The aim of this population-based study was the midterm evaluation of the safety, efficiency and durability of the Sandwich Technique for thoracoabdominal aortic aneurysm repair.

- Proximal neck ≥ 20mm in length (LSCA) and ≤ 40mm in diameter
- Normal Aorta ≥ 24mm in diameter (NA for AD)
- At least one renal and one visceral arteries (SMA preferentially) > 4mm in diameter
- Visceral artery landing zone ≥ 20mm in length (renal bifurcation, SMA first side branched)
- At lest 3 access arteries patency (up to 3 Sandwiches) > 7mm in diameter and 4 access arteries patency (4 Sandwiches)

Table 1 Demographics and Comorbidities

<table>
<thead>
<tr>
<th>Feature</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, Male</td>
<td>80.4</td>
</tr>
<tr>
<td>Sex, Female</td>
<td>19.6</td>
</tr>
<tr>
<td>Mean age (y)</td>
<td>70.3</td>
</tr>
<tr>
<td>Race, Caucasian</td>
<td>86.4</td>
</tr>
<tr>
<td>Race, Asian</td>
<td>13.6</td>
</tr>
<tr>
<td>Hypertension</td>
<td>58.7</td>
</tr>
<tr>
<td>Smoking</td>
<td>50.0</td>
</tr>
<tr>
<td>COPD</td>
<td>19.6</td>
</tr>
<tr>
<td>Coronary artery disease</td>
<td>32.6</td>
</tr>
<tr>
<td>Previous cardiac surgery</td>
<td>2.2</td>
</tr>
<tr>
<td>Previous coronary stenting</td>
<td>6.6</td>
</tr>
<tr>
<td>PAOD</td>
<td>26.0</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>26.0</td>
</tr>
<tr>
<td>Diabetes</td>
<td>32.6</td>
</tr>
<tr>
<td>Chronic renal insufficiency</td>
<td>13.2</td>
</tr>
<tr>
<td>Chronic cardiac failure</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Abbreviations: COPD, chronic obstructive pulmonary disease; PAOD, peripheral artery occlusive disease; SD, standard deviation.
Between October 2009 and October 2015, the Brazilian TAAA Sandwich Study Group Registry (10 Endovascular Centers in Brazil) collected information on 46 consecutive patients.

- Elective: 36 patients (78.3%)
- Urgent: 10 patients (21.7%)

TAAA Crawford’s classification (%)/diameter:
- Type I (15.2%) - mean Ø: 69 ± 6 mm
- Type II (10.8%) - mean Ø: 70 ± 7 mm
- Type III (15.2%) - mean Ø: 65 ± 5 mm
- Type IV (39.2%) - mean Ø: 63 ± 6 mm
- Type V (19.6%) - mean Ø: 56 ± 3 mm

Overall, 63% of the patients with juxtarenal and pararenal AAAs were candidates.

ST (n) / ChT (n):
- Type I (7/0)
- Type II (5/0)
- Type III (7/0)
- Type IV (9/9)
- Type V (0/9)

TOTAL (ST/ChT) (28/18)

Median Follow-up (months):
- Type I (34)
- Type II (18)
- Type III (22)
- Type IV (25)
- Type V (30)

TOTAL (26)

Stent graft (n) / Covered stent (n):
- Type I (23/23)
- Type II (19/16)
- Type III (22/22)
- Type IV (38/66)
- Type V (22/22)

TOTAL (116/141)

Stent graft per patient: 2.5
Covered Stent per patient: 3.1

Target Vessels (CT/SM/A/RA):
- Type I (7/7/12/26)
- Type II (4/5/9/18)
- Type III (6/7/13/26)
- Type IV (17/18/33/68)
- Type V (2/2/2/6)

TOTAL (18/28/80/153)

Technical Success (per vessel):
- Type I (23/26 = 88.5%)
- Type II (16/18 = 88.9%)
- Type III (22/26 = 84.6%)
- Type IV (64/68 = 94.1%)
- Type V (14/15 = 93.3%)

TOTAL (141/153 = 92.2%)

Median Follow-up: 26 months

Unfit for fenestrated/Branched stent graft: 23 (50%) patients

Technical Success (per patient):
- Type I (7/7 = 100%)
- Type II (5/5 = 100%)
- Type III (6/7 = 85.7%)
- Type IV (18/18 = 100%)
- Type V (9/9 = 100%)

TOTAL (45/46 = 97.8%)

30 day Related Mortality Rate:
- Type I (0/7 = 0%)
- Type II (1/5 = 20%)
- Type III (0/7 = 0%)
- Type IV (2/18 = 11.1%)
- Type V (0/9 = 0%)

TOTAL (3/46 = 6.5%)

Median Follow-up (26 months):
Early + Late Related Mortality Rate = 6.7%

Visceral Patency (per vessel):
- Type I (22/23 = 95.6%)
- Type II (15/16 = 93.7%)
- Type III (22/22 = 100%)
- Type IV (6/6/4 = 96.9%)
- Type V (14/15 = 93.3%)

TOTAL (135/140 = 96.4%)

Median Follow-up (26 months):
Late Related Mortality Rate:
- Type I = 0%
- Type II = 0%
- Type III = 14.3%
- Type IV = 0%
- Type V = 0.2%

TOTAL = 2.2%

Median Follow-up (26 months):
Intra Operative Endoleak Rate:
- Type I = 0%
- Type II = 0%
- Type III = 14.3%
- Type IV = 0.3%
- Type V = 0.2%

TOTAL (10/46 = 21.7%)

Median Follow-up (26 months):
Early + Late Related Mortality Rate = 6.7%
Results

The Brazilian TAAA Sandwich Study Group Registry

- Intra Operative Endoleak Type
  - Endoleak Type I (3/46 = 6.5%)
  - Endoleak Type II (5/46 = 10.9%)
  - Endoleak Type III (1/46 = 2.2%)
  - Endoleak Type IV (0/46 = 0%)
  - Endoleak Type V (0/46 = 0%)
  - TOTAL (9/46 = 19.6%)

  Median Follow-up (26 months)

- Intra Operative Endoleak Treatment
  - Type IA = Another SG (1)
  - Type IB = Iliac extension (1)
  - Type II = No
  - Type III = Another SG (1)

The Brazilian TAAA Sandwich Study Group Registry

- Persistent Endoleak (4/46 = 8.7%)
  - One Type IA = Another SG (1)
  - Two Type II Sac Stable = Watch
  - One Type II Sac Grown = Emboliz

  Median Follow-up (26 months)

- Late Endoleak (1/46 = 2.2%)
  - One Type II Sac Grown = CS in SMA

Discussion

- Reintervention Rate: 15.2%
- External iliac artery rupture: 2.2%
- TIA/Stoke: 2.2%
- External iliac artery dissection: 2.2%
- Axillary plexus injury: 2.2%
- Braquial Oclusion: 4.3%
- Femoral artery pseudoaneurysm: 2.2%
- Linfocele: 2.2%

- Technical success was achieved in 76 (99%) patients
- 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
- Over a mean 25 ± 16 months (range 1-121), 9 patients died of unrelated causes
- Nearly all patients (95%) demonstrated a decreased or stable aneurysm size

- Total of 187 snorkel/chimney grafts were successfully placed in 128 patients
- Technical success was 100%
- The mean aneurysm sac decreased significantly (P = .001) after follow up of 24.6
- Thirty-day mortality and midterm mortality were 0.8% and 17.2%, respectively
- Primary chimney graft patency was 95.7%
- Freedom from chimney graft-related reinterventions was 93.1%
Conclusions

The Sandwich Technique facilitates safe and effective aneurysm exclusion and target vessel revascularization in adverse anatomical scenarios, with sustained durability in midterm follow-up.