Carotid Artery Stenting for Symptomatic Patients
How to Maximize Benefit and Reduce Risk

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Conflict of Interest

• No conflict to report in relation to this presentation
Clinical Trials vs. Clinical Practice

I. Physicians make decisions in an environment of inescapable uncertainty despite all the available “evidence” – Or lack thereof.

II. Our individual bias colors our interpretation of the “evidence” as well as our clinical decisions

III. Operator experience and technique are never adequately accounted for in multi-center clinical trials
Options for Management of Carotid Artery Stenosis

Stand alone medical management

Medical management + Carotid revascularization

CAS vs. CEA

- High Surgical Risk Patients: Symptomatic & Asymptomatic
- Standard Surgical Risk Patients: Symptomatic & Asymptomatic

Maximizing benefit and reducing risk of CAS

- Role of patient
- Role of operator
- Role of devices
Stand Alone Medical Therapy

I. Medical therapy should be the cornerstone of any therapeutic modality in patients with carotid occlusive disease to reduce the global risk of stroke.

II. Stand alone medical therapy is inferior to CEA (and speculatively to CAS) assuming that procedural safety thresholds are met:
   A. Death/stroke <3% for asymptomatic patients
   B. Death/stroke <6% for symptomatic patients

III. The argument that “contemporary” medical therapy changes the balance of risk/benefit ratio of carotid revascularization in most patients is speculative and yet to be proven!
### CEA vs. CAS

#### High-Surgical Risk Patients: Symptomatic & Asymptomatic

#### The SAPPHIRE Trial: 3-Year Outcome

<table>
<thead>
<tr>
<th>Event</th>
<th>Stenting (N=167)</th>
<th>Endarterectomy (N=167)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>no. (%) [% as estimated by Kaplan–Meier method]</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>31 (18.6) [20.0]</td>
<td>35 (21.0) [24.2]</td>
<td>0.68</td>
</tr>
<tr>
<td>Cardiac cause</td>
<td>15 (9.0) [9.8]</td>
<td>15 (9.0) [10.9]</td>
<td>0.99</td>
</tr>
<tr>
<td>Neurologic cause</td>
<td>3 (1.8) [2.2]</td>
<td>4 (2.4) [2.9]</td>
<td>0.99</td>
</tr>
<tr>
<td>Other cause</td>
<td>13 (7.8) [9.4]</td>
<td>16 (9.6) [12.4]</td>
<td>0.70</td>
</tr>
<tr>
<td>Stroke</td>
<td>15 (9.0) [10.1]</td>
<td>15 (9.0) [10.7]</td>
<td>0.99</td>
</tr>
<tr>
<td>Major ipsilateral</td>
<td>2 (1.2) [1.3]</td>
<td>5 (3.0) [3.3]</td>
<td>0.45</td>
</tr>
<tr>
<td>Major nonipsilateral</td>
<td>1 (0.6) [0.6]</td>
<td>5 (3.0) [4.1]</td>
<td>0.21</td>
</tr>
<tr>
<td>Minor ipsilateral</td>
<td>9 (5.4) [6.1]</td>
<td>4 (2.4) [3.0]</td>
<td>0.26</td>
</tr>
<tr>
<td>Minor nonipsilateral</td>
<td>4 (2.4) [2.7]</td>
<td>4 (2.4) [2.8]</td>
<td>0.99</td>
</tr>
<tr>
<td>Myocardial infarction</td>
<td>9 (5.4) [6.1]</td>
<td>14 (8.4) [9.4]</td>
<td>0.39</td>
</tr>
<tr>
<td>Q-wave</td>
<td>0</td>
<td>2 (1.2) [1.2]</td>
<td>0.50</td>
</tr>
<tr>
<td>Non–Q-wave</td>
<td>9 (5.4) [6.1]</td>
<td>12 (7.2) [8.2]</td>
<td>0.65</td>
</tr>
<tr>
<td>Target-vessel revascularization</td>
<td>4 (2.4) [3.0]</td>
<td>9 (5.4) [7.1]</td>
<td>0.26</td>
</tr>
</tbody>
</table>

CEA vs. CAS

High-Surgical Risk Patients: Symptomatic & Asymptomatic

The SAPPHIRE Trial: 3-Year Outcome

CEA vs. CAS

High-Surgical Risk Patients: Symptomatic & Asymptomatic

I. CAS is at least as safe and effective as CEA in high surgical risk patients

II. Nonetheless, this term describes a diverse group of patients (symptom status, co morbidities) and clinical decisions need to be made on a case by case basis

III. Medical therapy alone should be strongly considered in asymptomatic patients who are high risk of CEA and CAS
CEA vs. CAS
Standard Surgical Risk Patients
Symptomatic Patients

• The RCTs
  – CAVATAS
  – EVA 3-S
  – SPACE
  – ICSS
  – CREST
Standard Surgical Risk Patients

Symptomatic Patients: The CAVATAS trial


- Mostly Carotid angioplasty
- No distal protection
### Standard Surgical Risk Patients

#### Symptomatic Patients: The CAVATAS trial

<table>
<thead>
<tr>
<th>Major outcome events</th>
<th>Endovascular group (n=251)</th>
<th>Surgical group (n=253)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>7 (3%)</td>
<td>4 (2%)</td>
<td>NS</td>
</tr>
<tr>
<td>Disabling stroke</td>
<td>9 (4%)</td>
<td>11 (4%)</td>
<td>NS</td>
</tr>
<tr>
<td>Non-disabling stroke</td>
<td>9 (4%)</td>
<td>10 (4%)</td>
<td>NS</td>
</tr>
<tr>
<td>Death or disabling stroke</td>
<td>16 (6%)</td>
<td>15 (6%)</td>
<td>NS</td>
</tr>
<tr>
<td>Death or any stroke</td>
<td>25 (10%)</td>
<td>25 (10%)</td>
<td>NS</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other outcome events</th>
<th>Endovascular group (n=251)</th>
<th>Surgical group (n=253)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cranial nerve palsy</td>
<td>0</td>
<td>22 (9%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Peripheral nerve palsy</td>
<td>0</td>
<td>2 (1%)</td>
<td>NS</td>
</tr>
<tr>
<td>Haematoma (requiring surgery or extending hospital stay)</td>
<td>3 (1%)</td>
<td>17 (7%)</td>
<td>&lt;0.0015</td>
</tr>
<tr>
<td>Myocardial infarction (non-fatal)</td>
<td>0</td>
<td>3 (1%)</td>
<td>NS</td>
</tr>
<tr>
<td>Pulmonary embolus</td>
<td>0</td>
<td>2* (1%)</td>
<td>NS</td>
</tr>
</tbody>
</table>
Standard Surgical Risk Patients
Symptomatic Patients:
The EVA 3S trial

CAS Arm:
- 39% treated by physicians in-training
- 1.8 patients per center per year
- No pre-dilatation: 83%
- No distal protection: 8%
- No pre-procedure dual antiplatelet therapy 17%

## Standard Surgical Risk Patients

Symptomatic Patients:
The EVA 3S trial

<table>
<thead>
<tr>
<th>Outcome Event</th>
<th>Endarterectomy (N=259)</th>
<th>Stenting (N=261)</th>
<th>Unadjusted Relative Risk (95% CI)</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonfatal stroke</td>
<td>7 (2.7)†</td>
<td>23 (8.8)‡</td>
<td>3.3 (1.4–7.5)</td>
<td>0.004</td>
</tr>
<tr>
<td>Symptoms lasting 7 days or more</td>
<td>6 (2.3)</td>
<td>20 (7.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nondisabling</td>
<td>6 (2.3)</td>
<td>16 (6.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Disabling§</td>
<td>1 (0.4)</td>
<td>7 (2.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Death</td>
<td>3 (1.2)</td>
<td>2 (0.8)</td>
<td>0.7 (0.1–3.9)</td>
<td>0.68</td>
</tr>
<tr>
<td>Fatal stroke</td>
<td>2 (0.8)†</td>
<td>1 (0.4)‡</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other cause</td>
<td>1 (0.4)¶</td>
<td>1 (0.4)¶</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any stroke or death</td>
<td>10 (3.9)</td>
<td>25 (9.6)</td>
<td>2.5 (1.2–5.1)</td>
<td>0.01</td>
</tr>
<tr>
<td>Any disabling stroke or death</td>
<td>4 (1.5)</td>
<td>9 (3.4)</td>
<td>2.2 (0.7–7.2)</td>
<td>0.26</td>
</tr>
</tbody>
</table>

The EVA 3S trial

- The EVA 3S investigators concluded that CEA is safer and more effective than CAS, but they also concluded that:
  - Operator experience with CAS does not matter!
  - Cerebral protection with CAS is not important!
  - Dual antiplatelet therapy prior to and after CAS is not important!

*Does that make sense?*
Standard Surgical Risk Patients
Symptomatic Patients: The ICSS trial

## Standard Surgical Risk Patients

**Symptomatic Patients:**

The ICSS trial

<table>
<thead>
<tr>
<th></th>
<th>Stenting group (n=828)</th>
<th>Endarterectomy group (n=821)</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time from randomisation to treatment (days)</strong></td>
<td>9 (5-17)</td>
<td>11 (5-24)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>≤14</td>
<td>578 (70%)</td>
<td>469 (57%)</td>
<td>..</td>
</tr>
<tr>
<td>&gt;14</td>
<td>250 (30%)</td>
<td>352 (43%)</td>
<td>..</td>
</tr>
<tr>
<td><strong>Time from most recent event to treatment (days)</strong></td>
<td>35 (15-82)</td>
<td>40 (18-87)</td>
<td>0.013</td>
</tr>
<tr>
<td>≤14</td>
<td>205 (25%)</td>
<td>151 (18%)</td>
<td>..</td>
</tr>
<tr>
<td>&gt;14</td>
<td>623 (75%)</td>
<td>668 (81%)</td>
<td>..</td>
</tr>
</tbody>
</table>

Data are number (%) or median (IQR) in the per-protocol analysis. Three patients in the endarterectomy group were randomised more than 12 months after onset of symptoms. The date of the most recent event was unknown in two patients (endarterectomy group). *Mann-Whitney U test.

**Table 2:** Time from randomisation and from most recent ipsilateral event to allocated treatment
Standard Surgical Risk Patients
Symptomatic Patients:
The ICSS trial

<table>
<thead>
<tr>
<th>Event</th>
<th>Stenting group (n=853)</th>
<th>Endarterectomy group (n=857)</th>
<th>Hazard ratio (95% CI)</th>
<th>Risk difference, % (95% CI)</th>
<th>p value*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke, death or procedural myocardial infarction</td>
<td>72 (8.5%)</td>
<td>44 (5.2%)</td>
<td>1.69 (1.16 to 2.45)</td>
<td>3.3% (0.9 to 5.7)</td>
<td>0.006</td>
</tr>
<tr>
<td>Any stroke</td>
<td>65 (7.7%)</td>
<td>35 (4.1%)</td>
<td>1.92 (1.27 to 2.89)</td>
<td>3.5% (1.3 to 5.8)</td>
<td>0.002</td>
</tr>
<tr>
<td>Any stroke or death</td>
<td>72 (8.5%)</td>
<td>40 (4.7%)</td>
<td>1.86 (1.26 to 2.74)</td>
<td>3.8% (1.4 to 6.1)</td>
<td>0.001</td>
</tr>
<tr>
<td>Any stroke or procedural death</td>
<td>68 (8.0%)</td>
<td>36 (4.2%)</td>
<td>1.95 (1.30 to 2.92)</td>
<td>3.8% (1.5 to 6.0)</td>
<td>0.001</td>
</tr>
<tr>
<td>Disabling stroke or death</td>
<td>34 (4.0%)</td>
<td>27 (3.2%)</td>
<td>1.28 (0.77 to 2.11)</td>
<td>0.8% (0.0 to 2.6)</td>
<td>0.34</td>
</tr>
<tr>
<td>All-cause death</td>
<td>19 (2.3%)</td>
<td>7 (0.8%)</td>
<td>2.76 (1.16 to 6.56)</td>
<td>1.4% (0.3 to 2.6)</td>
<td>0.017</td>
</tr>
</tbody>
</table>

Data are number of first events (Kaplan-Meier estimate at 120 days). Risk differences are calculated from Kaplan-Meier estimates at 120 days. *Log-rank test.

**Table 3**: Outcome measures within 120 days of randomisation (intention-to-treat population)
<table>
<thead>
<tr>
<th>Event Description</th>
<th>Stenting group (n=853)</th>
<th>Endarterectomy group (n=857)</th>
<th>Per-protocol analysis (events between 0 days and 30 days after treatment)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Stenting group (n=828)</td>
</tr>
<tr>
<td>Any stroke</td>
<td>65†</td>
<td>35</td>
<td>58†</td>
</tr>
<tr>
<td>Ipsilateral stroke</td>
<td>58</td>
<td>30</td>
<td>52</td>
</tr>
<tr>
<td>Ischaemic stroke</td>
<td>63</td>
<td>28</td>
<td>56</td>
</tr>
<tr>
<td>Haemorrhagic stroke</td>
<td>3</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Uncertain cause</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Non-disabling stroke</td>
<td>39</td>
<td>14</td>
<td>36</td>
</tr>
<tr>
<td>Lasting fewer than 7 days</td>
<td>9†</td>
<td>5†</td>
<td>8†</td>
</tr>
<tr>
<td>Lasting more than 7 days</td>
<td>31</td>
<td>9</td>
<td>29</td>
</tr>
<tr>
<td><strong>Disabling stroke</strong></td>
<td><strong>175</strong></td>
<td><strong>20</strong></td>
<td><strong>14</strong></td>
</tr>
<tr>
<td>Fatal stroke</td>
<td>9</td>
<td>2</td>
<td>8</td>
</tr>
<tr>
<td>Procedural myocardial infarction</td>
<td>3</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Non-fatal myocardial infarction</td>
<td>0</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td><strong>Fatal myocardial infarction</strong></td>
<td><strong>3</strong></td>
<td><strong>0</strong></td>
<td><strong>3</strong></td>
</tr>
<tr>
<td>Death unrelated to stroke or myocardial infarction</td>
<td>7</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Cranial nerve palsy</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Disabling cranial nerve palsy</strong></td>
<td>**1</td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>Haematoma</td>
<td>31</td>
<td>50</td>
<td>30</td>
</tr>
<tr>
<td><strong>Severe haematoma</strong></td>
<td><strong>9</strong></td>
<td><strong>28</strong></td>
<td><strong>8</strong></td>
</tr>
</tbody>
</table>
Standard Surgical Risk Patients

Symptomatic Patients: The ICSS trial
What is the primary endpoint?

• The 3-year rate of fatal or disabling stroke in any territory
The ICSS trial
Operator Qualifications

– Surgeon: 50 CEA

– Interventionalist: 50 stenting procedures (can be coronary or peripheral, with at least ten cases in the carotid artery).

• Centers that did not fulfill these criteria joined as supervised centers and their trial procedures had to be proctored by an outside surgeon or interventionist until the proctor was satisfied that the centre was proficient in undertaking the procedure.
The ICSS trial
Impact of Operator Qualifications on Outcome

During the trial, two sites were suspended. All the patients allocated to CAS (n=11, five with disabling stroke or death) or CEA during the same time period (n=9, one with fatal stroke) at these centers were included in the analyses.

In the CAS arm, 64 pts (8%) had their procedure aborted before the insertion of a stent:
- 38 due to difficulty gaining access to the stenosis
- 15 due to the finding of an occluded artery
- 7 due to a stenosis <50%
- 1 due to a fatal stroke
- 1 due to fatal myocardial infarction
- 2 due to other medical complications

In the CEA arm, only 2 pts (0.2%) had their procedure aborted due to allergy to anesthesia (1) or general distress (1).
The ICSS trial
Use of Embolic Protection Devices

- Embolic protection devices (EPDs)
  - The protocol recommended that EPDs should be used whenever the local investigator thought that one could be used safely, but this was not mandatory.
  - EPDs were not used in 28%
  - No proximal EPDs were used
The ICSS investigators concluded that CEA is safer and more effective than CAS (not based on the primary endpoint), but they also concluded that:

- Operator experience with CAS does not matter!
- Cerebral protection with CAS is not important!
Standard Surgical Risk Patients
Symptomatic Patients:
The SPACE trial

-Trial stopped prematurely due to lack of funding
-EPD use 29%
Standard Surgical Risk Patients

Symptomatic Patients: The SPACE trial

Standard Surgical Risk Patients

Symptomatic Patients: The SPACE trial

<table>
<thead>
<tr>
<th></th>
<th>Number (%)</th>
<th>Absolute difference&lt;sup&gt;+&lt;/sup&gt;</th>
<th>Odds-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CAS</td>
<td>CEA</td>
<td>CAS-CEA (90% CI)</td>
</tr>
<tr>
<td>Age ≤75 years</td>
<td>29/490 (5.92%)</td>
<td>26/438 (5.94%)</td>
<td>-0.02 (-2.65 to 2.56)</td>
</tr>
<tr>
<td>Age &gt;75 years</td>
<td>12/109 (11.01%)</td>
<td>11/146 (7.53%)</td>
<td>3.48 (-2.82 to 10.1)†</td>
</tr>
<tr>
<td>Male</td>
<td>28/431 (6.50%)</td>
<td>27/418 (6.46%)</td>
<td>0.04 (-2.80 to 2.86)</td>
</tr>
<tr>
<td>Female</td>
<td>13/168 (7.74%)</td>
<td>10/166 (6.02%)</td>
<td>1.71 (-3.03 to 6.53)†</td>
</tr>
</tbody>
</table>
The CREST trial

- Prospective, multicenter, randomized, controlled trial with blinded endpoint adjudication

- Comparing CEA and CAS in 2502 patients with symptomatic and asymptomatic stenosis

- 108 US and 9 Canadian sites

- Team included neurologist, interventionalist, surgeon, and research coordinator at each institution
The CREST trial
Primary Endpoint

- Peri-procedural
  - A composite of: any clinical stroke, myocardial infarction, death
- Post-procedure
  - Ipsilateral stroke up to 4 years
The CREST trial
Major Eligibility Criteria

• Symptomatic
  – ≥50% by angiography
  – ≥70% by ultrasound or
  – >70% by MRA/CTA if ultrasound is 50-69%

• Asymptomatic
  – ≥60% by angiography
  – ≥70% by ultrasound or
  – >80% by MRA/CTA if ultrasound is 50-69%
### The CREST trial

**Primary Endpoint**

<table>
<thead>
<tr>
<th>CAS vs. CEA</th>
<th>Hazard Ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.2% vs. 6.8%</td>
<td>HR=1.11</td>
<td>0.81-1.51</td>
<td>0.51</td>
</tr>
</tbody>
</table>
The CREST trial
Interaction with Primary Endpoint

• No effect detected for symptomatic status and sex

• Interaction suggested for age
# The CREST trial

## Primary Endpoint

<table>
<thead>
<tr>
<th></th>
<th>CAS vs. CEA</th>
<th>Hazard Ratio</th>
<th>95% CI</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Stroke</td>
<td>4.1% vs. 2.3%</td>
<td>HR=1.79</td>
<td>1.14-2.82</td>
<td>0.01</td>
</tr>
<tr>
<td>Major Stroke</td>
<td>0.9% vs. 0.7%</td>
<td>HR=1.35</td>
<td>0.54-3.36</td>
<td>0.52</td>
</tr>
<tr>
<td>MI</td>
<td>1.1% vs. 2.3%</td>
<td>HR=0.50</td>
<td>0.26-0.94</td>
<td>0.03</td>
</tr>
<tr>
<td>Cranial nerve palsey</td>
<td>0.3% vs. 4.8%</td>
<td>HR=0.07</td>
<td>0.02-0.18</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
CAS in Symptomatic Patients
What did we learn from clinical trials?

- EVA 3-S and ICSS
  - Inexperienced operators should not perform CAS in symptomatic patients with or without EPDs

- SPACE and CREST
  - CAS is a reasonable alternative to CEA in symptomatic patients when performed by reasonably experienced hands
Patient and Anatomic Selection Criteria
to Maximize Success and Avoid Complications
Who is at High Risk for CAS?

- Patient risk profiling for CAS is a crucial step to optimize success. However, patient selection should be done in the context of the following:
  - Patient-based risk
    - Clinical (age, symptom status, renal insufficiency)
    - Anatomic complexity
  - Operator-based risk
    - Experience
  - Access to devices
    - Stent design and embolic protection method
Who is at High Risk for CAS?
Impact of Age and Symptom Status

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Gray W. for the The CAPTURE Registry Investigators. CCI. 2007;70:1025–1033
Who is at High Risk for CAS?

Impact of CRI

Who is at High Risk for CAS?

Impact of CRI

• Measures to reduce morbidity in these patients:
  – Pre-procedure MRA to define anatomy and the potential working views, thereby reducing intra procedural iodinated contrast volume
  – Pre-procedure intravenous hydration and renal protective pharmacotherapy
  – Dilution of iodinated contrast with saline
Who is at High Risk for CAS?

Impact of Clinical Risk Factors

• The clinical indicators of increased procedural risk with CAS (age, symptoms, and renal insufficiency) are also indicators of increased risk of stroke / death with medical therapy and CEA.

• Therefore, none of these risk factors should be used alone as a reason to deny patients access to CAS

• The weight of clinical risk factors should be judged in the context of:
  – Concomitant anatomic complexity
  – Operator experience
Anatomic-Based Risk

- Difficult access to the common carotid artery:
  - Type III aortic arch +/- atherosclerotic disease
  - Common carotid artery disease
  - Common carotid artery tortousity
  - Arm access

- Lesion site complexity:
  - Severe proximal or distal kinks
  - Heavy calcifications, particularly when combined with tortuous origin of ICA
  - Thrombus
  - “String” sign
Who is at High Risk for CAS?
Aortic Arch Complexity
Who is at High Risk for CAS?
Common Carotid Artery Disease
Who is at High Risk for CAS?
Common Carotid Artery Tortuosity
Who is at High Risk for CAS?
Common Carotid Artery Tortuosity
- 74 yr. old asymptomatic patient.
- 90% RICA stenosis after CEA
- Aortic occlusion
Who is at High Risk for CAS?
ICA kinks / CCA disease / ECA disease

- 81 yr. old male with unstable angina and l-sided TIA:
  - 3 vessel CAD
  - 80% RICA stenosis with involvement of the CCA and ECA
  - Severe ICA tortousity
Who is at High Risk for CAS?
ICA Calcification / Tortousity
Who is at High Risk for CAS?

ICA Thrombus
What Is the String Sign?
Complications with CAS
Impact of Device Selection

I. Stent design
   A. The debate of the impact of open vs. closed cell design outcome is worthwhile but the jury is still out.

II. Type of EPD
   A. Although there are definite differences in the technical performance of EPDs it is unlikely that there is difference in outcome.
   B. Proximal protection devices have the potential to enhance procedural safety in certain clinical and anatomic patient subsets.
Complications with CAS
Role of the operator
Summary

- Patient risk profiling for CAS should be done in the context of overall patient condition and operator experience.

- None of the high risk elements is a contraindication for CAS on its own. However, as a rule of thumb the higher number of factors the higher the risk.

- The benefit to risk ratio can be optimized by:
  - Adhering to compelling indications to perform the procedure.
  - Pre-procedure imaging (CTA – MRA) to optimize patient selection.
  - Thoughtful procedural planning and execution.