rectum if needed), then less
- Step 7: confirmation, cause evaluation
- Step 8: cause-specific management in stroke unit
  - Plus swallowing evaluation, rehab, enteral nutrition, secondary prevention, BP targets
Acute Ischemic Stroke Causal Evaluation

- Large artery atherosclerosis
  - Glycated hemoglobin, total/HDL/LDL cholesterol, head/neck vascular imaging
- Cardioembolism
  - Cardiac rhythm monitoring, echocardiogram
- Stroke of other determined etiology
  - Suspect in persons < 55 years of age
  - Coagulation testing? Syphilis testing? Sickle cell anemia?
Intracerebral Hemorrhage: Ideal Management

- **Step 1**: Optimize airway, breathing, circulation
- **Step 2**: Noncontrast CT head, capillary glucose
- **Step 3**: Reverse coagulopathy, if applicable
- **Step 4**: Treat systolic BP > 150 mm Hg targeting 140 mm Hg; not with nitroprusside
- **Step 5**: Assess severity in standardized way
- **Step 6**: Surgical treatment for a few
- **Step 7**: Cause-specific manage in stroke unit
  - Plus rehabilitation, swallow evaluation, enteral nutrition, secondary prevention, BP targets
Overview: Subarachnoid Hemorrhage

- Step 1: optimize airway, breathing, circulation
- Step 2: noncontrast CT head, capillary glucose
  - CT unrevealing but SAH suspected → lumbar puncture
- Step 3: reverse coagulopathy, if applicable
- Step 4: treat systolic BP > 160 mm Hg, not w/ nitroprusside
- Step 5: angiography; severity assessment
- Step 6: surgical clipping or endovascular coiling if aneurysmal, with confirmatory imaging
- Step 7: nimodipine, if patient not hypotensive
- Step 8: cause-specific management in stroke unit
  - Plus rehabilitation, swallow evaluation, enteral nutrition, secondary prevention, BP targets
Basic Principles of Rehabilitation

• Examination of physical functioning
• Setting of goals for function
• Selection of interventions
• Intervention for specific impairments impeding ability to perform desired function
• Task-specific training
  • May initially require equipment to learn or relearn movement patterns
  • May initially require external feedback or cues from therapist

Now we get practical
Key Questions for Suspected Stroke

- Question 1: is this patient unstable now?
  - Airway?
  - Breathing?
  - Circulation?

- If “yes,” stabilize, then move to question 2
- If “no,” move to question 2

Disclaimer: not a guideline-based decision tree
Key Questions for Suspected Stroke

• Question 2a: fibrinolysis available in facility?
  • 2b. Ideal care available in facility?
    • 2c. Is another place better and reachable within 1-2 hours (or at least within window for reperfusion)?
      • 2d. Is medical transportation available?

  • 2a-2b “yes” → proceed with ideal care
  • 2a “yes,” 2b “no” 2b-2d “yes,” → consider fibrinolysis and transfer
  • 2a-2b “no,” 2c “yes,” 2d “no” → consider transfer if risks/benefits favorable
  • If 2a-2d “no” → provide “best available” care

Disclaimer: not a guideline-based decision tree
Key Questions for Suspected Stroke

- Question 3: is noncontrast CT head feasible?

  - If “yes,” obtain images to guide treatment per prior slides
  - If “no,” minimize risk of harm by focusing on points of guideline/evidence overlap

Disclaimer: not a guideline-based decision tree
Points of Friction When Stroke Type Unknown

- Blood pressure target different for each of
  - Ischemic stroke, pending fibrinolytic
  - Ischemic stroke, not given fibrinolytic
  - Ischemic stroke, given fibrinolytic
  - Intracerebral hemorrhage
  - Subarachnoid hemorrhage

- Antiplatelet therapy different for each of
  - Ischemic stroke due to cardioembolism
  - Ischemic stroke not due to cardioembolism
  - Hemorrhagic stroke

- Anticoagulant considerations different for each of
  - Ischemic stroke from atrial fibrillation
  - Ischemic stroke from atheroembolism
  - Hemorrhagic stroke
Overlapping Strategies with Evidence

- Use standardized risk-stratification instruments
- Reduce risk of venous thromboembolism
  - Intermittent pneumatic compression or pharmacologic prophylaxis preferred
- Evaluate swallow before feeding
- Physical rehabilitation early
- Treat some hypertension now and all of it later
  - If BP > 220/120 mm Hg, reduce by 15% in first 24 h
  - 72 hours after onset, target long-term BP < 130/80
- Advise cessation of smoking, use of stimulants
- Later, advise alcohol only in safe amounts
- Low-dose aspirin (≤ 160 mg daily) if strong indication and reasonably sure no worsening bleeding in brain
Strong Indications for Aspirin

- Presence of vascular stents*
- Existing atherosclerotic vascular disease
- High risk of ischemic stroke or ischemic heart disease, with multiple of
  - Hypertension
  - Diabetes
  - Cigarette smoking
  - Chronic kidney disease
  - Obesity
  - Siblings or parents with premature ischemia
    - Men < 55 years†
    - Women < 65 years†
Less Robust Stroke Recommendations

• Check baseline troponin
• Supplemental oxygen only for SpO2 < 94%
• Correct hypotension and hypovolemia
• Treat fever and its cause(s)
• Treat hypo- and hyperglycemia
• Regular skin checks for hospitalized patients
• Check for post-stroke depression
  • If known hemorrhagic stroke, caution with selective serotonin reuptake inhibitors
Treating Stroke When Type is Unknown

- Use standardized risk-stratification instruments
- Reduce risk of venous thromboembolism
  - Intermittent pneumatic compression or pharmacologic prophylaxis preferred
- Evaluate swallow before feeding
- Physical rehabilitation early
- Treat some hypertension now and all of it later
  - If BP > 220/120 mm Hg, reduce by 15% in first 24 h
  - 72 hours after onset, target long-term BP < 130/80
- Advise cessation of smoking, use of stimulants
- Advise alcohol only in safe amounts
- Low-dose aspirin (≤ 160 mg daily) if strong indication and reasonably sure no worsening bleeding in brain
  - Example: no clinical worsening for two weeks
Strong Indications for Long-Term Aspirin, Even if Prior Hemorrhagic Stroke

- Presence of vascular stents*
- Existing atherosclerotic vascular disease
- High risk of ischemic stroke or ischemic heart disease, with multiple of
  - Hypertension
  - Diabetes
  - Cigarette smoking
  - Chronic kidney disease
  - Obesity
  - Siblings or parents with premature ischemia
    - Men < 55 years†
    - Women < 65 years†
References (part 1)

- “SAB bei Aneurysma.png” by Hellerhoff on wikipedia.org is licensed under CC BY 3.0.
- “Intracerebral_hemorrhage.jpg” by Yadav YR et al on wikipedia.org is licensed under CC BY 2.0.
- “The Holy Grail of Valencia” by Jmjriz on wikipedia.org is licensed under CC BY 4.0.
References (part 2)

- J. Claude Hemphill. Stroke. The ICH Score, Volume: 32, Issue: 4, Pages: 891-897, DOI: (10.1161/01.STR.32.4.891)


