Update on the Value of Treating Aortic Aneurysms with a Combination of Multilayered Uncovered Stents Together with Covered Stents: Indications, Techniques and Results

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Disclosures
No

Mechanism of Multilayer Flow-modulating

Promoting thrombosis in the sac of aneurysm
Decrease velocity of blood flow
Change the flow pattern


Flow-modulating Strategy in Aorta
Experiences and Lessons

Advantage
If the diameter of aortic aneurysm was more than 60mm, aneurysms expansion and rupture were reported with Multilayer Flow Modulating (MLFM).
For Big Aneurysms, Clinic Outcome is not good.

Argument

From experience: Short sac entrance

<table>
<thead>
<tr>
<th>Impact</th>
<th>Table 1. Impact of aneurysm morphology on the sac thrombosis speed after flow-diverting strategy</th>
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<tbody>
<tr>
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<td>Fast-thrombosis group</td>
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<td></td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Aneurysm diameter</td>
<td>57.30±18.81</td>
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<tr>
<td>Proximal aortic neck</td>
<td>29.67±12.89</td>
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<tr>
<td>Sac entrance (SE)</td>
<td>15.0±17.83</td>
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Short-SE aneurysms manifested quicker thrombosis compared to wide-SE ones

6-month follow-up

The concept of sac entrance

Sac Entrance (SE):
The length of the flow Entrance into the Sac of aneurysm

A
B
Shorten the sac entrance: The joint procedure

The joint procedure: concept and design
The length of the aneurysm sac entrance could be shortened by a stent-graft covering part of it, followed by multiple layers of uncovered stents to cover the residual SE.

Validation of This Theory in Clinical Practice

Variation of the joint procedure: Type I TAAA

One or Two stent-grafts covering proximal aneurysm sac, uncovered stents covering reno-visceral segment

Type I TAAA: 62-year-old male
Stent-grafts covering proximal aneurysm sac, MLUS covering reno-visceral segment.
Follow-up CTA revealed complete thrombosis of the aneurysm sac and patent side branches.

Variation of the joint procedure: Type II TAAA

Two stent-grafts covering proximal aneurysm sac, A stent-graft covering distal aneurysm sac, uncovered stents covering reno-visceral segment

Type II TAAA with dissection: 46-year-old male
Stent-grafts covering proximal and distal aneurysm sac, MLUS covering reno-visceral segment.
Follow-up CTA revealed complete thrombosis of the aneurysm sac and patent side branches.

Variation of the joint procedure: Type III TAAA

One stent-graft covering proximal aneurysm sac, A stent-graft covering distal aneurysm sac, uncovered stents covering reno-visceral segment

Type III TAAA with dissection: 46-year-old male
Stent-grafts covering proximal and distal aneurysm sac, MLUS covering reno-visceral segment.
Follow-up CTA revealed complete thrombosis of the aneurysm sac and patent side branches.
Validation of This Theory in Clinical Practice

Type III TAAA: 80-year-old male

Stent-grafts covering proximal and distal aneurysm sac, MLUS covering reno-visceral segment. Follow-up CTA revealed complete thrombosis of the aneurysm sac and patent side branches.

Variation of the joint procedure: Type IV TAAA

A stent-graft covering distal aneurysm sac, uncovered stents covering reno-visceral segment

Type IV TAAA: 72-year-old male

A stent-grafts covering distal aneurysm sac, MLUS covering reno-visceral segment

Follow-up CTA revealed complete thrombosis of the aneurysm sac and patent side branches.

Variation of the joint procedure: Type V TAAA

One stent-graft covering proximal aneurysm sac, uncovered stents covering reno-visceral segment

Type V TAAA: 83-year-old female, pararenal saccular aneurysm

Pre-operative CTA: Side-wall saccular aneurysm involving the celiac trunk, and adjacent to the superior mesenteric artery and renal arteries
Validation of This Theory in Clinical Practice

**STEP 1:** Pre-stenting angiogram to confirm the size and location of the aneurysm.

**STEP 2:** The first uncovered stents was deployed to cover the entire aneurysm zone, providing circumferential bearing support for the subsequent stents.

**STEP 3:** A stent-graft was placed within the first bare stent to cover the most part of the sac entrance (SE), leaving a residual SE in the reno-visceral segment.

**STEP 4:** The second uncovered stents was deployed overlappingly to cover the residual sac entrance at the reno-visceral zone.

Follow-up findings

- Complete thrombosis and shrinkage of the aneurysm sac
- Patent collaterals

Mid-term Outcome of the Joint Procedure

Single-centre Retrospective Analysis of the Pilot Patient Cohort

- **From Feb 2012 to Oct 2018**
  - 46 selective TAAA patients (32 men, mean age: 67.8 years)
  - Type I: 14 cases; Type II 3 cases; Type III 7 cases; Type IV: 6 cases; Type V: 16 cases
  - TAAA diameter: 50mm-112mm Mean 59.5 ± 14.1 mm
  - Average follow-up length: 39 months
  - Aneurysm shrinkage was demonstrated in 24 patients; aneurysm stabilization was observed in 21 patients. 1 aneurysm expansion.
  - Mean aneurysm diameter decreased from 59.5 ± 14.1 mm to 51.3 ± 16.8 mm (p < 0.001)
  - Significant increase in sac thrombus deposition volume from 18.8 ± 10.2% to 93.6 ± 5.5% (p < 0.001)
  - The majority of side branches (182/184) were successfully preserved
Discussion: Changing in Flow Pattern

Flow pattern could change greatly after the joint procedure.

Pre-operative Angiogram
Flow dominated

Post-operative Angiogram
Backwards flow dominated

Discussion: Quicker thrombosis and More diameter decrease ratio

Joint procedure (Multilayered Uncovered with Covered Stents) compared with Flow Modulating Bare Stents (only Uncovered Stents)

Discussion: Indications for TAAA

TAAA diameter: 50mm-112mm

Limitation: Type 3 Endoleak with Expansion

Initial Conclusion of the Joint Procedure

Add one stent-graft and one bare stent

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