Invasive treatment of ACS is rarely indicated: ACS patients need good medical treatment and low LDL <3% of ACS patients should have invasive treatment and they are difficult to find

Henrik Sillesen MD, DMSc
Professor and Head of Dept.,
Rigshospitalet
University of Copenhagen, Denmark

Conflicts of interest
• Research support from:
  – Philips Ultrasound
  – Cook Medical
• Honaria from
  – Novo Nordisk
  – Bayer

Declining stroke risk in asymptomatic carotid stenosis – 75% reduction

Risk of ipsilateral stroke < 1% p.a.

Matar N et al, Cerebrovasc Dis 2014

Does imaging of atherosclerosis improve risk prediction?

Cerebrovascular Disease 2017

Optimal Medical Management Reduces Risk of Disease Progression and Ischemic Events In Asymptomatic Carotid Stenosis Patients: A Long-Term Follow-Up Study

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1Department of Interventional Radiology, University College London Hospitals NHS Foundation Trust, London, UK
2Department of Health Sciences Research, University of Copenhagen, Copenhagen, Denmark

A total of 804 patients
1,720 carotid arteries in total
438 carotid arteries studied for PECS
76 ± 3 months mean follow-up period

459 carotid ultrasound studies (corresponding to an average of 5.4 ± 4.4 studies per vessel)

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**Carotid stenosis (%)**

<table>
<thead>
<tr>
<th>overall</th>
<th>1139</th>
<th>18.97</th>
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<tbody>
<tr>
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<tr>
<td>&gt;50 (all list one side &gt;50)</td>
<td>349</td>
<td>5.81</td>
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<tr>
<td>Total</td>
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</tr>
</tbody>
</table>

Diagnosis of carotid stenosis based on standard Doppler criteria
Sillesen et al, JACC IMG 2012

**Risk of stroke is LOW**

- **Cumulative Stroke by CAS procedures:**
  - Annual all stroke risk in ACS: 0.4%

- **NEW European guidelines**

**Interpretation**

- **Risk of TIA/Stroke/Carotid revasc. becomes extremely low if risk factors are treated appropriately**

- **Progression of carotid stenosis is a sign of insufficient risk factor control and preventive treatment rather than a sign of increased risk of stroke!**

**ASYMPTOMATIC CAROTID STENOSIS NEW**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Class</th>
<th>Level</th>
<th>References</th>
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<tbody>
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<td>B</td>
<td>11,13,14,15-96, 96-87</td>
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<td>18</td>
<td>B</td>
<td>A</td>
<td>20-94-08</td>
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<td>19</td>
<td>A</td>
<td>A</td>
<td>14,54-93,95</td>
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</table>

**NEW EJVES 2018**

<table>
<thead>
<tr>
<th>Study</th>
<th>Events</th>
<th>CAS Events</th>
<th>CAS Total</th>
<th>OddsRatio</th>
<th>95% CI</th>
<th>SE (logOdds)</th>
<th>SE (logOdds)</th>
<th>SE (logOdds)</th>
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</tr>
</tbody>
</table>

**Figure 4:** The risk of 30-day death or stroke in primary CAS compared to carotid endarterectomy and carotid artery stenting, in symptomatic patients.
Imaging features with higher risk

<table>
<thead>
<tr>
<th>Feature</th>
<th>Annual rate of ipsilateral stroke (%)</th>
</tr>
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<tbody>
<tr>
<td>Silent infarction</td>
<td>Kakkos et al 2009 3.6%</td>
</tr>
<tr>
<td>Stenosis progression</td>
<td>Kakkos 2014 2%</td>
</tr>
<tr>
<td>Predominantly echolucent plaque</td>
<td>Gupta 2014 4%</td>
</tr>
<tr>
<td>Low GSM plaque/part of plaque</td>
<td>Kakkos 2015 5%</td>
</tr>
<tr>
<td>Large plaque area</td>
<td>Nicolaides 2010 4.6%</td>
</tr>
<tr>
<td>&gt; 3 micro ulcers on plaque</td>
<td>Madani 2011 6%</td>
</tr>
<tr>
<td>MRI intraplaque hemorrhage</td>
<td>Singh 2009 OR 3.6</td>
</tr>
<tr>
<td>Emboli on TCD</td>
<td>Markus 2010 OR 6.6</td>
</tr>
<tr>
<td>Emboli x dark plaque</td>
<td>Tozikain 2011 8.9%</td>
</tr>
<tr>
<td>Impaired cerebrovascular reserve</td>
<td>Gupta 2012 OR 3.9</td>
</tr>
</tbody>
</table>

However, these data were gathered 10-20 years ago!

Asymptomatic Carotid Stenosis

- **Very, very low risk of stroke – 0.3-0.5%/yr**
- **High risk of cardiovascular events**
- However, medical management works and lowers risk
- Carotid endarterectomy (or CAS) in general NOT warranted ...
- Unless a high risk plaque can be identified ...

We need 3D Ultrasound

Ultrasound plaque tomography

**plaque volume**

Knowing the area of plaque in each image and the distance in between, plaque volume can be calculated.
Automated identification of max plaque thickness

1 cm slice centered on max plaque thickness

Ultrasound in Med. & Biol. 2018

3D-US will improve

- Plaque quantification
  - Volume
  - Morphology
- Assessment of degree of stenosis
  - By improving angle-compensation since this can be done in 3D
- Speed of examination
- Make it easier to perform a good scan!

- Thank you for attention