Sizing and Landing Zones in IMH patients

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Disclosure

Speaker name:

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I have the following potential conflicts of interest to report:

- [x] 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
Challenges in IMH

- Diagnosis on imaging
- Natural History & Predictors of progression
- Uncomplicated IMH Timing of treatment
- Open Surgery versus TEVAR
- Timing of TEVAR
- Sizing & landing zones (treatment length)
Sizing and Landing Zones in IMH? Consensus papers & Guidelines

REPORT FROM THE SOCIETY OF THORACIC SURGEONS ENDOVASCULAR SURGERY TASK FORCE

Expert Consensus Document on the Treatment of Descending Thoracic Endovascular Stent

ACC/AHA Guideline

2010 ACCF/AHA/AATS/ACR/ASA/SCA/SCAI/SIR/STS/SVM Guidelines for the Diagnosis and Management of Patients With Thoracic Aortic Disease

A HA Scientific Statement

Surgical Management of Descending Thoracic Aortic Disease: Open and Endovascular Approaches

No answers!
## TEVAR- Heidelberg Experience (n=465)
### March 1997 – January 2016

<table>
<thead>
<tr>
<th>Condition</th>
<th>Total</th>
<th>Elective</th>
<th>Urgent / Emergent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thoracic aortic aneurysm (TAA)</td>
<td>85</td>
<td>63 (74.1)</td>
<td>22 (25.9)</td>
</tr>
<tr>
<td>Ruptured TAA</td>
<td>34</td>
<td>-</td>
<td>34 (100.0)</td>
</tr>
<tr>
<td>Thoracoabdominal aneurysm</td>
<td>78</td>
<td>52 (66.6)</td>
<td>26 (33.3)</td>
</tr>
<tr>
<td>Penetrating aortic ulcer (PAU)</td>
<td>67</td>
<td>34 (50.7)</td>
<td>33 (49.3)</td>
</tr>
<tr>
<td>Traumatic aortic rupture</td>
<td>28</td>
<td>-</td>
<td>28 (100.0)</td>
</tr>
<tr>
<td>Chronic Typ B dissection</td>
<td>57</td>
<td>42 (73.7)</td>
<td>15 (26.3)</td>
</tr>
<tr>
<td>Acute Typ B dissection</td>
<td>54</td>
<td>20 (37.1)</td>
<td>34 (62.9)</td>
</tr>
<tr>
<td>Intramural haematoma (IMH)</td>
<td>28</td>
<td>15 (55.6)</td>
<td>13 (44.4)</td>
</tr>
<tr>
<td>Typ A dissection</td>
<td>6</td>
<td>1 (16.7)</td>
<td>5 (83.3)</td>
</tr>
<tr>
<td>Aortobronchial fistula</td>
<td>10</td>
<td>-</td>
<td>10 (100.0)</td>
</tr>
<tr>
<td>Ruptured Patch-aneurysm</td>
<td>3</td>
<td>1 (33.3)</td>
<td>2 (66.6)</td>
</tr>
<tr>
<td>Patch-aneurysm</td>
<td>8</td>
<td>5 (62.5)</td>
<td>3 (37.5)</td>
</tr>
<tr>
<td>Anastomotic aneurysm</td>
<td>8</td>
<td>7 (87.5)</td>
<td>1 (12.5)</td>
</tr>
</tbody>
</table>
IMH – A complex entity within Acute Aortic Syndrome

Ref.: Ueda et al. Insights Imaging 2012
Indicators of IMH Progression

- Involvement of the ascending aorta
- Maximum aortic diameter ($\geq 50$ mm) on initial diagnostic imaging
- Severe pericardial effusion
- Huge or progressively increasing pleural effusion
- Progressive aortic dilatation at follow-up
- Persistent pain or haemodynamic instability, or both
- Increment of the aortic wall thickness
- Large intimal erosion

Ref.: Villacosta I et al., Heart 2009; 95:1130-39
Natural History - Regression

Ref.: Bischoff MS. Böckler D et al, submitted to JEVT
Natural History - Progression

Indications in 28 / 465 TEVAR

7/28 (25%): TEVAR without further imaging

21/28 (75%): TEVAR because of dynamic changes

Ref.: Böckler D et al , Endovascular Today, February 2014
Case - summarizing challenges of planning

Ref.: Böckler D et al, Endovascular Today, February 2014
Challenge # 1 - Sizing in IMH

Concept of Endolining

Ref.: Böckler D et al, Endovascular Today, February 2014
Keep in mind: fragile wall conditions
IMH – fragile wall conditions

- Radial force is NOT constant through treatment range
- Increased oversizing has larger associated radial force

![Diagram showing the effect of oversizing on radial force](attachment:image.png)

IMH, Dissection, Trauma

TAA
Stent Graft– induced New Entry after TEVAR for B Dissections

From the Society for Vascular Surgery

Stent graft-induced new entry after endovascular repair for Stanford type B aortic dissection

Zhihui Dong, MD,† Weiguang Fu, MD,† Yuqi Wang, MD,† Chunsheng Wang, MD,† Zhiping Yan, MD,† Daqiao Guo, MD,† Xin Xu, MD,† and Bin Chen, MD,† Shanghai, China

Background: Stent graft-induced new entry (SINE), defined as the new tear caused by the stent graft and excluding those arising from natural disease progression or iatrogenic injury from the endovascular manipulation, has been increasingly observed after thoracic endovascular aortic repair (TEVAR) for Stanford type B dissection in our center. SINE appears to be remarkably life threatening. We investigated the incidence, mortality, causes, and prevention of SINE after TEVAR for Stanford type B dissection. Methods: Data for 22 patients with SINE were retrospectively collected and analyzed from 650 patients undergoing TEVAR for type B dissection from August 2000 to June 2008. An additional patient was referred to our center 14 months after TEVAR was performed in another hospital. The potential associations of SINE with Marfan syndrome, location of SINE and endograft placement, and the oversizing rate were analyzed by Fisher exact probability test or t test. Results: We found 24 SINE tears in 23 patients, including SINE at the proximal end of the endograft in 15, at the distal end in 7, and at both ends in 1. Six patients died. SINE incidence and mortality reached 3.4% and 26.1%, respectively. Two SINE patients were diagnosed with Marfan syndrome, whereas there were only 6 Marfan patients among the 651 patients. The 16 proximal SINEs were evidenced at the greater curve of the arch and caused retrograde type A dissection. The eight distal SINEs occurred at the dissected flap, and five caused enlarging aneurysm whereas three remained stable. The endograft was placed across the distal aortic arch during the primary TEVAR in all 23 patients. The incidence of SINE was 33.3% among Marfan patients vs 3.26% among non-Marfan patients (P = .016). There was no significant difference in mortality between proximal and distal SINE (25% vs 28.6%, P > .99), incidence of SINE between endograft placement across the arch and at the straight portion of descending thoracic aorta (23 of 613 vs 0 of 38, P = .39), and the oversizing rate between SINE and non-SINE patients (13% ± 4.5% vs 16% ± 6.5%, P = .98). Conclusions: SINE appears not to be rare after TEVAR for type B dissection and is associated with substantial mortality. The stress yielded by the endograft seems to play a predominant role in its occurrence. It is important to take this stress-induced injury into account during both design and placement of the endograft. (J Vasc Surg 2010;52:1450-8.)

Impact of Conformability for IMH is important

No comparative studies of devices, but in the arch I personally believe so: Conformability is a key!
Sizing of Aortic Diameter: measure from inner to inner wall!

Ref.: Mehta M et al, Endovascular Today 2009, January

Include thrombus
Exclude calcium
Oversizing windows for different pathologies

**GORE TAG® Device and Conformable GORE TAG® Device Indicated Vessel Range**

- **GORE TAG® Device Diameters**
  - 21
  - 26
  - 28
  - 31
  - 34
  - 37
  - 40
  - 45

- **Conformable GORE TAG® Device Diameters**
  - 21
  - 26
  - 28
  - 31
  - 34
  - 37
  - 40
  - 45

**Aortic diameter 31mm: TAG 34 mm**

**Aortic diameter 31mm: CTAG 34 / 37 / 40mm**

**CTAG** - engineered for 6-33% oversizing conditions

> IMH with 31 mm > CTAG 34 mm = 10% Oversizing
Sizing on a workstation
Centerline measurements

Centerline Analysis of Aortic CT Angiographic Examinations: Benefits and Limitations

**OBJECTIVE.** The purpose of our study was to illustrate workflow, benefits, and limitations of centerline analysis compared with double oblique multiplanar reformations using aortic CT angiography data.

**CONCLUSION.** Semiautomatic centerline analysis is beneficial for the assessment of aortic geometry and allows precise measurements of aortic diameters and lengths. It can be simple, fast, and reproducible, but it should be used with care considering its inherent limitations. Manually adjusted multiplanar reformations remain an essential tool for intuitive visualization of the vascular anatomy.
Challenge # 2: Defining Landing Zones

In hospital mortality according to site of origin

Paraplegia According to LSA and treatment length

Ref.: (1) Evangelisa A et al, Circulation 2005;111:1063-70
Defining Landing Zones using IFU

- Aortic neck diameters should be measured from axial CTA films and should consist only of the flow lumen and not the aortic wall.
- Aortic neck inner diameters in the range of 16 – 42 mm.
- Three diameter measurements at least 1 cm apart are required for both the proximal (A,B,C) and distal (E,F,G) necks.
- Diameter measurements along the entire aortic neck must be within one intended aortic inner diameter range.
- Include thrombus in diameter measurements.
- Do not include circumferential calcium in diameter measurements.
- Measure all lengths along greater

- Proximal (L) and distal (J) neck lengths should be a minimum of 20 mm.

- Maximum diameter (D) and length of lesion (H) are taken for characterization and follow-up purposes.
- Total treatment length (K) is the minimum length of aorta that needs to be treated.
- Iliac and femoral diameters need to accommodate the appropriate size sheath or a conduit may be necessary: 
  GORE® DrySeal Sheath
  - 18 Fr = 6.8 mm OD
  - 20 Fr = 7.5 mm OD
  - 22 Fr = 8.3 mm OD
  - 24 Fr = 9.1 mm OD
  GORE® Introducer Sheath with Silicone Pinch Valve
  - 18 Fr = 6.9 mm OD
  - 20 Fr = 7.6 mm OD
  - 22 Fr = 8.3 mm OD
  - 24 Fr = 9.2 mm OD
Landing Zone in the Arch

Ref.: Böckler D et al., Gefäßchirurgie 2005, Vol 4:
Retrograde Arch Dissection

- Incidence is low 1.3% but mortality is high: 42%
- Associated with proximal bare stent induced injury

Ref.: Eggebrecht H et al, Circulation 2009; 120 (Suppl 1):S276-S281
Challenge # 3: Treatment length

In hospital mortality according to site of origin

Paraplegia According to LSA and treatment length

Ref.: (1) Evangelisa A et al, Circulation 2005;111:1063-70
Strategy 1: “Spot Stent Grafting”
Case Example: Spot Stent Grafting
Strategy 2: “total coverage”

➢ My personal strategy
Summary

- No official guidelines for sizing
- 0-10% Oversizing in IMH is recommended
- Landing zone = healthy aortic wall
  - According to IFU 20 mm of non-diseased landing zone
- Treatment length
  - Total coverage > higher rate of remodelling, less reintervention, but more invasive, more risks
- Arch is often involved
  - Device conformability and radial force is key
Conclusions

- IMH remains challenging pathology & anatomy
- Consensus statements and guidelines desirable
- If Tx, TEVAR is first choice
- CTAG in our hands: useful and beneficial
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