



Midterm outcome of CERAB and how to optimize results?

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Disclosures

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- W.L. Gore and associates
- Medtronic

Kissing stent configuration

- Meta-analysis on 605 patients
 - 81% primary patency at 2-year
 - 84% intermittent claudication
 - 53% TASC A & B
- Patency affected by:
 - Radial mismatch
 - Differences in stent conformation
 - The protrusion length of the stents in the distal aorta
 - Re-circulation, turbulence and stasis
 - Mesenchymal tissue, thrombus and intimal hyperplasia



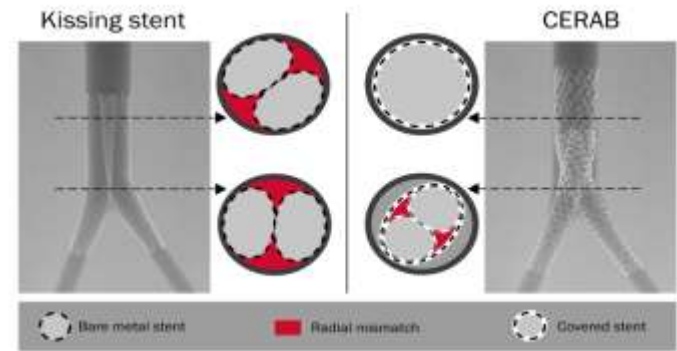
Covered Endovascular Reconstruction of the Aortic Bifurcation - CERAB

Goal: to provide a more anatomical and physiological endovascular reconstruction of the aortic bifurcation



Covered Endovascular Reconstruction of the Aortic Bifurcation - CERAB

- In vitro study and comparison of CERAB patients with matched KS patients
- No difference in preoperative anatomy or indication for intervention
- Significantly more mismatch in KS configuration

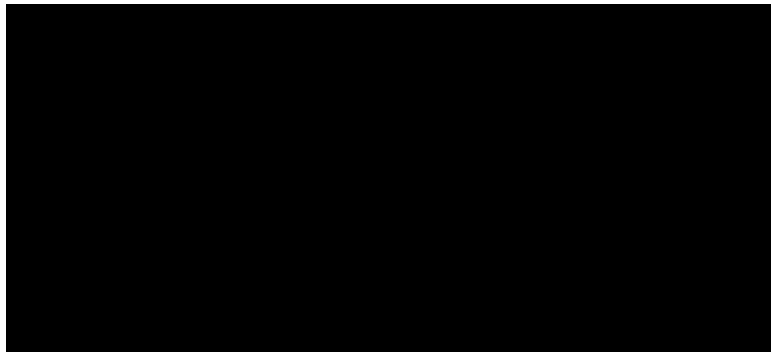
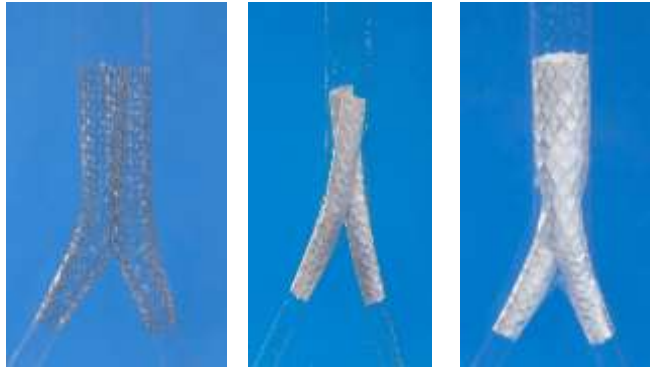


Method	Area (mm ²)/volume (mm ³)	CERAB mean (SD)	KS mean (SD)
Ellipse	Radial mismatch area	14.1 (4.2)	172.7 (70.0)*
	Radial mismatch volume	307.7 (131.2)	7268 (3810.9)*
ROI	Radial mismatch area	11.0 (4.8)	165.8 (71.5)*
	Radial mismatch volume	240(127.3)	7047.0 (3239.0)*

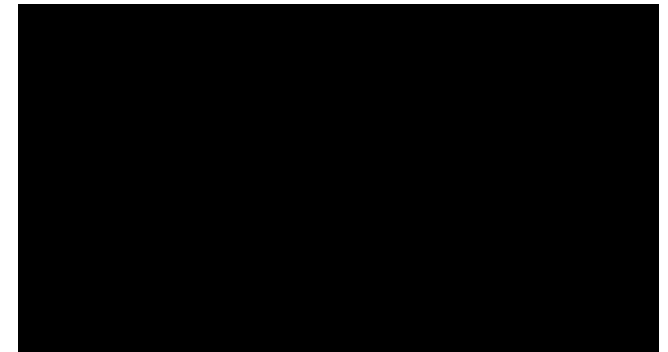
*denotes P <0.05

CERAB

Laser Particle Image Velocimetry



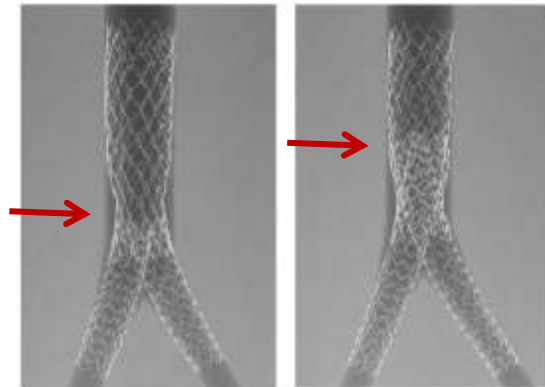
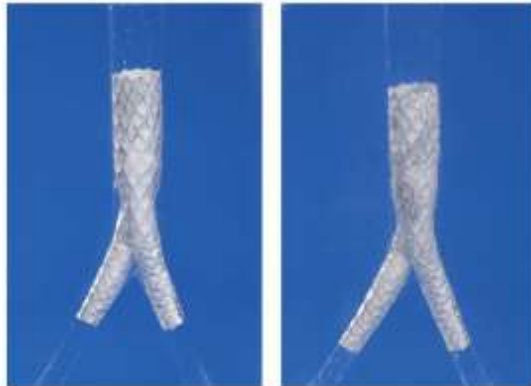
CERAB and BM kissing stents; Mostly laminar flow throughout the cardiac cycle



BM Kissing stents; turbulence and recirculation at phases B and C

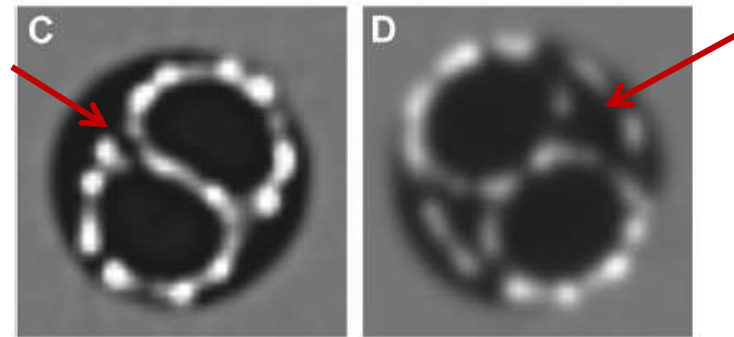
CERAB

The impact of limb placement



Suboptimal placed limbs:

- Inferior stent-to-wall apposition (Double-D configuration)
- 4-fold increase in mismatch area



Clinical results of CERAB

Midterm outcome

- February 2009 – July 2016
- 130 elective patients, two centers
- Age 61 (36-81) years, 69 male
- Chimney procedures excluded
- Previous aorto-iliac intervention in 41 %



Age, years, mean (range)	61 (36-81)	
	No.	%
Men	69	53
Risk factors		
Current smoking	100	78
Diabetes mellitus	46	35
Hypertension	96	74
Hyperlipidemia	121	93
Cardiac disease	61	47
Pulmonary disease	51	39
Carotid disease	26	20
Renal disease	25	19
ASA category		
1	0	0
2	73	57
3	50	39
4	6	5

Clinical results of CERAB

Midterm outcome

Rutherford classification:

- 1 n=1 0.8%
- 2 n=0 0.0%
- 3 n=84 66.1%
- 4 n=22 17.3%
- 5 n=18 14.2%
- 6 n=2 1.6%

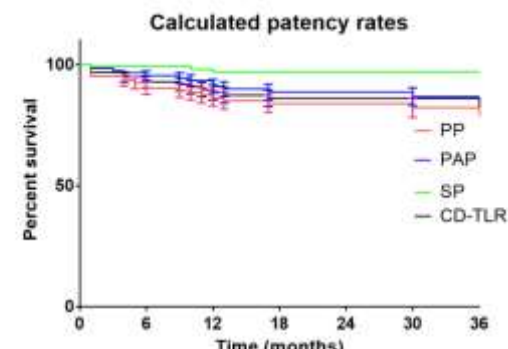
TASC -II classification:

- B n=7 (5.4%)
- C n=7 (5.4%)
- D n=116 (89.2%)

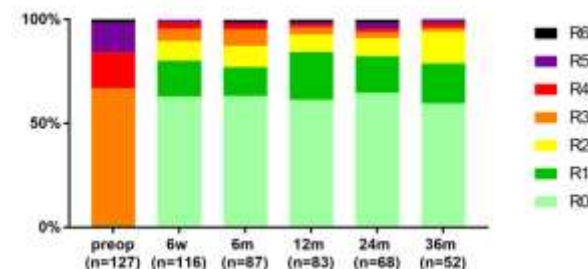
Clinical results of CERAB

Midterm outcome

- Median follow-up 24 months
- Total primary patency
 - 12 months 91%
 - 24 months 89%
 - 36 months 87%
- Secondary patency
 - 12 months 97%
 - 24 months 97%
 - 36 months 97%
- Clinical improvement at 36 months 96%
- Limb salvage rate at 36 months 97%

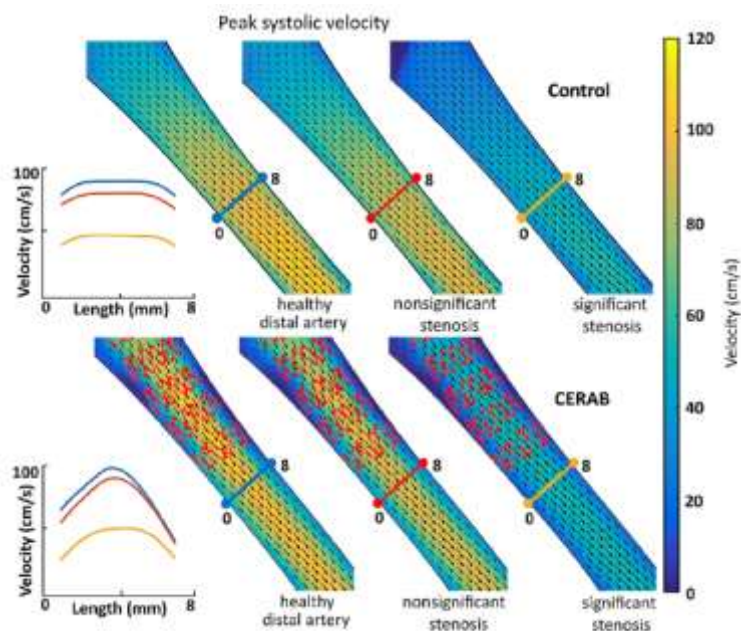


	0	6	12	18	24	30	36
Primary patency (PP)	0	8	12	18	24	30	36
No. At Risk	126	91	79	69	56	47	37
Patency (%)	100	90.8	88.2	83.9	83.9	82.1	82.1
SE (%)	0.0	2.8	3.3	3.6	3.6	4.0	4.0
Prim. Ass. Patency (PAP)	126	95	82	70	57	48	38
No. At Risk	100	95.5	91.1	86.7	82.3	80.8	86.8
Patency (%)	100	95.5	91.1	86.7	82.3	80.8	86.8
SE (%)	0.0	2.0	2.9	3.3	3.5	3.7	3.7
Secondary patency (SP)	126	88	85	74	61	52	43
No. At Risk	100	99.2	97.0	97.0	97.0	97.0	97.0
Patency (%)	100	99.2	97.0	97.0	97.0	97.0	97.0
SE (%)	0.0	0.8	1.7	1.7	1.7	1.7	1.7



Clinical results of CERAB

Role of outflow stenosis



HD significant outflow stenosis causes;

- 2-fold decrease in peak outflow velocity
- 3-fold decrease in TA-WSS in both CERAB and control

In CERAB the TA-WSS was 2-fold lower compared to the control model, independent of the lesion severity

Measurement	Control	CERAB	Lumen Diameter, mm	Lumen Loss, %	Pressure Difference, mm Hg
1	No stenosis	No stenosis	8	0	—
2	Insignificant stenosis	Insignificant stenosis	5	38	9
3	Significant stenosis	Significant stenosis	3	63	26
4	Occlusion	Occlusion	0	100	—

Outflow stenosis after CERAB will have a higher tendency to progress in time and may require early treatment

Clinical results of CERAB

Midterm outcome

Previous treatment of AIOD

- Surgical reconstruction of the aortoiliac segment (n=7);
- Endovascular intervention (N=46, 35%)
 - 46% PBA of the common iliac artery
(17% kissing balloons)
 - 37% Stenting of the common iliac artery
(31% kissing stents)

	Yes (n = 46), %	No (n = 80), %
One-year follow-up		
Primary patency	80	88
Primary assisted patency	91	97
Secondary patency	98	98
Three-year follow-up		
Primary patency	76	85
Primary assisted patency	83	88
Secondary patency	94	98



CERAB versus KS

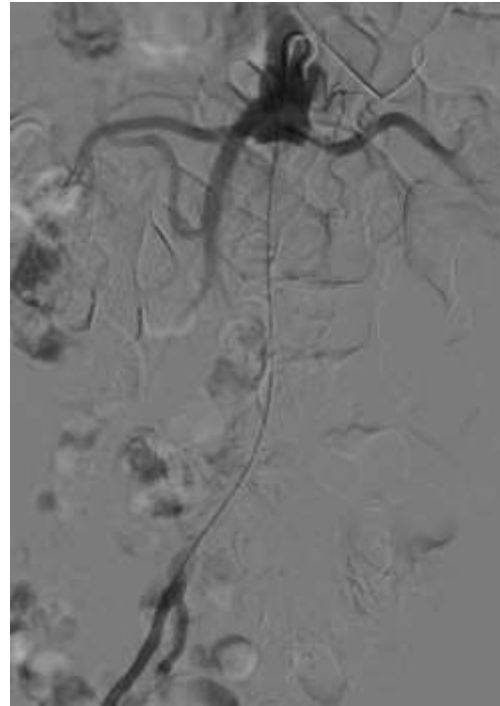
	KS meta-analysis	CERAB series
Number of patients	605	130
Previous interventions	27%	41%
Critical limb ischemia	16%	33%
TASC C and D	47%	94%

CERAB versus KS

	KS meta-analysis	CERAB series
Number of patients	605	130
Previous interventions	27%	41%
Critical limb ischemia	16%	33%
TASC C and D	47%	94%
Primary patency 24 months	81%	89%
Secondary patency at 24 months	93%	97%

Clinical results of CERAB

Renal protection



Clinical results of CERAB

Renal protection



Clinical results of CERAB

Use of chimney grafts

14 consecutive patients in three centers

11 male with mean age 61.2 ± 8.9 years

12/14 TASC D lesions

15 chimney grafts

inferior mesenteric artery (n=8)

right renal artery (n=4)

left renal artery (n=3)

Technical success 100%

Follow-up; 12 months (range 6–24)

Patency

CERAB 100%

Chimney 93%



Summary

- CERAB is related to the most optimal geometry and flow patterns and to a good clinical outcome is good up to 3-year follow-up
- Proper placement of the limbs and treatment of outflow stenosis are important to improve outcome
- Endovascular options seem unlimited, but the preferred treatment remains tailor made, particularly in complex cases



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