ChEVAR in practice – clinical application and techniques for success  M. Lachat
Disclosure

- Speaker name: Mario Louis LACHAT
- No COI
Collected World Experience About the Performance of the Snorkel/Chimney Endovascular Technique in the Treatment of Complex Aortic Pathologies

The PERICLES Registry

Konstantinos P. Donas, MD,‡ Jason T. Lee, MD,‡ Mario Lachat, MD,‡ Giovanna and Frank J. Veith, MD,§ on behalf of the PERICLES investigators

PAPERS OF THE 135TH ASA ANNUAL MEETING

The PROTAGORAS study to evaluate the performance of the Endurent stent graft for pararenal pathologic processes treated by chimney/snorkel endovascular technique

Konstantinos P. Donas, MD,‡ Giovanni B. Tursello, MD,‡ Claudia Pacoli, MD,‡ Georges A. Plinoukas, MD,‡‡ Giovanni Pedonecchi Tursello, MD,‡ Theranoskis Rivas, MD,‡‡ Martino Attazzano, MD,‡‡ and Daniele Gasparrini, MD,§ Ministry, Germany "Eulogy, Daily and J. Grance

Objective: The chimney/snorkel endovascular aortic repair (c/EVAR) is gaining ever greater acceptance in the treatment of pararenal pathologic processes. However, the published experience includes mainly short-term clinical results of several abdominal devices and types of chimney grafts. The aim of this study was the evaluation of the Endurent stent graft (Medtronic, Santa Rosa, CA) as a standardized abdominal device for c/EVAR. Methods: Between January 2009 and January 2012, prospectively collected data of high-risk patients with pararenal pathologic processes who underwent c/EVAR with placement of the Endurent abdominal device were analyzed. Results: Of the 124 follow-up cases, a technical success of 95.2% was observed, and no secondary interventions were needed. Conclusions: These data may suggest a promising role for the Endurent stent graft in c/EVAR procedures.

Mid- and Long-term Follow-up of chimney and/or Percutaneous Grafts and Risk Factors for Failure


Objective: The aim was to report on chimney and percutaneous grafts (CPG) and their mid and long-term outcomes when they were used to manage extra-anatomical arteries (EAA) in endovascular repair of pararenal (PRAA) or thoraco-abdominal aortic aneurysm (TAAA). Results: A total of 124 patients (mean age 74.5 ± 11 years) were included. In the PRAA group, 79 patients were treated with 25 (15% of 25) PRAA recipients, and 84 (170) TAAA recipients. In addition, factors associated with CPG failure are presented. Conclusions: Mid- and long-term results were generally good. However, endoleak, migration of the CPG, and secondary interventions were noted in 11% of cases

WHAT THIS PAPER ADDS

Long-term follow-up of chimney and percutaneous grafts for the treatment of pararenal and thoraco-abdominal aortic aneurysm is presented. This approach using off the shelf devices has been increasingly reported in recent years and with good results even in emergent settings. This risk factors analysis showed that inadequate branch graft length and chimney and percutaneous use in small and dissected target arteries contribute to late failure of this technique.

References

### Short-term results

<table>
<thead>
<tr>
<th></th>
<th>PG-EVAR</th>
<th>F/BEVAR</th>
<th>Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Renal failure</td>
<td>0-12.9%</td>
<td>7-22%</td>
<td>18-22%</td>
</tr>
<tr>
<td>ICU stay</td>
<td>2</td>
<td>2-4</td>
<td>4-5</td>
</tr>
<tr>
<td>Hospital stay</td>
<td>10</td>
<td>8-13</td>
<td>11-16</td>
</tr>
<tr>
<td><strong>Paraplegia</strong></td>
<td>2</td>
<td>0-31%</td>
<td>6</td>
</tr>
<tr>
<td>Stroke</td>
<td>0-3</td>
<td>0</td>
<td>3</td>
</tr>
</tbody>
</table>

### Long-term results

<table>
<thead>
<tr>
<th></th>
<th>PG-EVAR</th>
<th>F/BEVAR</th>
<th>Surgery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branch patency</td>
<td>96% (5-years)</td>
<td>90-99%</td>
<td>85-100%</td>
</tr>
<tr>
<td>Endoleak I/III</td>
<td>5%</td>
<td>0-5%</td>
<td>-</td>
</tr>
<tr>
<td>Stentgraft migration</td>
<td>0</td>
<td>0-1%</td>
<td>-</td>
</tr>
<tr>
<td><strong>Redos</strong></td>
<td>28%</td>
<td>15-25%</td>
<td>5-8%</td>
</tr>
</tbody>
</table>

Considering similar 30-day mortality rates!
## Aortic aneurysm type

<table>
<thead>
<tr>
<th>Type</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pararenal</td>
<td>69</td>
</tr>
<tr>
<td>Juxtarenal</td>
<td>44</td>
</tr>
<tr>
<td>Suprarenal</td>
<td>25</td>
</tr>
<tr>
<td>Thoracoabdominal</td>
<td>31</td>
</tr>
<tr>
<td>Crawford I</td>
<td>7</td>
</tr>
<tr>
<td>Crawford II</td>
<td>4</td>
</tr>
<tr>
<td>Crawford II</td>
<td>3</td>
</tr>
<tr>
<td>Crawford IV</td>
<td>9</td>
</tr>
<tr>
<td>Arch to Visceral</td>
<td>8</td>
</tr>
</tbody>
</table>

100 Ch-EVAR @ USZ

78%
Results

• Mean FUP 41 months (median 39; r 0-121)
  – > 5 years: 20 cases
  – > 3-5 years: 37 cases

• Aneurysm shrinkage about 15%
  – From 72mm to 61mm (P<.001)
Freedom from occlusion Functions

<table>
<thead>
<tr>
<th>months</th>
<th>0</th>
<th>30</th>
<th>60</th>
<th>90</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary patency</td>
<td>224</td>
<td>137</td>
<td>32</td>
<td>1</td>
</tr>
<tr>
<td>Secondary Patency</td>
<td>224</td>
<td>139</td>
<td>32</td>
<td>1</td>
</tr>
</tbody>
</table>
CP-EVAR Reinterventions (31)

• Early (30-day)
  – Endoleak (4)
  – CPG thrombosis (3)

• Follow-up
  – Endoleak (13)
  – CPG stenosis/thrombosis (11)
Material – Aorta/Branches
The Best Conditions for Parallel Stenting During EVAR: An In Vitro Study


WHAT THIS PAPER ADDS?
- Juxtarenal abdominal aortic aneurysms can be treated with conversion to the stent graft.
- This is the first study describing which is the best endograft oversizing during stent compression, and low risk of endograft infolding: 30% or less.
- It is also the first study describing different endografts parallelly used devices (Excluder and Endurant endografts), Viabahn, avoiding the combination of self-expanding stents (Viabahn) compression.

ARTICLE INFO
Article history: Received 12 June 2012 Accepted 21 August 2012 Available online 26 September 2012

Medi keywords: Aortic aneurysm, Abdominal Renal artery Endovascular procedures/methods Vascular surgical procedures/ instrumentation Stents Models, Cardiovascular

ABSTRACT
Objectives: The aim of this study was to determine which type of aortic aneurysmal neck with endograft Methods: In-vivo silicon models were constructed. Two different endografts: Excluder abdominal aortic and expanding Gore Viabahn Endgraft were tested, applying the kissing-balloon technique and computed tomography (CT). The size of the results in patients parallel-stent compression and main stent-graft infolding were recorded.

Results: Increasing oversizes 35%, 30%, and 40% significantly decreased gutters (115.6, 6.2, 4.3 mm², P < 0.001); nevertheless, main endograft infolding of most 40%-oversized stents was detected, particularly with Excluder devices. Lower stent compression, but wider gutters, were observed with the Excluder when compared to Endurant stent-grafts, and with Viabahn parallel stents. The Endurant: Viabahn combination resulted in maximum stent compression (35%).

Conclusions: Better endograft stent apposition was achieved when using 30% endograft oversizing. Lower stent compression, but wider gutters, were observed with the Excluder stent-graft and Viabahn parallel stent, achieving maximum stent compression with the Endurant: Viabahn combination.

Figure 4. A) Over-oversizing (40%) was related to endograft infolding (Excluder–Viabahn combination in this picture). B) Viabahn balloon-expandable stents showed higher compression resistance than C) Viabahn self-expanding stents (in these two examples, in combination with Endurant endografts).

✓ Medtronic & Advanta
✓ Gore Excluder/TAG & Viabahn
Use of covered chimney stents for pararenal aortic pathologies is safe and feasible with excellent patency and low incidence of endoleaks

Konstantinos P. Donas, MD, Felice Pecoraro, MD, Giovanni Torsello, MD, Mario Lachat, MD, Martin Austermann, MD, Dieter Mayer, MD, Giuseppe Panuccio, MD, and Zoran Rancic, MD, Münster, Germany; and Zurich, Switzerland

We present the clinical experience of consecutive series with use of balloon-expandable and self-expanding aortic stents (balloon-expandable covered stent group [BECS] vs self-expanding covered stent group [SECS]) in the management of challenging aortic pathologies requiring renal and/or visceral revascularization. Between January 2009 and May 2011, data for 37 high-risk patients from the BECS group (n = 25) and 12 from the SECS group (n = 12) were collected. All patients presented with pararenal aortic pathologies treated by the chimney endovascular approach. The chimney-graft technique is based on the deployment of a covered or bare stent-graft system created a conduit that runs outside the aortic main endograft, and the proximal fixation extending the sealing zones.

Results: Forty-six consecutive target vessels (43 renal arteries and 3 superior mesenteric arteries) were treated using the chimney technique for target vessel protection. Patients in the BECS group (n = 25) had significantly more target vessels than those in the SECS group (n = 12). There was one symptomatic occlusion of the BECS group treated by open thrombectomy of the left renal artery and placement of an Aesculap AG, Tuttingen, Germany) iliofemoral bypass. Additionally, one patient in the SECS group required a 5-mm balloon due to high-grade in-stent stenosis of a 6 × 5-mm balloon-expandable covered stent postoperatively. Overall, one perioperative (and not present in the computed tomographic scan) type Ia endoleak was detected in the BECS group. In contrast, five perioperative type Ia endoleaks were detected in the SECS group; however, only one of them was persistent in the radiological imaging. There was no extension of a 5-mm cuff, 1 year postoperatively, due to continuous aneurismal growth in any subgroup developed postoperative persistent renal insufficiency with need of hemodialysis. The follow-up procedure-related mortality was 0% for both BECS and SECS groups.

Neck length
Vessels at risk

Less vessels @ risk with PG-EVAR
Paraplegia risk

Less spinal artery coverage with PG-EVAR
### Mean neck length

<table>
<thead>
<tr>
<th></th>
<th>Preop</th>
<th>Postop</th>
<th>FUP</th>
</tr>
</thead>
<tbody>
<tr>
<td>JRAA</td>
<td>3.7 mm</td>
<td>20.2 mm</td>
<td>20.1 mm</td>
</tr>
<tr>
<td>SRAA</td>
<td>3.8 mm</td>
<td>23.2 mm</td>
<td>23.1 mm</td>
</tr>
<tr>
<td>Craw IV</td>
<td>5.1 mm</td>
<td>21.9 mm</td>
<td>22.0 mm</td>
</tr>
<tr>
<td>TAAA</td>
<td>3.5 mm</td>
<td>22.6 mm</td>
<td>22.3 mm</td>
</tr>
<tr>
<td>Overall</td>
<td>3.8 mm</td>
<td>21.6 mm</td>
<td>21.5 mm</td>
</tr>
</tbody>
</table>

Neck length (mean in mm)
A significant increase in Postop neck length  and FUP neck was observed for all the pathology group when compared to the preoperative length. No differences between Postop neck length  and FUP neck was observed.
Visceral debranching

Renal CGs

Visceral debranching
Visceral debranching

Renal PGs
<table>
<thead>
<tr>
<th>Outcomes @ USZ</th>
<th>Mortality at FUP</th>
<th>MAXTD</th>
<th>CPG patency</th>
<th>Reinterventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRAA vs TAAA</td>
<td>0.32</td>
<td>0.77</td>
<td>0.97</td>
<td>0.15</td>
</tr>
<tr>
<td>Elective vs nonelective</td>
<td>0.001</td>
<td>0.62</td>
<td>0.52</td>
<td>0.01</td>
</tr>
<tr>
<td>1-2 CPG vs 3-4 CPG</td>
<td>0.03</td>
<td>0.17</td>
<td>0.84</td>
<td>0.06</td>
</tr>
<tr>
<td>CG vs PG vs CPG</td>
<td>0.06</td>
<td>0.59</td>
<td>0.95</td>
<td>0.33</td>
</tr>
<tr>
<td>Renal vs visceral vs all</td>
<td>0.72</td>
<td>0.12</td>
<td>0.41</td>
<td>0.40</td>
</tr>
<tr>
<td>Aortic stentgraft</td>
<td>0.96</td>
<td>0.12</td>
<td>0.86</td>
<td>0.08</td>
</tr>
<tr>
<td>CPG stenosis (&gt;70%) and/or Very short CPGs (&lt;5mm) vs No «stenosis or short CPG»</td>
<td>0.30</td>
<td>0.76</td>
<td>0.06</td>
<td>0.02</td>
</tr>
<tr>
<td>Target vessel stenosis (&gt;50%) or a diameter &lt; 4 mm</td>
<td>0.65</td>
<td>0.09</td>
<td>0.04</td>
<td>0.05</td>
</tr>
</tbody>
</table>
• 96 (1.4 vessel per patient)
• Configuration
  – Chimney 46 (48%)
  – Periscope 50 (52%)
• Vessels
  – BCT/RSA 13 (14%)
  – RCA 7 (7%)
  – LCA 20 (21%)
  – LSA 56 (58%)
• HR: 21 patients
• Gore TAG 100%
66yo male

Wrap & SADB
3.5h (teaching case)
No transfusion

PG-TEVAR
0.5h
No transfusion
15 months FUP
Aneurysm sack behavior

Mean FUP 22 months (SD 17; 0-65)

Maximal Transverse Aneurysm Diameter

- Preoperative 61.4 mm (SD 17; 26-100) mm
- Postoperative 55.84 mm (SD 16; 26-94) mm

9.02% reduction P<.001
Reinterventions during FUP

6/41 (14.6%)

mean time to reintervention 2 months (SD 3; 0-15)

**Endoleaks**
- 2x coil embolization (Ia/Ib)
- 1x distal TEVAR relining/extension

**Branches**
- 1x stenting LSA PG
- 1x configuration change from chimney to periscope

**Others**
- 1x TAVI (pre-defined strategy)
Median FUP of 36 months

Chimney Technique for Aortic Arch Pathologies: An 11-Year Single-Center Experience

Nicola Mangialardi, MD; Eugenia Serrao, MD; Holta Kasemi, MD; Vittorio Alberti, MD; Stefano Fazzini, MD; and Sonia Ronchey, MD, PhD

Department of Vascular Surgery, San Filippo Neri Hospital, Rome, Italy.

Purpose: To report our single-center experience with the chimney technique for aortic arch pathologies and the mid- to long-term results in these patients.

Methods: From June 2002 to May 2013, 26 patients (18 men; mean age 71.2 years, 53-86) underwent thoracic endovascular aortic repair (TEVAR) combined with chimney technique. Indications for treatment were: a proximal landing zone <15 mm long distal to the left subclavian artery (LSA), thoracic aortic aneurysm (n=13), complicated type B aortic dissection (n=10), type I endoleak after previous TEVAR (n=2), and penetrating aortic ulcer (n=1). Treatment was performed in the emergency setting in 7 cases. The 28 chimney stent-grafts (double chimneys in 2 patients) were deployed in the innominate artery (n=7), left common carotid artery (n=10), and LSA (n=11). All patients underwent computed tomography before discharge, at 1, 6, and 12 months, and yearly thereafter.

Results: Technical success was 100%. One (3.8%) perioperative death was due to a cerebral hemorrhage. No major stroke was registered, but 3 (11.5%) minor strokes occurred (all resolved). Paraparesis developed in 2 (7.7%) patients. Median follow-up was 36.8 months (range 1-131), during which an additional 4 (15.4%) patients died, but only 1 death was aneurysm-related. Chimney graft patency was 89.3% (25/28); an asymptomatic fracture was found in a patent chimney stent-graft at the 18-month follow-up. The type I endoleak rate was 23% (n=6); 3 endoleaks associated with aneurysm sac enlargement were treated.

Conclusion: The chimney technique for aortic arch pathologies is safe and feasible and may be an option in patients considered at high risk for surgery or who are ineligible for conventional TEVAR, especially in the emergency setting. Concern persists regarding type I endoleak, and long-term follow-up remains mandatory.
Conclusions

Parallel grafts used in the aortic arch/visceral aorta

- Off-The-Shelf repair technique
- Safe in selected patients
- Behave durable up to 3 years mean follow-up
Conclusions

• Best results are achieved in **elective patients** where \( \leq 2 \) chimney or periscope grafts are used to preserve perfusion of **vessel(s)** >4mm diameter
PG-EVAR

Endurant & Advanta - CE approved procedure
Thank You!
ChEVAR in practice – clinical application and techniques for success  M. Lachat