Operative and mid-term outcomes of minimally invasive ascending aortic surgery: a propensity match study

Francesco Pollari [1], Matthias Angerer [1], Wolfgang Hitzl [2], Lucia Weber [1], Joachim Sirch [1], **Theodor (Teddy) Fischlein** [1]

1) Cardiac Surgery, Paracelsus Medical University – Klinikum Nürnberg, Nuremberg, Germany;
2) Research and Innovation Management (RIM), Team Biostatistics, Paracelsus Medical University, Salzburg (Austria).
Contact: theodor.fischlein@klinikum-nuernberg.de

Background

Elective ascending aorta replacement (AAR) is a major operation, requiring a full sternotomy and associated with mortality and morbidity. Minimally invasive approaches, such as mini/partial-sternotomy, were proven to be safe for valve-related procedures and could reduce the surgical trauma. However, the evidences assessing the outcome of AAR through a ministernotomy are poor. We aimed to investigate the short and mid-term outcomes of patients undergoing SAR through a partial or a full-sternotomy approach through a propensity matching analysis.

Fig. 1

Fig. 2
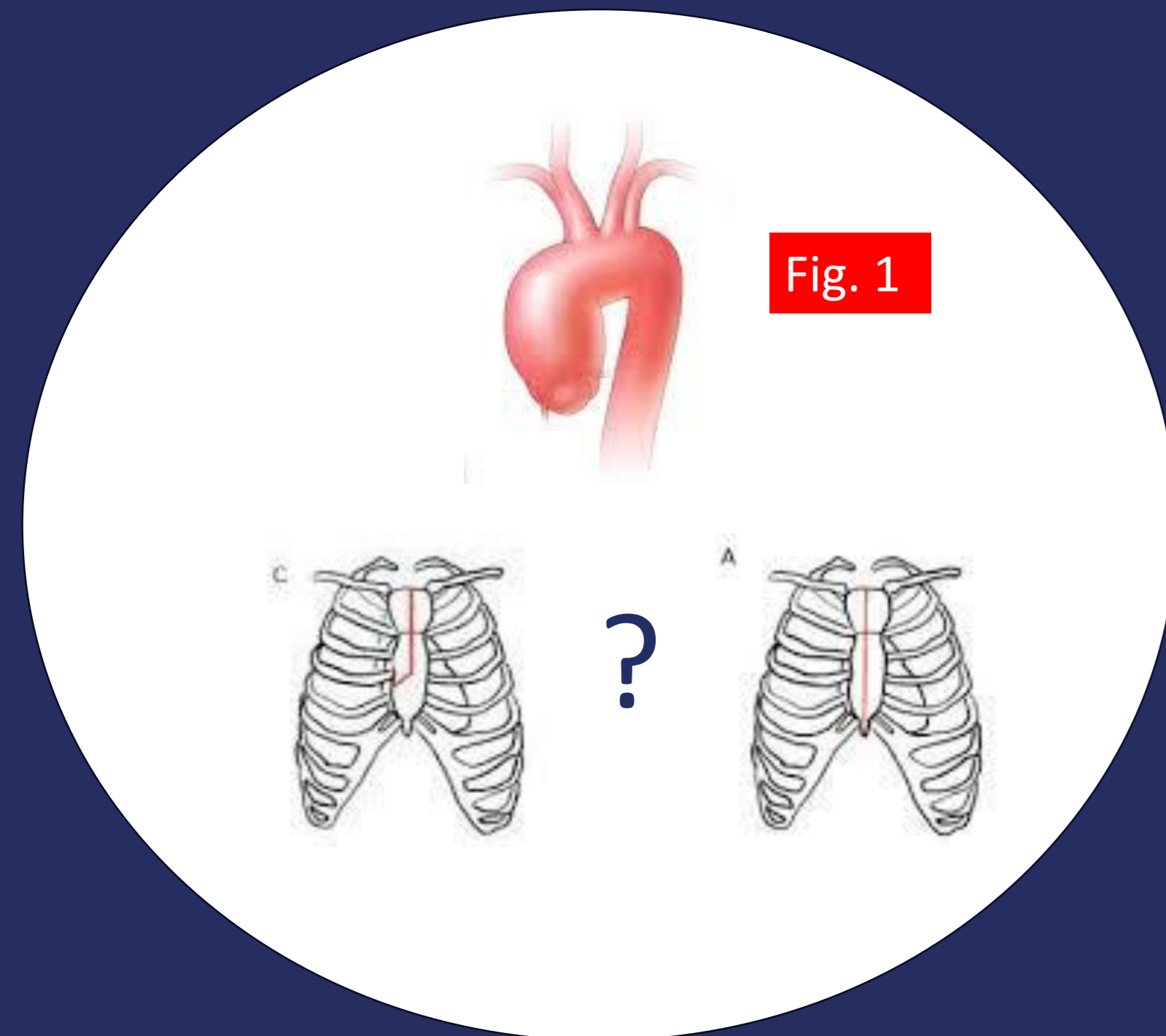
Methods

- We retrospectively included all patients (n=167), who underwent elective AAR in our institution between 2013 and 2020.
- Study population was divided in two groups according to the surgical access (n=40 in partial sternotomy or "PS", and n=127 in full sternotomy, or "FS").
- The majority of patients were operated with a brachiocephalic cannulation (PS=70% vs FS=61%, p=0.3) and selective cerebral perfusion (PS=65% vs FS=58%, p=0.3) in both groups.
- Due to the significant differences between the groups, a propensity matching 1:3 was applied (Figure 2).
- After propensity matching, only the preoperative EF was significantly different between the two groups.
- The table 1 shown the baseline characteristics before and after the matching.
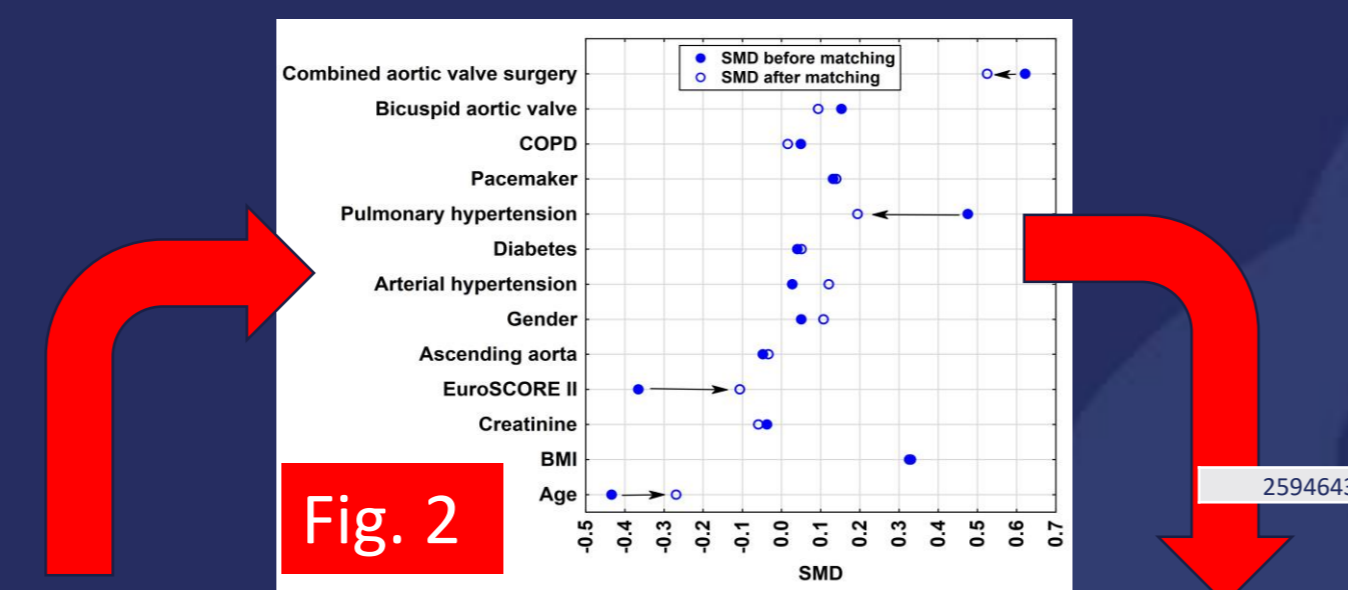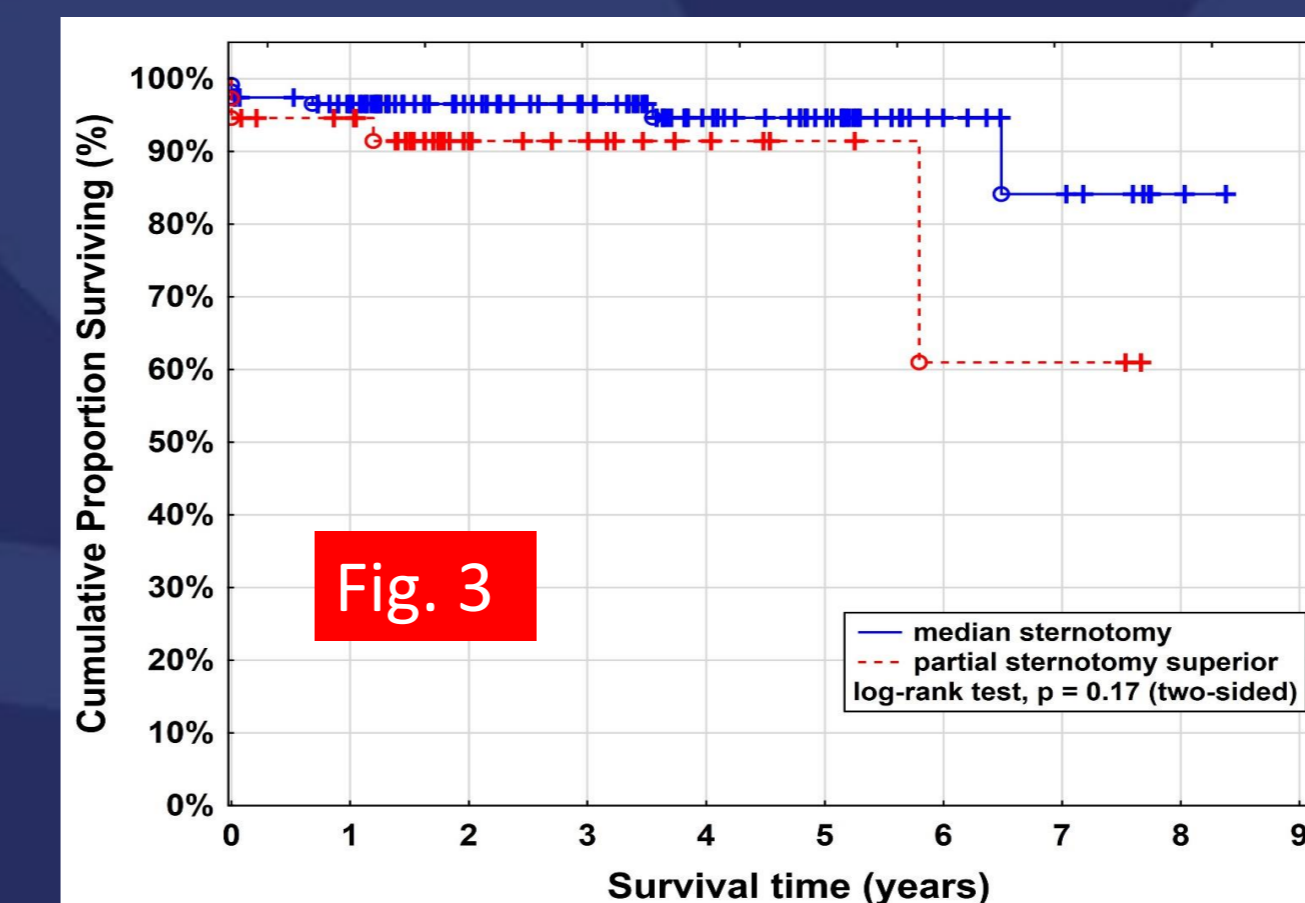
Table 1	Unmatched			Propensity score matched		
	PS patients (n=40)	FS patients (n=127)	p-value	PS patients (n=38)	FS patients (n=118)	p-value
Age (years)	66.1 (±10.4)	61.1 (±11.7)	0.02	65.4 (±10.4)	62.7 (±10.1)	0.2
Male gender	24 (69)	73 (57)	0.9	23 (61)	65 (55)	0.6
BMI (kg/m²)	26 (±4.5)	27.5 (±4.5)	0.07	26 (±4.5)	27.4 (±4.1)	0.08
Serum creatinine (mg/dl)	0.99 (±0.19)	0.98 (±0.19)	0.8	0.99 (0.19)	0.98 (0.2)	0.8
LVEF (%)	54.8 (±11)	58.4 (±8.9)	0.04	54.8 (±11.4)	58.5 (±9.1)	0.04
Prior Pacemaker	1 (3)	7 (6)	0.7	1 (3)	7 (6)	0.7
COPD	8 (20)	23 (18)	0.8	7 (18)	21 (18)	1
EuroSCORE II	8.5 (±8.6)	6.2 (±5)	0.04	7 (6.2)	6.5 (5.1)	0.5
Aneurysm diameter (mm)	51.1 (±8.2)	50.6 (±9.1)	0.8	51.3 (±8.5)	51 (±9.3)	0.9

- A telephone follow-up was conducted through direct contact with the patient or with the general practitioner.
- Primary outcomes were in-hospital complications.
- Secondary outcomes were survival and major adverse events at follow-up.

Results

- Table 2 shows the operative variable, the in-hospital complications and the outcomes at follow-up.
- PS group showed higher X-clamp and cardiopulmonary bypass times, probably due to higher use of valve reconstruction.
- Moreover, the postoperative ventilation time was significantly higher in the PS group, however not affecting the length of stay in ICU.
- The incidence of bleeding, stroke and mortality was similar between PS and FS group.
- The median and mean follow-up time were not significant between groups.
- Kaplan Meier analysis did not show significant differences between the PS and FS group (log-rank, p=0.17; Figure 3)

Fig. 3

Table 2	Unmatched		Propensity score matched		
	PS patients (n=40)	FS patients (n=127)	PS patients (n=38)	FS patients (n=118)	p-value
Conversion to full sternot.	0 (0)	-	0 (0)	-	1
Cross-clamp time (min)	95 (±29)	83 (±26)	94.2 (26.6)	83 (26.1)	0.02
CPB time (min)	164 (±47)	127 (±37)	164.2 (47.2)	126.8 (37.1)	<0.00001
Combined a.valve surgery	37 (93)	97 (75)	35 (92)	91 (76)	0.06
Ventilation time (h)	50 (±112)	21 (±56)	41.5 (98.8)	22.5 (58.5)	0.006
ICU stay (d)	4 (±4.6)	3 (±3)	3.6 (4.7)	2.9 (3.3)	0.1
Revision bleeding	1 (3)	2 (2)	4 (11)	3 (3)	0.06
Pericardial effusion	5 (13)	7 (6)	5 (13)	6 (5)	0.1
Sternal wound revision	0 (0)	0 (0)	0 (0)	0 (0)	1
Pacemaker implantation	1 (3)	3 (2)	1 (3)	2 (2)	0.6
Stroke	1 (3)	8 (6)	1 (3)	7 (6)	0.7
Hospital stay (days)	12 (±7)	11 (±5)	11.8 (±7.1)	10.9 (±4.7)	0.3
In-hospital mortality	2 (5)	3 (2)	2 (5)	3 (3)	0.6
Length of FU (years)					0.09
-Median [IQR]	2 [2.2]	3.3 [3.6]	2 [2.1]	3.3 [3.5]	
-Mean (±SD)	2.8 (±2.1)	3.4 (±2.1)	2.7 (±2.2)	3.4 (±2.1)	
Alive on FU date	35 (95)	119 (98)	33 (94)	110 (96)	0.3
Stroke (actuarial) FU	0 (0)	8 (7)	0 (0)	6 (5)	0.3
Myocardial infarction FU	0 (0)	1 (1)	0 (0)	1 (1)	1
Permanent Pacemaker Implantation	0 (0)	3 (2)	0 (0)	3 (3)	1
Cardiac reoperation FU	2 (5)	8 (7)	2 (6)	8 (7)	1

Conclusions

- The surgical ascending aorta replacement through a partial sternotomy is associated with longer X-clamp, CPB and ventilation times in comparison with full sternotomy.
- This fact does not affect the length of ICU and in-hospital stay as well as the rate of bleeding, stroke and mortality.
- The survival and rate of reoperation at follow-up are comparable between partial and full sternotomy.
- Surgical ascending aorta replacement can be safely performed through a minimally invasive approach.