Maastricht UMC+
Heart+Vascular Center

Pro- and cons of staging complex EVAR

Is there more to staging than lower paraplegia?

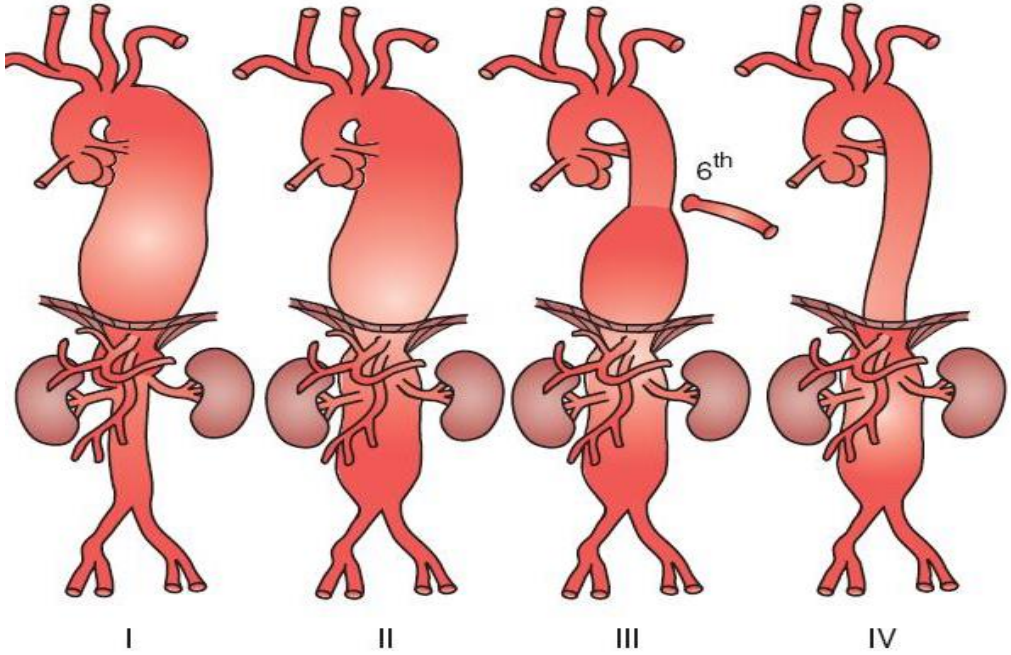
Barend Mees, Michiel de Haan, Geert Willem Schurink

23RD INTERNATIONAL EXPERTS SYMPOSIUM
CRITICAL ISSUES in aortic endografting 2019
LIVERPOOL UNITED KINGDOM MAY 23-24

Disclosures

Consulting: Cook, Bentley, Abbott, Getinge

Complex EVAR = endo TAAA repair

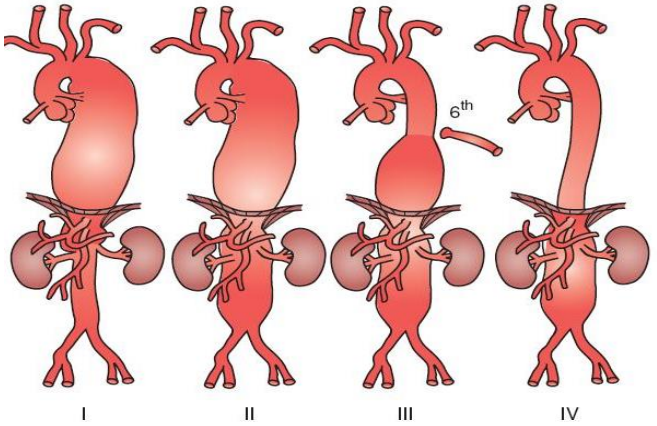


Types of staging

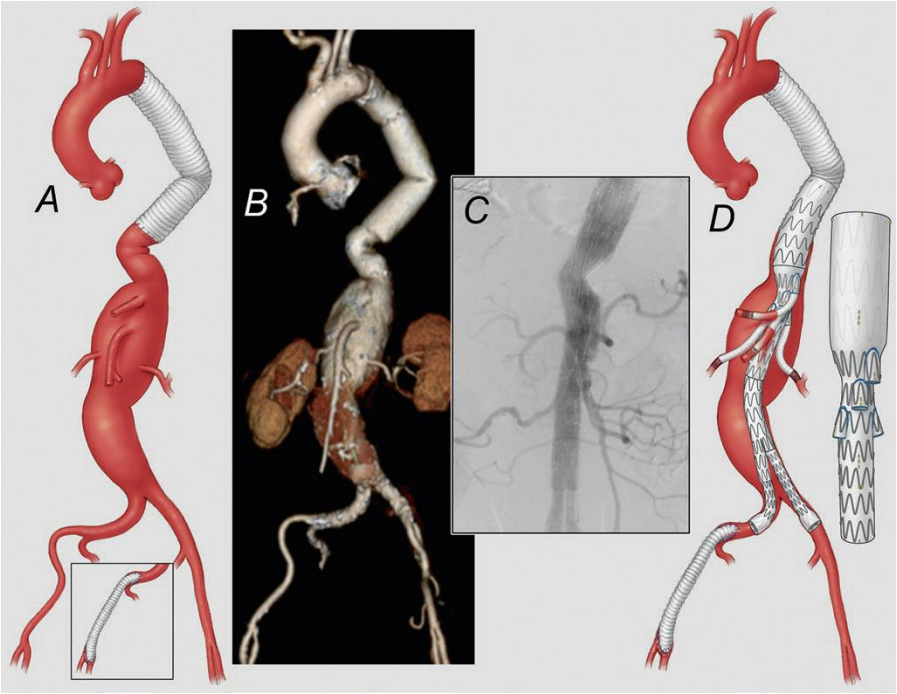
- Historical staging
- Arch/TEVAR first with/without debranching/access conduit
- Temporary sac perfusion
- Minimal Invasive Segmental Artery Coil Embolisation (MISACE)

Historical staging

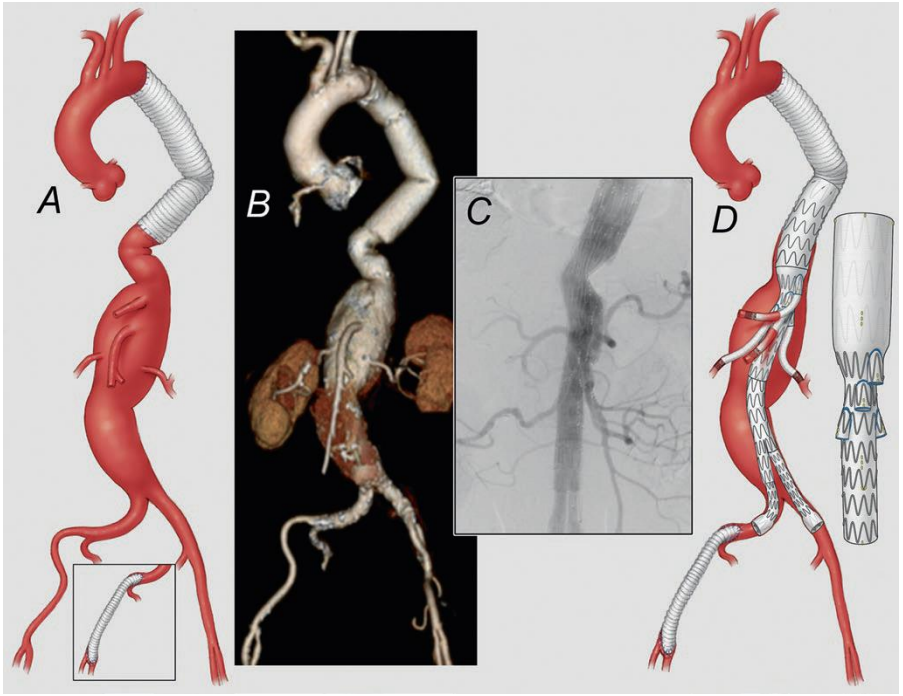
- 20-47% of patients with TAAA have had previous aortic repair
- Previous aortic repair is protective for mortality and development of SCI.



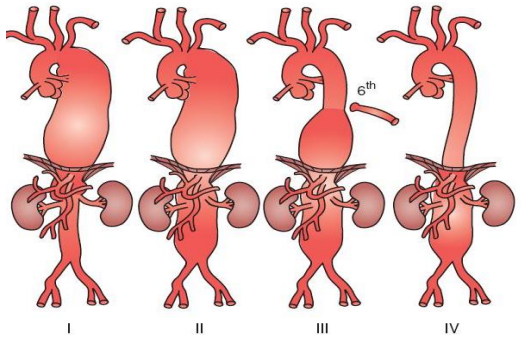
Previous Aortic Repair

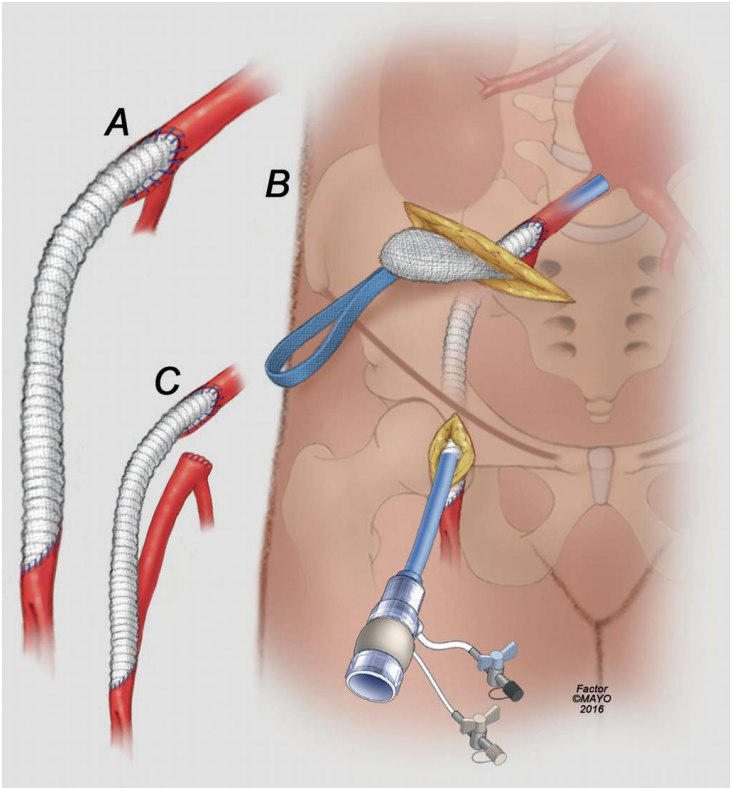


Iliofemoral conduit staging

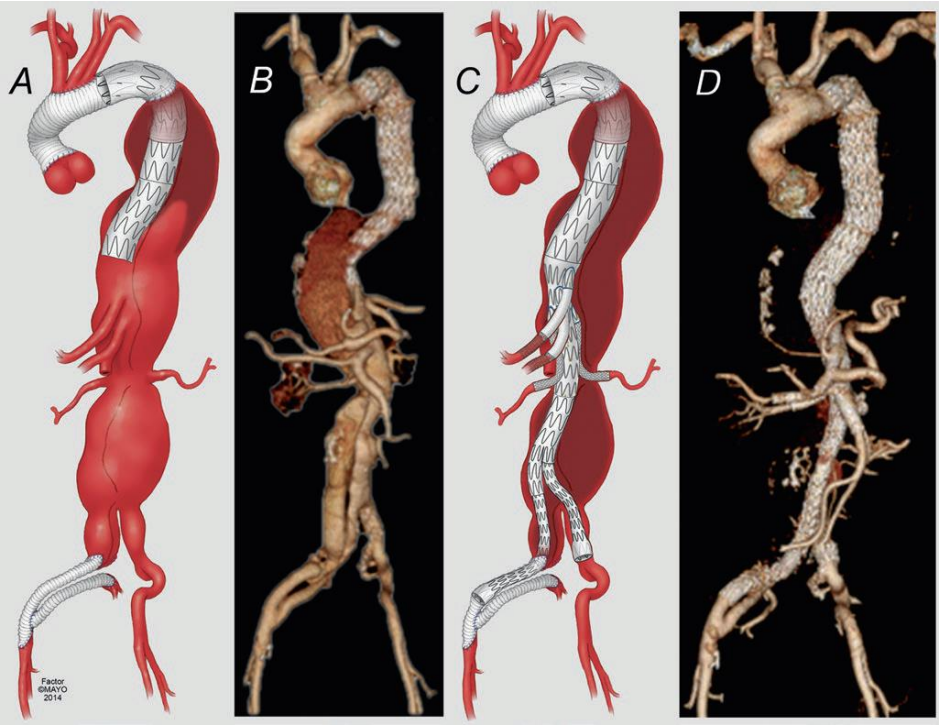


Patients who need conduits for staged procedures or extensive thoracoabdominal repairs (Types I to III) are preferentially treated with a permanent iliofemoral conduit to avoid need for redo retroperitoneal exposure and minimize risk of hemorrhage from associated coagulopathy that follows extensive aortic coverage.



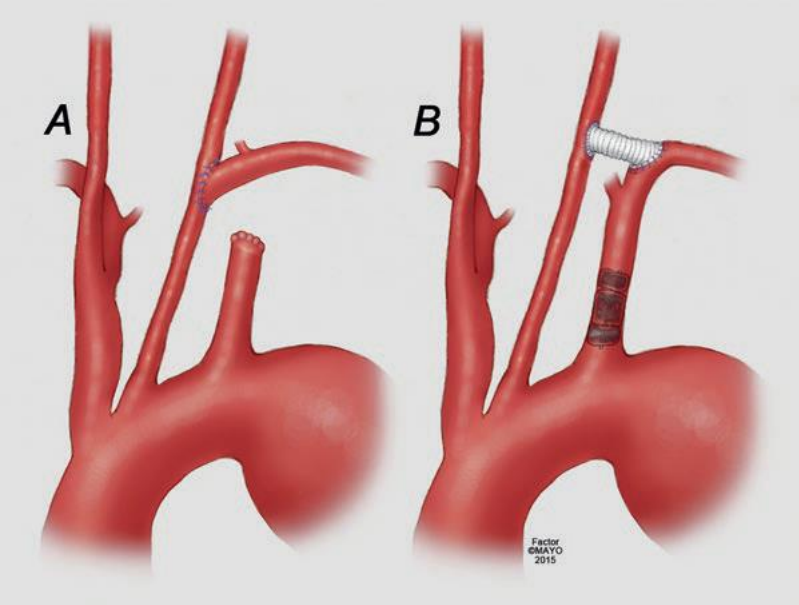


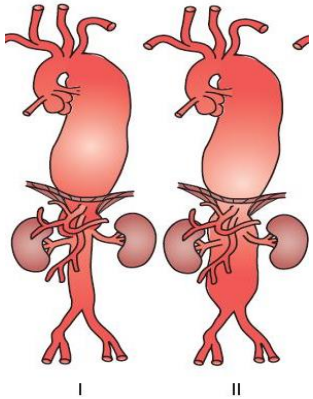
Ascending, Arch, FET first



TEVAR first

In Type I and II TAAAs TEVAR first is common staging strategy, especially in combination with carotid-LSA bypass





Staged endovascular repair of thoracoabdominal aortic aneurysms limits incidence and severity of spinal cord ischemia

Adrian O'Callaghan, MD, Tara M. Mastracci, MD, and **Matthew J. Eagleton, MD,** *Cleveland, Ohio*

Objective: Neurologic dysfunction remains a persistent complication of extensive aortic repair owing to disruption of the spinal collateral network. We hypothesized that staged repair might mitigate the incidence and severity of this spinal cord ischemia (SCI).

Methods: We conducted a retrospective cohort study of patients undergoing a Crawford type II repair of a thoracoabdominal aortic aneurysm between January 2008 and July 2013. Baseline demographics, incidence of prior aortic surgery, comorbidities, and outcomes were prospectively recorded. Staged repair was defined as intentional completion of the endovascular repair as two temporally separate procedures, referred to as a two-stage repair. Extent of aortic cover was

Conclusions: Staged repair appears both to protect against SCI and to enhance overall survival in extensive aortic repair. (J Vasc Surg 2015;61:347-54.)

prior aortic surgery), and unintentionally staged repair (n = 28; those with prior aortic surgery, without an intention to stage). Median time between stages was 5 months (range, 1-60 months). All groups were equivalent in terms of demographics and risk factors; however, the staged group had significantly greater proximal aortic cover ($P = .001$). The overall rates of SCI in the nonstaged and staged groups were 37.5% (12 of 32) and 11.1% (3 of 27), respectively ($P = .03$). Furthermore, all neurologic injuries in the staged group were temporary. The 30-day survival in the single-stage, two-stage, and unintentionally staged repairs was 18.8%, 0%, and 10.7%, respectively ($P = .52$).

Conclusions: Staged repair appears both to protect against SCI and to enhance overall survival in extensive aortic repair. (J Vasc Surg 2015;61:347-54.)

Staged endovascular repair of thoracoabdominal aortic aneurysms limits incidence and severity of spinal cord ischemia

Table II. Development of spinal cord ischemia (*SCI*)

Factor	*Total (N = 87), No. (%)*	*Single-stage repair (n = 32), No. (%)*	*Two-stage repair (n = 27), No. (%)*	*Unintentionally staged repair (n = 28), No. (%)*	P *value*

Staged endovascular repair of thoracoabdominal aortic aneurysms limits incidence and severity of spinal cord ischemia

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SCI	19 (21.8)	12 (37.5)	3 (11.1)	4 (14.3)	.025[c]
Time to development of SCI					.13[c]
None	68 (78.2)	20 (62.5)	24 (88.9)	24 (85.7)	
Immediate	9 (10.3)	5 (15.6)	2 (7.4)	2 (7.1)	
Delayed	10 (11.5)	7 (21.9)	1 (3.7)	2 (7.1)	
Duration of SCI					.033[a]
None	68 (78.2)	20 (62.5)	24 (88.9)	24 (85.7)	
Improved	11 (12.6)	7 (21.9)	3 (11.1)	1 (3.6)	
Permanent	8 (9.2)	5 (15.6)	0 (0.0)	3 (10.7)	
SCI severity score					.025[a]
None	68 (78.2)	20 (62.5)[b]	24 (88.9)[c]	24 (85.7)	
Weakness	8 (9.2)	5 (15.6)	2 (7.4)	1 (3.6)	
No antigravity	2 (2.3)	0 (0.0)	1 (3.7)	1 (3.6)	
Complete paralysis	9 (10.3)	7 (21.9)	0 (0.0)	2 (7.1)	

Staged endovascular repair of thoracoabdominal aortic aneurysms limits incidence and severity of spinal cord ischemia

Table III. Outcome results

Factor	*Total (N = 87), No. (%)*	*Single-stage repair (n = 32), No. (%)*	*Two-stage repair (n = 27), No. (%)*	*Unintentionally staged repair (n = 28), No. (%)*	P *value*
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Permanent	8 (9.2)	5 (15.6)	0 (0.0)	3 (10.7)	
30-day mortality	9 (10.3)	6 (18.8)	0 (0.0)	3 (10.7)	.052[b]
Prolonged intubation (FEVAR)	13 (14.9)	7 (21.9)	1 (3.7)	5 (17.9)	.11[b]
Tracheostomy (FEVAR)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
Dialysis (FEVAR)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	
AKI (FEVAR)	12 (13.8)	7 (21.9)	2 (7.4)	3 (10.7)	.26[b]
MI (FEVAR)	5 (5.7)	2 (6.3)	1 (3.7)	2 (7.1)	.99[b]

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Elective Fenestrated and Branched Endovascular Thoraco-abdominal Aortic Repair with Supracoeliac Sealing Zones and without Prophylactic Cerebrospinal Fluid Drainage: Early and Medium-term Outcomes

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Complex Aortic Team, Birmingham Heartlands Hospital, The Queen Elizabeth Hospital, University Hospitals Birmingham NHS Foundation Trust, Birmingham, UK

Eur J Vasc Endovasc Surg (2019) 57, 639–648

Elective Fenestrated and Branched Endovascular Thoraco-abdominal Aortic Repair with Supracoeliac Sealing Zones and without Prophylactic Cerebrospinal Fluid Drainage: Early and Medium-term Outcomes

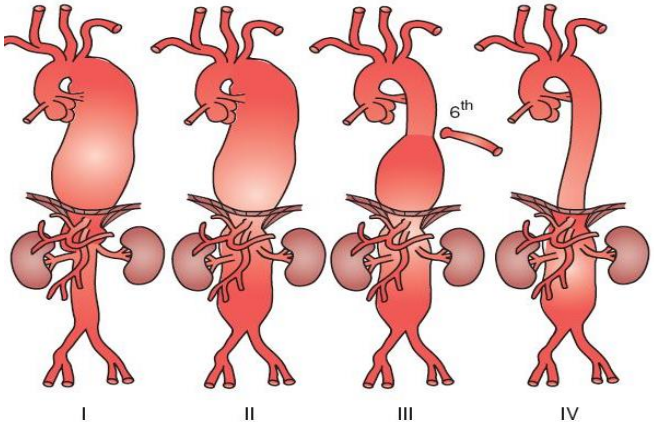
Table 4 Staged approach to endovascular treatment of juxtarenal or thoraco-abdominal aortic aneurysm in 92 patients

Stage 1	Stage 2	Stage 3	Number of patients (%)
Arch FEVAR	FEVAR		3 (1.1)
TEVAR	BEVAR/FEVAR		38 (14.1)
TEVAR	BEVAR/FEVAR	Limb	6 (2.2)
BEVAR/FEVAR	Distal body + limb/IBD		4 (3/1) (1.5)
BEVAR	One branch (CA/SMA/RA)		20 (18/1/1) (7.4)
BEVAR	One branch (CA/RA) + limb		2 (1/1) (0.7)
BEVAR	All branches	Limb	1 (0.4)
BEVAR	Amplatzer II plug to false lumen		1 (0.4)
FEVAR	Ilio-renal bypass + fenestration occlusion		1 (0.4)

Conclusion: Elective endovascular thoraco-abdominal aortic repair with SC sealing zones can be performed with low peri-operative risk and good medium-term outcomes. Selective staging without prophylactic CSF drainage contributed to a significant reduction in the incidence of SCI.

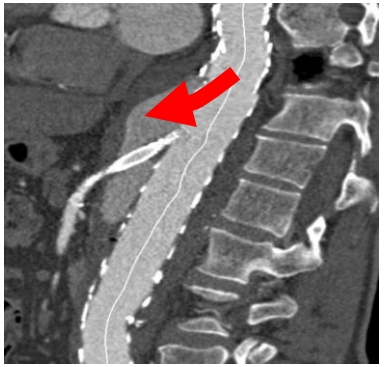
Historical and TEVAR staging

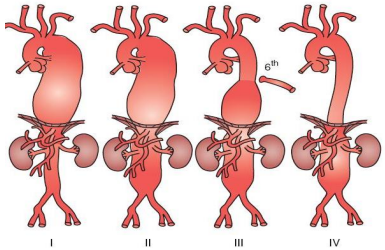
- Reduce operative time
- Reduce limb ischemia
- Reduce complications
- Reduce mortality and morbidity
- Reduce paraplegia



Temporary Aneurysm Sac Perfusion

- Perfusion branches
- Open branch
- Stent between stent graft components
- Unconnected iliac limb



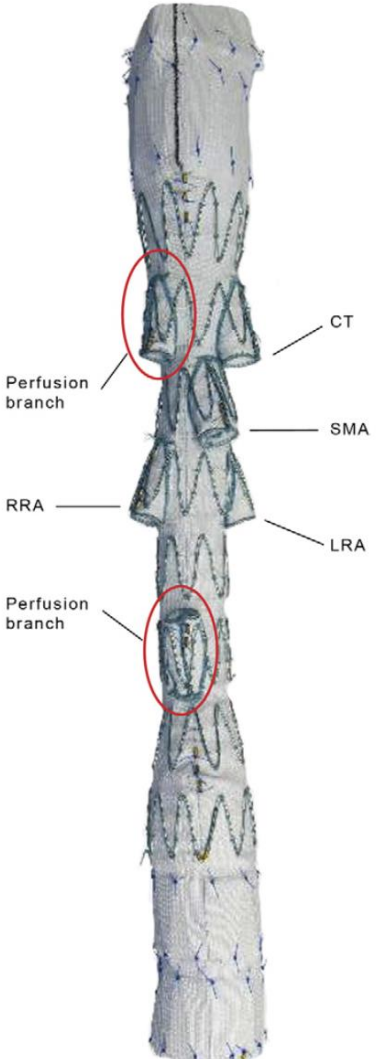


Perfusion branches

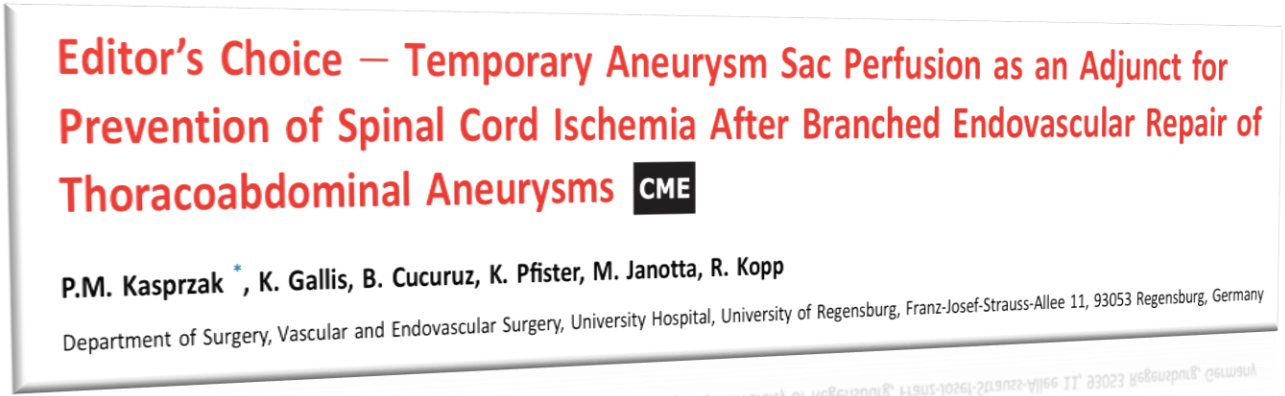
Elective sac perfusion to reduce the risk of neurologic events following endovascular repair of thoracoabdominal aneurysms

Seamus C. Harrison, MRCS, Obi Agu, MS, FRCS, Peter L. Harris, MD, FRCS, and Krassi Ivancev, MD, PhD, *London, United Kingdom*

Spinal cord ischemia (SCI) is a catastrophic complication of thoracoabdominal aortic aneurysm (TAAA) repair. This article describes our early experience with a technique for maintaining perfusion of segmental vessels (intercostals and lumbars) in the early postoperative period after endovascular repair of a TAAA, with "sac perfusion branches" added to custom-made stent grafts. These are closed 7 to 10 days after the first procedure to complete exclusion of the aneurysm. We have used this technique in 10 patients with type II TAAAs. One developed monoparesis of the right leg during a period of hypotension secondary to a cardiac event and died within 30 days. Two patients developed lower limb weakness after closure of the perfusion branches, both with full recovery. Controlled perfusion of segmental vessels with perfusion branches is feasible and may be a useful adjunct to prevent SCI, providing protection to spinal cord perfusion during the immediate postoperative period when risk of SCI is greatest. (J Vasc Surg 2012;55:1202-5.)



Open branch strategy



Editor's Choice – Temporary Aneurysm Sac Perfusion as an Adjunct for Prevention of Spinal Cord Ischemia After Branched Endovascular Repair of Thoracoabdominal Aneurysms CME

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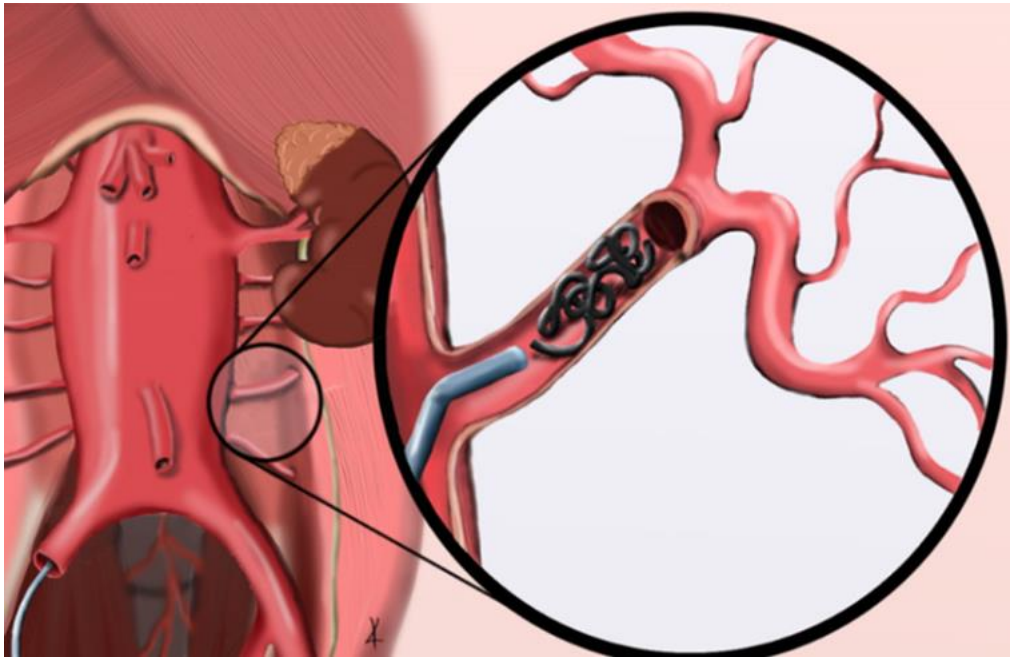
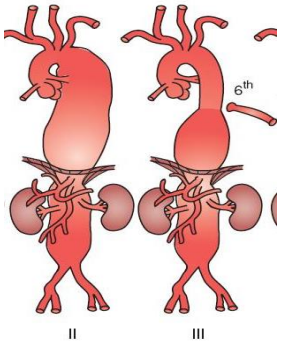
	Sac perfusion (n=40)	No Sac Perfusion (n=43)
Paraplegia	5%	21%

MISACE





MISACE

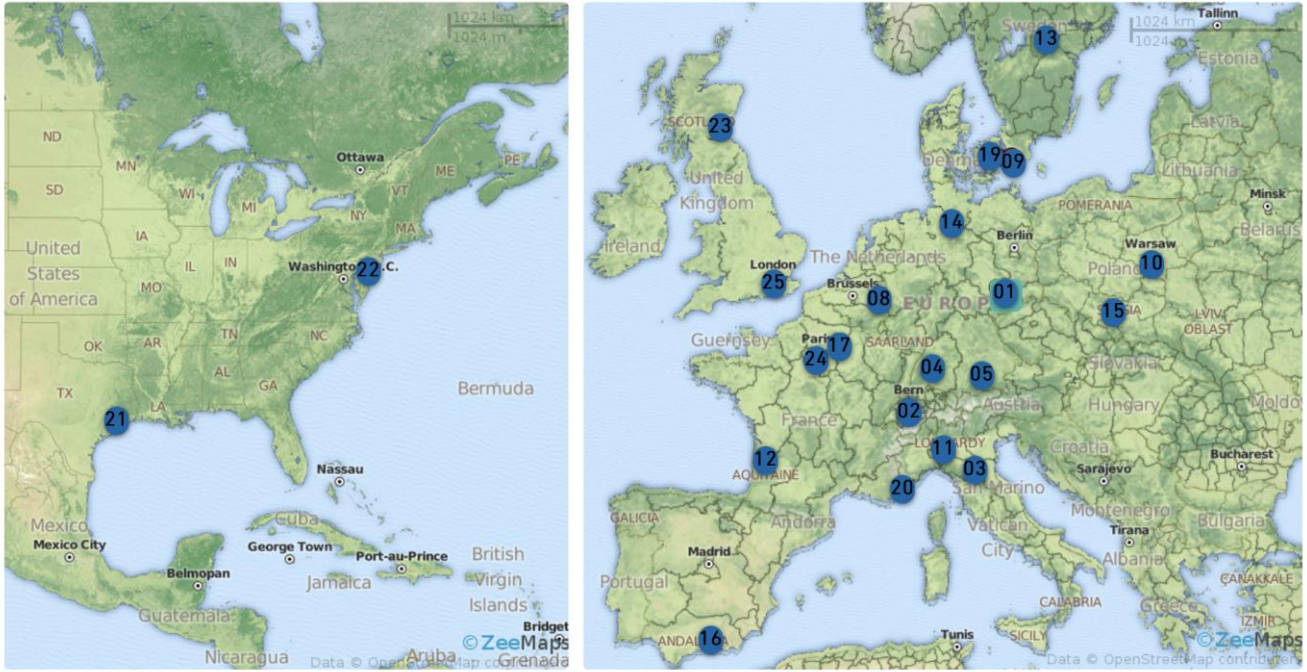
PERIPHERAL INTERVENTIONS

Ischaemic preconditioning of the spinal cord to prevent spinal cord ischaemia during endovascular repair of thoracoabdominal aortic aneurysm: first clinical experience

METHODS AND RESULTS: A cohort of 57 patients with TAAAs was treated by MISACE followed by ER between October 2014 and December 2017. The TAAA Crawford classification was: type I, n=5, type II, n=12; type III, n=27; type IV, n=13. The average maximum aortic diameter was 62.7±8.8 mm. Patients had a median of 5 coiled SAs (range: 1-19). MISACE was completed in one (n=22), two (n=24), three (n=7), four (n=3) or five (n=1) sessions. The maximum number of coiled SAs per session was six. After completion of MISACE, 77.7% of direct segmental arterial flow was occluded. After a mean of 83±62 days, 55 of the patients received total ER of their TAAA. At 30 days after ER no patient developed SCI and three patients had died.

CONCLUSIONS: MISACE to precondition the paraspinous collateral network prior to endovascular repair of thoracoabdominal aortic aneurysm is clinically feasible. The safety profile is promising and there is good reason to explore this new staging strategy further.

PAPAartis
fighting spinal cord injury



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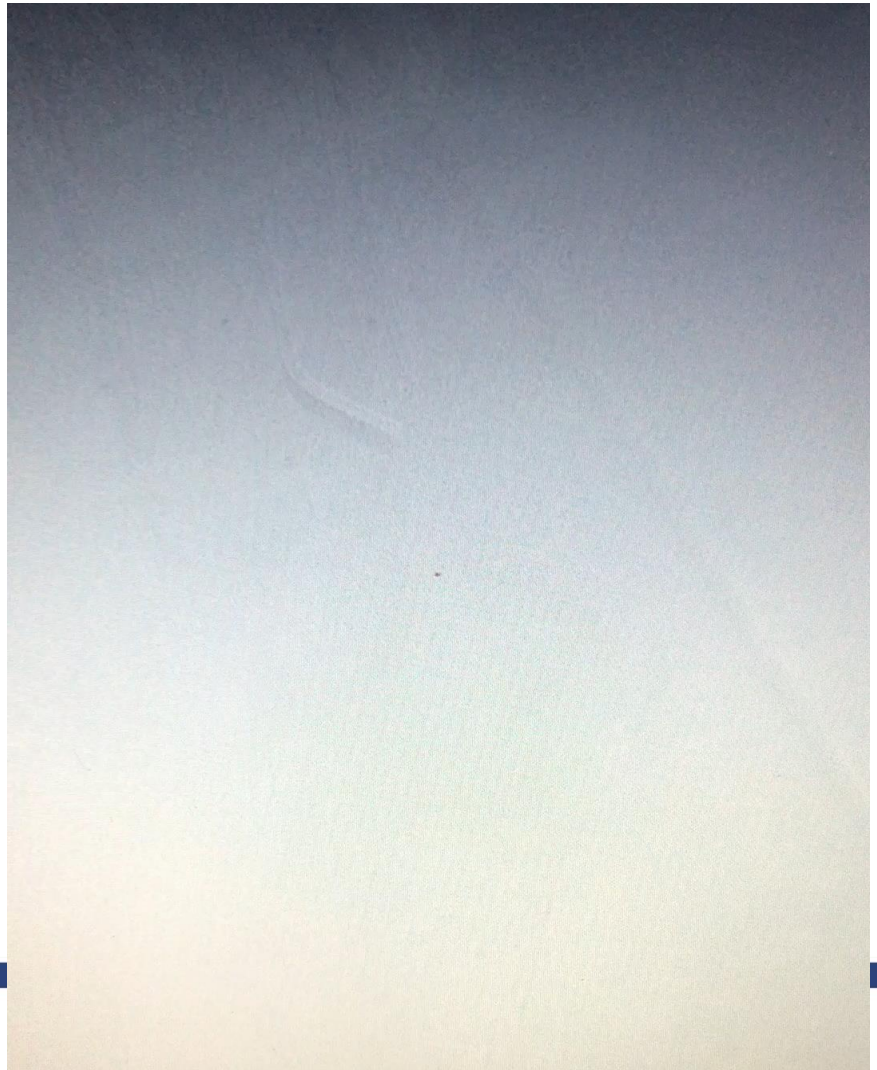
What are the cons of staging?

- Rupture
- Occlusion of target vessel
- Disturbed flow in sac causing emboli
- General anesthesia 2x
- Complication of coiling segmental arteries
- Patient satisfaction

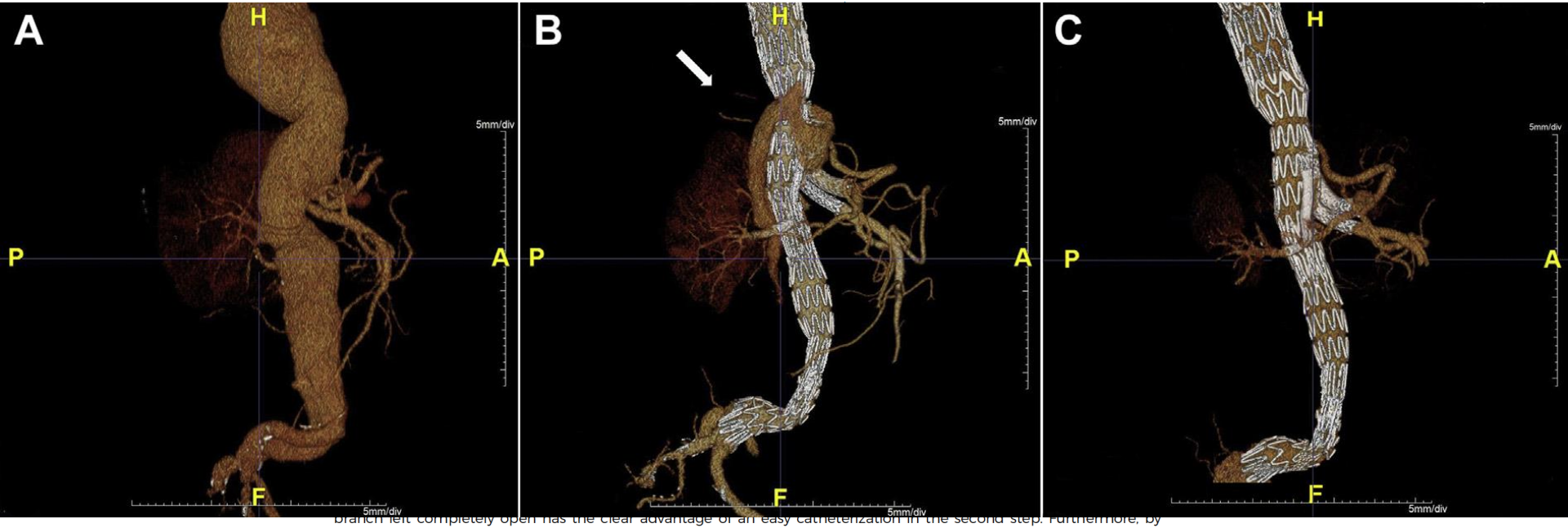
Rupture/Mortality before completion 2nd stage

- Cleveland 2/27
- Birmingham 1/92
- Regensburg 1/40
- Maastricht 0

Target vessel occlusion



The “bare branch” for safe spinal cord ischemia prevention after total endovascular repair of thoracoabdominal aneurysms



branch left completely open has the clear advantage of an easy catheterization in the second step. Furthermore, by having the target vessel stented with a bare stent, the risk of embolism is avoided. In this experience, there was no significant aneurysm sac growth in between the steps. Further comparative studies may determine whether there are different hemodynamic forces with this technique with respect to those already described in the literature. (J Vasc Surg 2018;■:1-9.)

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- **Disturbed flow in sac causing emboli**
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- Complication of coiling segmental arteries
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General anesthesia

- Maastricht axillary access and MEPS
- Regensburg 23% local anesthesia

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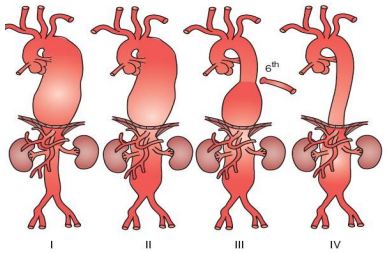
- Complication of coiling segmental arteries
- **Patient satisfaction**

There is no doubt that staging endo TAAA repair is beneficial

- Staging has reduced paraplegia rates dramatically
- It also reduces mortality and morbidity
- Only retrospective evidence
- Low or very low GRADE



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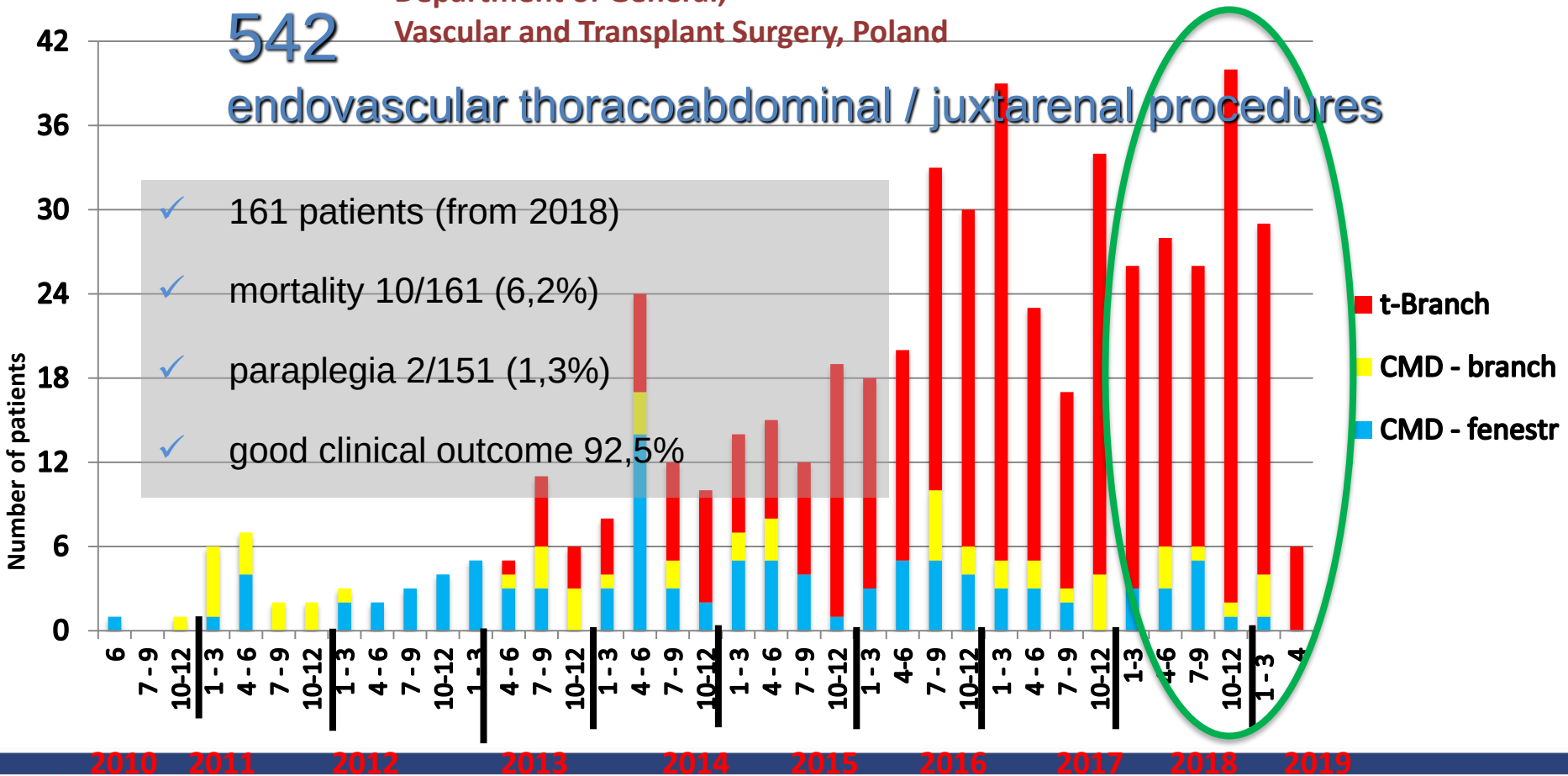
endovascular thoracoabdominal / juxtarenal procedures

- ✓ 161 patients (from 2018)
- ✓ mortality 10/161 (6,2%)
- ✓ paraplegia 2/151 (1,3%)
- ✓ good clinical outcome 92,5%



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