Does minimally invasive aortic replacement reduce risk of surgery?

Dr. MAURO DEL GIGLIO

Chief of the Department of Cardio-Vascular Surgery

Maria Cecilia Hospital – Cotignola (RA)

EuroValve
October 24-25 2014, Rome, Italy
Roma Eventi Fontana di Trevi

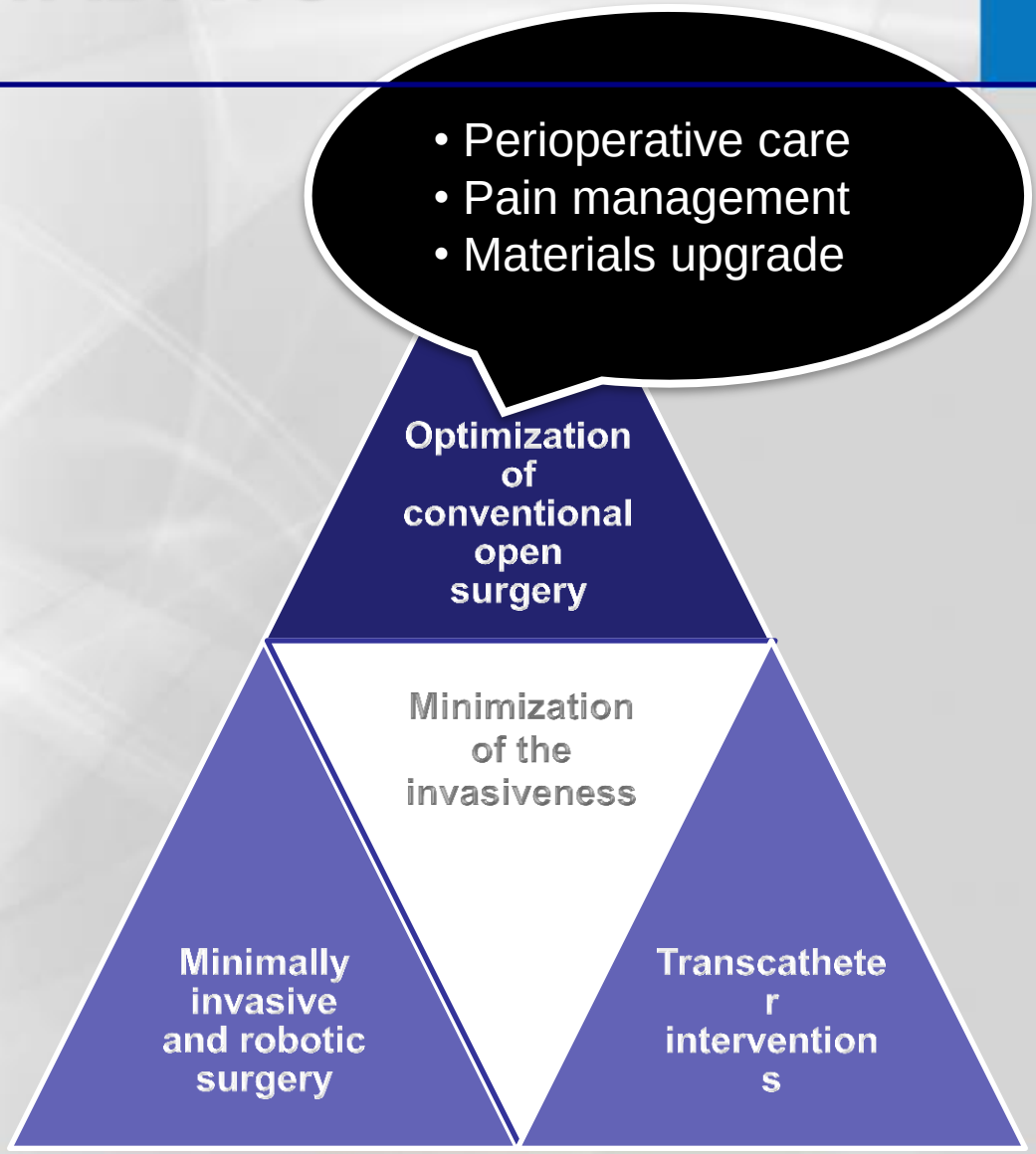
GVM CARE & RESEARCH

Suitability of INDICATIONS and TREATMENTS

NOWADAYS

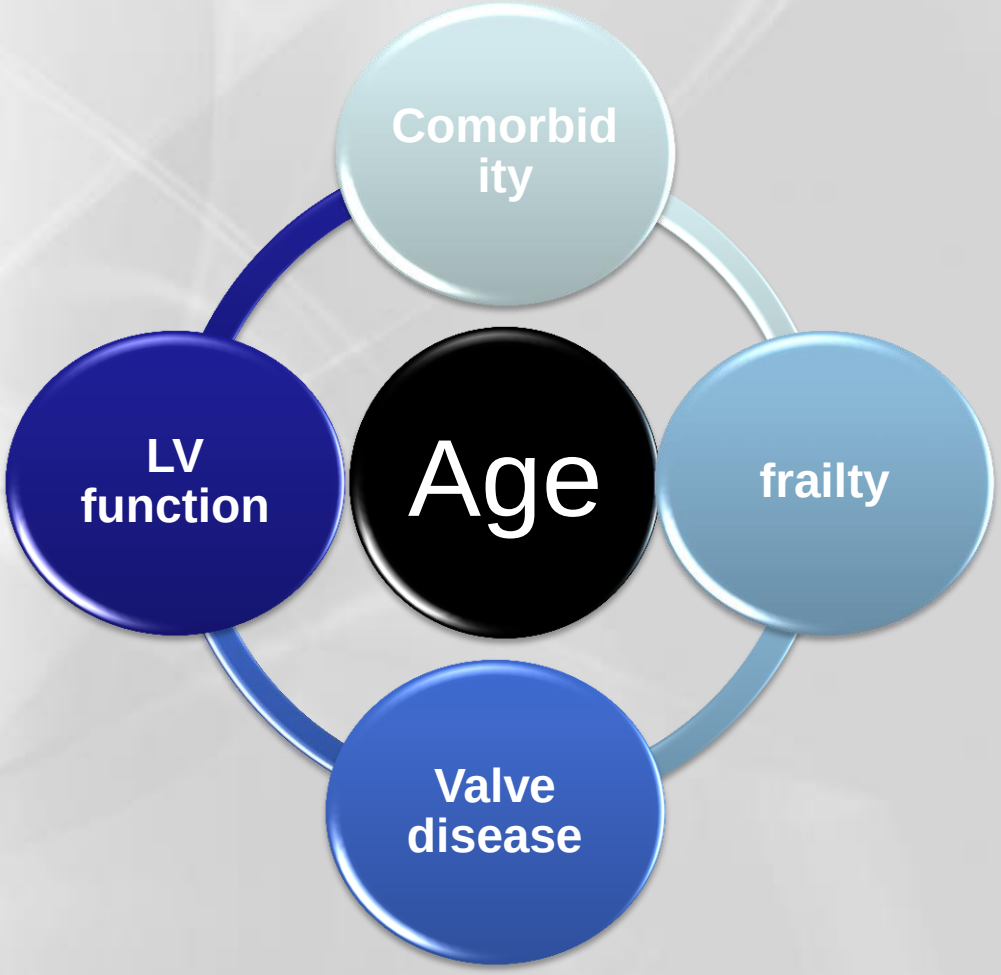
Surgery Purpose:

- Less invasivity
  - Lower the risk
  - Increase toleration
- Customization
  - Anatomy
  - Comorbidities
  - Patients own will



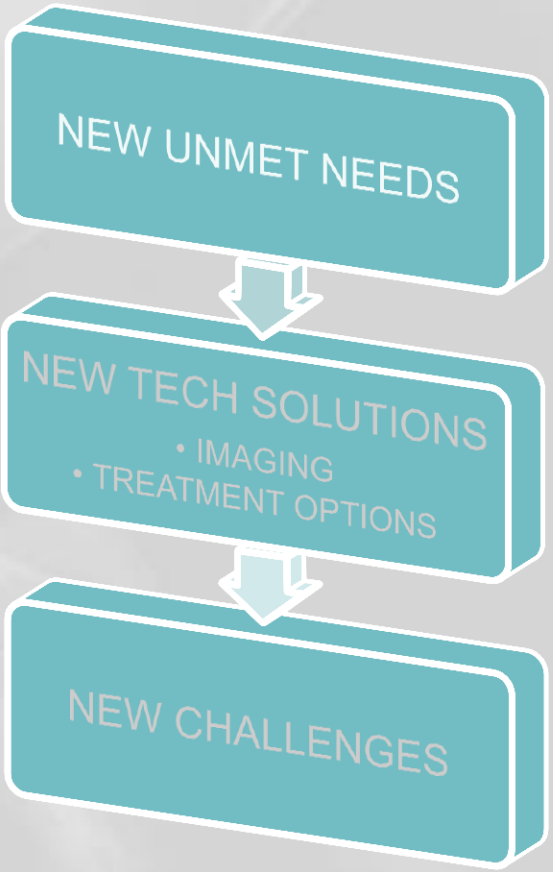
OPERATIVE RISKS

- Operative risks
  - Mortality
  - Morbidity
    - Early
    - Late
- Advantages
    - Survival
    - Quality of life

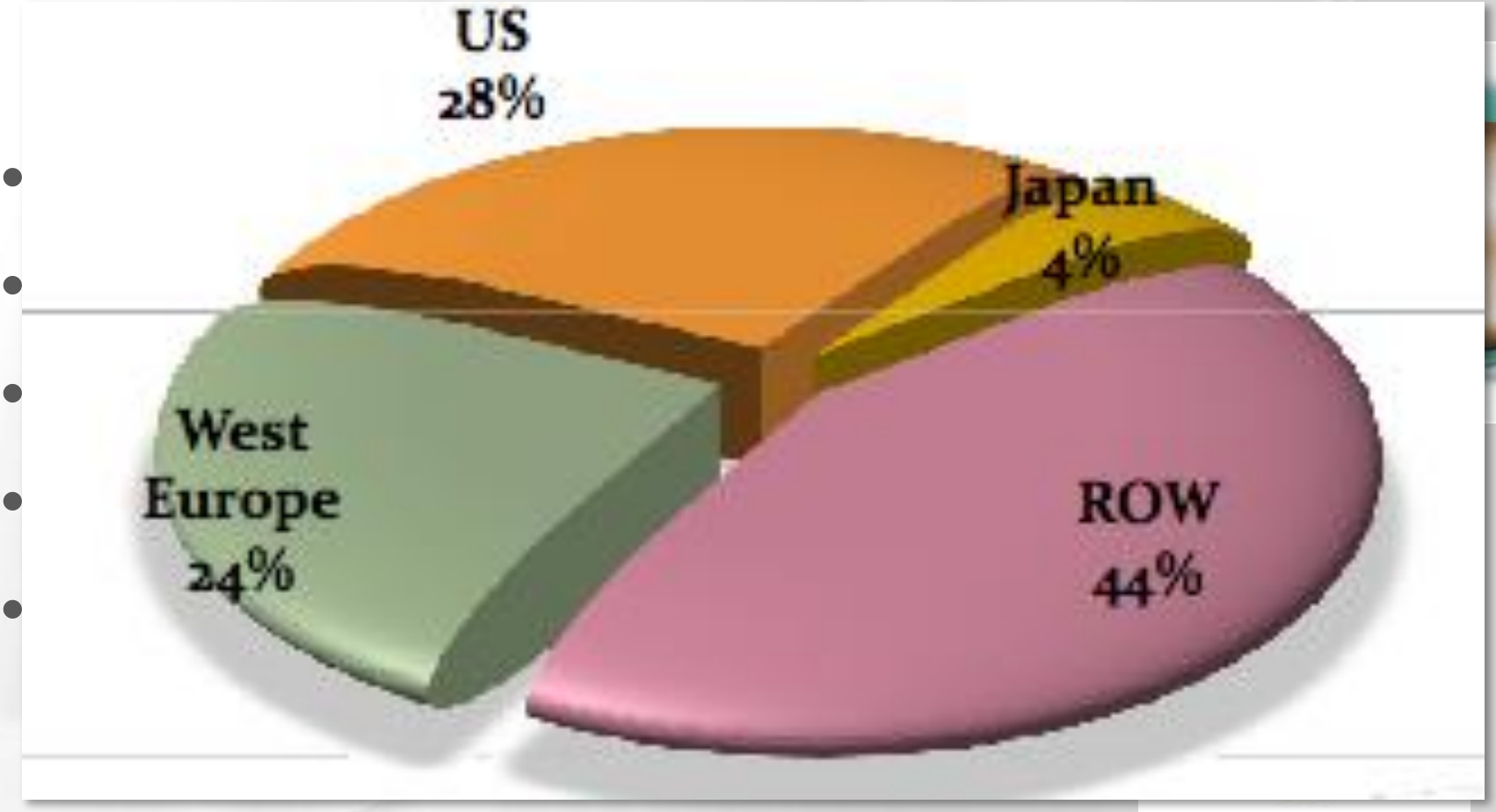


SCENERY IN PROGRESS

- Age, increase of life expectancy
- Prospectives
  - Quality vs longevity
  - Productivity
  - Phisical aspect
- Information
  - More aware patients
  - Referral pattern
- Limited resources and costs limitation



INDUSTRY INTERESTS



EUR 1,061 BILLIONS

Definition of Minimally Invasive Surgery

- **Cleveland Clinic**

  "*Minimally invasive cardiac surgery (MICS) allows access to the heart, its valves and vessels through small incisions, sometimes using specialized surgical instruments.*"

  For valve replacement or repair, surgeons can make one or two 3 - 4 inch (7-10 cm) incisions instead of the 6 - 8 inch (16-20 cm) incision required for traditional heart surgery.

- **The Society of Thoracic Surgeons**

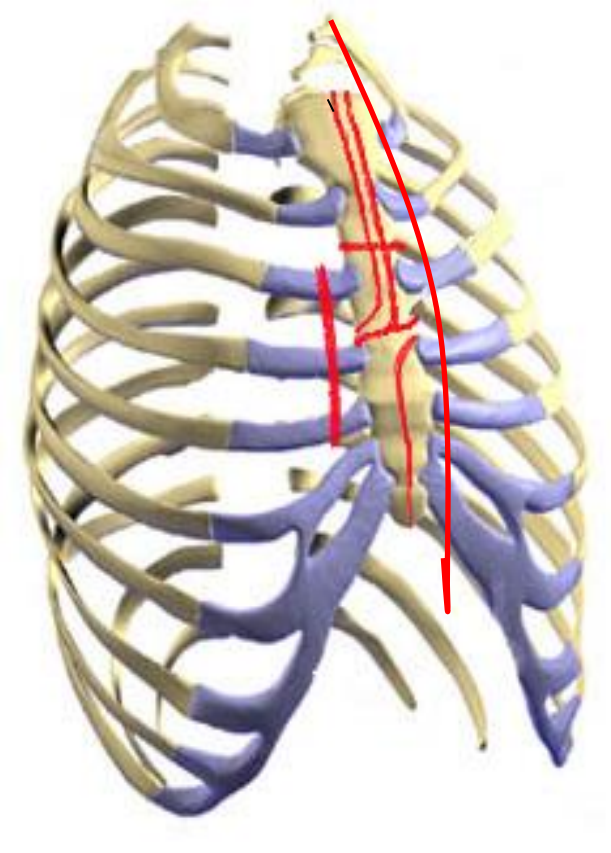
  "*Any procedure that has not been performed with a full sternotomy and cardiopulmonary bypass support. All other procedures, on or off pump with a small incision or off pump with a full sternotomy are considered minimally invasive*."

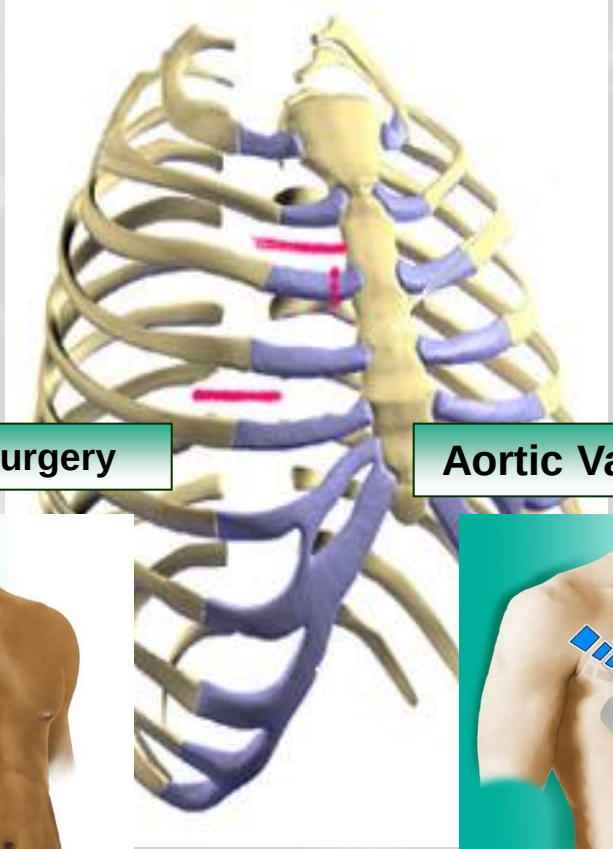
Definition of Minimally Invasive Surgery

At least one of these characteristics:

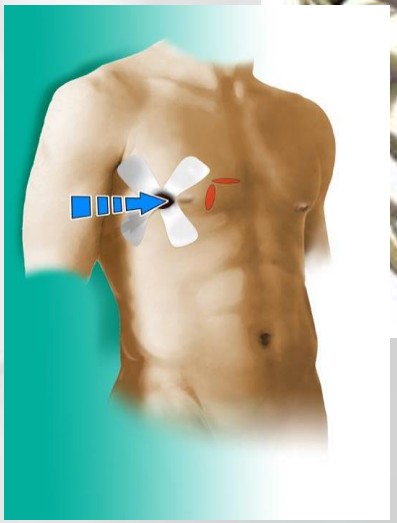
- Short operating time (including cardiopulmonary bypass and cross clamp time).
- Small incision, avoiding the full sternotomy

Conventional and minimally invasive incisions

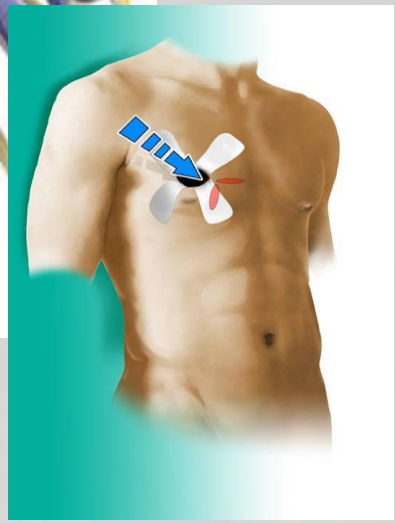




Mitral Valve Surgery



Aortic Valve Surgery



Upper Hemisternotomy

UPPER “J” MINI-STERNOTOMY

Upper Hemisternotomy vs Full Sternotomy

Minimal invasive aortic valve replacement surgery is associated with improved survival: a propensity-matched comparison†

Denis R. Merk[a,†], Sven Lehmann[a,†], David M. Holzhey[a], Pascal Dohmen[a], Pascal Candolfi[b], Martin Misfeld[a], Friedrich W. Mohr[a] and Michael A. Borger[a,*]

CONCLUSIONS

MIS is associated with excellent early and long-term survival when compared with conventional AVR surgery. Despite our observed longer myocardial ischaemic times and a higher re-exploration rate for bleeding, MIS AVR can be performed safely with very good early and long-term results that are at least equivalent to those achieved through a conventional sternotomy approach.

Table 4: Early postoperative outcomes in matched patients

Variables	MIS (n = 477)	FS (n = 477)	P-value
Low cardiac output	3/477 (0.6%)	8/477 (1.7%)	0.13
Intra-aortic balloon pump	2/477 (0.4%)	10/477 (2.1%)	0.021
Extracorporeal membrane oxygenation	1/477 (0.2%)	4/477 (0.8%)	0.18
Myocardial infarction	1/477 (0.2%)	3/477 (0.6%)	0.32
Cardiac arrhythmia	159/477 (33.3%)	171/477 (35.8%)	0.38
Re-exploration	20/477 (4.2%)	7/477 (1.5%)	0.009
Red blood cell transfusion >3	134/477 (28.1%)	94/477 (19.7%)	0.002
Delirium	28/477 (5.9%)	10/477 (2.1%)	0.003
Cerebrovascular accident	3/441 (0.7%)	9/441 (2.0%)	0.083
Wound infection	0/477 (0%)	0/477 (0%)	–
Dialysis	17/477 (3.6%)	17/477 (3.6%)	1.0
Respiratory failure	32/474 (6.8%)	33/474 (7.0%)	0.90
Ventilation >24 h	30/125 (24.0%)	24/125 (19.2%)	0.36
Reintubation	13/125 (10.4%)	19/125 (15.2%)	0.27
Tracheotomy	7/470 (1.5%)	10/470 (2.1%)	0.47
New pacemaker	20/477 (4.2%)	20/477 (4.2%)	1.0
In-hospital mortality	2/477 (0.4%)	11/477 (2.3%)	0.013
Hospital length of stay	12.9 ± 6.7	12.3 ± 5.6	0.35

European Journal of Cardio-Thoracic Surgery (2014) 1–7
doi:10.1093/ejcts/ezu068

UPPER "J" MINI-STERNOTOMY

Our experience at Maria Cecilia Hospital 2010 – 2014

569 PATIENTS

Age: 75 (26 - 90) 55.36% male

EuroSCORE: 6 (0 – 18) Logistic ES: 6.19 (0.88 – 77.95) REDO: 30 (5.27%)

Bicuspid valves: 8.61%

Skin-to-skin time: 163 (97-370) CPB time: 69 (28-206) ACC time: 59 (24-157)

Biological prostheses: 88.4%

MORTALITY: 1.99%

ICU stay (hours): 45 (13-792) Hospital stay (days): 7 (3-140)

Right Mini-thoracotomy

RIGHT ANTERIOR THORACOTOMY (RAT)

- RAT was first described by Rao and Kumar
- Galloway et al modified the right parasternal approach reported by Cosgrove and Sabikand Cohn but the right parasternal approach has been largely abandoned because of the incidence of chest wall hernia and also because of the incision crossing skin lines.
- transverse sternotomy and partial upper or lower sternotomy have been widely used but still require some form of sternotomy.
- Several small early series using right minithoracotomy have reported favorable results in selected patients. Few series >100 patients have been reported.

Aortic Valve Replacement Through Right Minithoracotomy in 306 Consecutive Patients

(*Innovations* 2010;5:326–330)

Donald D. Glower, MD, Teng Lee, MD, and Bhargavi Desai, BS

POSSIBLE BENEFITS OF MINI-THORACOTOMY

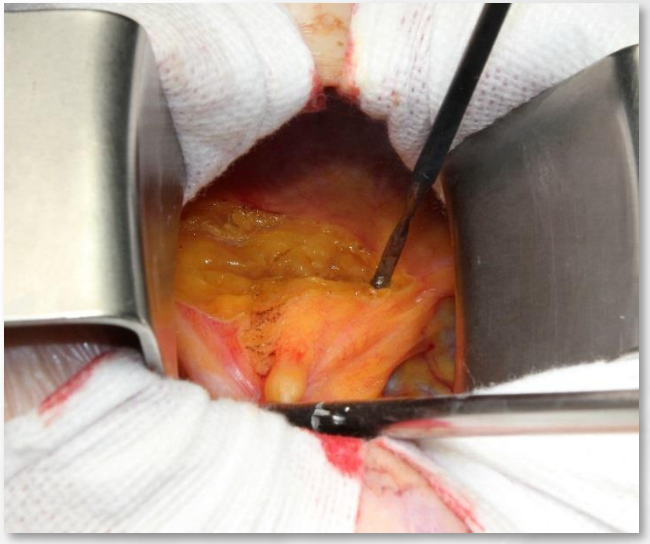
- Pain Reduction
- Improved cosmetic results
- Early mobilization, recovery and return to activity
- Reduced ICU and hospital stay
- Less transfusion required and
- Lower risk of bleeding
- Less wound complications
- Improved postoperative pulmonary function
- High psychological acceptance

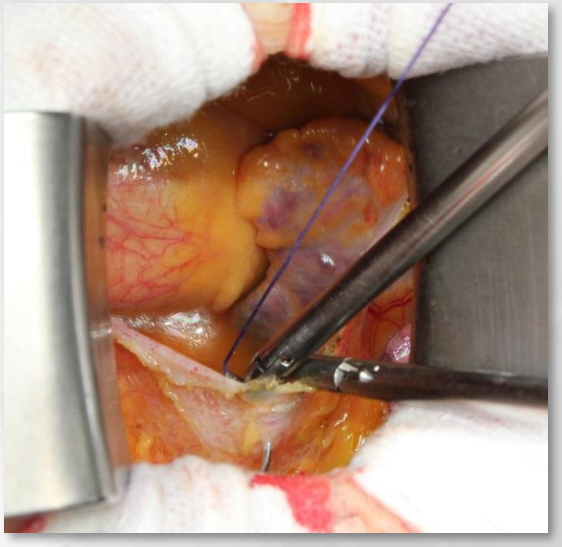
MINI-THORACOTOMY AVR

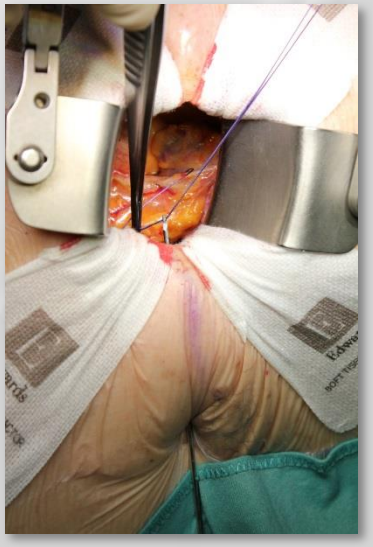
MINI-THORACOTOMY AVR

PATIENT POSITIONING

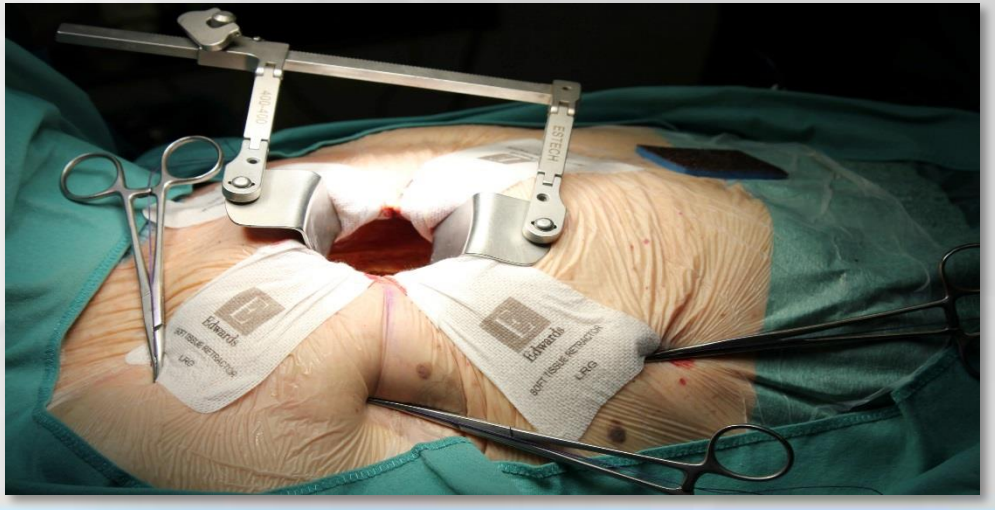
MINI-THORACOTOMY AVR





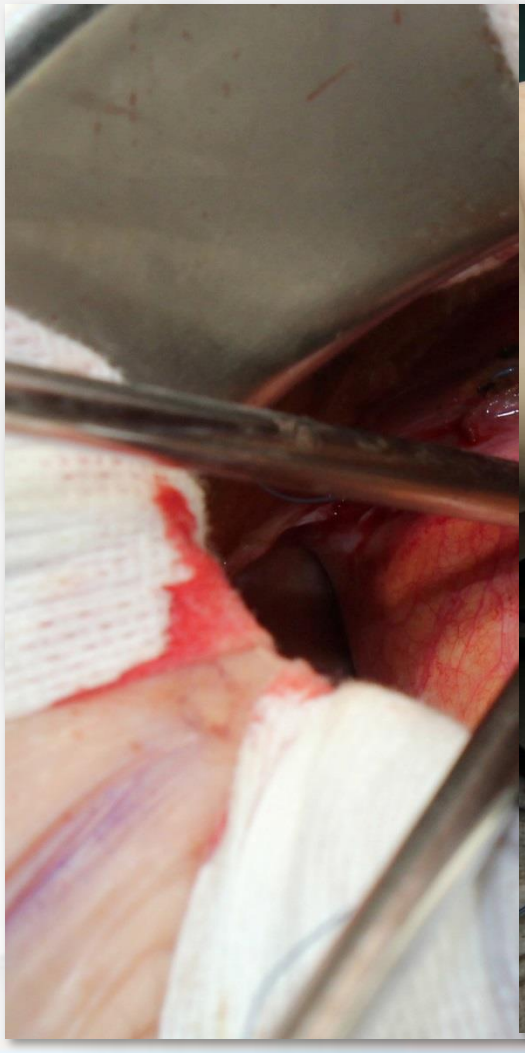


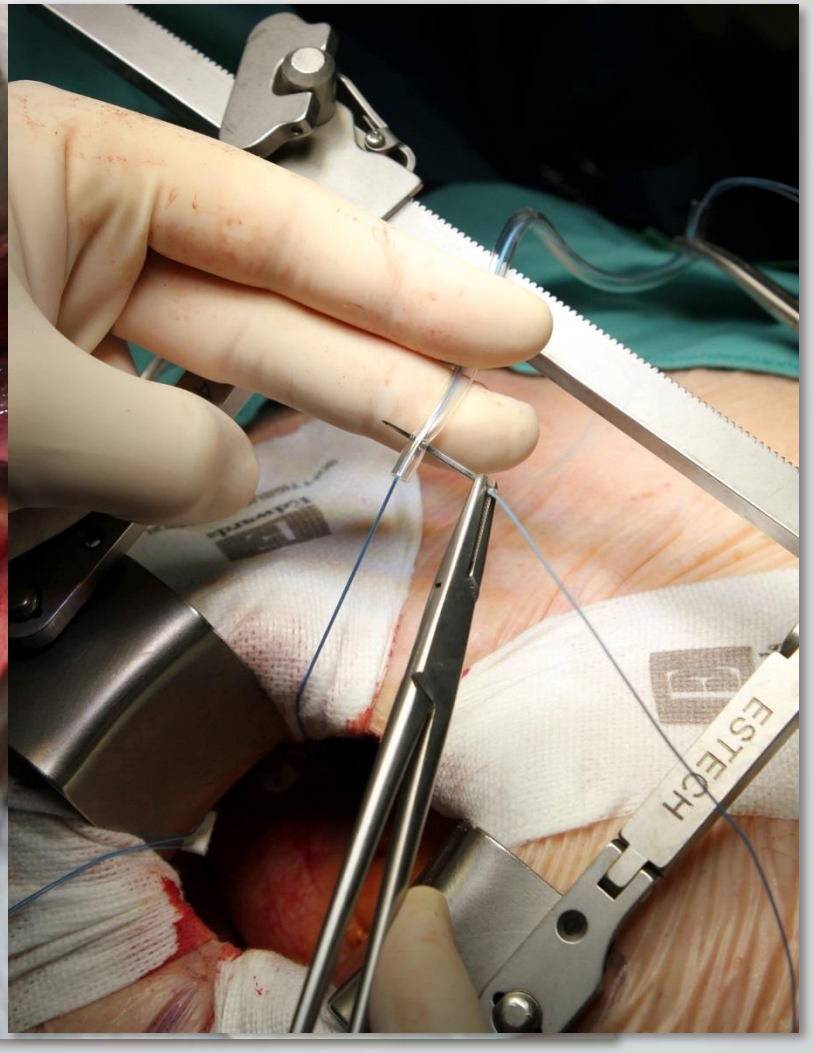
PERICARDIAL STITCHES



MINI-THORACOTOMY AVR

AORTIC PURSE STRINGS

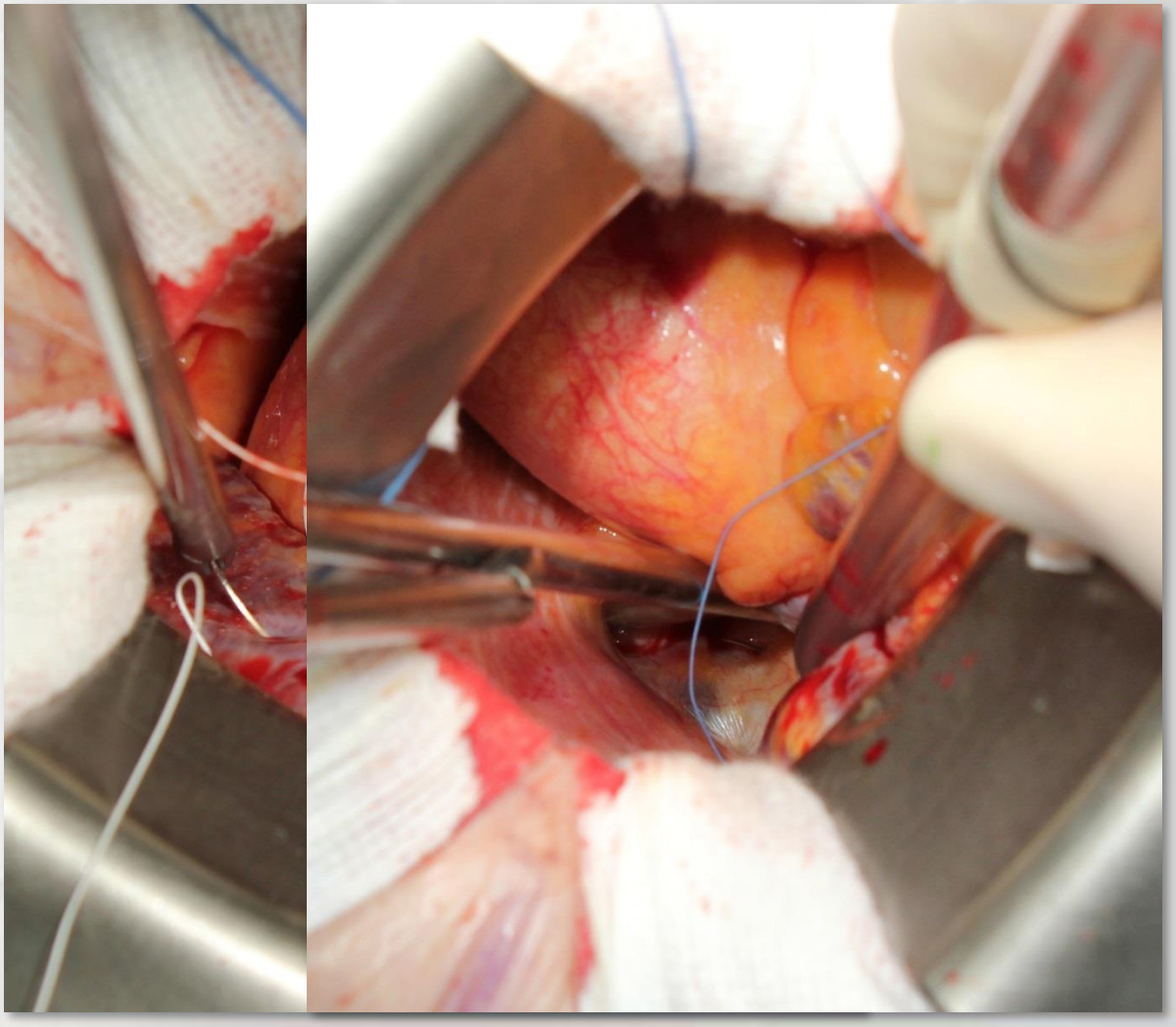




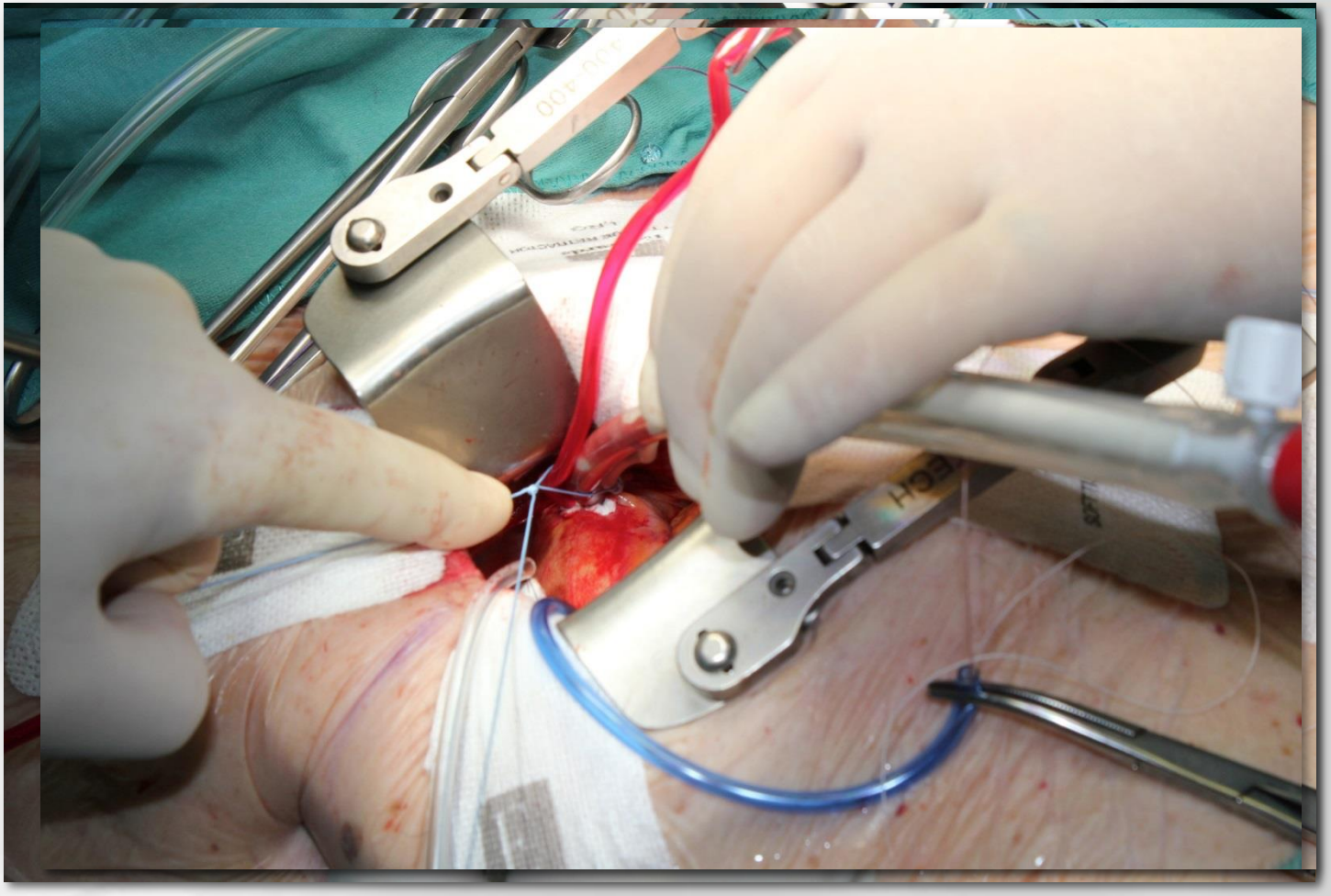
MINI-THORACOTOMY AVR

RIGHT ATRIUM

SUPERIOR PULMONARY VEIN



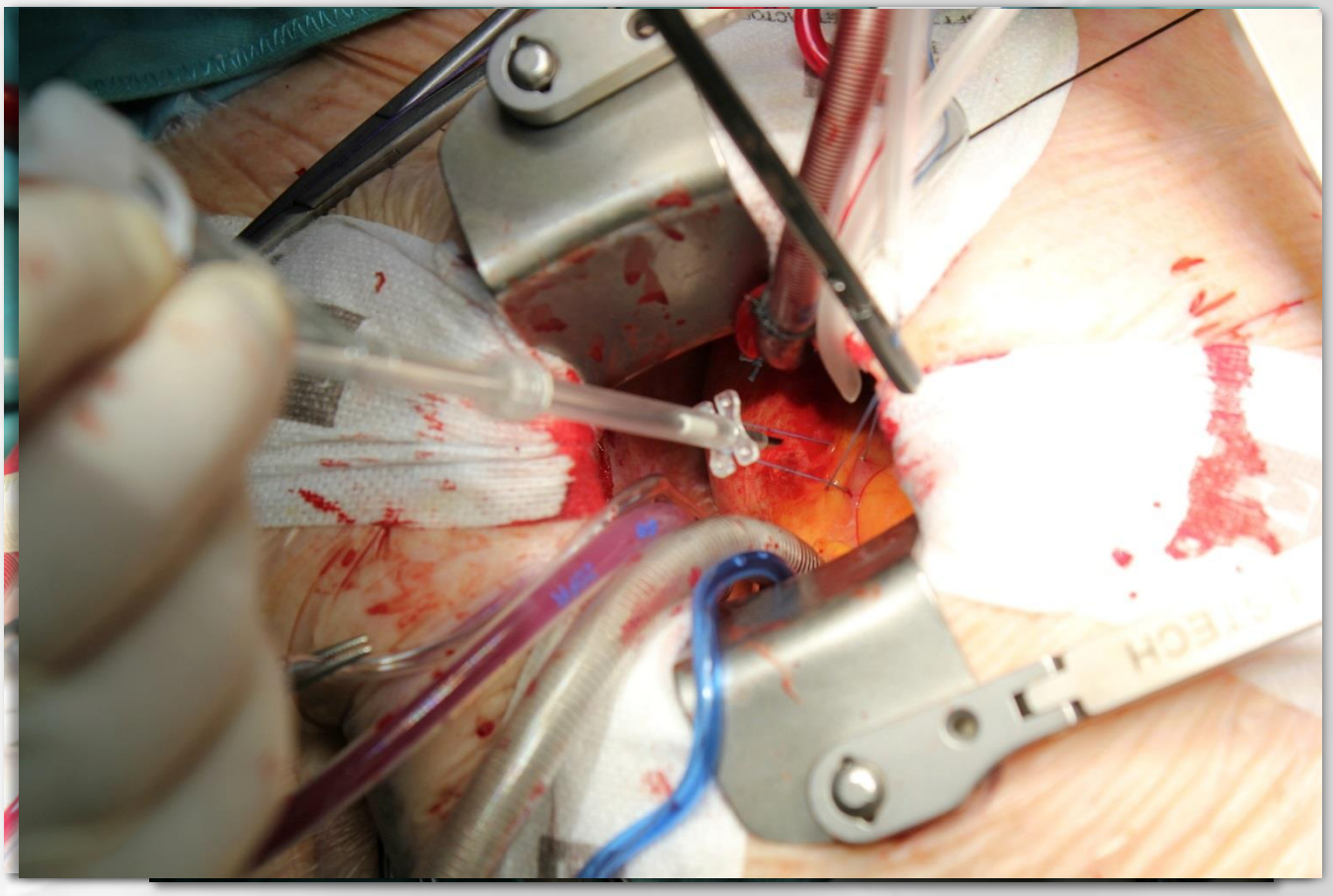
MINI-THORACOTOMY AVR



AORTIC CANNULATION

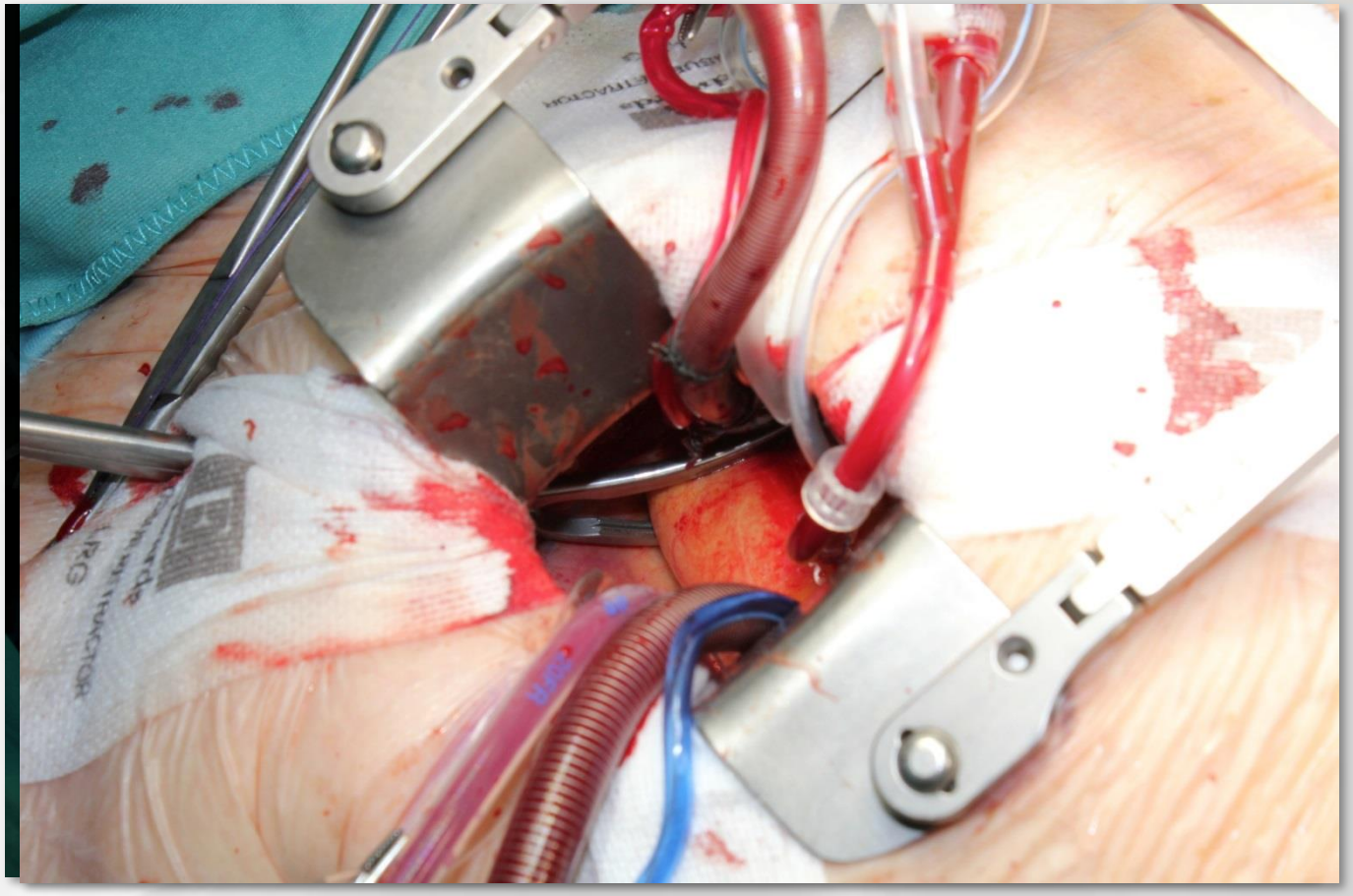
MINI-THORACOTOMY AVR

RIGHT ATRIUM CANNULATION



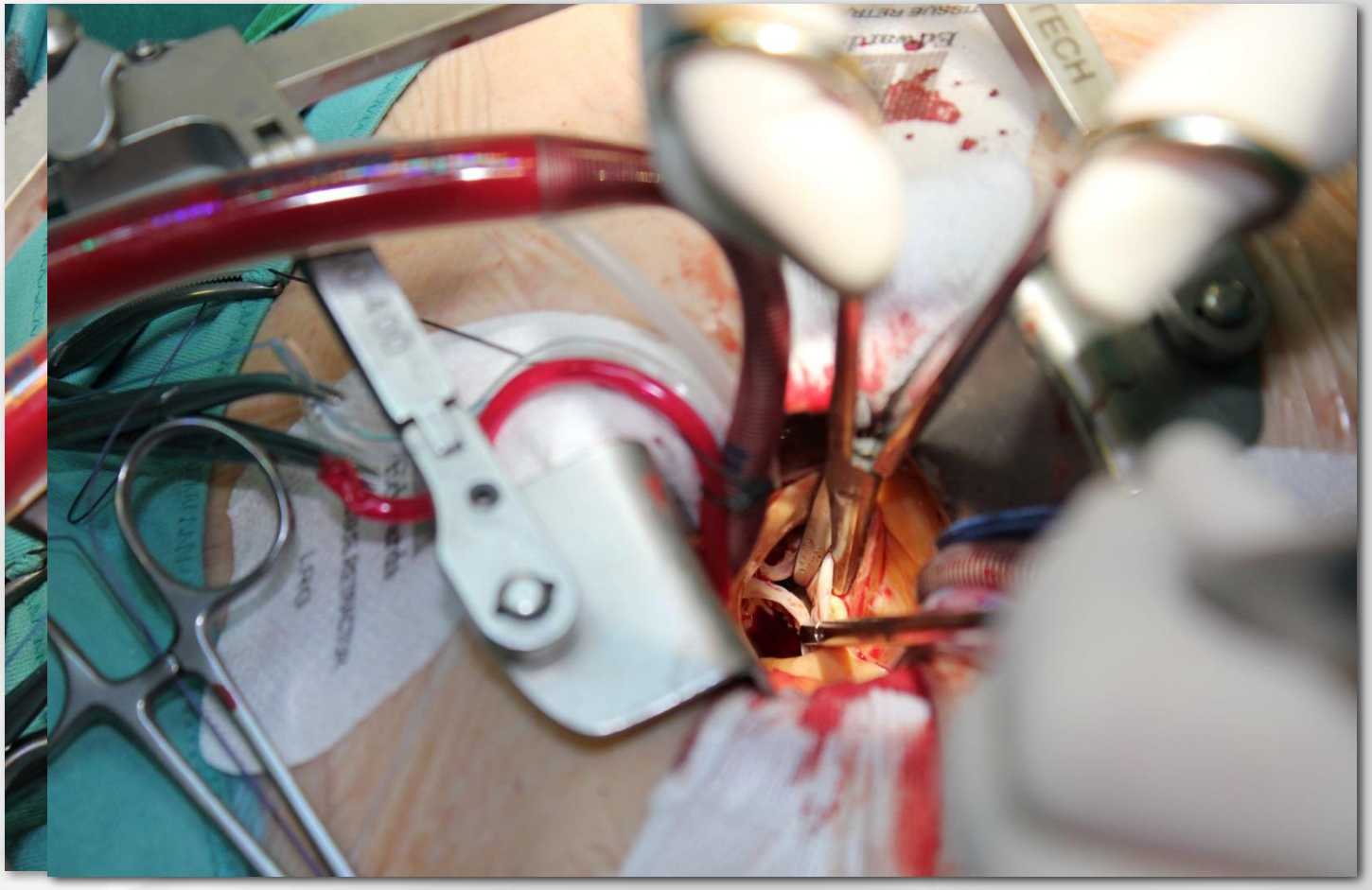
MINI-THORACOTOMY AVR

AORTIC CROSS CLAMPING



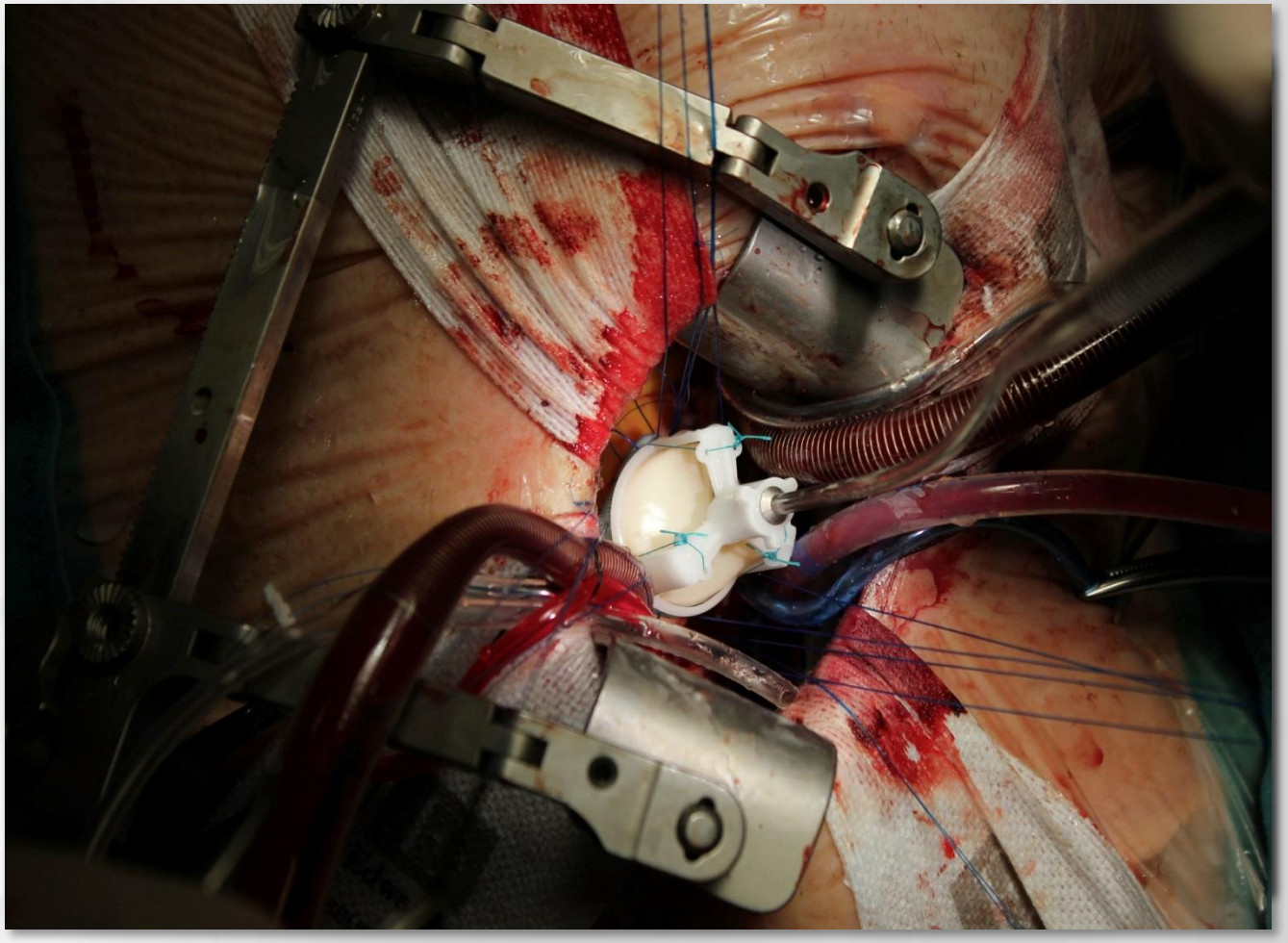
MINI-THORACOTOMY AVR

DISEASED VALVE REMOVING



MINI-THORACOTOMY AVR

PROSTHESIS IMPLANTATION



MINI-THORACOTOMY AVR

FINAL RESULT

Right Minithoracotomy vs Full Sternotomy

Minimally Invasive and Conventional Aortic Valve Replacement: A Propensity Score Analysis

Daniyar Gilmanov, MD, Stefano Bevilacqua, MD, Michele Murzi, MD, Alfredo G. Cerillo, MD, Tommaso Gasbarri, MD, Enkel Kallushi, MD, Antonio Miceli, MD, and Mattia Glauber, MD

Department of Adult Cardiac Surgery, G. Pasquinucci Heart Hospital, Gabriele Monasterio Foundation, Massa, Italy

Background. The study aimed to compare the short-term results of aortic valve replacement through minimally invasive and sternotomy approaches.

Methods. This is a retrospective, observational, cohort study of prospectively collected data on 709 patients undergoing isolated primary aortic valve replacement between 2004 and 2011. Of these, 338 were performed through either right anterior minithoracotomy or upper ministernotomy. With propensity score matching, 182 patients (minimally invasive group) were compared with 182 patients in conventional sternotomy (control group).

Results. After propensity matching, the 2 groups were comparable in terms of preoperative characteristics. Cardiopulmonary bypass time (117.5 vs 104.1 min, $p < 0.0001$) and aortic cross-clamping time (83.8 vs 71.3 min, $p < 0.0001$) were longer in the minimally invasive group, with no difference in length of stay (median 6 vs 5 days, $p = 0.43$), but shorter assisted ventilation time (median 8 vs 7 hours, $p = 0.022$). Overall in-hospital mortality was identical between the groups (1.64 vs 1.64%, $p = 1.0$). No difference in the incidence of major and minor postoperative complications and related morbidity was observed. Minimally invasive aortic valve replacement was associated with a lower incidence of new onset postoperative atrial fibrillation (21% vs 31%, $p = 0.04$). Reduction of the complication rate was observed. Median transfusion pack per patient was higher in the control group (2 vs 1 units, $p = 0.04$).

Conclusions. Our experience shows that mini-access isolated aortic valve surgery is a reproducible, safe, and effective procedure and reduces assisted ventilation duration, the need for blood product transfusion, and incidence of post-surgery atrial fibrillation.

(Ann Thorac Surg 2013;96:837–43)

Right Minithoracotomy vs Full Sternotomy

Table 2. Clinical Outcome of Propensity Matched Patients

Variables	CAVR (n = 182)	MIAVR (n = 182)	*p* Value
CPB time, minutes	104.1 ± 34.6	117.5 ± 41.9	<0.0001
Aortic cross-clamping time, minutes	71.3 ± 27.5	83.8 ± 28.5	<0.0001
In-hospital mortality	3 (1.6)	3 (1.6)	1.0
Assisted ventilation time, hours[a]	8 (6–11)	7 (6–9)	0.022
Assisted ventilation longer than 12 hours	33 (18.1)	23 (12.6)	0.2
Assisted ventilation longer than 24 hours	9 (4.9)	4 (2.2)	0.27
Low cardiac output syndrome	1 (0.5)	2 (1.1)	0.26
New onset of AF	57 (31.3)	39 (21.4)	0.043
Third degree atrioventricular block	2 (1.1)	2 (1.1)	1.0
Permanent CVA (stroke)	4 (2.2)	2 (1.1)	0.69
Transient CVA	1 (0.5)	1 (0.5)	1.0
Hemodialysis	2 (1.1)	3 (1.6)	0.41
Infective complications	5 (2.7)	4 (2.2)	0.28
Pulmonary complications	8 (4.4)	10 (5.5)	0.58
Pleural effusion requested drainage	5 (2.7)	10 (5.5)	0.19
Reexploration for bleeding	11 (6.0)	8 (4.4)	0.63
Revision for other reasons	2 (1.1)	5 (2.7)	0.45
Blood transfusion pack per patient, unit[a]	2 (0–3)	1 (0–2)	0.046
Postoperative in-hospital length of stay, days[a]	6 (5–7)	5 (5–6)	0.43
Postoperative length of stay more than 6 days	53 (29.1)	48 (26.4)	0.62

[a] Median value (25th to 75th percentile).

Values are expressed as n (%) unless otherwise specified.

AF = atrial fibrillation; CAVR = conventional aortic valve replacement; CPB = cardiopulmonary bypass; CVA = cerebrovascular accident; MIAVR = minimally invasive aortic valve replacement.

Ann Thorac Surg
2013;96:837–43

Right Minithoracotomy

Our experience at Maria Cecilia Hospital 2010 – 2014

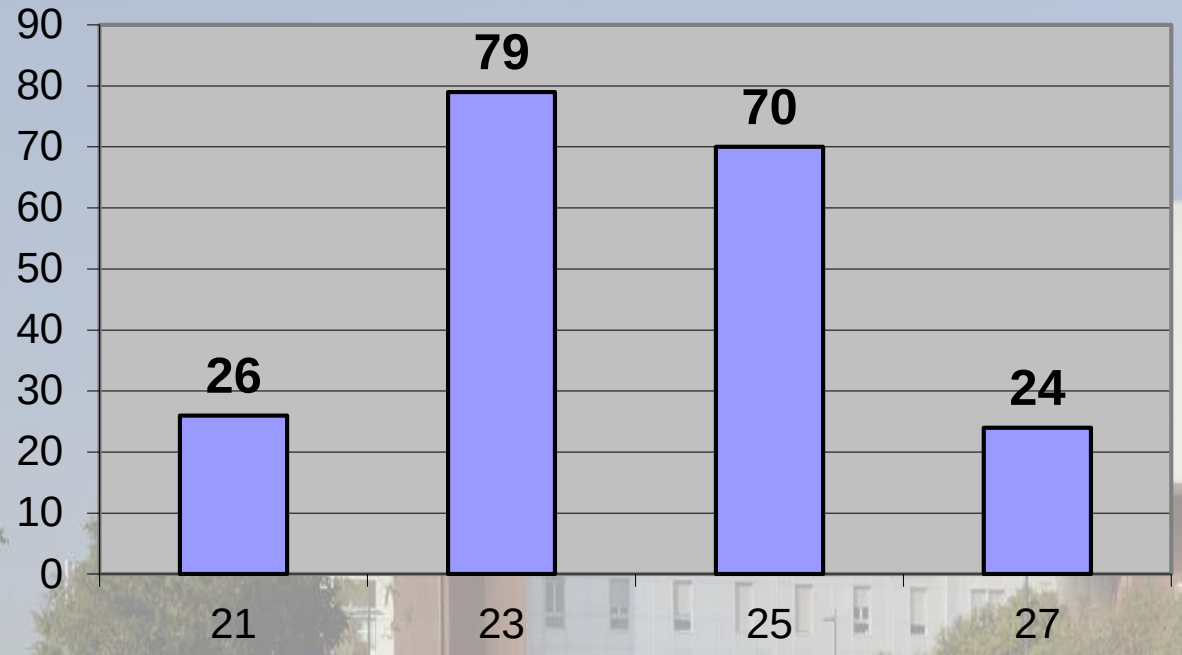
Number of patients	**218 consecutive**
Gender (males)	**122 (55.96%)**
Median age	**75 (range 16-93)**
CPB Time (median)	**60 (range 41-210) → 53.5 (range 41-69)**
ACC Time (median)	**48 (range 31-134) → 42 (range 31-58)**

*** Last 50 patients**

Sole absolute contraindication to the approach:
left pneumectomy

Right Minithoracotomy

Our experience at Maria Cecilia Hospital 2010 – 2014



Mean size 23.9 ± 1.7
Median size 23

Single surgeon - Single prosthesis experience

Right Minithoracotomy

Our experience at Maria Cecilia Hospital 2010 – 2014

- **MORTALITY: 3 (1.49%)**
- **Bleeding coming mainly from chest wall requiring reoperation in 4% of the cases without sequelae**
- **1 single case of wound infection in a redo pt with porcelain aortic arch not eligible for TAVI**
- **Paravalvular leaks**
  - **Two evaluated at intraoperatory TEE and corrected by restarting CBP**
  - **No PVL at discharge**

Right Minithoracotomy

Our experience at Maria Cecilia Hospital 2010 – 2014

Table 4 . Outcome ♣

Characteristics	Peripheral Cannulation (N=42)	Central Cannulation (N=164)	Total (N=206)
Ventilation time (h)			
Mean ± SD	8 ± 6	9 ± 12	9 ± 11
Median (min - max)	6 (0-30)	6 (0-120)	6 (0 - 120)
ICU stay (h) ♦			
Mean ± SD	56 ± 89	61 ± 109	60 ± 105
Median (min - max)	40 (15 – 598)	40 (13-1258)	40 (13-1258)
Discharged alive (%)	42 (100)	161 (98.2)	203 (98.5)
Discharged to (%)			
Home	22 (52.4)	77 (47)	99 (48.1)
Rehabilitation	18 (42.9)	81 (49.4)	99 (48.1)
Other	2 (4.8)	6 (3.6)	8 (3.9)
Hospital stay (days)			
Mean ± SD	14.4 ± 24.4	11.7 ± 8.2	12.3 ± 13.2
Median (min - max)	9 (5 – 164)	10 (5-59)	9 (5-164)

♣ Values display total number of patients reported as mean ± standard deviation and as median (range).

♦ ICU= intensive care unit;

Article in press…

Aortic valve replacement via right mini-thoracotomy: is it really biologically minimally invasive?

Elisa Mikus MD[1], Simone Turci MD[2] , Simone Calvi MD[1], Massimo Ricci MD[2], Luca Dozza MS,[3] Mauro Del Giglio MD, PhD[1, 2].

Right Minithoracotomy

Critiques to the technique…

~ 60 articles

1. ~~RIB AVULSIO~~
2. ~~RIMA D~~
3. ~~LO~~ ~~ME~~
4. ~~ERIA~~
5. ~~NEEDED~~
6. ~~ERAL CANNULATION~~
7. ~~W "REPRODUCIBILITY"~~
8. ~~PROSTHESIS UNDERSIZING~~

WHY NOT?

Meta-Analysis

A Meta-Analysis of Minimally Invasive Versus Conventional Sternotomy for Aortic Valve Replacement

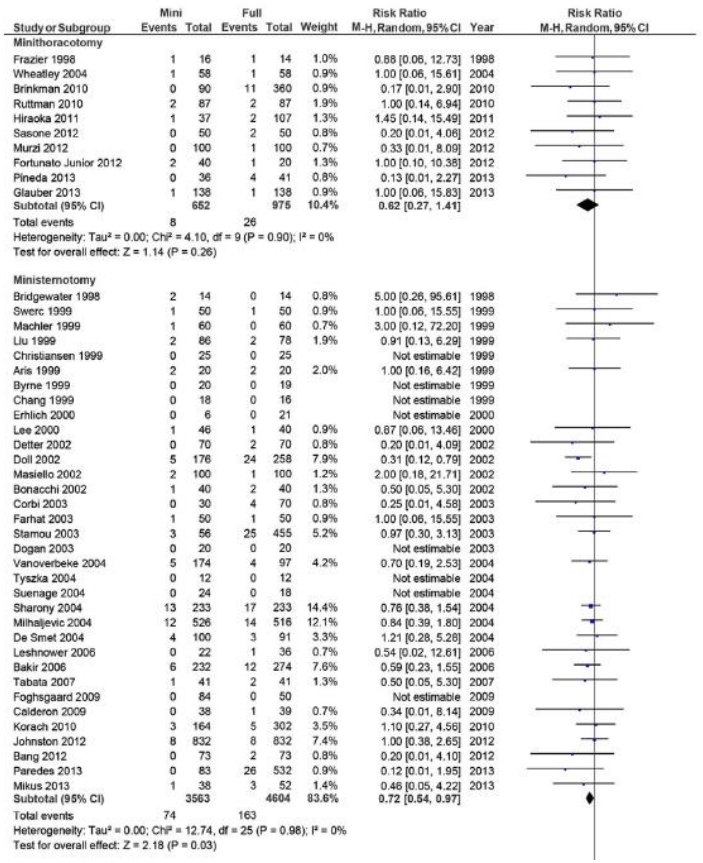
Kevin Phan, BS(Adv), Ashleigh Xie, Marco Di Eusanio, MD, PhD, and Tristan D. Yan, MBBS, PhD

The Collaborative Research (CORE) Group, Macquarie University, Sydney, New South Wales, Australia; Cardiovascular Surgery Department, Sant'Orsola-Malpighi Hospital, Bologna University, Bologna, Italy; and Department of Cardiothoracic Surgery, Royal Prince Alfred Hospital, Sydney Medical School, University of Sydney, Sydney, New South Wales, Australia

Minimally invasive aortic valve replacement (AVR) is increasingly used as an alternative to conventional AVR, despite limited randomized evidence available. To assess the evidence base, a systematic search identified 50 comparative studies with a total of 12,786 patients. A meta-analysis demonstrated that minimally invasive AVR is associated with reduced transfusion incidence, intensive care stay, hospitalization, and renal failure, and has a mortality rate that is comparable to conventional AVR. The evidence quality was mostly very low. Given the inadequate statistical power and heterogeneity of available studies, prospective randomized trials are needed to assess the benefits and risks of minimally invasive AVR approaches.

(Ann Thorac Surg 2014;98:1499–511)

Meta-Analysis



Study or Subgroup	Mini Events	Mini Total	Full Events	Full Total	Weight	Risk Ratio M-H, Random, 95% CI	Year
Minithoracotomy							
Frazier 1998	1	16	1	14	1.0%	0.88 [0.06, 12.73]	1998
Wheatley 2004	1	58	1	58	0.9%	1.00 [0.06, 15.61]	2004
Brinkman 2010	0	90	11	360	0.9%	0.17 [0.01, 2.90]	2010
Ruttman 2010	2	87	2	87	1.9%	1.00 [0.14, 6.94]	2010
Hiraoka 2011	1	37	2	107	1.3%	1.45 [0.14, 15.49]	2011
Sasone 2012	0	50	2	50	0.8%	0.20 [0.01, 4.06]	2012
Murzi 2012	0	100	1	100	0.7%	0.33 [0.01, 8.09]	2012
Fortunato Junior 2012	2	40	1	20	1.3%	1.00 [0.10, 10.38]	2012
Pineda 2013	0	36	4	41	0.8%	0.13 [0.01, 2.27]	2013
Glauber 2013	1	138	1	138	0.9%	1.00 [0.06, 15.83]	2013
Subtotal (95% CI)		652		975	10.4%	0.62 [0.27, 1.41]	
Total events	8		26				
Heterogeneity: Tau² = 0.00; Chi² = 4.10, df = 9 (P = 0.90); I² = 0%							
Test for overall effect: Z = 1.14 (P = 0.26)							
Ministernotomy							
Bridgewater 1998	2	14	0	14	0.8%	5.00 [0.26, 95.61]	1998
Swerc 1999	1	50	1	50	0.9%	1.00 [0.06, 15.55]	1999
Machler 1999	1	60	0	60	0.7%	3.00 [0.12, 72.20]	1999
Liu 1999	2	86	2	78	1.9%	0.91 [0.13, 6.29]	1999
Christiansen 1999	0	25	0	25		Not estimable	1999
Aris 1999	2	20	2	20	2.0%	1.00 [0.16, 6.42]	1999
Byrne 1999	0	20	0	19		Not estimable	1999
Chang 1999	0	18	0	16		Not estimable	1999
Erhlich 2000	0	6	0	21		Not estimable	2000
Lee 2000	1	46	1	40	0.9%	0.87 [0.06, 13.46]	2000
Detter 2002	0	70	2	70	0.8%	0.20 [0.01, 4.09]	2002
Doll 2002	5	176	24	258	7.9%	0.31 [0.12, 0.79]	2002
Masiello 2002	2	100	1	100	1.2%	2.00 [0.18, 21.71]	2002
Bonacchi 2002	1	40	2	40	1.3%	0.50 [0.05, 5.30]	2002
Corbi 2003	0	30	4	70	0.8%	0.25 [0.01, 4.58]	2003
Farhat 2003	1	50	1	50	0.9%	1.00 [0.06, 15.55]	2003
Stamou 2003	3	56	25	455	5.2%	0.97 [0.30, 3.13]	2003
Dogan 2003	0	20	0	20		Not estimable	2003
Vanoverbeke 2004	5	174	4	97	4.2%	0.70 [0.19, 2.53]	2004
Tyszka 2004	0	12	0	12		Not estimable	2004
Suenage 2004	0	24	0	18		Not estimable	2004
Sharony 2004	13	233	17	233	14.4%	0.76 [0.38, 1.54]	2004
Milhaljevic 2004	12	526	14	516	12.1%	0.84 [0.39, 1.80]	2004
De Smet 2004	4	100	3	91	3.3%	1.21 [0.28, 5.28]	2004
Leshnower 2006	0	22	1	36	0.7%	0.54 [0.02, 12.61]	2006
Bakir 2006	6	232	12	274	7.6%	0.59 [0.23, 1.55]	2006
Tabata 2007	1	41	2	41	1.3%	0.50 [0.05, 5.30]	2007
Foghsgaard 2009	0	84	0	50		Not estimable	2009
Calderon 2009	0	38	1	39	0.7%	0.34 [0.01, 8.14]	2009
Korach 2010	3	164	5	302	3.5%	1.10 [0.27, 4.56]	2010
Johnston 2012	8	832	8	832	7.4%	1.00 [0.38, 2.65]	2012
Bang 2012	0	73	2	73	0.8%	0.20 [0.01, 4.10]	2012
Paredes 2013	0	83	26	532	0.9%	0.12 [0.01, 1.95]	2013
Mikus 2013	1	38	3	52	1.4%	0.46 [0.05, 4.22]	2013
Subtotal (95% CI)		3563		4604	83.6%	0.72 [0.54, 0.97]	
Total events	74		163				
Heterogeneity: Tau² = 0.00; Chi² = 12.74, df = 25 (P = 0.98); I² = 0%							
Test for overall effect: Z = 2.18 (P = 0.03)							
Total (95% CI)		**4614**		**5997**	**100.0%**	**0.74 [0.56, 0.96]**	
Total events	**89**		**195**				

Risk Ratio M-H, Random, 95% CI

0.002 0.1 1 10 500

Favours MIAVR Favours CAVR

Heterogeneity: Tau² = 0.00; Chi² = 17.88, df = 37 (P = 1.00); I² = 0%

Test for overall effect: Z = 2.27 (P = 0.02)

Fig 2. Perioperative mortality in patients undergoing minimally invasive aortic valve replacement (MIAVR) vs conventional aortic valve replacement (CAVR). (M-H = Mantel-Haenszel test.) The solid squares denote the risk ratio and are proportional to the weights used in the meta-analysis. The solid vertical line indicates no effect. The diamond denotes the weighted risk ratio, and the lateral tips of the diamond indicate the associated confidence intervals (CIs). The horizontal lines represent the 95% CIs.

(Ann Thorac Surg 2014;98:1499–511)

Meta-Analysis

The minimally invasive approach to AVR has advantages of decreased ICU days and hospital stay, which may be attributed to the reduced surgical trauma associated with MIAVR. Furthermore, subgroup analysis demonstrated decreased wound infections with minithoracotomy than with ministernotomy and CAVR. These benefits may be translated from the smaller incision, sternum preservation, and integrity of the costal cartilages associated with the minithoracotomy approach.

(Ann Thorac Surg 2014;98:1499–511)

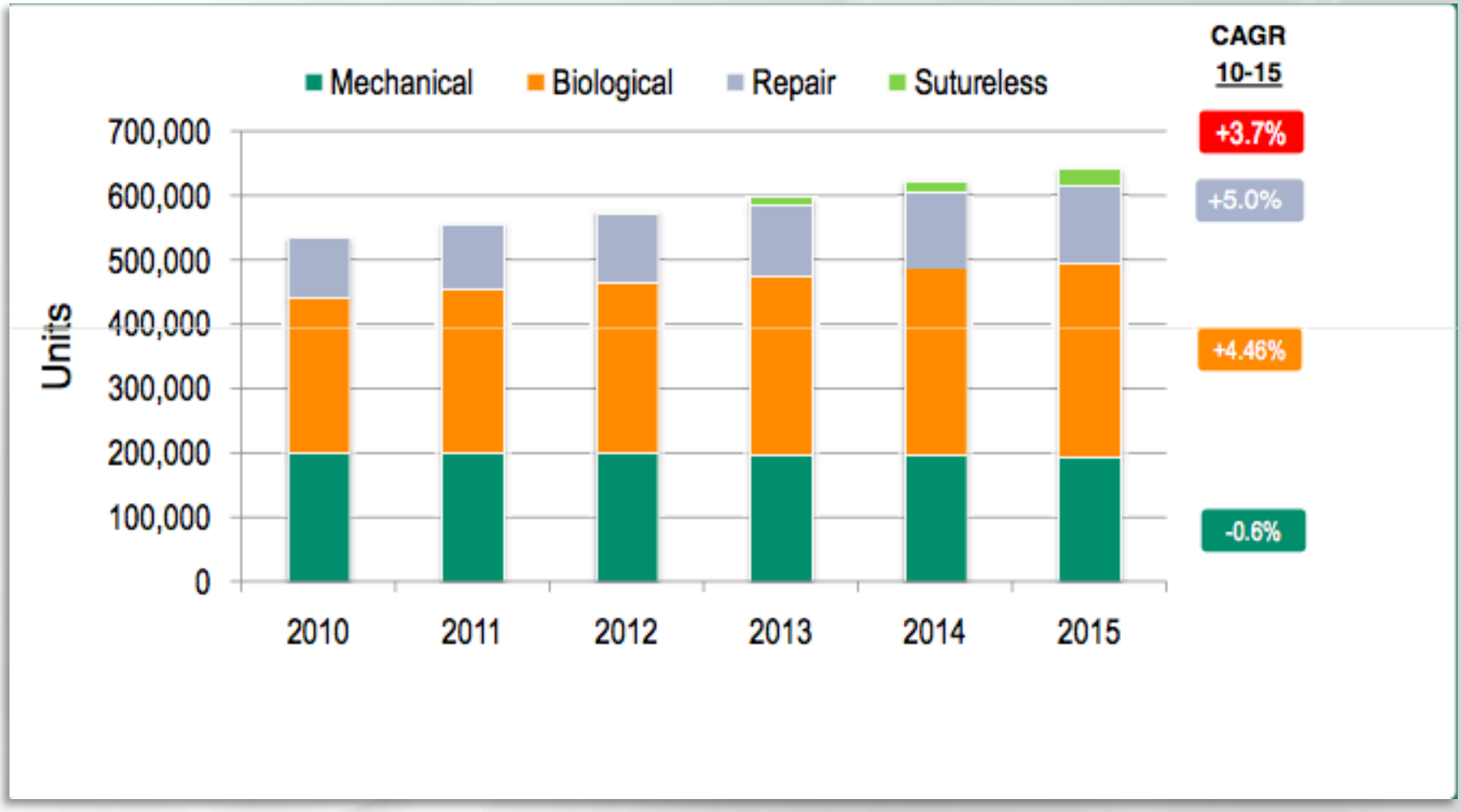
trauma. Although proponents of CAVR have argued that these advantages of MIAVR are offset by drawbacks of longer operation durations, the current meta-analysis indicates that differences in CPB and cross-clamp durations are, in fact, relatively short (range, 8 to 9 minutes).

In conclusion, current evidence suggests that MIAVR is associated with reduced death, ICU stay, hospitalization, renal failures, transfusions, and pain, but only slightly longer durations of cross-clamping and CPB. Given the paucity of high-quality evidence, a multicenter prospective RCT should be conducted prospectively with adequate power and follow-up duration to measure clinical, resource, and time-related outcomes to definitively assess MIAVR procedures.

SUTURELESS

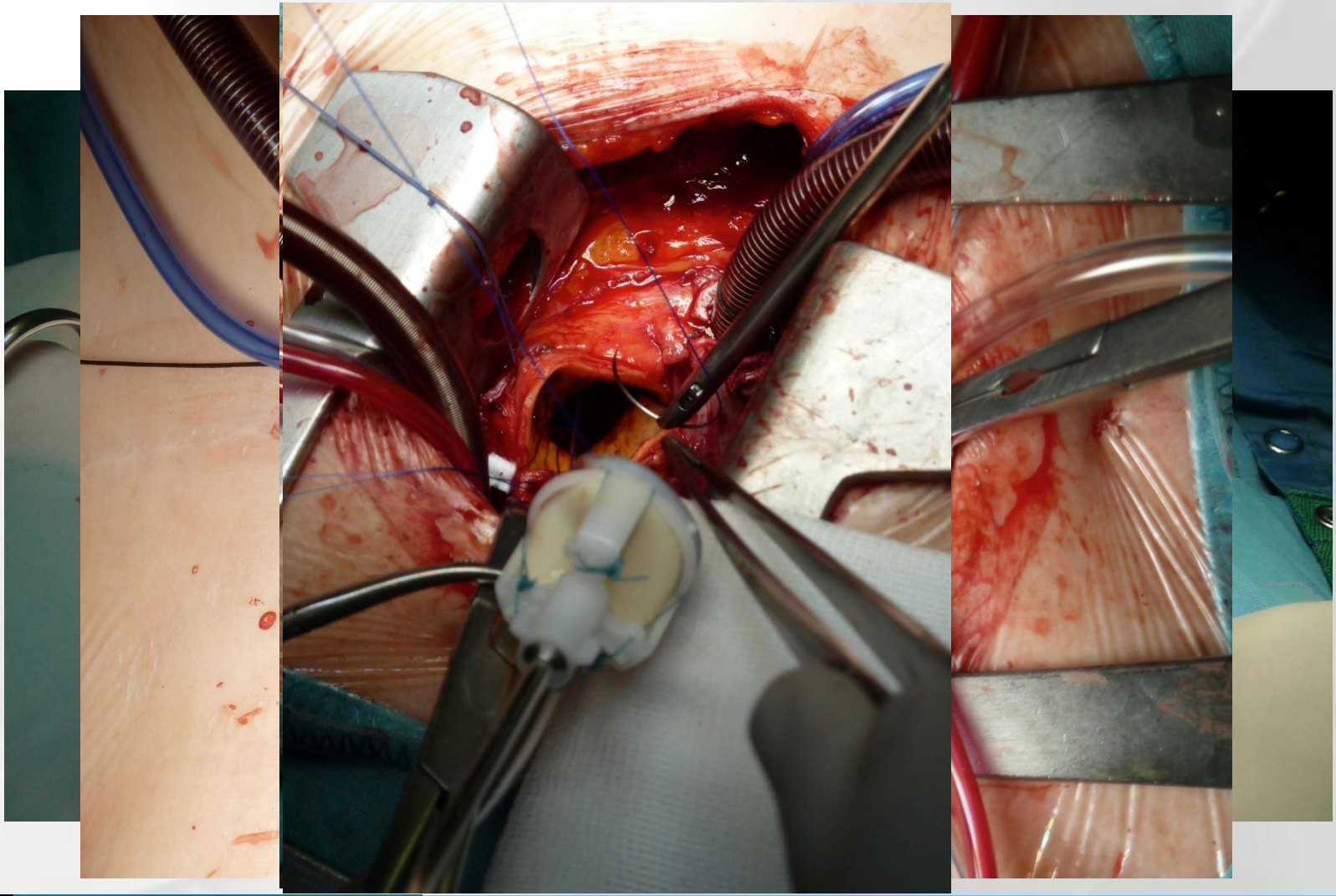
E AREA
MA

EUROPEAN MARKET TRENDS



MINI-STERNOTOMY AORTIC VALVE REOPERATION

AORTIC VALVE REOPERATION



Redo:
UPPER "J" MINI- vs FULL-STERNOTOMY

Upper 'J' Ministernotomy versus Full Sternotomy: An Easier Approach for Aortic Valve Reoperation

Elisa Mikus, Simone Calvi, Alberto Tripodi, Mauro Lamarra, Mauro Del Giglio

Department of Cardiothoracic and Vascular Surgery, Maria Cecilia Hospital, GVM for Care & Research, ES Health Science Foundation, Cotignola (RA), Italy

The Journal of Heart Valve Disease 2013;22:295-300

Table II: Operative results and early outcome.

Variable	Mini-sternotomy (n = 38)	Full sternotomy (n = 52)	p-value
CPB time (min)+	67.00 (28)	72.00 (47)	0.686
Cross-clamp time (min)+	51.00 (28)	53.50 (28)	0.993
IABP#	0 (0)	1 (1.9)	-
Mechanical ventilation (h)+	6.00 (5)	8.50 (11)	0.027
ICU time (h)+	48.00 (34)	46.25 (46)	0.364
Cerebrovascular accident#	1 (2.6)	1 (1.9)	0.822
Re-exploration for bleeding#	3 (7.9)	3 (5.8)	0.690
Postoperative dialysis#	2 (5.3)	4 (7.7)	0.690
Postoperative PM implantation#	4 (10.5)	5 (9.6)	0.887
RBC units+	2.00 (4)	3.50 (5)	0.485
Platelet units and FFP units+	0.00 (0)	0.00 (0)	0.737
Hospital mortality#	1 (2.6)	3 (5.8)	0.476

+Values are median (interquartile range).
#Values in parentheses are percentages.
CPB: Cardiopulmonary bypass; FFP: Fresh-frozen plasma; IABP: Intra-aortic balloon pump; ICU: Intensive care unit; PM: Pacemaker; RBC: Red blood cell.

AORTIC VALVE REOPERATION

Our experience at Maria Cecilia Hospital 06/2007 - 4/2014

Table 1 . Single center experience

Characteristics	Patient Population (N=52)
Age (yr)	
Mean ± SD	70.7 ± 12.5
Median (min - max)	75.5 (30 – 84)
Male sex (%)	30 (57.7)
Body-mass Index	
Mean ± SD	25.9 ± 4.6
Median (min - max)	25.2 (17.5 – 36.7)
Chronic lung disease (%)	9 (17.3)
Renal Failure (%) (creat. >2mg/dl)	6 (11.5)
Active Endocarditis	2 (3.8)
EuroSCORE (%) ♦	
Mean ± SD	10.8 ± 3.2
Median (min - max)	11 (5 – 22)
Previous CABG (%)	30 (57.7)
CPB time (min) ♣	
Mean ± SD	72.7 ± 25.5
Median (min - max)	65.5 (38 – 144)
Cross-clamp time (min)	
Mean ± SD	56.4 ± 22.7
Median (min - max)	49.0 (31 - 130)
Ventilation time (h)	
Mean ± SD	23.9 ± 62.6
Median (min - max)	7 (3 - 408)
ICU stay (h) ♠	
Mean ± SD	84.5 ± 103.6
Median (min - max)	48 (20 – 595)
Postoperative myocardial infarction (%)	0 (0)
Discharged alive (%)	51 (98.1)

Article in press…

MINI-STERNOTOMY
AORTIC ROOT SURGERY

AORTIC ROOT MINI-STERNOTOMY

State-of-the-art - Cardiac general

Ministernotomy approach for surgery of the aortic root and ascending aorta

Sossio Perrotta[a,*], Salvatore Lentini[b]

[a]Department of Cardiothoracic Surgery, Sahlgrenska University Hospital, 413 45, Gothenburg, Sweden
[b]Department of Cardiac Surgery, University Hospital 'G Martino', Messina, Italy

Received 30 March 2009; received in revised form 30 June 2009; accepted 15 July 2009

Interactive CardioVascular and Thoracic Surgery 9 (2009) 849-858

1141 Medline articles
186 Cochrane articles
514 CINAHL database articles

50 articles with the following cases:
*Tabata: 79
*Byrne: 44
*Perrotta: 40 (Bentall)
*Sun: 16
*Svensson: 69 + 54

- Surgery of the aortic root via mini-sternotomy is SAFE, however there are not enough studies comparing minimally invasive access and conventional sternotomy
- Few reports in literature on ROOT REMODELING or REIMPLANTATION through mini-sternotomy

AORTIC ROOT MINI-STERNOTOMY

Our experience at Maria Cecilia Hospital 2010 - 2014

AORTIC ROOT REIMPLANTATION (DAVID I)
via MINI-STERNOTOMY

CONCLUSIONS

- In our experience the advantages of MIC approach include early mobilization and rehabilitation, excellent aesthetic result and lower risk of wound complications

- Cardiopulmonary bypass, aortic cross-clamp and skin-to-skin time were comparable to those operated with a standard full sternotomy approach at our department.

CONCLUSIONS

- The **total central cannulation** can be easily performed:
  - better venous drainage
  - usual set up
  - without increasing the surgical time
  - avoiding groin incisions

- Our data confirms that MIC is a safe alternative for patients requiring isolated aortic valve replacement or aortic root surgery

IN THE USUAL WAY…