Outcome of thoracic endovascular aortic repair with single aortic arch chimney in high risk patients.

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Disclosure

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I do not have any potential conflict of interest
Purpose

• Reporting our experience, selection criteria and outcome of single AAC.
• Preferable method in high risk patient with decreasing to gutter area related endoleak in multiple chimney stent grafts.
Patients and Methods

• A retrospective, Single center study (2012 - 2016).
• Gangnam Severance Endovascular Aortic Registry (332 patients whose aortic pathology managed by TEVAR).

• 24 patients underwent Single AAC TEVAR at our hybrid operation room.

• The indication for treatment (aortic aneurysm, Aortic dissection (Debakey I and III) and trauma (type I-IV)

• Both planned and unplanned chimney was included in this study.
Planning and selection

Ishimaru classification

- Comorbidities (age >65 years, coronary artery disease, heart failure, chronic obstructive disease, and impaired renal function)
- Anatomical characteristics (thoraco-sternotomy incision and two stage open repair)
- Risk for anticoagulation as in trauma patients.
- Combined both chimney and bypass in those with challenging anatomy.
Clinical practice zone 0 AAC
Zone 0 AAC
### Results

**Table I. Patients characteristics and demographic data**

<table>
<thead>
<tr>
<th>Zone</th>
<th>N</th>
<th>Zone 1</th>
<th>N</th>
<th>Zone 2</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 0</td>
<td>4 (100)</td>
<td>Zone 1</td>
<td>1 (100)</td>
<td>Zone 2</td>
<td>17 (89.5)</td>
</tr>
<tr>
<td>Zone 1</td>
<td>1 (100)</td>
<td>Zone 2</td>
<td>19 (89.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zone 2</td>
<td>19 (89.5)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Age (SD)**
  - Zone 0: 69.0 (10.9)
  - Zone 1: 72
  - Zone 2: 51.9 (19.8)

- **Males (%)**
  - Zone 0: 4 (100)
  - Zone 1: 1 (100)
  - Zone 2: 17 (89.5)

- **BMI (SD) (kg/m²)**
  - Zone 0: 23.6 (3.3)
  - Zone 1: 24.2
  - Zone 2: 24.4 (2.5)

- **Comorbidities**
  - **HTN (%)**
    - Zone 0: 4 (100)
    - Zone 1: 1 (100)
    - Zone 2: 8 (42.1)
  - **Smoking (%)**
    - Zone 0: 3 (75)
    - Zone 1: 1 (100)
    - Zone 2: 9 (47.4)
  - **Obesity (%)**
    - Zone 0: 1 (25)
    - Zone 1: 0
    - Zone 2: 4 (21.1)
  - **CAOD (%)**
    - Zone 0: 1 (25)
    - Zone 1: 0
    - Zone 2: 6 (31.6)
  - **CVA (%)**
    - Zone 0: 1 (25)
    - Zone 1: 0
    - Zone 2: 5 (26.3)
  - **CRF (%)**
    - Zone 0: 0
    - Zone 1: 0
    - Zone 2: 3 (15.8)

- **Pathology**
  - **Aneurysm (%)**
    - Zone 0: 3 (75)
    - Zone 1: 1 (100)
    - Zone 2: 3 (15.8)
  - **Dissection (%)**
    - Zone 0: 1 (25)
    - Zone 1: 0
    - Zone 2: 6 (31.6)
  - **Trauma (%)**
    - Zone 0: 0
    - Zone 1: 0
    - Zone 2: 10 (52.6)
  - **Prior aortic surgery (%)**
    - Zone 0: 1 (25)
    - Zone 1: 2 (10.6)

- **Clinical presentation**
  - **Elective (%)**
    - Zone 0: 3 (75)
    - Zone 1: 1 (100)
    - Zone 2: 4 (21.1)
  - **Emergency (%)**
    - Zone 0: 1 (25)
    - Zone 1: 0
    - Zone 2: 15 (79.9)
Table II. Procedure details

<table>
<thead>
<tr>
<th>Zone</th>
<th>Zone 0</th>
<th>Zone 1</th>
<th>Zone 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N= 4</td>
<td>N= 1</td>
<td>N= 19</td>
</tr>
<tr>
<td>Procedure time (min) (SD)</td>
<td>372 (167)</td>
<td>210</td>
<td>119 (63)</td>
</tr>
<tr>
<td>CSF drainage (%)</td>
<td>1 (25)</td>
<td>0</td>
<td>3 (15.8)</td>
</tr>
<tr>
<td>General Anesthesia (%)</td>
<td>4 (100)</td>
<td>1 (100)</td>
<td>17 (89.5)</td>
</tr>
<tr>
<td>Company</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>COOK (%)</td>
<td>0</td>
<td>1 (100)</td>
<td>13 (68.4)</td>
</tr>
<tr>
<td>Medtronic (%)</td>
<td>4 (100)</td>
<td>0</td>
<td>6 (31.6)</td>
</tr>
<tr>
<td>Chimney insertion scenario</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>planned</td>
<td>4 (100)</td>
<td>0</td>
<td>18 (94.7)</td>
</tr>
<tr>
<td>Unplanned</td>
<td>0</td>
<td>1 (100)</td>
<td>1 (5.3)</td>
</tr>
<tr>
<td>Types of chimney stent</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iliac Limb</td>
<td>3 (75)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Stent graft</td>
<td>1 (25)</td>
<td>1 (100)</td>
<td>15 (79.9)</td>
</tr>
<tr>
<td>Stent graft+ bare metal stent</td>
<td>0</td>
<td>0</td>
<td>3 (15.8)</td>
</tr>
<tr>
<td>Self-expandable stent</td>
<td>0</td>
<td>0</td>
<td>1 (5.3)</td>
</tr>
<tr>
<td>Adjunctive procedures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Open access</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Prior de-branching bypass grafts (n)</td>
<td>4</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Technical success (%)</td>
<td>4 (100)</td>
<td>1 (100)</td>
<td>19 (100)</td>
</tr>
</tbody>
</table>
### Table III. In hospital and follow up outcome.

<table>
<thead>
<tr>
<th></th>
<th>Zone 0 N= 4</th>
<th>Zone 1 N= 1</th>
<th>Zone 2 N= 19</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>30 days outcome</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortality (%)</td>
<td>1 (25)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Stroke (%)</td>
<td>0</td>
<td>0</td>
<td>1 (5.3)</td>
</tr>
<tr>
<td>Paraplegia (%)</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Respiratory failure (%)</td>
<td>1 (25)</td>
<td></td>
<td>1 (5.3)</td>
</tr>
<tr>
<td>Renal failure (%)</td>
<td>0</td>
<td>0</td>
<td>1 (5.3)</td>
</tr>
<tr>
<td>ICU (SD) (hours)</td>
<td>189 (249)</td>
<td>28</td>
<td>168 (195)</td>
</tr>
<tr>
<td>Length of hospital stay (SD) (days)</td>
<td>17.8 (11.4)</td>
<td>9</td>
<td>31.7 (28.3)</td>
</tr>
<tr>
<td><strong>Follow up outcome</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late surgical conversion (%)</td>
<td>0</td>
<td>0</td>
<td>1 (5.3)</td>
</tr>
<tr>
<td>Endoleak (%)</td>
<td>0</td>
<td>0</td>
<td>3 (15.8)</td>
</tr>
<tr>
<td>Re-intervention (%)</td>
<td>1 (25)</td>
<td>0</td>
<td>3 (15.8)</td>
</tr>
<tr>
<td>Patency of chimney stents (%)</td>
<td>4 (100)</td>
<td>1 (100)</td>
<td>18 (94.7)</td>
</tr>
</tbody>
</table>
Re-intervention
Complicated Case
Discussion

Open Repair

• Extensive Aortic aneurysm is a complex problem

But it can be managed safely.

Total endovascular repair
Selected cases

- Anatomic suitability
- Material availability
- Costs
- X-ray exposure
- Follow up?
Hybrid surgery

Open Surgery + Endovascular Repair

“The way to a wider application of endovascular technology for management of complex aortic disease”

Hollier LH. J Endovasc Surg 1998
AAC appeared to be acceptable less invasive treatment strategy in our high risk patients especially emergency situations.
A current systematic evaluation and meta-analysis of chimney graft technology in aortic arch

✓ Although, we did 67% of our procedures under emergency situation, our technical success was 100% perioperative overall mortality and neurological event was one patient (4.1%) for each.
Gutter endoleak

• TunWang et al, 26 reported that double chimney was associated with gutter endoleak in 13% that require re intervention.

• The largest published experience of AAC stents with TEVAR for zone 0 and zone 1 they had 11% endoleak and their re-intervention rate of (33%) that was contributed by them to the use of more than one AAC. (Igor Voskresensky et al, J Vasc Surg 2017; 66 (1): 9-20.-3)

• Our study had 3 endoleaks but no intervention for gutter area endoleak.
Home message

- Single AAC is safe and effective in high risk patients both for zone 0 and zone 2.

- single chimney decreasing rate of gutter area endoleak and of benign nature that sealed with cessation of anticoagulant.