70TH ESCVS CONGRESS & 7TH IMAD MEETING

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Treatment strategies for infected aortic grafts

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NO DISCLOSURES RELATED TO THE TOPIC

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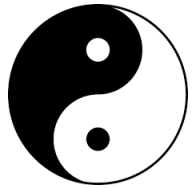
Aortic graft infection

- **Graft infection after aortic surgery is an underrecognized and underreported entity.**

- **The incidence of aortic graft infection is 0.4%-0.7% for endo and 0.6%-3% for open procedures.**



- **Secondary aortoenteric fistulas: 30% of aortic graft infections with mortality rates 25% to 100%**

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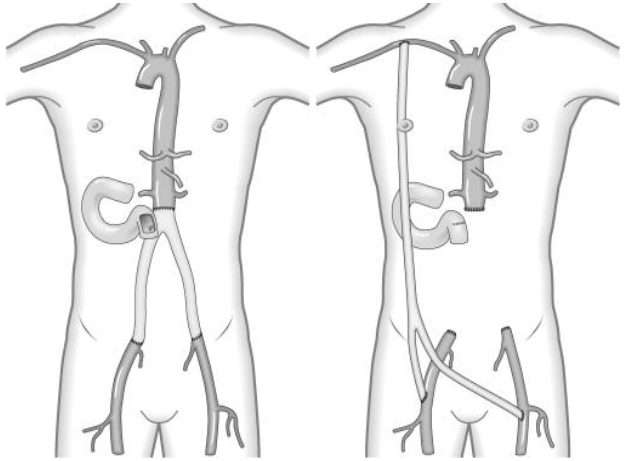
Management of aortic graft infection and secondary AEF

Total Graft Excision + gut repair

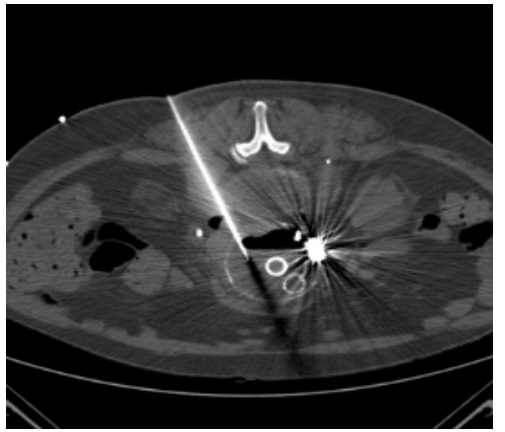
Partial Graft Excision + gut repair

- Graft Excision without replacement
- Graft Excision & Extra-anatomic bypass
- In Situ Aortic Graft Replacement



Graft Preservation

- Gut repair and endovascular reconstruction
- Gut repair and antibiotics
- EVAR and antibiotics
- Non operative management (drains + antib)



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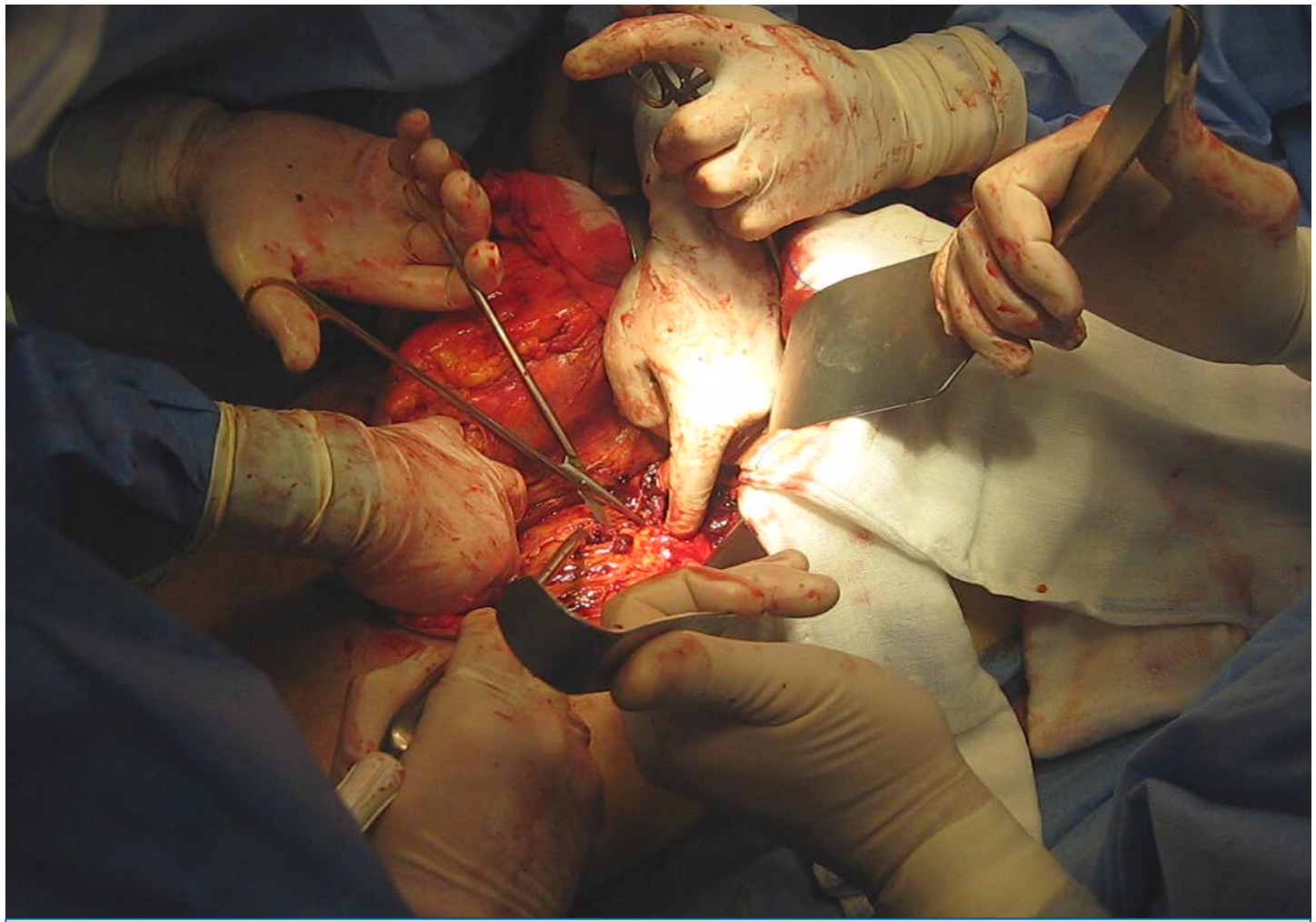
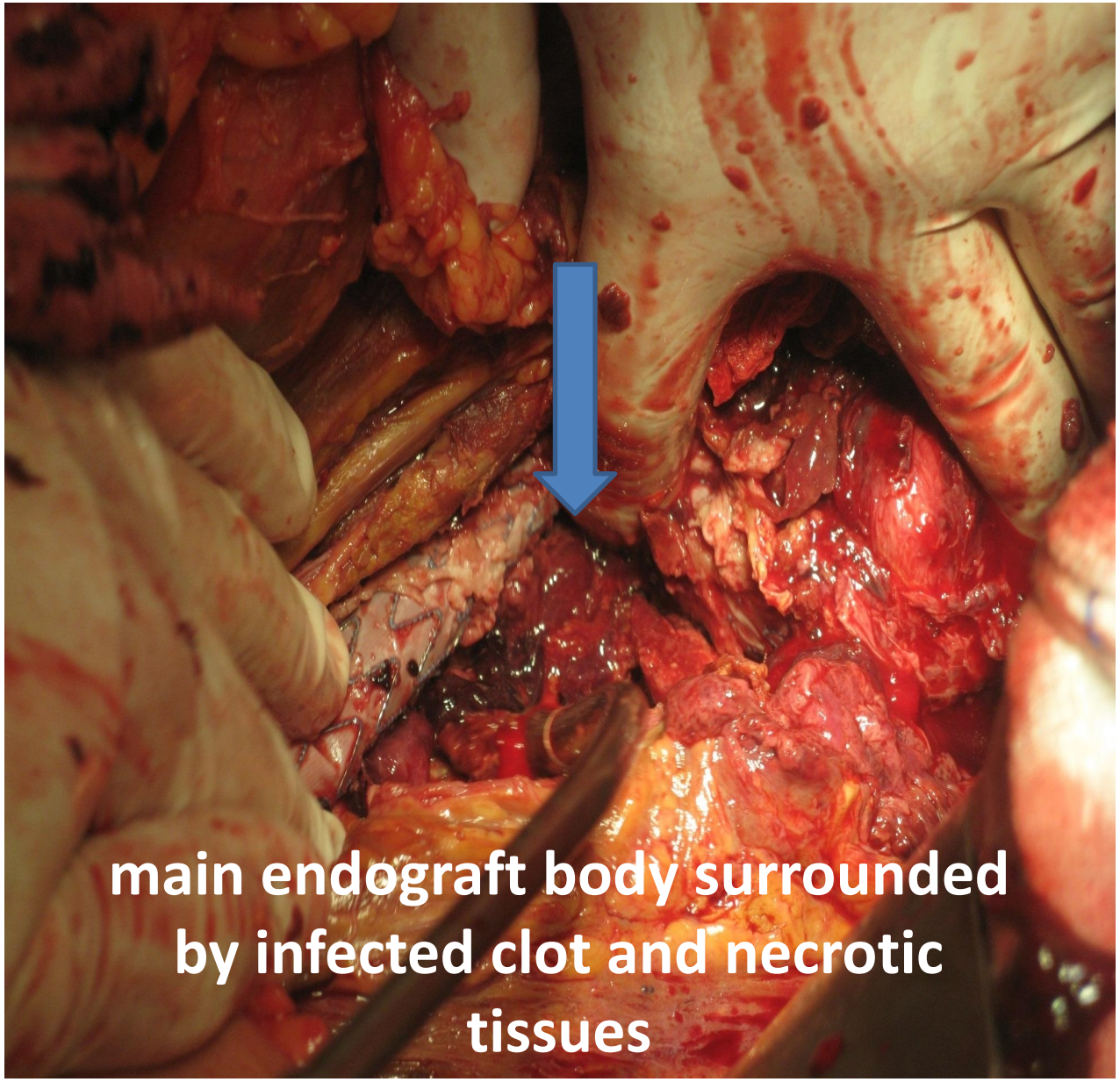
Aortic Graft infection and AEF 3 y. post EVAR

Retroperitoneal approach for proximal aortic clamping

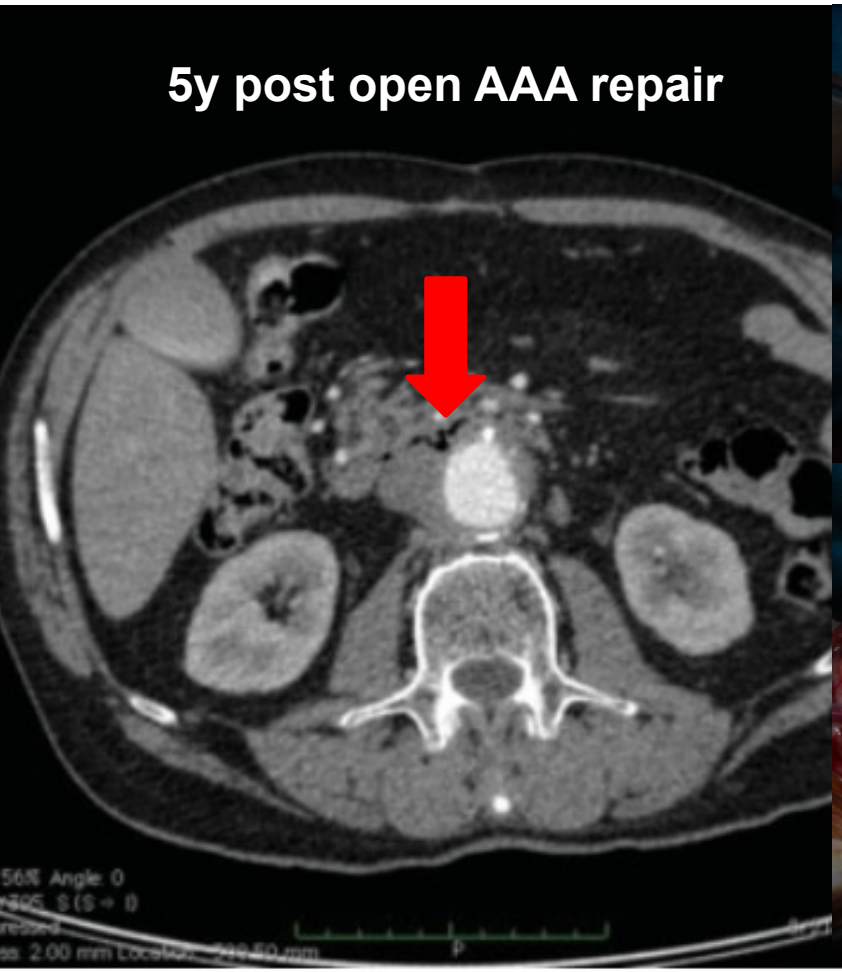


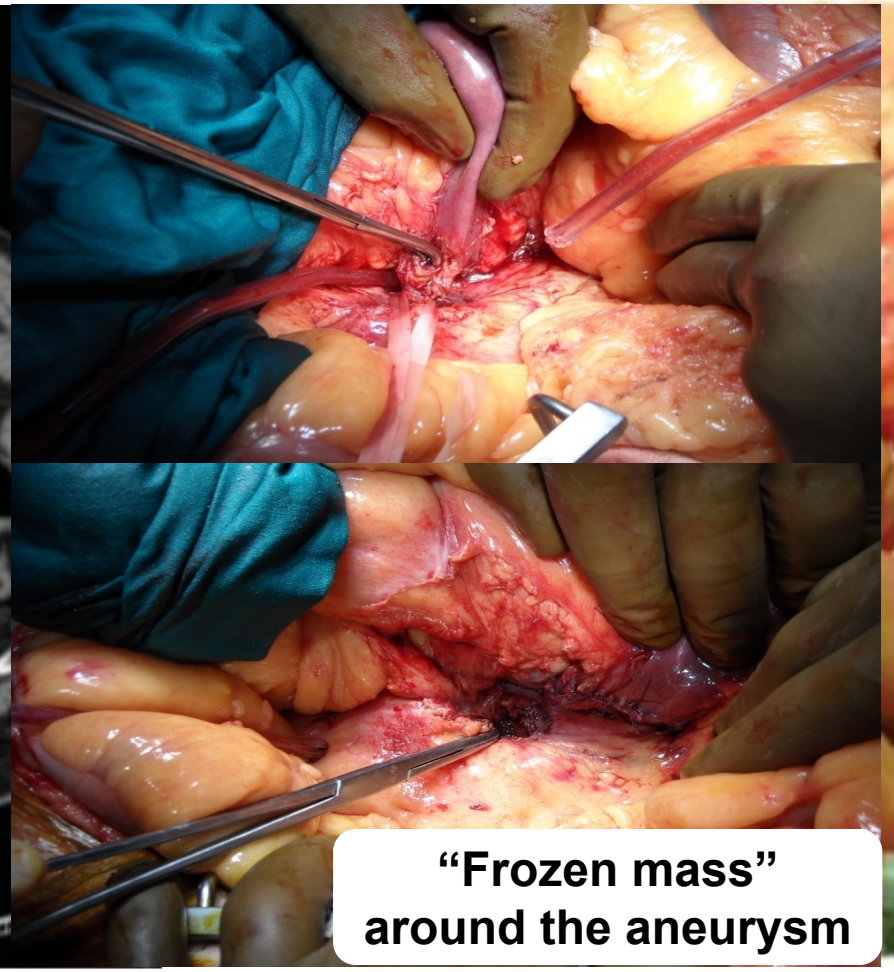
Visceral rotation C. Liapis
The aorta is exposed right up to the celiac trunk
Proximal and distal cross clamping, the aneurysm wall is opened

Aortic Graft infection and AEF 3 y. post EVAR



Secondary AEF: Preservation of the graft EVAR + gut restoration





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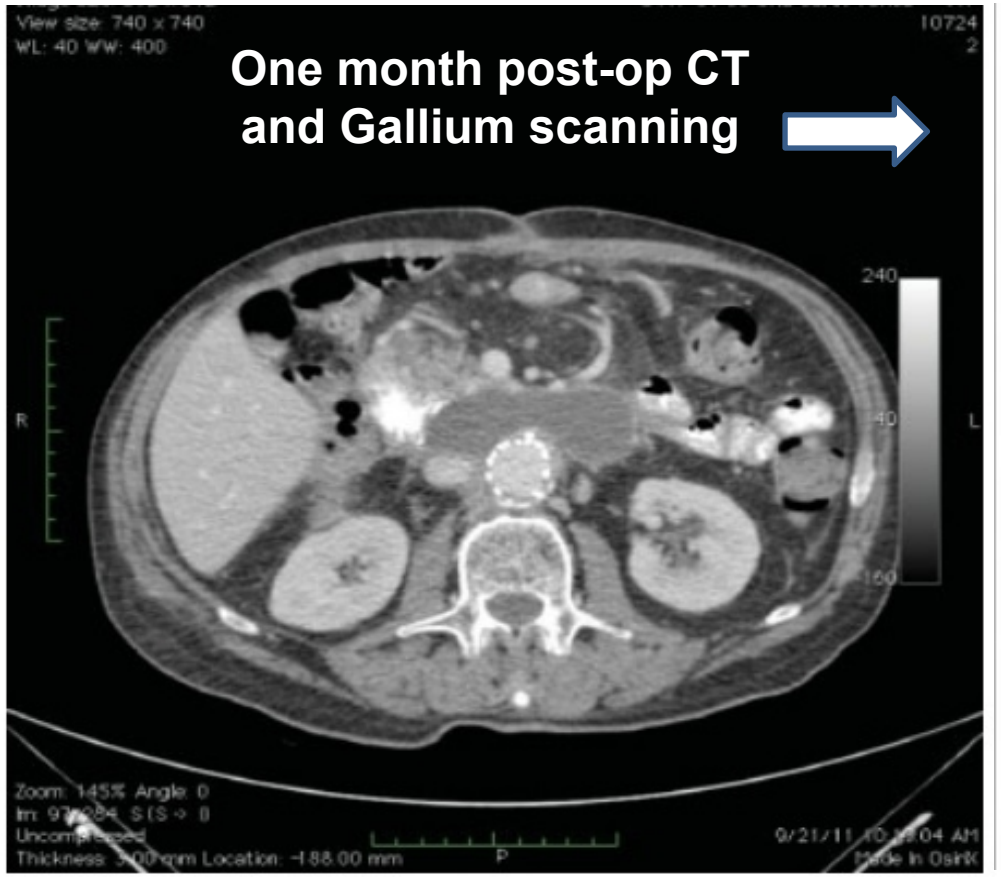
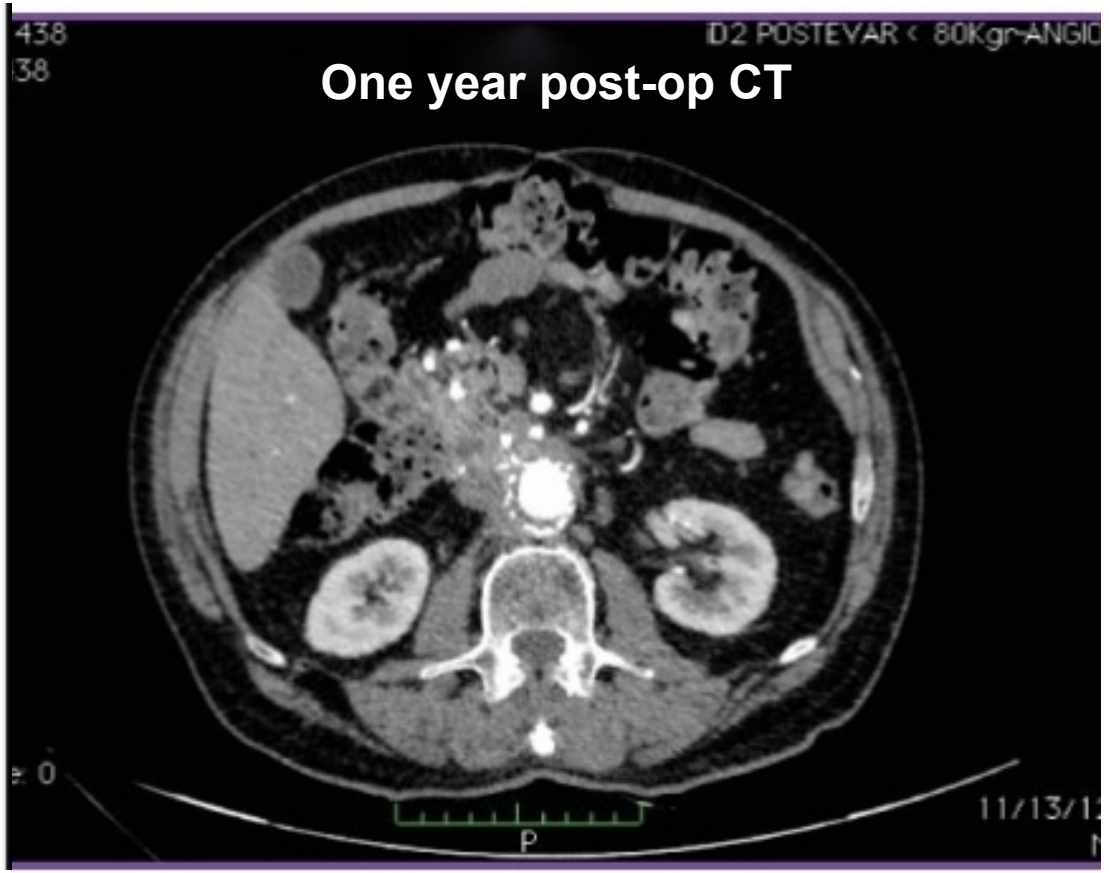
Secondary AEF:
EVAR + gut restoration





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Surgical strategies in patients with vascular graft infection

The VASGRA cohort study

n = 137

62 (45%) received debridement

47 (34%) total graft replacement

12 (9%) partial graft replacement

16 (12%) managed conservatively

Anagnostopoulos A. et al. Eur J Vasc Endovasc Surg. Aug. 2021

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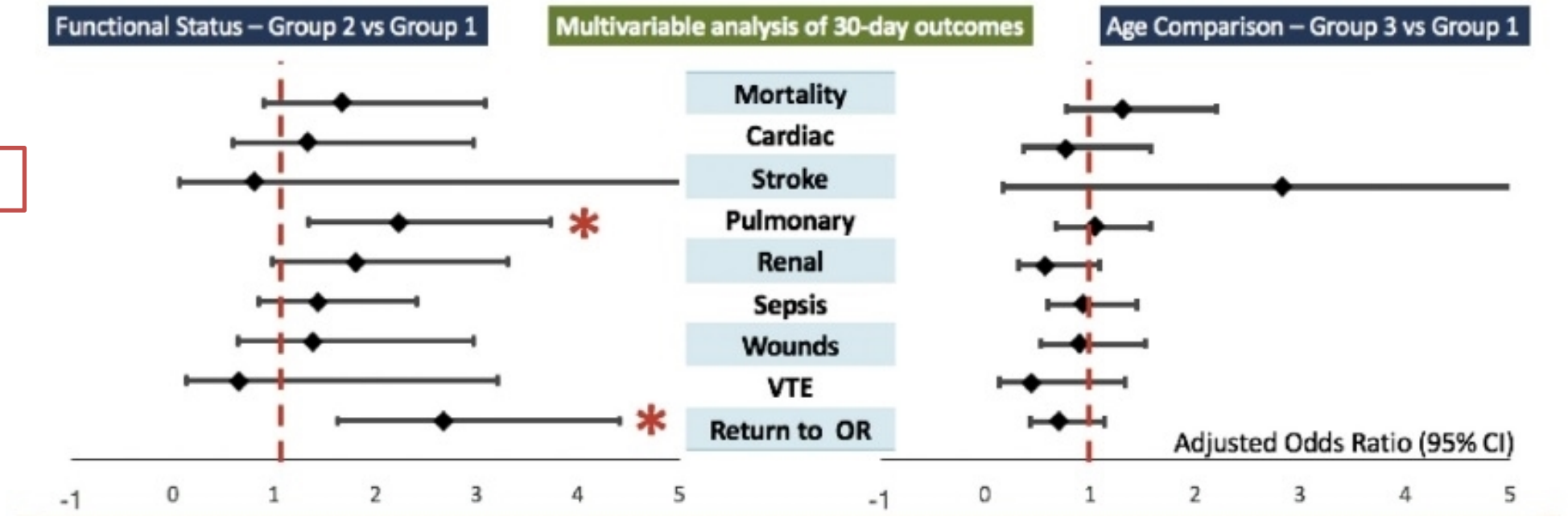
Functional status and age on perioperative outcomes in aortic graft infection surgery (NSQIP Study)

n = 814



Dependent functional status has significant association with adverse outcomes after excision of infected abdominal aortic grafts, whereas old age alone does not.

Chaudhry SA et al. J Vasc Surg. April 2022

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Aortic graft infection: Total or partial resection Thoracic / Thoraco-abdominal

Recommendation 22

For fit patients with proven thoracic/thoraco-abdominal vascular graft/endograft infection, total graft explantation is recommended.

Class	Level	References
I	B	Kahlberg *et al.* (2019),[100] Moulakakis *et al.* (2013)[117]

Recommendation 26

For patients with thoracic/thoraco-abdominal vascular graft/endograft infection, partial explantation may be considered if infection is limited.

Class	Level	References
IIb	C	Kahlberg *et al.* (2019)[100]

Chakfé N. et.al. ESVS 2020 Management Guidelines for Vascular Graft and Endograft Infections
Eur J Vasc Endovasc Surg (2020) 59, 339-384

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Aortic graft infection: Total or partial resection Abdominal

Recommendation 38

For fit patients with an abdominal aortic vascular graft/endograft infection, complete excision of all graft material and infected tissue is recommended for definitive treatment.

Class	Level	References
I	B	Batt *et al.* (2018),[17] O'Connor *et al.* (2006)[180]

Recommendation 41

Partial excision of infected an aortic vascular graft/endograft may be considered when infection is documented as limited and the remaining material is well incorporated.

Class	Level	References
IIb	C	Mirzaie *et al.* (2007),[163] Simmons *et al.* (2017),[186] Phang *et al.* (2019)[187]

Chakfé N. et.al. ESVS 2020 Management Guidelines for Vascular Graft and Endograft Infections
Eur J Vasc Endovasc Surg (2020) 59, 339-384

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Aortic graft infection: In situ reconstruction after total or partial removal of the graft

Twenty-one studies and 1.052 patients.

Meta-analysis: rates of early/late mortality, amputations and reinfection.

Total resection: early mortality 16.8% (urgency, males, omentoplasty)
late mortality 28.5%
reinfection 11% (males, fistula, virulent organisms)

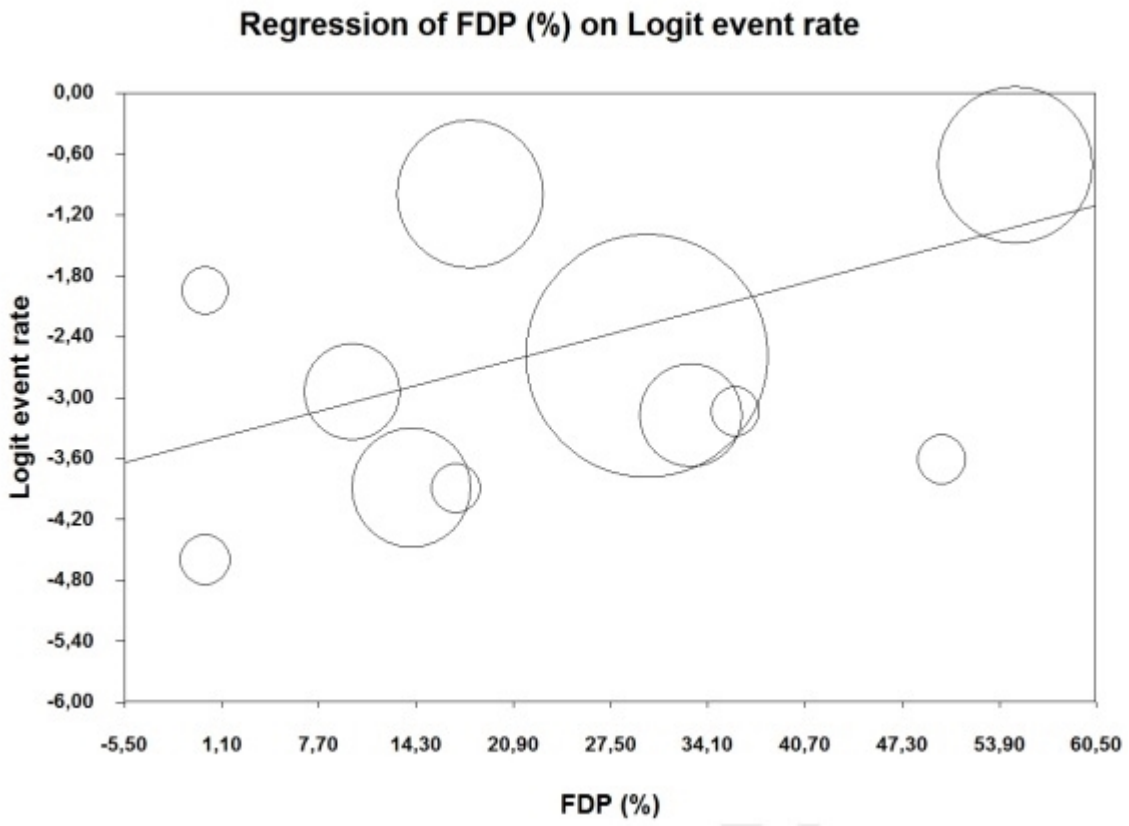
} (p < .0001)

Partial resection: early mortality 10.5%
late mortality 18%
reinfection 27% (fistula)

} **no statistical correlation**

Batt M. et al. Research Group for Vascular Graft Infection. J Cardiovasc Surg (Torino). 2020

Presence of fistula and event rate



Batt M. et al. Research Group for Vascular Graft Infection. J Cardiovasc Surg (Torino). 2020

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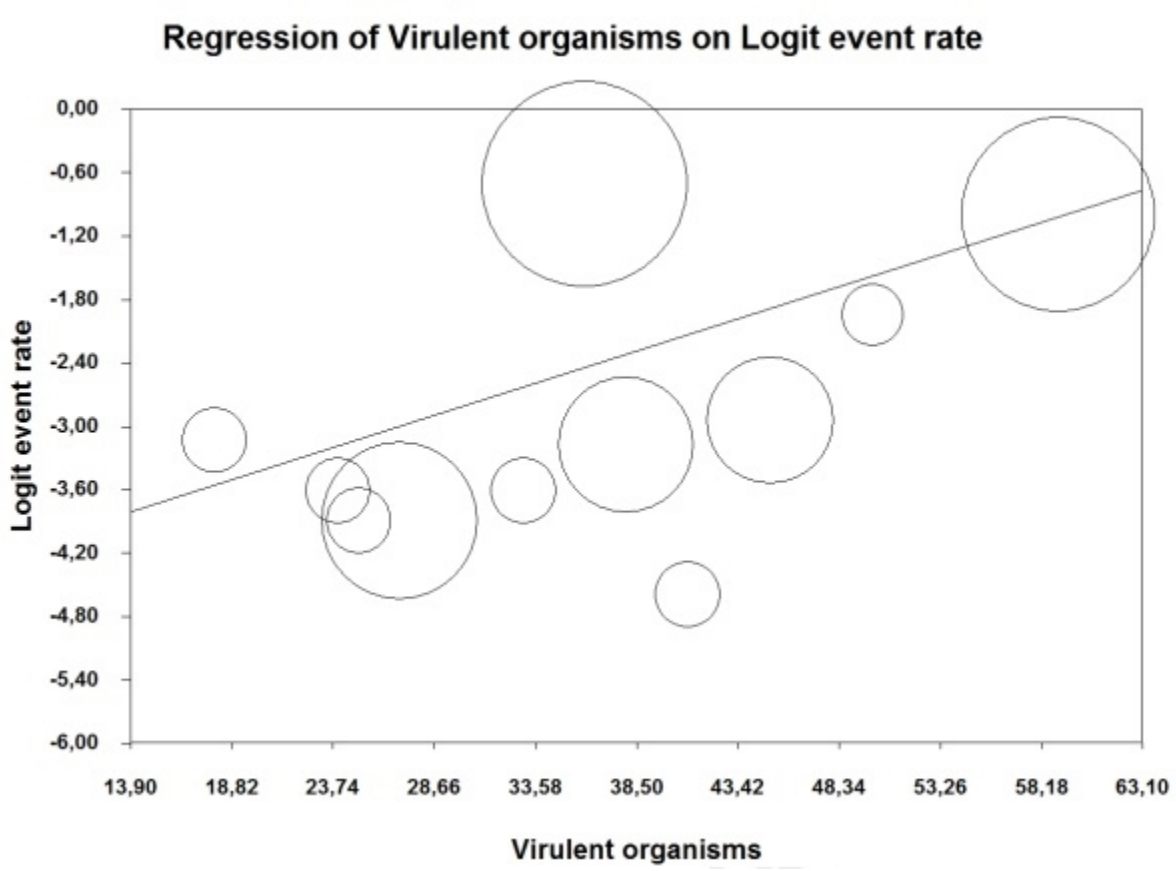
Virulent organisms and event rate



Batt M. et al. Research Group for Vascular Graft Infection. J Cardiovasc Surg (Torino). 2020

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Outcomes after partial resection of infected aortic grafts

VASCULAR Low Frequency Disease Consortium VLFDC

n=114, Males 70%, median age 70.

Previous vascular history: 97% open aortic procedure.

(77% aortobifemoral, 16% aortobiiliac, 0.8% thoracic).

Treatment: partial resection and: A. extra-anatomic (47%) or B. in situ (53%).

Thirty-day mortality: 17.5%. Median follow-up: 17 months.

Janko M. … Liapis CD. Ann Vasc Surg. Oct. 2021

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Outcomes after partial resection of infected aortic grafts

Follow up: Patency 72%, major amputation 11%

Cox regression: Candida infection and aortoenteric fistula: increased risk of mortality (HR 2.4; P = 0.01) (HR 1.9, P = 0.03).

Persistent early infection: 26%. Reinfection: 39% (older, AEF, P < 001)

Kaplan - Meier estimated median survival 3.6 years.

No survival difference between groups (P = 0.6).

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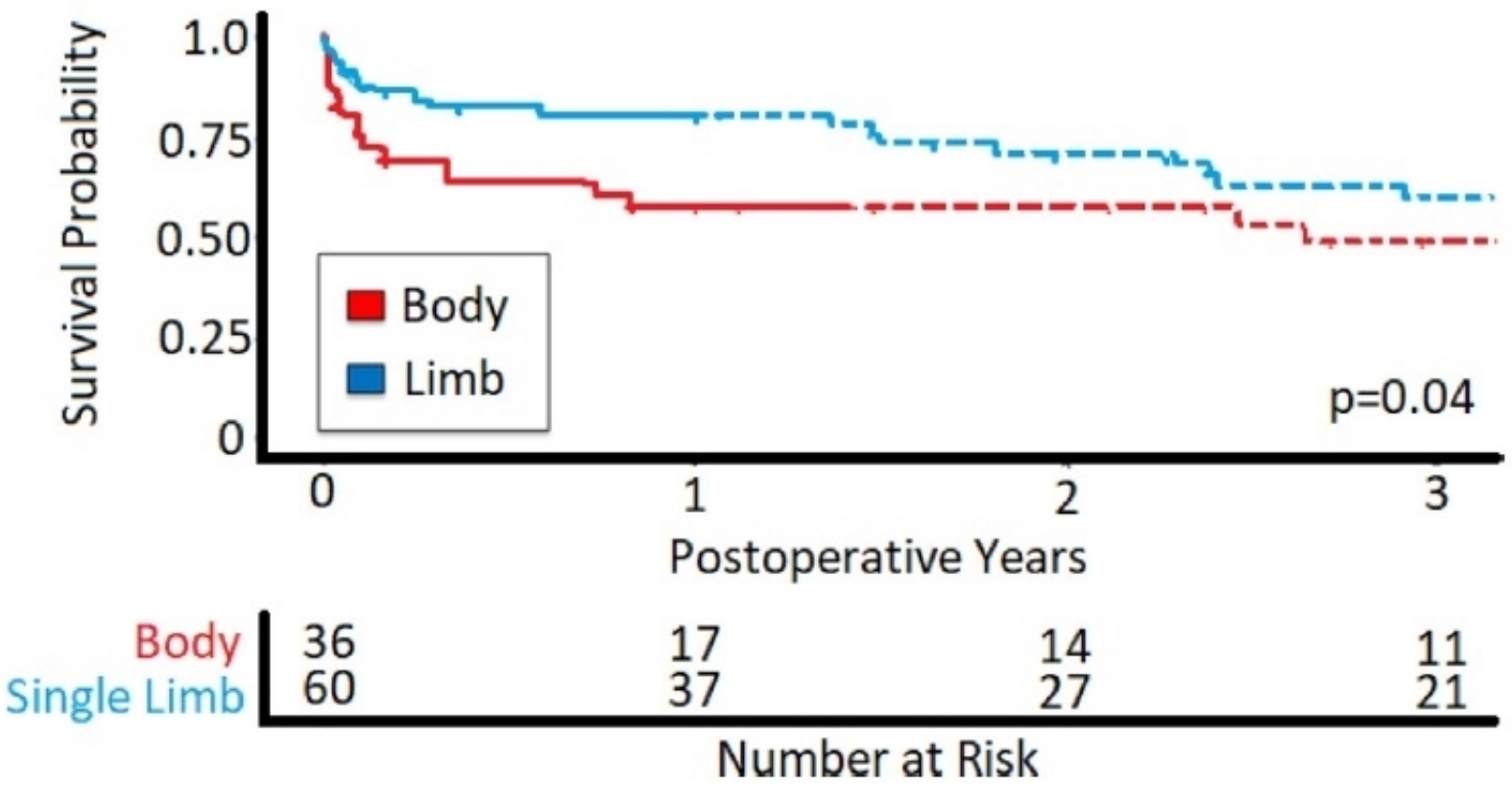
Survival difference between main body and limb resections



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Patency and limb salvage after partial graft resection

	All patients with patency data ($N=105$)	Patent at last follow-up ($N=76$)	Not patent at last follow-up ($N=29$)	Amputated ($N=12$)	P
Any post-repair infection	41 (39)	24 (32)	17 (59)	5 (12)	**0.01**
Early persistent postoperative infection (<30 days)	26 (25)	17 (22)	9 (31)	2 (8)	0.36
Late reinfection (>30 days)	23 (28)	10 (13)	13 (45)	4 (17)	**<0.01**
Death	49 (47)	35 (46)	14 (48)	7 (14)	0.84
AEF on presentation	32 (31)	26 (34)	6 (21)	4 (13)	0.18
Abdominal resection	32 (33)	21 (28)	11 (38)	4 (13)	0.79
Single limb resection	64 (66)	39 (51)	18 (62)	6 (9)	0.79
ISR	53 (50)	39 (51)	14 (48)	6 (11)	0.78
EAB	52 (50)	37 (49)	15 (52)	6 (12)	0.78

Comparisons performed between patients with patent bypass repairs at last follow-up versus those without patent repairs.

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Management of AGI with aortoenteric fistula: EAB vs ISB

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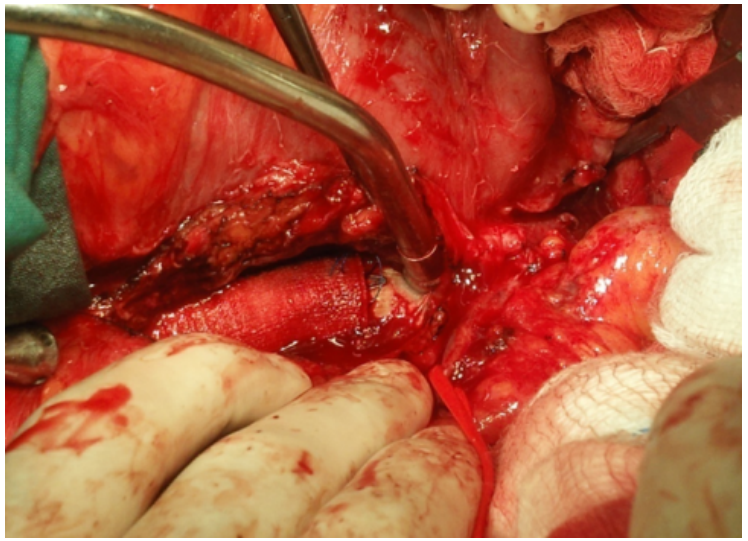

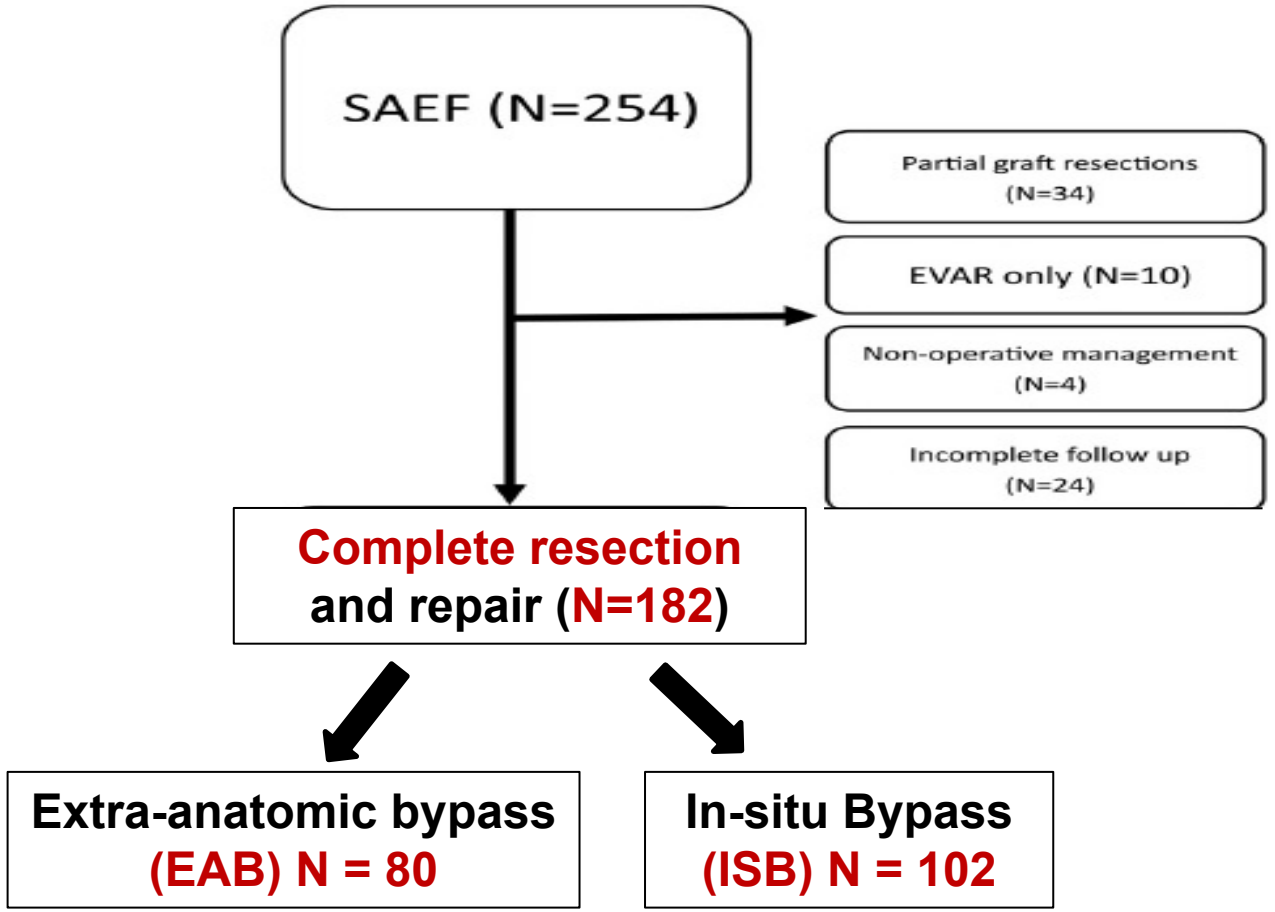

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Symptoms and findings at diagnosis

Variable	Entire cohort (N = 182)	ISB (n = 102)	EAB (n = 80)	*P*
Age at SAEF, years	72 (65-77)	70	74	**.01**
Invasive procedure between initial implantation and infection	46 (25)	16 (16)	30 (38)	**<.01**
Time to SAEF, months	45 (15-102)	36	54	.13
Symptoms at presentation				
Pain	105 (58)	60 (59)	45 (56)	.73
Gastrointestinal bleeding	95 (52)	51 (50)	44 (55)	.5
Fever/chills	79 (43)	45 (44)	34 (43)	.83
Hypotension	35 (19)	18 (18)	17 (21)	.54
Rupture	9 (5)	6 (6)	3 (4)	.51
Diagnostic test				
CTA	166 (97)	97 (96)	69 (86)	
Duplex ultrasound	1 (0.5)	1 (1)	0 (0)	
Direct fluid aspiration	13 (7)	7 (7)	6 (6)	
Enteroscopy	28 (15)	13 (13)	15 (18)	
Magnetic resonance imaging	1 (0.5)	1 (1)	0 (0)	
PET/CT	11 (5)	5 (10)	6 (8)	
White blood cell scan	10 (5)	7 (7)	3 (4)	

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ISB or EAB in the treatment of AEF: Pre and intraoperative infectious data

Culture results	Entire cohort (N = 182)	ISB (n = 102)	EAB (n = 80)	P
No growth	53 (29.1)	29 (28)	24 (30)	.82
Pseudomonas	6 (3.3)	5 (5)	1 (1)	.17
Staphylococcus epidermidis	11 (6.0)	9 (9)	2 (3)	.08
MRSA	18 (9.9)	11 (11)	7 (9)	.8
Streptococcus	29 (15.9)	12 (12)	17 (21)	.08
Candida	27 (14.8)	18 (18)	9 (11)	.23
Escherichia coli	22 (12.1)	15 (15)	7 (9)	.22
Polymicrobial	6 (3.3)	5 (5)	1 (1)	.17

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ISB or EAB in the treatment of AEF: 30 day results

Variable	ISB	EAB	*P*
Death	32 (31)	25 (31)	.97
Myocardial infarction	6 (6)	4 (5)	.79
Stroke	0 (0)	0 (0)	1
Graft rupture / aorta-related hemorrhage	11(11)	2 (3)	.03
Sepsis	15 (15)	21 (26)	.11
Acute renal failure	19 (19)	23 (28)	.11
Dialysis	5 (5)	12 (15)	.02
Operative site infection	8 (8)	9 (11)	.9
Lower extremity amputation	2 (2)	1 (1)	.71

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Factors affecting long term mortality: Multivariable Cox regression

Variable	Unadjusted HR (95% CI)	*P*	Adjusted HR (95% CI)	*P*
Antibiotic duration	0.89 (0.82-0.96)	.002	0.92 (0.86-0.98)	.01
Rifampin	0.14 (0.05-0.39)	.002	0.20 (0.05-0.39)	.03
Aortic coverage	0.78 (0.53-1.14)	.19		
Pseudomonas	5.7 (0.79-41.3)	.08		
Gastrointestinal bleed at presentation	1.7 (1.2-2.5)	.007		
Presenting age with SAEF	1.03 (1.008-1.9)	.007		
History of contamination at initial implantation	1.4 (1.006, 1.87)	.05		
Congestive heart failure	1.005 (0.99-1.01)	.16		
Tobacco abuse	1.006 (0.99-1.01)	.09		

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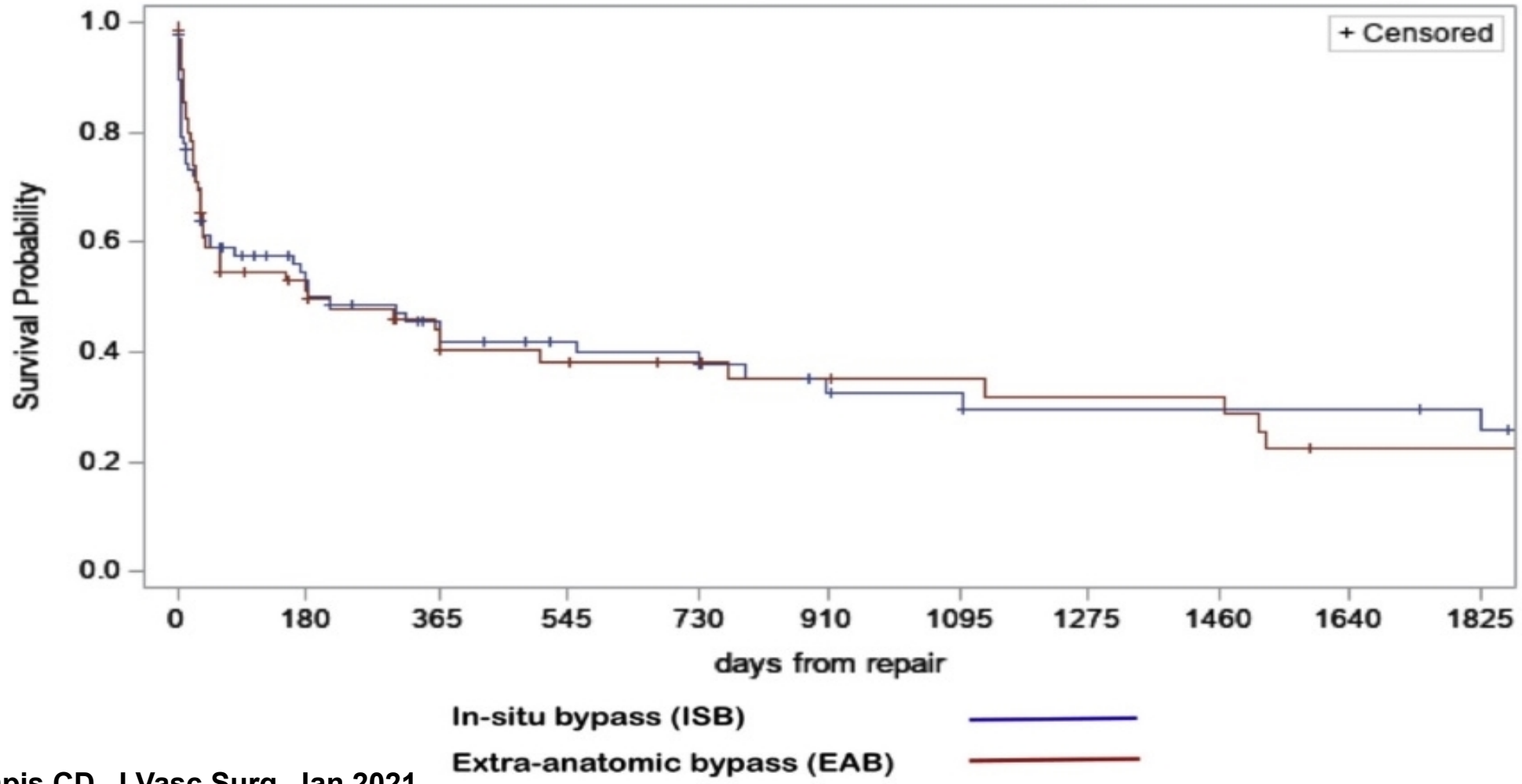
Infection-free survival stratified by extra-anatomic vs in-situ bypass



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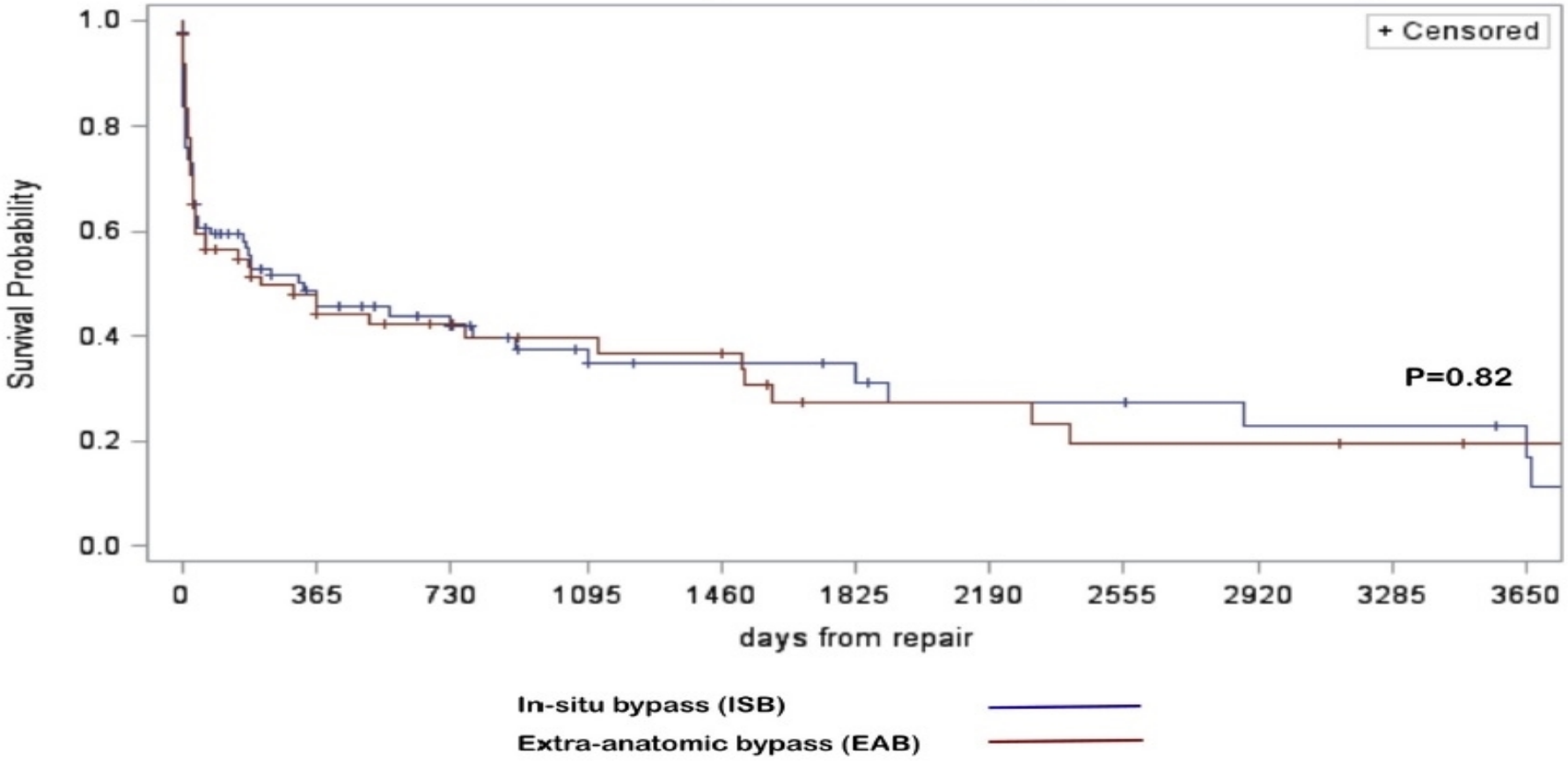
Survival stratified by extra – anatomic and in-situ bypass



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Conclusions I

- Aortic graft infection, especially with aortoenteric fistula, remains a highly lethal clinical entity with overall survival 48% at 1 year and 27% at 5 years.
- Total removal of the infected material is the goal of the treatment.
- As an individual decision, partial resection, followed by ISR or an extra-anatomic bypass might be an option.
- There is no significant difference in long term survival between in-situ vs extra-anatomic reconstruction.

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Conclusions II

- Successful treatment is based on low virulence organisms, patient's general condition and the urgency of the procedure.
- If polymicrobial, fungal or Gram negative organisms are present, total excision of the infected graft is recommended.
- Late reinfection correlates strongly with early persistent postoperative infection. Is it the same condition ?
- We advocate individualization of the treatment in specialized units by multidisciplinary teams.

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Inauguration of the
“Christos Liapis” Complex Aneurysm Unit,
Athens Medical School

Thank you for your attention

Strawberry moon
Cape Sounion, 15/6/2022