# Robotic valvular surgery

# From skepticism to standard of care

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# Disclosure

- I have no disclosure, except that I work for 3 surgeons.

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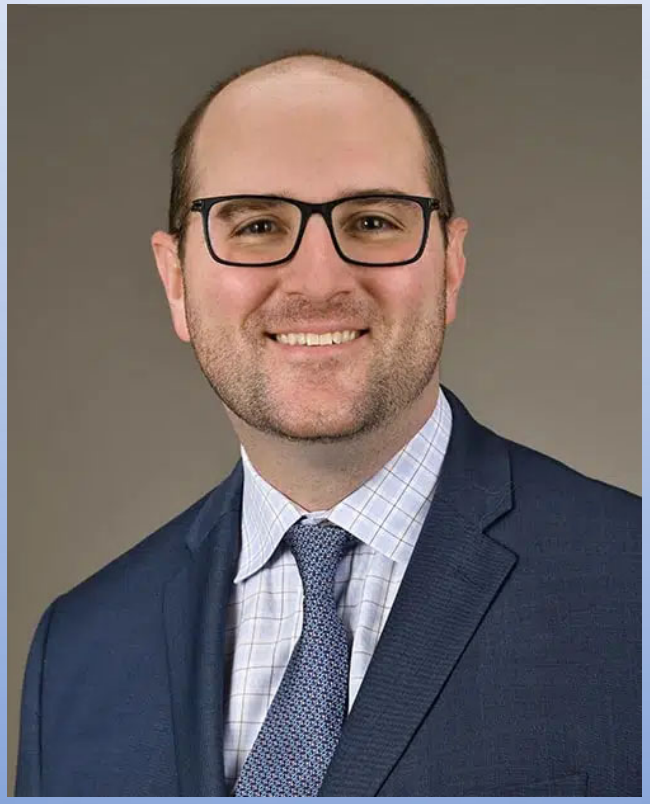


# Objectives

- INTRODUCTION TO ROBOTIC VALVULAR HEART SURGERY
- PRE OPERATIVE PLANNING
- EXPECTED OUTCOMES & POSSIBLE COMPLICATIONS
- WHAT WE NEED TO KNOW

# History of the robot….

*He who is fixed to a star does not change his mind…..Leonardo da Vinci*

# Why do Robotic Surgery?

CONS

- More expensive
- New platform – New risk
- Cumbersome for the staff, especially for the OR team

PROS

- Better visualization for the surgeon
- Better ergonomics
- Avoiding sternal incision
- Less post op discomfort
- Robotic surgery is the future


## Minimally invasive or sternotomy approach in mitral valve surgery: a propensity-matched comparison

Marek Pojar, Mikita Karalko, Martin Dergel & Jan Vojacek

*Journal of Cardiothoracic Surgery* **16**, Article number: 228 (2021) | Cite this article

- **Data from > 500 patients comparing mini invasive vs sternotomy**
  - **30 day mortality was similar**
  - **No difference were seen in the incidence of:**
    - **Stroke**
    - **Surgical site infection**
    - **Myocardial infarction**
- **Difference -> mini invasive approach fewer blood transfusions (59% vs 76% in the conventional group; p=0.001)**
- **Re-operative for bleeding (3% vs 9%; p= 0.03)**

- **Hospital cost?? Higher operative cost offset by lower post operative cost.**

# Table 3 Matched hospital costs (EUR)

From: Minimally invasive or sternotomy approach in mitral valve surgery: a propensity-matched comparison

| | Matched Patients | | |
|---|---|---|---|
| | MINI | STERNOTOMY | *p*-value |
| **Variable** | **n = 158** | **n = 225** | |
| Total hospital costs | 11,828 ± 6907 | 12,732 ± 99,936 | 0.48 |
| Operative costs | 5364 ± 1566 | 4778 ± 1920 | < **0.001** |
| Blood products costs | 210 (0–393) | 316 (109–545) | < **0.001** |
| Postoperative costs | 5054 (3993–6532) | 5905 (4611–8304) | **0.004** |

Hospital cost: Higher operative cost offset by lower post operative cost.

# Valvular heart disease

**Valvular heart disease prevalence by age**

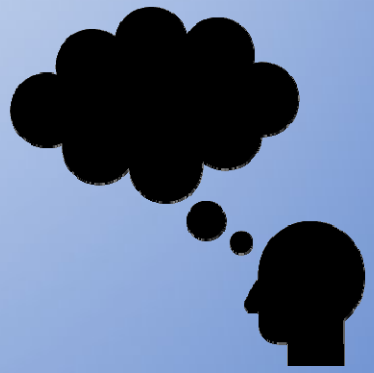
| | <45 years (%) | 45 to 54 years (%) | 55 to 64 years (%) | 65 to 74 years (%) | >75 years (%) |
|---|---|---|---|---|---|
| **AS** | 0.02 | 0.1 | 0.2 | 1.3 | 2.8 |
| **AR** | 0.2 | 0.1 | 0.7 | 1.0 | 2.0 |
| **MS** | 0.0 | 0.1 | 0.2 | 0.2 | 0.2 |
| **MR** | 0.5 | 0.1 | 1.0 | 6.4 | 9.3 |

AS: aortic stenosis; AR: aortic regurgitation; MS: mitral stenosis; MR: mitral regurgitation.

*Original figure modified for this publication. Nkomo VT, Gardin JM, Skelton TN, et al. Burden of valvular heart diseases: a population-based study. Lancet 2006; 368:1005. Table used with the permission of Elsevier Inc. All rights reserved.*



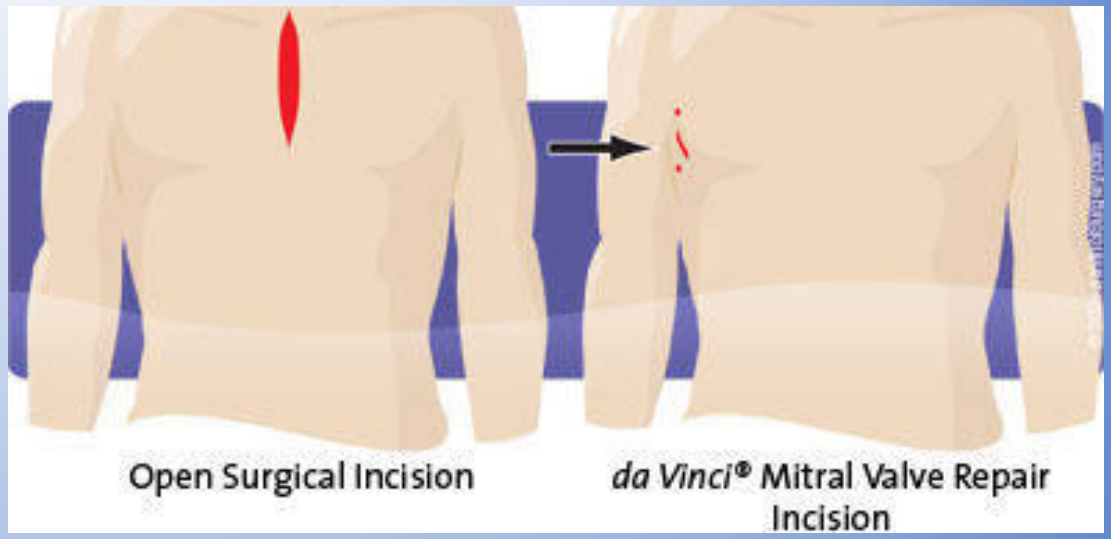
What about the patient(s) who do not qualify for transcatheter aortic valve replacement, mitral valve clip or balloon valvuloplasty



# Pre operative planning: Steps to success

## Goals

- Safety
- Address the pathology physiology without compromise
- Incision size and location



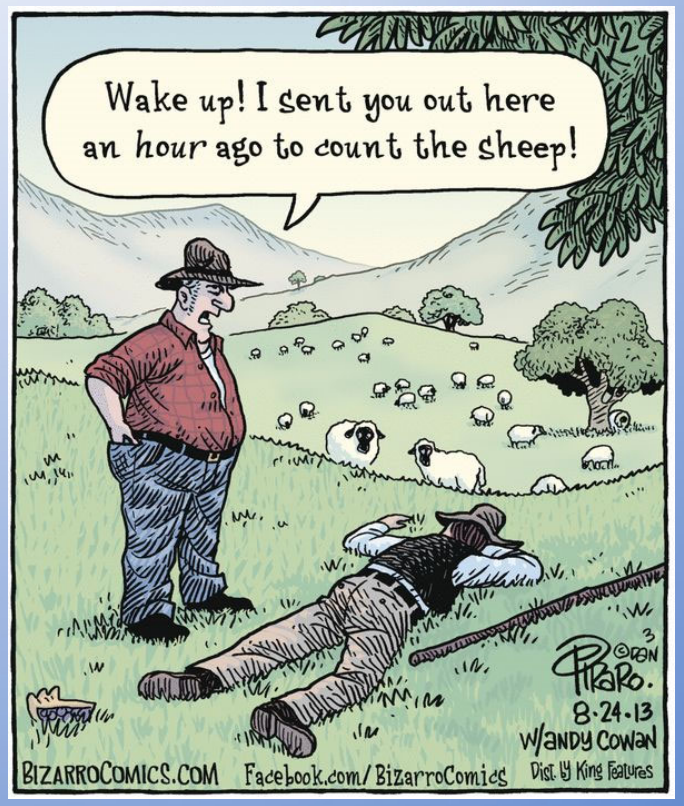
# Guiding Principles: Robotic Surgery

- **All patients CAN, though not all SHOULD**
- **Do the SAME operation**
- **Ensure a SAFE operation**
- **Leave with a SUCCESSFUL repair or replacement**

*******Patient selection is KEY*******

# Concomitant Procedures

- **Possible**
  - ASD/PFO
  - Ablation
  - Myxoma
- **Exclude (generally)**
  - CABG
  - Aorta surgery
  - REDO, prior thoracotomy



# Pre operative Studies

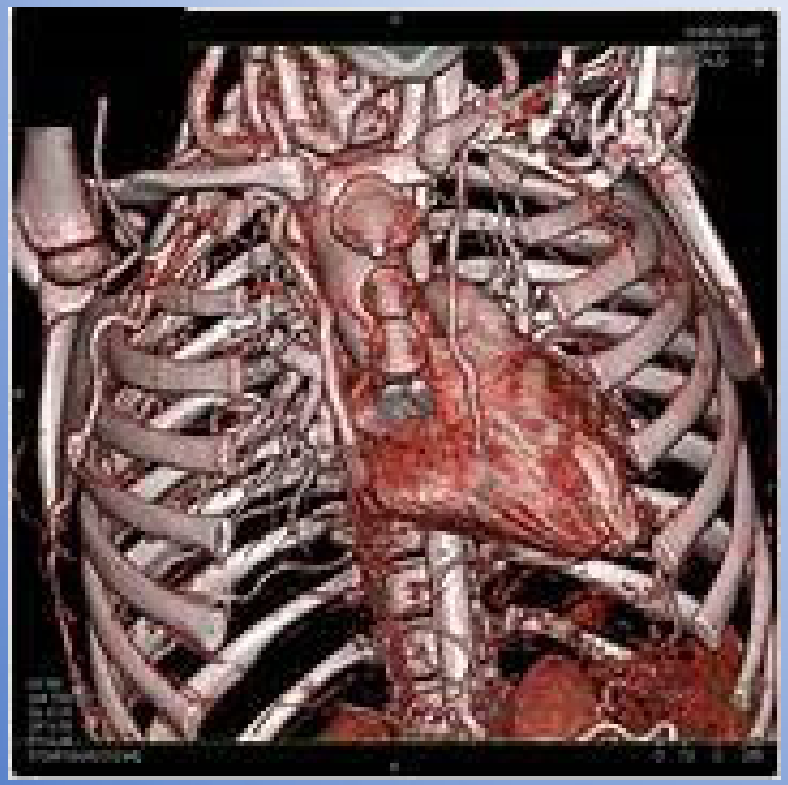
- **Is the patient symptomatic?**
- **Qualifying Echo (TTE or TEE)**
- **LHC vs CTA coronary**
- ***EVERYONE Gets CT Chest/abdomen/pelvis***
- **Free of infection (check labs, UA, good history and PE, check dentation)**

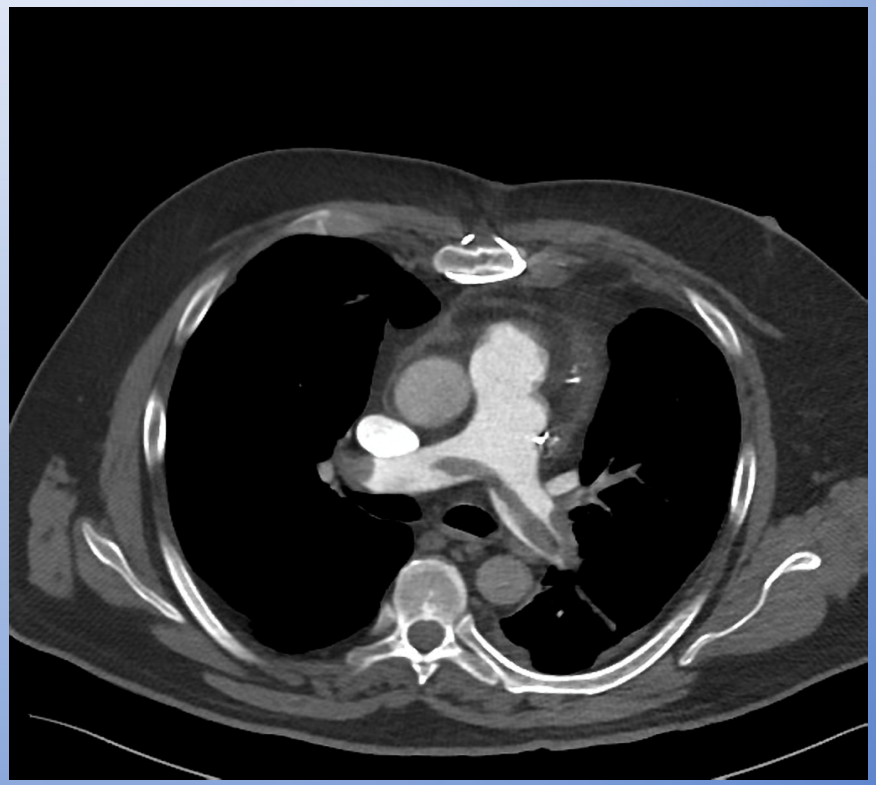
# CT Chest / Abdomen / Pelvis

- **Aortoiliac atherosclerosis** → Key trap to avoid
  - **Femoral perfusion is not safe**

**Axillary access?**

# Clean CT scan





# Less-Invasive Mitral Valve Operations: Trends and Outcomes From The Society of Thoracic Surgeons Adult Cardiac Surgery Database

James S. Gammie, MD, Yue Zhao, PhD, Eric D. Peterson, MD, MPH, Sean M. O'Brien, PhD, J. Scott Rankin, MD, and Bartley P. Griffith, MD

Division of Cardiac Surgery, University of Maryland Medical Center, Baltimore, Maryland; Duke Clinical Research Institute, Durham, North Carolina; and Centennial Medical Center, Vanderbilt University, Nashville, Tennessee

*Background.* The purpose of this study was to examine utilization and outcomes of less-invasive mitral valve (LIMV) operations in North America.

*Methods.* Between 2004 and 2008, 28,143 patients undergoing isolated mitral valve (MV) operations were identified in The Society of Thoracic Surgeons Adult Cardiac Surgical Database (STS ACSD). The LIMV operations were defined as those performed with femoral arterial and venous cannulation.

*Results.* The LIMV operations increased from 11.9% of MV operations in 2004 to 20.1% in 2008 ($p < 0.0001$). In 2008, 26% of STS ACSD centers performed at least one LIMV operation, with a median of 3 per year. Patients in the LIMV group were younger and had fewer comorbidities. Median perfusion (135 versus 108 minutes) and cross-clamp times (100 versus 80 minutes, $p < 0.0001$) were longer in the LIMV group. Mitral valve repair rates were higher in the LIMV group (85% versus 67%, $p < 0.0001$). Adjusted operative mortality was similar (odds ratio 1.13, 95% confidence interval: 0.84 to 1.51, $p = 0.47$). Blood transfusion was less common (odds ratio 0.86, 95% confidence interval: 0.76 to 0.97, $p < 0.0001$) while stroke was more common (OR 1.96, 95% confidence interval: 1.46 to 2.63, $p < 0.0001$) in the LIMV group.

*Conclusions.* In selected patients, LIMV operations can be performed with equivalent operative mortality, shorter hospital stay, fewer blood transfusions, and higher rates of MV repair than conventional sternotomy. However, perfusion and cross-clamp times were longer, and the risk of stroke was significantly higher. Beating- or fibrillating-heart LIMV techniques are associated with particularly high risks for perioperative stroke.

(Ann Thorac Surg 2010;90:1401–10)



Although the earliest open mitral valve operations

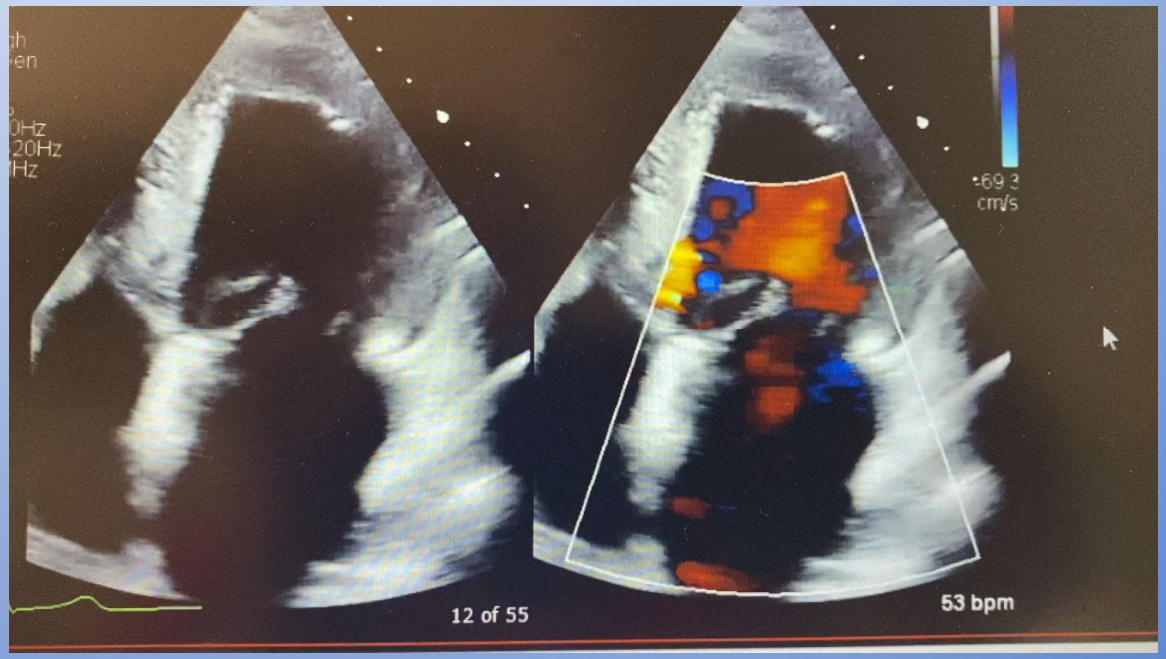
prefer a nonsternotomy approach, but outcomes have

# Atherosclerosis

76 YO Female with severe primary MR, wanted robotic mitral valve repair

Asymptomatic, no other major cardiac history

No obstructive CAD on cath



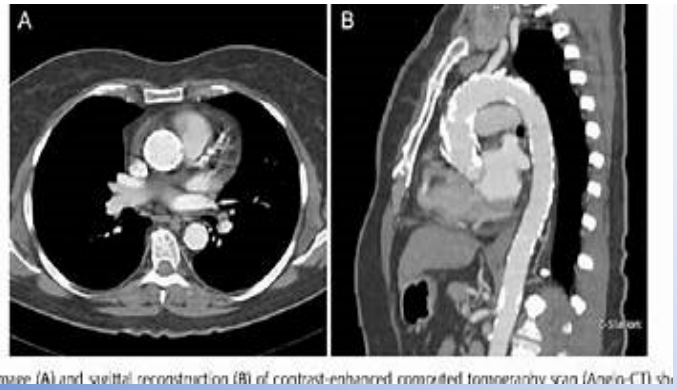
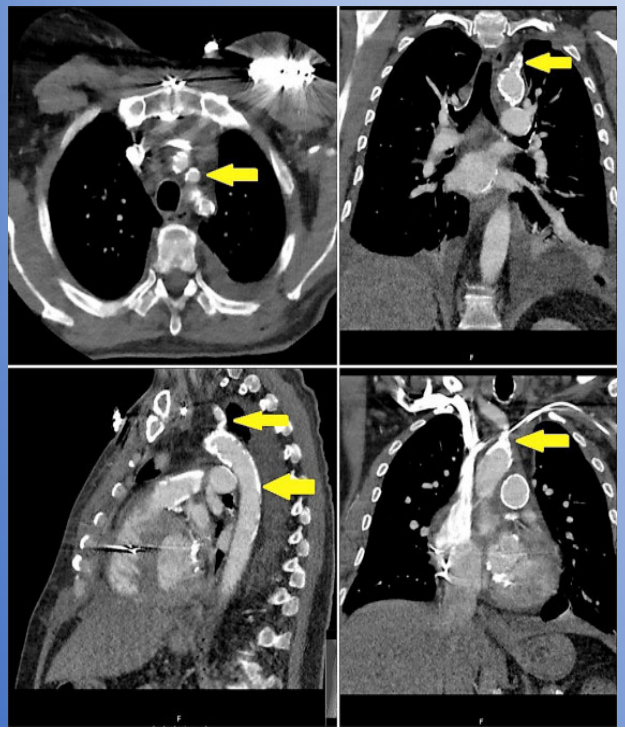
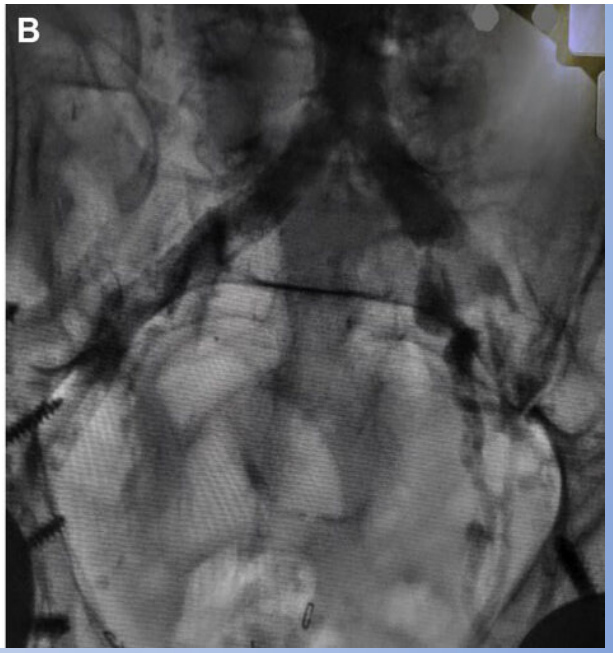



Image (A) and sagittal reconstruction (B) of contrast-enhanced computed tomography scan (Angio-CT) sh




# PERFECT ECHO, BUT……

# Contra-indications to Robotic surgery (not absolute contra-indication)

- Elevated hemidiaphragm
- Connective tissue disorder
- Previous right thoracotomy
- Ascending aorta > 4.0 cm
- Severe MAC
- STS > 4
- Pectus excavatum
- Previous sternotomy

# Intra-op set up

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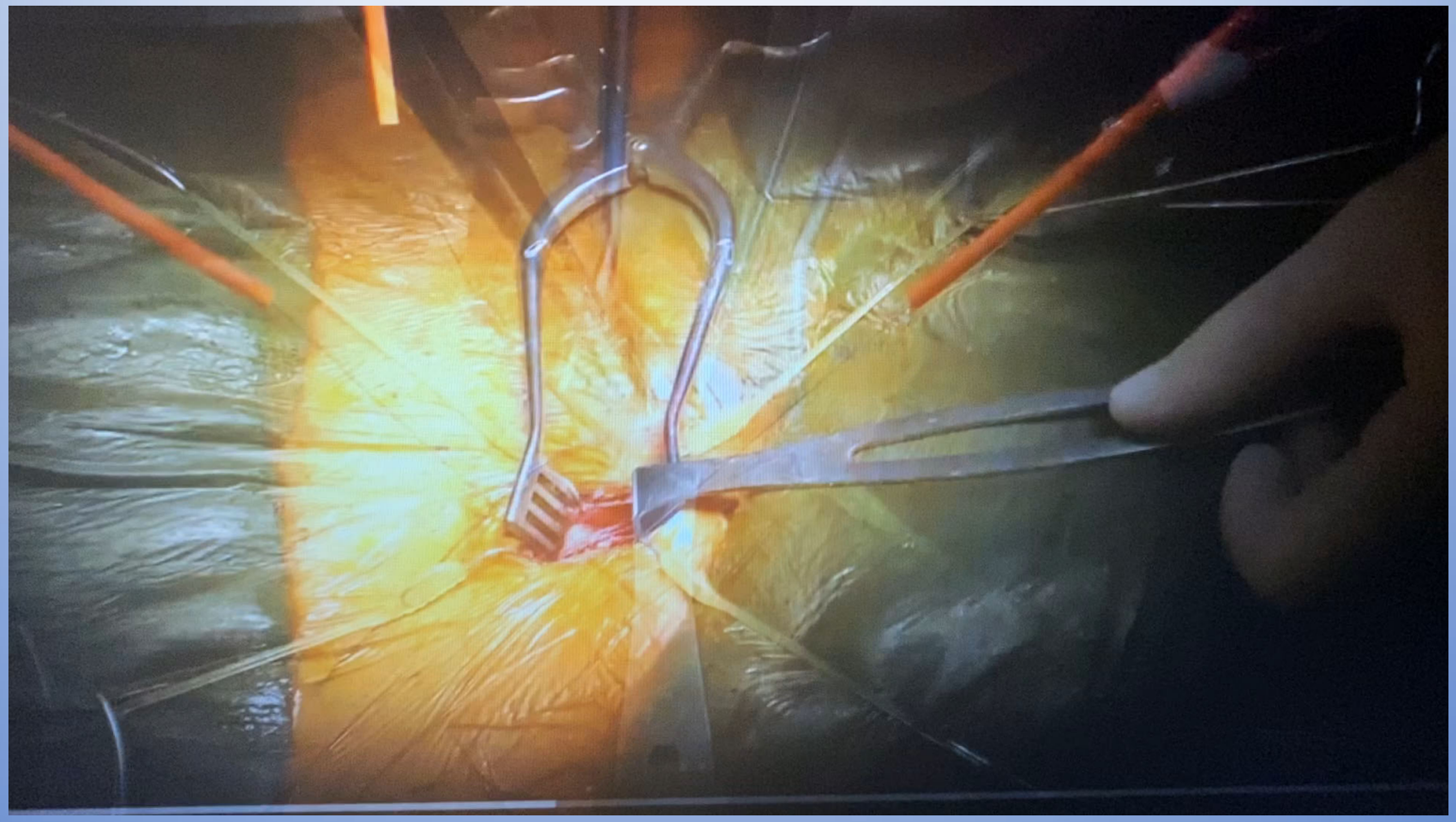
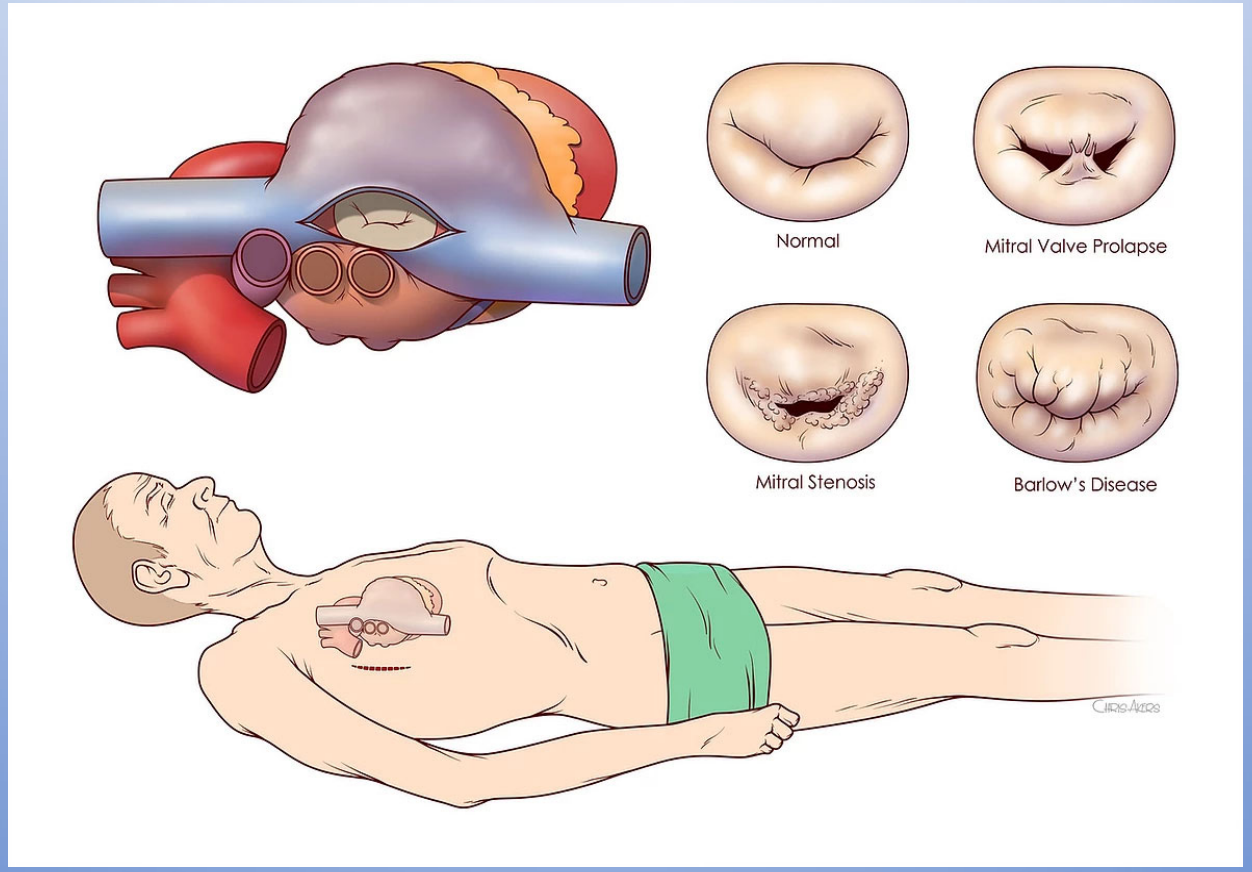
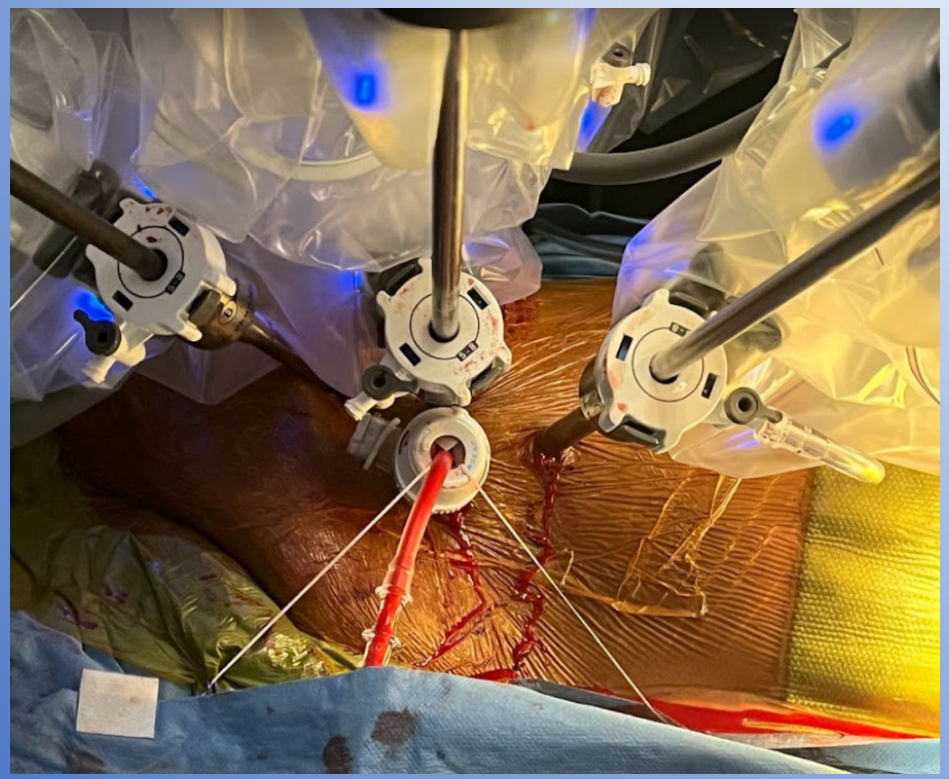
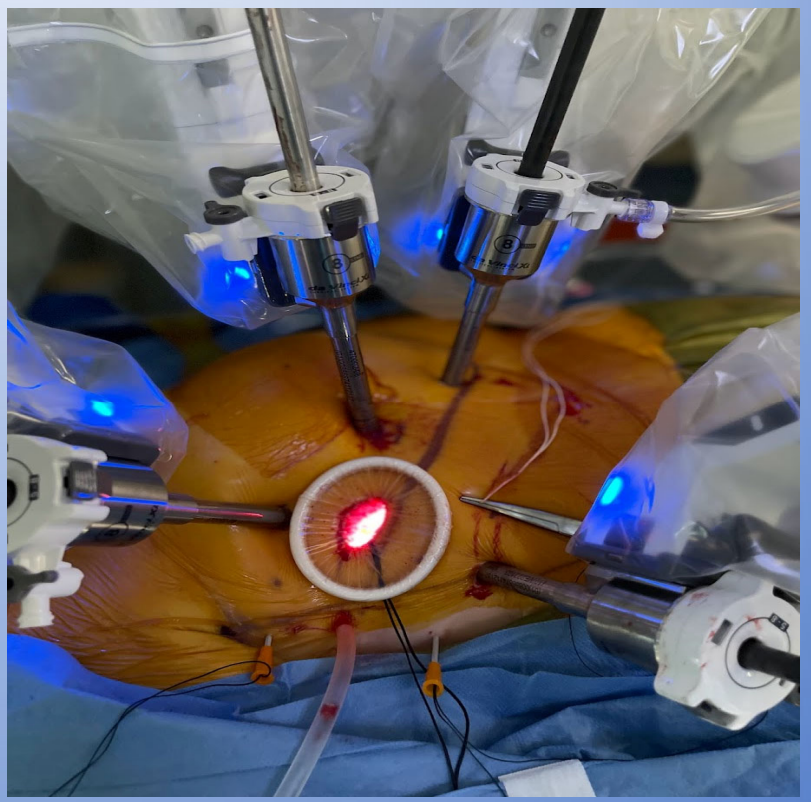


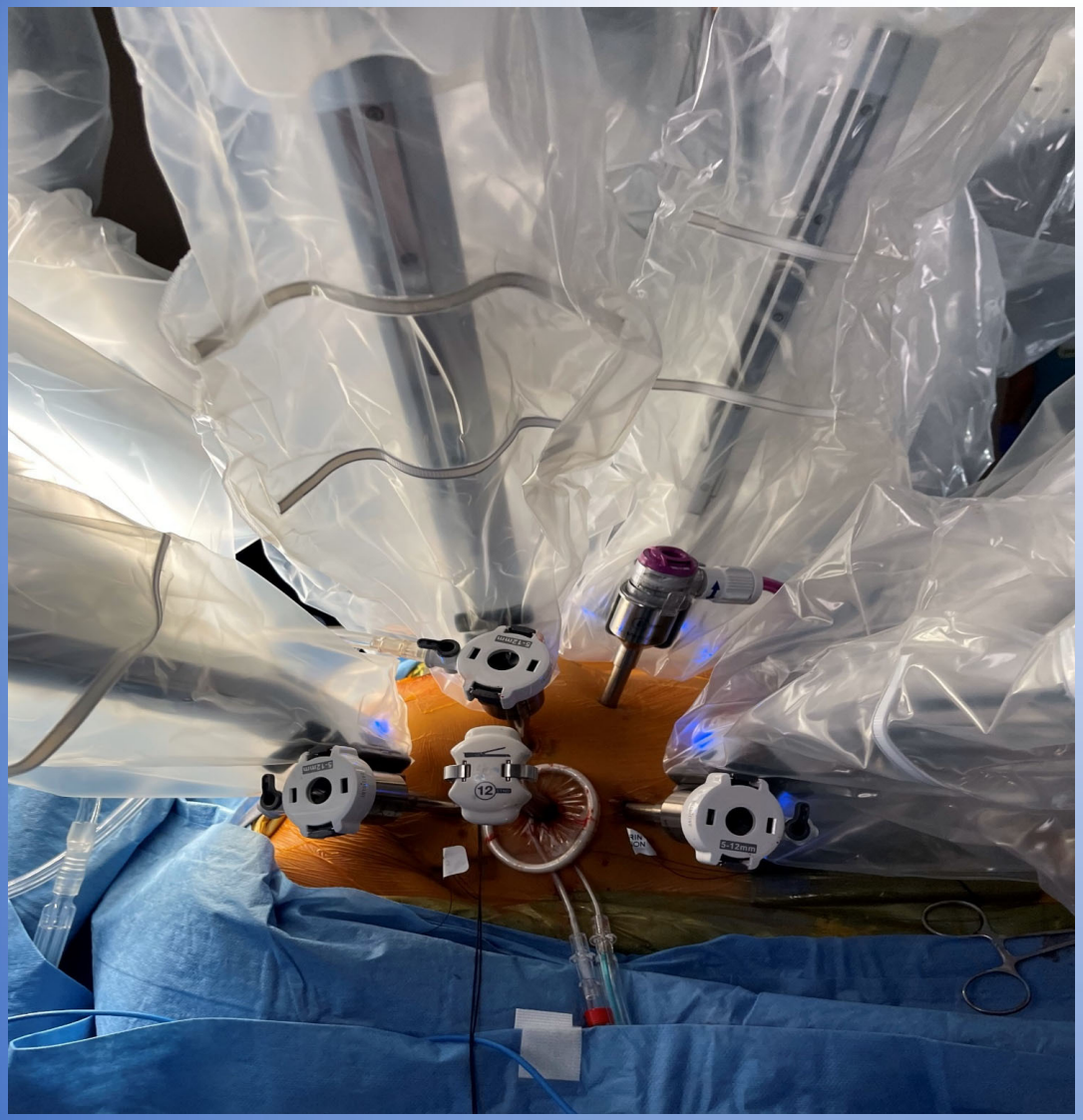
# INCISION LOCATION



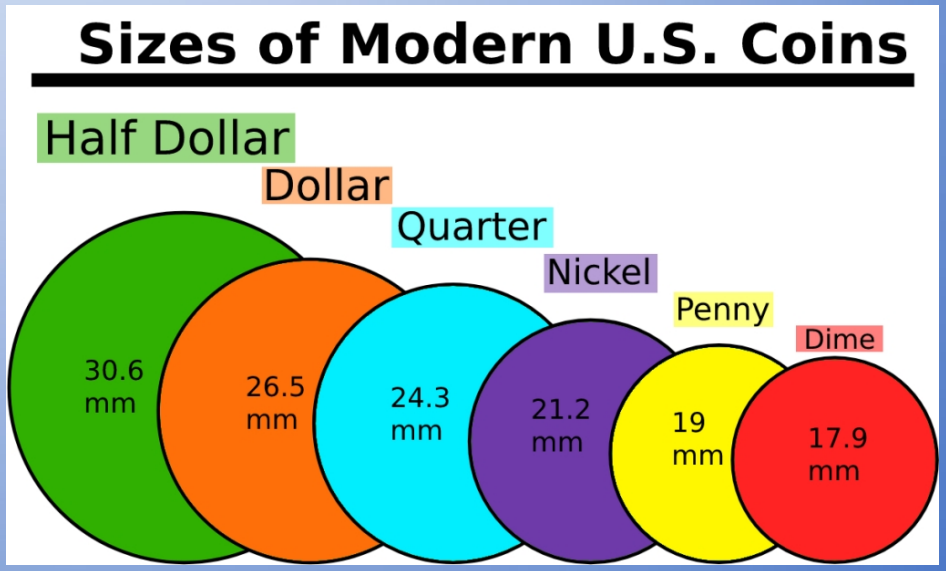
# Intra-op set up





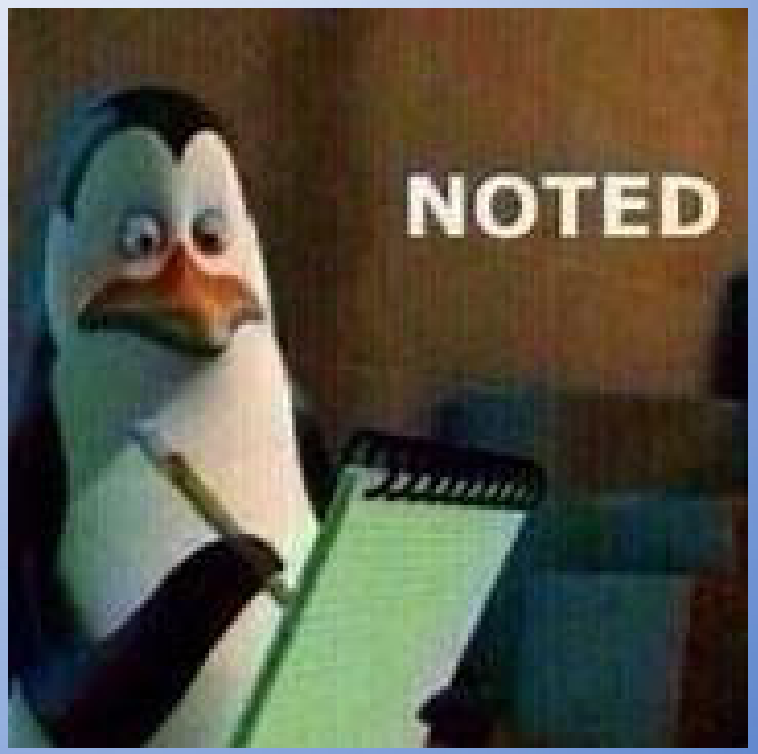



12 millimeters
is equivalent to
0.47244094488189 inches


Sizes of Modern U.S. Coins
Half Dollar
Dollar
Quarter
Nickel
Penny
Dime
30.6 mm
26.5 mm
24.3 mm
21.2 mm
19 mm
17.9 mm

# Post Operative Consideration

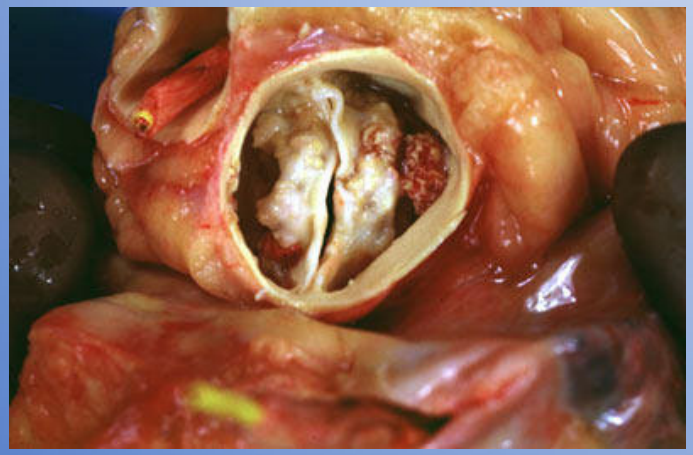
- Unilateral lung  pulmonary edema (UPE)
  - Prolonged aortic clamping associated with CPB times is one of the major risk factors for UPE.
  - ICU -> iN.O.
  - High flow O2/Vapotherm
  - Lasix
- Arrhythmias
  - Atrial fibrillation
  - PPM



# Post operative consideration

- Inotropes/pressors
- Fluid overload
- Pain

If you are curious, here is a picture of a normal aortic valve



And here is a picture of a stenotic aortic valve that is bicuspid with

calcified leaflets

# THANK YOU!!

UTCVSurgery

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https://med.uth.edu/cvs/

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# References


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Robotics in cardiac surgeryAH Sepehripour, Specialty Registrar, G Garas, Specialty Registrar, T Athanasiou, Consultant Cardiothoracic Surgeon, and R Casula, Consultant Cardiothoracic Surgeon

Transcatheter Treatment of Valvular Heart Disease: A Review Laura J Davidson[1], Charles J Davidson[1] Affiliations expand PMID: 34156404 DOI: 10.1001/jama.2021.2133

Pojar, M., Karalko, M., Dergel, M. *et al.* Minimally invasive or sternotomy approach in mitral valve surgery: a propensity-matched comparison. *J Cardiothorac Surg* 16, 228 (2021). https://doi.org/10.1186/s13019-021-01578-9 Download citation