Chimney techniques in Challenging anatomies during EVAR

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Disclosure

Speaker name: .........Hazem Habboub.

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)

X I do not have any potential conflict of interest
The proximal landing zone is one of the important limiting factors for endovascular aneurysm repair (EVAR) and represents the single most important factor for success or failure of the therapy.

It is estimated that 30% to 40% of patients are not eligible for EVAR using currently available conventional devices.*

Alternative treatment options include open repair, hybrid debranching procedures, and fenestrated and branched endograft

What are the difficult anatomy situation:

1. short and difficult sealing zone <10mm

2. Proximity of aortic side branch to stent graft sealing

3. significant difference between the level of branches of aorta (most common)
The chimney technique was originally described by Greenberg*


an adjunctive procedure involving branch vessel stenting during intentional endograft coverage of the vessel origin to maintain branch perfusion
- The chimney endovascular technique has been primarily suggested as:
  1. a rescue procedure for overstented aortic side branches during endovascular treatment.
  2. to increase the sealing zone in cases of an insufficient neck for endovascular approach.
Pre operative plan study:
computed tomography angiogram (CTA) datasets reconstructed on a three-dimensional (3D) workstation in all patients. **Mandatory**

Number of chimney stented branches are identified. for a single renal chimney, the new proximal landing zone was moved to the base of the contralateral (superior) renal artery, for two renal chimneys it was moved to the SMA
Chimney-EVAR technique.
- GA technique, except one
- Bilateral femoral accesses and axillary or brachial access were obtained in the usual manner.
- Guide wires placed in the aorta. The intended branch vessel was selectively catheterized and 7F, 90-cm sheath was advanced over stiff hydrophilic guide wire and deeply intubated into the target branch vessel.
- The patient was heparinized to maintain an activated clotting time of 200 to 250 s. ~ 5000 IU Heparin
- The endograft main body was next deployed below the proximal target vessel (superior renal, SMA). The endograft main body stabilized the long branch vessel sheaths for introduction of the chimney stents. The conformability of the graft is very crucial to reduce the gutter effect.
**Chimney-EVAR technique.**

- The chimney stent/s (Atrium/Insitu) were inserted into the transbrachial (axillary) sheath and positioned at least 20 mm into the branch vessel and the superior edge of the stent was positioned 5 to 10 mm above the covered portion of the main body. The average stent length is 37-58 mm.

- The sheath was pulled back and the chimney stent(s) deployed.

- The contralateral gate was cannulated and the limb deployed.

- **Final step,** simultaneous “kissing” balloon molding was performed using a compliant aortic balloon in the endograft and re-inflation of the balloons for the stents.

- Completion angiography was performed and if any proximal endoleaks seen they were re-ballooned.
Case

Insitu

37 mm stent
**Patient demographic and anatomical data**

<table>
<thead>
<tr>
<th>No.</th>
<th>6 in 2 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years, mean SD)</td>
<td>~72</td>
</tr>
<tr>
<td>Male (n, %)</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>Comorbidities (n, %)</td>
<td></td>
</tr>
<tr>
<td>CAD</td>
<td>5 (100)</td>
</tr>
<tr>
<td>MI</td>
<td>3 (60%)</td>
</tr>
<tr>
<td>Arrhythmia</td>
<td>1 (20%)</td>
</tr>
<tr>
<td>HTN</td>
<td>4 (80%)</td>
</tr>
<tr>
<td>COPD</td>
<td>3 (60%)</td>
</tr>
<tr>
<td>CRI</td>
<td>2 (40%)</td>
</tr>
<tr>
<td>Creatinine (mg/dL, mean SD)</td>
<td>~1.4</td>
</tr>
<tr>
<td>Aneurysm size (mm, mean SD)</td>
<td>~66.8</td>
</tr>
<tr>
<td>Infrarenal LZ length (mm, median, range)</td>
<td>~3mm</td>
</tr>
<tr>
<td>Chimney LZ length (mm, median, range)</td>
<td>42 (37-58)</td>
</tr>
<tr>
<td>Neck length gained (mm, median, range)</td>
<td>30 (25-40)</td>
</tr>
<tr>
<td>Neck diameter for Ch-EVAR (mm, mean SD)</td>
<td>28 mm</td>
</tr>
</tbody>
</table>
Number of chimney vessels

<table>
<thead>
<tr>
<th>Description</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single renal artery</td>
<td>4</td>
</tr>
<tr>
<td>Bilateral renal artery</td>
<td>1</td>
</tr>
<tr>
<td>SMA and Renal</td>
<td>1</td>
</tr>
</tbody>
</table>
Results/Jordan:

- successful implantation of the chimneys in all 6 patients. 100%.
- Renal insufficiency: 1 patient with the single renal artery, the stent was occluded and pt. had Acute renal insufficiency
- Survival: all 6 at 6 month follow up
Results/ Jordan:

- Stent patency: at 6 month
  In total 5/6 (83.3%).
  in patients with bilateral renal chimney and SMA chimney was 100%.

- Type 1 endo leak:
  No type 1 endo leak seen in our group at 6 month follow up.

- Mid term survival:
  6 patients on 6 months follow up 100%
  2 patients/2 on 12 months follow up 100%
Do we have evidence

- > 40 published series since 2008
- 378 renovascular chimneys in 185 patients from 10 centers
  * 162 elective
  * Ruptured
  * 10 symptomatic
- median follow up ranged from 2-24 months.( 12 months)

30 day mortality:
- (elective)
  - Chimney: 2.3%
  - FEVAR: 4.1%
  - Open: 5.1%
- Globalstar
- NSOIP

30 day mortality:
- (ruptured)
  - Chimney: 15.4%
  - Open: 25%
  - NSOIP
Chimney EVAR series for pararenal aortic pathologies (> 5 cases)

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>No.of Pt.</th>
<th>30day MORTALITY (%- N)</th>
<th>Renal Failure (%-N)</th>
<th>Type 1 endoleak (5-N)</th>
<th>Type 3 endoleak (%-N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ohralander</td>
<td>2008</td>
<td>6</td>
<td>0.0- 0</td>
<td>16.7-1</td>
<td>0.0 -0</td>
<td>0.0 -0</td>
</tr>
<tr>
<td>Hiramoto</td>
<td>2009</td>
<td>8</td>
<td>0.0-0</td>
<td>12.5-1</td>
<td>0.0- 0</td>
<td>0.0- 0</td>
</tr>
<tr>
<td>Bruen</td>
<td>2011</td>
<td>21</td>
<td>4.8- 1</td>
<td>28.6-6</td>
<td>4.8- 1</td>
<td>0.0- 0</td>
</tr>
<tr>
<td>Coscas</td>
<td>2011</td>
<td>16</td>
<td>12.5- 2</td>
<td>18.8-3</td>
<td>6.3- 1</td>
<td>0.0- 0</td>
</tr>
<tr>
<td>Donas</td>
<td>2011</td>
<td>72</td>
<td>0.0- 0</td>
<td>8.3- 6</td>
<td>1.4- 1</td>
<td>0.0- 0</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
<td></td>
<td>2.4%</td>
<td>13%</td>
<td>2.4%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Tips and tricks:
- use long balloon expandable stents to give more spiraling effect.
- use high pressure balloon expandable stents with adequate lengths
- dynamic CT post procedure help to define early leak and redo balloon inflation.
- reduce the gutter effect by simultaneous inflation of the balloon.
- high conformability stents relax better to the stent and limit the leak at the level of the gutters
Indications for Ch-EVAR:
- Higher-risk patients with juxtarenal or suprarenal aortic aneurysms >5.5 cm.
- Infrarenal aneurysms with short conical, and/or severely angulated proximal neck.
- Proximal para-anastomotic pseudoaneurysms after open infrarenal repair.
- Persistent proximal type I endoleaks after conventional EVAR.
- Aortic occlusion. Starting at the renal level.
Conclusion
- high successful rate of implantation and low morbidity and mortality of the procedure

- At the current time, chimney techniques are best viewed as complementary (vs. competing) techniques in the continuing effort to overcome the morbidity of open repair of these aneurysms.

- This procedure provides an alternative for emergency patients who are poor candidates for complex open surgical repair and has the advantage that stents can be used that are currently already available in most institutions.

- Do The results Justify their use: Absolutely
  However the use of any technique without adequate seal is never justified
Conclusion

- The chimney technique is feasible with the majority of available abdominal endografts. This allows urgent endovascular treatment of symptomatic or ruptured aneurysms available endoprosthesis.

- The chimney technique presently fills an unmet need in cases where more advanced endograft technologies are not yet available in emergency situation.

- Even if fenestrated devices were available, as they require a minimum of 4mm of infrarenal neck, only ~ 23.8% of patients in the current series would have been potential candidates.
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