Variability In Operating Time For The Same Procedure by Different Surgeons: How Does It Correlate With Outcomes: Do Slow Surgeons Get Worse Results?

Jack L. Cronenwett, M.D.
Dartmouth-Hitchcock Medical Center
Medical Director, SVS PSO

Carotid Endarterectomy
• Most homogeneous operation in VQI
  – Selected only elective, primary operations without concomitant procedures or high anatomic risk
• 26,327 CEAs by 1,188 surgeons in 2014-2015
  – Multivariable model to identify factors associated with longer operation time
  – Evaluated association of operation time with surgical outcomes

26,327 Elective Carotid Endarterectomies
Operation Time (Minutes)
Percentage of Procedures
Mean: 114 Minutes
Median: 108 Minutes
25th Percentile: 85 Minutes
75th Percentile: 136 Minutes

Factors Increasing CEA Operation Time

<table>
<thead>
<tr>
<th>Factor</th>
<th>Additional Minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male Gender</td>
<td>7.3</td>
</tr>
<tr>
<td>Non-White Race</td>
<td>8.1</td>
</tr>
<tr>
<td>High BMI</td>
<td>4.3</td>
</tr>
<tr>
<td>PreOp ASA</td>
<td>5.4</td>
</tr>
<tr>
<td>PreOp Plavix</td>
<td>6.3</td>
</tr>
<tr>
<td>Dextran</td>
<td>5.2</td>
</tr>
<tr>
<td>Conventional (vs Eversion)</td>
<td>6.3</td>
</tr>
<tr>
<td>EEG</td>
<td>5.6</td>
</tr>
<tr>
<td>Stump Pressure</td>
<td>5.1</td>
</tr>
<tr>
<td>Drain</td>
<td>2.0</td>
</tr>
<tr>
<td>Completion Duplex</td>
<td>12.7</td>
</tr>
<tr>
<td>Completion Arteriogram</td>
<td>11.7</td>
</tr>
<tr>
<td>Re-explore artery after closure</td>
<td>26.2</td>
</tr>
</tbody>
</table>
Factors Increasing CEA Operation Time Based on Prevalence Across All Centers

- Male Gender: 7%
- Non-White Race: 2%
- High BMI: 3%
- PreOp ASA: 3%
- Non-Eversion: 7%
- EEG: 6%
- Stump Pressure: 1%
- Drain: 1%
- Dextran: 1%
- Re-explore artery after closure: 2%
- Completion Duplex: 22%
- Completion Arteriogram: 2%
- Low Surgeon Volume: 39%

Chi Pie Based on Multivariable Model

Annual Surgeon Volume and CEA Time

- +26 Minutes
- +20 Minutes
- +13 Minutes
- 106 Minutes

Vascular Quality Initiative®

Carotid Endarterectomy Operation Time
- Mean time 114 minutes
- Varies significantly among VQI surgeons
  - Some patient factors increase this
  - Completion duplex adds 13 minutes
  - Low volume surgeons take up to 26 minutes longer

- Is longer operation time associate with worse outcomes?

CEA: Cranial Nerve Injury vs OR Time

- P<.001

CEA: Major Complication vs OR Time

- Myocardial Infarction, New Dysrhythmia, Congestive Heart Failure, Wound Infection, Reperfusion symptoms, Re-operation

CEA: Post-op Stroke/TIA vs OR Time

- P<.001
**Conclusions**

- Operation time for carotid endarterectomy varies by surgeon, procedure and patient factors.
- Low volume surgeons operate slower.
- Longer operations are associated with worse outcomes.
- Operating faster will improve outcomes.
- More likely that surgeons who operate faster have higher surgical skill, which improves outcome.