Distal extended branched PETTICOAT—a new endovascular technique to induce false lumen thrombosis in complex aortic dissections

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No conflict of interest
A patent true lumen in the distal aorta after aortic root/arch surgery or thoracic SG-placement for AD is not benign!

Patient with 12 cm ruptured false lumen (FL) aneurysm, who died despite successful arch replacement

Persistent FL perfusion through distal entries

- Close relation in between patent FL, aortic growth rate and late mortality >40%
Remaining FL-perfusion through tears related to reno-visceral branches still causes aneurysmal degeneration of the aorta

Torn out ostium of the celiac trunc

Backflow into thoracic FL

Aneurysmal degeneration of abdominal aorta

Might lead to rupture and death
So far described methods to treat FL-dilatation

1. Open repair (Cowan, 2003; Rigberg, 2006)
2. Hybrid procedures (Böckler 2008)
3. Endovascular approach with CM fenestrated/branched SG in elective cases (Oikonomou 2014)

Common features:

- 30 day mortality and spinal cord malperfusion over 10%
- All reno-visceral branches have to be bypassed or stented
Proximal descending aortic stentgraft plus distal bare metal stent: The PETTICOAT Concept (Nienaber et al., 2006)
Conclusions: Combined proximal stent-grafting with distal bare stenting appears to be a feasible approach for the management of Type B aortic dissection. Although this approach clearly improved true lumen perfusion and diameter, it failed to completely suppress false lumen patency. However, it should be acknowledged that contemporary data on this approach is limited to small studies with variable results.

Improvement of true lumen perfusion and diameter

but: complete FL- Thrombosis in the abdominal aorta in only 13,5%

➢ For obvious reasons !!!
Intimal fenestrations related to branch vessels = torn out orifices of FL-originating reno-visceral branches were neglected.
Dissection stents alone are not capable to induce complete attachment of delaminated abdominal aortic wall, when major reno-visceral branches were torn out, adjunctive procedures are needed.
Solution: branched Petticoat = Implantation of balloon expandable covered stents through preexisting entries and struts of dissection stents into FL originating arteries
Re-establishment of blood flow to FL originating target vessels exclusively from TL simultaneously leads to sealing of corresponding tear in the dissection membrane.

Advanta V12

SES

Cook GZSD stent

LRA
**Distal extended branched Petticoat** for the sealing of all relevant entries with off the shelf devices.

- **infrarenal aortic entry**
- **iliac entry**

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- **Thoracic SG**
- **Dissection stent**
- **Advanta V12**
- **Gore C3 Excluder bifurcated SG**
- **IBD**
Deeb Petticoat in a 60y old male patient with 66 mm post dissection TAAA 8 years after incidence of TBAD

- has the potential to induce total FL thrombosis in the thoracic and abdominal aorta as well as the iliac arteries
Deeb Petticoat for the sealing of all relevant entries

<table>
<thead>
<tr>
<th>Deeb Petticoat</th>
<th>SMA</th>
<th>Petticoat alone</th>
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03.02.16  deeb PETTICOAT
Deeb Petticoat for the sealing of all relevant entries

Deeb Petticoat  renals  Petticoat alone
Deeb Petticoat for the sealing of all relevant entries

Deeb Petticoat  Infrarenal aorta  Petticoat alone
Deeb Petticoat for the sealing of all relevant entries
Deeb Petticoat for the sealing of all relevant entries

Deeb Petticoat  iliakc arteries  Petticoat alone
Deeb Petticoat for the sealing of all relevant entries

Deeb Petticoat, IBD right

Iliac bifurcation

Petticoat alone
comparision of status before and after deeb Petticoat in symptomatic 56 y, m, 10 years after initial therapy for type A dissection and 6 years after thoracic SG

after deeb Petticoat

Thoracic SG alone

Celiac trunc
comparision of status after thoracic SG alone and deeb Petticoat

after deeb Petticoat  Thoracic SG alone

SMA
comparism of status after thoracic SG alone and deeb Petticoat

after deeb Petticoat

Thoracic SG alone

Right Renal Artery
comparism of status after thoracic SG alone and deeb Petticoat

after deeb Petticoat

Thoracic SG alone

Infrarenal aorta
comparism of status after thoracic SG alone and deeb Petticoat

after deeb Petticoat

Thoracic SG alone

Iliac arteries
comparism of status after thoracic SG alone and deeb Petticoat

after deeb Petticoat

Thoracic SG alone

Iliac bifurcations with bilateral IBD´s
Results and Comparism of deeb Petticoat with alternative methods

- Deeb Petticoat in 19 patients, 13 Type A, 6 Type B

- Redo-setting, 2 m to 14 y after initial treatment

- Exclusively Cook GZSD Dissection stents were used, in combination with Advanta/ICAST, mostly Gore C3 excluder and 9 IBD´s

- 28 aortic branches were supplied with BECS
  3 celiac truncks, 2 SMA´s, 21 RA´s, 7 RRA´s and 16 LRA´s

- in 12 cases (63%) only 1 FL– originating renal artery had to be stented
Results and Comparism of deeb Petticoat with alternative methods

- In contrast to all other techniques renal function was ameliorated

- No aortic branch vessel obstructions were observed in limited follow-up (3–32m)

- Less branch vessel complications can be expected in long term follow-up compared to other methods, as only 1.5 vessels per patient on average were stented
Results and Comparism of deeb Petticoat with alternative methods

- TL originating spinal arteries in the thoracoabdominal junction are preserved
- Deeb Petticoat is perfectly designed for a percutaneous staged approach
- No spinal cord malperfusion observed
- No 30 day– mortality, no aortic related late death
- Extremely low complication rate (one asymptomatic loss of hypogastric artery, 2 iliac branch obstructions)
Conclusions

- Thoracoabdominal dissections and TAAA are completely different diseases

- Dissections have something that aneurysms do not have:
  - an often shrinked and perforated but resilient intimal hose

- This hose can be reinforced and expanded and perforations can be sealed

- The distal extended branched Petticoat technique is perfectly able to do so

T-branch in acute symptomatic type B dissection with preexisting TAAA