COMBINED TECHNIQUE

CHIMNEY + FENESTRATED ENDOGRAFT

FOR COMPLEX ANEURYSMS

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DISCLOSURE

SPEAKER NAME:

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I HAVE THE FOLLOWING POTENTIAL CONFLICTS OF INTEREST TO REPORT:

☐ CONSULTING

☐ EMPLOYMENT IN INDUSTRY

☐ STOCKHOLDER OF A HEALTHCARE COMPANY

☐ OWNER OF A HEALTHCARE COMPANY

☐ OTHER(S)

☒ I DO NOT HAVE ANY POTENTIAL CONFLICT OF INTEREST
Combination of CGs and FEVAR may reduce some of the drawbacks of each technique:
- Improved endograft-to-wall apposition by decreasing the number of chimney grafts
- Lower consequent risk of type Ia endoleak
- A single home-made fenestration is more easily made and more rapidly delivered
Combination of Chimneys and Fenestrated Endografts in the Treatment of Complex Aortic Aneurysms.

Caradu C, Morin J, Midy D, Lepidi S, Ducasse E.

45 consecutive patients
Combined CG FEVAR
July 2010 – July 2016

25 patients
CM FEVAR + CG

- **CM Zenith® fenestrated endograft**
  - planned without the fenestration to 1 renal
  - when renal origin-SMA <2 hrs
  - or renal origin-proximal edge of the graft <15 mm
  - If acutely angled aortic neck
    - fenestration was planned on the side where good endograft to wall apposition was anticipated
  - CGs were used to revascularize remaining target vessels

20 patients
Home-Made FEVAR + CG

- When aneurysm treatment could not be delayed
  - a physician-modified endograft **using standard Zenith® or Endurat® graft** was planned with only one HM fenestration for one renal artery
HOLE CREATED IN THE FABRIC WITH CUTTERING PEN
SNARE USED AS A RADIO-OPACIFIER AND SEWN WITH 5/0 PROLÈNE SUTURE
DEVICE IS RESHEATHED AND CHECKED RADIOGRAPHICALLY. MEAN PREPARATION TIME 15 MIN.
 DETAILS OF RECONSTRUCTED VESSELS

Mean number of target vessels/patient: **2.9**

**Table 2.** Details of the 130 Reconstructed Vessels.\(^a\)

<table>
<thead>
<tr>
<th>Variable</th>
<th>CT</th>
<th>SMA</th>
<th>LRA</th>
<th>RRA</th>
<th>ARA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fenestrations</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scallop</td>
<td>—</td>
<td>21 (16)</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Custom-made</td>
<td>—</td>
<td>1 (1)</td>
<td>16 (12)</td>
<td>10 (8)</td>
<td>—</td>
</tr>
<tr>
<td>Homemade</td>
<td>—</td>
<td>—</td>
<td>15(^b) (11)</td>
<td>7(^b) (5)</td>
<td>—</td>
</tr>
<tr>
<td>Chimneys</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open</td>
<td>1 (1)</td>
<td>16 (12)</td>
<td>8 (6)</td>
<td>14 (11)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Covered</td>
<td>—</td>
<td>—</td>
<td>5 (4)</td>
<td>13 (10)</td>
<td>—</td>
</tr>
<tr>
<td>Total reconstructed</td>
<td>1 (1)</td>
<td>38 (29)</td>
<td>44 (34)</td>
<td>44 (34)</td>
<td>3 (2)</td>
</tr>
<tr>
<td>Intentional coverage</td>
<td>—</td>
<td>—</td>
<td>1</td>
<td>1</td>
<td>NA</td>
</tr>
</tbody>
</table>

Abbreviations: ARA, accessory renal artery; CT, celiac trunk; LRA, left renal artery; NA, data not available; RRA, right renal artery; SMA, superior mesenteric artery.

\(^a\)Data are given as the counts (percentage).

\(^b\)One homemade fenestration included in the count was abandoned because of unsuccessful cannulation.
**DETAILS OF RECONSTRUCTED VESSELS**

Mean oversizing: **20%**

Most represented configurations were:
- a scallop for the SMA or an open chimney
- an open or covered CG for the highest renal artery
- and a fenestration (Custom-made or HM) for the other

<table>
<thead>
<tr>
<th></th>
<th>CG F-EVAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operative Time (min)</td>
<td>183.6±8.2</td>
</tr>
<tr>
<td>Fluoroscopy Time (min)</td>
<td>55.3±18.9</td>
</tr>
<tr>
<td>Kerma-Area-Product (Gy/cm²)</td>
<td>13.0±4.8</td>
</tr>
<tr>
<td>Contrast Volume (mL)</td>
<td>97.8±23.3</td>
</tr>
</tbody>
</table>
**POST-OPERATIVE OUTCOMES**

- Perioperative successful aneurysm exclusion: 44 patients (97.8%)
  - 1 low-flow type Ia EL
  - No open conversion

- Target vessels successfully reconstructed: 98.5% (128/130)
  - 98.5% [107/109 vessels] if scallops were excluded
  - One HM fenestration did not open properly in a patient presenting with a ruptured aneurysm, he went into haemorrhagic shock during the procedure and the left renal artery had to be abandoned
  - A second HM fenestration was successfully targeted but it was impossible to push the stent inside the left renal artery because of severe downward angulation

- Perioperative technical success: 93.3% (42/45)

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SURVIVAL

- 30-day mortality: 5 (11%)
  - In-Hospital mortality: 6 (13%)

- Median follow-up: 11.2 months (range 1-42 months)

- 2 (4%) after elective procedures
  - 1 haemorrhagic shock caused by an EIA rupture (despite early coverage)
    - history of type Ia/III ELs treated 2 years ago by cuff extension+additional limb grafts after migration
  - 1 mesenteric ischemia (early occlusion of SMA open chimney)

- 3 (7%) after emergency procedures
  - 2 haemorrhagic shocks
  - 1 acute mesenteric ischemia despite patent chimney to SMA due to large mesenteric hematoma

- Mid-term mortality
  - 4 myocardial infarctions
  - 1 urothelial carcinoma
  - 1 subdural hematoma

- No aneurysm rupture
- No graft migration
ENDOLEAKS

**Type Ia EL**

- **4 (9%)**

**Last FU**

- **1 (2%)**

- **2 Coil embolization + Cuff extension**

- **1 Conversion of open chimney into covered one + ballon dilation**

- **1 remaining type Ia EL under close surveillance: stability**

**Median follow-up**

- **11.2 months (range 1-42 months)**

**Freedom from type I EL (%)**

- **95%**

- **86%**

**Log rank p value = 0.08**
ENDOLEAKS

Late Type II EL
10 (22%)

Last FU
3 (7%)
Persisting
Type II ELs

No secondary/late type II EL

4 spontaneously disappeared

3 treated by embolization

Median follow-up
11.2 months
(range 1-42 months)

93%
SIZE OF ANEURYSM SAC

Figure 4. Maximum aneurysmal diameter’s evolution

- Diminution ≥5mm: 18 (55%)
- Stability: 15 (45%)
- Mean aneurysm sac regression/patient: 4.7 ± 6.9 mm (range: 0-24)

Median follow-up: 11.2 months (range 1-42 months)
PATENCY OF TARGET VESSELS

Target vessel's patency rate (%)

Log rank p value = 0.59

95% CI

<table>
<thead>
<tr>
<th>Months elapsed</th>
<th>Chimney</th>
<th>Fenestration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># at risk</td>
<td>% survival</td>
</tr>
<tr>
<td>0</td>
<td>60</td>
<td>100.0</td>
</tr>
<tr>
<td>12</td>
<td>33</td>
<td>95.0</td>
</tr>
<tr>
<td>18</td>
<td>21</td>
<td>95.0</td>
</tr>
<tr>
<td></td>
<td>16</td>
<td>95.0</td>
</tr>
</tbody>
</table>
DISCUSSION: PER-OPERATIVE DATA

### PERICLES (CG-EVAR)
- 13 centers
- 517 patients
- 898 chimney grafts
- Procedure time: 233 min
- Fluoroscopy time: 61 min
- Amount of contrast: 162 mL

### FEVAR
  - Meta-analysis: 9 centers
  - 629 patients
  - 1622 target vessels
- Procedure time: 180-350 min
- Fluoroscopy time: 34.3-78 min
- Amount of contrast: 96.3-270 mL

### COMBINED CG-FEVAR
- Procedure time: 184 min
- Fluoroscopy time: 55 min
- Amount of contrast: 98 mL
DISCUSSION: SURVIVAL

PERICLES (CG-EVAR)
- 13 centers
- 517 patients
- 898 chimney grafts
- 30-day mortality: 4.9%
  → 3.7% excluding ruptured aneurysms
- Survival: 79% @ 17.1 months

FEVAR
  - Meta-analysis: 9 centers
  - 629 patients
  - 1622 target vessels
  - 30-day mortality: 2.1% (1.2%-3.7%)
  - Survival: 84% @ 15 months
  - Meta-analysis: 12 centers
  - 776 patients
  - 1728 target vessels
  - 30-day mortality: 2.5% (1.6%-4.1%)

COMBINED CG-FEVAR
- 30-day mortality: 11%
  → 4.5% excluding ruptured aneurysms
- Survival: 71% @ 18 months

But 33% were in emergent setting
DISCUSSION: TECHNICAL SUCCESS

PERICLES (CG-EVAR)
- 13 centers
- 517 patients
- 898 chimney grafts
- 502/517 cases: 97.1%

COMBINED CG-FEVAR
- 42/45 cases: 93.3%

FEVAR
  - Meta-analysis: 9 centers
  - 629 patients
  - 1622 target vessels
  - 90.7% (87.7%-92.5%)
  - Meta-analysis: 12 centers
  - 776 patients
  - 1728 target vessels
  - 92.8%
DISCUSSION: TARGET VESSELS' PATENCY

**PERICLES (CG-EVAR)**
- 13 centers
- 517 patients
- 898 chimney grafts
- 94.1% @ 17.1 months
- KM Estimates:
  - 91.8% @ 1 year
  - 89.2% @ 2 years
  - 87.0% @ 3 years

**COMBINED CG-FEVAR**
- 2 cannulation failures: HM fen
  - Hostile anatomy (small target arteries + severe downward angulation)
  - Absence of “diameter-reducing ties” in this early experience
- KM Estimates (excluding scallops):
  - 95% @ 1 year
  - 95% @ 2 years

**FEVAR**
  - 650 patients
  - 1679 target vessels
  - KM Estimates:
    - 94% @ 1 year
    - 84% @ 5 years
  - Meta-analysis: 9 centers
    - 629 patients
    - 1622 target vessels
    - 93.2% @ 15 months
  - Meta-analysis: 12 centers
    - 776 patients
    - 1728 target vessels
    - 94.5% @ 12-month
DISCUSSION: ENDOLEAKS

- CG-FEVAR surgery even when more vessels need reconstruction
  - \ incidence and size of gutters
  - \ endograft-to-wall apposition

- 1.7 reconstructed vessels/patient in PERICLES vs 2.9 in our study
  - Comparable type Ia endoleak rates even though more vessels were reconstructed

- Hostile anatomy and conditions
  - 15.6% of patients with angulated aortic neck >45°
  - 33% undergoing emergency procedures

- Type Ia endoleaks successfully treated in 3 patients during FU
  - only 1 patient still presents a type Ia endoleak
CONCLUSION

- Combined CG-FEVAR shows good technical feasibility
  - More number of eligible patients when standard FEVAR is predicted to be technically difficult or contra-indicated
  - Could be a straightforward and effective approach
    - In emergent settings
    - But also in elective cases
  - A single home-made fenestration is more easily shaped and more rapidly delivered

Results in larger series and other experimented centres as well as longer-term follow-up are awaited and should be compared to those of CG-EVAR and FEVAR.
THANK YOU FOR YOUR ATTENTION