Multilayer Stents to treat Acute Aortic Dissections

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Conflict of Interest

NONE
Guidelines

- TEVAR in TBAD is a pre-emptive measure to avoid late complications by inducing aortic remodelling
The Challenge

Dissection - A Spiral with Multiple Reentries
Dissections are Unpredictable

CHAOS

Non linear Function

Logarithmic Spiral  J Bernoulli
Multilayer Stents – What is it all about?

- Turbulent flow – Laminar Flow
- Wall Shear Stress
- Pressure – Thrombus - Diameter
CONCEPT

- Multilayer Flow Modulator (MFM®) vs Monolayer Flow Diversion

Multilayer – 3D (MFM®)

Monolayer – 2D
The Concept
Wall Stress vs Pressure

\[ \sigma_m = \text{Main stress} \]
\[ \sigma_l = \text{Longitudinal stress} \]
\[ \sigma_r = \text{Radial stress} \]

\[ \sigma_r = \delta P \approx 0 \]

\[ \sigma_m \approx \sigma_l \]

Pressure (\(\delta P\)) = 0

Remove the risk of Expansion and rupture
The Concept
Aneurysm w/o branches IN VITRO PVI STUDY

Endothelial cells stop at the edge of branches

Animal Study (Dr Bonneau, INRA & NAMSA, France)
Endothelialization of the MFM®
Patient CFD_032_006

Courtesy: Dr Barchiche
Aortic Explant Histology (9 months)
Prove of Endothelialization

Macro photo and location of histology

Courtesy Dr. Kostache
When the MFM May Not Be Effective:

- **Due to Technical Errors**

  Lack of sufficient proximal and distal healthy zone to avoid peri-MFM leak (*it needs at least 2cm for enough sealed wall apposition*)

  Lack of sufficient overlapping; It needs at least 3cm. (*overlapping in front of the branches does not effect the lamination of the flow*)

  The large size must be inserted in the small one to avoid endoleak type III

  Stenosed branches must be treated prior to MFM deployment
CONTRAINDICATIONS

- Ruptured Aneurysm
- Shaggy Aorta
- Takayasu’s Arteritis
- Arterio-venous fistula
- Porcellaine Aorta
- Diameter > 6.5 cm
Without MFM

With MFM

Dr Diethrich, Phoenix Az.
RESULTS POST-PROCESSING

FU 31 months

23%

21%
Computational fluid analysis of symptomatic chronic type B aortic dissections managed with the Streamliner Multilayer Flow Modulator

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ABSTRACT

Objective: Managing symptomatic chronic type B aortic dissection (SCTBAD) by the Streamliner Multilayer Flow Modulator (SMFM) stent (Cardilast, Isnes, Belgium) is akin to provisional structural support to induce complete attachment of the dissection flap, but with the ability of aortic remodeling. This study investigated the SMFM’s capability to enact healing of SCTBAD.

Methods: Clinical data for 12 cases comprising preoperative and postoperative treatment of SCTBAD were obtained from a multicenter database hosted by the Multilayer Flow Modulator Global Registry, Ireland. A biomechanical analysis, by means of computational fluid dynamics modeling of the hemodynamic effects and branch patency associated with the use of the SMFM was performed for all cases. The mean length of the dissections was 30.23 ± 13.3 cm. There were 30 SMFMs used, which covered 69 aortic branches.

Results: At 1-year follow-up, the true lumen volume increased from 175.74 ± 98.83 cm³ to 209.87 ± 128.79 cm³; the false lumen decreased from 135.2 ± 92.03 cm³ to 123.39 ± 110.11 cm³. The false lumen index decreased from 0.29 ± 0.13 (preoperatively) to 0.21 ± 0.15 (postoperatively). The primary SMFM treatment of SCTBAD increased carotid perfusion by 25% ± 21% (P = 0.016) and suprarenal perfusion by 78% ± 32% (P = 0.001). The wall pressure distribution blended along the newly enlarged true lumen, whereas the false lumen wall pressure decreased by 6.25% ± 4.81% for the primary group (cases 1-7) and by 3.84% ± 2.59% for the secondary group (cases 8-12).

Conclusions: SMFM reduces the false lumen wall pressure through flow modulation. It preserves patency of all branches, minimizing the incidence of short-term complications. The SMFM is a valuable option in managing primary SCTBAD, without midterm complications. ([Vasc Surg 2016; 1:1].)
Green arrow – False Lumen Exclusion
Example of Lumbar Perfusion
Patient DA_040_001 - 3D

- 28 Years Old Female Patient with Type B Dissection

Courtesy by Dr Kostache
Visible Reduction of the False Lumen size and flow

- @M11 – Residual Flow in the False Lumen to keep on feeding the Intercostals and Lumbar Arteries (without this Paraplegia is the prognosis) drained through lumbars
Lumbar Perfusion preserved avoiding Paraplegia.
Contra indication - Type A Dissection ??
Type A Dissection Clamp related after CABG

Combination: Bare Metal + Medtronic Graft
When there is no time for Chimneys

Type B Dissection, Rupture, Retrograde Type A Dissection
Essential Technical Details

SUFFICIENT OVERLAP

COMBINATION OF TECHNIQUES
78 year old female Patient
Acute Ischemia left leg
True Lumen Compression
80 % True Lumen Reduction
Re Expansion True Lumen
ACUTE TYPE B DISSECTION
INCREASING BACK PAIN

67 year old female patient
Retrograde Dissection
Aortic Arch MFM Stent

- Perfusion of Supraaortic vessels from True Lumen
Technical Issues

Minimal Stent Coverage to achieve Flow Modulation

8 cm
Study Design: An International, Multicenter, Prospective, Non-randomized Study

Countries:
- Germany
- Israel
- UK
- Brasil
- Romania
- Belgium
- China
- Japan
- Netherlands
- Singapore
- Korea

Dragon Study:
Multilayer Stents in Acute Type B Dissections
Conclusion: The effects of Flow Modulation in Acute Dissections

- Aortic Remodeling
- False Lumen Reduction
- Preservation of Branches
- Avoiding Paraplegia
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