Intraop Completion Control Study by Duplex or Angiography Is a MUST after CEA

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Intraoperative Completion Studies, Local Anesthesia, and Antiplatelet Medication Are Associated With Lower Risk in Carotid Endarterectomy

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Background and Purpose—In Denmark, all surgical or interventional procedures on the carotid circulation may be documented in a registry to track quality assurance data. We analyze data on the association between procedural and perioperative variables and 30-day stroke or death rates after carotid endarterectomy.

Methods—Between 2009 and 2014, analyses of 142,074 elective carotid endarterectomy procedures were documented in the database. The primary outcome of this secondary data analysis was in-hospital stroke or death. Major stroke or death, minor stroke or death, or other stroke or death were secondary outcomes. Adjusted relative risks (RRs) were assessed by multivariable adjusted regression analysis.

Results—142,074 elective carotid endarterectomy procedures were performed on 105,349 patients, with a mean age of 72.2 years and 56.6% being men. In-hospital stroke or death occurred in 264 patients (0.18%). In-hospital death occurred in 115 patients (0.08%), major stroke or death occurred in 125 patients (0.09%), and minor stroke or death occurred in 9 patients (0.01%). Patients with diabetes were independently associated with strokes or deaths (RR 1.25; 95% CI 1.16-1.35), carotid endarterectomy with previous stroke compared with primary endarterectomy (RR 1.31; 95% CI 1.13-1.50), and intraoperative completion studies by diffusion- and perfusion-weighted imaging (RR 0.81; 95% CI 0.70-0.94), and perioperative antiplatelet medication (RR 0.83; 0.78-0.89). The length of stay and a short course of antiplatelets were also associated with lower risks. However, these were interpreted very cautiously.

Conclusions: Our study supports the routine use of completion studies, such as diffusion-weighted imaging, and perioperative completion studies were independently associated with shorter hospital stay and fewer strokes or deaths after carotid endarterectomy. Stroke. 2017;129:535-542. DOI:10.1161/JAHA.116.000441

142,074 elective CEA procedures
S/D - Asx 1.4%
- Sx 2.5%
Self-reported
Not 30 day outcomes
Only 50% neuro

Conclusions:

Limitations
First, because this is an observational study, patients were not randomized for the variables analyzed in this study, and all results are to be construed as associations rather than causal relationships. Even though some variables in this study were significantly associated with better outcomes, any recommendation for clinical practice should be drawn carefully. However, comprehensively might be useful for generating hypotheses for future randomized or nonrandomized prospective trials.
**Multivariate regression Analysis**

Risk of dying is related to (%):

- Local
- No monitoring
- Eversion
- Shunt use
- No antiplatelet

**Conclusions**

Fourth, because indications for inoperative shunt use were not available, we were not able to analyze the association between routine, selective, or no shunting on the perioperative outcome.

Fifth, the database does not provide information on specific comorbidities, cardiovascular risk profile, routine medication, timing of antiplatelet medication, intraoperative heparin or protamine application, and reasons for the application of a certain operative technique or adjunct measure. Therefore, residual confounding might be possible. Equally, no information is supplied on whether intraoperative completion studies caused an operative revision or not. No information is reported about the cause of death.

**Risks with Completion Angiography?**

1. Where to put the needle?
   - Proximal CCA below the patch
   - Through the patch
   - Risk of dissection flap, embolization, reclamping the artery

2. How to standardize imaging?
   - C-arm vs flat plate single view-What type of table?
   - Cervical, intracerebral or both? 2 views?

3. Who interprets and what are your thresholds for reintervention?

**Mandatory Completion Angiography**

- May be harmful
- May be unnecessary – (Cost, OR time)
- May be misleading – False positives
Mandatory Completion Duplex Study

- May be unnecessary – (Cost, Availability of the technician, OR time, incidence of true positive low).
- May be misleading – False positives, risk of reclamping, extending length of surgery, opening patch

CREST: Final Word?

2502 Randomized patients

No difference in 1st composite endpoint

BUT

Stroke/Death Risk with CAS is 2 times higher

4.8% vs 2.6% (p=0.01)

CREST RESULTS

CREST: Endpoint components

<table>
<thead>
<tr>
<th>Complication</th>
<th>CAS</th>
<th>CEA</th>
<th>HR</th>
<th>CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peri-procedural CVA</td>
<td>4.1%</td>
<td>2.3%</td>
<td>1.79</td>
<td>1.14-2.62</td>
<td>0.01</td>
</tr>
<tr>
<td>Peri-procedural MI</td>
<td>1.1%</td>
<td>2.3%</td>
<td>0.50</td>
<td>0.26-0.94</td>
<td>0.03</td>
</tr>
<tr>
<td>Peri-procedural Major CVA</td>
<td>0.9%</td>
<td>0.7%</td>
<td>1.35</td>
<td>0.54-3.36</td>
<td>0.52</td>
</tr>
<tr>
<td>Peri-procedural CN palsies</td>
<td>0.3%</td>
<td>4.8%</td>
<td>0.07</td>
<td>0.02-0.18 &lt;0.0001</td>
<td></td>
</tr>
<tr>
<td>Ipsilateral CVA after peri-procedural period ≤4 years</td>
<td>2.0%</td>
<td>2.4%</td>
<td>0.94</td>
<td>0.50-1.76</td>
<td>0.85</td>
</tr>
</tbody>
</table>

Surgical Principles of Neuroprotection

- Isolate bifurcation before treating lesion
- Clamping and loop control of CCA
- Backbleeding to wash out debris
- Intraoperative EEG monitoring/Selective Shunt
- Antiplatelet therapy
- Statin therapy
- Blood pressure control
- Hand held CWD
**Conclusions**

**Mandatory completion Angiogram/Duplex Study**
- Unnecessary
- May be misleading
- May be harmful

**Recommendations**
- Meticulous intraoperative technique
- Careful attention to periop medical management including aspirin, statin and blood pressure control
- Intraprocedural monitoring with selective shunt use
- Continuous wave doppler
- Selective use of duplex or angiography
- Opportunity to prospectively study the use of and indications for completion studies