Double Aortic and Mitral Valve-in-Valve Implantation

Technical tips and tricks

Jian (James) Ye, MD FRCPC

Clinical Professor of Surgery

St. Paul's Hospital, University of British Columbia

AP VALVES 2018, Seoul

Centre for Heart Valve Innovation
St. Paul's Hospital, Vancouver

UBC

HEART CENTRE AT ST. PAUL'S HOSPITAL

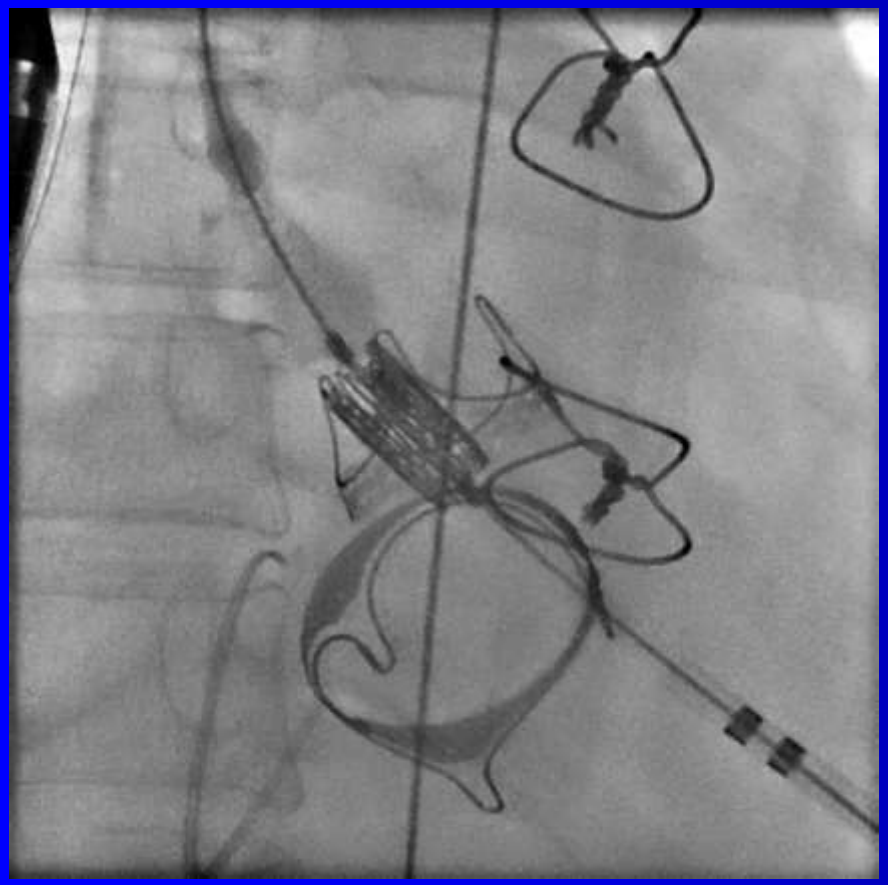
Disclosure

Consultant: **Edwards Lifesciences**

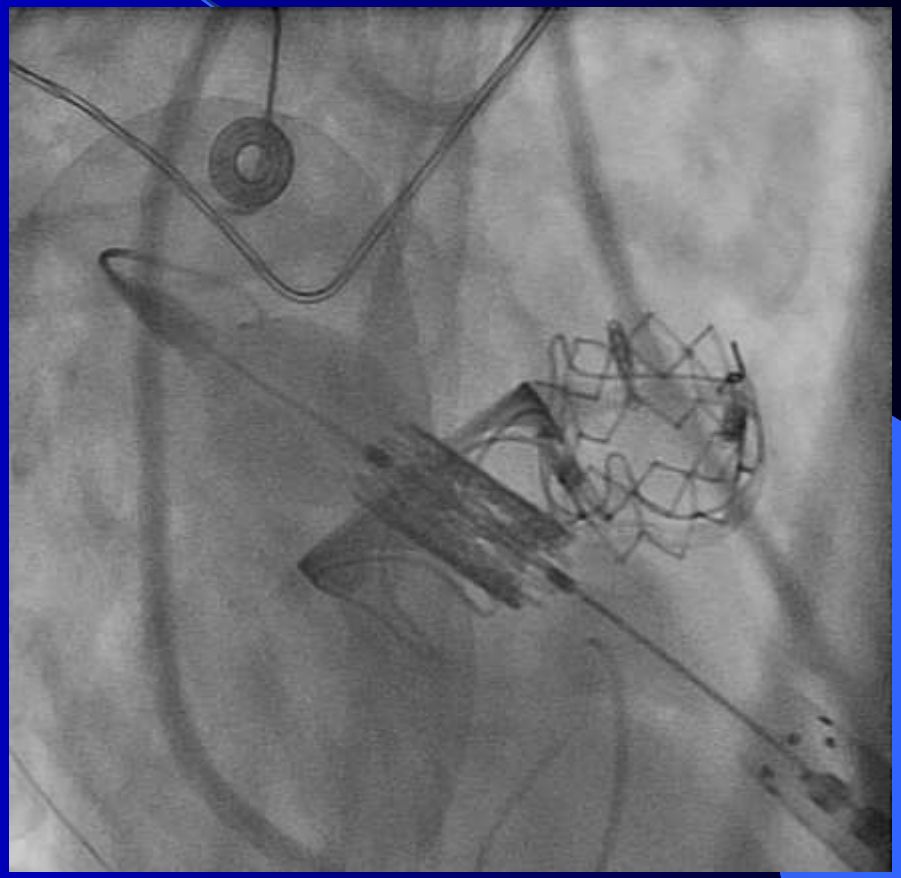
JC Medical Inc.

Double aortic and mitral valve-in-valve case

Transapical Approach

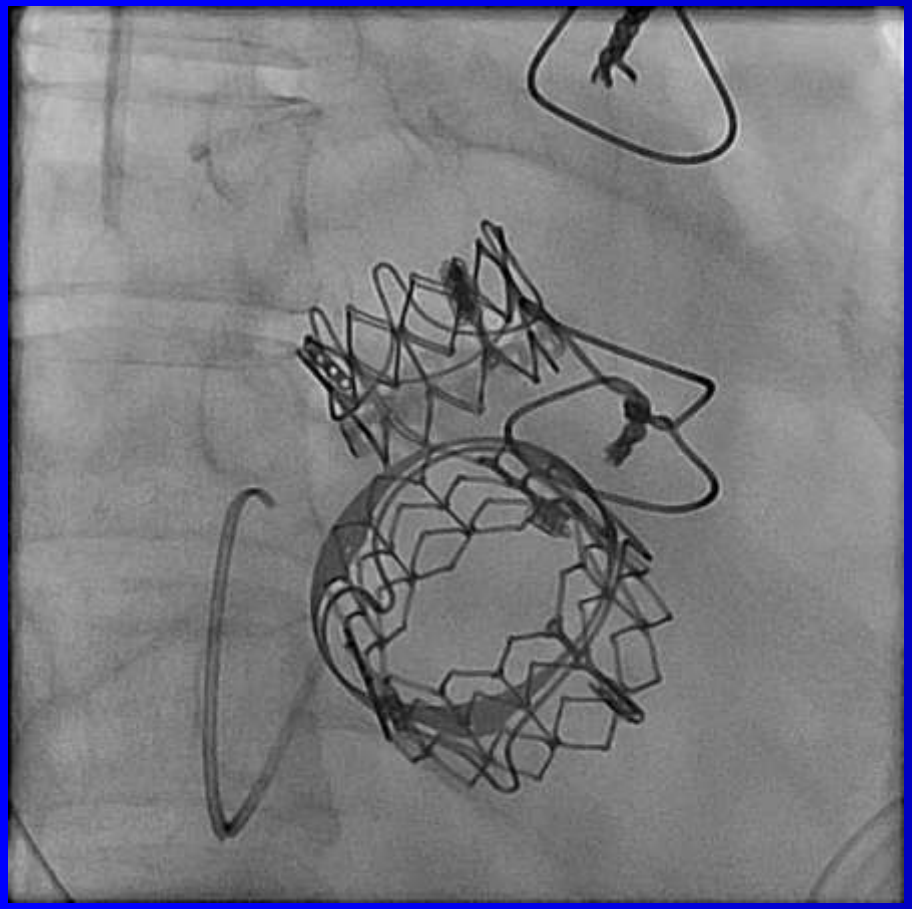


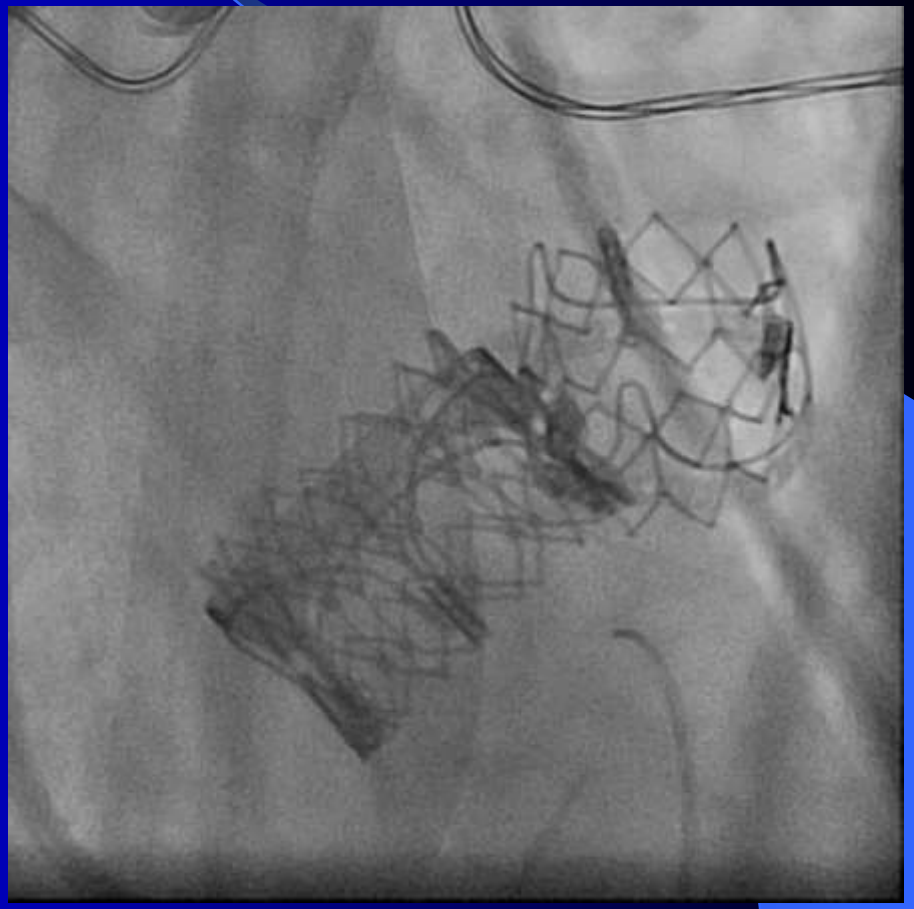
Aortic VinV



Mitral VinV

Double Aortic and Mitral Valve-in-Valve Implantation





Tips and Tricks

Confirming True Failure of Bioprothesis

- **TEE is necessary prior to consideration of VinV:**
  - **Small size of bioprosthesis**
  - **Obese patient**
  - **Moderately elevated pressure gradient with a small aortic valve area**
  - **Rapid progression of stenosis**
  - **Early failure**
  - **Endocarditis?**

Understanding unique futures of surgical valves

Unique design of each surgical valve

CE Perimount Magna

CE Perimount Magna Ease

Sorin Mitroflow

Trifecta (St. Jude Medical)

Medtronic Hancock II

Medtronic Mosaic

CE Porcine SAV

Biocor

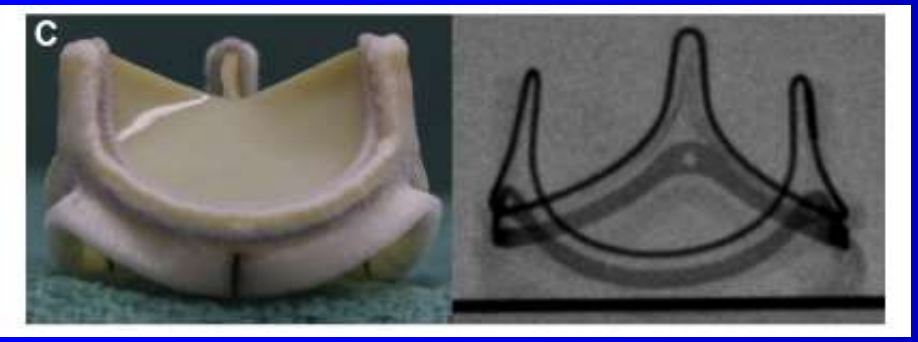
Edwards Prima Plus

Medtronic Freestyle

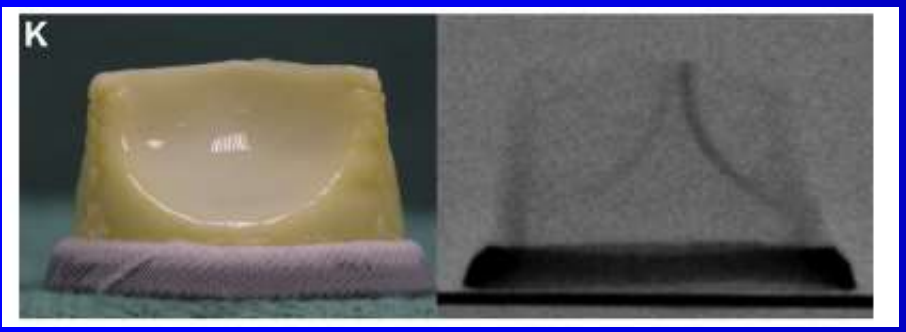
St. Jude Toronto SPV

Sorin Freedom

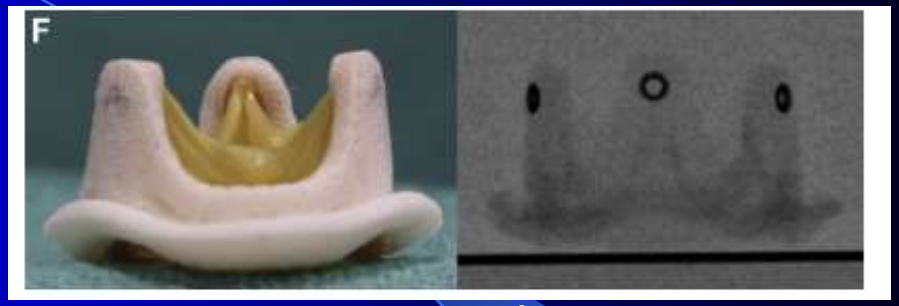
Visibility of valves on fluoroscopy



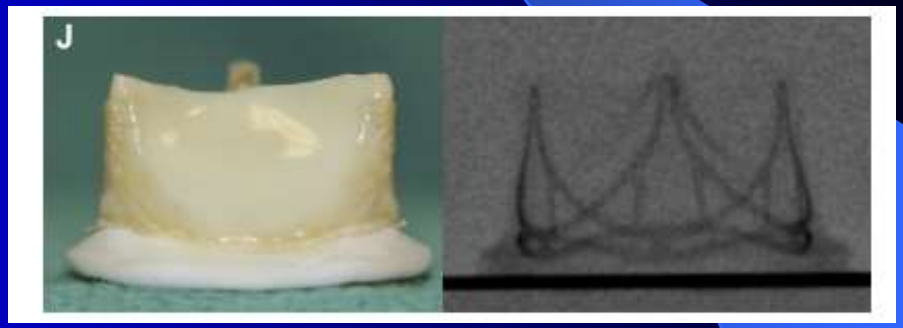
Magna Ease



Mitroflow



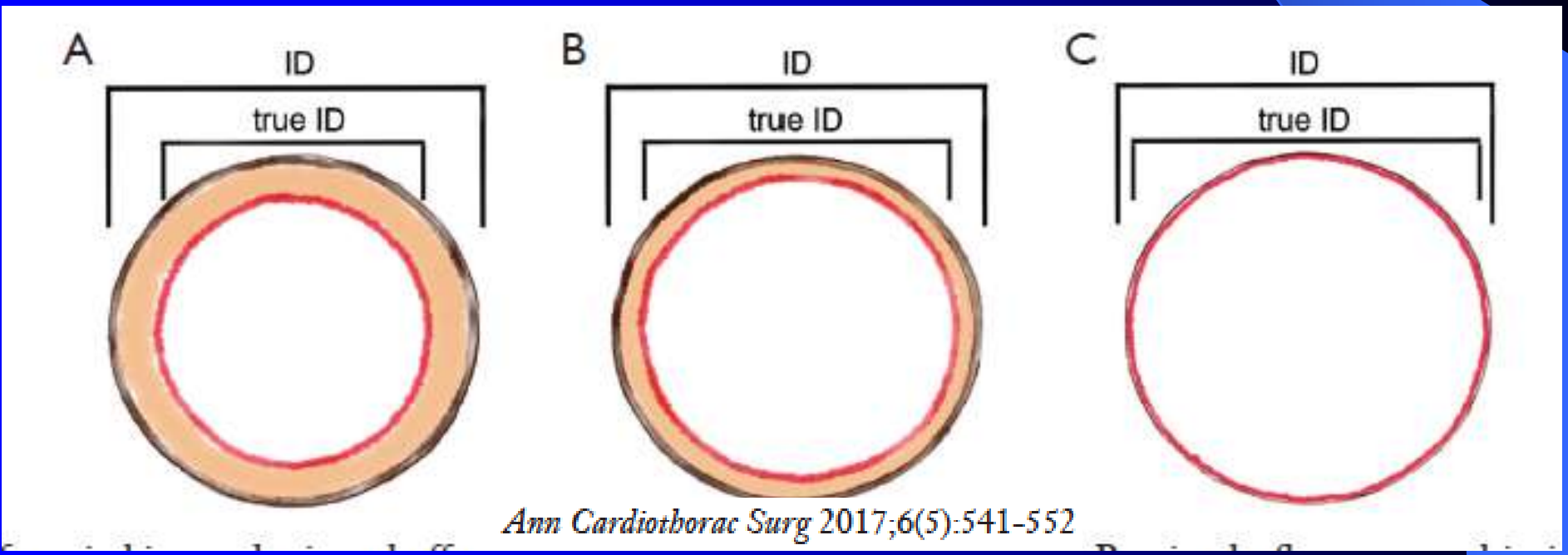
Mosaic



Trifecta

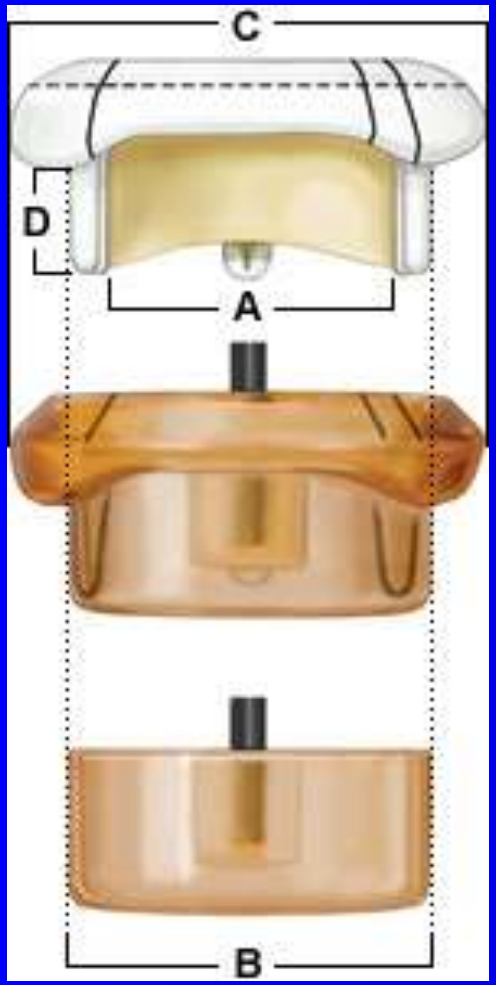
Epic

True Internal Diameter



Ann Cardiothorac Surg 2017;6(5):541-552

Marked valve size
(Magna pericardial tissue valve)



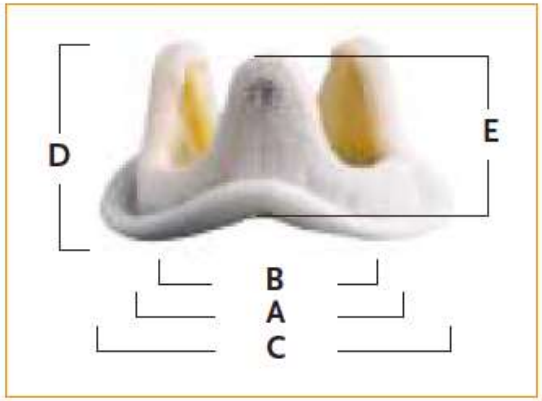
A	Stent diameter (wireform)
B	Tissue annulus diameter
C	External sewing ring diameter
D	Anterior effective profile

Size	25 mm	27 mm	29 mm	31 mm	33 mm
A	25	27	29	31	31
B	28	29.5	31.5	33.5	33.5
C	36	38	40	42	44
D	7	7.5	8	8.5	8.5

Marked valve size
(Mosaic tissue valve)

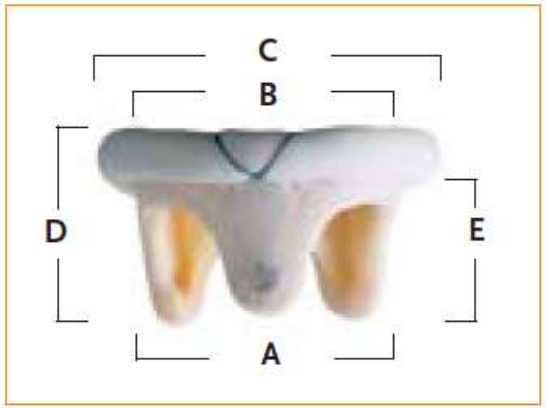
Mosaic Aortic Bioprosthesis Model 305

Catalog Number	Valve Size (Stent O.D.†) (A)	Orifice Diameter (Stent I.D.) (B)	Suture Ring Diameter (C)	Valve Height (D)	Aortic Protrusion (E)
	(±0.5 mm)	(±0.5 mm)	(±1 mm)	(±0.5 mm)	(±0.5 mm)
30501901	19	17.5	25.0	13.5	11.0
30502101	21	18.5	27.0	15.0	12.0
30502301	23	20.5	30.0	16.0	13.5
30502501	25	22.5	33.0	17.5	15.0
30502701	27	24.0	36.0	18.5	15.5
30502901	29	26.0	39.0	20.0	16.0



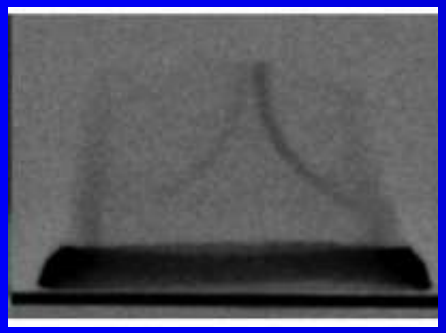
Mosaic Mitral Bioprosthesis Model 310

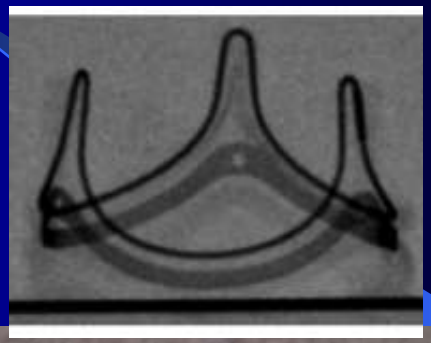
Catalog Number	Valve Size (Stent O.D.†) (A)	Orifice Diameter (Stent I.D.) (B)	Suture Ring Diameter (C)	Valve Height (D)	Ventricular Protrusion (E)
	(±0.5 mm)	(±0.5 mm)	(±1 mm)	(±0.5 mm)	(±0.5 mm)
31002501	25	22.5	33.0	18.0	13.5
31002701	27	24.0	35.0	19.0	14.0
31002901	29	26.0	38.0	20.5	15.5
31003101	31	28.0	41.0	22.0	17.0
31003301	33	30.0	43.0	23.0	17.5



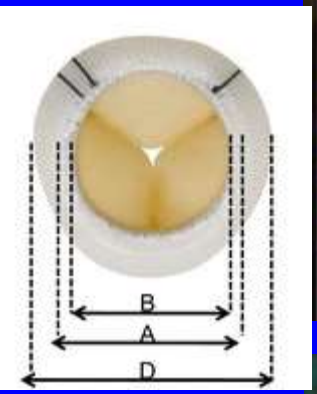
† Equivalent to annulus diameter

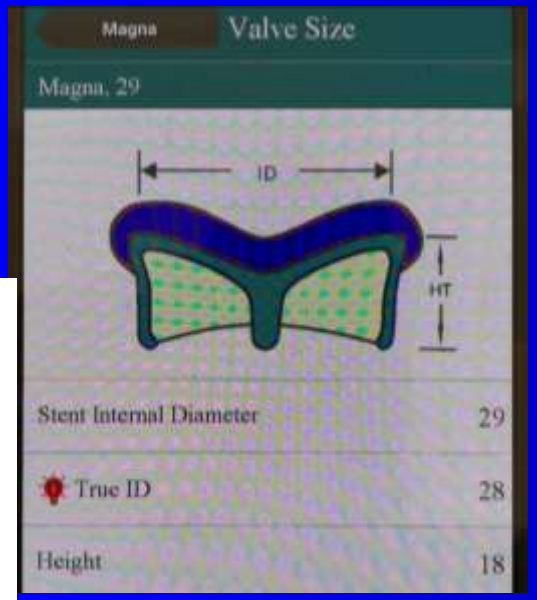
Is CT measurement of ID reliable?

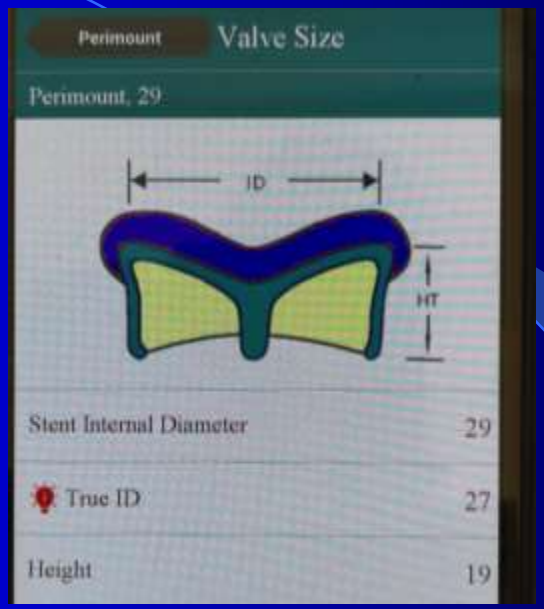


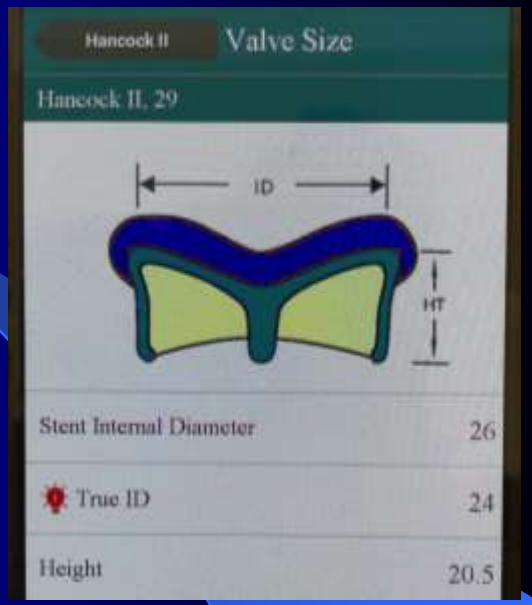


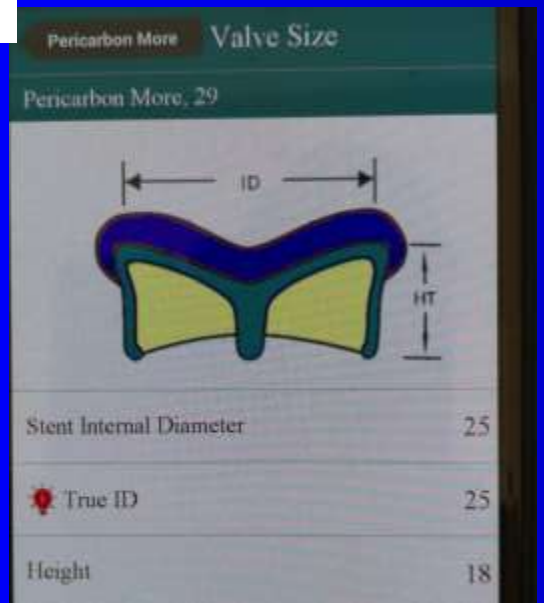
True Internal Diameter

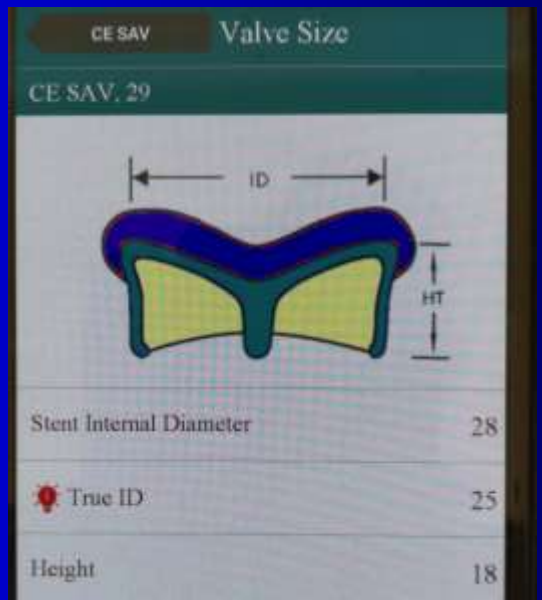


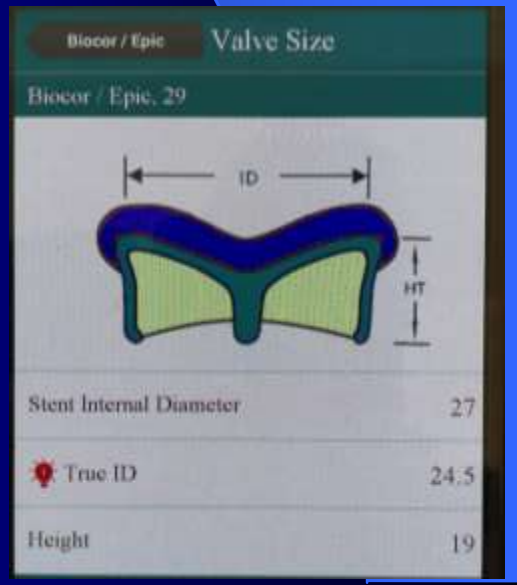




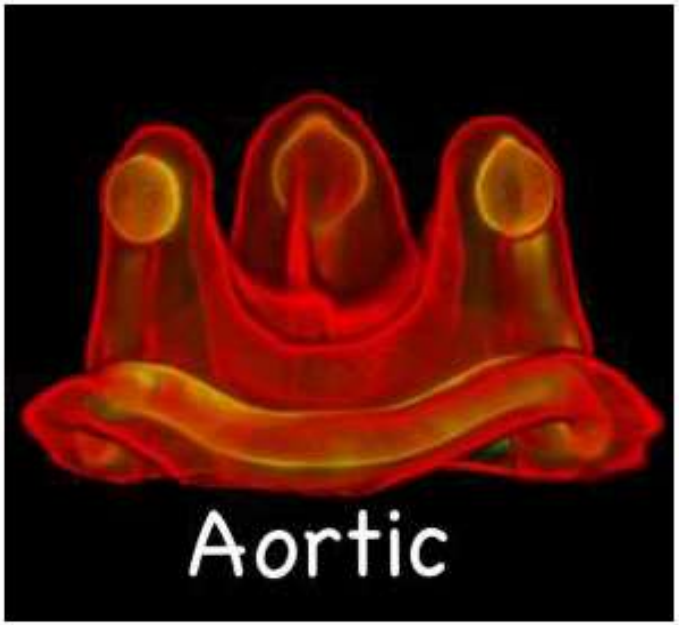


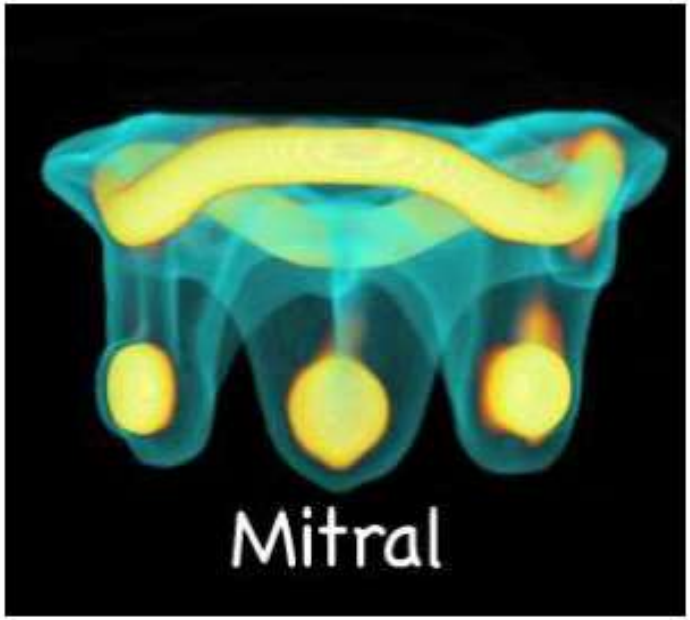






Valve in Valve Apps



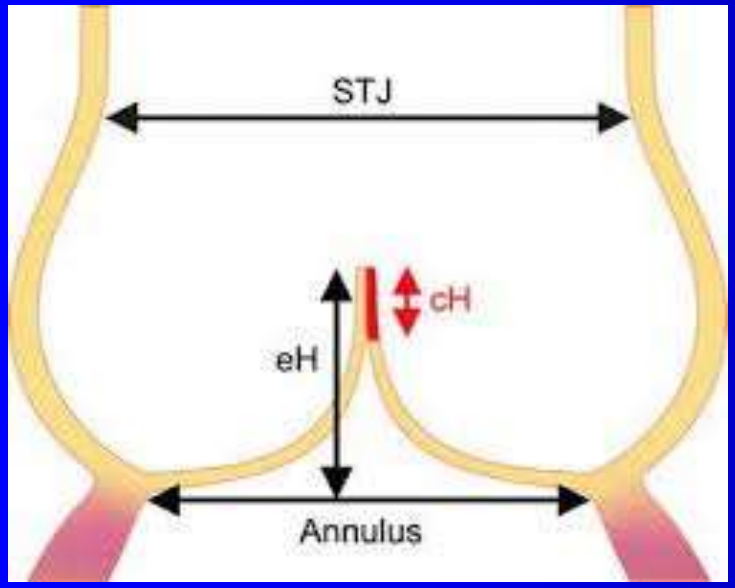


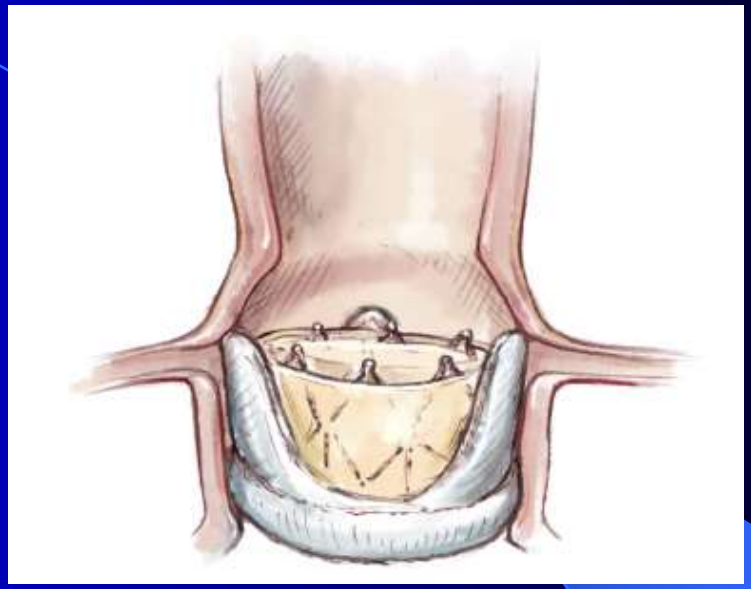
Free to download

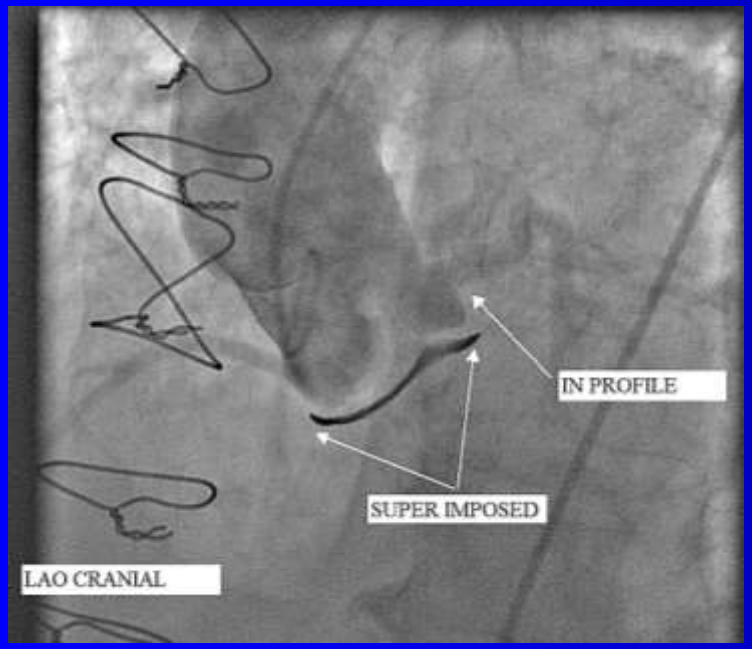
Risk factors for coronary obstruction

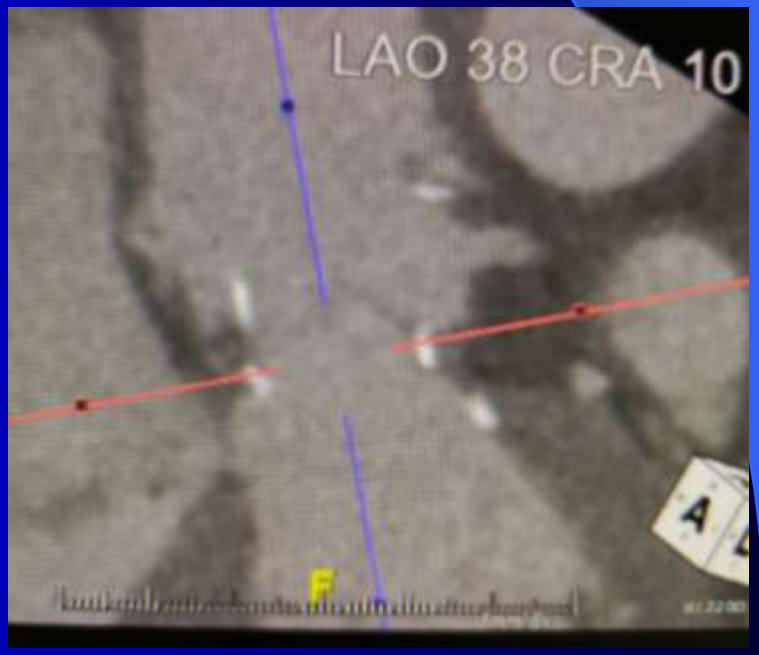
- **Anatomic factors:**
  - **Narrow aortic root**
  - **Narrow and low STJ**
  - **Low coronary ostium**
- **Unfavorable designs of tissue valves:**
  - **High profile of tissue valves**
  - **Outside-mounted tissue valve**
- **Tilted surgical valve**
- **Technical factors:**
  - **Too much oversizing**
  - **Selection of PHVs**

Aortic Root

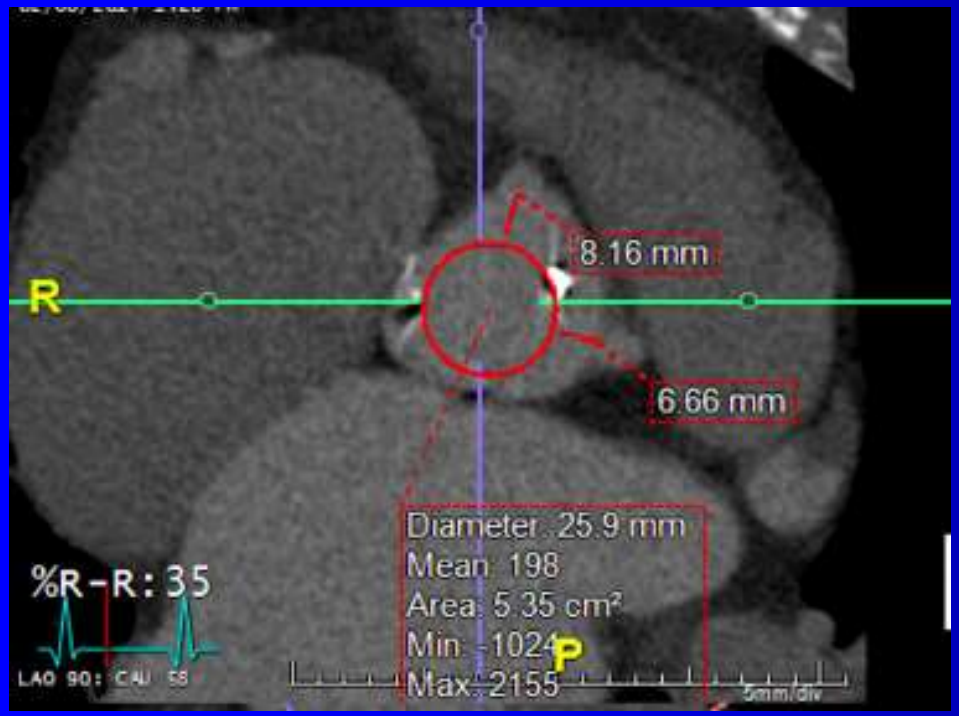

STJ
cH
eH
Annulus

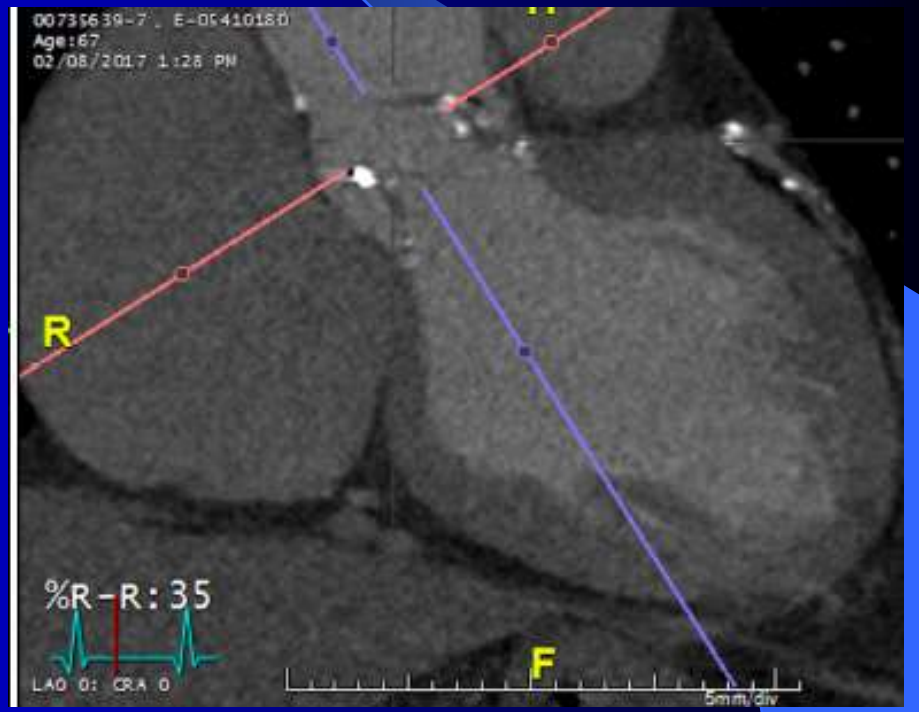



IN PROFILE
SUPER IMPOSED
LAO CRANIAL


LAO 38 CRA 10

VCT to assess risk of coronary obstruction



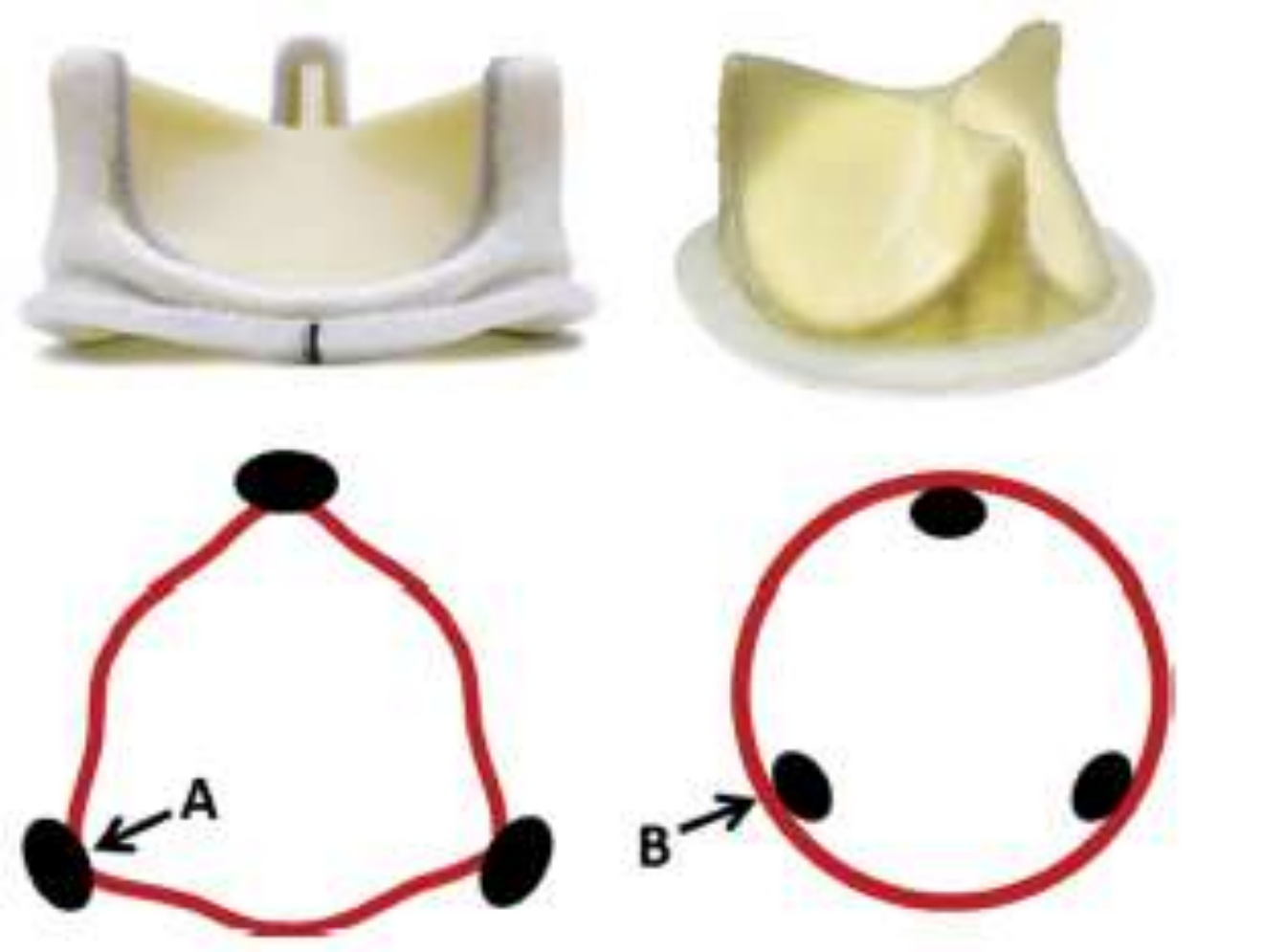


Design of bioprotheses

Profile

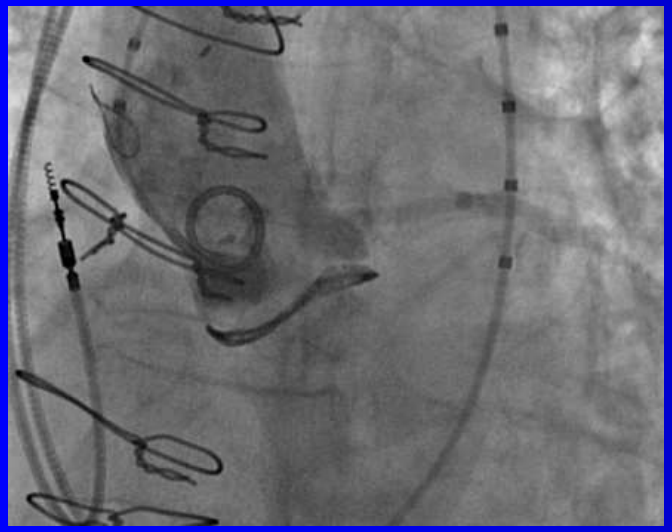
Design of bioprotheses

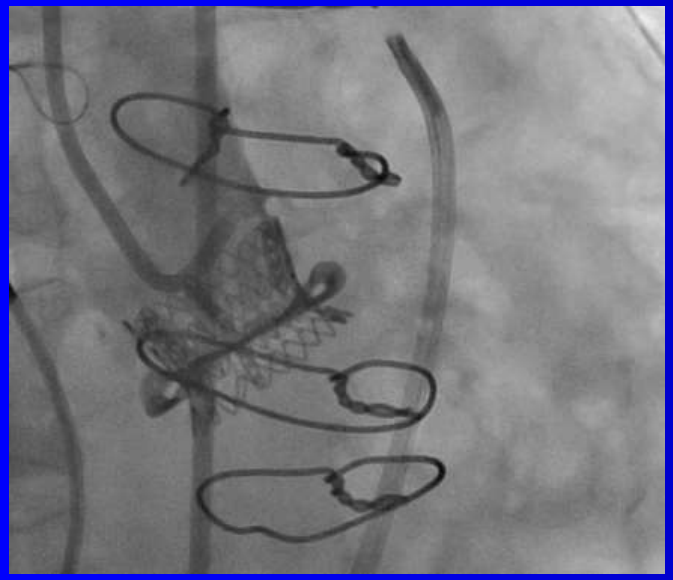
Outside vs inside mounted leaflets

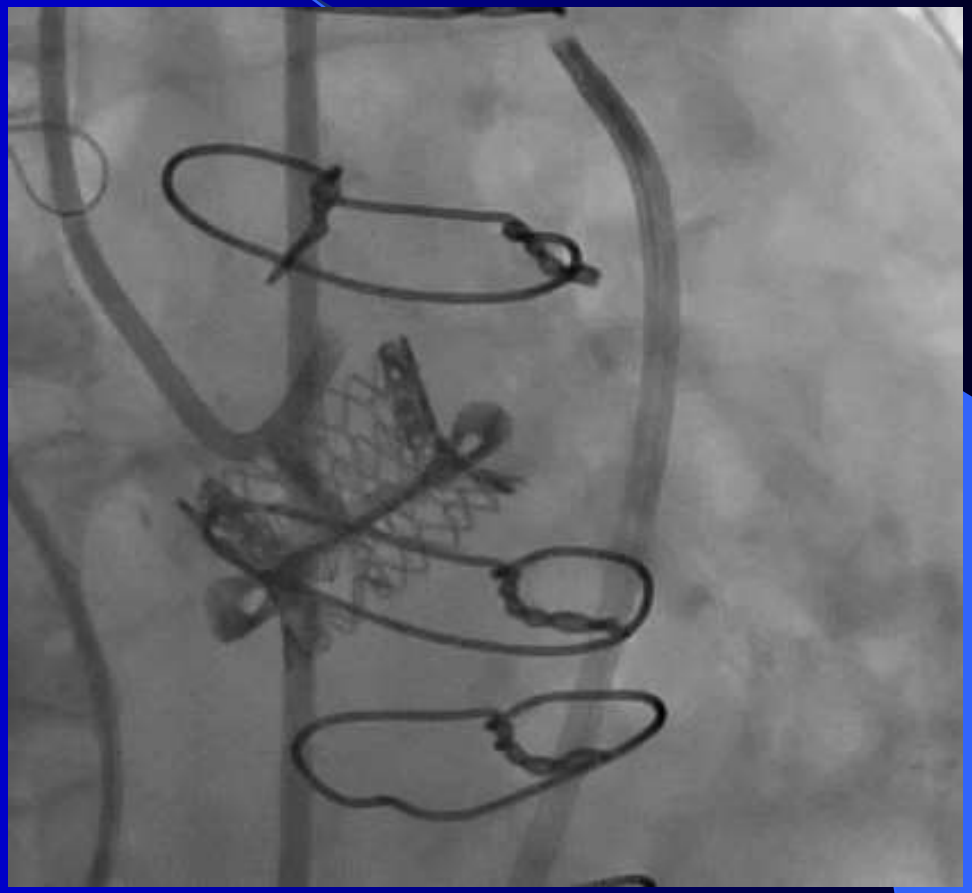


Left Main Occlusion

Many risk factors in this case

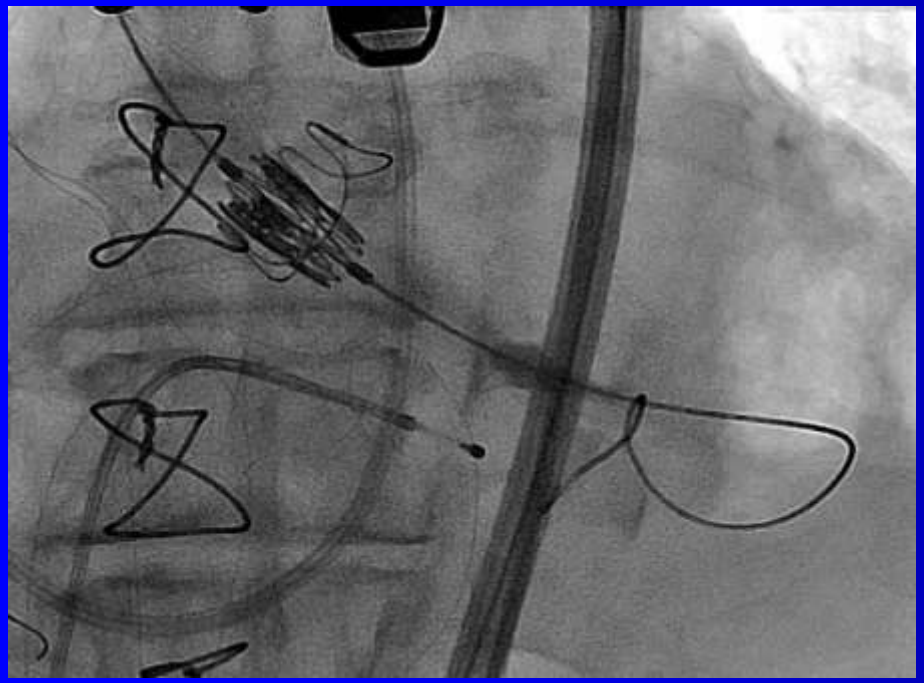


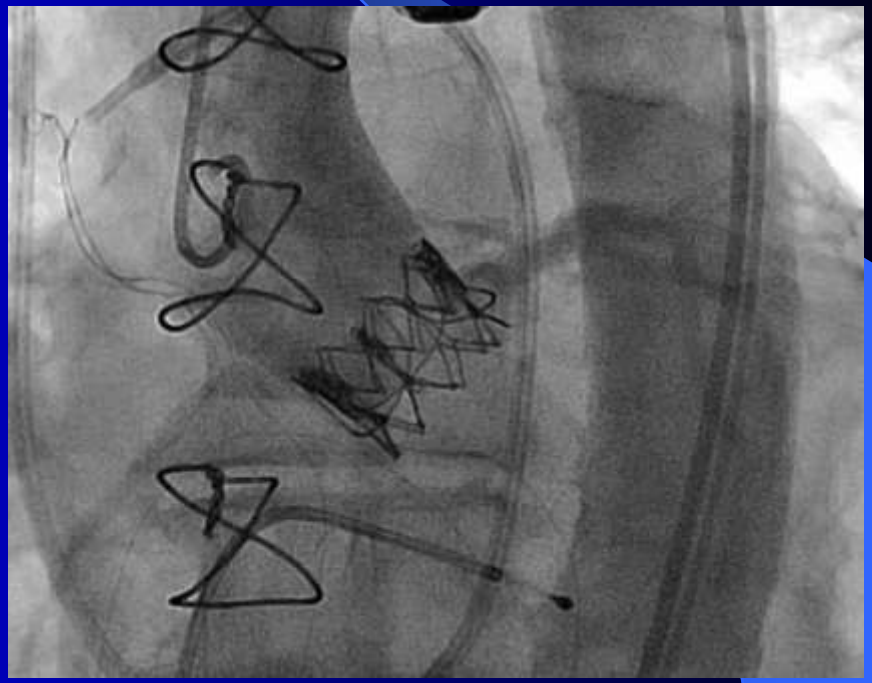




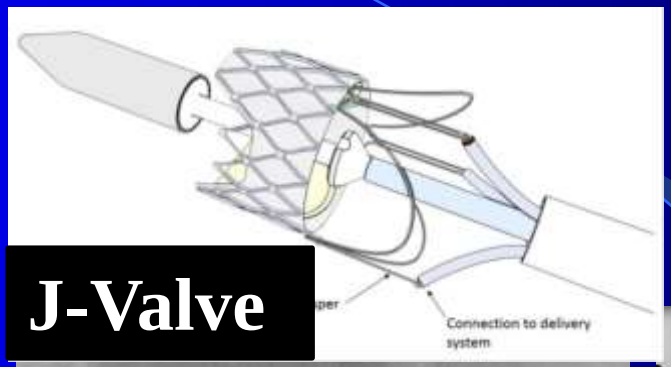
Left Main Obstruction

less risk factors

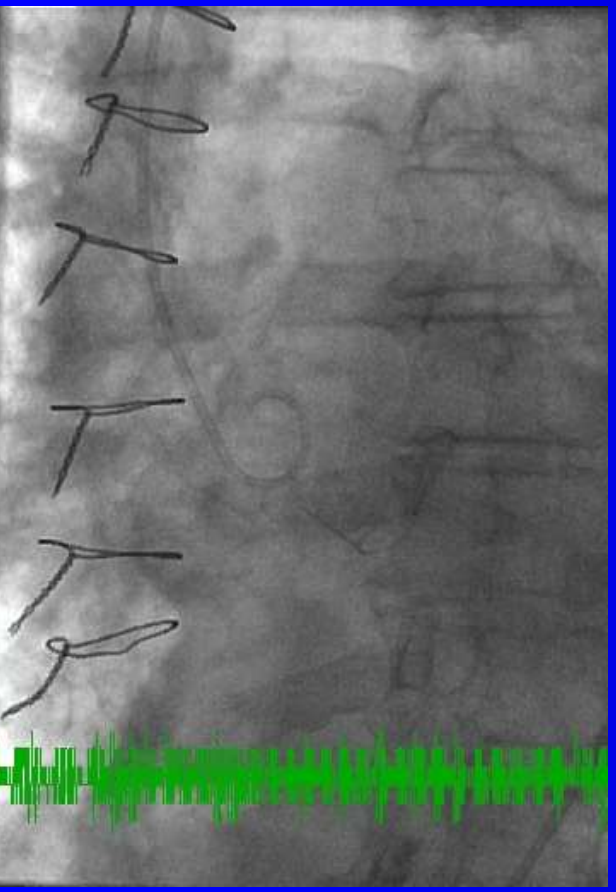


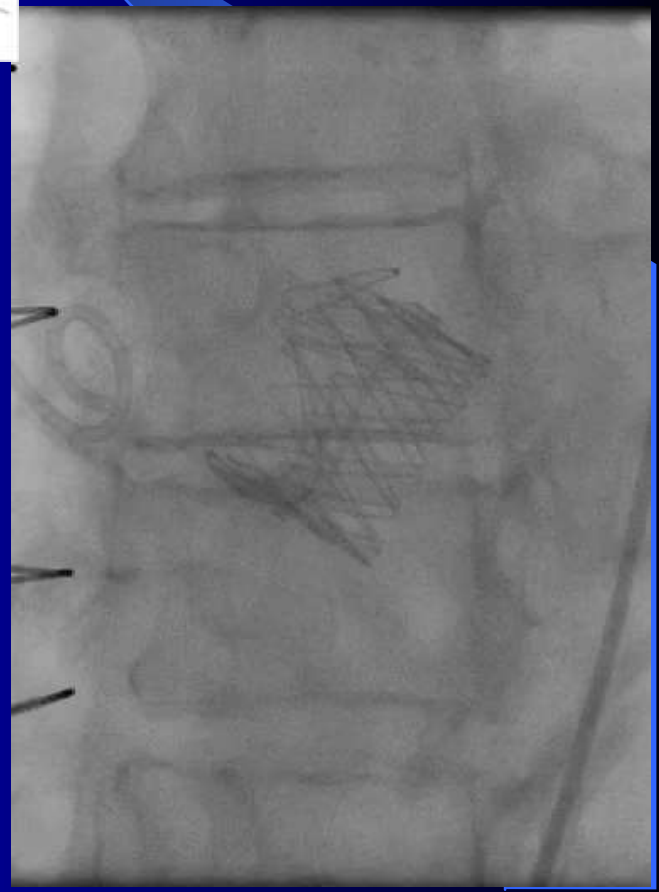


Selecting an appropriate THV in patients with high risk of LM obstruction

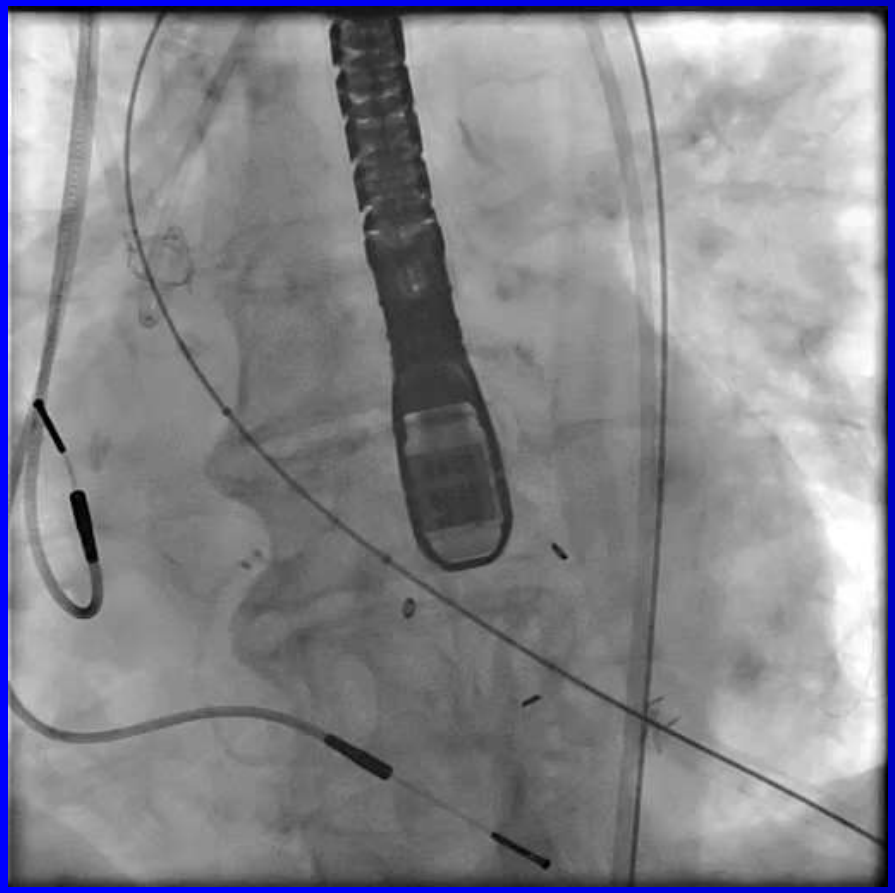


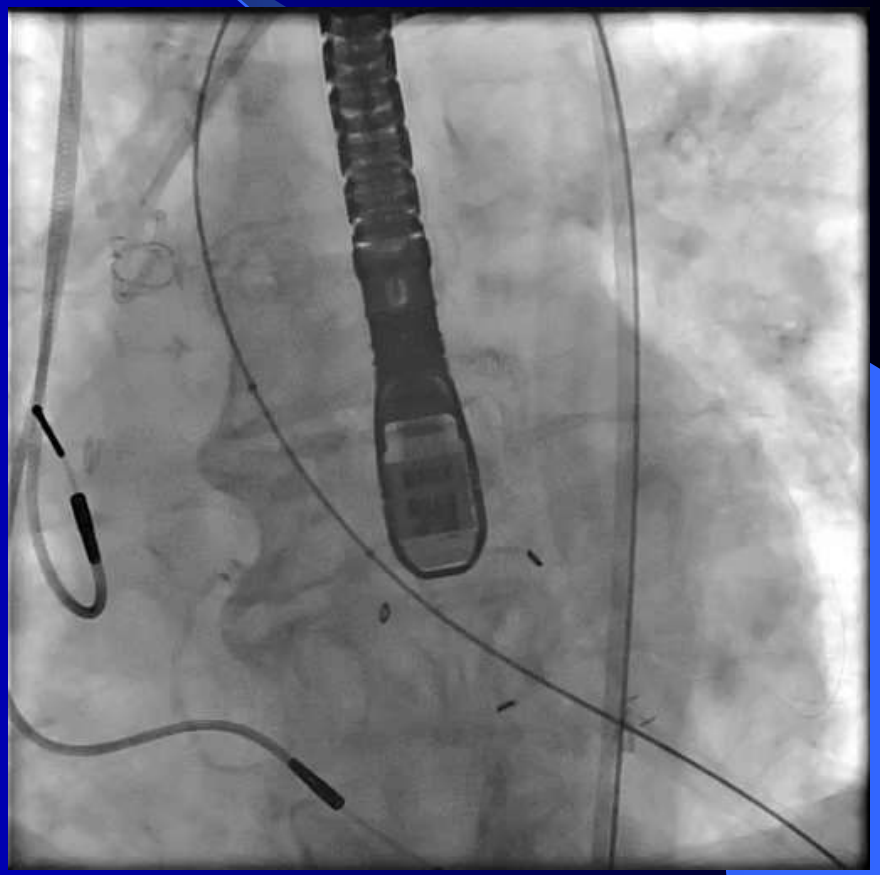
J-Valve





Potential Malposition of aortic THV due to mitral tissue valve





Approach in patients with aortic and mitral valve-in-valve

Transapical for both aortic and mitral VinV

vs

Transeptal for mitral VinV + Transfemoral for aortic VinV

Determining THV size

- True ID of surgical stented valve
- CT measurement of annulus size of surgical stentless valve
- VCT estimated distance to each coronary ostium
- STJ height and size
- AS vs AI of bioprosthesis, which may influence valve selection
- Neo-LVOT size – mitral valve-in-valve

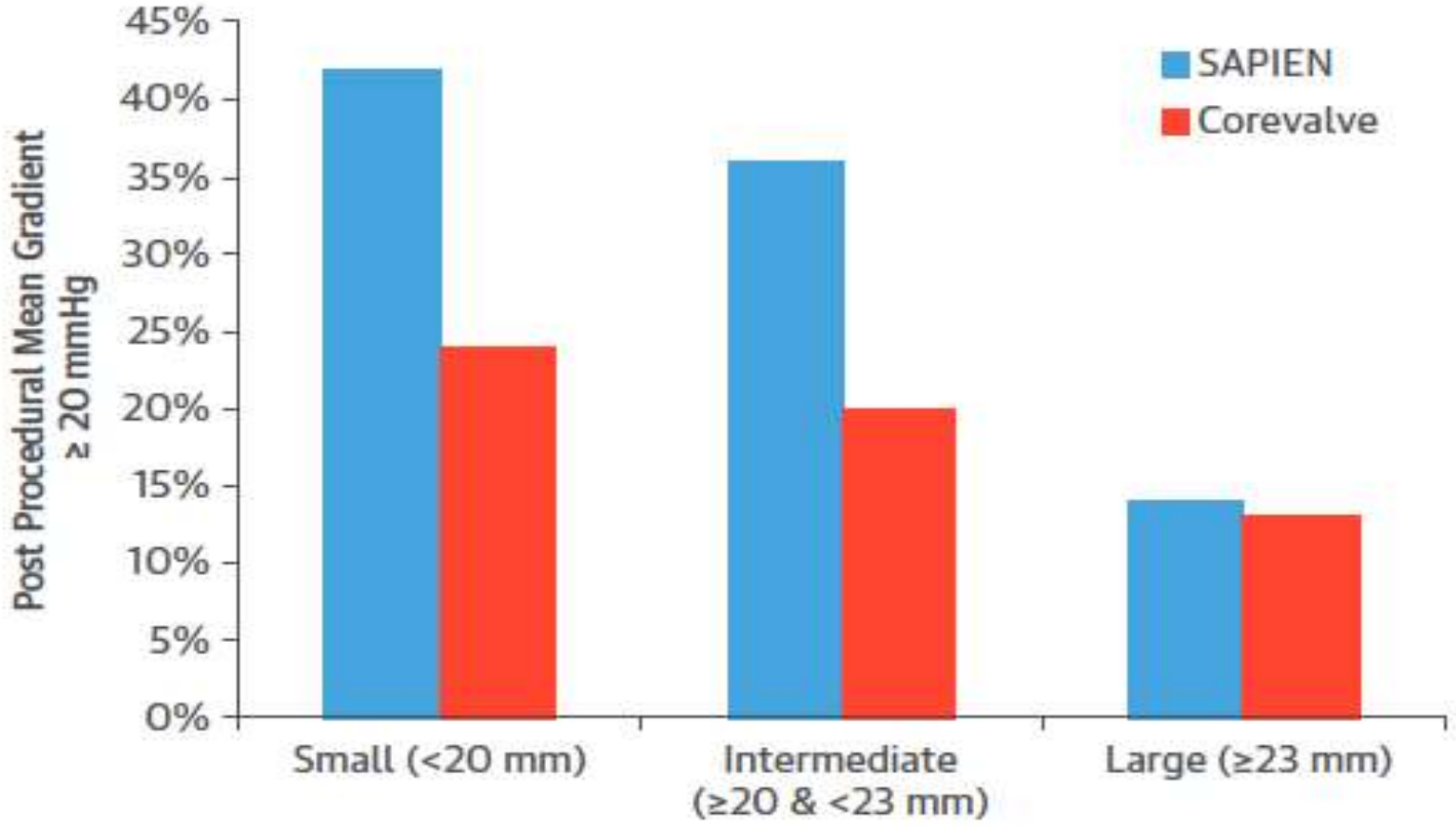
Small surgical valve is an independent risk factor for reduced long-term survival

TABLE 4 Factors Influencing the Survival of Aortic VinV Patients (n = 42)

	Univariate Model		Multivariate Model	
	Hazard Ratio (95% CI)	p Value	Hazard Ratio (95% CI)	p Value
Female	2.485 (0.614-10.07)	0.202		
PVD	2.752 (0.747-10.14)	0.128		
PASP ≥60 mm Hg	2.906 (0.692-12.21)	0.145		
LVEF <50%	1.742 (0.489-6.207)	0.392	2.945 (1.472-25.99)	0.049
CABG ± CAD	0.784 (0.177-3.475)	0.749		
Creatinine 100-149 mmol/l	0.925 (0.127-6.749)	0.938		
Creatinine ≥150 mmol/l	2.126 (0.428-10.57)	0.357		
DM	2.601 (0.639-10.59)	0.182	4.779 (0.741-11.71)	0.125
CVA	0.773 (0.995-6.304)	0.810		
Surgical valve size <23 mm	3.420 (0.951-12.30)	0.060	6.186 (1.001-22.82)	0.013

Global VinV Registry

FIGURE 6 Rate of High Transvalvular Gradients Following Aortic Valve-in-Valve Procedures

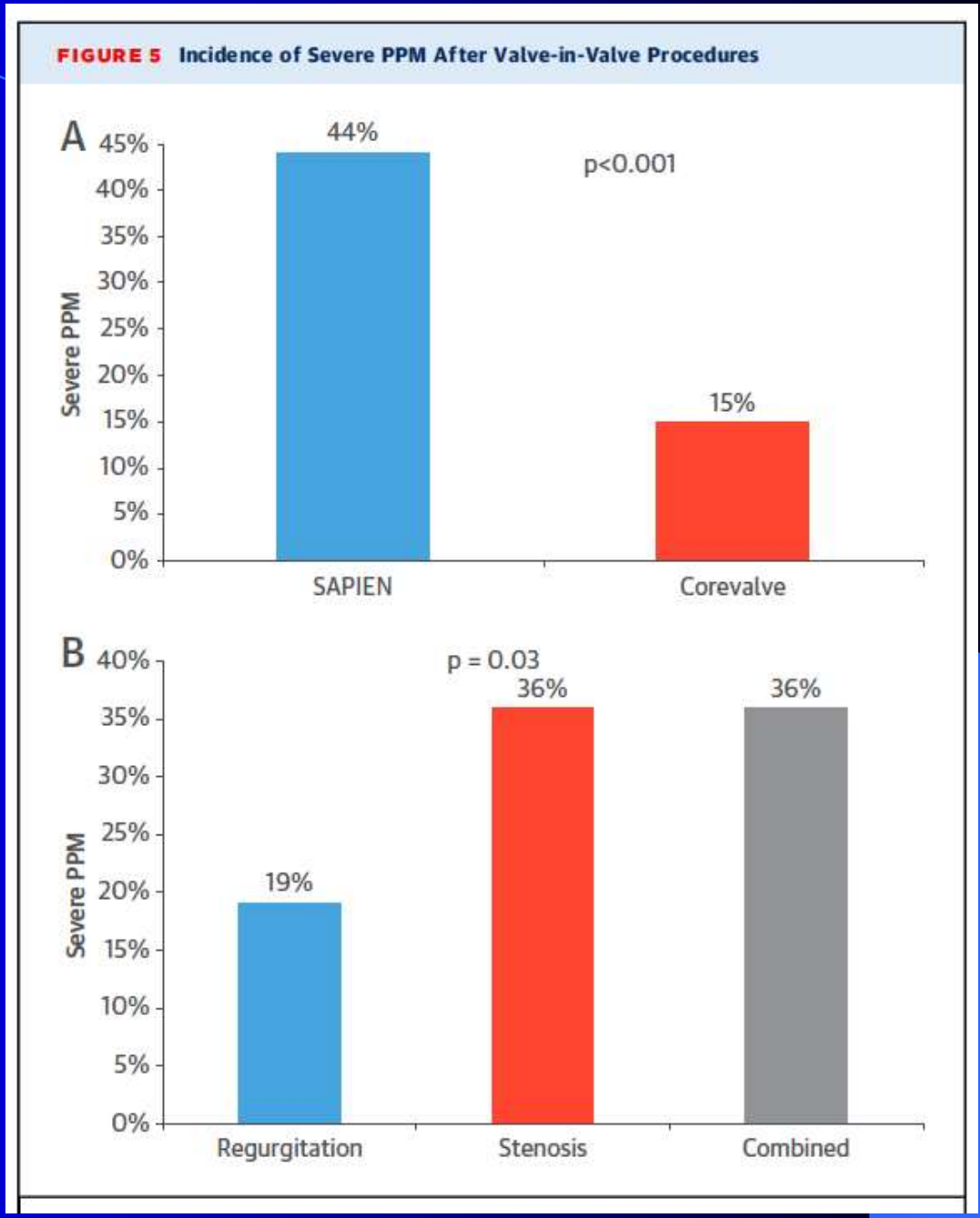


Dvir D, et al. JAMA 2014;312:162-70

Global VinV Registry

Severe PPM = Effective orifice area <0.65 cm2/m2

Dvir D. EuroPCR, May 21, 2015



Select an appropriate THV

- **ID > 20mm: most types of THVs are OK**
- **ID < 20mm: Supra-annularly mounted THVs, such as Evolut R**
- **ID < 20mm: Evolut R, S3, or other THV with breaking surgical basal ring**

Potential for fracture of basal ring

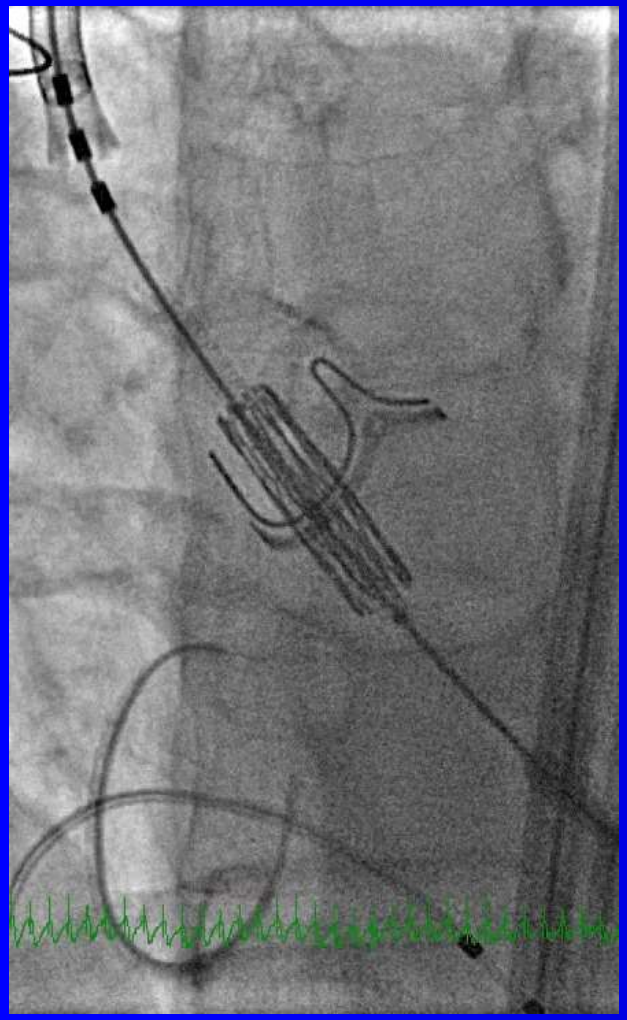
Table 1: Combined Results of Bioprosthetic Valve Fracture Bench Testing

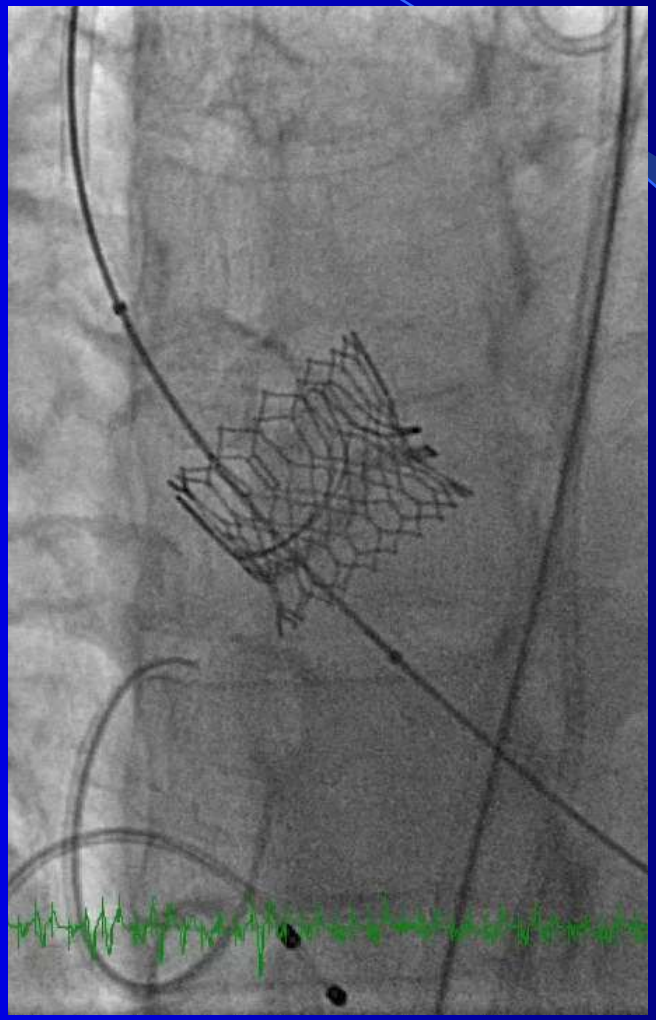
Manufacturer/ Brand	Valve Size	Bard TRU Balloon Fracture/Pressure	Bard Atlas Gold** Fracture/Pressure	Appearance After Fracture
St. Jude Trifecta 	19 mm 21 mm	NO NO	NO NO	
St Jude Biocor Epic 	21 mm	YES/ 8 atm	NOT TESTED	
Medtronic Mosaic 	19 mm 21 mm	YES/ 10 atm YES/ 10 atm	YES/ 10 atm YES/ 8 atm	
Medtronic Hancock II 	21 mm	NO	NOT TESTED	
Sorin Mitroflow 	19 mm 21 mm	YES/ 12 atm YES/ 12 atm	NOT TESTED YES/ 10 atm	
Edwards MagnaEase 	19 mm 21 mm	YES/ 18 atm YES/ 18 atm	YES/ 19 atm YES/ 21 atm	
Edwards Magna 	19 mm 21 mm	YES/ 24 atm YES/ 24 atm	NOT TESTED	

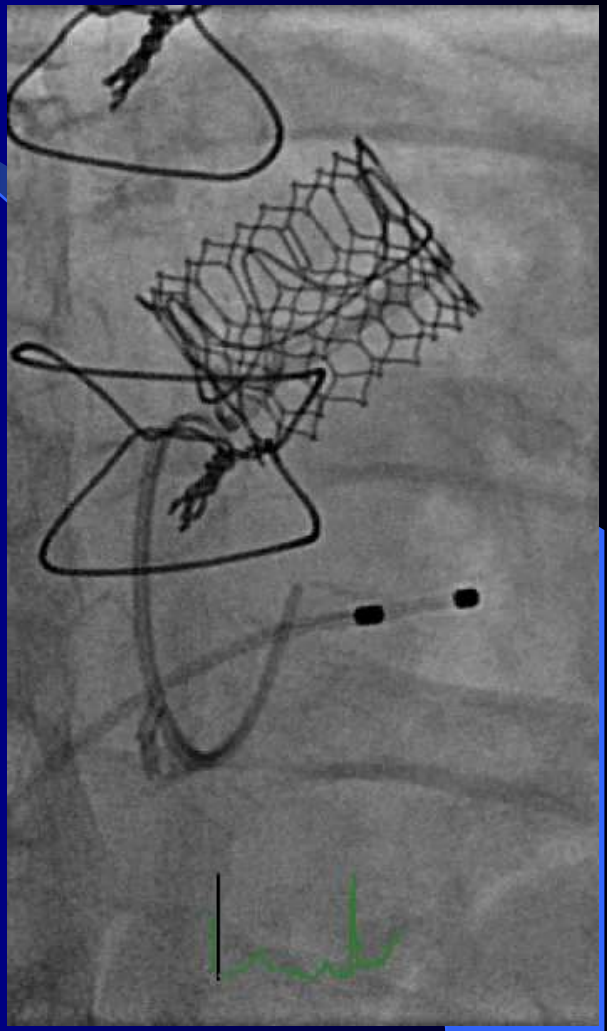
*Balloons sized 1 mm larger than valve size. The Medtronic Mosaic and Sorin Mitroflow have no metal ring. Therefore, their appearance after fracture remains unchanged. Source: Johansen, et al., 2017; Allen, et al., 2017; **these data obtained from Johansen et*

Ann Thorac Surg 2017;104:1501–8

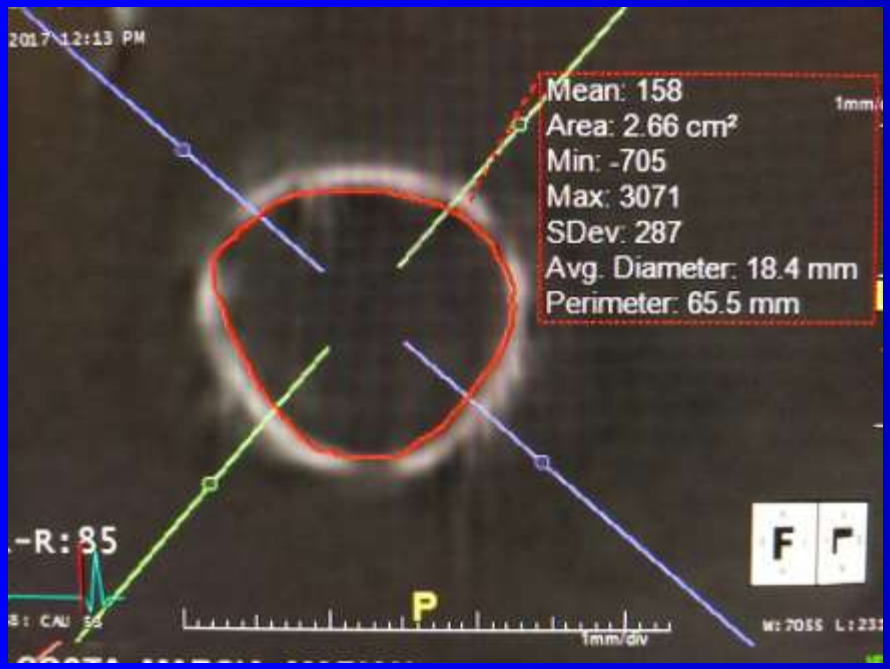
Fracture of surgical basal ring



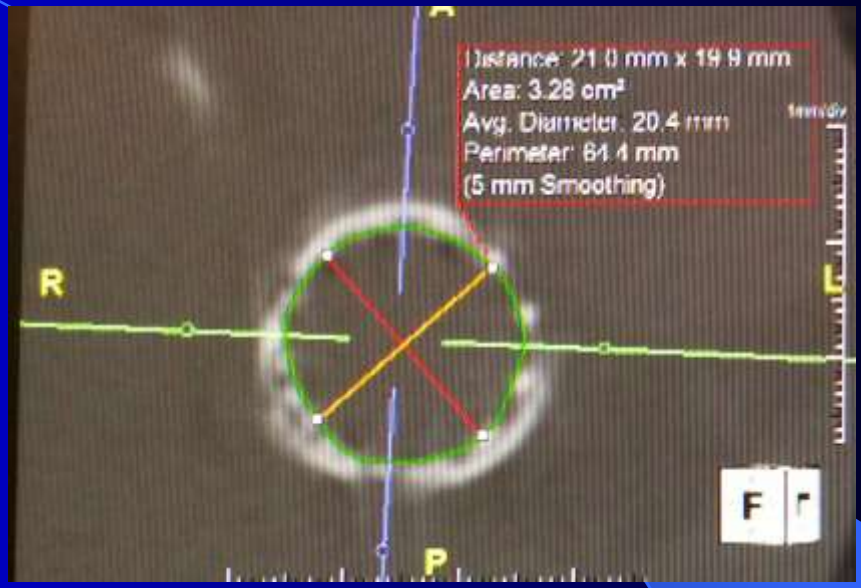


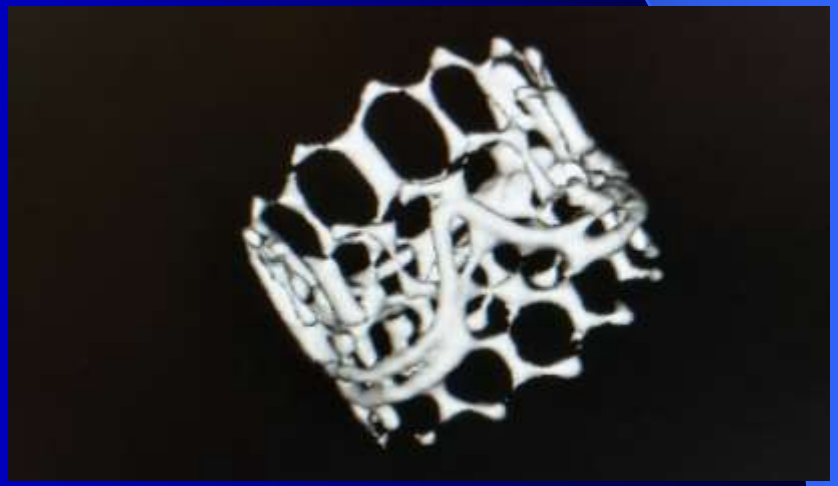


Fracture of surgical basal ring



Pre-fracture



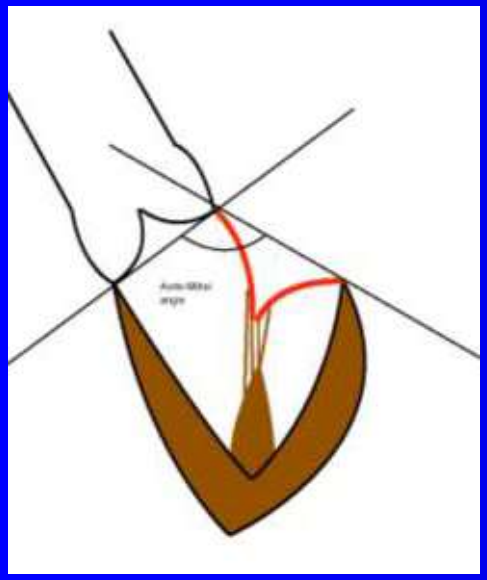


Post-fracture

Mitral V-in-V in double aortic and mitral V-in-V

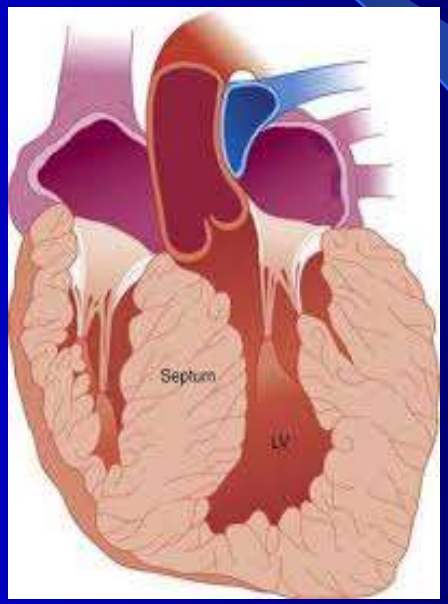
- Usually, no size issue
- Slightly more oversizing
- Ruling out LA thrombosis
- LVOT assessment

Predicting factors for LVOT obstruction



Aortomitral angulation

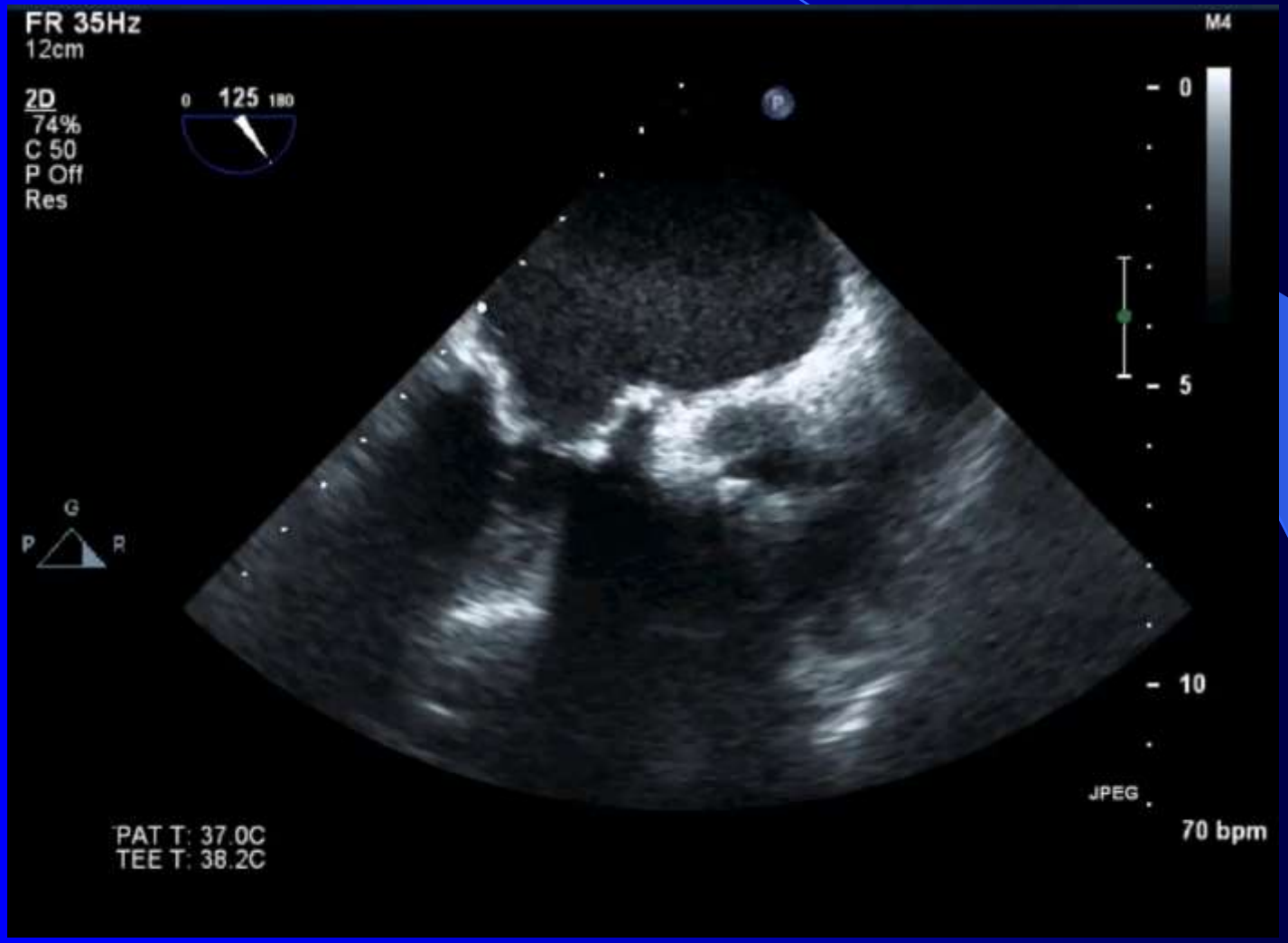
LV size



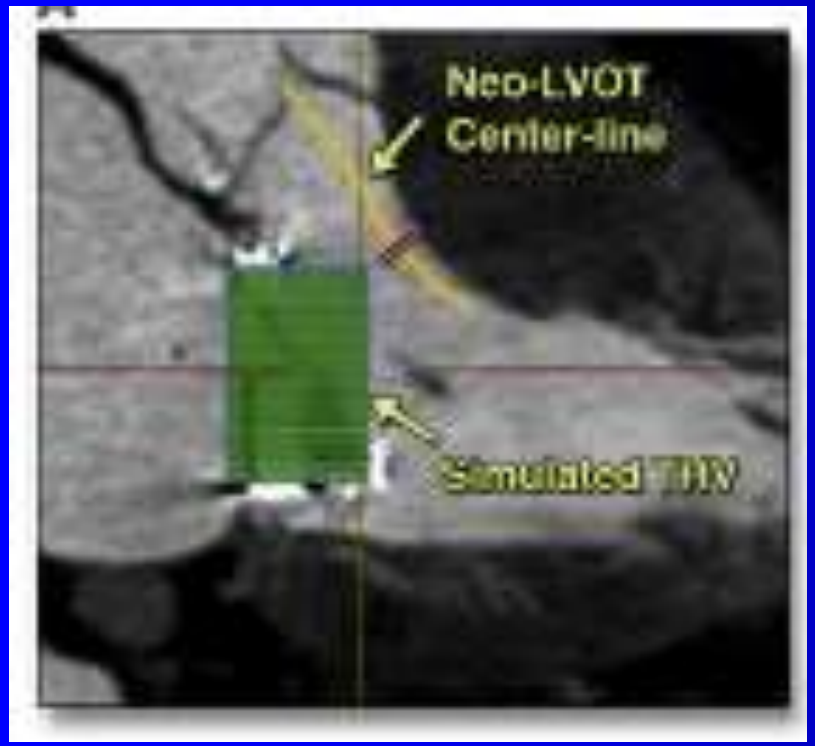
Ventricular septum

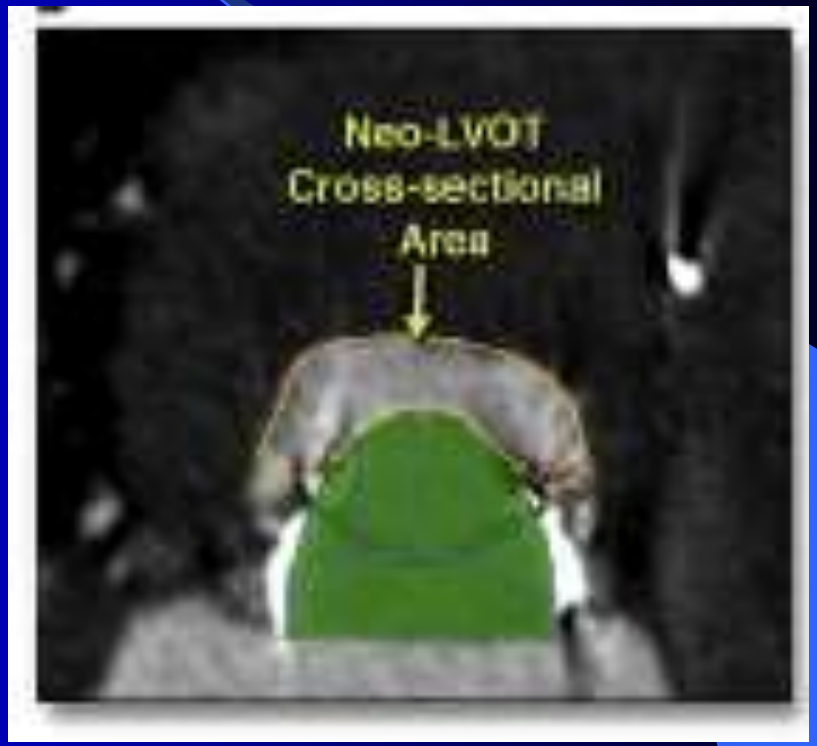
Profile of surgical valve

TEE to assess LVOT

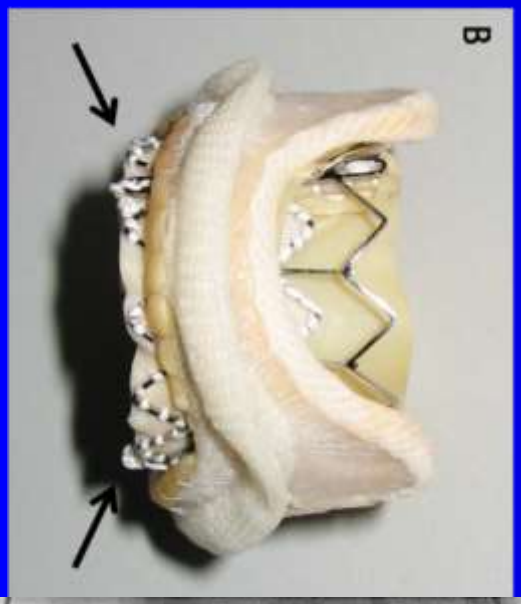


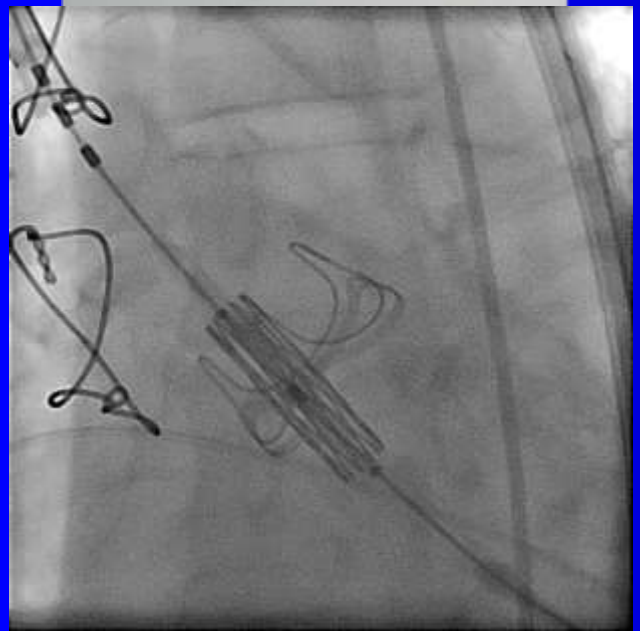
CT to assess risk of LVOT obstruction



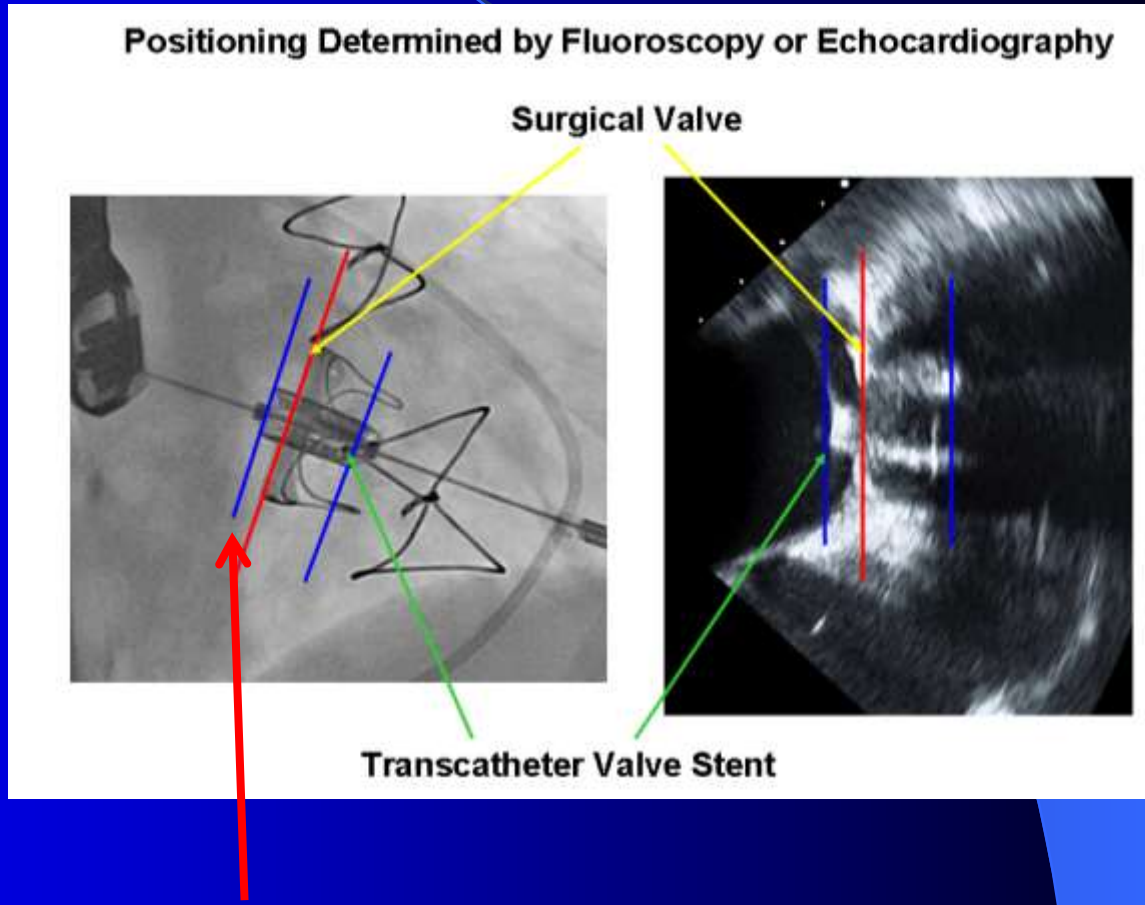


Optimal Position of THV





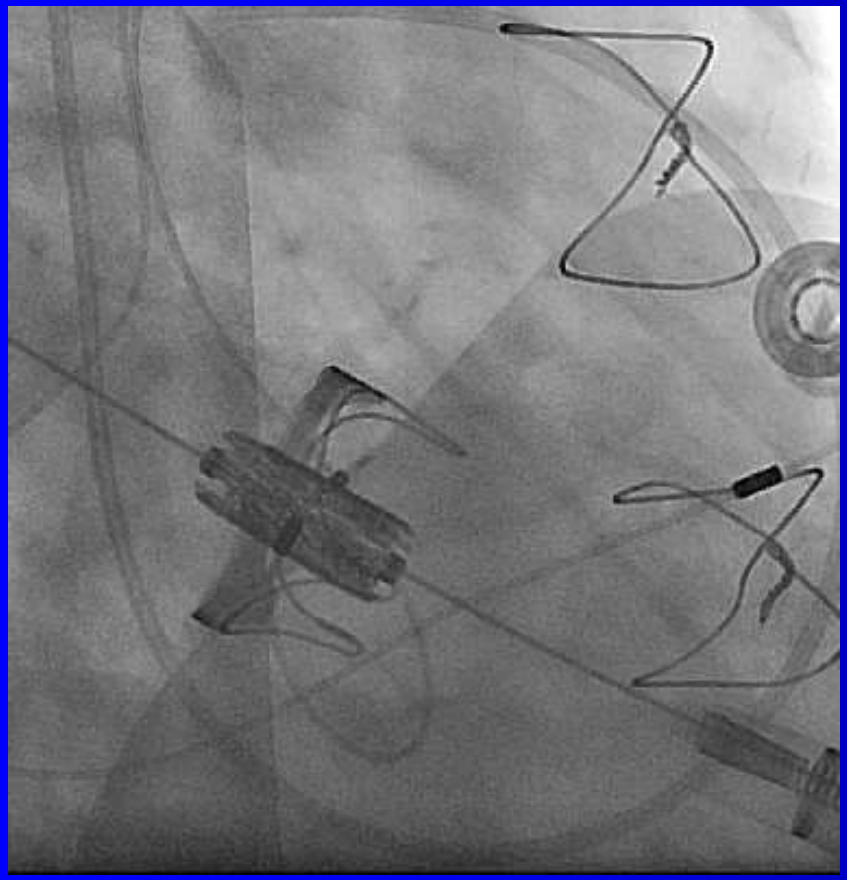
Positioning Determined by Fluoroscopy or Echocardiography

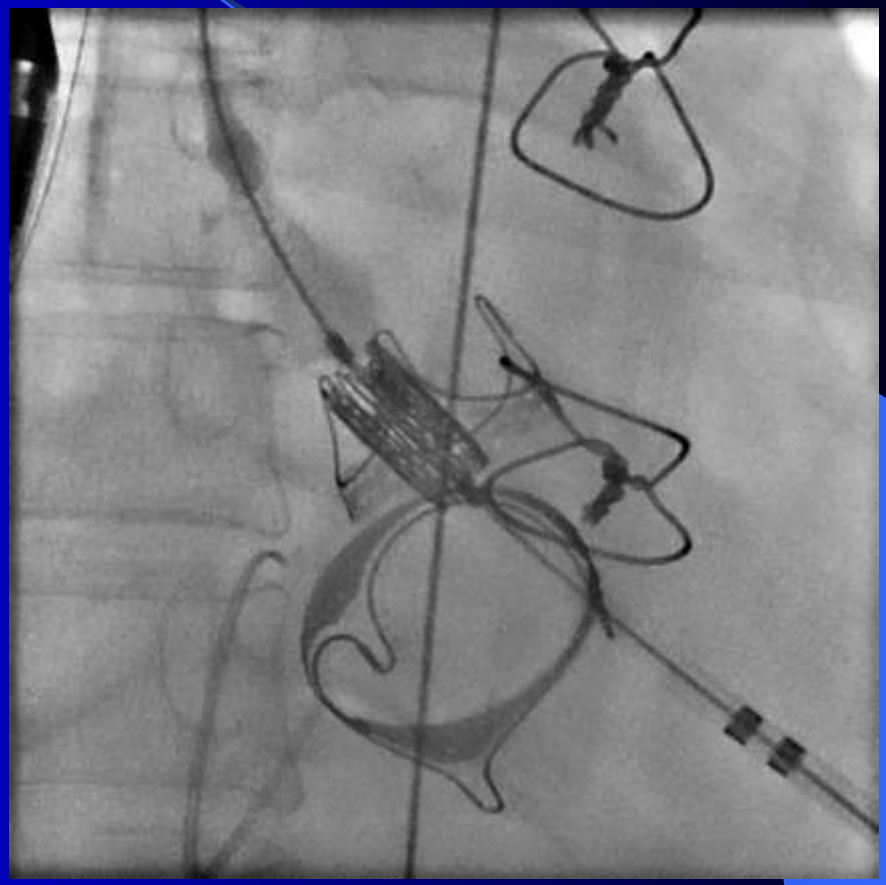


2-3 mm

Slightly Oversizing

Outflow side > inflow side or a visible waist





Clinical Experience in double aortic and mitral VinV

- 10 year clinical experience at our center
- CT assessment is essential
- Apical approach is excellent, performing aortic v-in-v first
- Extremely low mortality and morbidity
- Excellent clinical outcomes
- Become a favorable therapy for failed double aortic and mitral tissue valves at our center
- Anticoagulation with ASA + Warfarin


THANKS!