Optimal Treatment Of Carotid Restenosis After CEA, and After CAS

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Disclosure

Speaker name:
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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)

I do not have any potential conflict of interest
Restenosis

Reports describing long-term follow-up indicate that restenosis >50% occurs:
- in 6-37% of patients after CEA


Restenosis after CAS & CEA

Restenosis was more common after Endovascular (OR 2.41, 95% CI 1.28 to 4.53, P = 0.007)

Bonati et al. Cochrane Review 2012
Carotid restenosis after CAS & CEA

How to deal with it:

- Diagnosis

- Indication to treatment

- Treatment options
A potential source of error in using US after CAS is that reduced compliance in the stented artery may result in elevated velocity relative to the native artery.
**CORRECT DIAGNOSIS OF IN-STENT RESTENOSIS**

<table>
<thead>
<tr>
<th>% Stenosis</th>
<th>PSV (cm/s)</th>
<th>EDV (cm/s)</th>
<th>ICA/CCA</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;30</td>
<td>&gt;104</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>30-50</td>
<td>105 – 174</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>50-70</td>
<td>175 - 299</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>&gt;70</td>
<td>&gt;300</td>
<td>&gt; 140</td>
<td>&gt; 3.8</td>
</tr>
</tbody>
</table>

*receiver operator characteristic (ROC) curve*

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**Setacci et al. Stroke 2008;39:1189-96**
Result from CREST

Restenosis rate after CAS and CEA is similar with a threshold of 3 m/s

Carotid restenosis after CAS & CEA

How to deal with it:

- Diagnosis

- Indication to treatment

- Treatment options
Accompanying neurological events have been reported in only 1-10% of patients with restenosis, raising doubt as to the benefit of treating asymptomatic restenosis.

Bonati et al. Cochrane Review 2012
“Restenosis is generally benign and does not require revascularization except when it leads to:

- recurrent ischemic symptoms
- or progresses to preocclusive severity”

“Under these circumstances, it may be justifiable to repeat revascularization, either by CEA in the hands of an experienced surgeon or by CAS”.

Restenosis after CAS or CEA

Indication for treatment of carotid restenosis

- **Symptomatic pts (>50%)**
- **Asymptomatic pts (>80%)**

**But**
Carotid restenosis after CAS & CEA

How to deal with it:

- Diagnosis

- Indication to treatment

- Treatment options
Treatment options for restenoses following CEA or CAS

**Endovascular treatment**
- PTA
- Cutting balloon angioplasty
- Re-stenting (primary/after PTA, CBA)
- DEB
- DES

**Surgical treatment (stent removal)**
- CEA
- bypass
184 patients with ISR

Table 4
Interventions Used for ISR

<table>
<thead>
<tr>
<th>Intervention to Treat ISR</th>
<th>No. of Pts</th>
<th>Restenosis after ISR Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeat PTA</td>
<td>54</td>
<td>8 (15)</td>
</tr>
<tr>
<td>Balloon angioplasty (PTA)</td>
<td>31</td>
<td>7 (23)</td>
</tr>
<tr>
<td>Cutting balloon angioplasty</td>
<td>23</td>
<td>1 (4.3)</td>
</tr>
<tr>
<td>Repeat CAS</td>
<td>31</td>
<td>4 (13)</td>
</tr>
<tr>
<td>Angioplasty and repeat CAS</td>
<td>24</td>
<td>1 (4.2)</td>
</tr>
<tr>
<td>Drug-eluting stent</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>CEA with stent removal</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>Carotid artery bypass</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Interposition graft with reversed RSV</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Interposition graft: PTFE</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>ICA-ECA interposition</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Brachytherapy</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

Note.—Values in parentheses are percentages. ECA = external carotid artery; ICA = internal carotid artery; PTFE = polytetrafluoroethylene; RSV = reversed saphenous vein.

Conclusion
- Several treatment with acceptable short-term results
- Limited quality of the currently available data (variability of results and study designs)
- No recommendation can be made for any specific therapy.
expected number of events per year
per 100 event-free patients

<table>
<thead>
<tr>
<th>Complication</th>
<th>Annual rate</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>All-cause mortality</td>
<td>3.43</td>
<td>(3-3.9)</td>
</tr>
<tr>
<td>Stroke-related mortality</td>
<td>1.31</td>
<td>(1-1.6)</td>
</tr>
<tr>
<td>Fatal/disabling stroke</td>
<td>1.70</td>
<td>(1.4-2.1)</td>
</tr>
<tr>
<td>All neurological complications</td>
<td>3.45</td>
<td>(3-3.9)</td>
</tr>
<tr>
<td>In-stent restenosis (&gt;50%)</td>
<td>1.49</td>
<td>(1.2-1.8)</td>
</tr>
<tr>
<td>Reintervention</td>
<td>1.08</td>
<td>(0.8-1.4)</td>
</tr>
</tbody>
</table>
RESULTS
Reintervention

Reintervention (64 cases)
- 4 stent removals (2 acute thrombosis*)
- 60 further endovascular approaches
  - 23 PTA
  - 14 PTA + stenting
  - 8 cutting balloon + stenting
  - 15 cutting balloon

Hazard ratios for reintervention in the total population

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Hazard ratios</th>
<th>95% CI</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stent design (stainless vs nitinol)</td>
<td>0.98</td>
<td>(0.6-1.7)</td>
<td>0.95</td>
</tr>
<tr>
<td>Free cell area (mm$^2$)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt; 2.5</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5-5</td>
<td>0.48</td>
<td>(0.1-3.5)</td>
<td>0.47</td>
</tr>
<tr>
<td>5-7.5</td>
<td>1.00</td>
<td>(0.4-2.3)</td>
<td>0.99</td>
</tr>
<tr>
<td>&gt; 7.5</td>
<td>1.16</td>
<td>(0.6-2.3)</td>
<td>0.68</td>
</tr>
</tbody>
</table>

*p-value of global test for association between free cell area and time to in-stent restenosis

Stent design material and free cell areas are not significantly associated with the incidence of ISR and incidence of reintervention.
Univariate e multivariate analysis: results

- prior surgical carotid restenosis (p=0.039)
- + postoperative fever (OR = 5.3)
- + need of pre-dilatation (OR = 3.9)
- + presence of concomitant malignancy or auto immune disease (OR = 3.4)
OCT after PTA for in-stent restenosis

Good angiographic result after simple PTA, but …..
OCT after PTA for in-stent restenosis

LESSON LEARNED:
PTA alone is no more a good option!!
Better re-stenting!

**Disadvantages**
- Increase arterial stiffness
- Kink or bend in the distal ICA ➔ major hyperplastic reaction at the distal end of the second stent (?)

**Advantage**
- Plaque containment
Restenosis after CAS

CEA with removal of the plaque and stent is a viable option for management of ISR in selected patients when distal control can be obtained beyond the stented segment.