Echocardiographic evaluation of cardiac remodeling in dissection and non-dissection patients after frozen elephant trunk implantation

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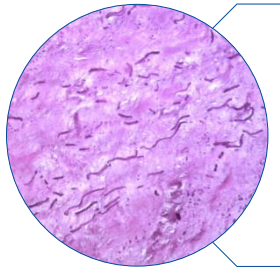
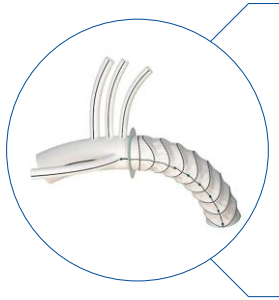
Study Objective



The proximal native aorta has the highest elastic fiber content with utmost importance for the windkessel function



Total arch replacement using the frozen elephant trunk technique inevitably leads to substantial proximal aortic resection and replacement

These alterations could lead to an increased cardiac workload and cause changes in left ventricular function and dimensions

Aim

To evaluate the effect of total aortic arch replacement using the FET technique on cardiac remodeling in terms of left ventricular function and dimensions.

UNIVERSITÄTS HERZZENTRUM FREIBURG · BAD KROZINGEN

Patients and Methods

University Hospital Freiburg

Germany

03/13 - 04/22

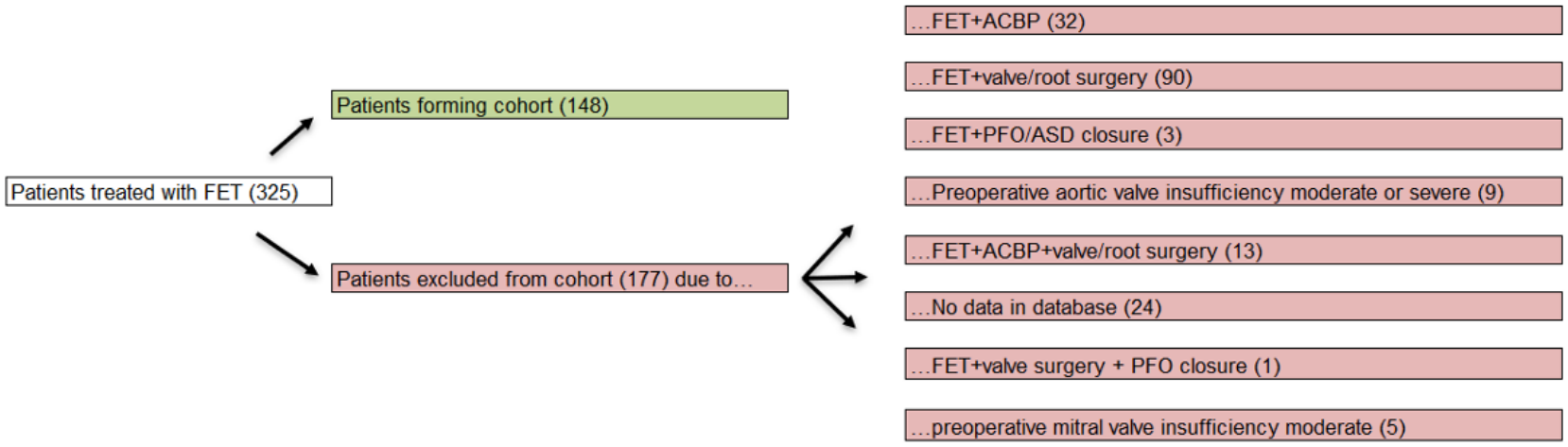
325 patients

148 isolated FETs

Exclusion criteria:

1. preoperative moderate and severe valve stenosis or regurgitation

2. concomitant valve, root or cardiac procedures were excluded



Patients and Methods

Hospital XXX

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325 patients

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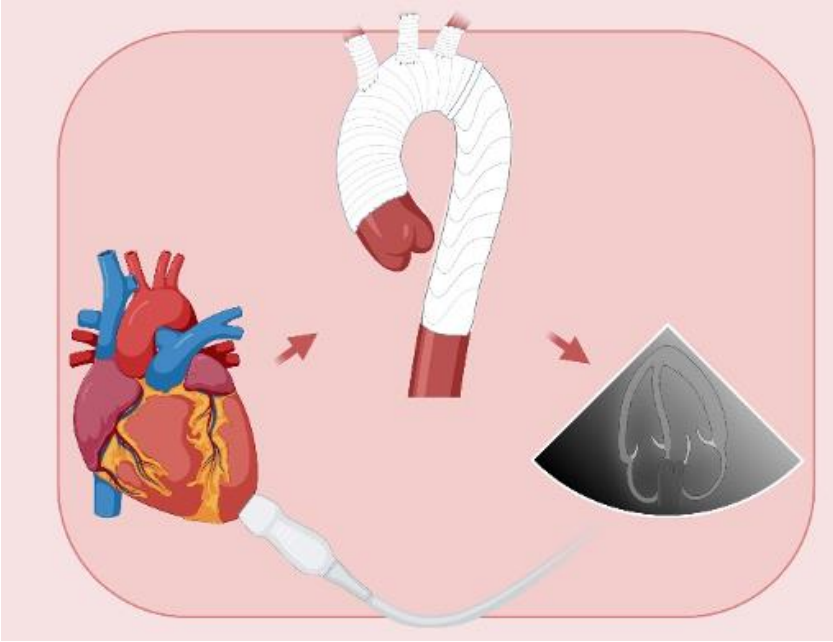
Data cruration

Echocardiographic assessment before and after surgery as well as during follow-up, including left and right ventricular function and measurements as well as valve pathologies.

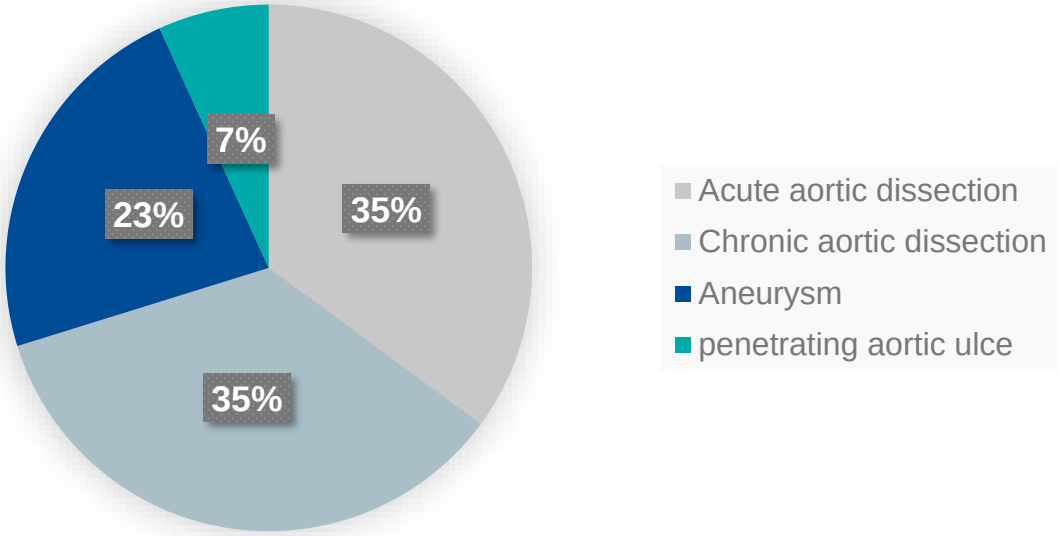


Baseline Data

Background Methods Results Conclusions

- 148 patients (Age: 63.2 [53.8-71.8] years)
- 69 (46.6%) redo cases
- 16 (10.8%) patients with connective tissue disorder

Underlying disease



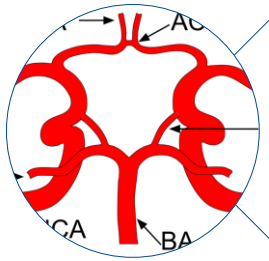
	Dissection	Non-Dissection	p-value	Total
	n = 104	n = 44		n = 148
Age (years)	60.5 [51.2-67.7]	69.6 [63.9-75.5]	<0.001	63.2 [53.8-71.8]
Sex (male)	70 (67.3)	26 (59.1)	0.510	96 (64.9)
Body-Mass-Index	25.3 [24-29.1]	26 [23.9-27.3]	0.821	25.71 [23.94-28.52]
Cardiovascular risk factors				
Diabetes (insulin)	2 (2)	1 (2.4)	0.874	3 (2)
Dyslipidaemia	28 (27.5)	17 (40.5)	0.735	45 (30.4)
History of smoking	44 (43.1)	26 (61.9)	0.261	70 (47.3)
Hypertension	84 (82.4)	40 (95.2)	0.594	124 (83.8)
Previous Stroke	11 (10.8)	5 (11.9)	0.331	16 (10.8)
Previous acute kidney injury	12 (12)	8 (18.6)	0.932	20 (13.5)
Chronic obstructive pulmonary disease	9 (9)	5 (11.6)	0.035	14 (9.5)
Coronary artery disease	15 (15)	12 (27.9)	0.193	27 (18.2)
Bicuspid aortic valve	1 (1)	1 (2.3)	-	2 (1.4)
Connective tissue disorder	16 (16)	0 (0)	-	16 (10.8)
Previous aortic or cardiac surgery				
Previous surgery	57 (54.8)	12 (27.3)	0.284	69 (46.6)
Follow up interval (years)	1.5 [0.4-2.9]	0.6 [0.2-2.2]	<0.001	1.23 [0.24-2.54]
Aortic re-do	55 (55.6)	9 (20.9)	0.022	64 (43.2)
Acute dissection	52 (50)	0 (0)	-	52 (35.1)
Chronic dissection	52 (50)	0 (0)	-	52 (35.1)
Acute type A dissection	24 (23.1)	0 (0)	-	24 (16.1)
Chronic type A dissection	1 (0.96)	0 (0)	-	1 (0.7)
Acute type B dissection	12 (11.5)	0 (0)	-	12 (8.1)
Chronic type B dissection	7 (6.7)	0 (0)	-	7 (4.7)
Residual type B dissection after surgery for type A dissection	38 (36.5)	0 (0)	-	38 (25.7)
Acute non-A non-B dissection	16 (15.4)	0 (0)	-	16 (10.8)
Chronic non-A non-B dissection	6 (5.8)	0 (0)	-	6 (4.1)
Aneurysm	0 (0)	34 (77.3)	-	34 (23)
Penetrating aortic ulcer	0 (0)	10 (22.7)	-	10 (6.8)

Data are presented as number (%), or median [interquartile range];

Baseline Data

Background Methods Results Conclusions

As defined by exclusion criteria **no concomitant procedures**



Beating-heart technique in **23.6%**

Trilateral cerebral perfusion in **16.2%**

In-hospital mortality: **4%**

Disabling stroke: **9.5%**

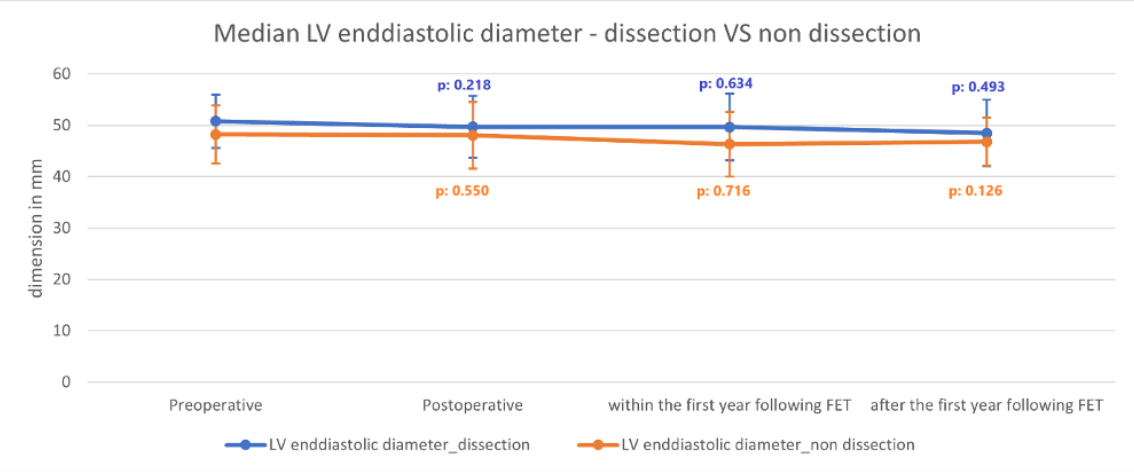
Symptomatic SCI: **0.7%**

	Dissection	Non-Dissection	p-value	Total
	n = 104	n = 44		n = 148
Concomitant procedures				
Aortic root conduit	0 (0)	0 (0)	-	0 (0)
Valve-sparing root replacement	0 (0)	0 (0)	-	0 (0)
Aortic valve replacement	0 (0)	0 (0)	-	0 (0)
Coronary artery bypass grafting	0 (0)	0 (0)	-	0 (0)
Operation time (min)	375 [329.25-418.75]	326 [298-360]	<0.001	360 [314-405]
Cardiopulmonary bypass time (min)	197 [166-226]	179 [158-205]	0.139	185.5 [162.75-221.5]
Cross-clamp time (min)	110 [90.5-137.5]	96 [80-124.5]	0.926	106 [88-129.75]
Lowest body temperature (°C)	24.8 [24-25.3]	24.9 [23.9-25.5]	0.773	24.8 [24-25.4]
Beating-heart technique	28 (28.3)	7 (16.3)	0.451	35 (23.6)
Unilateral cerebral perfusion	12 (12.4)	4 (9.3)	0.537	16 (10.8)
Bilateral cerebral perfusion	69 (71.1)	31 (72.1)	0.254	100 (67.6)
Trilateral cerebral perfusion	16 (16.5)	8 (18.6)	0.849	24 (16.2)
Postoperative Outcomes				
In-hospital mortality	3 (3)	3 (7)	-	6 (4)
Re thorax for bleeding	7 (7.1)	6 (14)	0.398	13 (8.8)
Open thorax	9 (9.1)	1 (2.3)	0.746	10 (6.8)
Intracranial bleeding	2 (2)	1 (2.3)	0.876	3 (2.0)
Stroke	14 (14.1)	6 (14)	0.398	20 (13.5)
Disabling stroke	10 (10.1)	4 (9.3)	0.565	14 (9.5)
Non-disabling stroke	4 (4)	2 (4.7)	0.823	6 (4)
TIA	2 (2)	2 (4.7)	-	4 (2.7)
Dialysis	6 (6.1)	2 (4.7)	0.692	8 (5.4)
Paraplegia	1 (1)	0 (0)	-	1 (0.7)
Tracheotomy	3 (3)	3 (7)	-	6 (4)
Delirium	15 (15.2)	2 (4.9)	0.634	17 (11.5)
Days ICU	5.5 [3-9]	6 [4-10]	0.426	6 [3-9]
Days Hospital	16 [13.75-21.5]	17 [11-22]	0.429	16 [13-21]

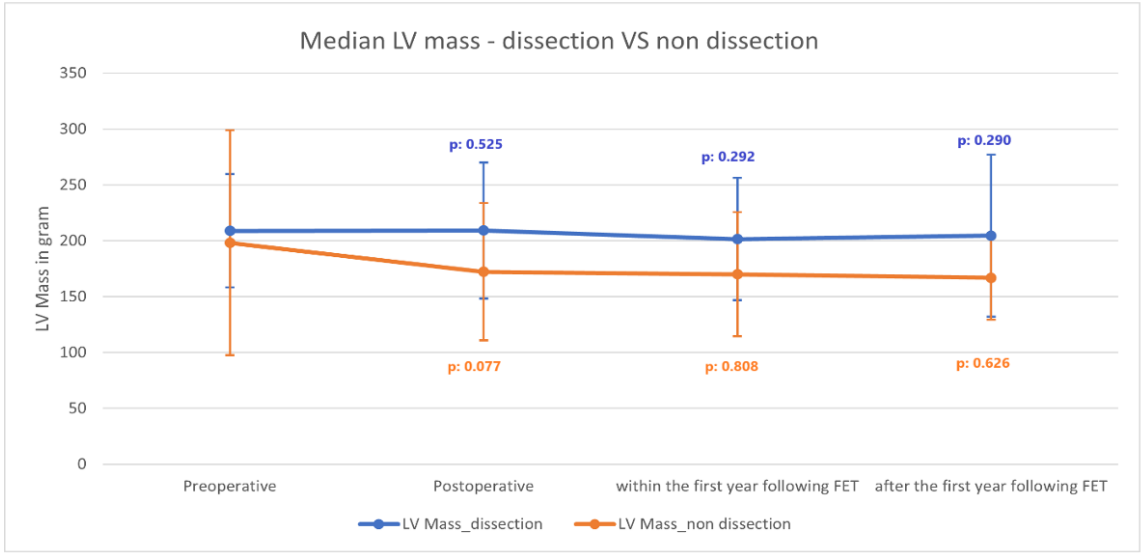
Data are presented as number (%), or median [interquartile range].

Cardiac remodeling

Background Methods Results Conclusions



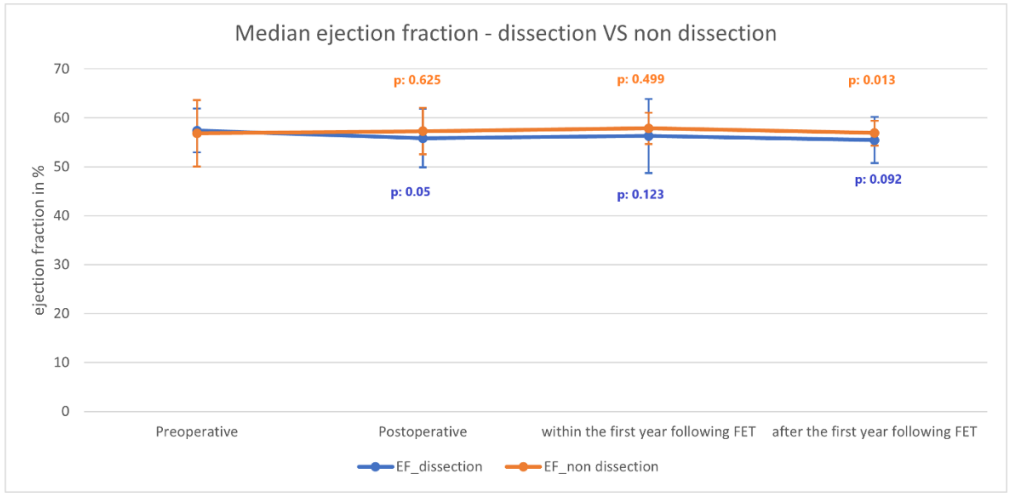
no significant changes in median LV enddiastolic diameter



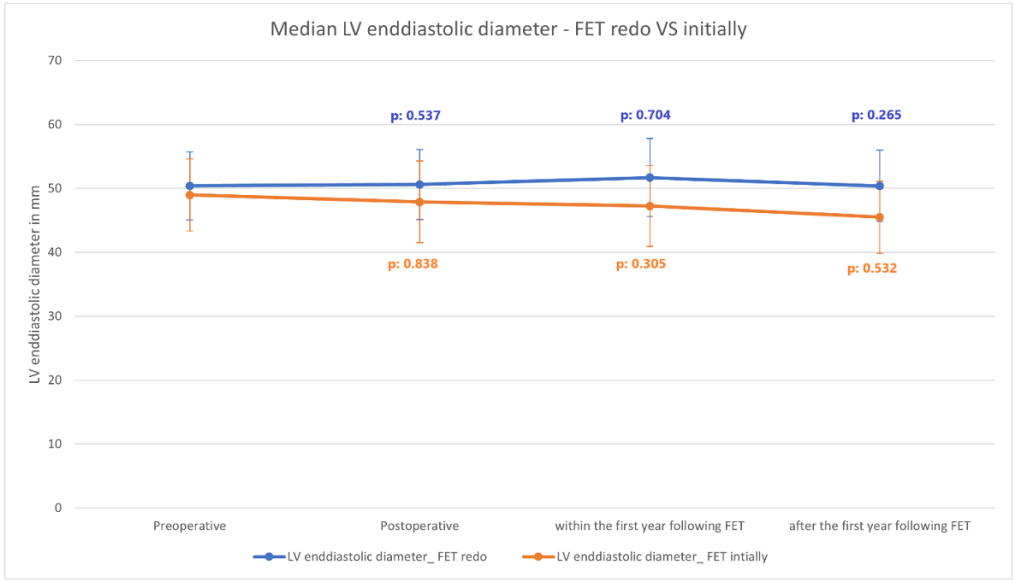
No significant changes in median left ventricular mass

Cardiac remodeling

Background Methods Results Conclusions



no significant changes in median LV ejection fraction



No difference between initial and redo FET

Conclusions

Although dissection patients show in the immediate postoperative phase an increase in mild valve regurgitation and a decrease of ejection fraction, these changes do not stay significant during follow up, do not lead to a need for reoperation and do not seem to have clinical relevance for the long-term outcome

With strict treatment of cardiovascular risk factors including blood pressure control to normal values, the implantation of a FET hybrid prosthesis has no negative effect on cardiac remodeling in dissection patients

FET also has no measurable effect regarding negative cardiac remodeling independently of the fact if it is implanted initially or as aortic redo procedure in the first two years after implantation.

Summary

Cardiac remodeling after total aortic arch replacement using the frozen elephant trunk technique

Key question

Does FET implantation induce negative cardiac remodelling in dissection or non-dissection patients?

Key findings

1. Dissection and non-dissection patients show a statistically significant increase of mild valve insufficiencies postoperatively
2. In the immediate postoperative phase, dissection patients show a mild reduction of ejection fraction
3. After the first year following FET, non-dissection patients show a statistically significant ejection fraction increase and septal diameter decrease

Take-home message

With strict treatment of cardiovascular risk factors, FET implantation has no measurable negative impact on cardiac remodelling in dissection and non-dissection patients.