



MINIMALLY INVASIVE AORTIC VALVE REPLACEMENT SURGARY VIA RIGHT ANTERIOR THORACOTOMY: OUR EXPERIENCES AND MANAGING CASES WITH UNFAVOURABLE ANATOMY

Nguyen Minh Ngoc M.D.
Centre of Cardiovascular Surgery
Hanoi Heart Hospital




INTRODUCTION

Hanoi Heart Hospital

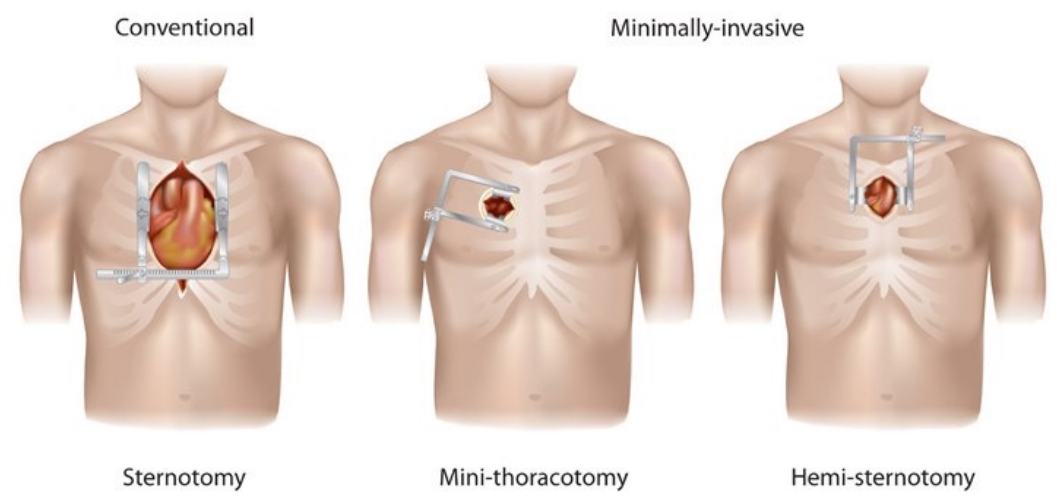
- One of the biggest cardiology center in Northern Vietnam
- About 2000 cases of open-heart surgery annually : Both congenital and acquired heart disease
 - 800 – 900 cases of valve surgery
 - 400 – 500 cases of Mini-invasive Valve surgery





Aortic valve replacement surgery

- Conventional sternotomy
- Upper hemisternotomy
- Right anterior thoracotomy (RAT)



STERNOTOMY APPROACH

- Full sternotomy or upper hemisternotomy
- Bleeding risk
- Sternal infection
- High-risk patient: elderly, diabetes,...



Mini AVR vs Sternotomy

- Less pain
- Reduce bleeding
- Reduce sternal infection risk
- Shorter ICU time, hospital stay time

Right anterior minithoracotomy versus conventional aortic valve replacement: A propensity score matched study

Mattia Glauber, MD, Antonio Miceli, MD, PhD, Daniyar Gilmanov, MD, Matteo Ferrarini, MD, Stefano Bevilacqua, MD, Pier A. Farneti, MD, and Marco Solinas, MD

TABLE 3. Postoperative outcomes

Outcome	RT (n = 138)	FS (n = 138)	P value
Mortality (n)	1 (0.7)	1 (0.7)	1
Stroke (n)	1 (0.7)	2 (1.5)	1
Reexploration for bleeding (n)	9 (6.5)	6 (4.3)	.6
New-onset postoperative AF (n)	25 (18.1)	41 (27.9)	.03
Blood transfusions (n)	26 (18.8)	47 (34.1)	.006
Wound infection (n)	0	1 (0.7)	1
Ventilation time (h)			.004
Median	6	8	
Range	5–9	6–11	
Hospital stay (d)			.02
Median	5	6	
Range	4–6	5–7	





Mini AVR vs Sternotomy

- Less pain
- Reduce bleeding
- Reduce sternal infection risk
- Shorter ICU time, hospital stay time

Minimally Invasive Aortic Valve Replacement Provides Equivalent Outcomes at Reduced Cost Compared to Conventional Aortic Valve Replacement: A “Realworld” Multi-institutional Analysis

Ravi K. Ghanta, MD¹, Damien J. Lapar, MD, MSc¹, John A. Kern, MD¹, Irving L. Kron, MD¹, Allen M. Speir, MD², Edwin Fonner Jr., DrPH³, Mohammed Quader, MD⁴, and Gorav Ailawadi, MD¹

Conclusions—Mortality and morbidity outcomes of mini-AVR are equivalent to conventional AVR. Mini-AVR is associated with **decreased ventilator time, blood product utilization, early discharge, and reduced total hospital cost**. In contemporary clinical practice, mini-AVR is safe and cost-effective.



- 
- 
- RAT approach: lower postoperative morbidities, shorter hospital stay comparing to ministernotomy

Minimally invasive aortic valve replacement using right minithoracotomy is associated with better outcomes than ministernotomy

Antonio Miceli, MD, PhD, Michele Murzi, MD, Danyiar Gilmanov, MD, Raffaele Fugà, MD, Matteo Ferrarini, MD, Marco Solinas, MD, and Mattia Glauber, MD

Conclusions: Minimally invasive AVR using RT was associated with lower postoperative morbidities and a shorter hospital stay than MS. (J Thorac Cardiovasc Surg 2013; ■:1-5)





Preoperative assessment

- Limited access to special instruments: Cygnet clamp, Rib retractor
- Sutureless valve and Cor-knot elevated the cost
-





Preoperative assessment

- High risk or low risk patient ?
- Echocardiography
- CT-Scanner of the Aorta
- Valve selection





Preoperative CT scanner of the aorta

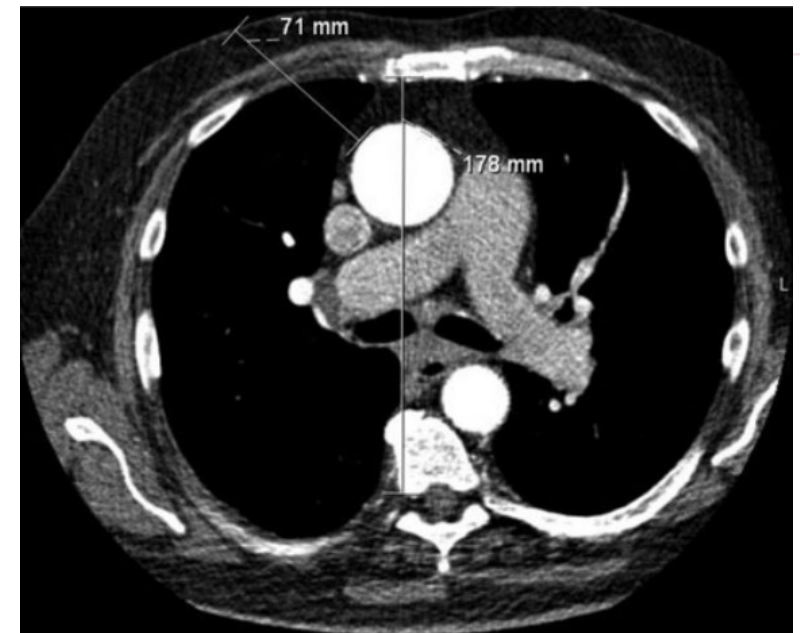
- Position of the ascending aorta and aortic valve, relating to sternum and chest wall
- Right-side or left-side aorta ?
- Annulus size, LVOT size
- Peripheral artery disease



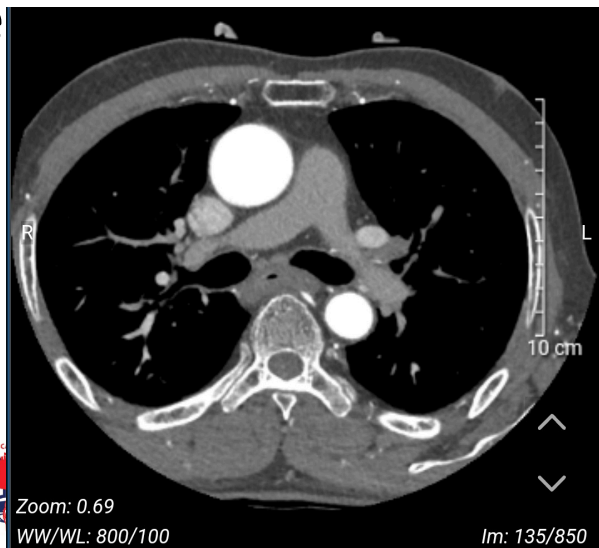
Favourable anatomy:

- Right-side aorta
- Valve and aorta not too far from chest wall (thin patient)
- Not so much calcification of the valve (regurgitation valve)

=> The cases to begin with high successful rate



M. Glauber et al.



among the intercostal spaces, ascending aorta, and aortic valve. Patients were suitable for RT only if the following criteria were met: (1) at the level of main pulmonary artery, the ascending aorta was rightward (more than one half located on the right in respect to the right sternal border); and (2) the distance from the ascending aorta to the sternum did not exceed 10 cm.



Preoperative ct-Scanner

Unfavourable anatomy:

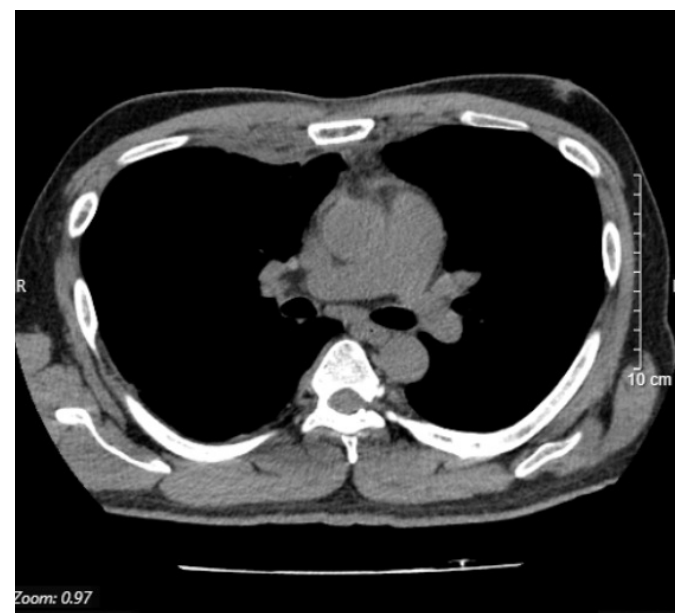
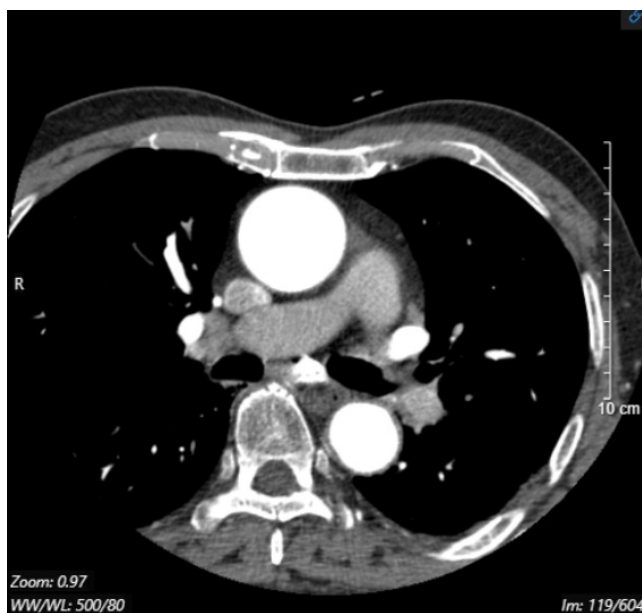
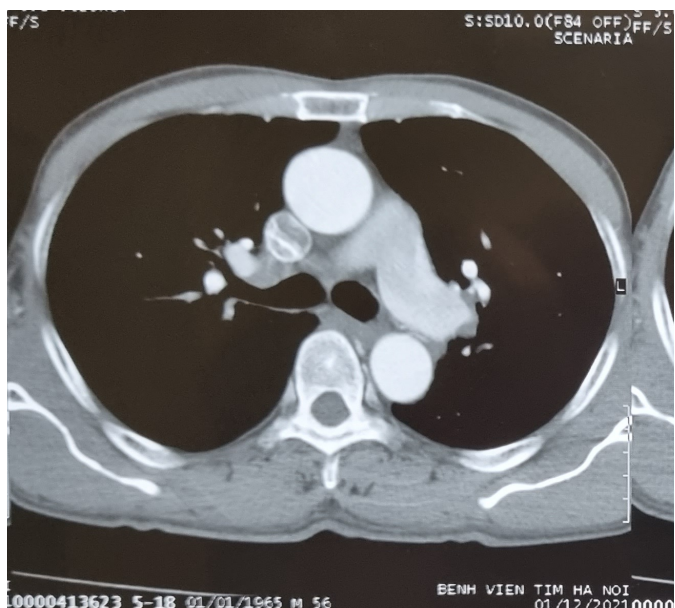
- Left-side aorta
- Valve too far from chest wall
- Heavy calcification of the valve
- Small annulus

=> More challenging cases



Left-side aorta

- Upper Hemi-sternotomy?
- Can be done via RAT

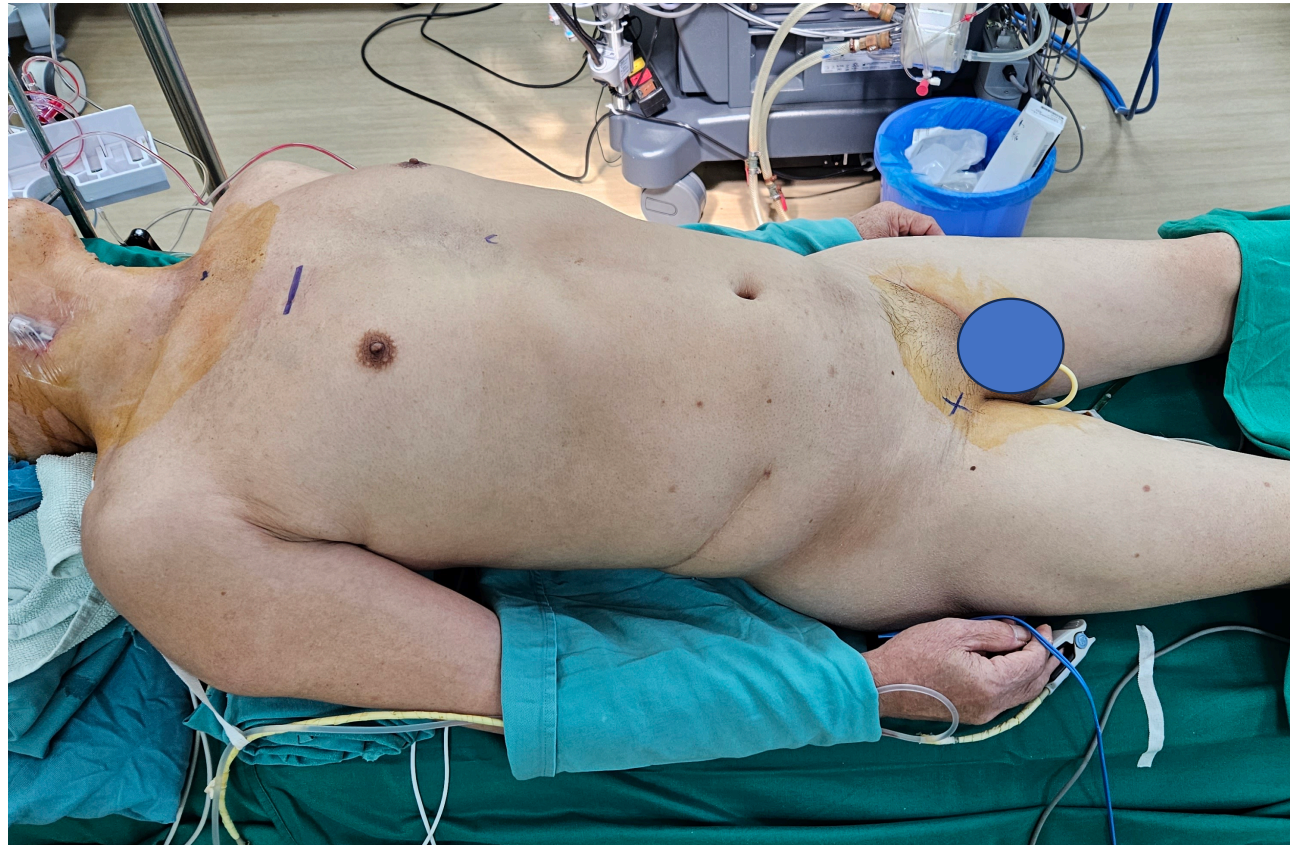


Patient positioning

Supine position

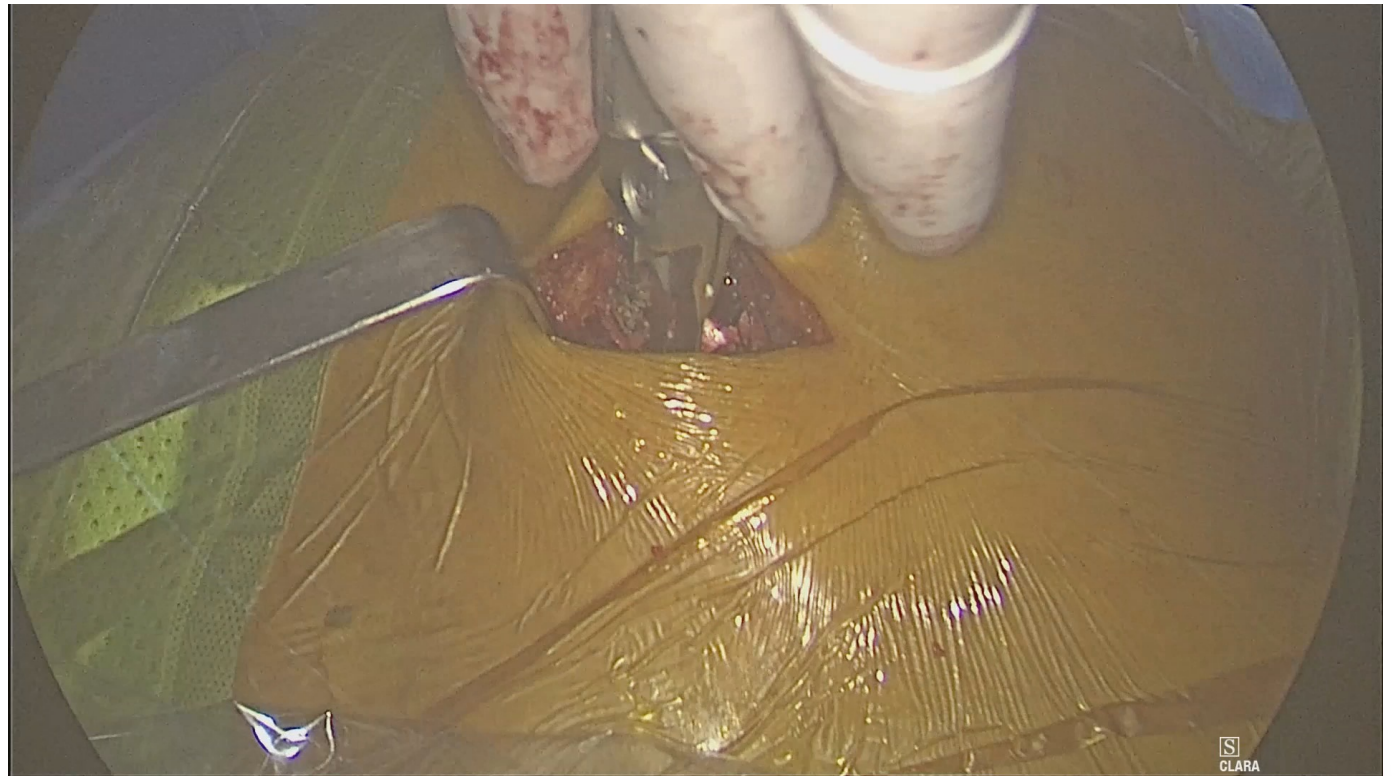
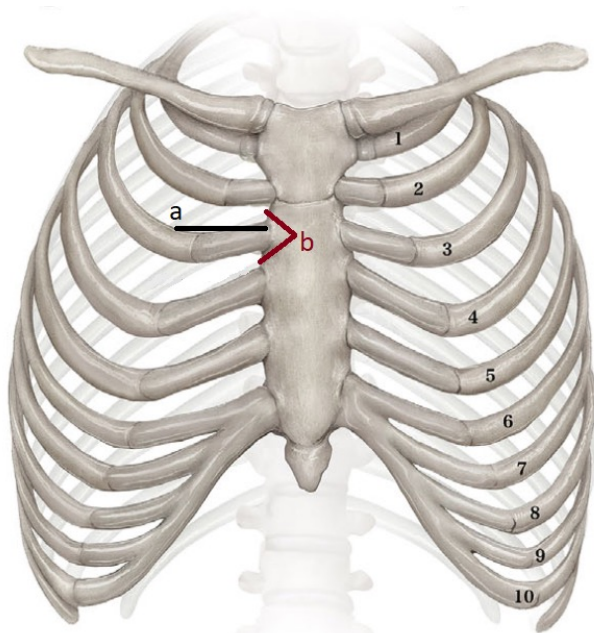
Pillow below shoulder

Defibrillator electrodes



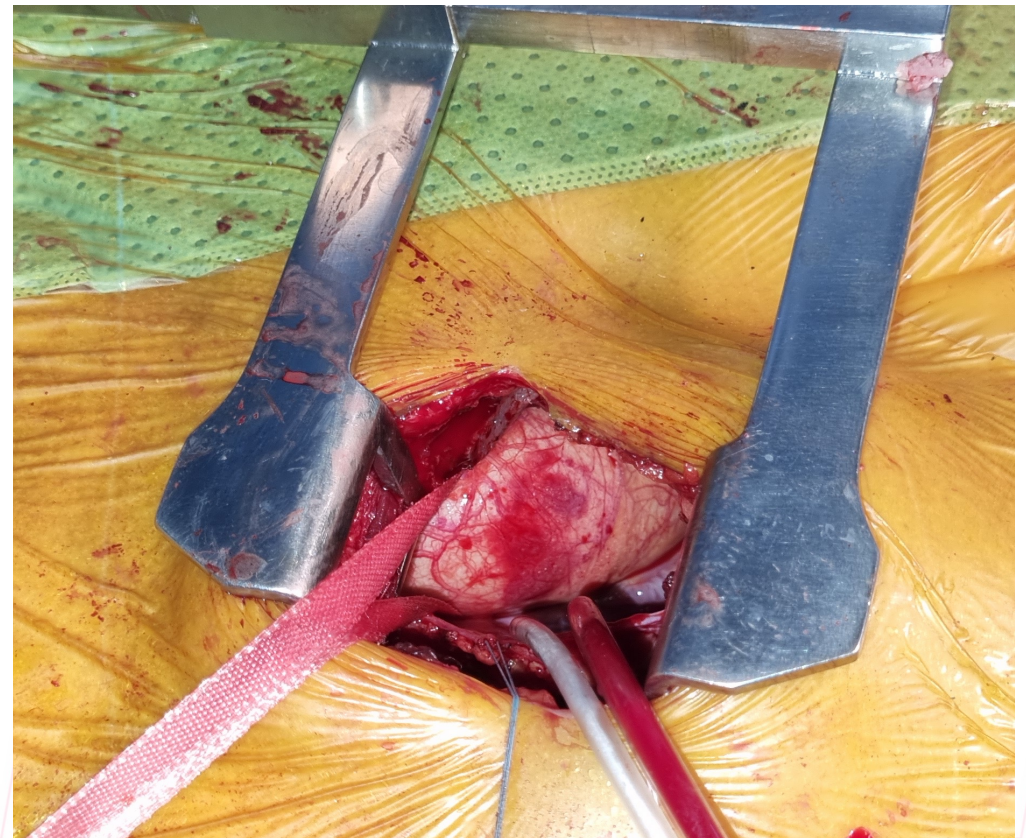
OUR MODIFICATIONS

- Make skin incision in second intercostal space
- Third rib is separated from sternum with an arrow-shaped cut (using saw) instead of cartilage dislocation

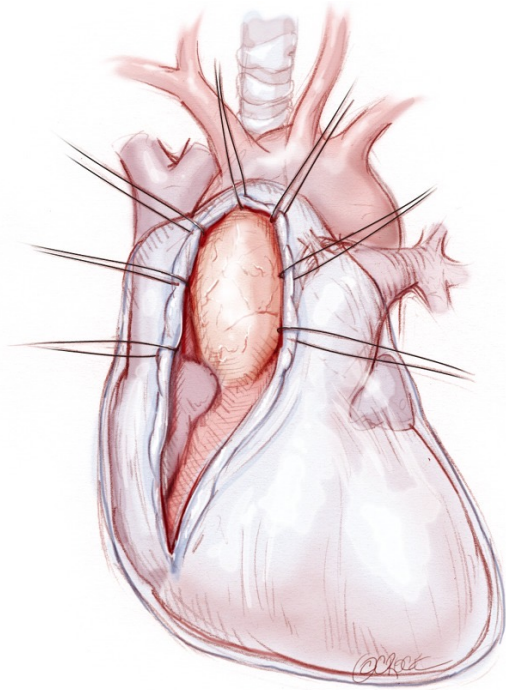


OUR MODIFICATIONS

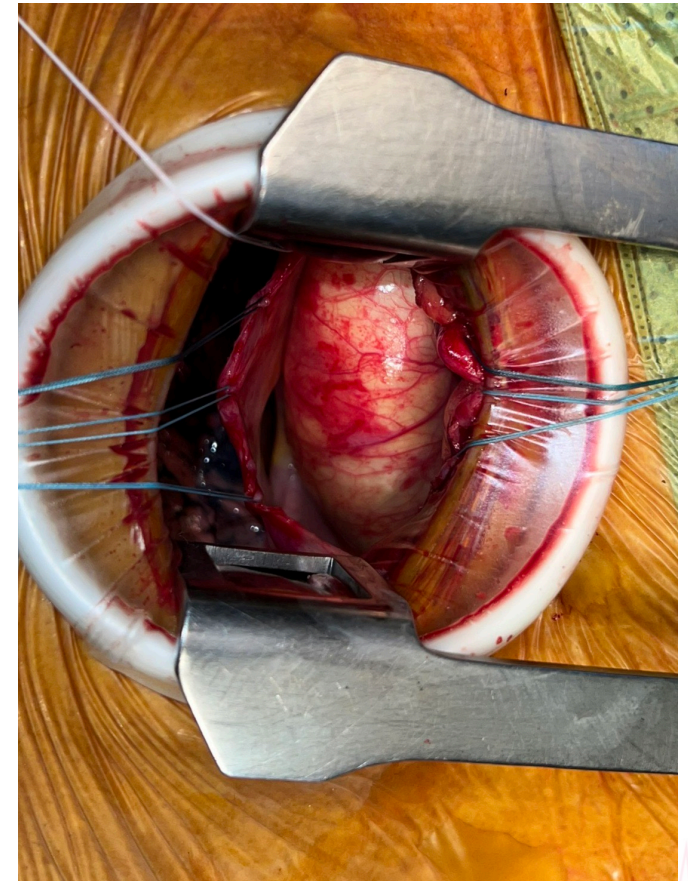
- Gain more surgical field towards the left
- Better exposure of left-side aorta
- Better vision => easier technique



- Stay suture placement: pull the aorta towards surgeon

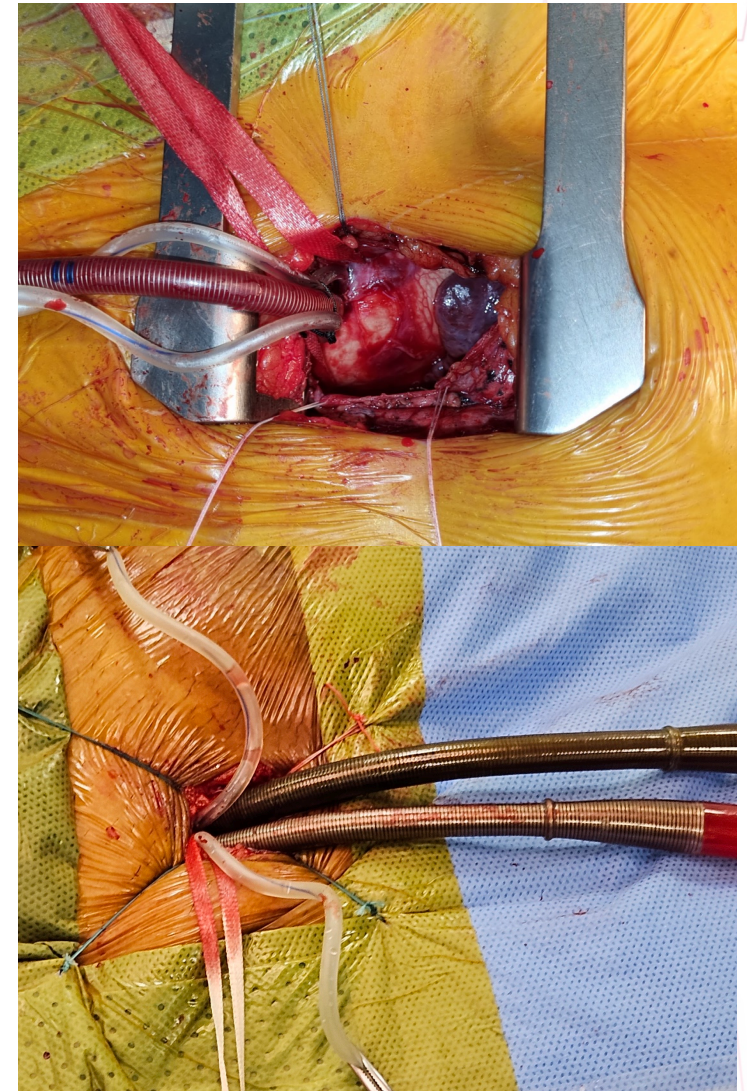


Lamelas J. et al.



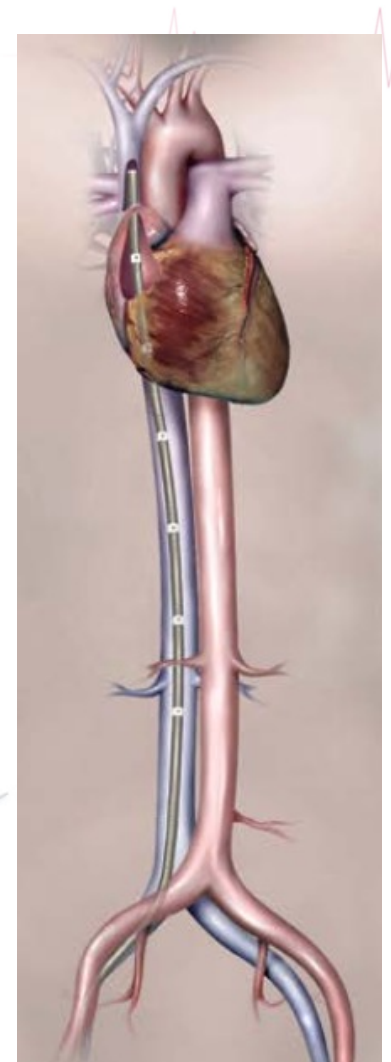
CARDIOPULMONARY BYPASS SETUP

- Peripheral arterial cannulation is more favorable
- Not all patient are suitable
- => Flexible setup depends on patient's condition
- Ascending aorta cannulation
 - Elderly patients
 - Peripheral artery atherosclerosis
 - Reduces risk of retrograde blood flow
 - Not really affects surgical field



CARDIOPULMONARY BYPASS SETUP

- Venous cannulation: two-stages cannula through the femoral vein, Seldinger technique
- TEE assistance, or direct touch
- Cannula with a lot of side holes: better decompressing of RV.
- Biggest size possible:
 - BSA<1.6 : size 23
 - BSA>1.6 : Size 25

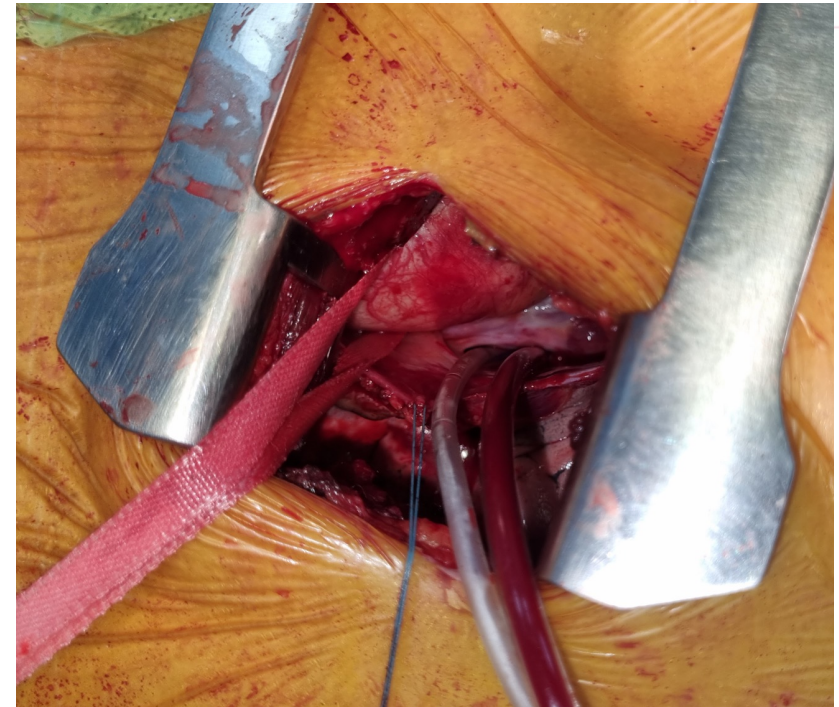




CARDIOPULMONARY BYPASS SETUP

Left heart venting placement:

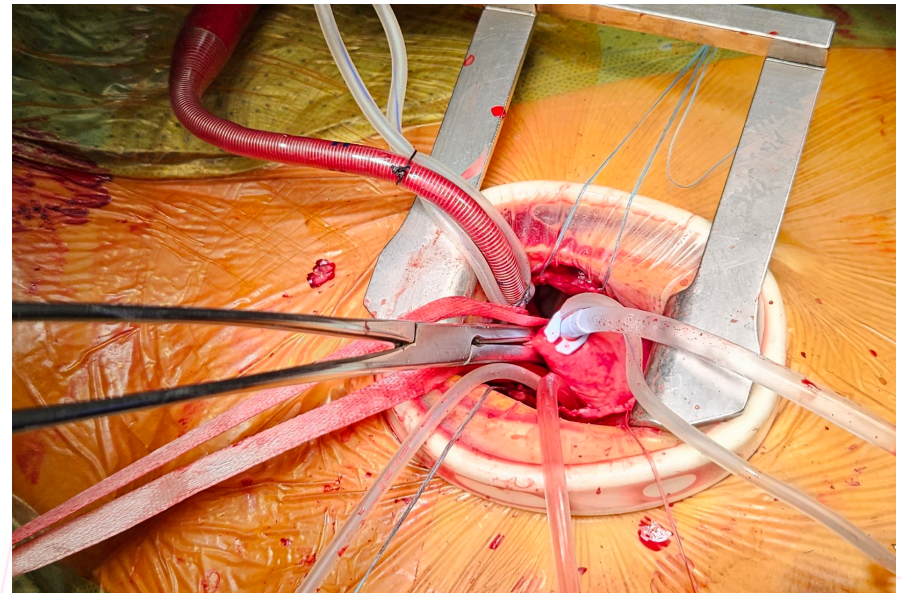
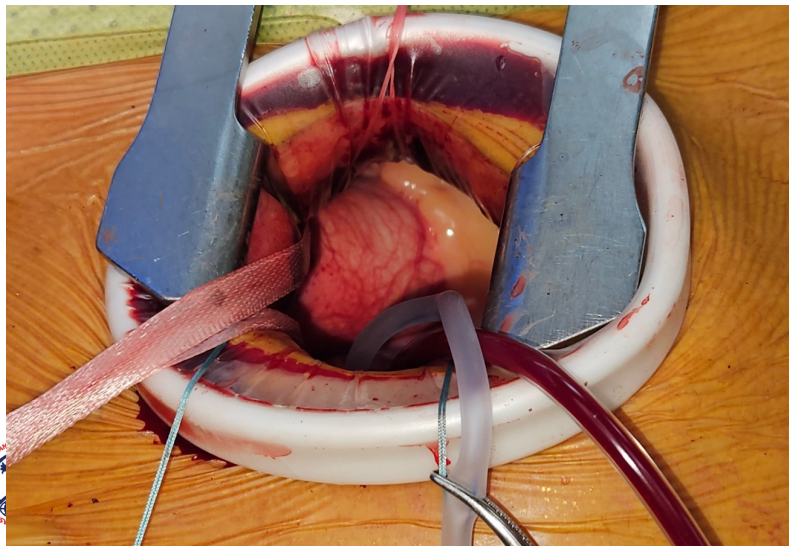
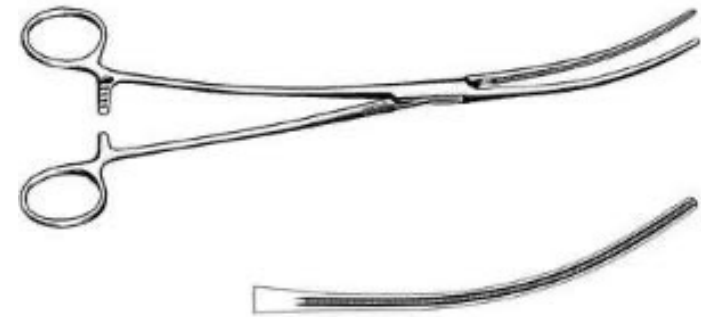
- If possible, a suction catheter should be placed through mitral valve for better venting, cleaner vision*



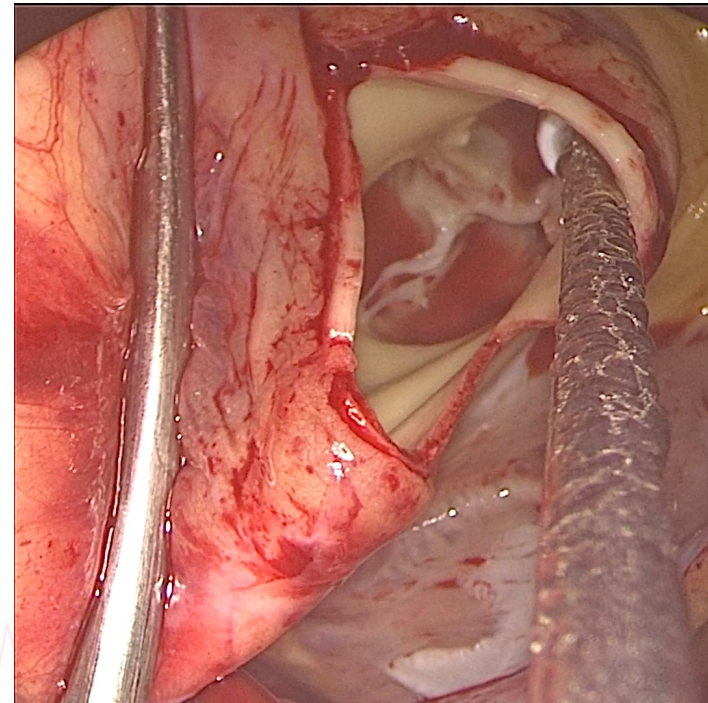
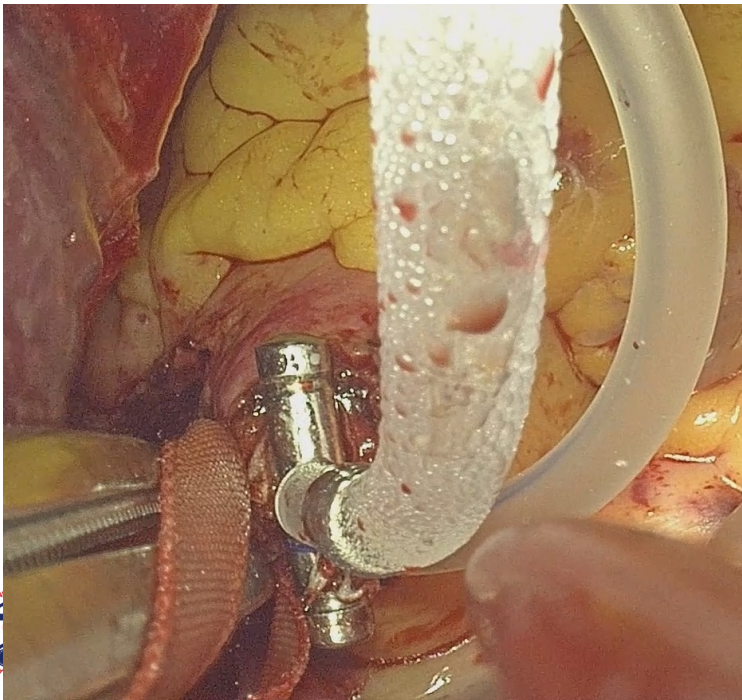


Aortic clamp selection

- *Ordinary De Bakey clamp*
- *Aorta loop placement: better mobilizing, more secure clamping*

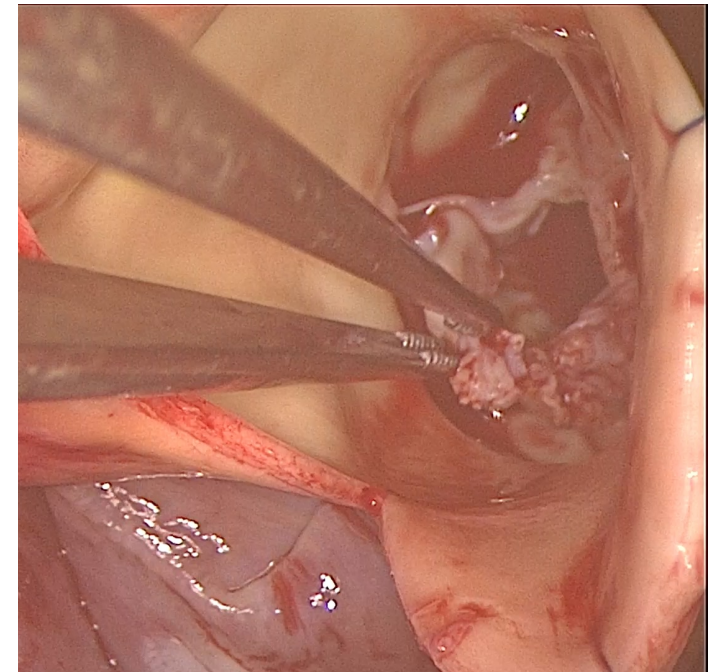
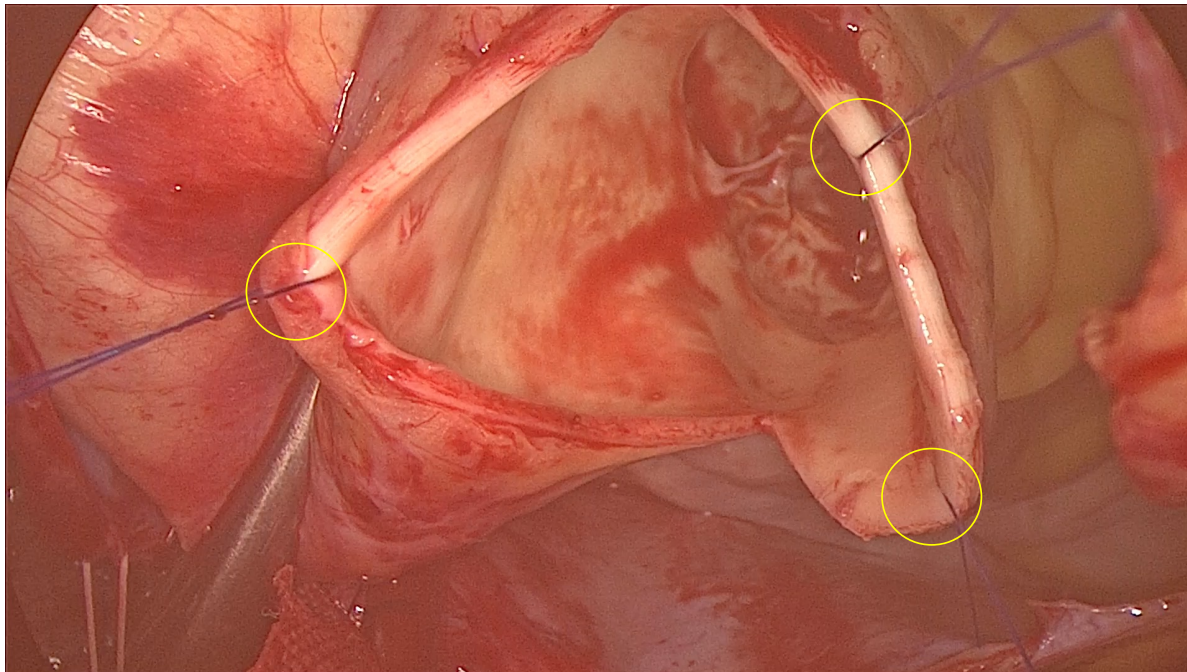


- *Myocardial protection*
- *Crystalloid solution (Custodiol)*
- *No AV regurgitation: Aortic root needle*
- *AV regurgitation: directly into coronary ostia*



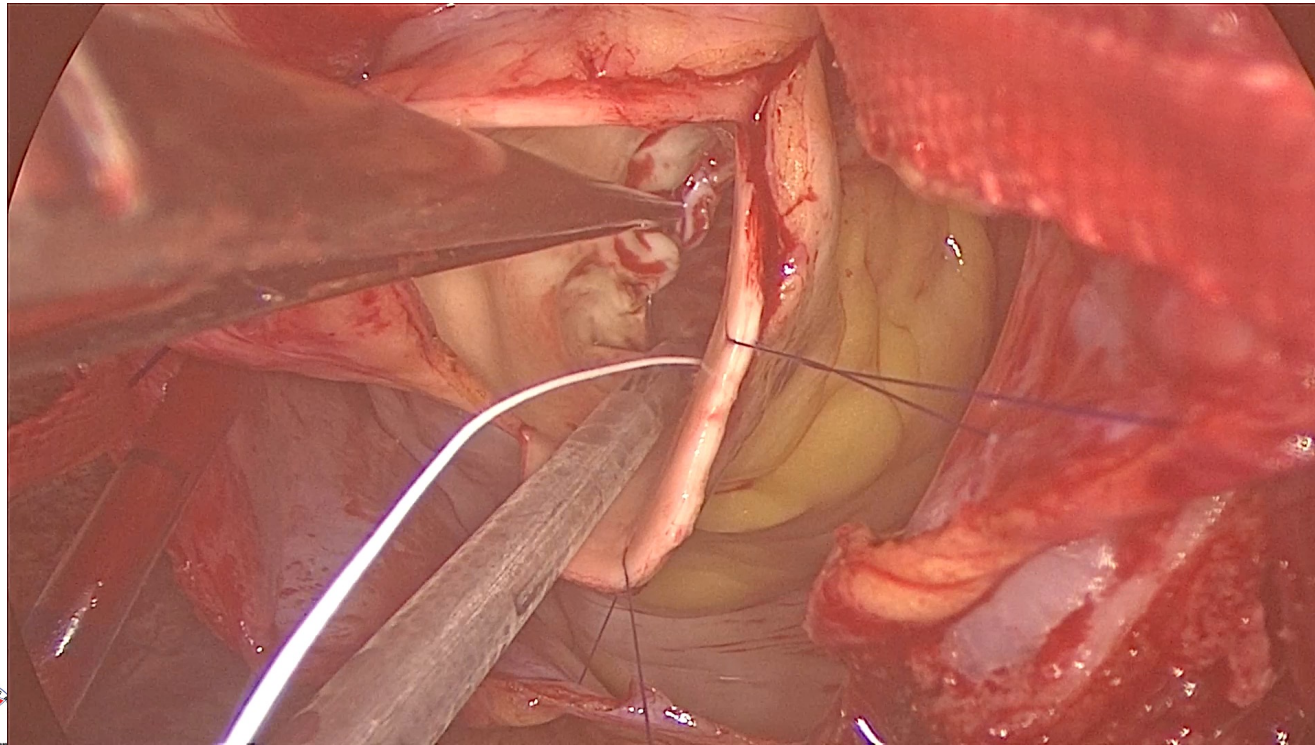
Aortic valve exposure

- *Horizontal incision*
- *Three retracting suture*



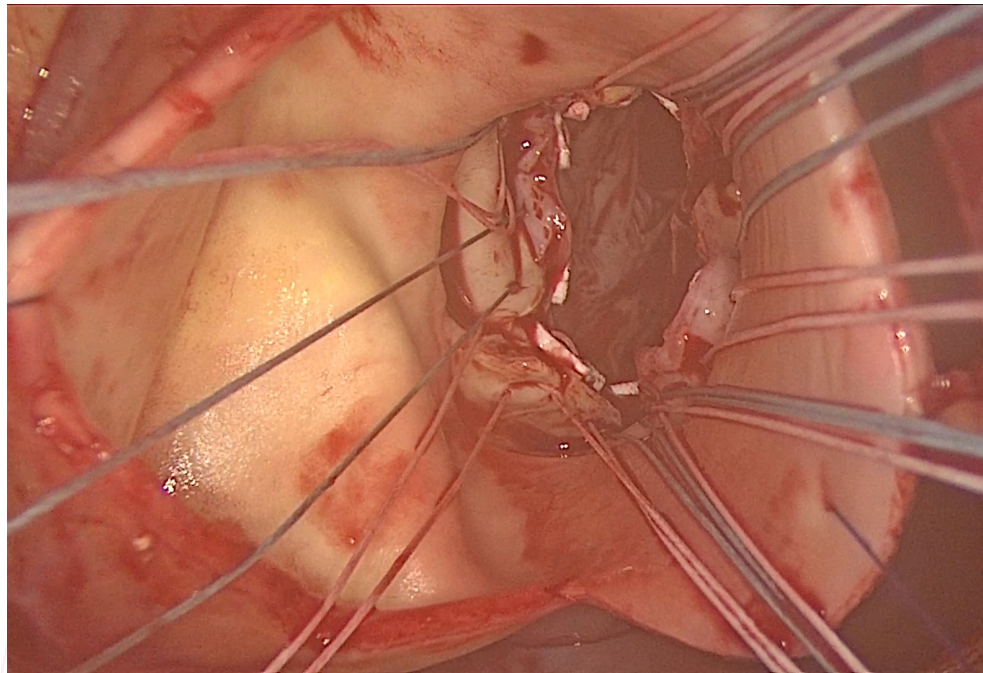
Suture placement

- *Everting or non-everting*
- *Start from NCC-LCC commissure, clockwise order*
- *The previous suture placing helps exposure the valve annulus for the next one*

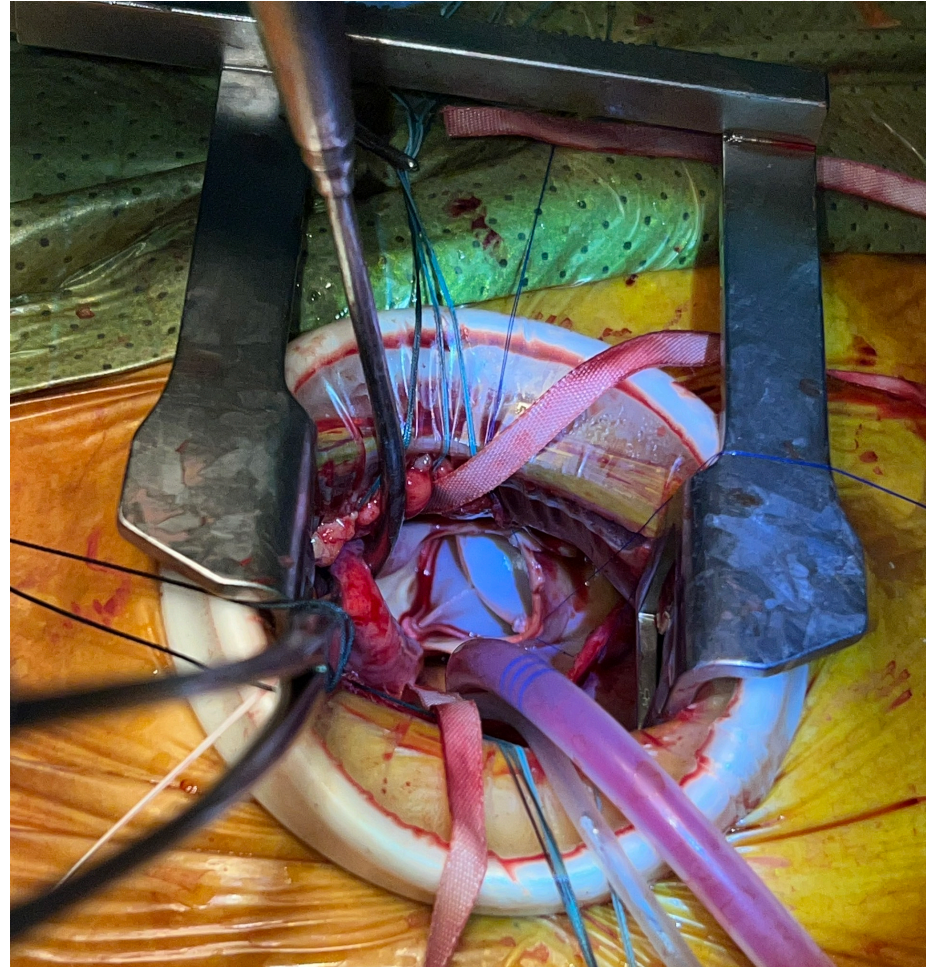
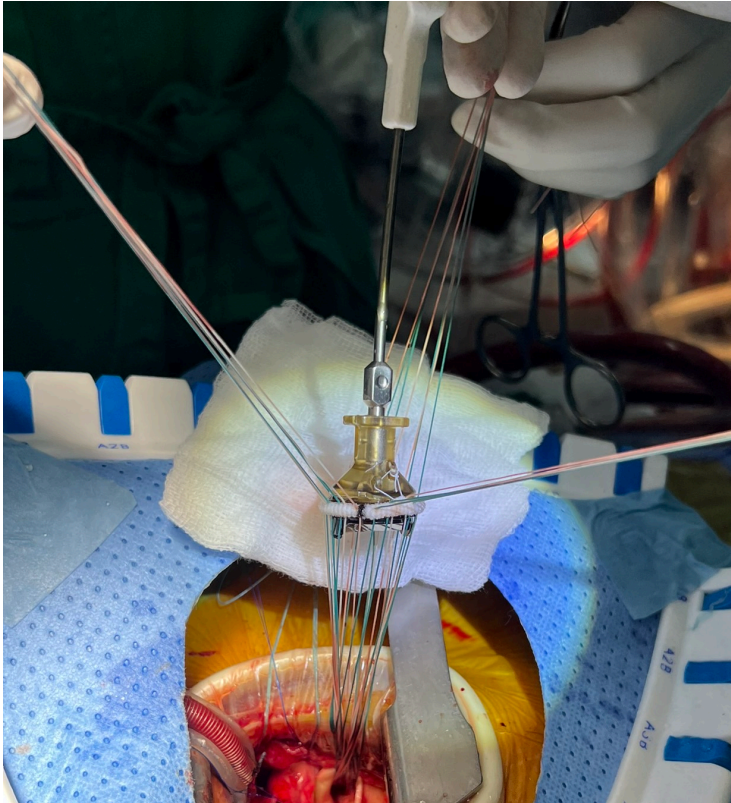


Suture placement

- *Everting or non-everting*
- *Start from NCC-LCC commissure, clockwise order*
- *The previous suture placing helps exposure the valve annulus for the next one*

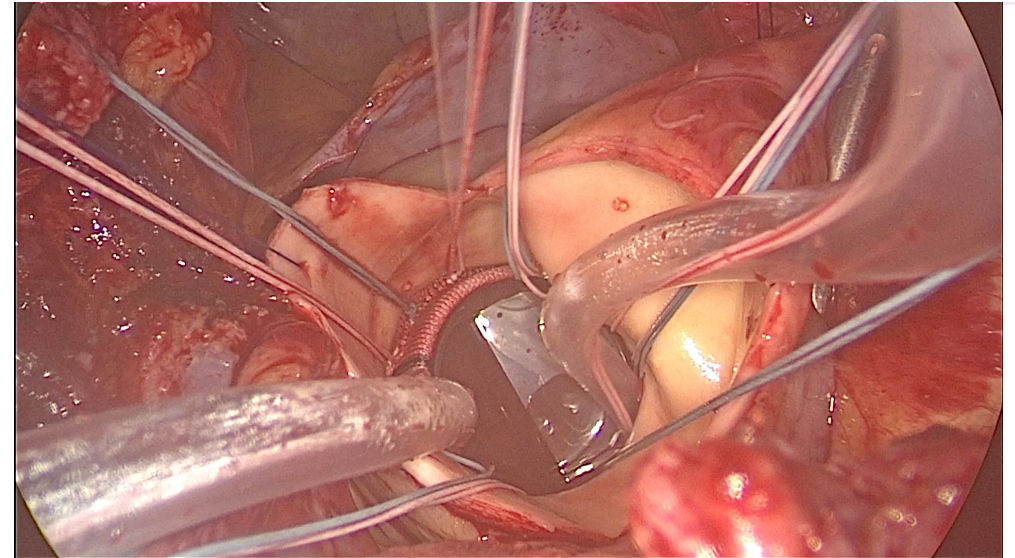


Valve insertion



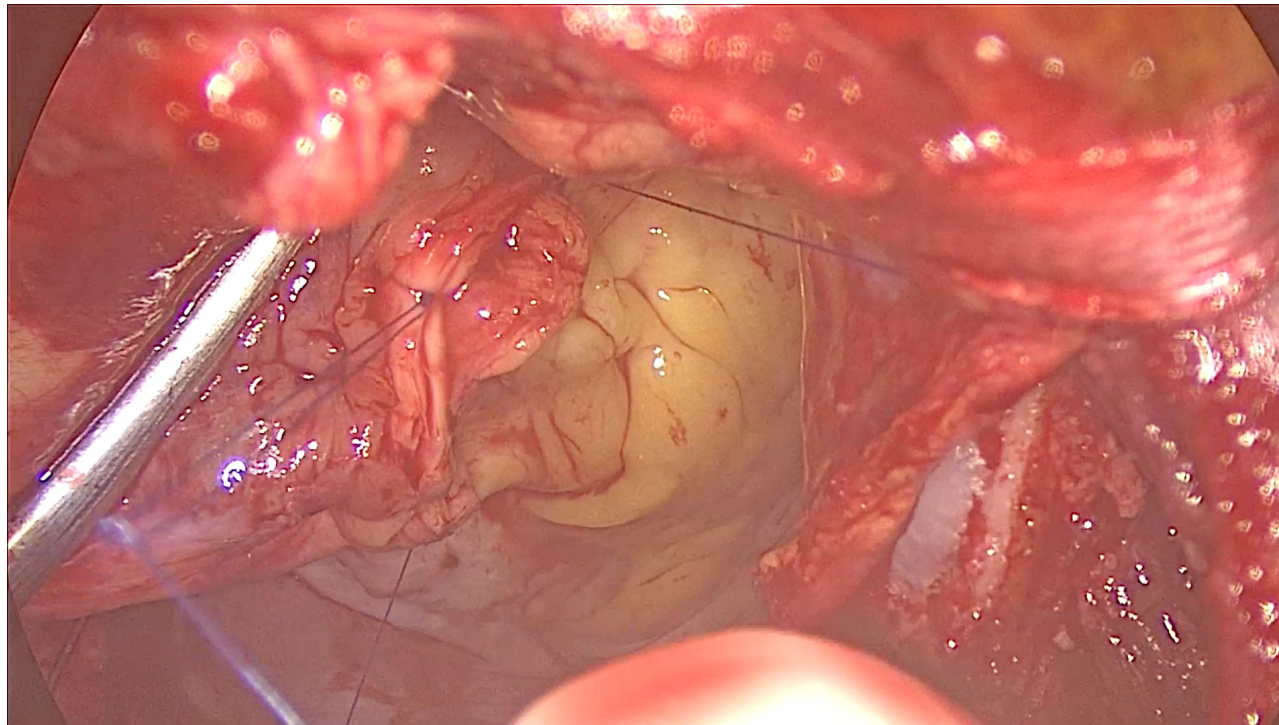
Knot tying

- *Hand tying should be applied whenever possible*
- *Knot pusher*
- *Cor-knot*




Aorta closure

- *Double-layer suture*
- *Thin aortic wall: Pericardial patch or Dacron patch reinforcement*





Some special scenario

- *Adhesion of the pericardial cavity*
 - *Small annulus which required an enlargement*
 - *Pectus excavatum*
- 



Cosmetic results





Our results

Since 2020: 137 cases

Mean ages	60.9 ± 11.53 (25-86)
Elderly patients (>75)	26.2% (36/137)
Peripheral arteries disease	20.4% (28/137)
Chronic kidney disease	2.1% (3/137)
COPD	5.8% (8/137)





Our results



Left-side aorta	30.6% (42/137)
Central cannulation	17.5% (24/137)
Conversion to sternotomy	0.7% (1/137)
Mean Ao Clamp time (min)	84.5 (64 – 142)
Mean CPB time (min)	117.7 (80 – 187)



Early complications

Reop due to bleeding <ul style="list-style-type: none">- Pleural cavity thrombosis due to chest wall bleeding- Aorta bleeding at the position of the aortic root needle- Bleeding in the posterior wall of the aorta, need to convert to sternotomy	2.1% (3/137)
Renal failure (need hemodialysis)	0.7% (1/137)
BAV (need permanent pacemaker)	1.4% (2/97)
In-hospital mortality	0%





CONCLUSIONS

- Aortic valve replacement via right anterior thoracotomy (2nd intercostal space) approach was safe and effective, even in high-risk patients, patients with unfavorable anatomy
- Various technique modification may be applied to improve surgical field, lower surgical time and risk
- Patient selection was important, anatomical challenging cases should be performed by experienced team





THANK YOU FOR YOUR ATTENTION !

