Management of Carotid Artery Disease in Patients Undergoing Cardiac Procedures

Marco Roffi
Cardiology
University Hospital
Geneva, Switzerland
Disclosure

Speaker name:

.....Marco Roffi..............................................................

I have the following potential conflicts of interest to report:

- Consulting
- Employment in industry
- Stockholder of a healthcare company
- Owner of a healthcare company
- Other(s): unrestricted institutional research grants from Biotronik, Abbott Vascular, Medtronic, Boston Scientific, Biosensor
Stroke after Cardiac Surgery and its Association with Asymptomatic Carotid Disease: An Updated Systematic Review and Meta-analysis

A.R. Naylor*, M.J. Bown
# Stroke and Open Heart Surgery

<table>
<thead>
<tr>
<th>Patients Factors</th>
<th>Surgical Factors</th>
<th>Cerebrovascular factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Older age</td>
<td>- On-pump surgery</td>
<td>- Symptomatic carotid stenosis</td>
</tr>
<tr>
<td>- History of TIA/stroke</td>
<td>- Prolonged cardiopulmonary bypass / aorta cross-clamping</td>
<td>- Degree of stenosis severity</td>
</tr>
<tr>
<td>- Severe atherosclerosis; of the ascending aorta / aortic arch</td>
<td>- Calcified aorta, atheromatous plaque in the aorta</td>
<td>- Plaque morphology</td>
</tr>
<tr>
<td>- Peripheral artery disease</td>
<td>- Need for proximal anastomosis and side clamping of the aorta</td>
<td>- Progressive stenosis</td>
</tr>
<tr>
<td>- Atrial fibrillation</td>
<td>- Valve surgery, combined coronary and valve surgery</td>
<td>- Embolic signals on transcranial doppler</td>
</tr>
<tr>
<td>- Hypertension</td>
<td>- Redo surgery</td>
<td>- Contralateral carotid stenosis/occlusion</td>
</tr>
<tr>
<td>- Diabetes</td>
<td></td>
<td>- Isolate hemisphere</td>
</tr>
<tr>
<td>- Heart failure / severe left ventricular dysfunction</td>
<td></td>
<td>- Intracranial microvascular disease</td>
</tr>
<tr>
<td>- Renal failure</td>
<td></td>
<td>- Schemic lesions in the carotid territory</td>
</tr>
</tbody>
</table>

Stroke and Open Heart Surgery


Combined CEA-CABG

- US population based study from 1993 to 2002
- N= 657‘877, combined CABG/CEA
  - 1.1% 1993
  - 1.6% 2002

CEA/CABG vs. CABG
  → stroke or death OR 2.25 (P<0.0001)

No change over time in rate of perioperative stroke or death in the CEA/CABG group

Dubinsky RM and Lai SM. Neurology 2007;68195-7
## Guidelines on Carotid Revascularization Prior to Open Hear Surgery

<table>
<thead>
<tr>
<th>Guideline</th>
<th>Year</th>
<th>Recommendation</th>
<th>Grade/Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>American carotid (a)</td>
<td>2011</td>
<td>Carotid revascularization by CEA or CAS with embolic protection before or concurrent with myocardial revascularization surgery is reasonable in patients with greater than 80% carotid stenosis who have experienced ipsilateral retinal or hemispheric cerebral ischemic symptoms within 6 months. In patients with asymptomatic carotid stenosis, even if severe, the safety and efficacy of carotid revascularization before or concurrent with myocardial revascularization are not well established.</td>
<td>Class IIa, LOE C</td>
</tr>
<tr>
<td>American CABG (b)</td>
<td>2011</td>
<td>In the CABG patient with a previous TIA or stroke and a significant (50% to 99%) carotid artery stenosis, it is reasonable to consider carotid revascularization in conjunction with CABG. In such an individual, the sequence and timing (simultaneous or staged) of carotid intervention and CABG should be determined by the patient’s relative magnitudes of cerebral and myocardial dysfunction.</td>
<td>Class IIa, LOE C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>In the patient scheduled to undergo CABG who has no history of TIA or stroke, carotid revascularization may be considered in the presence of bilateral severe (70% to 99%) carotid stenoses or a unilateral severe carotid stenosis with a contralateral occlusion.</td>
<td>Class IIb, LOE C</td>
</tr>
<tr>
<td>European peripheral (c)</td>
<td>2011</td>
<td>Carotid revascularization is recommended in 70–99% symptomatic carotid stenosis. Carotid revascularization may be considered in 50–69% symptomatic carotid stenosis, depending on patient-specific factors and clinical presentation. Carotid revascularization may be considered in asymptomatic men with bilateral 70–99% carotid stenosis or 70–99% carotid stenosis and a contralateral occlusion. Carotid revascularization may be considered in asymptomatic men with 70–99% carotid stenosis and ipsilateral previous silent cerebral infarction.</td>
<td>Class I, LOE C</td>
</tr>
</tbody>
</table>
Meta-Analysis 97 studies, 8972 procedures → 30-days death/stroke/MI 10-12%

CEA/CABG vs. CAS/CABG

- US Nationwide Inpatient Sample
- Concomitant coronary and carotid revascularization 2000-2004
- Of the 27’084 procedure performed in the five-year period only 3.3% (N=887) CAS → CABG

Comparison of Results of Carotid Stenting Followed by Open Heart Surgery Versus Combined Carotid Endarterectomy and Open Heart Surgery (Coronary Bypass With or Without Another Procedure)

Khaled M. Ziada, MD\textsuperscript{b,*}, Jay S. Yadav, MD\textsuperscript{a}, Debra R. Mukherjee, MD\textsuperscript{b}, Michael S. Lauer, MD\textsuperscript{a}, Deepak L. Bhatt, MD\textsuperscript{a}, Samir Kapadia, MD\textsuperscript{a}, Marco Roffi, MD\textsuperscript{c}, Nirav Vora, MD\textsuperscript{a}, Irving Tiong, MD\textsuperscript{a}, and Christopher Bajzer, MD\textsuperscript{a}

30 Day Adverse Events, (%)

- **CS + OHS, (N = 56)**
  - MI: 12.6
  - Stroke: 9.0
  - Death: 5.4
  - Death, MI, or Stroke: 10.7
  - \(p = 0.06\)

- **CEA + OHS, (N = 112)**
  - MI: 3.3
  - Stroke: 1.8
  - Death: 7.2
  - Death, MI, or Stroke: 21.6
  - \(p = 0.08\)
  - \(p = 0.65\)

Ziada KM et al. AJC 2005;96:519-23
Carotid revascularization in Open Heart Surgery (OHS) population (1997–2009)

- Carotid Endarterectomy (CEA)
  - Staged CEA-OHS
  - Combined CEA-OHS
  - 90 days

- Carotid Artery Stenting (CAS)
  - Staged CAS-OHS
  - 90 days

Shishehbor et al, JACC 2013
Primary end point: Composite of death, stroke and myocardial infarction (MI)

Secondary end points: death, stroke, MI

Interval death, stroke, MI

Staged CEA-OHS

Combined CEA-OHS

Staged CAS-OHS

Shishehbor et al, JACC 2013
Statistical Methods

- Time to event analysis
- Multiphase hazard function model
- Modulated renewal strategy
- Propensity score adjustment

Results

Carotid revascularization and OHS, n=350

CEA, n=45

Interval deaths
n=3

OHS
n=42

Combined CEA-OHS
n=195

CAS, n=110

Interval deaths
n=6

OHS
n=104

Shishehbor et al, JACC 2013
## Three Group Comparison

<table>
<thead>
<tr>
<th>Comparison</th>
<th>Primary Composite end point</th>
<th>Adjusted HR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early phase</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staged CAS-OHS vs. Combined CEA-OHS</td>
<td></td>
<td>0.76 (0.33-1.76)</td>
<td>0.52</td>
</tr>
<tr>
<td>Staged CEA-OHS vs. Combined CEA-OHS</td>
<td></td>
<td>3.74 (1.78-7.89)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Staged CAS-OHS vs. Staged CEA-OHS</td>
<td></td>
<td>0.20 (0.08-0.52)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Shishehbor et al, JACC 2013
Primary Composite Endpoint

Shishehbor et al, JACC 2013
Management of Patients With Carotid Stenosis Undergoing CABG

- Symptomatic carotid stenosis ≥ 70%
  - Stable CAD
    - CAS → CABG (or CEA/CABG)
  - Unstable CAD
    - CEA/CABG or hybrid CAS/CABG

- Asymptomatic carotid stenosis ≥ 80%
  - Estimated death/stroke rate for the carotid procedure ≤ 3%
    - Yes
      - CABG only
    - No
      - Stable CAD
        - CAS → CABG (or CEA/CABG)
      - Unstable CAD
        - CEA/CABG

No perfect solution
• High risk, independently of revascularization strategy
• Stroke multifactorial
• CEA/CABG has significant morbidity and mortality
• If the patient is stable from a coronary standpoint, CAS \(\rightarrow\) CABG is an attractive alternative to CEA/CABG

The purpose of carotid revascularization prior to open heart surgery is not just perioperative stroke reduction (much more) but long-term stroke prevention
Management of Carotid Artery Disease in Patients Undergoing Cardiac Procedures

Marco Roffi
Cardiology
University Hospital
Geneva, Switzerland