

Mortality in patients with acute type A aortic dissection:
using the GERAADA-Score for risk assessment and
comparison of perioperative factors and outcomes in groups of various risk

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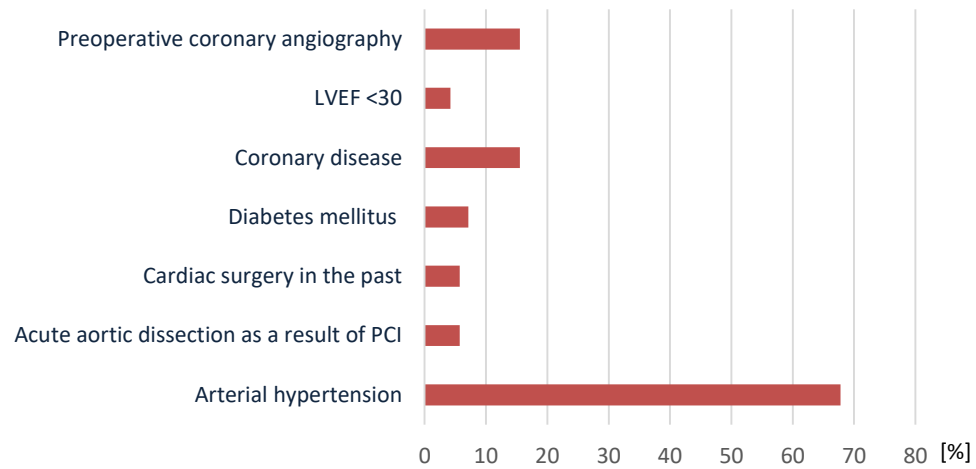
Inclusion criteria:

- age ≥ 18 years
- surgical treatment of AADA between 01/01/2011 and 12/31/2020 at the HDZ NRW

Demographics:

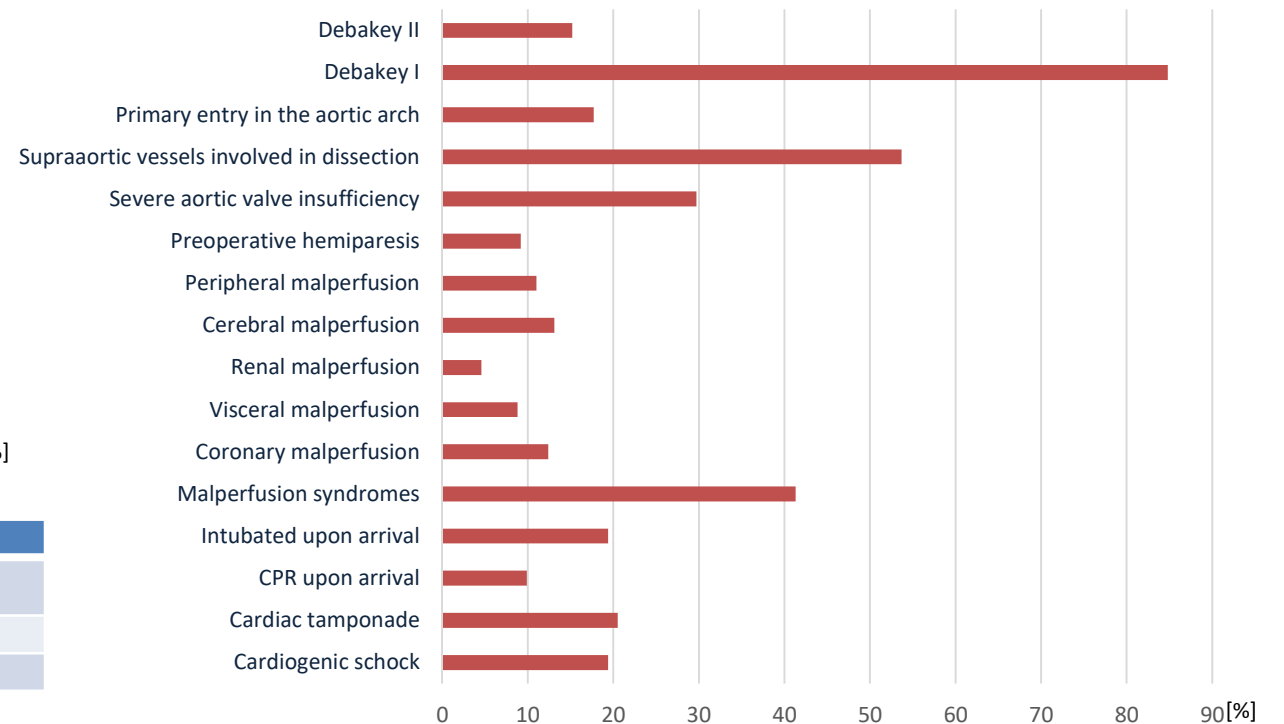
- n=283 patients
- age 62.0 ± 11.2 years
- 116 female (40.9%)

Preoperative factors

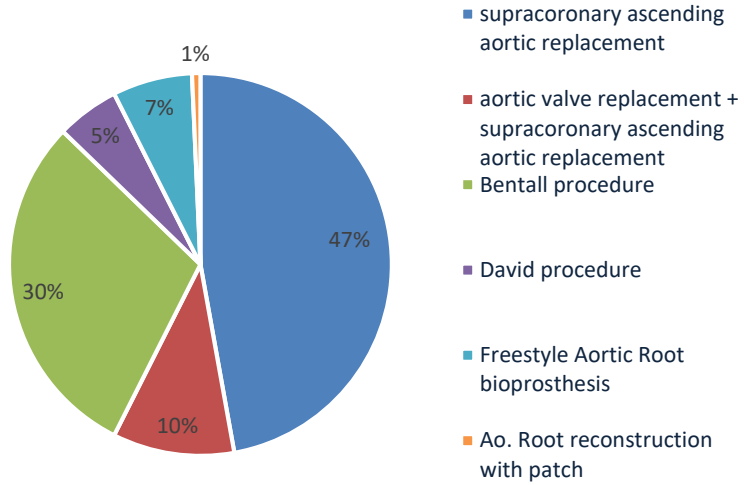


Score system	Mean, [%]	Standard deviation, [%]
Euroscore II	22.5	14.3
STS	6.7	4.2
GERAADA-Score	20.8	11.2

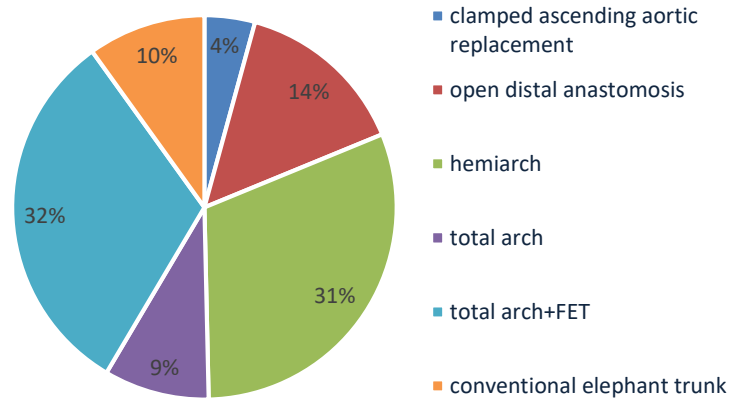
Complications of aortic dissection and its morphology



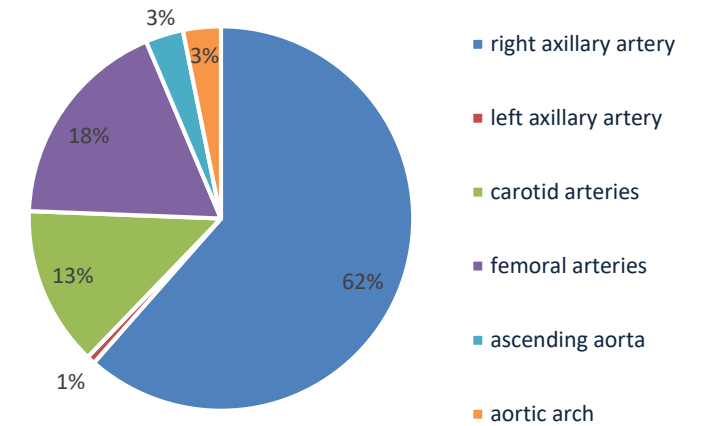
Aortic root reconstruction



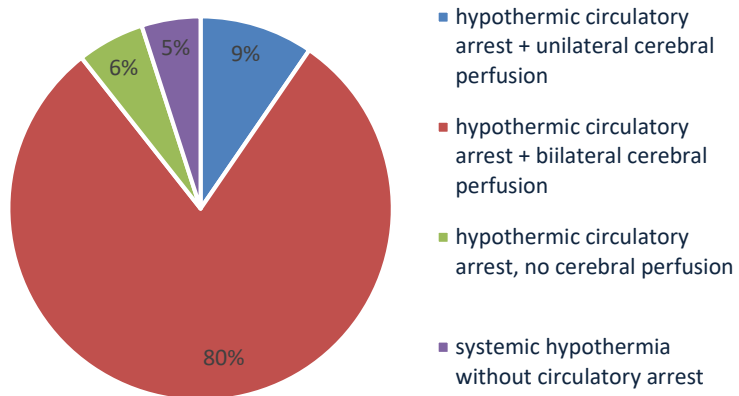
Technique of aortic arch repair



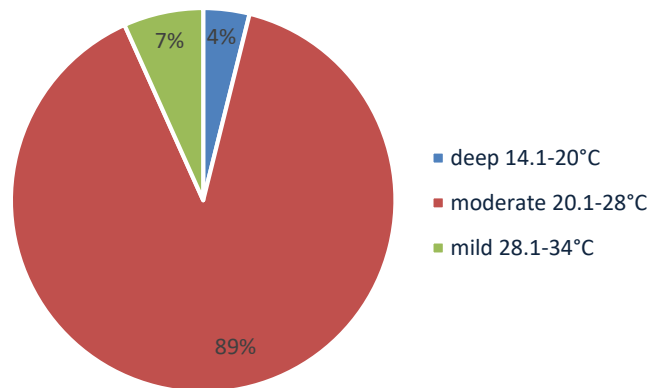
Canulation site for CPB



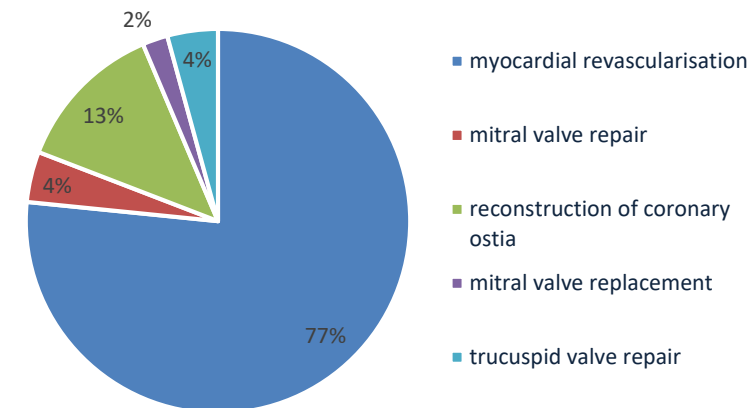
Methods of cerebral and end-organ protection



Classification of hypothermia



Concomittant procedures



Mortality and follow-up:

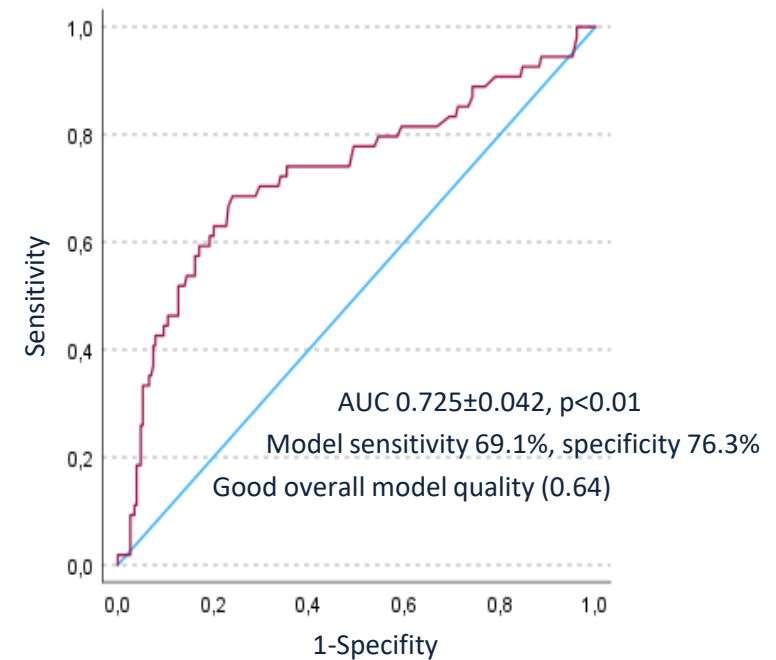
In-hospital mortality 19.1% (54/283)

30-day mortality 19.4% (55/283)

Mean follow-up 2.4±2.0 years (range 1-10 years)

1-year mortality 26.6% (74/278)

GERAADA-Score based 30-day mortality prediction



ROC curve of GERAADA-Score based 30-day mortality prediction

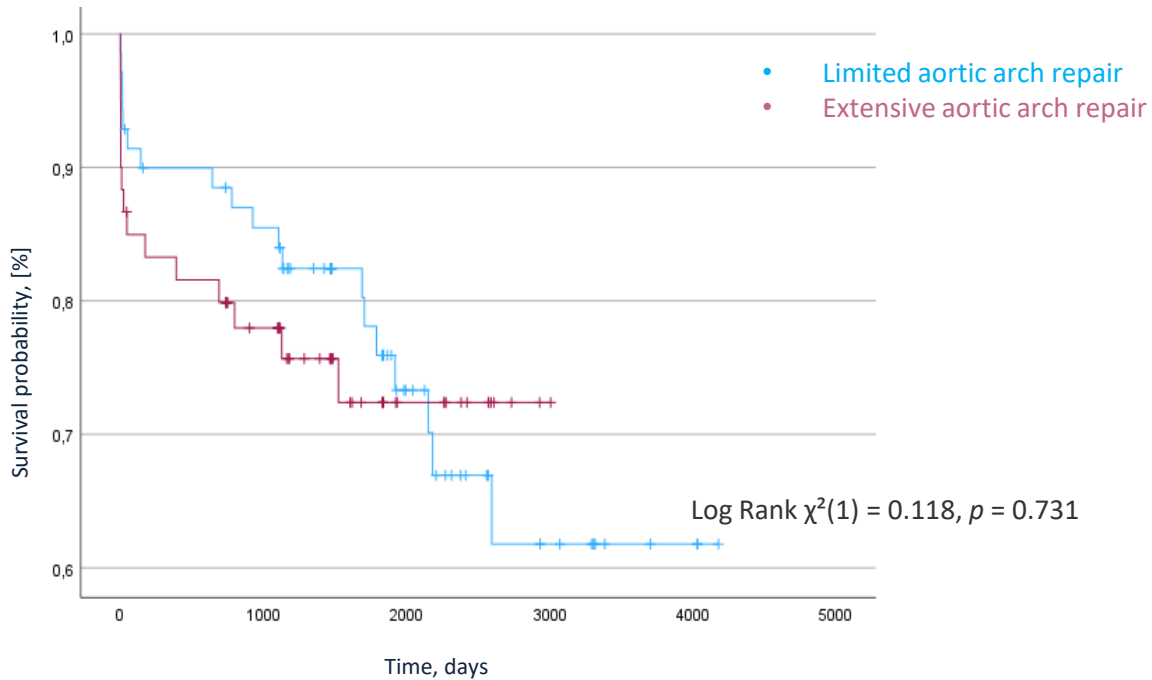
Group	GERAADA-Score
Low risk	0 < GERAADA-Score < 14
Intermediate risk	14 ≤ GERAADA-Score < 20
High risk	GERAADA-Score ≥ 20

Risk groups (1)

Factor	Low risk GERAADA-Score < 14 N=129	Intermediate risk 14 ≤ GERAADA-Score < 20 N=61	High risk GERAADA Score ≥ 20 N=92	p-value
Aortic dissection morphology, n (%)				
Primary entry in the aortic arch	11 (8.5)	16 (26.2)	23 (25.0)	<0.001
Supraaortic vessels involved in dissection	51 (39.5)	45 (73.8)	56 (60.9)	<0.001
Malperfusion	28 (21.5)	24 (39.3)	65 (70.7)	<0.001
- coronary	5 (3.8)	6 (9.8)	24 (26.1)	<0.001
- visceral	3 (2.3)	2 (3.3)	20 (21.7)	<0.001
- renal	2 (1.5)	2 (3.3)	9 (9.8)	0.013
- cerebral	8 (6.2)	11 (18.0)	18 (19.6)	0.006
- peripheral	12 (9.2)	8 (13.1)	11 (12.0)	0.676
Preoperative condition, n (%)				
Preoperative hemiparesis	2 (1.5)	8 (13.1)	16 (17.4)	<0.001
Intubated upon arrival	1 (0.8)	5 (8.2)	49 (53.3)	<0.001
Cardiogenic shock	3 (2.3)	2 (3.3)	28 (30.4)	<0.001
Cardiac tamponade	20 (15.6)	5 (8.2)	33 (36.7)	<0.001
CPR upon arrival	2 (1.5)	1 (1.6)	25 (27.2)	<0.001
Cardiac surgery in the past	2 (1.5)	4 (6.6)	10 (10.9)	0.012
Lactate, mmol/l	2.1 ± 3.4	1.7 ± 1.12	3.3 ± 2.9	0.035

Risk groups (2): Postoperative complications

Factor	Low risk GERAADA-Score < 14 N=129	Intermediate risk 14 ≤ GERAADA-Score < 20 N=61	High risk GERAADA Score ≥ 20 N=92	p-value
Complications, n (%)				
Ischemic stroke	34 (26.4)	17 (27.9)	36 (39.1)	0.064
TIA	7 (5.4)	2 (3.3)	3 (3.3)	0.064
Intracranial hemorrhage	2 (1.6)	0 (0.0)	5 (5.4)	0.064
Anoxic encephalopathy	1 (0.8)	0 (0.0)	3 (3.3)	0.064
Tracheostomy	19 (14.8)	12 (20.7)	26 (29.2)	0.037
Mechanical circulatory support	7 (5.4)	2 (3.3)	19 (20.7)	<0.001
Visceral ischemia	6 (4.7)	1 (1.7)	19 (20.9)	<0.001
Renal replacement therapy	49 (37.7)	26 (42.6)	54 (58.7)	0.007
Sepsis	12 (9.2)	8 (13.1)	19 (20.7)	0.051
Outcomes*, n (%)				
30-day mortality	13 (10.0)	4 (6.6)	38 (41.3)	<0.001
1-year mortality	17 (13.1)	9 (14.8)	48 (52.2)	<0.001
Aortic reoperation	13 (10.0)	1 (1.6)	3 (3.3)	0.031



Patients at risk

Limited aortic arch repair

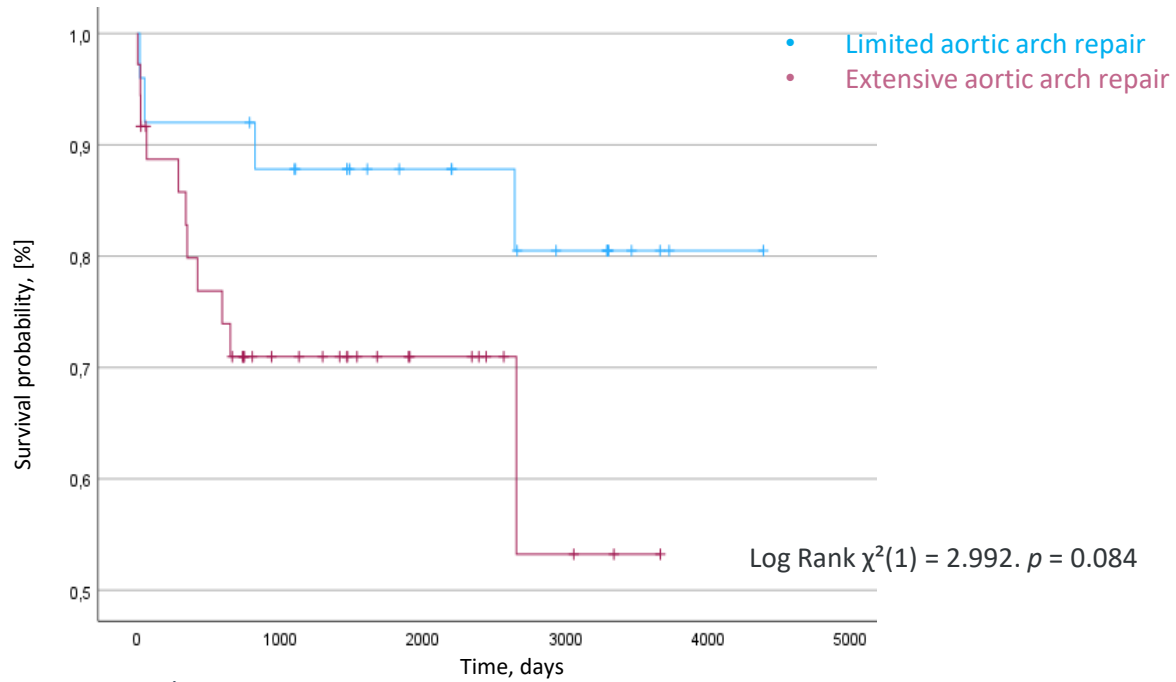
70 57 25 10 3

Extensive aortic arch repair

60 40 12 1 0

Kaplan-Meier estimate for long term survival after extensive aortic repair (red line) compared to limited aortic repair (blue line) for acute type A aortic dissection with low predicted risk based on the GERAADA-Score (GERAADA-Score < 14)

Complications	Limited aortic repair, n (%) ascending ± hemi arch N=69	Extensive aortic repair, n(%) ascending + total arch N=60	p-value
Ischemic stroke	14 (20.3)	21 (35.0)	0.062
TIA	1 (1.4)	3 (5.0)	0.062
Rethoracotomy for bleeding	12 (17.1)	15 (25.0)	0.188
Delayed chest closure	9 (12.9)	14 (23.3)	0.092
Tracheostomy	9 (13.0)	10 (16.9)	0.355
Mechanical circulatory support	6 (8.6)	1 (1.7)	0.086
Visceral ischemia	3 (4.3)	3 (5.1)	0.576
Renal replacement therapy	19 (27.1)	30 (50.0)	0.006
Sepsis	17 (24.3)	17 (28.3)	0.373
Outcomes			
30-day mortality	5 (7.1)	8 (13.3)	0.190
1-year mortality	7 (10.0)	10 (16.7)	0.194
Aortic reoperation	11 (15.7)	8 (13.3)	0.449



Patients at risk

	0	1000	2000	3000	4000
Limited aortic arch repair	25	21	14	9	1
Extensive aortic arch repair	36	17	8	3	0

Kaplan-Meier estimate for long term survival after extensive aortic repair (red line) compared to limited aortic repair (blue line) for acute type A aortic dissection with intermediate predicted risk based on the GERAADA-Score ($14 \leq \text{GERAADA-Score} < 20$)

Complications	Limited aortic repair, n (%) ascending \pm hemi arch N=25	Extensive aortic repair, n (%) ascending + total arch N=36	p-value
Ischemic stroke	6 (24.0)	10 (27.8)	0.650
TIA	0 (0.0)	1 (2.8)	0.650
Rethoracotomy for bleeding	3 (12.0)	9 (25.0)	0.177
Delayed chest closure	1 (4.0)	6 (16.7)	0.131
Tracheostomy	2 (8.0)	10 (30.3)	0.037
Mechanical circulatory support	0 (0.0)	2 (5.6)	0.344
Visceral ischemia	0 (0.0)	1 (2.9)	0.583
Renal replacement therapy	4 (16.0)	22 (61.1)	<0.001
Sepsis	2 (8.0)	6 (16.7)	0.280
Outcomes			
30-day mortality	2 (8.0)	3 (8.3)	0.455
1-year mortality	2 (8.0)	7 (19.4)	0.193
Aortic reoperation	2 (8.0)	3 (8.3)	0.671

30-day mortality: 41.3% (38/92)

Extensive aortic repair: 30-day mortality 47.8% (22/46)

Limited aortic repair: 30-day mortality 34.8% (16/46)

p=0.145

1-year mortality 52,2% (48/92)

Extensive aortic repair: 1-year mortality 58,7% (27/46)

Limited aortic repair: 1-year mortality 45,7% (21/46)

p=0.413

Aortic reoperation rate 8.7%

with in-hospital mortality of 11.2% (2/17)

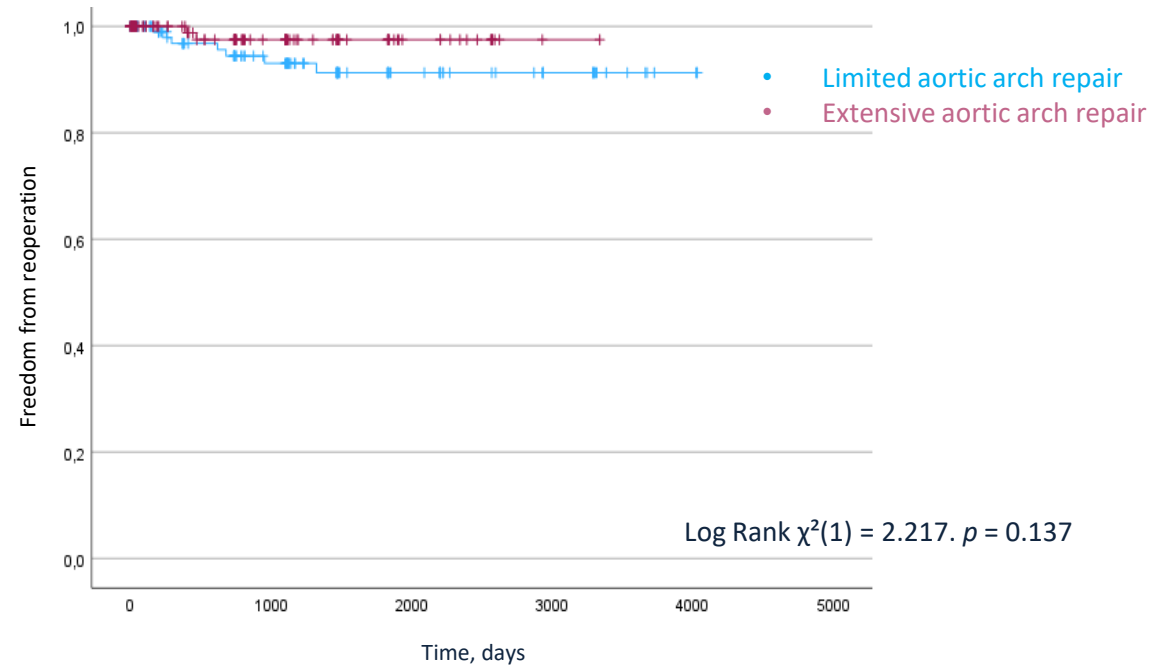
Complications	Limited aortic repair, n(%) ascending ± hemi arch N=46	Extensive aortic repair, n(%) ascending + total arch N=46	p-value
Ischemic stroke	11 (23.9)	18 (39.1)	0.120
TIA	1 (2.2)	1 (2.2)	0.120
Intracranial hemorrhage	5 (10.9)	1 (2.2)	0.120
Anoxic encephalopathy	2 (4.3)	6 (13.0)	0.120
Rethoracotomy for bleeding	12 (26.1)	15 (32.6)	0.324
Delayed chest closure	9 (16.9)	13 (28.9)	0.214
Tracheostomy	14 (31.1)	12 (27.3)	0.435
Mechanical circulatory support	8 (17.4)	11 (23.9)	0.304
Visceral ischemia	4 (8.9)	15 (32.6)	0.005
Renal replacement therapy	25 (54.3)	29 (63.0)	0.283
Sepsis	10 (21.7)	9 (19.6)	0.500
Outcomes			
30-day mortality	16 (34.8)	22 (47.8)	0.145
1-year mortality	21 (45.7)	27 (58.7)	0.148
Aortic reoperation	4 (8.7)	4 (8.7)	0.643

In overall sample

Indication for reoperation	n (%)
N=17	
Dilatation of residual aorta and anastomotic leak or redissection	11 (64.74)
Severe aortic valve insufficiency	2 (11.8)
Infection	3 (17.6)
Stenosis of supraaortic vessels	1 (5.9)

Operation	n (%)
N=17	
Total arch	7 (41.2)
Hemi arch	2 (11.8)
Aortic valve or root- replacement	4 (23.5)
Revision of anastomosis	3 (17.6)
Extraanatomic bypass	1 (5.9)
Evacuation of pleural empyema	1 (5.9)
TEVAR	1 (5.9)

Separate analysis of reoperations due to dilatation of residual aorta



Patients at risk

Limited aortic arch repair	141	67	32	16	3
Extensive aortic arch repair	142	54	15	1	0

GERAADA score provides a good quality of outcome-prognosis and aids in decision-making regarding operative strategy

This analysis suggests non-inferiority of extensive aortic arch repair in low-risk patients with regard to 30-day outcomes

Higher incidence of postoperative complications after extensive arch repair in intermediate risk patients

No prognostic benefit of extensive arch repair in high-risk patients, demonstrating highest in-hospital and 30-day mortality

Acceptable results and low incidence of reoperations