Parallel Grafts: Chimneys, Snorkels, Periscopes, Sandwiches

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Disclosure

Frank J Criado, MD, FACS, FSVM

Medtronic: Honoraria for consulting, speaking/training
Chimneys - Snorkels

They emerged in two different settings:

- Bail-out/Rescue
- No access to FGs
Chimneys (PGs) Historical Evolution

- Greenberg 2001: renal
- Criado 2003: arch (left carotid)
- Larzon 2004: arch (left carotid)
- Criado 2007: longer chimneys
- Malina 2008: the term ‘chimneys’
- Mayer-Lachat 2008: periscopes
- Lobato 2008: sandwich graft1
- Lobato 2009: sandwich graft2
- Kasirajran 2010: TAAA PGs
- Galvagni 2011: TAAA PGs
Parallel Grafts

Snorkels
Chimneys
Periscopes
CHIMPS
Sandwich grafts
Parallel Grafts

- Branch-vessel flow
- Parallel conduit
  - parallel to aortic endograft
  - BMS Bx or Sx, CS, SG
  - length: S, M, L
- Gutters
Ch-EVAR
Chimney and Periscope Grafts Observed Over 2 Years After Their Use to Revascularize 169 Renovisceral Branches in 77 Patients With Complex Aortic Aneurysms

Mario Lachat, MD; Frank J. Veith, MD; Thomas Pfammatter, MD; Michael Glenck, MD; Dominique Bettex, MD; Dieter Mayer, MD; Zoran Rancic, MD, PhD; Steffen Gloekler, MD; and Felice Pecoraro, MD

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Purpose: To evaluate the performance of periscope and/or chimney grafts (CPGs) in the endovascular treatment of pararenal or thoracoabdominal aneurysms using off-the-shelf devices.

Methods: Between February 2002 and August 2012, 77 consecutive patients (62 men; mean age 73±9 years) suffering from pararenal aortic (n=55), thoracoabdominal (n=16), or arch to visceral artery aneurysms (n=6) were treated with aortic stent-graft implantation requiring chimney and/or periscope grafts to maintain side branch perfusion. CPGs were planned in advance and were not used as bailout. A standardized follow-up protocol including computed tomographic angiography, laboratory testing, and clinical examination was performed at 6 weeks; 3, 6, and 12 months; and annually thereafter.

Results: Technical success was achieved in 76 (99%) patients; 1 branch stent-graft became dislocated from a renal artery, which could not be re-accessed. Overall, 169 target vessels (121 renal arteries, 30 superior mesenteric arteries, 17 celiac trunks, and 1 inferior mesenteric artery) were addressed with the chimney graft configuration in 111 and the periscope graft configuration in 58. In total, 228 devices were used for the CPGs: 213 Viabahn stent-grafts and 15 bare metal stents. Over a mean 25±16 months (range 1–121), 9 patients died of unrelated causes. Nearly all (95%) of the patients demonstrated a decreased or stable aneurysm size on imaging; there was a mean 13% shrinkage in aneurysm diameter. Twenty patients had primary type I/III endoleaks at discharge; in follow-up, only 3 of these were still present (no secondary or recurrent endoleaks were noted). Additional endovascular maneuvers were required for CPG-related complications in 13 patients from intervention throughout follow-up. Overall, 4 CPGs occluded (98% target vessel patency); no stent-graft migration was observed. Renal function remained stable in all patients.

Conclusion: In this series, the use of CPGs has proven to be a feasible, safe, and effective way to treat thoracoabdominal and pararenal aneurysms with maintenance of blood flow to the renovisceral arteries. Nearly all of the aneurysms showed no increase in diameter over a >2-year mean follow-up, which supports the midterm adequacy of the CPG technique as a method to effectively revascularize branch vessels with few endoleaks or branch occlusions.

J Endovasc Ther. 2013;20:597–605
Midterm Results of Endovascular Aortic Repair With Chimney Stent-Grafts

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Section of Vascular Surgery, Departments of 1Surgery and 2Radiology, Yale University School of Medicine, Yale-New Haven Hospital, New Haven, Connecticut, USA.

CONCLUSION

Midterm results of endovascular aortic repair with chimney and periscope stent-grafts are favorable and show that this technique can serve as a viable treatment strategy for patients with aortic pathology. The chimney procedure is likely to continue to play an important role in the future of endovascular surgery because of multiple advantages over alternative techniques, including off-the-shelf availability, high flexibility, and wide applicability. Long-term data are needed to provide more information regarding safety and durability and to improve treatment and follow-up strategies, which could further accommodate developments in this field and lead to an improved prognosis for patients with aortic disease.
Parallel stentgraft techniques such as chimneys are readily available and safe off-the-shelf solutions for complex aortic necks.

Univ.-Prof. Dr. med. Giovanni Torsello
Universitätsklinikum Münster
Centrum für Vaskuläre und Endovaskuläre Chirurgie

87% @ 3 years

83% @ 3 years

Type 1a endoleak (>30 days)

3%

median FU: 15 months (0.1-56)

Mean FU: 14 months (0-56)
Conclusions after the first 100 patients

- Parallel grafts are ready available and safe solutions in emergent cases
- Encouraging survival and reintervention-free survival rates
- Low rates of type 1a endoleaks
- Successful AAA shrinkage

*Torsello et al. 2014*
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,‡ Giovanni Torsello, MD, PhD,§ and Frank J. Veith, MD;¶ on behalf of the PERICLES investigators

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<tbody>
<tr>
<td><strong>Total patients</strong></td>
<td>517</td>
<td></td>
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<tr>
<td>European centers (N = 9)</td>
<td>398</td>
<td></td>
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<td>United States centers (N = 4)</td>
<td>119</td>
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<tr>
<td><strong>Disease, n (%)</strong></td>
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<tr>
<td>Degenerating aneurysm</td>
<td>404 (78.1)</td>
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<tr>
<td>Penetrating ulcer</td>
<td>12 (2.3)</td>
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<tr>
<td>Type 1a endoleak from prior EVAR</td>
<td>45 (8.7)</td>
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<tr>
<td>Para-anastomotic aneurysm from prior open AAA repair</td>
<td>43 (8.3)</td>
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<tr>
<td>Intramural hematoma/type B dissection</td>
<td>13 (2.5%)</td>
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<td><strong>Classification, n (%)</strong></td>
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<tr>
<td>Juxtarenal AAA</td>
<td>360 (69.6)</td>
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<tr>
<td>Suprarenal AAA</td>
<td>129 (25.0)</td>
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<tr>
<td>Type IV TAAA</td>
<td>28 (5.4)</td>
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<td><strong>Clinical status, n (%)</strong></td>
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<tr>
<td>Asymptomatic</td>
<td>415 (80.3)</td>
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<tr>
<td>Symptomatic</td>
<td>52 (10.0)</td>
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<tr>
<td>Rapidly growing</td>
<td>21 (4.1)</td>
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<tr>
<td>Rupture</td>
<td>29 (5.6)</td>
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**Graph**

- **Freedom from Patency Loss**
- **Months**

- Graph shows a decreasing trend in freedom from patency loss over time, with a notable level maintained at 2 years (0.25) and beyond.
The case *for* Ch-EVAR:

- Urgent/emergent procedures
- Branch-vessel bail-out
- No access to F-EVAR or lacking necessary resources or required anatomy
The case *for* Ch-EVAR:

- Urgent/emergent procedures
- Branch-vessel bail-out
- No access to F-EVAR or lacking necessary resources or required anatomy
- *Planned elective complex EVAR*…?
The case *for* Ch-EVAR:

1-2 vessels *only!*
Device Choices for renal chimneys stents:

- Bx vs. Sx
- Covered vs. BMS
Ch-EVAR Challenges

- Type I endoleak (up to 10%)
- Mechanical interaction
- Questions Re. long-term durability
- Lack of strong evidence basis
A Proof-of-Concept In Vitro Study to Determine if EndoAnchors Can Reduce Gutter Size in Chimney Graft Configurations

Wouter W. Niepoth, BSc; Jorg L. de Bruin, MD; Kak K. Yeung, MD, PhD; Rutger J. Lely, MD; Andrea N. Devrome, PhD; Willem Wisselink, MD, PhD; and Jan D. Blankensteijn, MD, PhD
Z-2 TEVAR up to 40%

LSA Overstenting

C-S Bypass
Z-1 TEVAR
Z-0 TEVAR
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