EVAR-TAVR in Patients with Hostile Anatomies

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Disclosure

Nombre: Oscar A. Mendiz

- Consultant: Medtronic, Astra Zeneca.
- Meeting Sponsorship; Cook, Endologix
EVAR-TEVAR Limitations

Long term EVAR-TEVAR success depends highly upon the proximal aortic neck for effective “seal” at this point to exclude the aneurysms, without Type I endoleak, and device fixation to avoid migration.

Distal fixation zone is also important for these issues.

The following are anatomic limitation for successful procedures:

- Short neck (<15mm, abdominal < 20 Thoracic)
- Neck angulations > 40°
- Presence of mural thrombus in the neck
- Tapering or reverse tapering
- Both iliac compromise.
- Thoracoabdominal aneurysms
- Juxtarenal aneurysms
Limitation for TEVAR

- Short Neck, Left subclavian artery compromise. The most common.
Type B Aortic Dissection: Left Subclavian coverage

Aortic Dissection Compromising the Aortic Arch: Hybrid Approach

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Nº Ptes</th>
<th>30-day Mortality</th>
<th>1-year Survival</th>
<th>Stroke</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bergeron</td>
<td>2006</td>
<td>25</td>
<td>8%</td>
<td>88%</td>
<td>8%</td>
</tr>
<tr>
<td>Melissano</td>
<td>2007</td>
<td>37</td>
<td>11%</td>
<td>86</td>
<td>5.4%</td>
</tr>
<tr>
<td>Czerny</td>
<td>2007</td>
<td>27</td>
<td>7.4%</td>
<td>83%</td>
<td>0</td>
</tr>
<tr>
<td>Bockler</td>
<td>2010</td>
<td>40</td>
<td>7.5%</td>
<td>87.5%</td>
<td>2.5%</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>129</td>
<td>10%</td>
<td>85%</td>
<td>3%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>n=24</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-hospital Mortality</td>
<td>4.2%</td>
</tr>
<tr>
<td>False Lumen Thrombosis</td>
<td>95.6%</td>
</tr>
<tr>
<td>Survival @ 28 months</td>
<td>92.1 ± 8%</td>
</tr>
</tbody>
</table>

Combined Approach: Surgical Debranching
A Percutaneous Technique for Preservation of Arch Branch Patency During Thoracic Endovascular Aortic Repair (TEVAR): Retrograde Catheterization and Stenting

Frank J. Criado, MD
Division of Vascular Surgery and Vascular Intervention, Union Memorial Hospital-MedStar Health, Baltimore, Maryland, USA.

Modified from Criado F. tctmd.com
Endovascular Options: Chimney

Planned treatment:
iliac extension graft stent to allow left subclavian artery patency
Endoprothesis in arch and descending aorta

Endovascular procedure: 13mm x 7.5 cm iliac extension in subclavian artery and 38mm x 20 cm tubular segment in arch and thoracic aorta
Aortic Arch Chimney (Endovascular Debranching)
Aortic Arch Chimney (Endovascular Debranching)

Previous Tyrone David’s surgery +LIMA to LAD
Stent Graft Inside a Previous “Elephant Trump” Graft
Thoraco-Abdominal Aneurysms
TEVAR for Thoraco-abdominal Aneurysms: Abdominal Surgical Debranching
Fenestrated Graft

Thoraco-abdominal aneurysm

Previous surgical AAA repair

Images courtesy of Dr John Anderson (tctmd.com)
Branched Graft

Images courtesy of
Dr John Anderson (modified)
Fenestrated Endografts: Mortality

Meta-analysis: 11 Studies
660 procedures
30-day mortality 2.0%
Fenestrated Endografts: Endoleaks

Target Vessels Patency

Patency @ 5 Years: 93.3±1.9%

Verhoeven et al. EJVES 2010;39:529
Ramificated Stent Graft
Toraco-Abdominal Aneurysm: Snorkel or Periscope Technique
Endovascular Repair of AAA: Anatomic Indications

Case Selection for EVAR: Types of AAA

Endoluminal

Endoluminal
Iliac Aneurysms
Bilateral Iliac Aneurysms: Hybrid Approach
Bilateral Iliac Aneurysms: Hybrid Approach

External-Internal Iliac By-pass
Both Iliac Compromise: Bifurcated Branches
Bilateral Iliac Aneurysms: Bifurcated Branches
Bilateral Iliac Aneurysms:
Bifurcated Iliac Branch & Contralateral Plug Embolization
Bilateral Iliac Aneurysms: Bifurcated Iliac Branch & Contralateral Plug Embolization

Same patient. Control CT scan at 6 months.
Long-term Results of Iliac Aneurysm Repair with Iliac Branched Endograft: 5-Year Experience on 100 Consecutive Cases

100 consecutive patients between 2006 and 2011.

<table>
<thead>
<tr>
<th></th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Periprocedural Technical Success</td>
<td>95</td>
</tr>
<tr>
<td>Mortality</td>
<td>-</td>
</tr>
<tr>
<td>Patency of Internal Iliac branch (5 years)</td>
<td>91.4</td>
</tr>
<tr>
<td>Freedom from any Reintervention (1 year)</td>
<td>90</td>
</tr>
</tbody>
</table>
Endovascular treatment of iliac aneurysm: Concurrent comparison of Side Branch Endograft vs. Hypogastric Exclusion

74 patients. 32 receiving side branch endograft and 42 with hypogastric exclusion.
No intestinal ischemia or deaths occurred.
There were no significant differences in failures of hypogastric side branch deployment (2/32) compared with hypogastric coiling (3/42).
Reintervention rates were similar (5/32 vs. 4/42) at one year.
Buttock claudication & erectile disfunction were more frequent after hypogastric exclusion.

Isolated Iliac Aneurysm Without Proximal Neck: “Sandwich Technique”

Two Parallel Self-expanding Nitinol Stent Grafts
Juxtarenal and hostile Neck AAA


Hallet et al: Comprehensive Vascular and Endovascular Surgery, 2004
Hostile Neck for AAA

Definition: one or more of the following anatomical features.

- Diameter >28 mm
- Angulation >60
- Length <15 mm
- Thrombus
- Flare

Sather P, et al. European J of Vasc and Endovasc Surg 2012;44;556e561
Fenestrated Grafts:

Scallops

Fenestrated body

Main Bifurcated body

Iliac stamp

Fenestrations
Juxtarenal pseudoaneurysms: Fenestrated Graft

Balloon expandable stent

Scallops
Fenestrated Graft
Fenestrated Graft

Renal stenting with balloon expandable stent
Fenestrated Endovascular Grafting: The French Multicentre Experience

134 patients from 16 French centers Between 2004 & 2009.

30-day mortality rate 2%

Conversion to open surgery 1%

A total of 12 procedure-related reinterventions were performed during the follow up of 15 months.
Cardiovascular Surgery

Early Results of Fenestrated Endovascular Repair of Juxtarenal Aortic Aneurysms in the United Kingdom

- 318 Ptes. from 14 centers (2007-2012)

![Graph showing early results of fenestrated endovascular repair](image)

- Technical Success: 99%
- Periop. Mortality: 4.1%
- Target Vessel Lost: 0.6%
- Early Reinterven. (<30-day): 7.1%
Early Results of Fenestrated Endovascular Repair of Juxtarenal Aortic Aneurysms in the United Kingdom

On behalf of the British Society for Endovascular Therapy and the Global Collaborators on Advanced Stent-Graft Techniques for Aneurysm Repair (GLOBALSTAR) Registry

Survival

Survival Without Reintervention

Freedom from Stent Distortion

1-year Freedom from Reintervention 90%
This could be the final result of the absence of neck if you have the money to pay, the skills to implant the device and the time to wait for the prosthesis.
EVAR in Short Neck AAA: Chimney Technique
If you have no money or time, there is the chimney technique
The chimney graft technique for preserving visceral vessels during endovascular treatment of aortic pathologies

<table>
<thead>
<tr>
<th></th>
<th>n=93 Ptes (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urgent Procedures (symptomatic or ruptured)</td>
<td>23 (24)</td>
</tr>
<tr>
<td>Primary Technical Success</td>
<td>93 (100)</td>
</tr>
<tr>
<td>Type I Endoloek</td>
<td>10 (10.7)</td>
</tr>
<tr>
<td>30-day Mortality</td>
<td>4 (4.3)</td>
</tr>
</tbody>
</table>
This could be a cheaper and faster final result of the absence of neck.

But remember that you still need skills.
Chimney Technique:
AAA without proximal neck
Fenestrated Graft: Long term complication

Renal Stent Graft Disconnection

Renal stent disconnection
Fenestrated Graft: Long term complication

Renal Stent Graft Disconnection:

Stent graft re-connection
Fenestrated Graft: Long term complication

- Renal Stent Graft Disconnection:

  - Stent graft re-connection

  - Aneurysms!
Fenestrated Graft: Long term complication

- Renal Stent Graft Disconnection:

  Stent graft re-connection
Importance of Oversizing

11% Oversizing
30% oversizing the ideal
40% Oversizing = infolding
Chimney Drawback: 1-year Stent Occlusion
Comparison of outcomes with open, fenestrated, and chimney graft repair of juxtarenal aneurysms: are we ready for a paradigm shift?

2750 patients with juxtarenal aneurysms from 25 studies between 2001 & 2012

<table>
<thead>
<tr>
<th></th>
<th>Open Surgery (n=1725)</th>
<th>f-EVAR (n=931)</th>
<th>Chimney-EVAR (n=94)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-day Mortality (%)</td>
<td>5.3</td>
<td>3.4</td>
<td>2.4</td>
<td>ns</td>
</tr>
<tr>
<td>Target Vessel Preservation (%)</td>
<td></td>
<td>98.6</td>
<td>98</td>
<td>ns</td>
</tr>
<tr>
<td>Type I Endoleak (%)</td>
<td></td>
<td>4.3*</td>
<td>10*</td>
<td>0.002</td>
</tr>
<tr>
<td>Stroke (%)</td>
<td>0.1*</td>
<td>0.3</td>
<td>3.2*</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>New Onset Dialysis (%)</td>
<td>3.9*</td>
<td>1.5*</td>
<td>2.1</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>
**EVAR for AAA in Ptes with Hostile Neck Anatomy**

<table>
<thead>
<tr>
<th>Special / Additional procedure intra index procedure</th>
<th>FAVOURABLE NECK (n=296)</th>
<th>HOSTILE NECK (n=139)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unplanned Balloon Expandable Stent, Aortic Cuff or Stent Graft</td>
<td>25 (8.4%)</td>
<td>35 (25.1%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Chimney technique for both renal arteries</td>
<td>0</td>
<td>9 (6.5%)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Chimney technique for the lower renal artery</td>
<td>0</td>
<td>2 (1.5%)</td>
<td>0.19</td>
</tr>
<tr>
<td>Fenestrated EVAR</td>
<td>0</td>
<td>3 (2.3%)</td>
<td>0.064</td>
</tr>
<tr>
<td>Total</td>
<td>25 (8.4%)</td>
<td>49 (35.2%)</td>
<td>&lt;0.0001</td>
</tr>
</tbody>
</table>

35% of Ptes with Hostile Neck required additional o dedicated procedures/devices

Mendiz O, et al. Submitted
**Chimney: Pros**

- **PROS:**
  - Great for bail-out & rescue
  - Availability (time)
  - Suitable for most cases
  - Cost advantage??
  - Better than expected

- **CONS:**
  - Sealing (type I endoleak ~10%)
  - Still Complex
  - Mechanical problems (stent collapse)
  - Uncertain long-term durability
  - Lack of strong evidence

Modified from Criado F. tctmd.com
### EVAR in Ptes with Hostile Neck Anatomy

#### Analysis of outcomes for hostile and favourable necks

<table>
<thead>
<tr>
<th>Outcomes</th>
<th>Favourable Neck n=296</th>
<th>Hostile Neck n=139</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>30-day Outcomes</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Success</td>
<td>292 (98.6)</td>
<td>136 (97.8)</td>
<td>0.83</td>
</tr>
<tr>
<td>30-day mortality</td>
<td>3 (1.01)</td>
<td>3 (2.1)</td>
<td>0.6</td>
</tr>
<tr>
<td>Type I Endoleak</td>
<td>4 (1.3)</td>
<td>6 (4.3)</td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Follow-Up</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall Mortality</td>
<td>13 (4.3)</td>
<td>3 (2.1)</td>
<td>0.37</td>
</tr>
<tr>
<td>AAA related mortality</td>
<td>4 (1.3)</td>
<td>0</td>
<td>0.56</td>
</tr>
<tr>
<td>Type 1 endoleak</td>
<td>9 (3.04)</td>
<td>10 (7.1)</td>
<td>0.076</td>
</tr>
<tr>
<td>Type 2 endoleak</td>
<td>25 (8.44)</td>
<td>9 (6.47)</td>
<td>0.6</td>
</tr>
<tr>
<td>Type 3 endoleak</td>
<td>3 (1.01)</td>
<td>1 (0.71)</td>
<td>0.81</td>
</tr>
<tr>
<td>Migration</td>
<td>2 (0.67)</td>
<td>1 (0.71)</td>
<td>0.56</td>
</tr>
<tr>
<td>Reintervention</td>
<td>16 (5.4)</td>
<td>15 (10.79)</td>
<td>0.066</td>
</tr>
</tbody>
</table>

Mendiz O, et al. Submitted
Conclusions

- Fenestrated/branched/bifurcated grafts offer the promise of extending benefit of endovascular therapy for Ptes with aortic aneurisms & hostile anatomy.
- Fenestrated and bifurcated grafts are a potential but expensive solution.
- Long time for manufacturing is a limitation for fenestrated & Branched Devices.
- However, with time, money and skill they have good short and mid-term outcomes.
- Chimney and other similar techniques can be a cheaper and faster solution, which seems to have acceptable outcomes.
- All these techniques need further investigation.
Gracias por su Atención
Thank you for your Attention