Carotid Artery Disease and What’s Pertinent

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Goal of treatment of carotid disease

- Identify those at risk of developing symptoms
- Prevent patients at risk from developing symptoms
- Prevent people who have already been symptomatic from developing further and worsening symptoms
Carotid Disease

- Most common disease process: atherosclerosis
  - Other rare disease entities: Fibromuscular dysplasia, carotid artery aneurysms, dissections and carotid body tumors
- Increased risk:
  - Cigarette smoking, high cholesterol, diabetes, age, obesity, CKD
- Symptoms:
  - TIA (transient ischemic attacks) - precedes 15-20% of CVAs
    - Amaurosis fugax
    - <24 hrs
  - CVA (cerebrovascular accidents)
    - More than 24 hours
  - Syncope?
Symptoms

- Motor or sensory deficit contralateral to affected carotid artery
- Amaurosis ipsilateral to affected carotid artery
Pathophysiology of carotid plaquing

- At bifurcation of carotid
  - Where artery splits into two, high shear stress and tendency for stagnation of blood
  - Over time, an ulcer can form through the fibrous cap of the plaque.
  - Platelets then deposit within the ulcer
    - These platelets lead to more platelets
  - As blood flows into the ulcer, the platelets and other debris can embolize up the internal carotid and into the brain
    - Can cause a TIA, CVA or nothing
      - Transcranial doppler example
  - Further study into morphology of plaque to identify high risk patients.
Stroke

- 600,000 strokes per year in U.S.
- 150,000 deaths from stroke per year
- 3rd leading cause of death
Causes of stroke

- Hemorrhagic (15%)
- Non-hemorrhagic (85%)
  - Cardioembolic
    - Afib, valvular disease
  - Large vessel disease 10-20%
    - Carotid artery atherosclerotic disease
  - Small vessel disease
    - Usually hypertension induced
- Hematologic disorders
  - Polycythemia, hypercoagulable state
Imaging of the Carotid arteries

- **Ultrasound**
  - Least invasive, low risk
  - Measure Peak systolic velocity and end diastolic velocity
    - Allows an estimate of percent stenosis
  - Good screening tool

- **CTA**
  - Tends to underestimate
  - Helps delineate anatomical variations
    - High or low bifurcation
    - Aneurysmal/fmd and other rare entities
  - Risk of contrast allergy and renal impairment
CTA

- Narrowed lumen from dissection
- Normal internal carotid artery
- Hematoma in carotid wall

1. [Image of CTA showing anatomical structures and annotations]
Imaging of the Carotid arteries

- **MRA**
  - Tends to overestimate
  - Technology may be institutionally dependent
    - Risk of magnet: patient metal
  - Gadolinium toxicity
  - Nephrogenic systemic fibrosis

- **Digital Subtraction Angiography**
  - Most invasive
  - Less iv contrast
  - Gold standard
  - Risk of access site and stroke (0.1 percent)
  - Tie breaker

- Rare tests PET/CT and Transcranial doppler (TCD)
MRA and DSA
How do we identify people at risk of developing a stroke from carotid stenosis

- History and physical
  - Carotid Bruit
    - Low sensitivity and specificity
  - Eye Exam
    - Hollenhorst plaque
- Screening Ultrasounds
  - High rate of detection of disease in asymptomatic patients
  - Low yield if other risk factors not present
  - US Preventive Services Task force currently recommends in patients at high risk
- People with potential symptoms
Treatment of Carotid Stenosis

- Asymptomatic vs Symptomatic
  - same three options just when utilize is different

- Best medical therapy
  - Aspirin, Plavix and statins
  - Control risk factors

- Surgery (revascularization)
  - Carotid endarterectomy

- Stenting (revascularization)
  - Unless hospital/surgeon is in a trial, only approved in symptomatic patients
Indications for Revascularization

- Largely independent of method of revascularization
- Symptomatic disease
- Asymptomatic disease
- 3% rule (ACAS 2.3% stroke/death)
- We will ignore posterior fossa and external carotid disease today
Contraindications to Revascularization

- Disabling stroke, especially with altered LOC
- Total occlusion
- Medical comorbidities
- Life expectancy too short to derive benefit
Symptomatic Disease

- 70 - 99%
- NASCET 2 year follow up
  - 26% stroke risk in medical arm
  - 9% stroke risk in surgical arm
Symptomatic Disease

- 50 - 69%
- NASCET 5 year follow up
  - 22.7% stroke risk in medical arm
  - 15.7% stroke risk in surgical arm
Symptomatic Disease

- Symptoms within 120 days
- Increased risk reduction with greater degrees of stenosis
- Especially benefits males > 75
- There is benefit for women, but not as dramatic
Asymptomatic Disease

- > 60%
- ACAS 5 year follow up
  - 11% stroke risk in medical arm
  - 5.1% stroke risk in surgical arm
Asymptomatic Disease

- No increased risk reduction with greater degrees of stenosis
- Greatest benefits in patients < 65
- Lesser benefit in women
- Consider limiting to
  - > 80%
  - contralateral occlusion or high grade stenosis
  - ulcerated lesions
Anatomy
Endarterectomy vs. Stenting

- High-risk for endarterectomy - CMS criteria
- CEA vs. CAS trials
Anatomic High Risk for Endarterectomy

- Anatomically inaccessible lesion
- Cervical immobility
- Prior neck dissection
- Tracheostomy
- Contralateral cranial nerve injury
- Radiation
- Contralateral occlusion
- Recurrent stenosis
Medical High Risk for Endarterectomy

- COPD
- NYHA III or IV CHF
- EF < 30%
- Unstable angina
- Recent MI
Endarterectomy Outcomes

- **Symptomatic**
  - 0.6 - 1% death
  - 5 - 7% stroke/death
- **Asymptomatic**
  - 2.3% stroke/death
Endarterectomy Outcomes

- Cranial nerve injury: 4 - 7%
- Hemorrhage: 3%
- MI: 1 - 2.6%
- Hyperperfusion syndrome/intracranial hemorrhage: 1%
- Restenosis: 3 - 6%
- Infection: 0.3 - 0.8%
Stenting Outcomes

- Randomized trials plagued by:
  - bias
  - operator inexperience
  - aberrant CEA outcomes
  - nonstandardized EPD
  - angioplasty without stent
## Stenting Outcomes

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<th>CAS stroke/death</th>
<th>CEA restenosis</th>
<th>CAS restenosis</th>
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Technical Aspects of Endarterectomy

- GA or regional
- Routine or selective shunting
- Monitoring
- Eversion or longitudinal endarterectomy
- ***Patch or no patch***