Carotid Stenosis

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Review of Primary Studies

- NINDS – National Institute of Neurological Disorders and Stroke
- 2 large studies to determine who would benefit from surgery
  - ACAS – Asymptomatic Carotid Artery Stenosis (1995)

NASCET – High Grade Stenosis
(North American Symptomatic Carotid Endarterectomy Trial)

- CEA found to be highly beneficial for symptomatic patients
- Stenosis of 70-99%
- In surgery group, 2 year risk of stroke or death decreased from greater than 1 in 4 to less than 1 in 10

NASCET - Moderate stenosis

- Symptomatic patients with moderate carotid stenosis
  - 50-69%
- Found to be beneficial
  - In surgery group risk of stroke or death reduced
  - Failure rate in medical group 22.2%
  - Failure rate in surgical group 15.7%
  - From 1 in 4 patients to 1 in 7 patients

NASCET

- Low grade stenosis
- In men – even if symptomatic if stenosis < 50% - no intervention
- In women – even if symptomatic if stenosis <70% - no intervention

ACAS (Asymptomatic Carotid Atherosclerosis Study)

- CEA found to be beneficial
- Asymptomatic men
- Stenosis of 60-99%
- 5 year risk of stroke reduced from 1 in 10 to 1 in 20
- Decreased from 10% to 5%
**Women (the exception)**

- Risk with intervention higher in women than men
- No intervention on asymptomatic women
- Exception – increasing degree of stenosis on serial imaging or ulceration

**CREST Study**

*(Carotid Revascularization Endarterectomy vs Stenting Trial)*

(2013)

- No significant difference in 4 year stroke or death risk
- Symptomatic or Asymptomatic
- The significant difference
  - Lower rate of stroke in the surgery group
  - Lower rate of heart attack in the stenting group
- Age makes a difference
  - Younger patients do better with stenting (69 and younger)
  - Older patients do better with CEA
  - The older the patient, the better they do with surgery compared to stenting

**The culprit**

- Plaque buildup - atherosclerosis
- Carotid bifurcation most often affected
- Can extend into the proximal ICA (internal carotid artery)
- Causes luminal narrowing
- Can be associated with ulceration
- Stroke can be caused by:
  - Thromboembolism from ruptured plaque or clot
  - Hemodynamic compromise

**Carotid Artery**

- Plaque buildup
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  - Hemodynamic compromise
Quick take aways
Symptomatic – intervene if stenosis >50%
Asymptomatic – intervene on male if > 60%
Women – generally don’t intervene if asymptomatic
Risk of stroke higher with stent
Risk of heart attack higher with CEA
Older patients do better with CEA
Younger patients do better with stent

Timing of Endarterectomy
• Time sensitive – greatest benefit when performed within 2 weeks of the last ischemic event (NASCET)
• Benefit falls significantly with greater delay
• In study of 1700 patients – 37% of early recurrent strokes occurred within 7 days
• Exception – large volume stroke must delay due to risk of hemorrhagic conversion
• If thrombus overlying the plaque also must delay CEA
• Wait 6-8 weeks and reimaged with CTA
• May demonstrate stenosis not too severe

Endarterectomy
• A standard right carotid endarterectomy approach was carried out
• Bifurcations identified and isolated
• We proceeded with heparinization
• And elevation of the systolic blood pressure to greater than 140.
• After five minutes of heparinization, we proceeded with crossclamping of the internal carotid, common carotid, external carotid and the superior thyroid arteries.

Carotid Endarterectomy
Endarterectomy

- The arteriotomy was fashioned sharply
- and then we proceeded with endarterectomy.
- Once the plaque was removed, we explored the lumen and
- removed all debris and ensured that there were no intimal flaps.
- The wound was copiously irrigated with heparinized saline multiple times throughout the course of its exposure.

Endarterectomy

- We then proceeded with closure of the arteriotomy from either end of the suture line using running 6-0 Prolene suture.
- Prior to tying off the suture line the lumina were backbled and filled with pure heparin.
- We then tied off the suture line.
- The external carotid, superior thyroid and common carotid clamps were removed, and after five heartbeats the internal carotid clamp was removed.
- A single interrupted 6-0 Prolene suture was placed for hemostasis.

Endarterectomy

- The wound was irrigated copiously with antibiotic saline multiple times.
- Additional hemostasis was carried out with FloSeal hemostatic agent and Surgicel.
- Closure then proceeded in the standard fashion.
- No complications were encountered.
- Incision approximated with glue and steristrips

Video

- We hope!!!

Complications
Risk/Benefit Ratio

- Risk of complications must be low in order to justify CEA to reduce stroke risk
- Overall morbidity and mortality with CEA
  - should be <6% in symptomatic patients
  - <3% in asymptomatic patients
Complications

• New focal neurological deficits can arise from
  • acute ischemic stroke
  • or cerebral hyperperfusion syndrome following CEA
  • Hyperperfusion is defined as a major increase in ipsilateral cerebral blood flow that is well above the metabolic demands of the brain tissue.
  • Quantitatively, hyperperfusion is a 100% or greater increase in CBF compared with baseline.
  • Can occur with rapid restoration of normal perfusion pressure
  • Reperfusion syndrome can occur as a complication of carotid endarterectomy, stenting, or thrombolytic therapy for stroke
  • Severe ipsilateral headache, seizures, focal neurologic deficit (without ischemia)

Complications – CREST Study

<table>
<thead>
<tr>
<th></th>
<th>Stent</th>
<th>CEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 year</td>
<td>6.4%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Symptomatic pts.</td>
<td>8.0%</td>
<td>6.4%</td>
</tr>
<tr>
<td>Asymptomatic</td>
<td>4.5%</td>
<td>2.7%</td>
</tr>
<tr>
<td>Periprocedural</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>0.7%</td>
<td>0.3%</td>
</tr>
<tr>
<td>Stroke</td>
<td>4.1%</td>
<td>2.3%</td>
</tr>
<tr>
<td>MI</td>
<td>1.1%</td>
<td>2.3%</td>
</tr>
</tbody>
</table>

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Severe ipsilateral headache, seizures, focal neurologic deficit (without ischemia)

Post-operative

• Observed in the ICU overnight
• Monitor blood pressure
• Observe for chest pain
• Observe for neck hematoma
• Frequently discharged home the next day

Post-operative

• ASA 325 mg started
• At 1 month follow up decrease to 81 mg daily unless patient is taking the ASA for other reasons
• If patient was on Plavix prior to surgery, discharge patient on Plavix and 81mg aspirin if on Plavix for cardiovascular or other reason
• If patient was on anticoagulant, resume medication 48-72 hours post-operative if on anticoagulant for reason other than for stroke prevention
  • Discharge on ASA 81 mg even if on anticoagulant

Post-op Visit

• 1 month post-operative
• Stroke symptoms since surgery?
• Significant headaches?
• Review antiplatelets/anticoagulants
• Review pre-op CTA or MRA
  • Arrange for CEA on opposite side if meets criteria
• Enter recall for dopplers in 1 year
Now on to endovascular treatment