Management of Acute Stroke

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Learning Objectives

- Define stroke
- Discuss major stroke syndromes
- Learn to differentiate ischemic stroke subtypes
- Discuss management of different stroke subtypes
  - Acute treatment
  - Cardioembolic stroke
  - Carotid stenosis

Case #1:

65 y/o man with history of atrial fibrillation admitted to the ICU with pneumonia.
- 10:00 pm - following all commands and moving all four extremities symmetrically. No events overnight.
- 6:30 am - Opening eyes to voice and agitated, but not following commands. There is spontaneous movement of his LUE/LLE, but none on his right side.
- Warfarin has been continued, INR is 1.6.
- Blood pressure is 190/95
Which of the following should be the first step in the management or evaluation of this patient?

A. Consult to interventional radiology for intra-arterial thrombolysis
B. Aggressive blood pressure control
C. IV tPA
D. Aspirin 325mg PO
E. Noncontrast Head CT

Is this an ischemic stroke or could this be something else?

Hemorrhage
Mass lesion
Seizure
Metabolic abnormality (hypoglycemia, hyperglycemia)
Migraine

Decide on acute management

IV tPA?
IA tPA/thrombectomy?

I suspect stroke:
What do I need to do immediately?

- Is this an ischemic stroke or could this be something else?
  - Hemorrhage
  - Mass lesion
  - Seizure
  - Metabolic abnormality (hypoglycemia, hyperglycemia)
  - Migraine

- Decide on acute management
  - IV tPA?
  - IA tPA/thrombectomy?

Diagnosis

- Recognize the symptoms!
- Clinical History – most important piece of information!
  - What are the symptoms?
  - How did they start?
  - Last known normal?
  - Last known normal?
  - Course since symptoms started?
  - History of similar symptoms?
  - Review of systems?
Neurologic Exam

- Brief focused neurologic exam – are there FOCAL findings?
- NIH Stroke Scale
  - Reliable and validated score to evaluate stroke severity and outcomes
  - Good inter-rater reliability
  - Correlates well with infarct size (higher the score, bigger the stroke)
  - May miss posterior circulation strokes – if you suspect, LOOK for it!

What is a Stroke??

- Loss of brain function due to a disturbance in the blood supply to the brain

- **Intracerebral Hemorrhage** 10%
- **Subarachnoid Hemorrhage** 5%
- **Ischemic Stroke** 85%

How to Clinically Differentiate Hemorrhage from Infarct

- Not possible without imaging!
- Some features more common with hemorrhage
  - Seizure at onset
  - Decreased level of consciousness
  - Headache

*Stroke 2013; 44(3): 870-947*
*Stroke 2010; 41:2108-2129.*
Ischemic Stroke versus ICH

Which of the following should be the first step in the management or evaluation of this patient?
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D. Aspirin 325mg PO
E. Noncontrast Head CT

Case Reminder:
65 y/o man with history of atrial fibrillation admitted to the ICU with pneumonia.
- 10:00 pm - following all commands and moving all four extremities symmetrically. No events overnight.
- 6:30 am - Opening eyes to voice, but not following commands. There is spontaneous movement of his LUE/LLE, but minimal movement on his right side. He is more agitated than the evening prior.
- Warfarin has been continued, INR is 1.6.
- Blood pressure is 190/95
Neurologic Exam:
- Patient has a gaze deviation to the L
- No blink to threat on R, blinks to threat on L
- R lower facial droop
- R leg withdraws minimally to pinch, no other movement seen
- R leg is antigravity, does withdraw with pinch
- Normal strength and sensation L side
- He is unable to tell you his name, but makes a sound when trying to talk. He is able to nod/shake his head appropriately to some questions. Unable to name any objects. Follows a few simple commands.

Common Large Vessel Stroke Patterns

Anterior Circulation
- ACA Occlusion:
  - Contralateral hemiparesis: Leg weakness > Arm
  - Contralateral sensory loss: Leg/arm
  - Confusion, personality changes

- MCA occlusion:
  - Contralateral hemiparesis: Arm and face weakness > Leg
  - Contralateral sensory loss: Arm/faces > Leg
  - Aphasia (usually left brain)
  - Spatial neglect (usually right brain)
  - Homonymous hemianopia on opposite side of the infarct
  - Gaze deviation towards side of stroke

Posterior Circulation
- PCA occlusion:
  - Homonymous hemianopia on opposite side of the infarct
  - Contralateral sensory loss
  - Possible aphasia
  - Disconjugate gaze (uncommon)

- Vertebro-basilar occlusion:
  - Ataxia, vertigo, diplopia, dysarthria, hiccups, nausea, vomiting
  - Disconjugate gaze
  - Crossed signs
  - Decreased LOC

Classic Lacunar Syndromes
- Small penetrating branches of arteries occlude
- Common locations of infarcts:
  - Basal ganglia, Thalamus, Cerebellum, Pons
- Common syndromes:
  - Pure motor hemiparesis
  - Pure sensory stroke
  - Sensorimotor
  - Clumsy hand dysarthria
  - Ataxia hemiparesis
Our Case.

- Noncontrast head CT: subtle hypodensity in the left MCA territory,
  hyperdense L MCA

How would you summarize the deficits?
- L gaze preference, R homonymous hemianopsia, R hemiparesis (F/A>L), aphasia
  (expressive>receptive)

Where would you localize this stroke?
A. Right MCA territory
B. Left ACA territory
C. Left MCA territory
D. Left PCA territory
E. Basilar artery territory
Case #1 reminder:
65 y/o man with history of atrial fibrillation admitted to the ICU with pneumonia.
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- Warfarin has been continued, INR is 1.6.
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Which of the following are contraindications for IV tPA in this patient?
A. Sedative medications received overnight
B. History of atrial fibrillation
C. INR of 1.6
D. Time elapsed since last known normal
E. Radial arterial line

IV tPA for Ischemic Stroke
- Only FDA approved treatment for treatment of arterial ischemic stroke
  - Up to 3 hours from last known normal
- Not approved, but standard practice to use up to 4.5 hours
  - Considerations: Age>80, NIHSS >25, Combination of DM and prior stroke
- As time progresses, chance of benefit decreases, and risk of hemorrhage increases
IV tPA – Risks and Benefits

- 0-3 hour window
  - 12% absolute increase (32% relative) in number of patients with minimal or no disability at 3 months (NNT=8.3)
  - Symptomatic ICH in 6% of tPA treated group

- 3-4.5 hour window
  - 7.2% absolute improvement (14% relative) in number of patients with minimal or no disability at 3 months (NNT=13.9)
  - 7.9% risk of symptomatic ICH (3.5% in placebo group)

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tPA for Cerebral Ischemia within 3 hours of onset – changes in outcome due to treatment

Final Outcome:
- Normal or Nearly Normal
- Better
- No Major Change
- Worse
- Severely Disabled or Dead

Early Course:
- No early worsening
  - Early worsening w/hemorrhage

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Stroke 2010: 41; 300-306

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Figure 2: Effect of timing of intravenous treatment on good stroke outcome (reRt, r-rtPA)

Outcomes in Mild Stroke or Rapidly Improving Stroke

Table 1. Outcomes at Hospital Discharge for Ischemic Stroke With Mild and Rapidly Improving Stroke Who Arrive Within 4.5 Hours of Symptom Onset

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Total (n=6288)</th>
<th>MS (n=1246)</th>
<th>RE (n=1073)</th>
<th>MMR (n=1316)</th>
<th>PMR (n=1759)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death during admission %</td>
<td>0.8</td>
<td>0.7</td>
<td>1.1</td>
<td>0.4</td>
<td>-0.0001</td>
<td></td>
</tr>
<tr>
<td>Discharge directly home %</td>
<td>70</td>
<td>73.4</td>
<td>78.1</td>
<td>77.3</td>
<td>-0.0001</td>
<td></td>
</tr>
<tr>
<td>Able to ambulate independently, %*</td>
<td>72.8</td>
<td>75.5</td>
<td>68.4</td>
<td>77.1</td>
<td>-0.0001</td>
<td></td>
</tr>
<tr>
<td>LDL (≤ 3.4 mm Hg)</td>
<td>41.1</td>
<td>80.0</td>
<td>62.8</td>
<td>57.0</td>
<td>-0.0001</td>
<td></td>
</tr>
</tbody>
</table>

*Not selected in those with documented ability to ambulate independently at baseline.

- Patients presenting in the tPA window, but not given tPA

Romano et al. Stroke. 2016;47

Contraindications for IV tPA

<table>
<thead>
<tr>
<th>Absolute</th>
<th>Relative</th>
</tr>
</thead>
<tbody>
<tr>
<td>Head CT with hemorrhage</td>
<td>History of intracranial hemorrhage</td>
</tr>
<tr>
<td>Symptoms suggestive of SAH</td>
<td>ST elevation MI (3 months)</td>
</tr>
<tr>
<td>Major head trauma (1 mos)</td>
<td>Major surgery (4q days) – Now intracranial/intraspinal surgery 3 mos</td>
</tr>
<tr>
<td>Active bleeding, acute bx</td>
<td>GI or urinary tract hemorrhage (24 days)</td>
</tr>
<tr>
<td>Arterial puncture, non-compressible site (7 days)</td>
<td>Subarachnoid hemorrhage</td>
</tr>
<tr>
<td>Blood glucose &lt;50, sx improving with correction</td>
<td>Minor or rapidly improving neurological deficits – now removed</td>
</tr>
<tr>
<td>Bleeding diathesis/UCMs – now no specific INR, PT/INR, platelet count</td>
<td></td>
</tr>
<tr>
<td>Sustained BP &gt;85/60 – now &quot;severe uncontrolled hypertension&quot;</td>
<td></td>
</tr>
</tbody>
</table>


Interventional Treatment for Large Vessel Acute Ischemic Stroke

- Recent evidence now supports that thrombectomy in the setting of anterior circulation large vessel occlusion improves patient outcomes (OR=2 for “good” functional outcome)
- In COMBINATION with IV tPA
- Time is brain – all trials opened vessels within 4-5 hours of onset of symptoms

Interventional Trials

<table>
<thead>
<tr>
<th>Study</th>
<th>N</th>
<th>Diagnosis</th>
<th>Median NIHSS</th>
<th>Intervention</th>
<th>Median NIHSS</th>
<th>Time to groin puncture</th>
<th>Mortality at 90 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mr. CLEAN</td>
<td>500</td>
<td>6.9</td>
<td>12</td>
<td>10</td>
<td>80%</td>
<td>200s (95-300)</td>
<td>30%</td>
</tr>
<tr>
<td>ESCAPE</td>
<td>454</td>
<td>12h (pts in-cl)</td>
<td>16</td>
<td>17</td>
<td>76%</td>
<td>200s (95-200)</td>
<td>30%</td>
</tr>
<tr>
<td>EXTEND-IA</td>
<td>70</td>
<td>8h</td>
<td>947 ischemic</td>
<td>25</td>
<td>100%</td>
<td>200s (95-200)</td>
<td>5%</td>
</tr>
<tr>
<td>ISAR-PRO</td>
<td>156</td>
<td>8h</td>
<td>96</td>
<td>17</td>
<td>100%</td>
<td>220s (95-420)</td>
<td>9%</td>
</tr>
<tr>
<td>SWIFT-PRIME</td>
<td>196</td>
<td>8h</td>
<td>96</td>
<td>17</td>
<td>70%</td>
<td>220s (95-284)</td>
<td>60%</td>
</tr>
</tbody>
</table>

Most patients received IV tPA PLUS embolectomy
Time to revascularization was FAST

Interventional Treatment - The Impact
Which of the following are contraindications for IV tPA in this patient?

A. Sedative medications received overnight
B. History of atrial fibrillation
C. INR of 1.6
D. Time elapsed since last known normal
E. Radial arterial line

Case #2:
56 y/o woman, unknown medical history is brought to ED after being found confused at a store.
- VS: T 39.2, BP 98/60, P 115
- CBC shows a leukocytosis (WBC 15)
- On neuro exam: Confused, oriented to name only, and follows commands only intermittently. She moves all four extremities spontaneously.

An infectious workup is done and blood and urine cultures are pending.
What is the most important next step in evaluation and management of this patient’s strokes?

A. Immediate treatment with heparin drip for presumed cardio-embolic source
B. No specific management is needed, continue treating the medical illness
C. Transthoracic or transesophageal echocardiogram
D. IV tPA
E. Neurosurgery consult

Cardioembolic Stroke

- Key findings on CT/MRI to suggest a cardiac source:
  - Multiple infarcts
  - Multiple vascular territories
  - Large vessel occlusions (such as in case #1)
- Different cardiac sources:
  - Atrial fibrillation ~ 50%
  - LV mural thrombus
  - Valvular heart disease
  - Less common: atrial myxoma, endocarditis

Bacterial Endocarditis and Stroke

- Most neurologic complications prior to antibiotics
- Risk of hemorrhage is high
- Mycotic aneurysms ~5%
  - high risk for hemorrhage
- AVOID anticoagulation if possible
- Management:
  - Antibiotics
  - Consider valve replacement
  - Risk of hemorrhage high in first 2 weeks

European Heart Journal 2009; 30(19): 2369-413
Other Cardioembolic Sources

- Atrial fibrillation and infarct
  - *No evidence for heparin bridge in the acute setting*
  - In most cases, start warfarin and let INR drift up
  - Consider acute anticoagulation if continuing to accumulate new infarcts
- LV mural thrombus after acute MI
  - Need longer term anticoagulation
  - Less clear if acute anticoagulation indicated
  - Consider acute anticoagulation if continuing to accumulate new infarcts

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What is the most important next step in evaluation and management of this patient’s strokes?

A. Immediate treatment with heparin drip for presumed cardioembolic source
B. No specific management is needed, continue treating the medical illness
C. **Transthoracic or transesophageal echocardiogram**
D. IV tPA
E. Neurosurgery consult

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Case #3:
A patient with DM, HTN, h/o CAD admitted with hypertensive urgency. Admission BP was 190s/110s, and has now improved to the 160s/90s.
- On morning rounds, reports a 10 min episode of RUE numbness/weakness the night prior.
- In retrospect, had a similar episode 2 days prior lasting <5 min.
- While waiting for neuro consult - Has a third episode that morning with R facial droop and RUE weakness lasting 20-25 minutes.
- Now back to normal with a normal neuro exam.
  - Neuro team recommends CTA head and neck
What would be included in your early management of this patient?
A. Intensive blood pressure lowering with goal blood pressure <130/80
B. Vascular surgery consult
C. Consult to interventional radiology for intra-arterial thrombolysis
D. IV tPA
E. Cardiology consult

Transient Ischemic Attack
• Episode of temporary, focal, cerebral dysfunction due to vascular disease
  • Classic definition <24 hours
  • Reality, most <10 minutes
• High risk of stroke following TIA
  • 7 days: ~ 8%
  • 30 days: ~ 10%
  • 90 days: 10-20% (average 11%)
• Risk within 90 days after stroke: 2-7% (avg 4%)
TIA and Carotid Stenosis

- Recurrent TIAs in the setting of severe carotid stenosis among the highest risk for stroke
- Stuttering, crescendo TIAs are a critical warning sign

Management of Symptomatic Carotid Stenosis

- Proven benefit of CEA and carotid stenting in symptomatic severe carotid stenosis
  - NASCET, ECST, CREST
- Pooled data from ECST and NASCET trials:
  - Greatest benefit: men, >75 years old, early randomization
  - NNT = 5 for those randomized within 2 weeks
- TIA or minor stroke:
  - Low risk from early surgery
  - Early treatment more beneficial
    - RRR 30% in first two weeks, 18% 2-4 weeks, 11% >4 weeks

What would be included in your early management of this patient?

A. Intensive blood pressure lowering with goal blood pressure <130/80
B. Vascular surgery consult
C. Consult to interventional radiology for intra-arterial thrombolysis
D. IV tPA
E. Cardiology consult
Summary – Acute Ischemic Stroke Management

- First priority – diagnosis and distinguish from mimics
- Is this patient a candidate for acute therapy (IV tPA or intervention?)
- Where would I localize this stroke and what is the likely etiology?
- Secondary stroke prevention –
  - The “usual” – antiplatelet, statin, BP management, etc
  - Other situations – endocarditis, atrial fibrillation, carotid stenosis

Questions??