Strokes: Classification, Intervention, Prevention

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What is a stroke?

• **Ischemic**
  – Obstruction within an intracranial blood vessel
  – Transient Ischemic Attack (TIA)
    • Temporary obstruction within an intracranial blood vessel

• **Hemorrhagic**
  – Ruptured intracranial blood vessel
    • Intracranial hemorrhage
    • Subarachnoid Hemorrhage
    • Subdural Hematoma
ISCHEMIC STROKE
Types of Ischemic Strokes

• Embolic
  – Blood clot forms from somewhere else in the body and blocks an intracranial vessel
    • Usually from the heart

• Thrombotic
  – Blood clot that forms on a blood vessel
    • Large vessel occlusion from atherosclerosis
    • Small vessel occlusion aka lacunar infarction

• Systemic Hypoperfusion
Symptoms

• Anterior Circulation
  – Aphasia
  – Amaurosis fugax (transient monocular blindness)
  – Homonymous hemianopia
  – Hemiparesis
  – Hemisensory deficit

• Posterior Circulation
  – Diplopia, nystagmus (vertical), bilateral vision loss
  – Ataxia
  – Vertigo
  – Loss of Consciousness
  – Dysarthria
  – Vomiting
• Broca’s – Expressive aphasia or broken speech
  – Inferior frontal gyrus
  – [http://www.youtube.com/watch?v=f2iIMEBmMnPM](http://www.youtube.com/watch?v=f2iIMEBmMnPM)

• Wernicke’s – Receptive aphasia or word salad
  – Superior temporal gyrus
  – [http://www.youtube.com/watch?v=dKTdMV6cO2w](http://www.youtube.com/watch?v=dKTdMV6cO2w)
Ischemic Strokes

**MCA (Branches of Frontal, Parietal, Temporal):** Contralateral weakness, sensory loss, neglect, acalcula, agraphia, aphasia

**ACA (Frontal & Parietal):** contralateral weakness, numbness, abulia, mood disturbance, aphasia

**PCA (Occipital):** homonymous hemianopia

**AICA (Junction of medulla and pons):** vertigo, ipsilateral deafness, ipsilateral facial weakness

**PICA (Cerebellum):** vertigo, headache, gait ataxia, dysmetria

**Basilar artery (Pons):** diplopia, dysarthria, contralateral weakness, vertigo, locked in syndrome
Epidemiology

- Fourth leading cause of death in the US
- Number one cause of adult disability in the US
- 80% preventable
- Approximately 795,000 strokes each year
  - One stroke every 40 seconds
  - A life is taken every four minutes
- 87% Strokes are ischemic
- 13% are hemorrhagic
  - >30% of all stroke deaths
- Estimated direct and indirect cost of stroke in 2010 is $73.7 billion
Non Modifiable Risk Factors

- Risk doubles each decade after >55 years old
- Gender: male > female
- Race/Ethnicity: African-American and Hispanic
- Family history of stroke
- Genetic Causes: Marfan Syndrome, CADASIL, Fabry Disease, Sickle Cell Disease
Sickle Cell Disease

• Homozygous SCD
• Children with SCD should be screened with transcranial doppler starting at the age of 2
• Transfusion therapy is effective for reducing stroke risk in children
Modifiable Risk Factors

• Hypertension
  – Medically treat Hypertension
    • < 140/90 in general population
    • <130/80 in diabetes or renal disease
  – Risk reduction of -50% if lower SBP by 20mmHg
  – Risk reduction of -30% if lower DBP by 5mmHg
Modifiable Risk Factors

• Cigarette use
  – Smoking 1 cigarette can increase HR & mean BP
  – Active and passive smoke is associated with the development of atherosclerosis
  – Multimodal techniques should be offered: counseling, nicotine replacement, oral smoking cessation mediations
  – The status of tobacco use should be addressed at every patient encounter
Modifiable Risk Factors

• Diabetes
  – Identifying those with poor glycemic control
  – Goal hemoglobin A1C <7.0
  – Ensure diabetics have optimal control of their blood pressure
    • ACEI or ARB is useful with those having HTN & DM
Modifiable Risk Factors

• Hyperlipidemia
  – Screen every five years in adults
    • Should be more often if coronary heart disease risk factors are present
      – HTN, DM, cigarette smoking, family history
  – Statin Therapy
  – Goals
    • LDL < 100 ( <70 if DM or CAD)
    • HDL >50
    • TG < 150
Modifiable Risk Factors

• Alcohol Use
  – American Heart Association
    • Increased stroke risk if
      – >1 unit/day females and >2 units/day for males
      – Excessive alcohol use can increase risk up to +69%

What is a unit of alcohol?
  4 oz wine
  12 oz beer
  2 oz liquor
Modifiable Stroke Risk Factors

• Body Mass Index
  – Goal BMI <25

• Exercise
  – 2 hours 30 minutes per week of moderate intensity
    • Walking briskly 3.5 mph
    • Recreational Swimming
    • Cycling 5-9mph level terrain
  – 1 hour 15 minutes per week of vigorous intensity
    • Jogging 5 mph
    • Swimming laps
    • Cycling >10mph level terrain or steep hills
Modifiable Risk Factors

• Atrial Fibrillation
  – Consider using CHADS\textsubscript{2} Score to determine need for anticoagulation versus antiplatelet therapy
  – Active screening for patients >65 years with pulse taking and ECG can be useful
  – Atrial Fibrillation occurs in 10-15\% of those with hyperthyroidism

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Points</th>
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<tbody>
<tr>
<td>Congestive Heart Failure</td>
<td>1</td>
</tr>
<tr>
<td>HTN</td>
<td>1</td>
</tr>
<tr>
<td>Age &gt;75</td>
<td>1</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1</td>
</tr>
<tr>
<td>Stroke/TIA</td>
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## CHADS$_2$ Score

<table>
<thead>
<tr>
<th>Score</th>
<th>Risk</th>
<th>Anticoagulation Therapy</th>
<th>Considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Low</td>
<td>None or <strong>Aspirin</strong></td>
<td>Aspirin daily</td>
</tr>
<tr>
<td>1</td>
<td>Moderate</td>
<td>Aspirin or Warfarin</td>
<td>Aspirin daily or raise <strong>INR</strong> to 2.0-3.0, depending on patient preference</td>
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<tr>
<td>2 or greater</td>
<td>Moderate or High</td>
<td><strong>Warfarin</strong></td>
<td>Raise <strong>INR</strong> to 2.0-3.0, unless contraindicated</td>
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</table>

<table>
<thead>
<tr>
<th>CHADS$_2$ Score</th>
<th>Annual Stroke Risk %</th>
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<tbody>
<tr>
<td>0</td>
<td>1.9</td>
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<tr>
<td>1</td>
<td>2.8</td>
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<tr>
<td>2</td>
<td>4.0</td>
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<tr>
<td>3</td>
<td>5.9</td>
</tr>
<tr>
<td>4</td>
<td>8.5</td>
</tr>
<tr>
<td>5</td>
<td>12.5</td>
</tr>
<tr>
<td>6</td>
<td>18.2</td>
</tr>
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</table>
Obstructive Sleep Apnea

- 1.7 – 3.3 increases risk of stroke

For picture:
http://media.npr.org/assets/img/2011/08/15/cpap-0a9965490dde66be8571021a5db11323791bde76-s6-c30.jpg
Carotid Stenosis

• Consider treating with endarterectomy or stenting assuming adequate life expectancy
• Symptomatic Stenosis
  – >50% by catheter angiography
  – >70% by carotid doppler
  – Within two weeks from symptoms
• Asymptomatic Stenosis >70%
• Total Occlusions are not a candidate for surgery
Carotid Endarterectomy

For picture click: http://www.surgery.hku.hk/vdc_cea.php
Carotid Artery Stent

For picture click : http://www.cardiochoices.com/cardiovascular-procedures/carotid-stent-implant
Hormone Therapy

• Increased risk of stroke
• Postmenopausal hormone therapy should not be used for stroke prevention
• Contraceptives may be harmful with additional stroke risk factors
Hypercoagulable Disease

• Consider only in cryptogenic cases / stroke in young
• Primary prothrombotic states
  – Antithrombin III Deficiency
  – Protein C / Protein S Deficiency
  – Antiphospholipid Antibodies
  – Lupus anticoagulant
  – Anticardiolipin Antibodies
  – Factor V Leiden Deficiency
  – Prothrombin 20210A Mutation
  – Hyperhomocysteinemia
Other Risk Factors

- Primary Cardiac Tumors
- Vegetations
- Prosthetic Cardiac Valves
- Cardiomyopathy
- Coronary Artery Disease
- Mitral & Aortic Valvular Heart Disease
- Endocarditis
- Procedures: Pacemaker, Cardiac Bypass, Cardiac Catheterization
- Acute Myocardial Infarction
- Aortic Arch Embolism
- Patent Foramen Ovale
- Large artery atherosclerosis
- Small Artery Occlusion (lacunar)
- Vasculitis
- Left Atrial Thrombus
- Arterial dissection
Acute Treatment – Ischemic Stroke

• IV Tissue Plasminogen Activator (tPA)
• Indications:
  – Last known normal <3 hours**
  – No blood on CT Head
  – Disabling deficit

Contraindications:

• Clinically improving
• Recent surgery or trauma (<3mo)
• Internal bleed (<22d)
• INR >1.7

• PLT <100k
• Very large infarctions
• Prior ICH, AVM, brain tumor
• Elevated blood pressure >185/110
Extended IV tPA window

Additional exclusion criteria for the 3-4.5 hour window

- Age > 80
- H/O prior stroke & diabetes
- Any anticoagulant use prior to admit (even if INR<1.7)
- NIHSS >25
Other Acute Ischemic Stroke Interventions

<table>
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<tr>
<th>Procedure</th>
<th>Time Window</th>
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<tbody>
<tr>
<td>Intra Arterial tPA</td>
<td>Up to 6 hours</td>
</tr>
<tr>
<td>Mechanical Thrombectomy</td>
<td>Up to 8 hours</td>
</tr>
<tr>
<td>Hemicraniectomy</td>
<td>Select population of large MCA strokes</td>
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</table>
Workup

- Immediate CT Head without contrast
  - *Negative CT does not rule out acute ischemia!!*
- MRI Brain +/- contrast
- Echocardiogram (TEE in select cases)
- Cardiac Telemetry
- Imaging of intra/extracranial vessels
  - Doppler vs CTA vs MRA
- Labs
  - CBC, BMP, PT, PTT, Lipids, A1C, +/- hypercoagulable labs
- Swallow Study/PT/OT
- Penumbra protection: permissive hypertension, euglycemia, euthermia
Ischemic Stroke Treatment Continued

• Antiplatelet Regimen
  – Aspirin 81 – 325mg daily
  – Plavix (clopidogrel) 75mg daily
  – Aggrenox (aspirin 25mg and dipyridamole 200mg) BID

• Anticoagulation in select cases
  – Coumadin (warfarin)
  – Newer drugs:
    • Direct thrombin inhibitor
      – Pradaxa (dabigatran)
    • Factor Xa Inhibitors
      – Xarelto (rivaroxaban)
      – Eliquis (apixaban)
INTRACRANIAL HEMORRHAGE
Intracranial Hemorrhage

• Risk Factors
  – Age
  – Hypertension
  – Pregnancy
  – Race: Black > Hispanic > Caucasian
  – Drug use: Amphetamines and cocaine
  – Coumadin (warfarin) Usage
  – Intracranial Tumors
ICH Symptoms

- Failing memory that rapidly increases in severity
- Headache
- Nausea/Vomiting
- Loss of consciousness
- Refer back to prior slide on ischemic stroke symptoms
Evaluation of ICH

• CT Head without contrast
• Treat hypertension
  – SBP goal 140-160
• Correct coagulopathy
• Glucose <140
• Normothermia
• Surgery only if patient is deteriorating
Correcting Coagulopathy

- **Warfarin Bleeds**
  - 2 units FFP and 10 mg IV Vitamin K
    - Repeat PT/INR at 4 hours
      - If INR > 1.3, give another round of FFP / Vitamin K

- **Heparin or Low Molecular Weight Heparin (Lovenox)**
  - Protamine Sulfate
    - Dose depends on amount of heparin
    - Check PTT

- **Newer Anticoagulants – no definitive treatment**
  - Prothrombin Complex Concentrate (PCC)
  - Recombinant Factor VIIa
John is a 67 year old who woke up at 8AM with left face, arm, and leg weakness. He waited to see if his symptoms would go away. When it did not, he dialed 911. He presents to your ER at 10AM. CT Head is normal. His blood pressure is 210/120.

What is your next step?

a. Administer IV Tissue Plasminogen Activator immediately

b. Acutely lower his blood pressure to <185/110 then immediately administer IV Tissue Plasminogen Activator

c. Call the interventionalist because he is outside the window and may qualify for thrombectomy

d. Give him aspirin and admit for further workup
PANCE/PANRE PEARL

Remember the clock for IV Tissue Plasminogen Activator (tPA) starts at the patient’s last known well. This means if the patient woke up with symptoms, you must ask when they were last known to be normal. If outside any acute treatment interventions, you should admit them for further work up and administer anti-platelet therapy.