Long-Term Results of CEA
Patch versus Eversion

Ash Mansour, M.D., RPVI, FACS
Professor of Surgery

Endarterectomy History

- Oct. 1951: Carrea et al
- Jan. 1953: Strully et al
- Aug.1953: DeBakey
- May 1954: Eastcott et al
- Jul. 1954: Denman et al
- Dec.1955: Lin et al

Fact #1

- Carotid endarterectomy is better than BMT
- Carotid endarterectomy is equivalent to carotid stenting in stroke, MI and death
- CREST-2 trial underway

Cas vs. CEA Hazard Ratio 95% CI

<table>
<thead>
<tr>
<th>Event</th>
<th>CAS (%)</th>
<th>CEA (%)</th>
<th>HR</th>
<th>95% CI</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>4.1 vs. 2.3%</td>
<td>HR = 1.79; 95% CI: 1.14-2.82</td>
<td>0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MI</td>
<td>1.1 vs. 2.3%</td>
<td>HR = 0.50; 95% CI: 0.26-0.94</td>
<td>0.03</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Disclosures

- None

Carotid Endarterectomy

Technique

- Early results:
  - Stroke
  - Mortality
  - Cranial nerve injury
- Late results:
  - Recurrent stenosis
  - Stroke
**EVERest trial**

Eversion versus conventional carotid endarterectomy: Late results of a prospective multicenter randomized trial

Pasquale Car, MD; Giuseppe Ciupini, MD; Paolo De Carlo, MD; Stefano Zampieri, MD; Roberto Chiara, MD; Giuseppina Copi, MD; Dominico Pomati, MD; Filippo Polistri, MD; Carlo Speroni, MD; Vincenzo Stea, MD; Ernesto Noviello, MD; and Collaborators of the EVERest Study Group. Peripheral Vascular Society: Beta.

*J Vasc Surg 2000; 31:19*

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**EVERest Trial**

Eversion 678 1353
Standard

Pim C 675 419
Patch

Recurrent stenosis 2.8% 7.9% 1.5%

*J Vasc Surg 2000; 31:19*

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**Ann Surg 2000; 232:119**

A Prospective Randomized Study on Bilateral Carotid Endarterectomy: Patching Versus Eversion

Enzo Ballota, MD; Laura Rizzoli, MD; Giuseppe De Giuse, MD; Antonio Torri, MD; Claudio Barroschi, MD; Pietro Albironzoni, MD; Mario Sadori, MD; and Patrigna Musciarri, MD.

From the "Division of Vascular Surgery and the Vascular Medical Clinic of the Department of Medical and Surgical Sciences, and the Department of Neurosurgical and Psychiatric Sciences, University of Padua, School of Medicine, Padua, Italy."

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**Patch versus Eversion**

*Ballota et al.*

<table>
<thead>
<tr>
<th></th>
<th>Patch</th>
<th>Eversion</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time</td>
<td>53</td>
<td>31</td>
<td>0.01</td>
</tr>
<tr>
<td>Shunt use</td>
<td>39%</td>
<td>1%</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Bleeding</td>
<td>15%</td>
<td>2.8%</td>
<td>0.05</td>
</tr>
<tr>
<td>Restenosis</td>
<td>4.7%</td>
<td>0</td>
<td>0.02</td>
</tr>
<tr>
<td>Occlusion</td>
<td>7%</td>
<td>1.2%</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*Ann Surg 2000; 232:119*

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**Eversion versus Conventional**

Table 6: Summary of Most Frequently Quoted Randomized Control Trials Comparing Eversion Carotid Endarterectomy with Conventional Carotid Endarterectomy

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>Stroke/Mortality at 30 Days (%)</th>
<th>Restenosis (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>1997</td>
<td>0.7/1 2</td>
<td>2.2/6.9</td>
</tr>
<tr>
<td>Everest</td>
<td>1998</td>
<td>1.3/1.3</td>
<td>2.4/4.1</td>
</tr>
<tr>
<td>Ballota</td>
<td>1999</td>
<td>0/2.9</td>
<td>0/4.9</td>
</tr>
</tbody>
</table>
Results of Eversion
- Similar stroke, MI and death rates
- Faster
- Fewer hematomas
- No foreign body
- Similar or better recurrent stenosis

Redundant carotids
- Shortening
- No patch
- Faster

Fact #2
- Patching is required to decrease restenosis
- Women and small arteries more prone
- Eversion is better than primary closure
- Eversion is equivalent to patching in early results

Real World?
A comparison of results with eversion versus conventional carotid endarterectomy from the Vascular Quality Initiative and the Mid-America Vascular Study Group

Stroke, complications, long-term survival: no difference
Recurrent stenosis @ 2 years: 11.2% vs. 5.7%

Spectrum Health Grand Rapids
Recurrent Stenosis by Duplex

<table>
<thead>
<tr>
<th>RESTENOSIS</th>
<th>EVERSION 177</th>
<th>CONVENTIONAL 453</th>
</tr>
</thead>
<tbody>
<tr>
<td>One year</td>
<td>10</td>
<td>11</td>
</tr>
<tr>
<td>Follow-up</td>
<td>14 (7.9%)</td>
<td>23 (5.1%)</td>
</tr>
<tr>
<td>40 months</td>
<td>2 (1.1%)</td>
<td>9 (1.98%)</td>
</tr>
<tr>
<td>Reoperation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SUMMARY
- Carotid endarterectomy with eversion is a good operation
- Recurrent stenosis is not a problem
- Eversion should be chosen with redundant carotids
- Learning curve
How do you define restenosis?

<table>
<thead>
<tr>
<th>Study</th>
<th>Year</th>
<th>n</th>
<th>Mortality at 30 Days (%)</th>
<th>Restenosis (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroobandt et al.</td>
<td>1997</td>
<td>51</td>
<td>Not reported</td>
<td>19, 5, 8%</td>
</tr>
<tr>
<td>Lund</td>
<td>1996</td>
<td>60</td>
<td>9%</td>
<td>29, 5, 1%</td>
</tr>
<tr>
<td>Rosenhek et al.</td>
<td>1995</td>
<td>31</td>
<td>10%</td>
<td>16, 3, 5%</td>
</tr>
<tr>
<td>Moore et al.</td>
<td>1994</td>
<td>86</td>
<td>10%</td>
<td>3, 7%</td>
</tr>
<tr>
<td>Kastrati et al.</td>
<td>1994</td>
<td>91</td>
<td>10%</td>
<td>3, 5%</td>
</tr>
<tr>
<td>Albers et al.</td>
<td>1993</td>
<td>82</td>
<td>10%</td>
<td>4, 0%</td>
</tr>
<tr>
<td>Albers et al.</td>
<td>1992</td>
<td>82</td>
<td>10%</td>
<td>7, 3%</td>
</tr>
</tbody>
</table>

Restenosis rates based on intravascular ultrasound angiography studies showing >50% diameter stenosis, not duplex scanning.

This study comprised 73 patients undergoing femoro-popliteal endarterectomy who had primary closure on one side and ostial or proximal anastomosis without occlusion only reported one restenosis rate.