Transcatheter Mitral Valve Repair and Replacement: Case Examples

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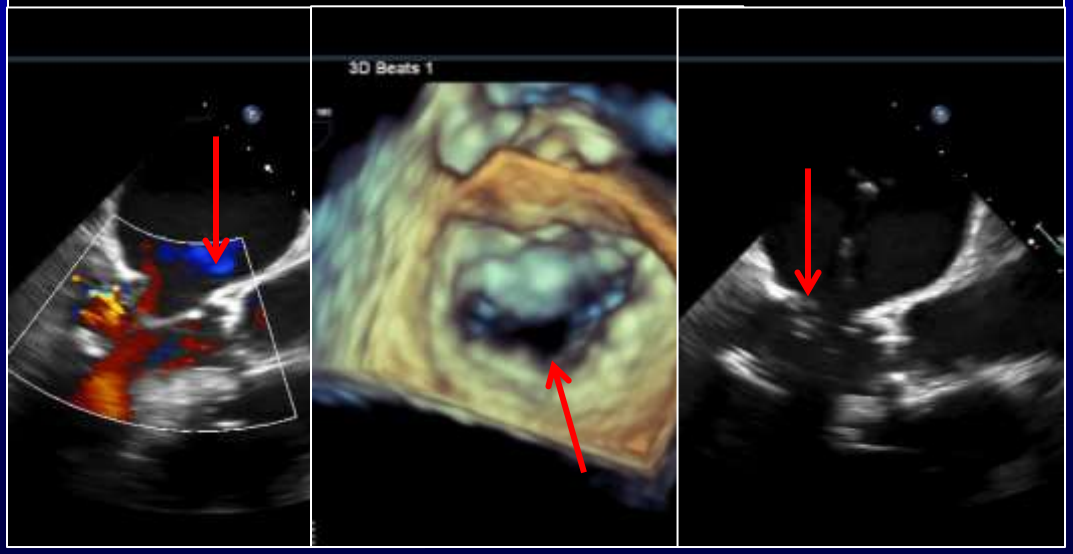
66 y/o male with severe AS and severe MR (NYHA 3-4)

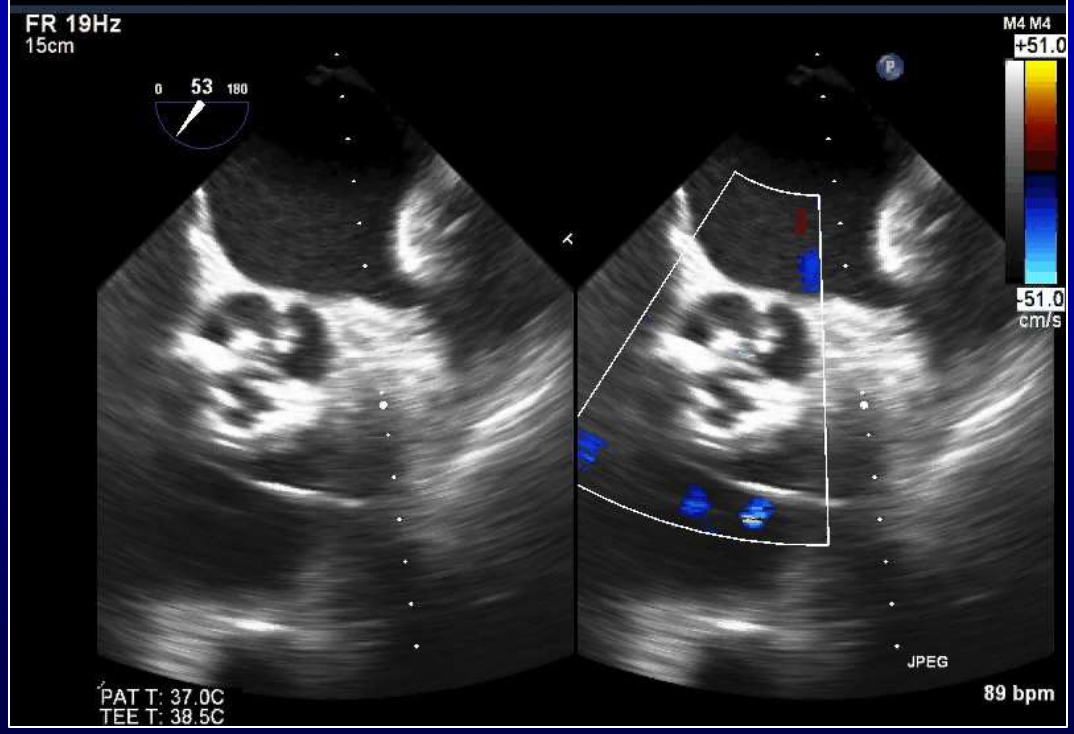
Cardiopulmonary arrest, during anesthesia induction for dual valve surgery, likely secondary to severe pulmonary hypertension (PAP 80)

Patient referred for transcatheter management of severe MR and severe AS

Severe MR with flail P2

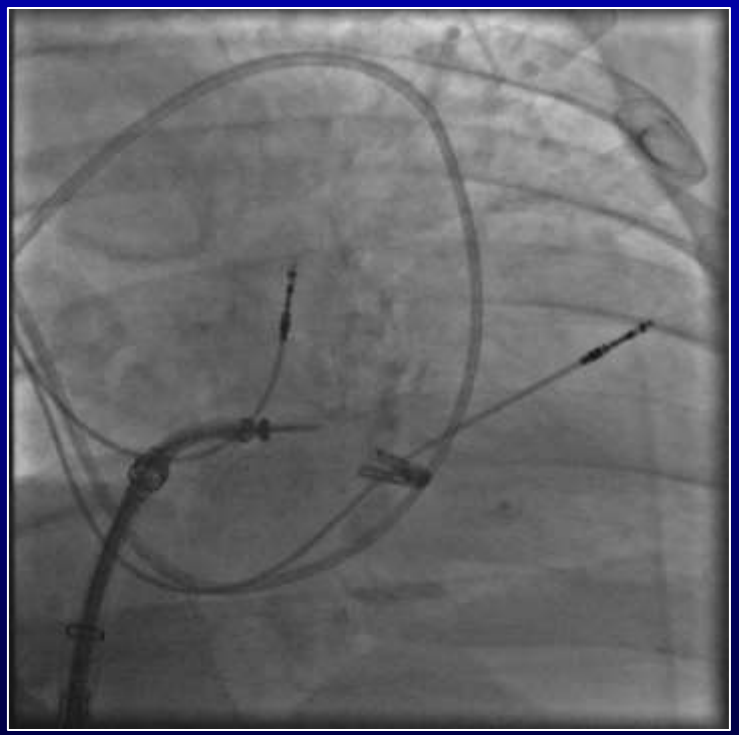


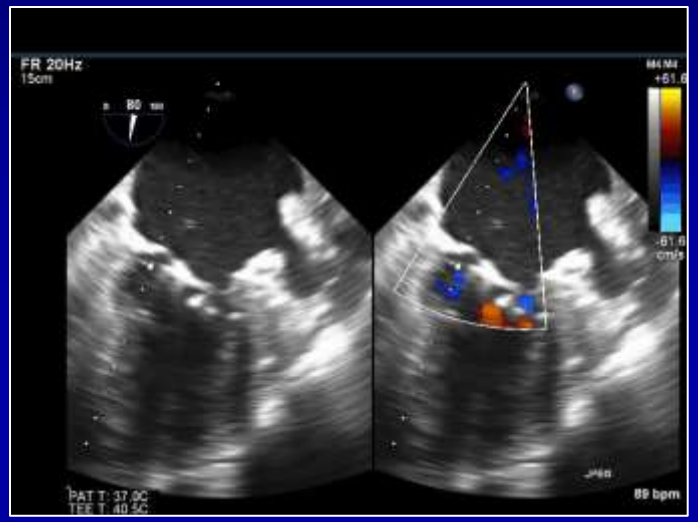
Severe AS

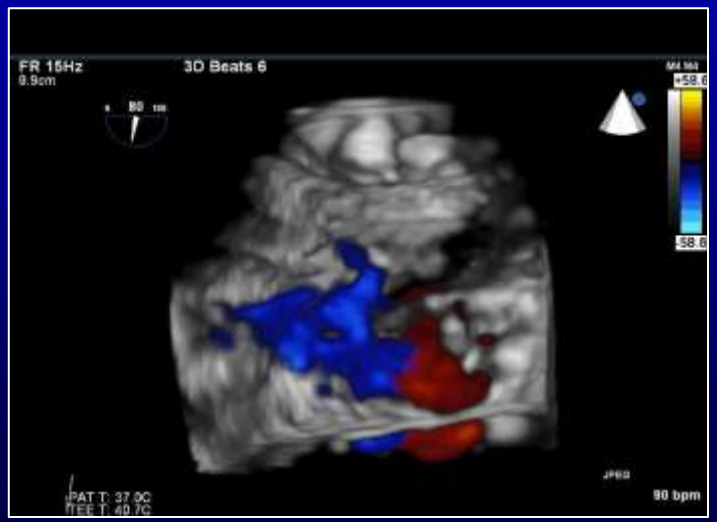


Simultaneous MitraClip and TAVR performed

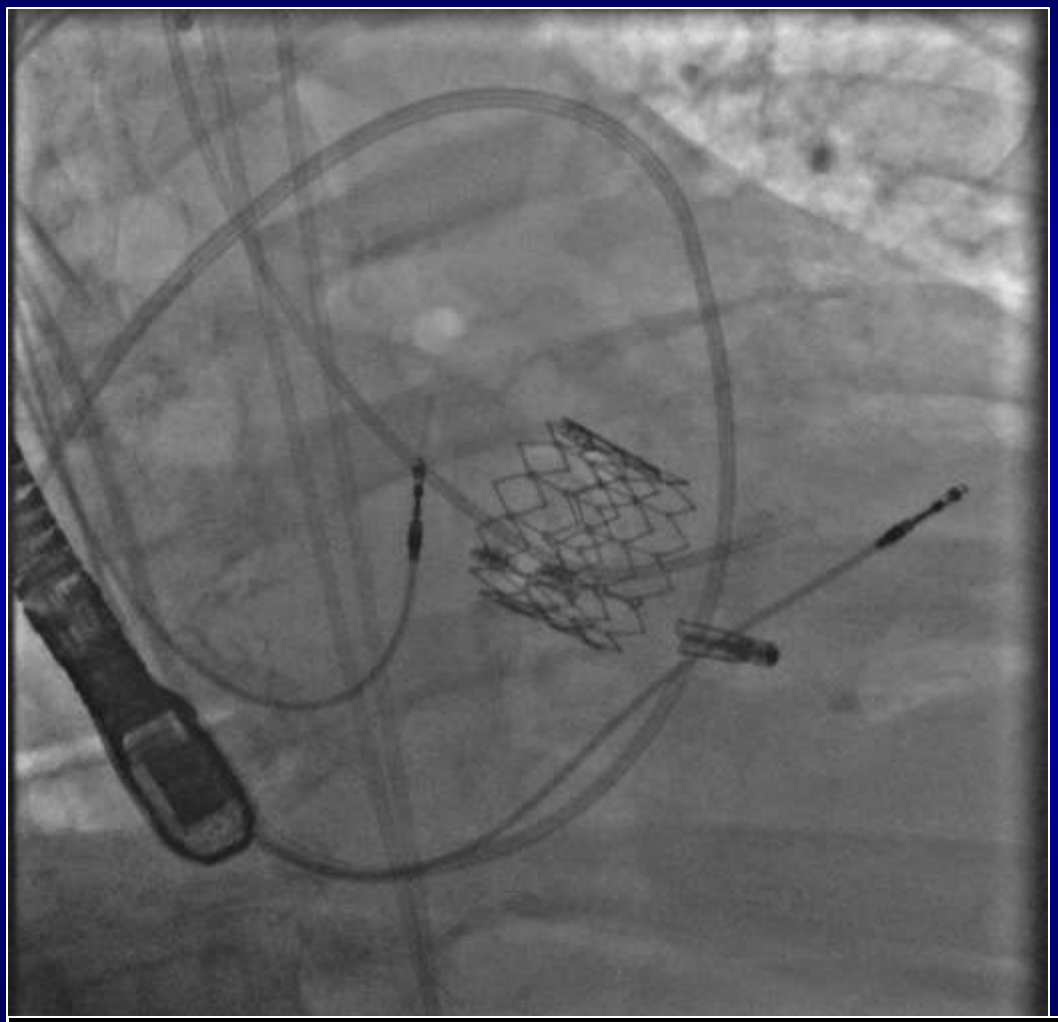
MitraClip deployment with trivial residual MR



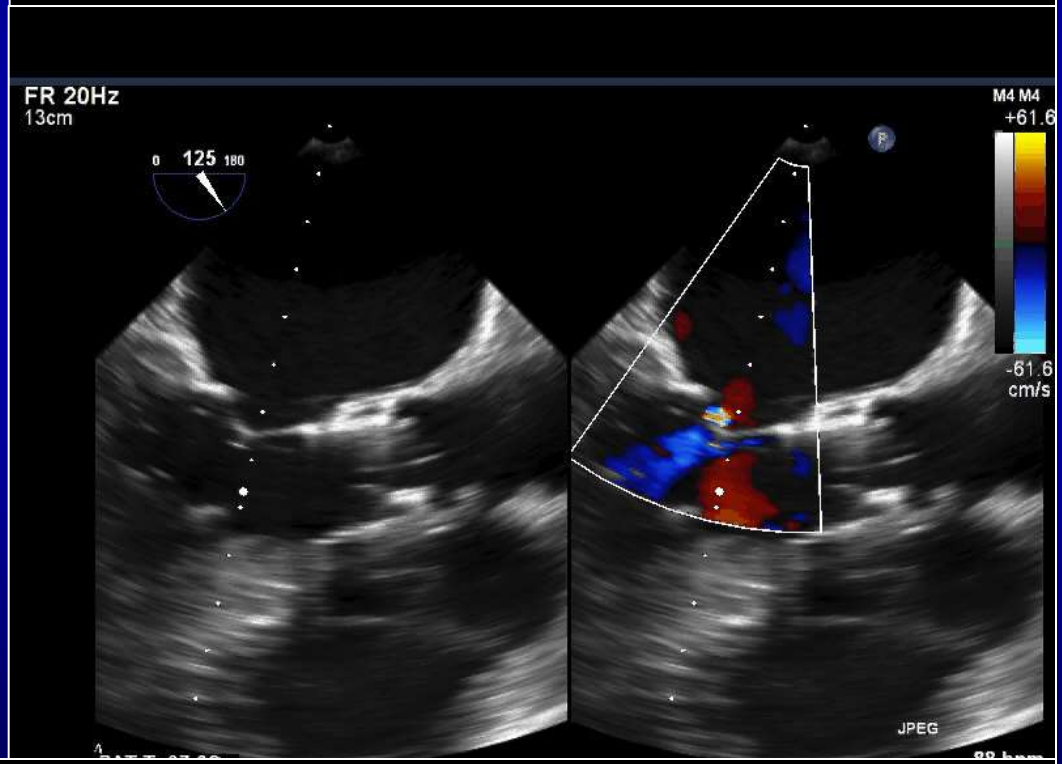




Simultaneous MitraClip and TAVR performed



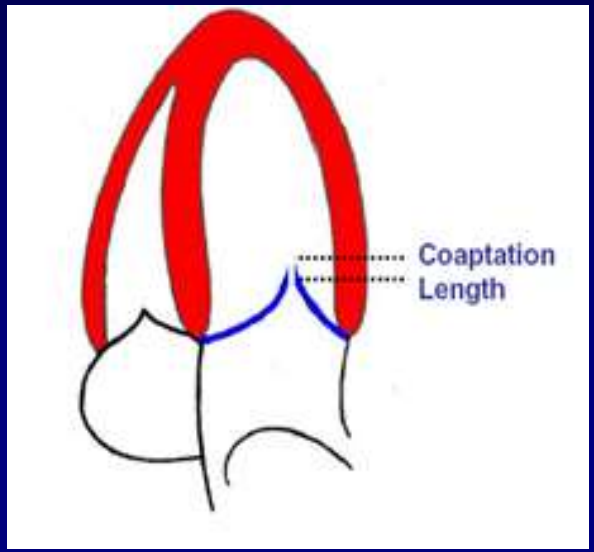
29mm Sapien-XT deployment with trivial residual AR

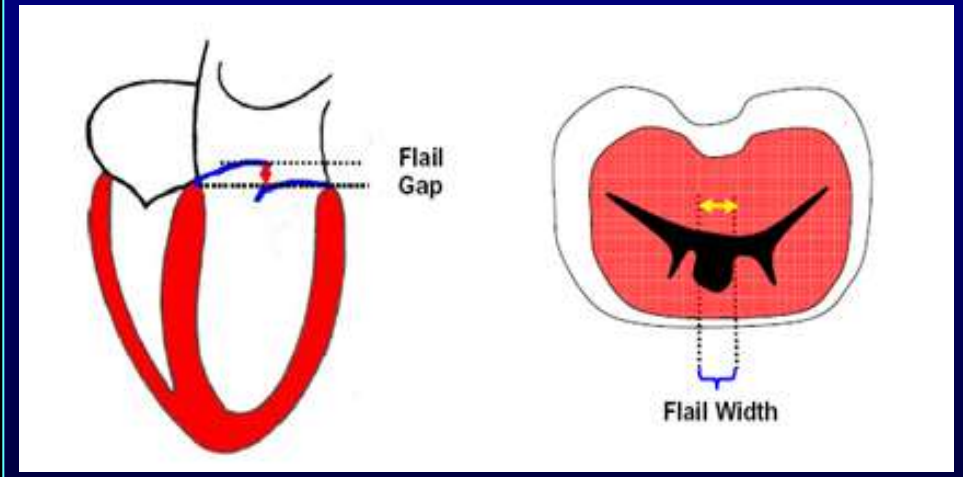


Patient discharged to home on post-procedure Day 6
NYHA Class II at 1 month

Case Selection: Suitable Anatomy

- Non rheumatic MR originating from a localized area of the valve
- Etiology: degenerative or functional
- Sufficient leaflet tissue for mechanical coaptation
- Valve anatomic exclusions
  - Flail gap >10mm
  - Flail width >15mm
  - Calcified leaflet
- MVA ≥ 4 sq cm

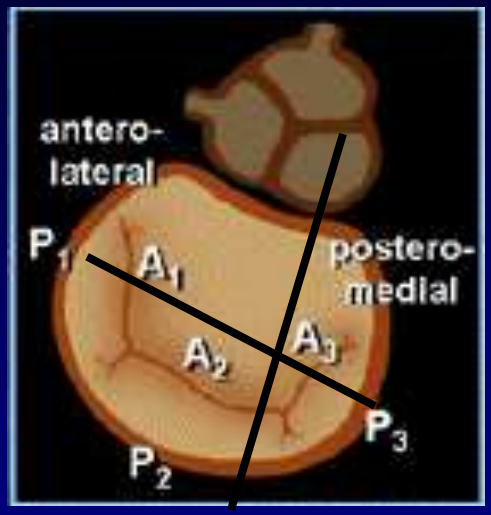


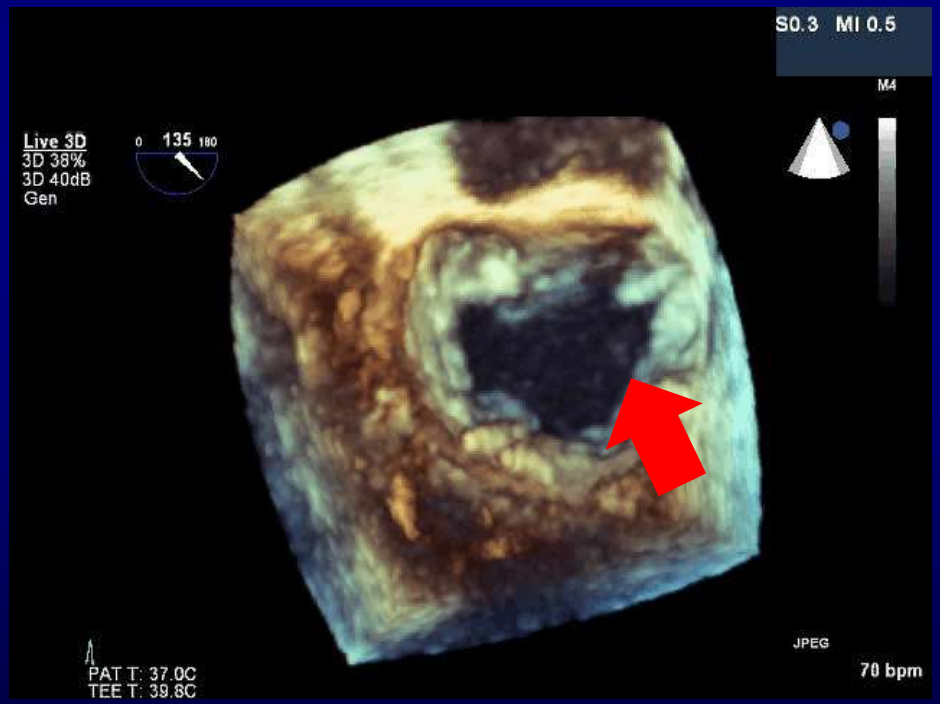


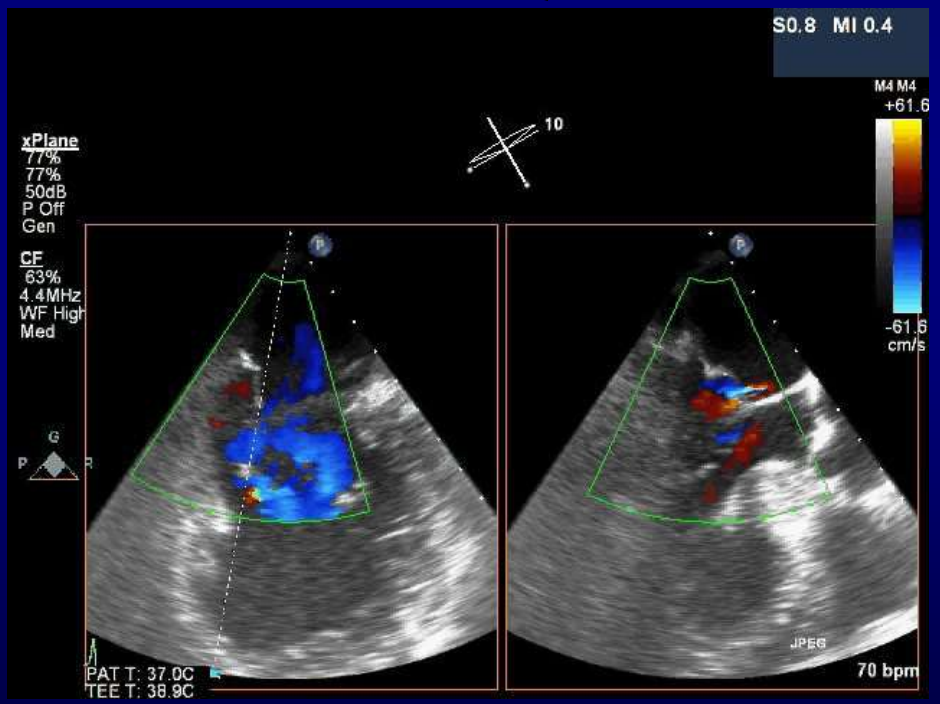
Expanded indications of the MitraClip: Beyond the EVEREST criteria

- A1P1 or A3P3 flail or prolapse
- Failed surgical repair
  - Ring annuloplasty, or snapping of artificial chord
- HOCM : Systolic anterior motion with MR
- End stage heart failure with MR
  - Delay heart transplantation or VAD

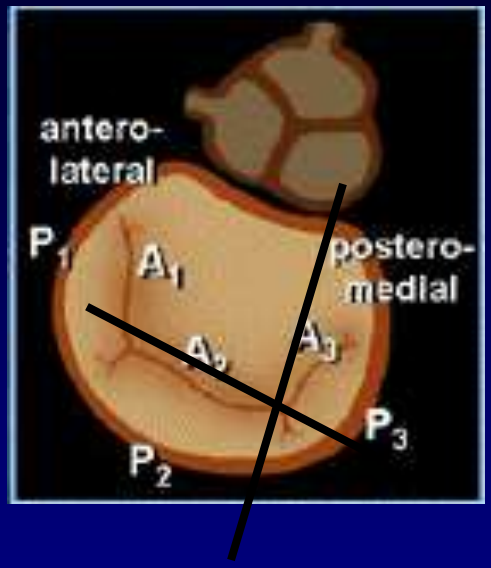
Flail P2/P3 segment

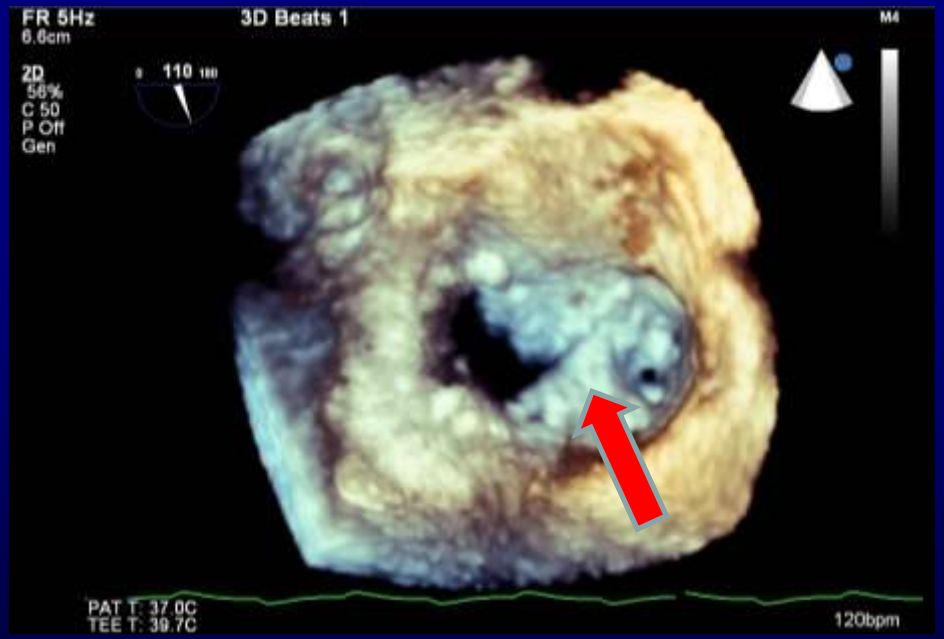


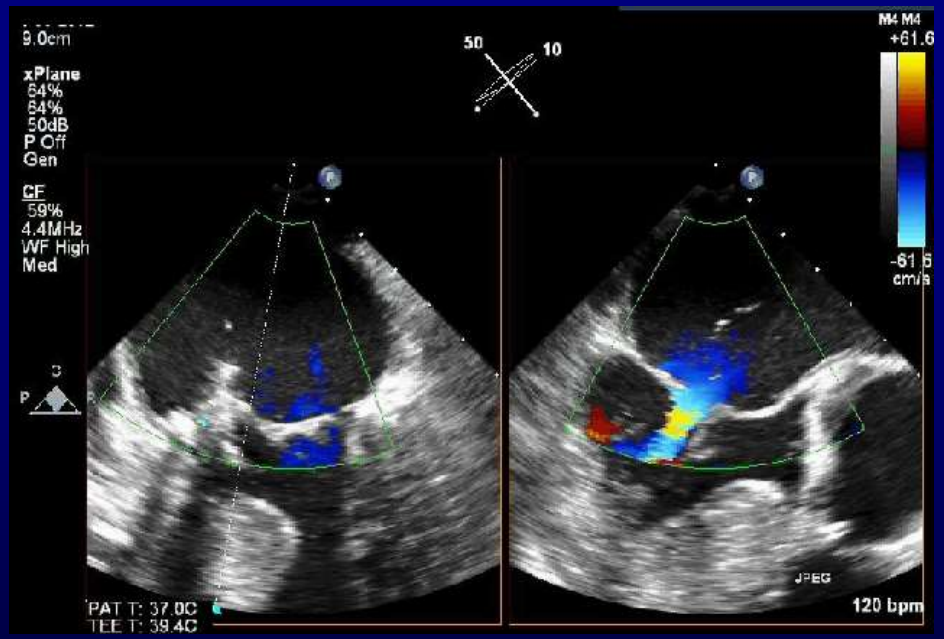




MitraClip for a Flail P2/P3



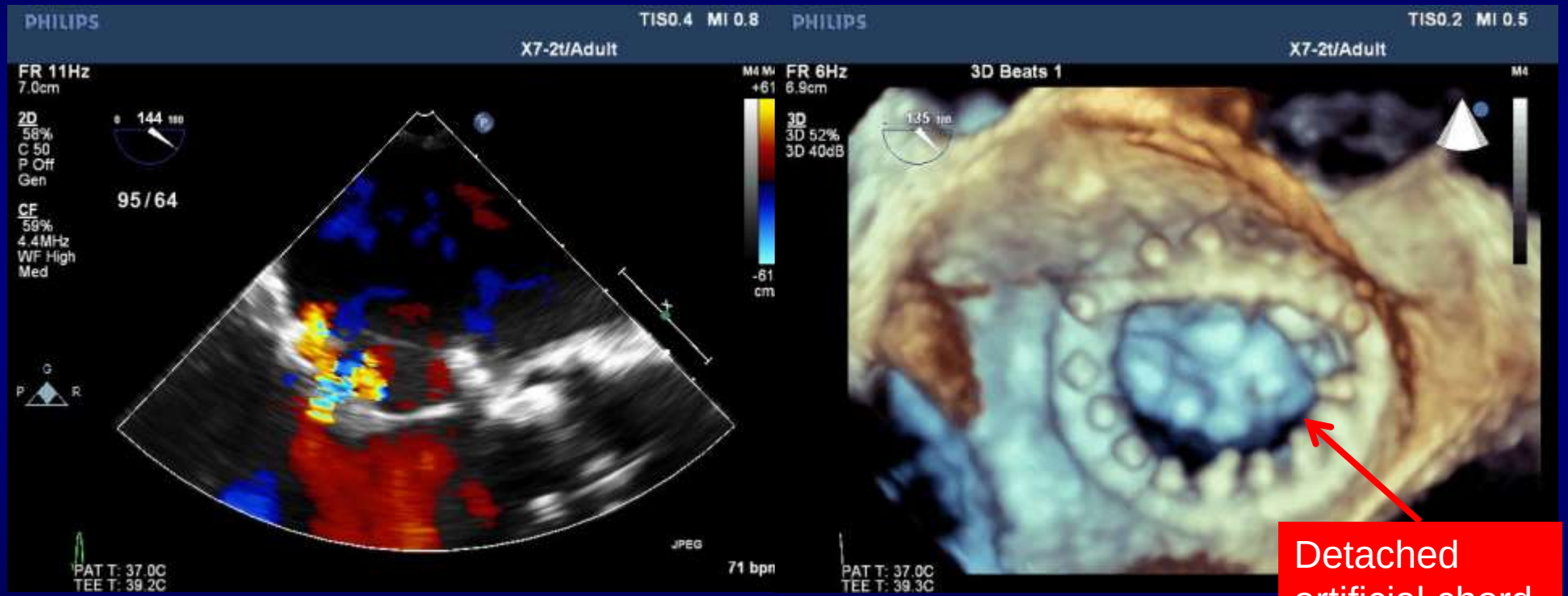




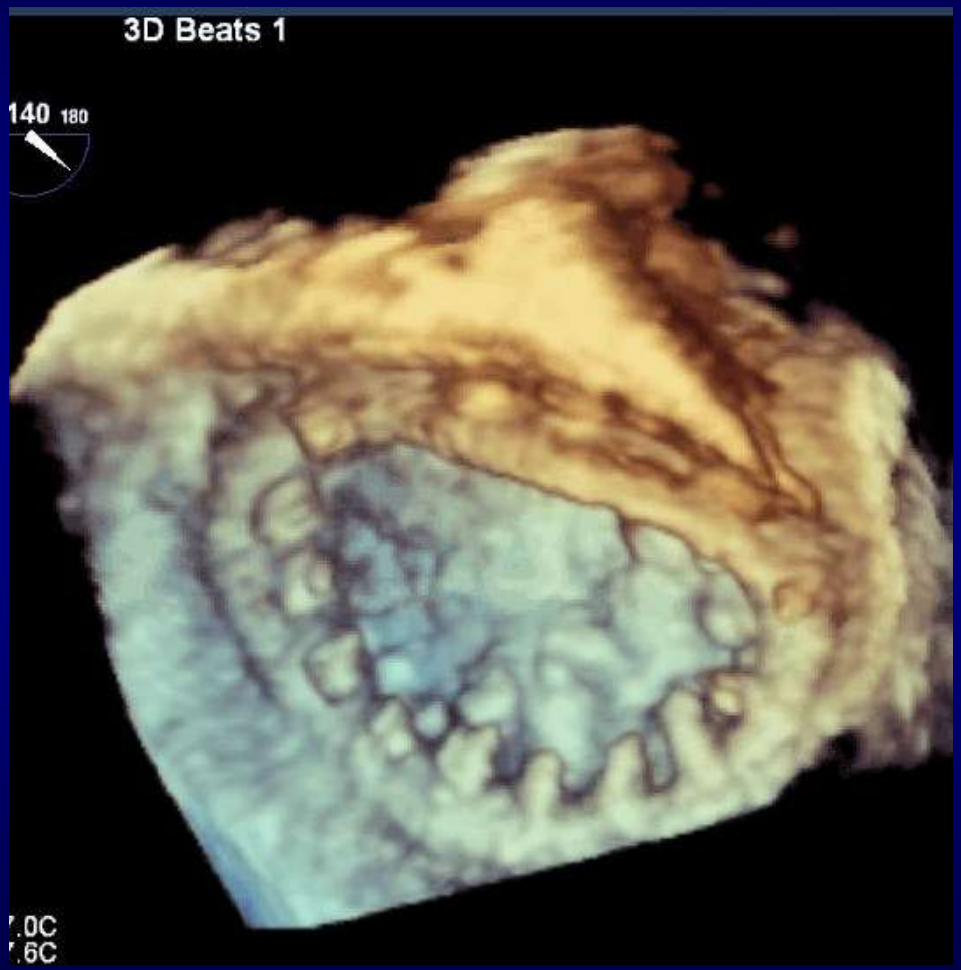
Cedars-Sinai Medical Center

71 yr old male with previous CABG underwent Mitral valve repair (artificial chords and surgical ring)

Presents: Shortness of breath and loud systolic murmur 10 days after surgery



One clip > Trace MR



- Both **patient and surgeon** became less short of breath
- Patient discharged home next morning

Case 1

70 year-old Male

Presented at 8:30 AM

Sudden onset shortness of breath for last 3 weeks

Admitted in hypotension and VT 3 days ago

Acute renal failure

Cardiogenic shock needed inotropes

Urgent treatment

Past Medical History

- HIV
- HTN
- Afib
- Prior MV repair in 2008 now with severe MR and posterior flail

STS Risk of Mortality

for Repair	26.6%
for Replacement	39.2%

Pre procedural condition

BP 90/60 on low dose dopamine

JVP 20 cm

Urine output < 100 cc in 24 hours

Holosystolic murmur

Normal coronary arteries by CTA

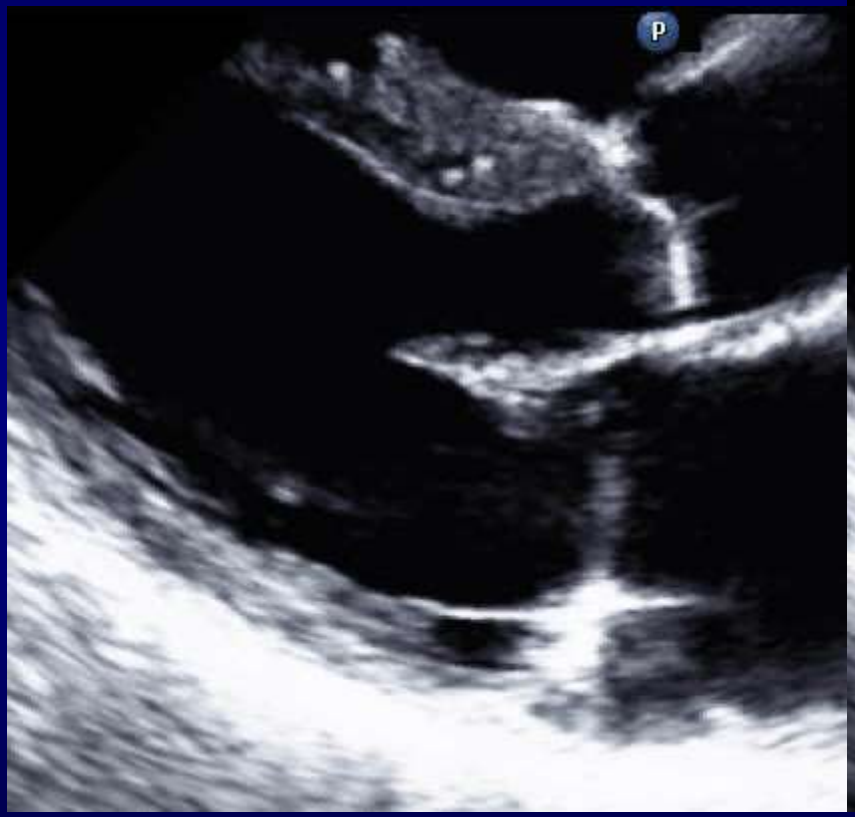
Labs

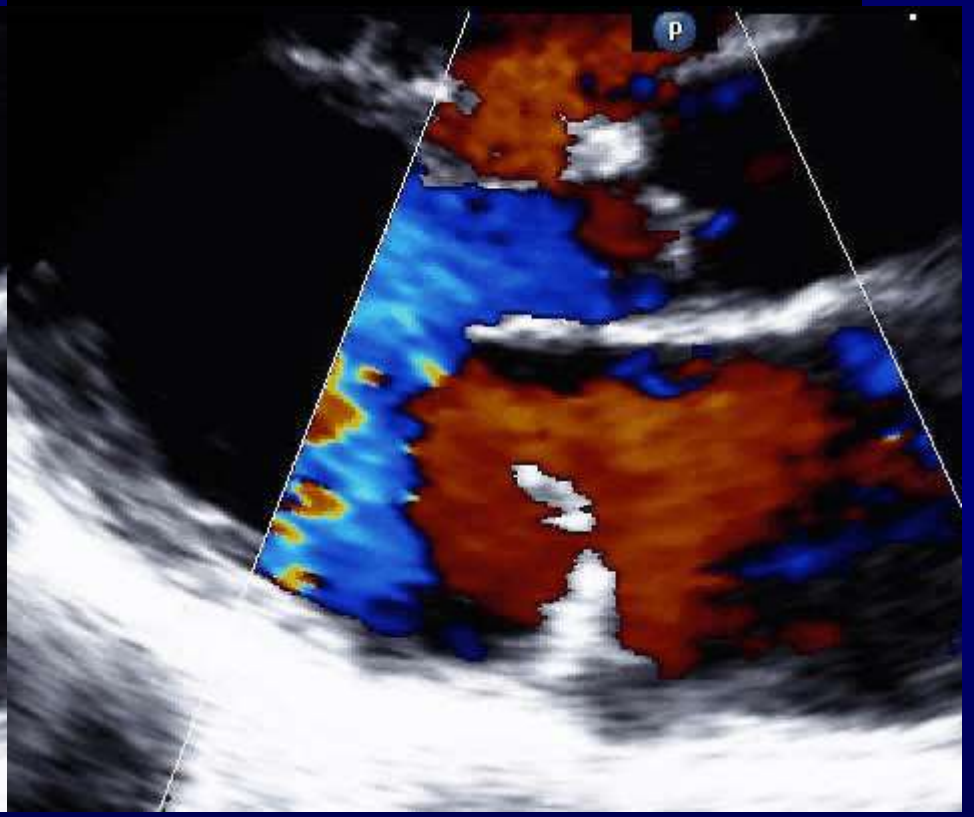
Hemoglobin	12.6 g/dl
WBC	7200 /mcL
Creatinine	4.2 mg/dl
Bilirubin	3.8 mg/dl
ALT	933 U/L
AST	1145 U/L

Baseline TTE:

Long axis view

Dd/Ds = 58/44 mm,
LVEF = 56%,
LA diameter = 55 mm
Estimate PA pressure 49 mmHg



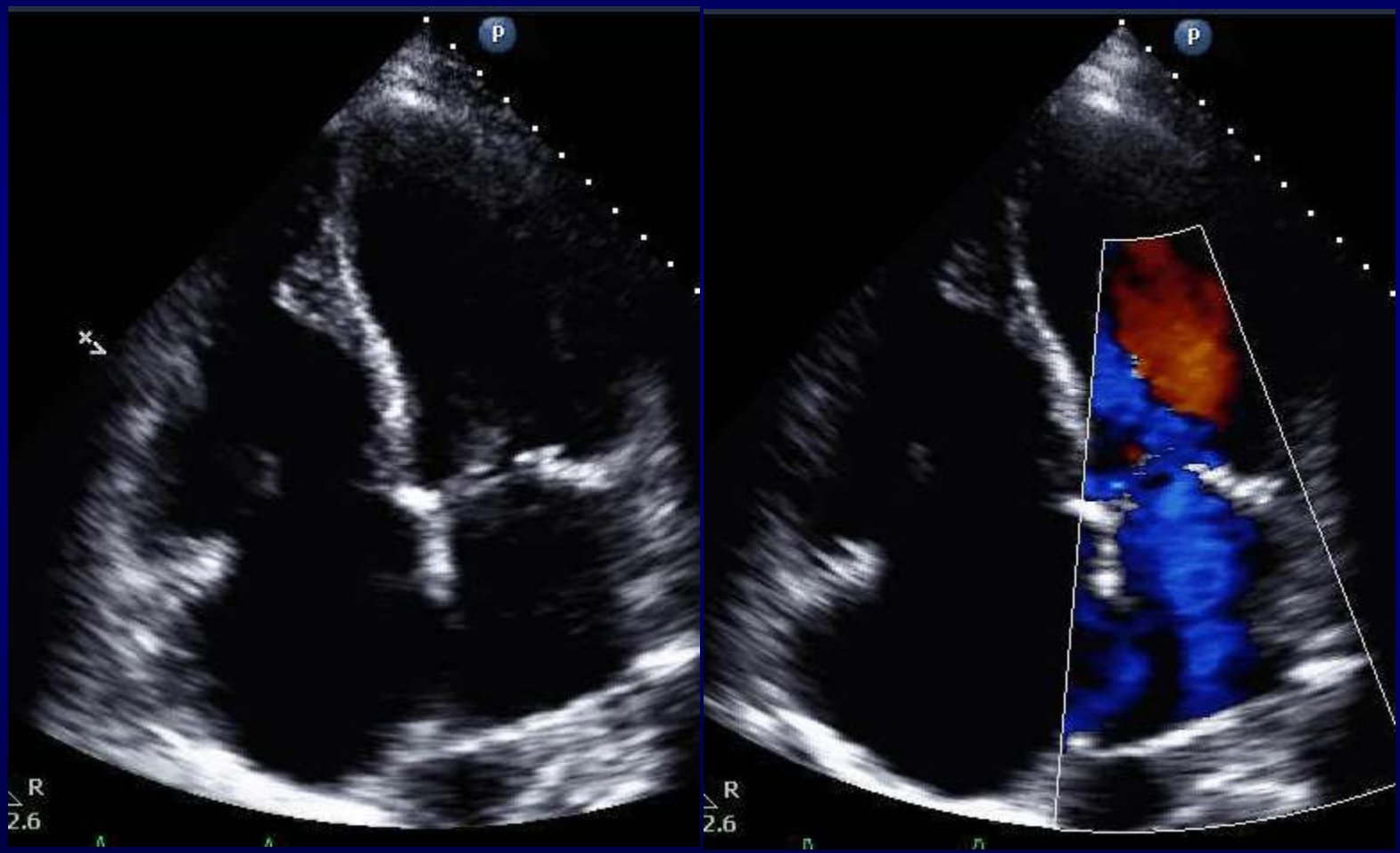


Post repair with an annuloplasty ring
Thickened both mitral leaflets and annular calcification
Anterior directed severe MR jet due to flail of the posterior mitral leaflet

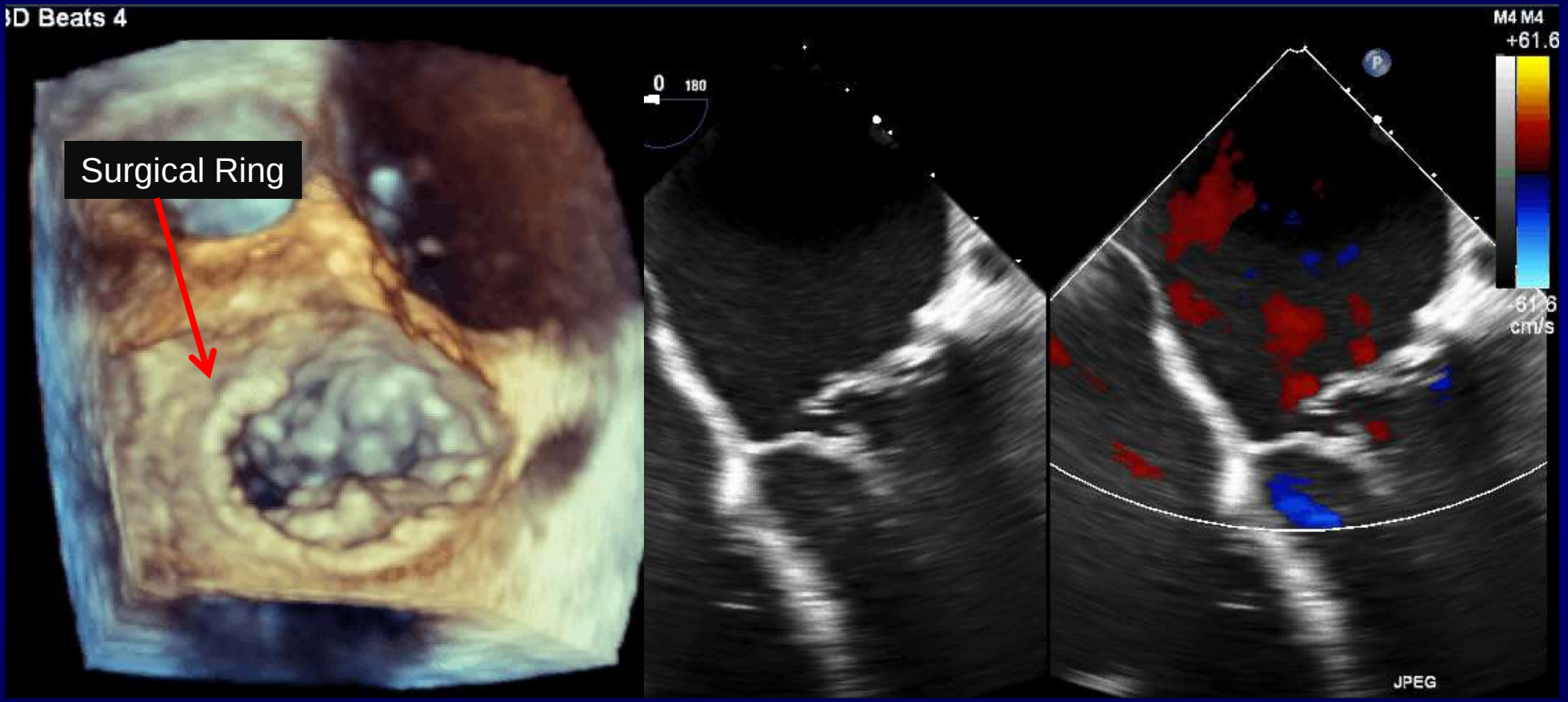
Baseline TTE:

4 Chamber view

MV E/A 2.0,
TMPG peak/mean 6.3/2.1 mmHg,
MR EROA 0.56cm^2



Previous procedure TEE

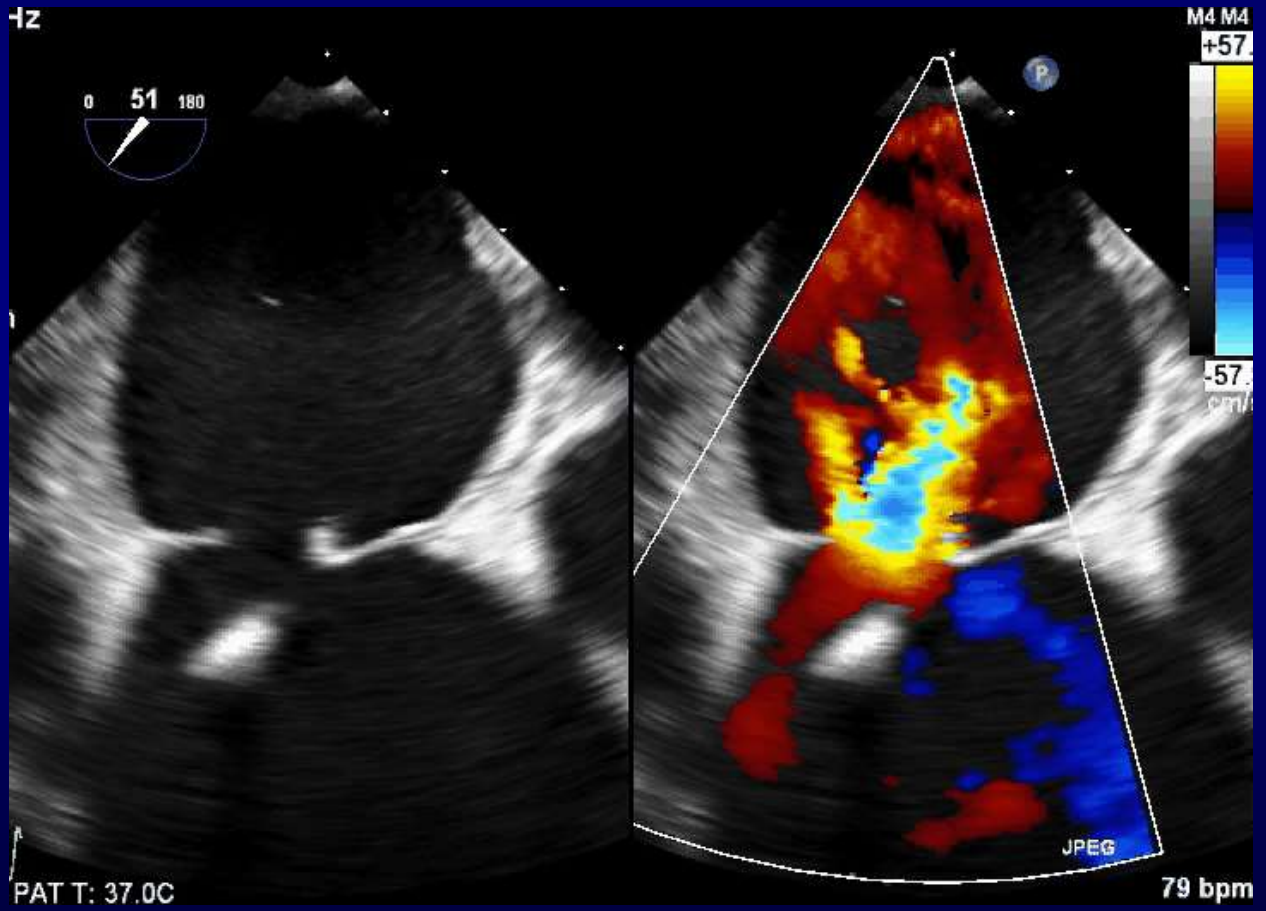


Transmitral mean gradient = 2 mmHg

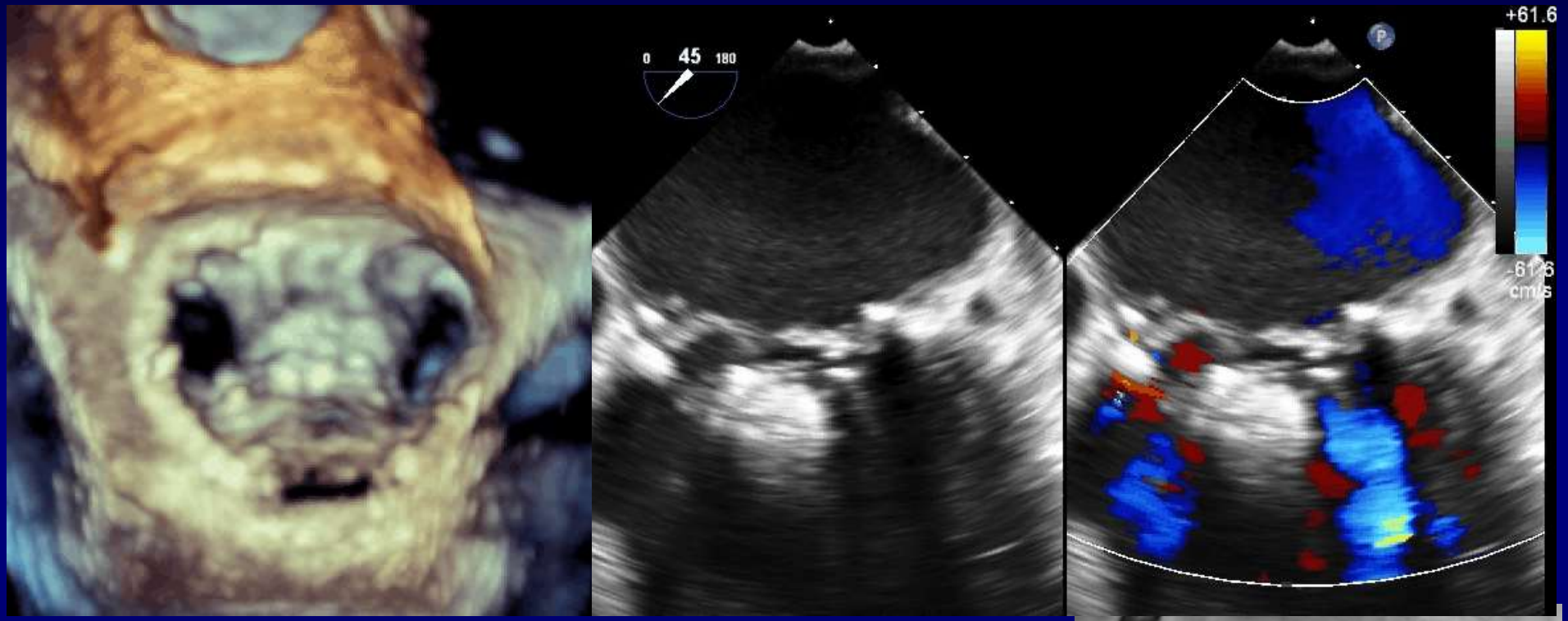
Procedure

Following septal puncture, BP 78/40 mmHg, SpO_2 45%

Iatrogenic right-to–left ASD shunt



Post 3 Clips TEE

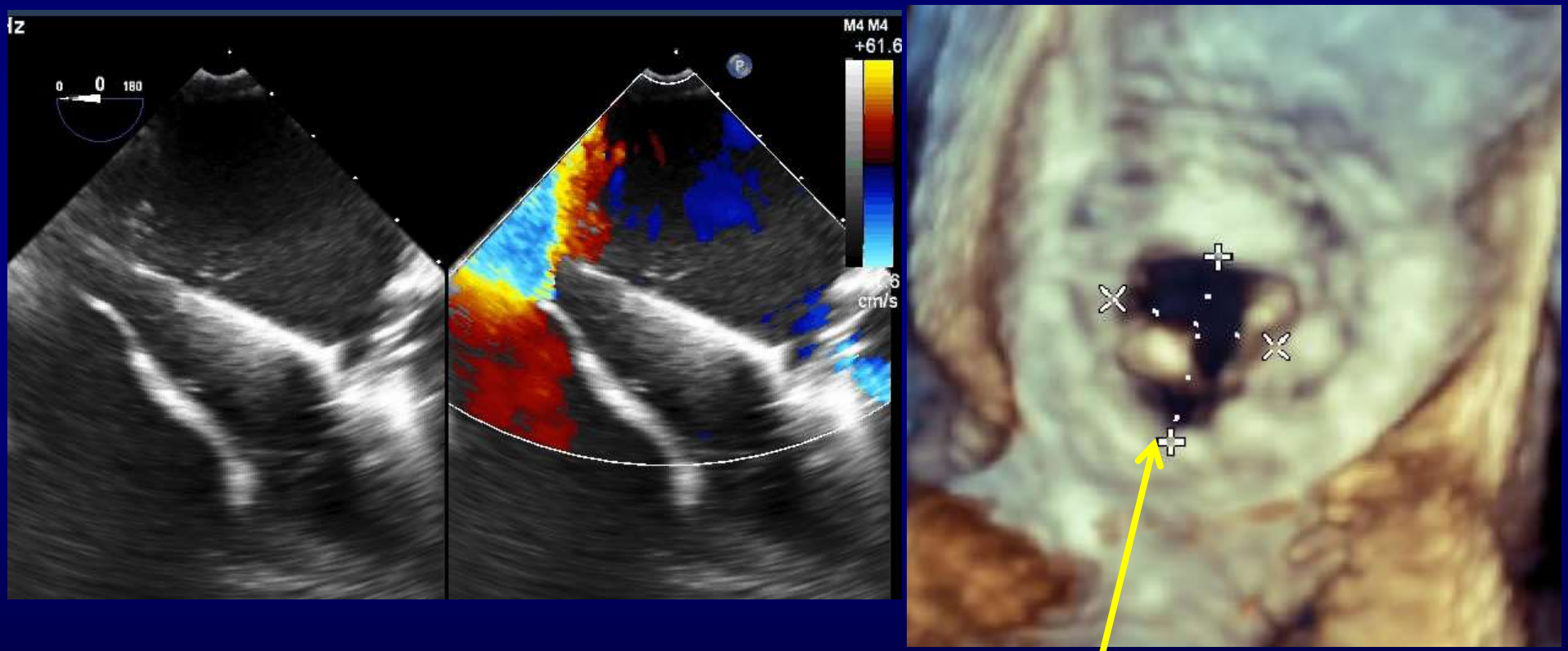


3 MitraClips in A2-P2 segment
MR was reduced from severe to trace

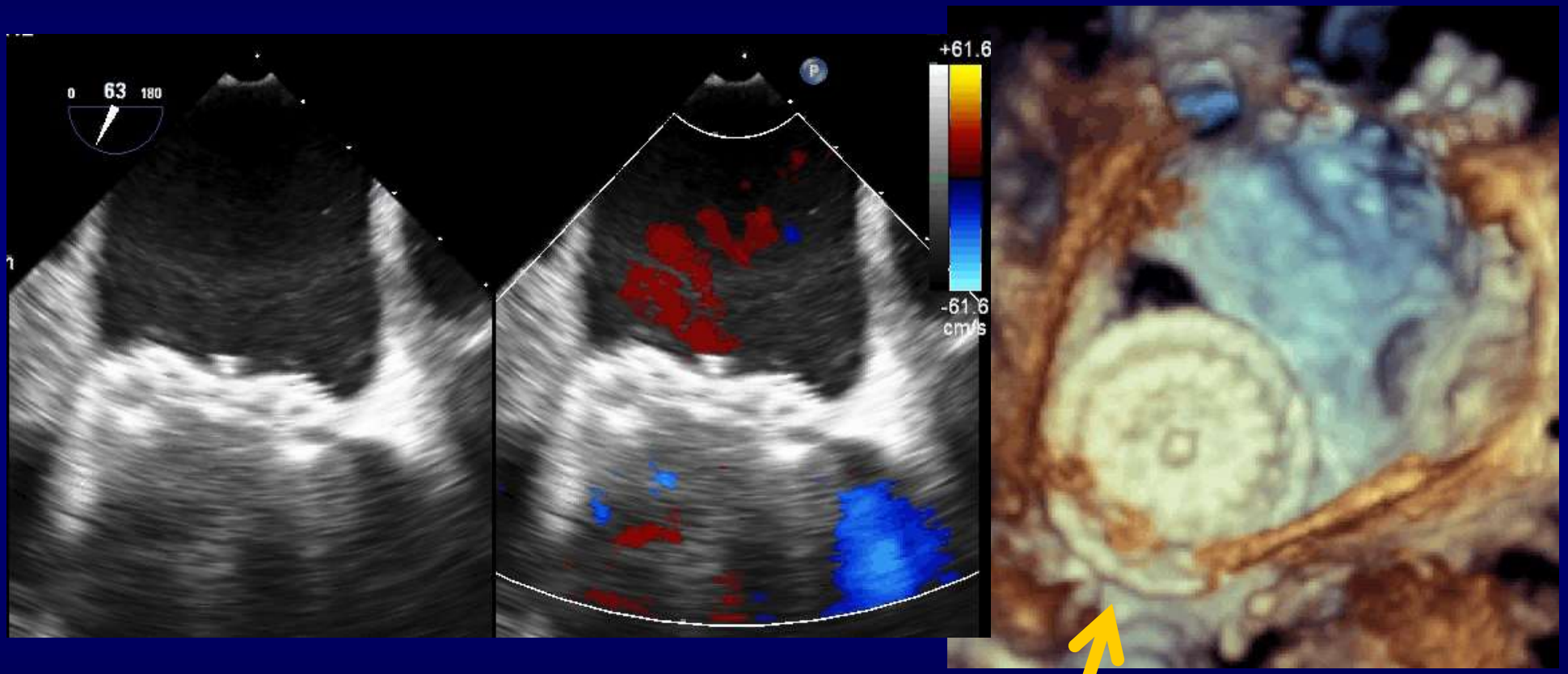
Transmitral mean gradient = 5 mmHg

Assessment of Septal Hole

Right to Left shunt, Hole size: 1.6x1.8 cm



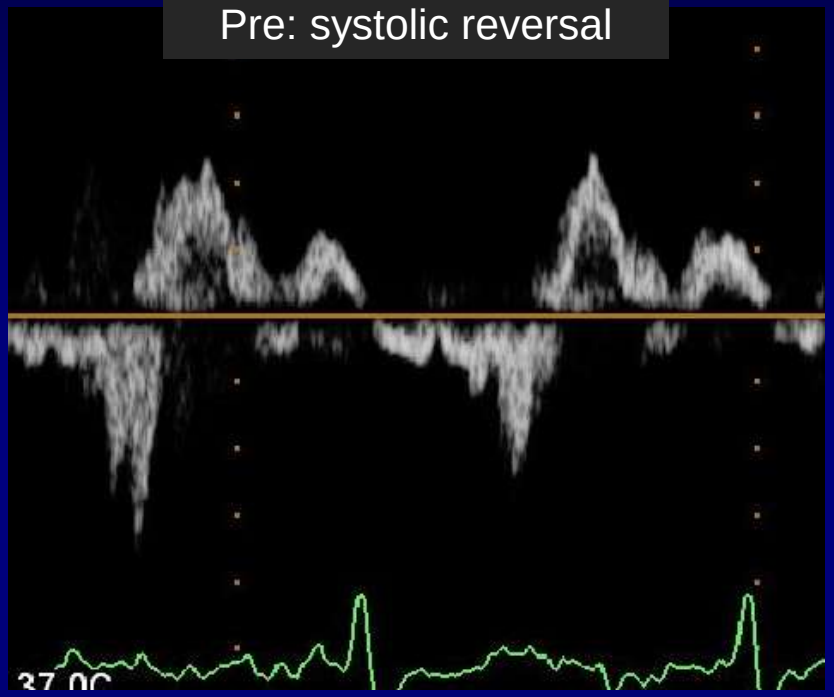
Post ASD occluder 22-mm device



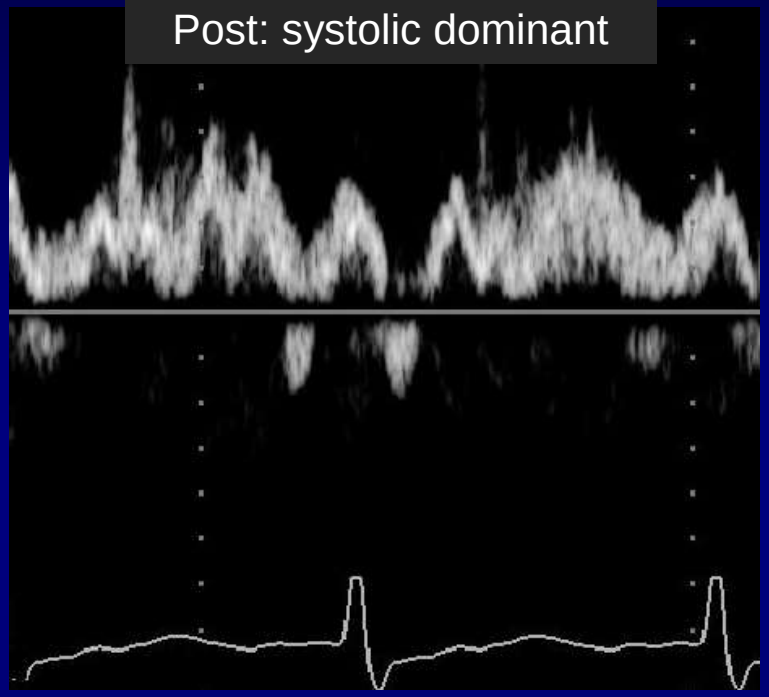
Post-procedural Assessment

Pulmonary vein flow

Pre: systolic reversal



Post: systolic dominant



Pressure Study

LA pressure 55 → 25 mmHg (V wave)

22 → 16 mmHg (mean)

CO 6.4 → 9.3 L/min,

CI 3.5 → 5.2 L/min/m^2

Mean trans mitral PG 5 mmHg

Post Procedure Hospital Course

Liver and kidney injuries were revealed
Follow up TTE showed trace MR
Discontinued inotropes on POD5
Vital signs were stable
Discharged home on POD7

Labs base line		at Discharge
Hemoglobin	12.6 g/dl	12.1 g/dl
WBC	7200 /mcL	3500 /mcL
Creatinine	4.2 mg/dl	1.5 mg/dl
Bilirubin	3.8 mg/dl	0.9 mg/dl
ALT	933 U/L	189 U/L
AST	1145 U/L	64 U/L

TTE 4ch

Pre

Post

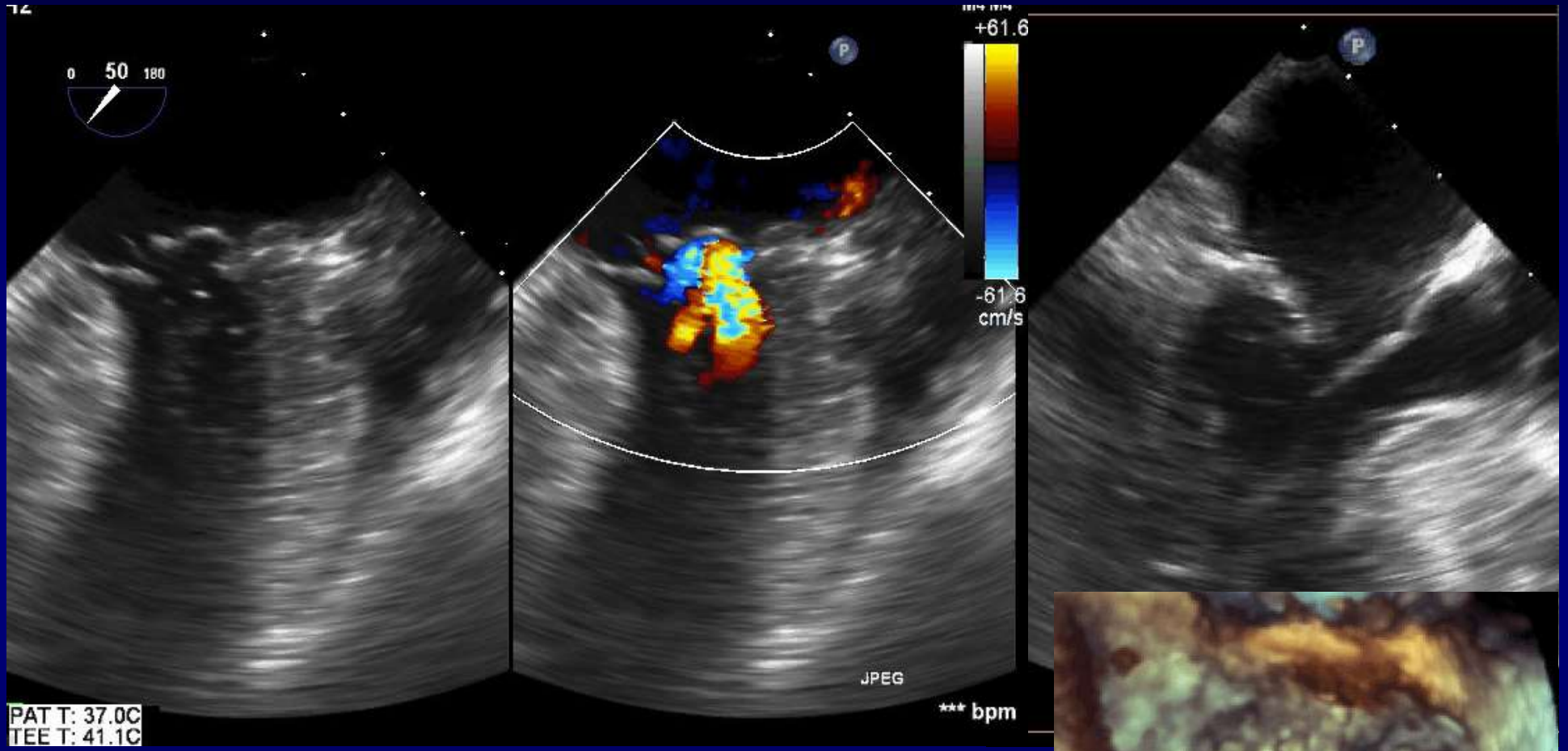
Case 2

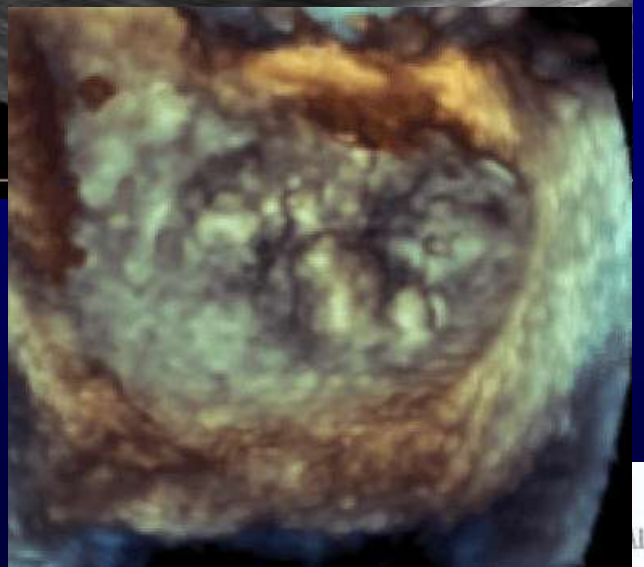
78 year-old Male

History of CAD s/p PCI, Hypertension, DM, Hyperlipidemia,

Acute left heart failure and cardiac arrest
Pt was resuscitated
IABP was inserted
TEE confirm severe MR due to P2 frail
Taken to OR found porcelain aorta then chest was closed
Transferred for Transcatheter treatment to our hospital

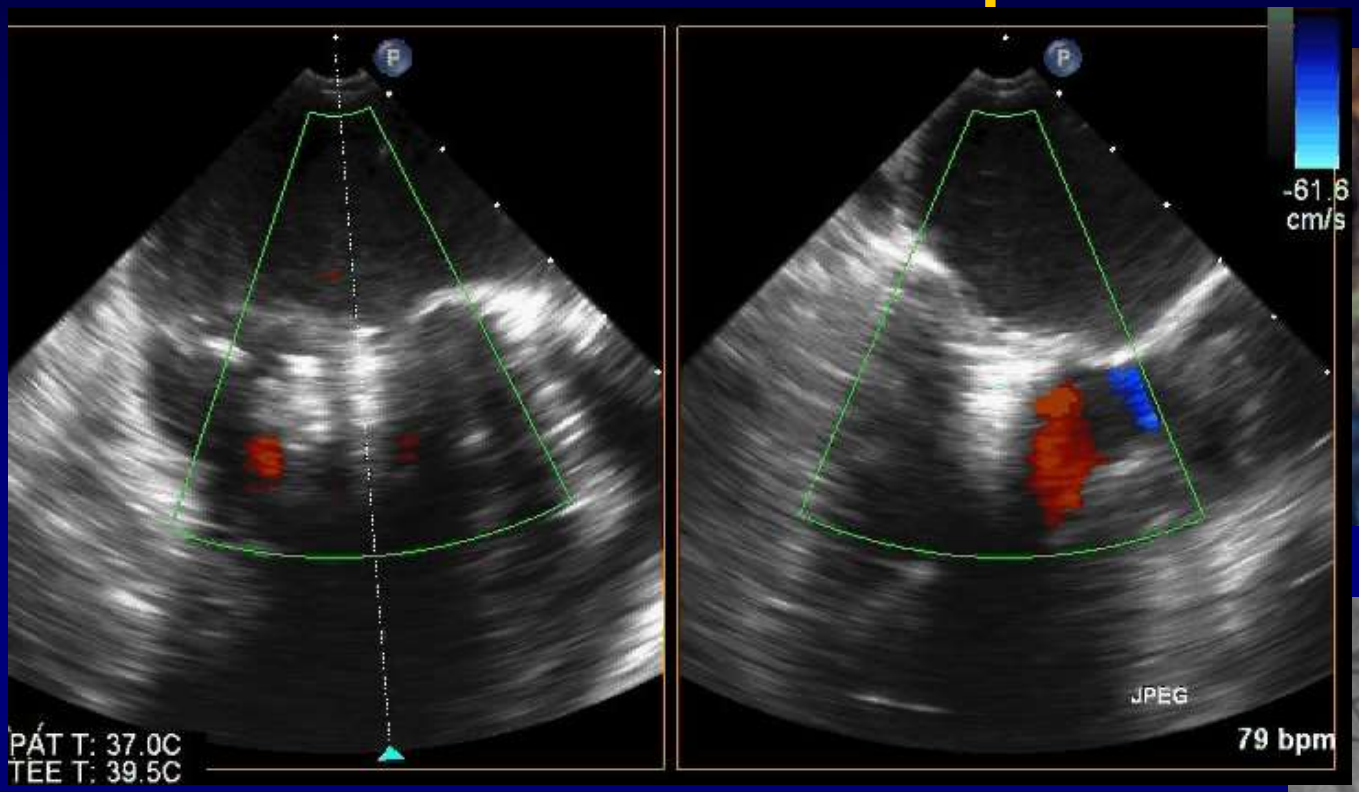
Baseline TEE





CO: 3.2 L/min, CI: 1.7 L/min/m^2
LA pressure: V wave 16, mean 11
Transmitral mean gradient = 2 mmHg

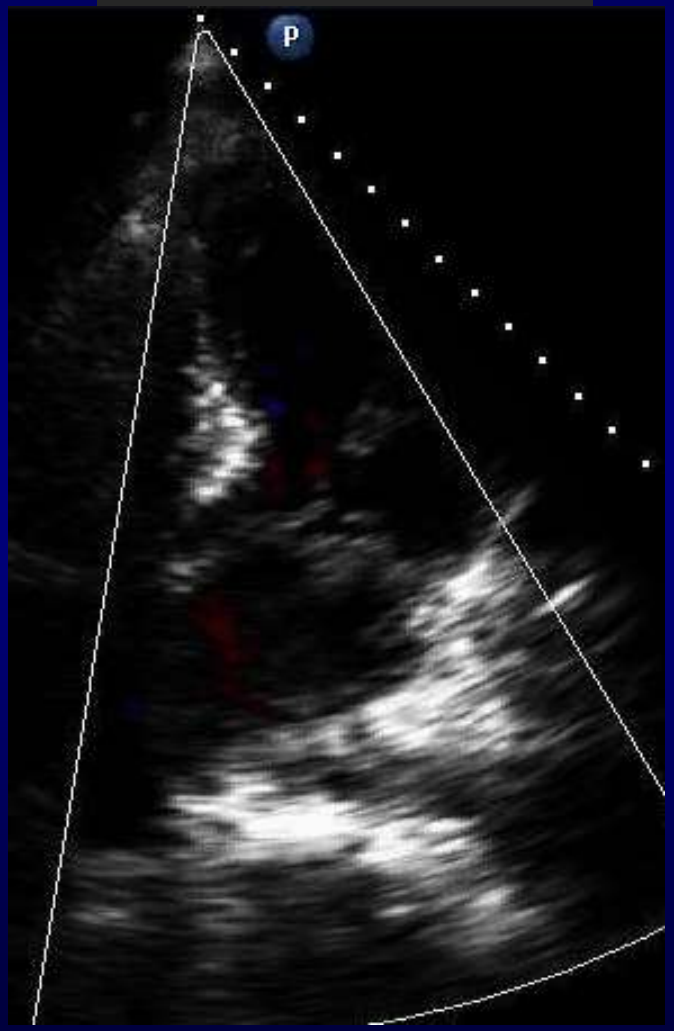
Post 2 Clips TEE



2 MitraClips in A2-P2 segment
MR was reduced from severe to trace
CO: 4.4 L/min, CI: 2.3 L/min/m^2
LA pressure: V wave 11, mean 9
Transmitral mean gradient = 3 mmHg

TTE 4ch

Pre



Post

Conclusion

- MitraClip can be a life saving procedure in selected patients in cardiogenic shock.
- The procedure is safe even in near death situation.

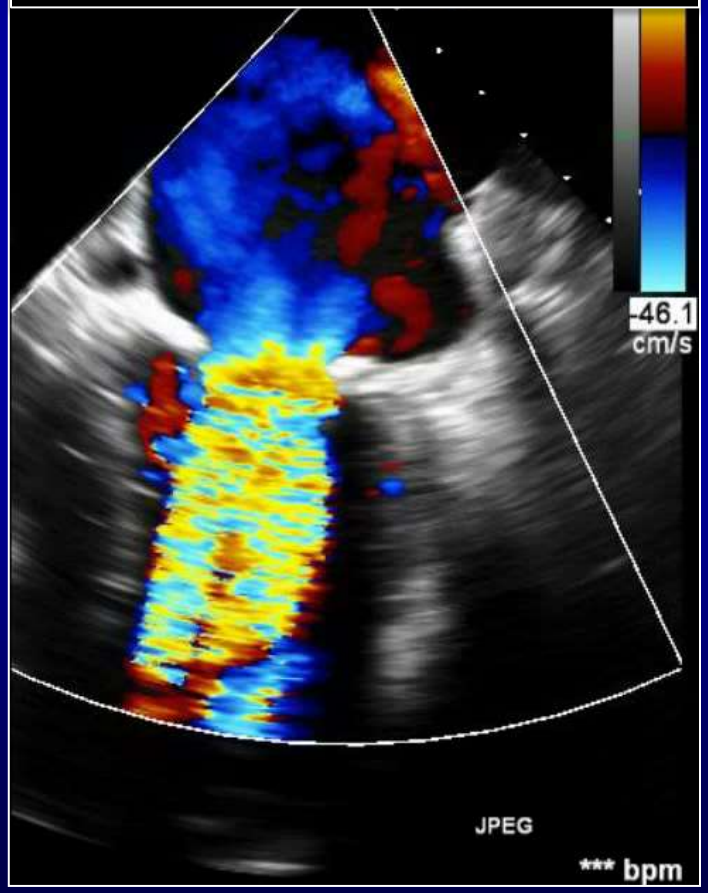
49 y/o female referred for percutaneous management of mitral and aortic valve disease

- Severe mitral stenosis and moderate-severe mitral regurgitation
- Diastolic congestive heart failure, NYHA III
- Severe pulmonary hypertension, on supplemental oxygen at night, 2 L
- End stage renal disease, on hemodialysis
- Thrombocytopenia (platelet count 80)
- Occluded SVC
- Central retinal occlusion
- Transient ischemic attack
- Diabetes mellitus
- Frequent pneumonias
- Frailty

Patient deemed inoperable for surgical valve replacement

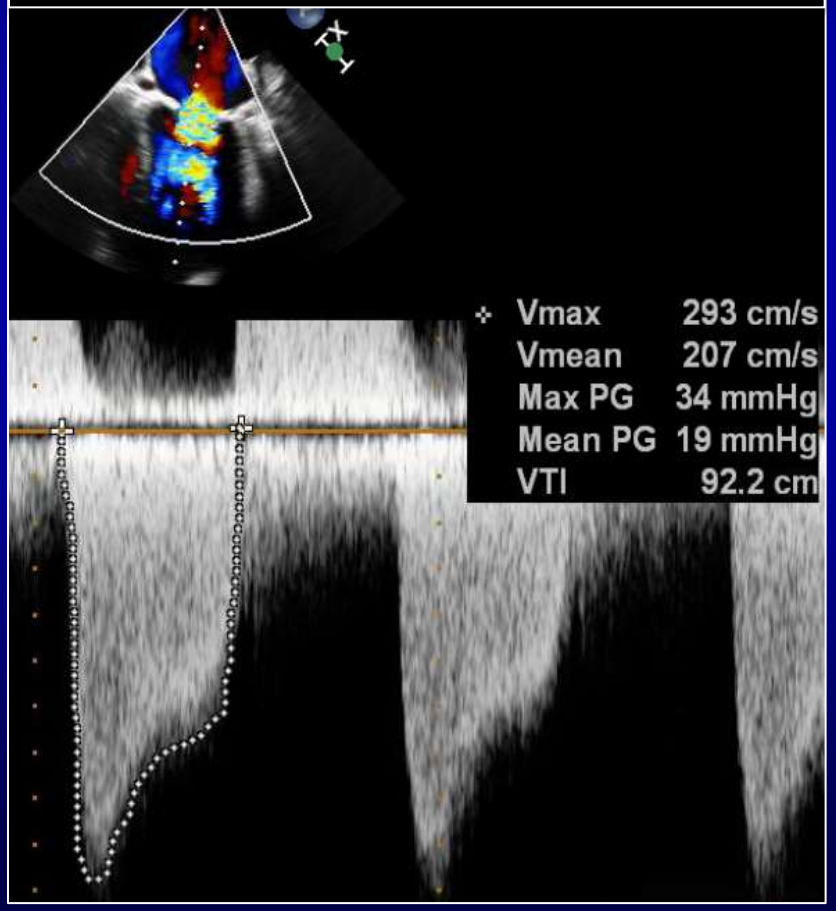
Severe mitral stenosis and moderate mitral regurgitation

Moderate-severe MR

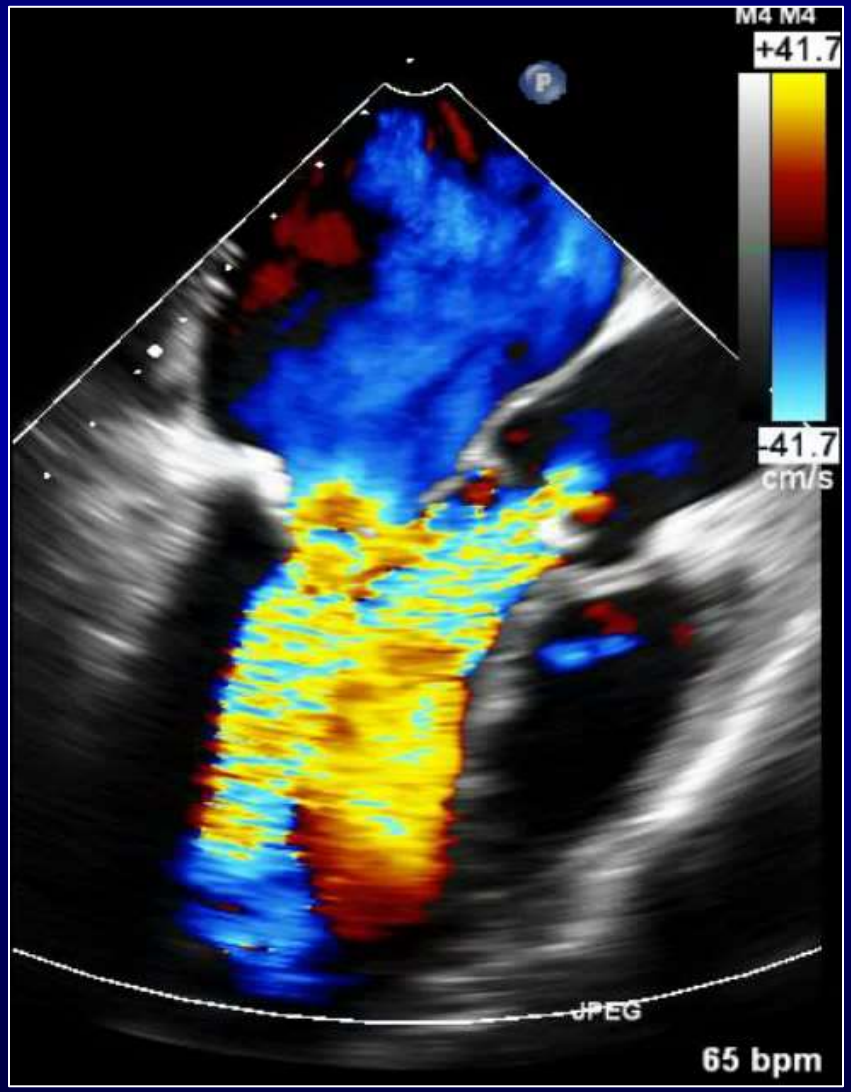


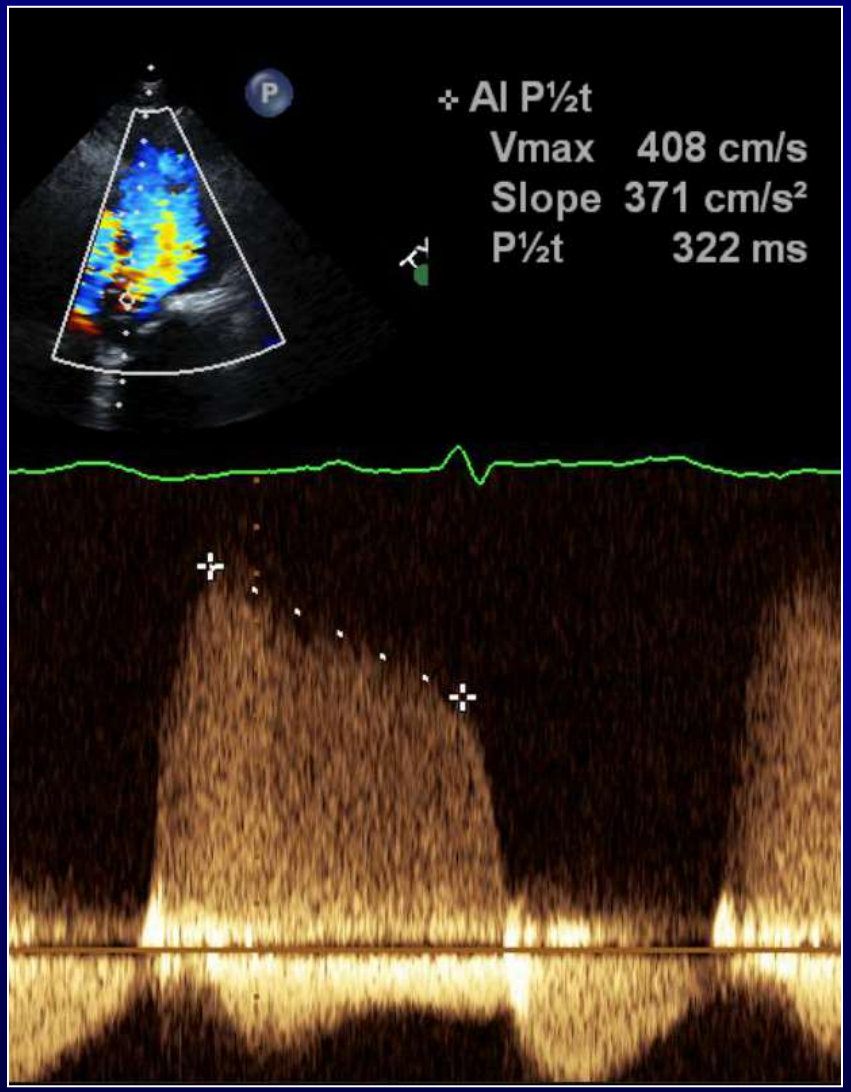
Severely restricted mitral valve leaflets with severe MAC

Severe mitral stenosis

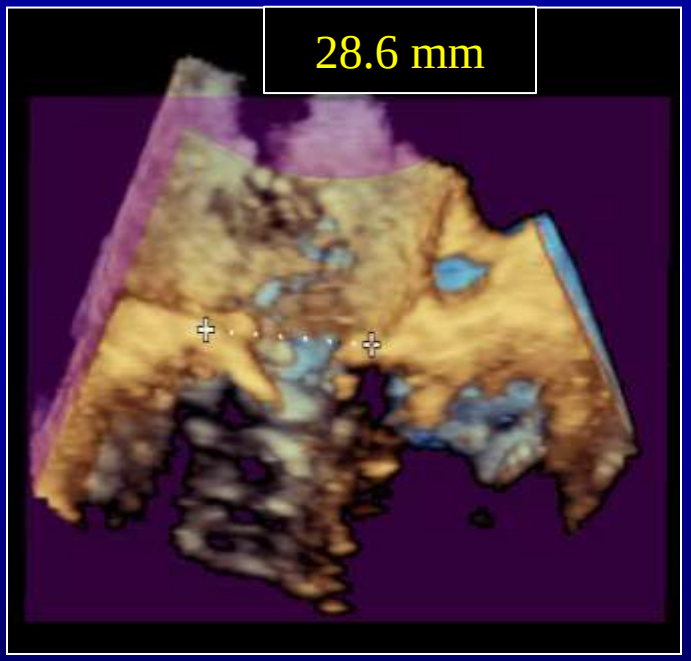


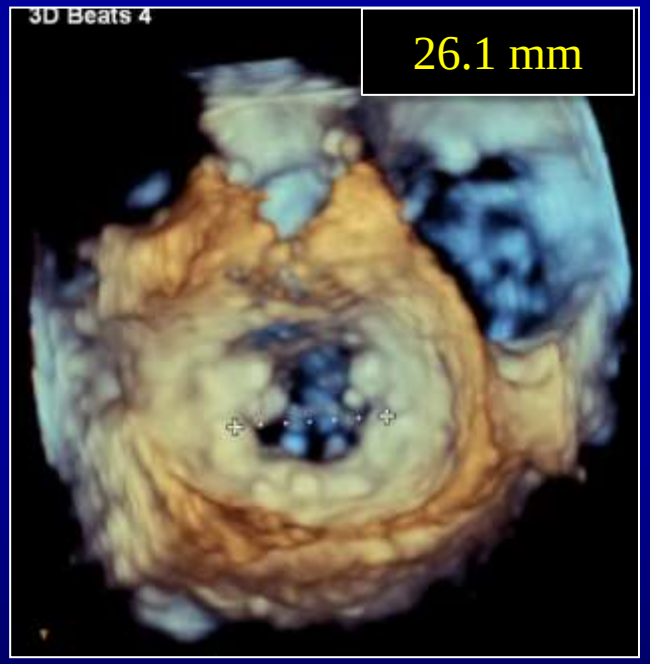
Coexisting moderate-severe AR

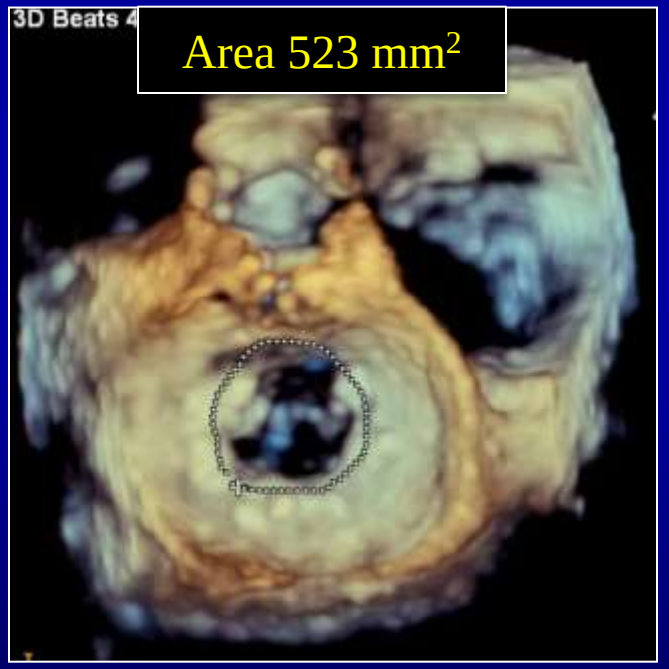




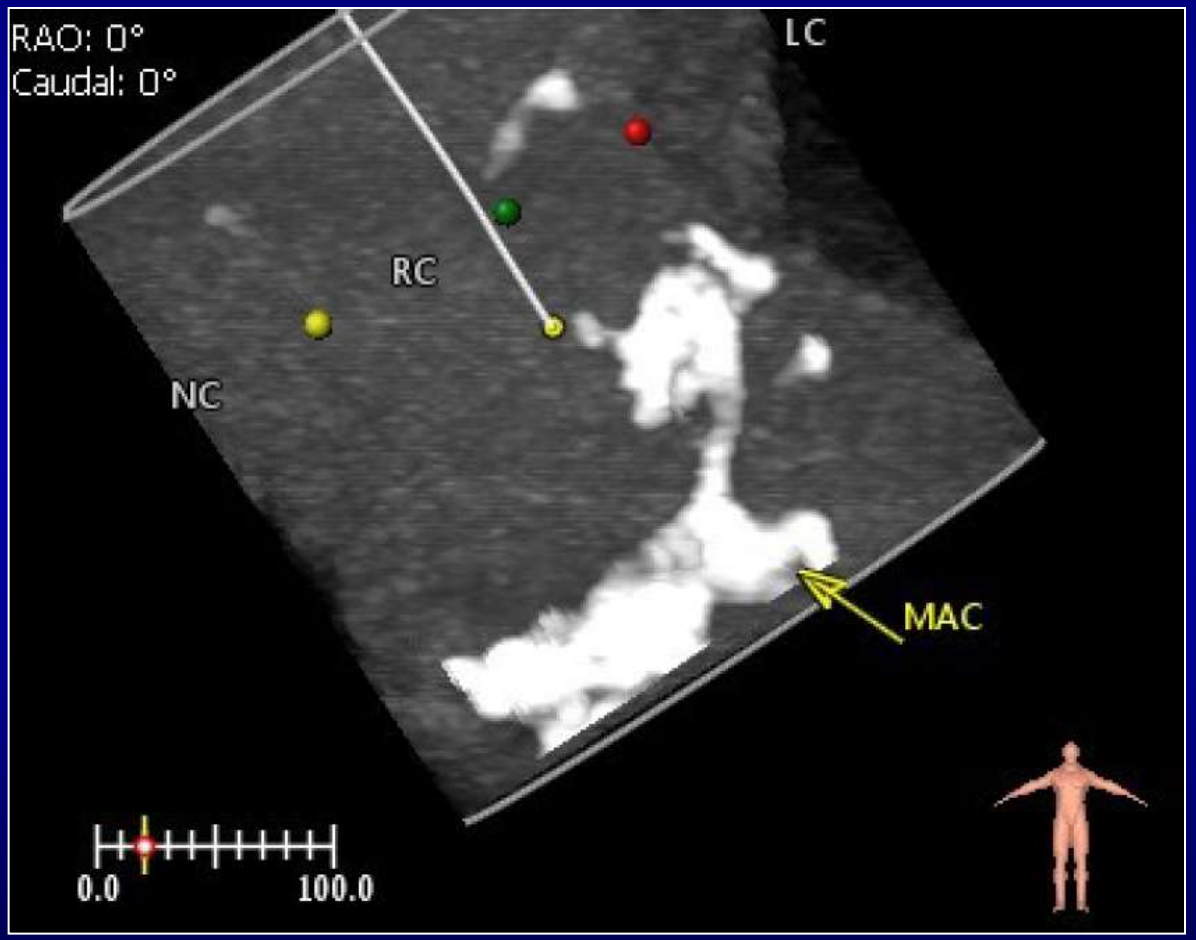
3D TEE based mitral annular dimensions





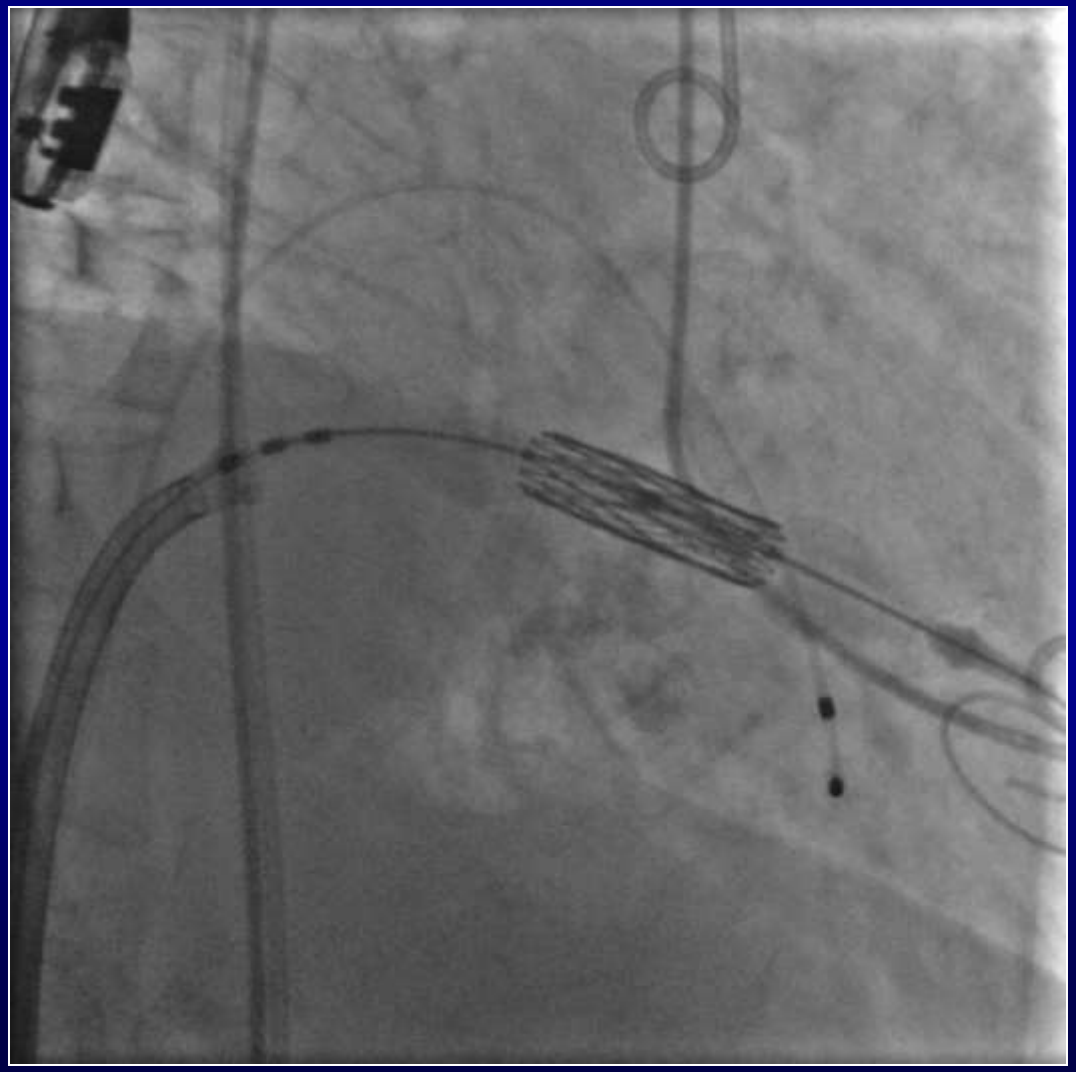


Mitral annular calcification on CT



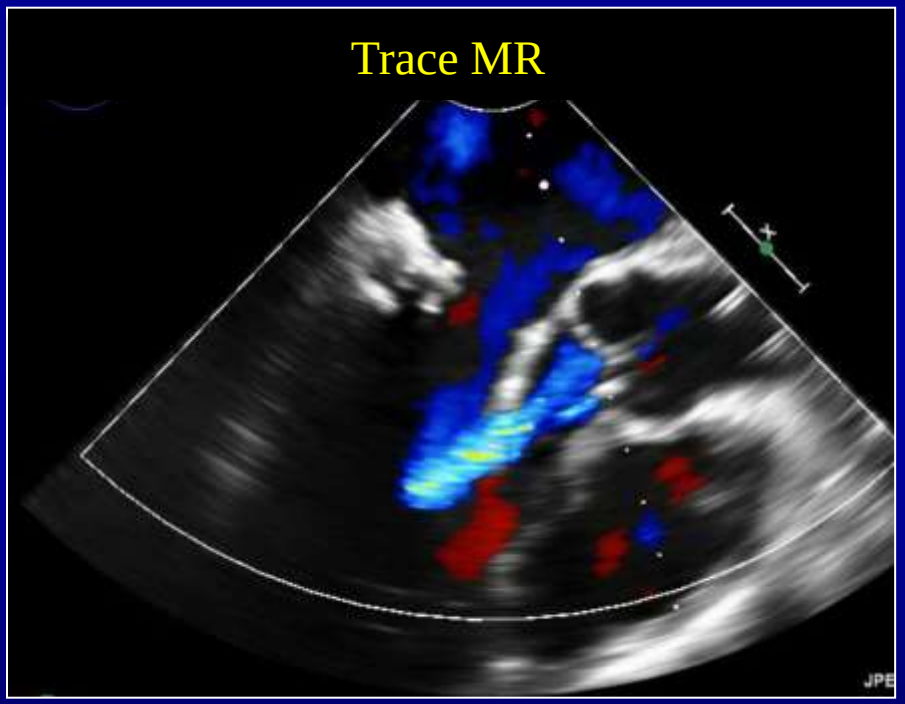
Transcatheter mitral valve replacement with a 29mm Sapien 3 valve

Rapid pacing at 180bpm

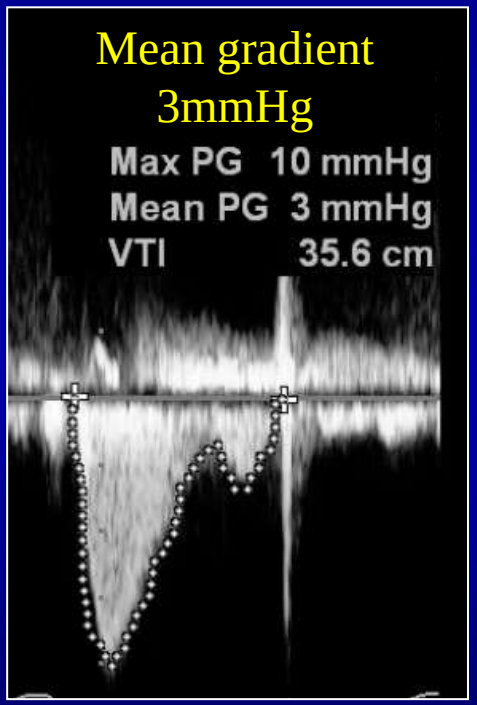


Final result

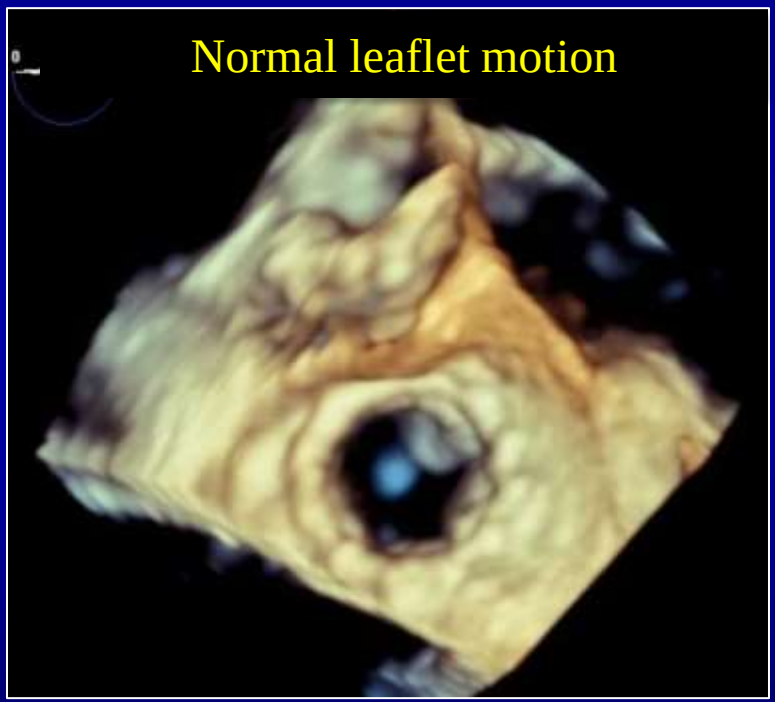
Trace MR



Mean gradient
3mmHg



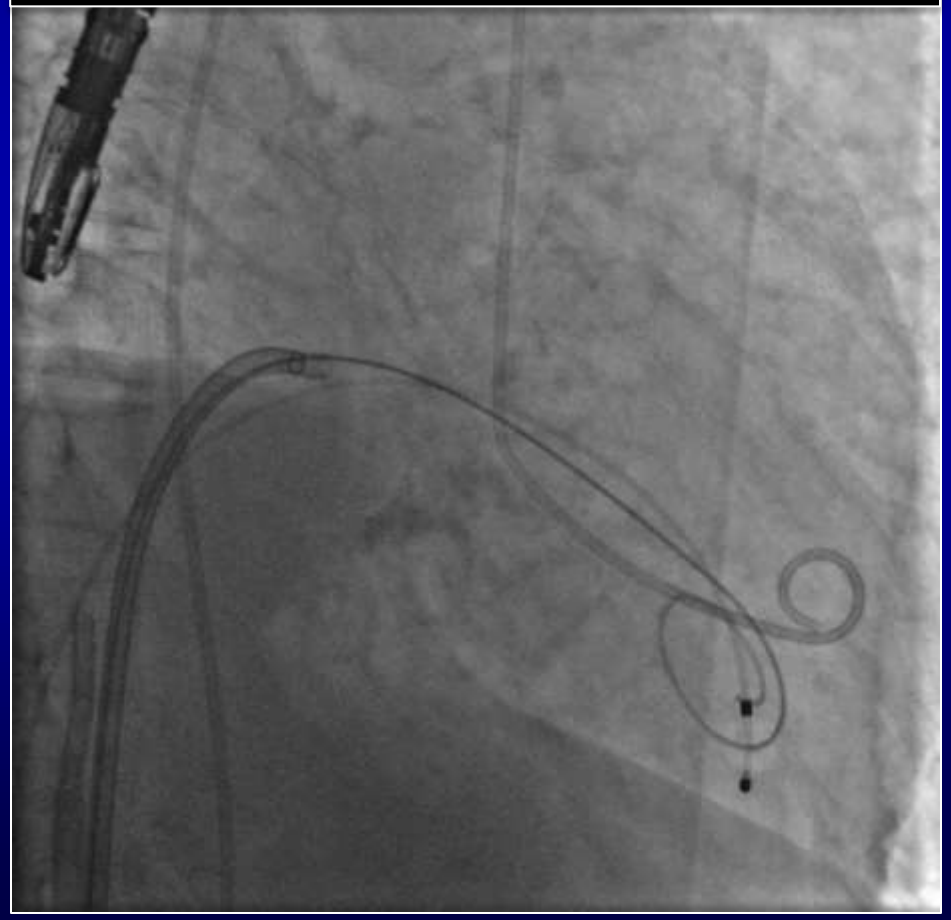
Normal leaflet motion



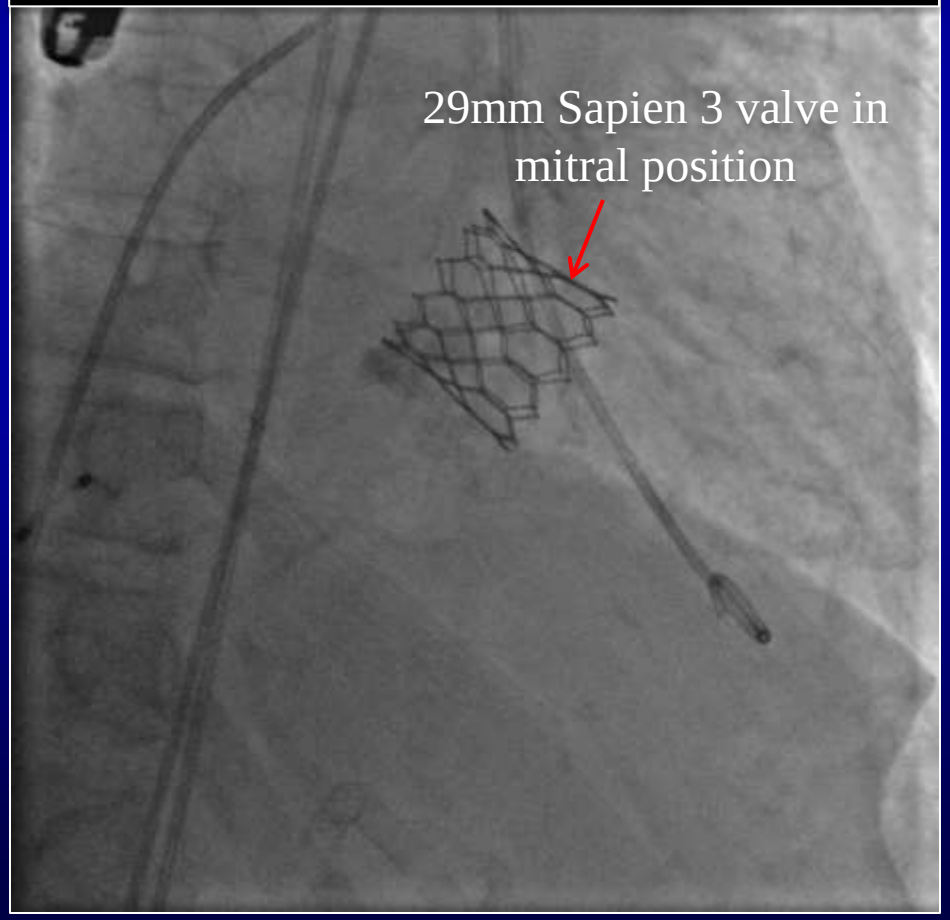
Left ventriculogram

No signficant MR

Baseline
Moderate-severe MR



Post-intervention
No significant MR



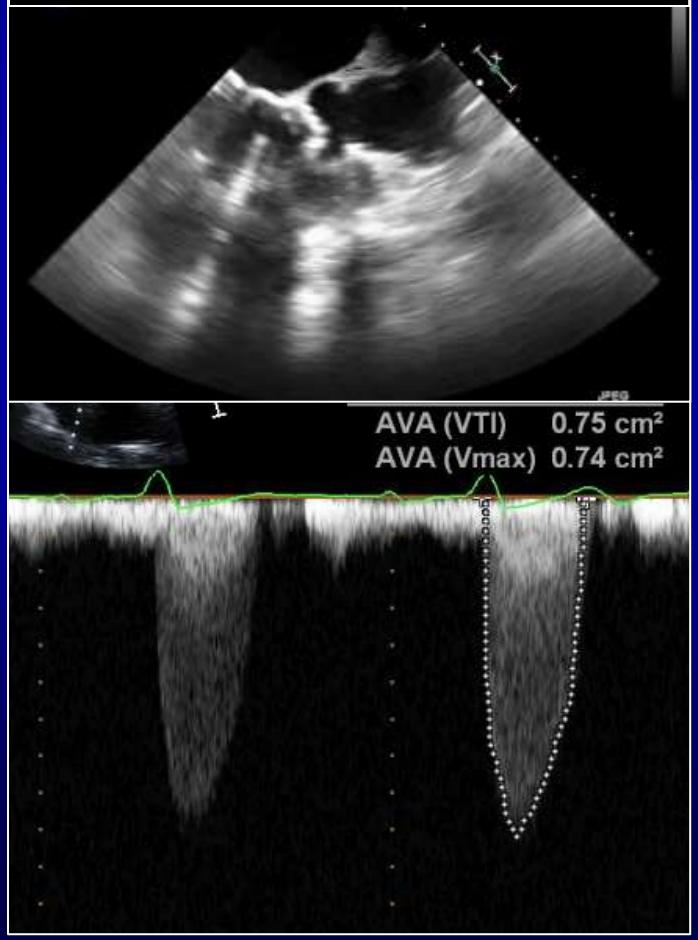
Case: Sapien in MAC in a patient with Portico valve

79 y/o male with severe aortic stenosis and severe mitral stenosis

Patient enrolled in the PORTICO trial

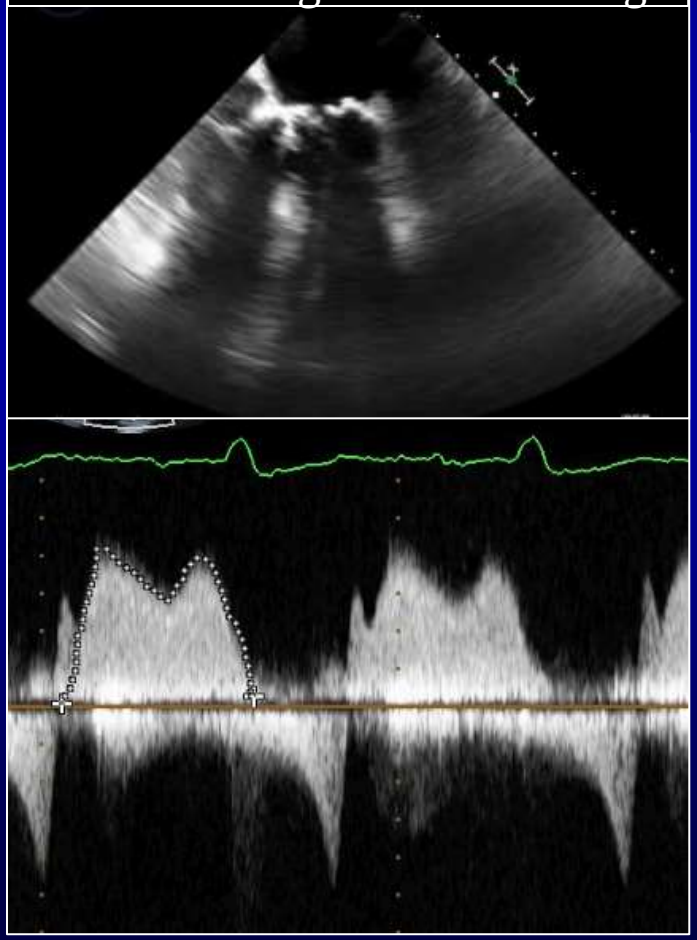
Severe aortic stenosis

Mean mitral gradient 49mmHg

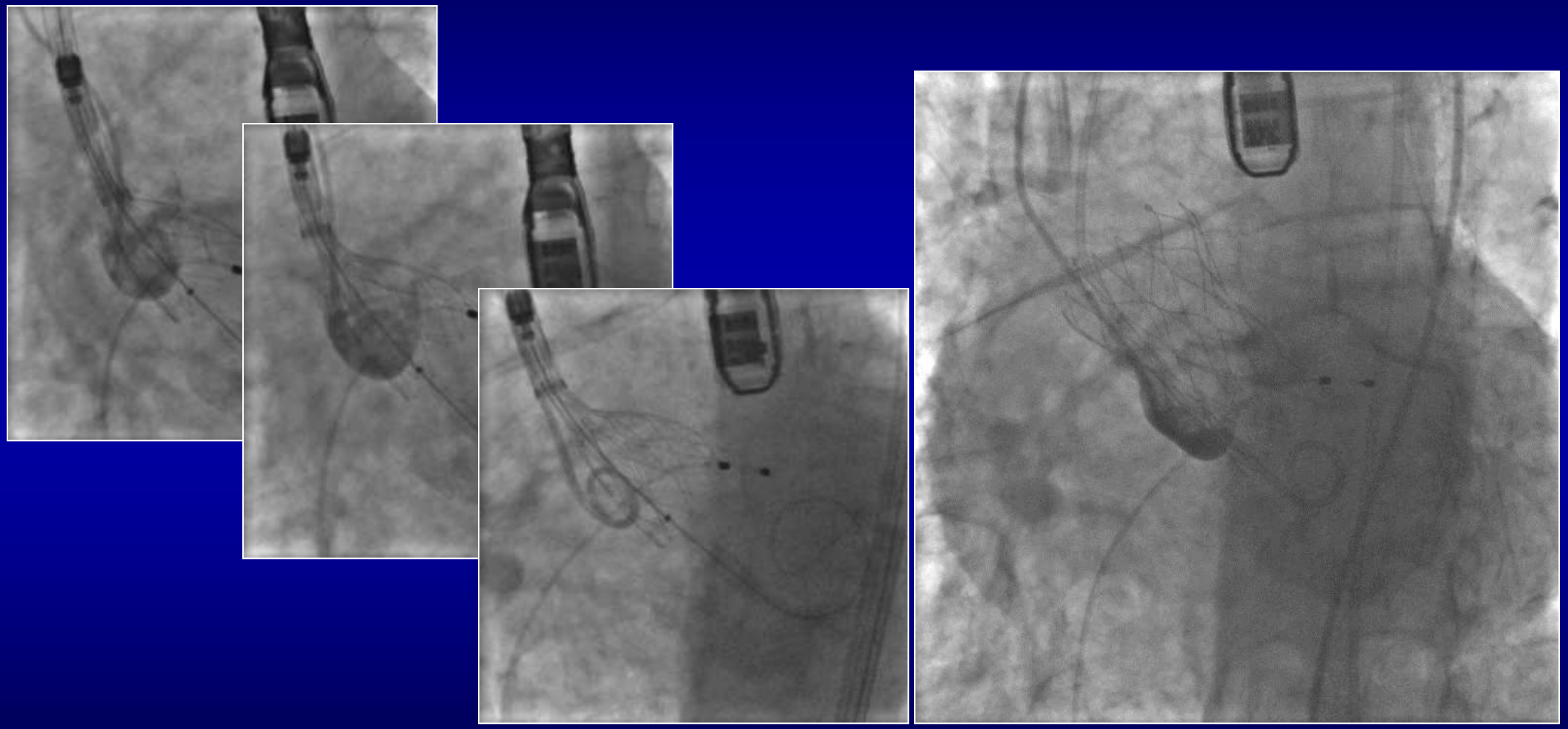


Moderate-severe mitral stenosis

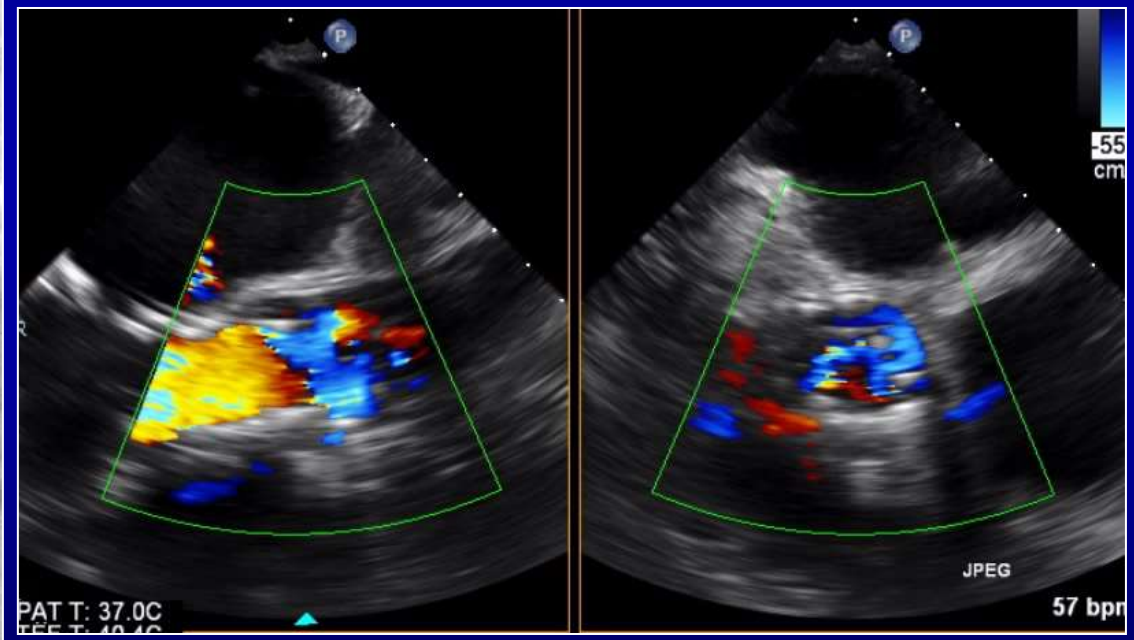
Mean mitral gradient 10mmHg



27mm Portico deployed by transfemoral approach



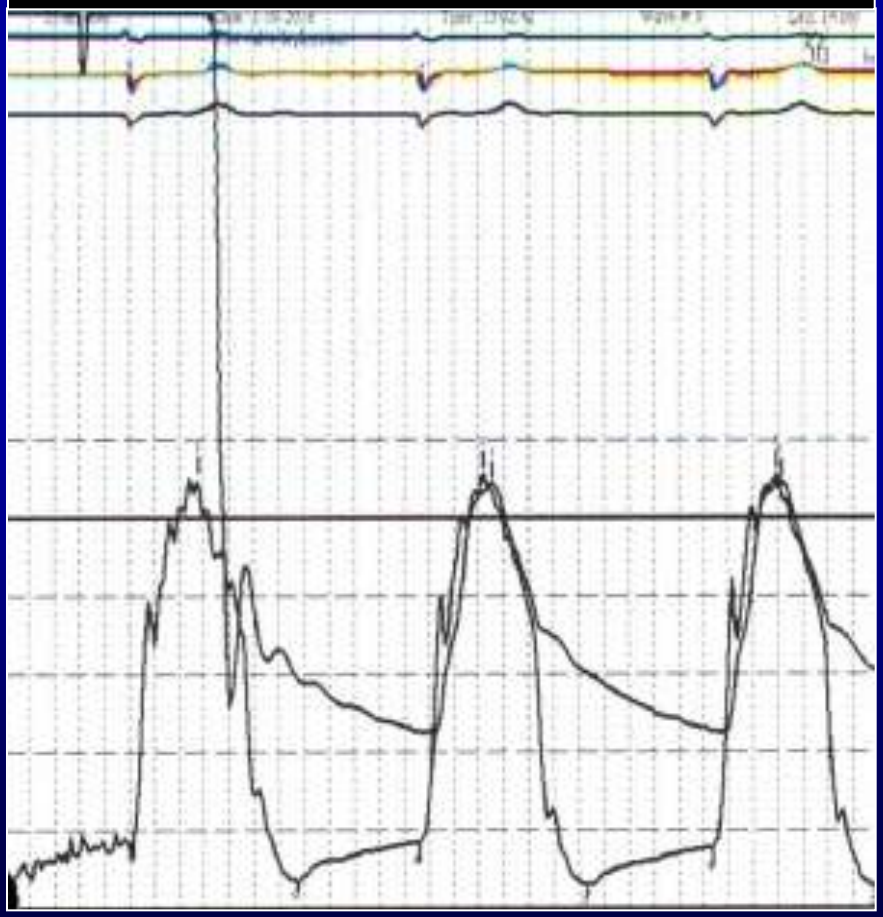
Final result
Trivial paravalvular AR



Invasive hemodynamics

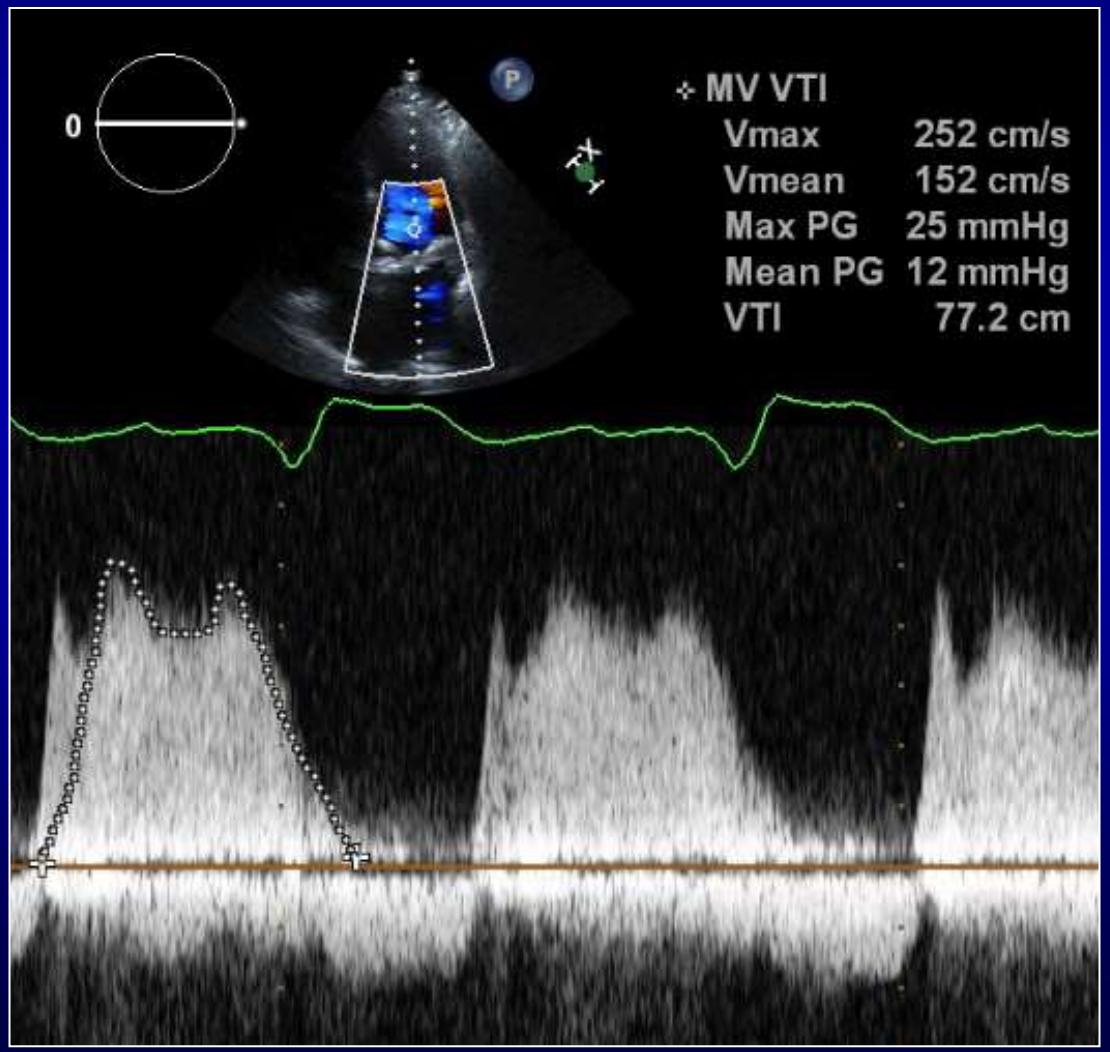
Baseline
Mean gradient 47.5mmHg

s/p 29mm Portico
Mean gradient 10.7mmHg



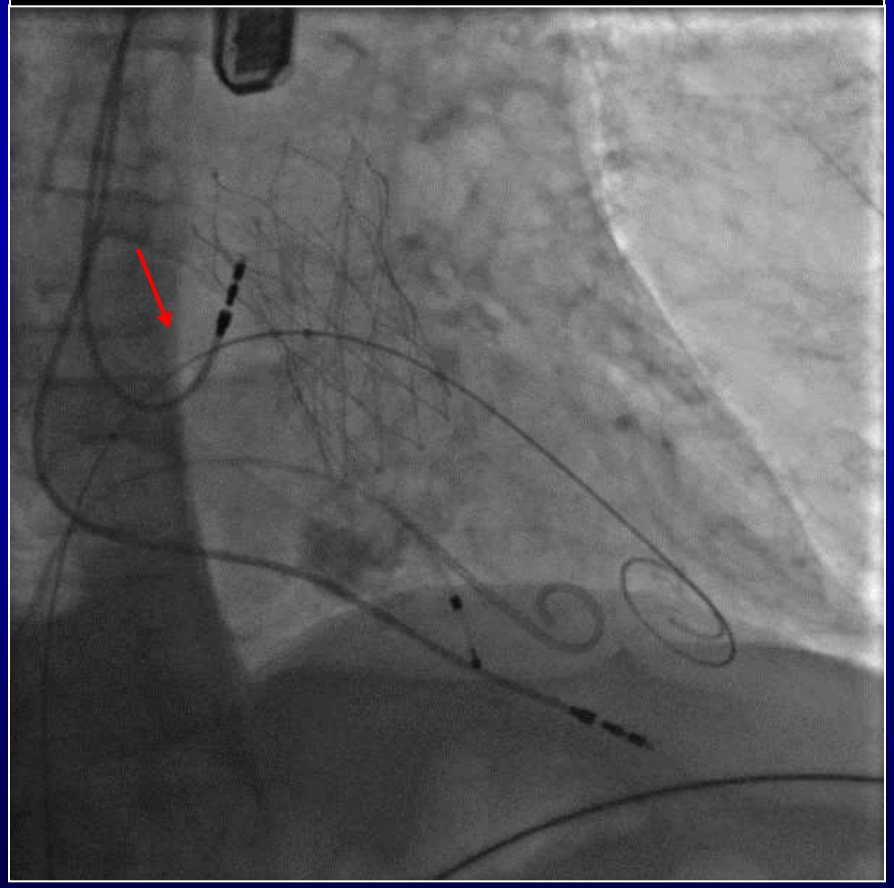
Patient continued to experience worsening heart failure

Rising mitral gradients (12mmHg)

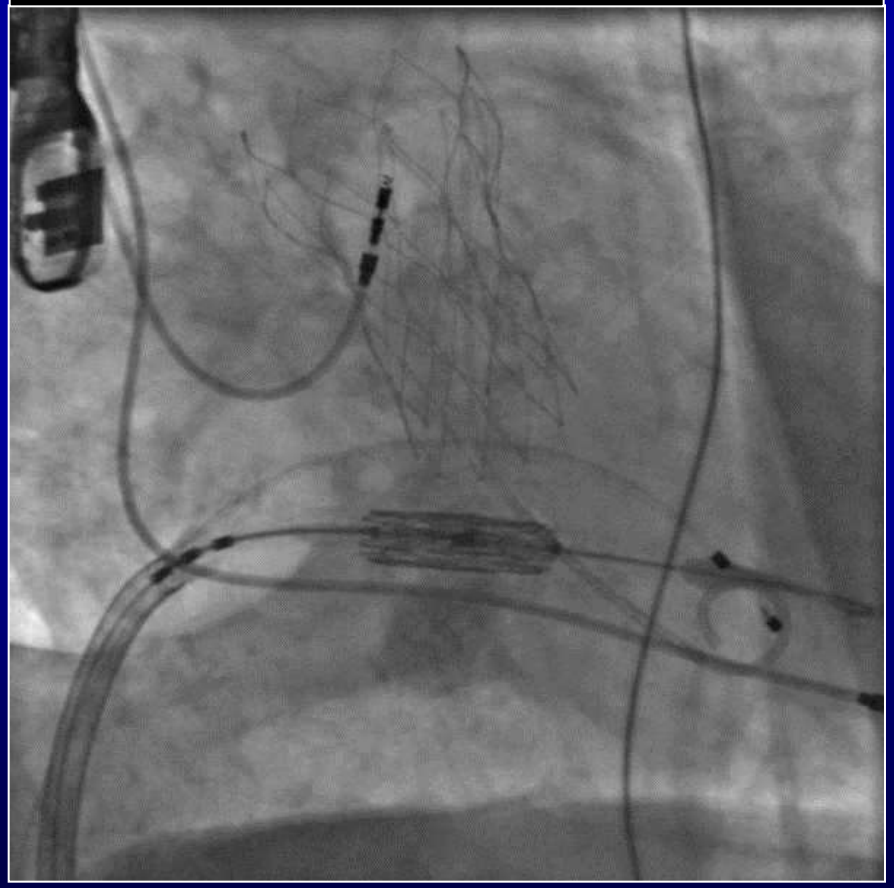


Patient brought to the cath lab for transseptal Sapien in MAC implantation

Atrial septostomy performed with a 12mmx4cm Z Med balloon

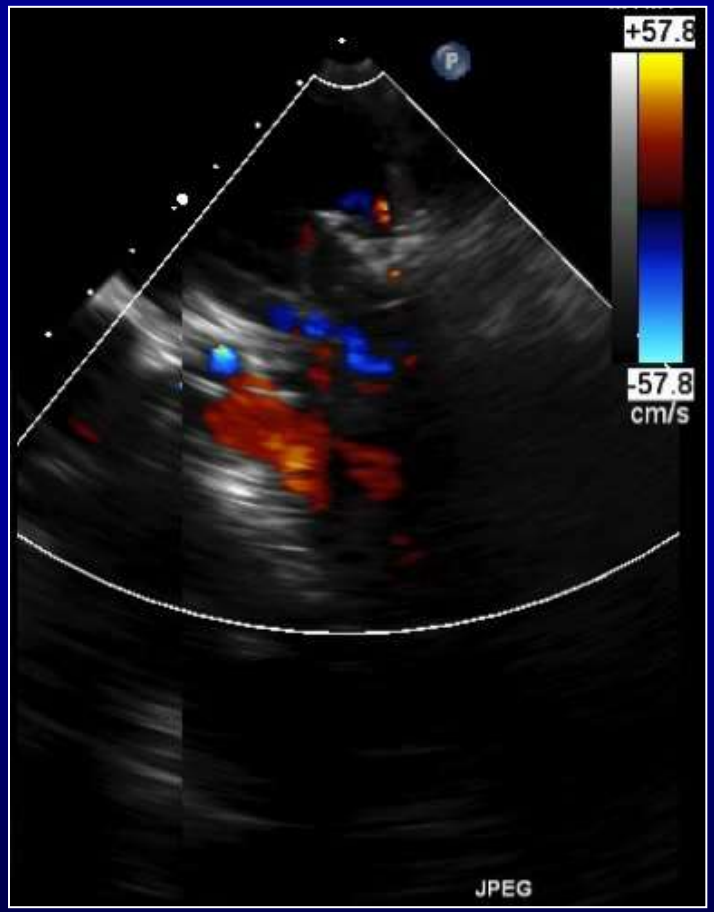


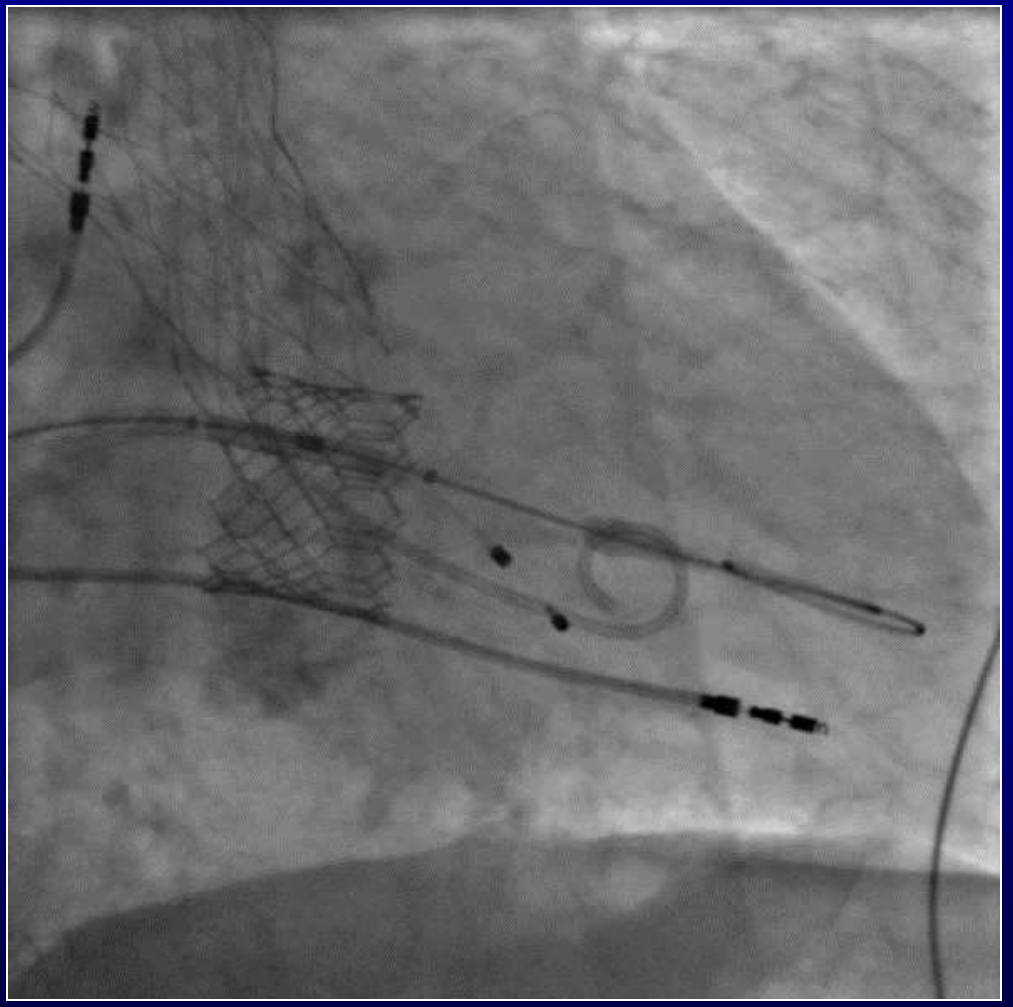
26mm Sapien 3 in mitral annular calcium



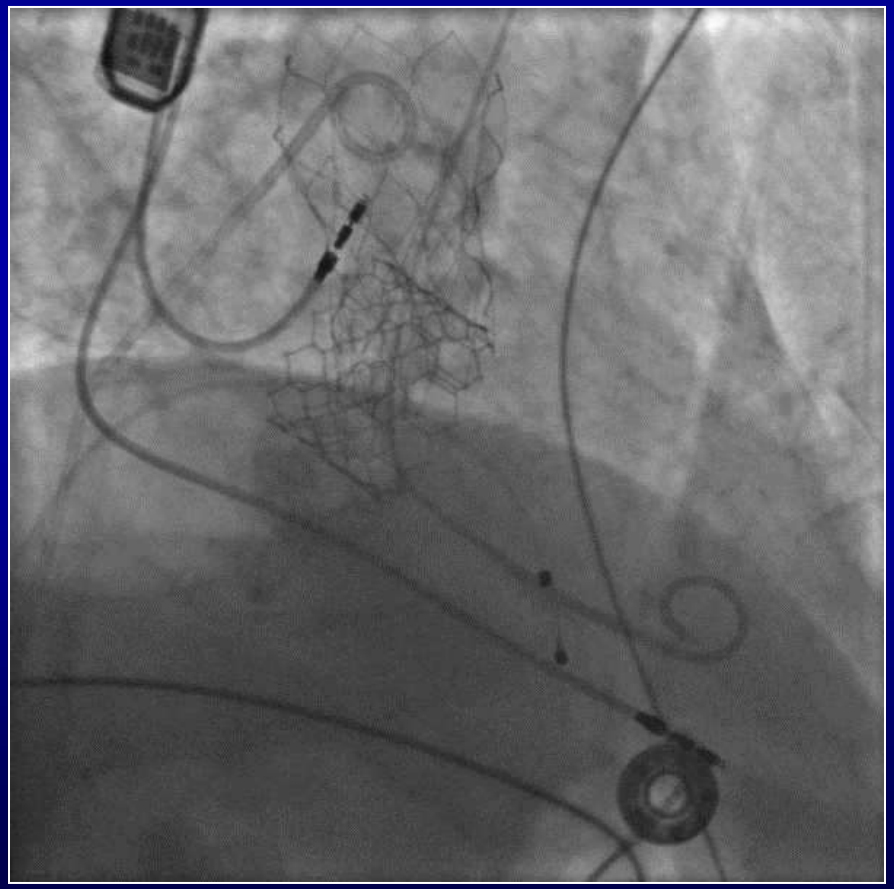
Moderate paravalvular MR after TMVR

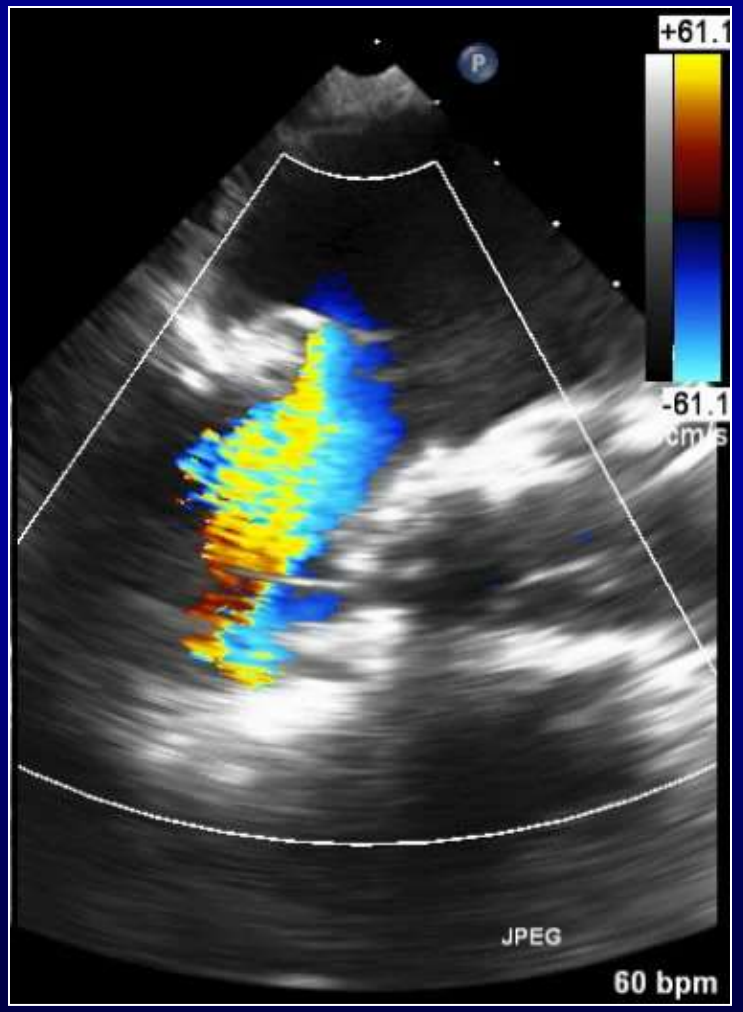
Post-dilation performed with the valve balloon





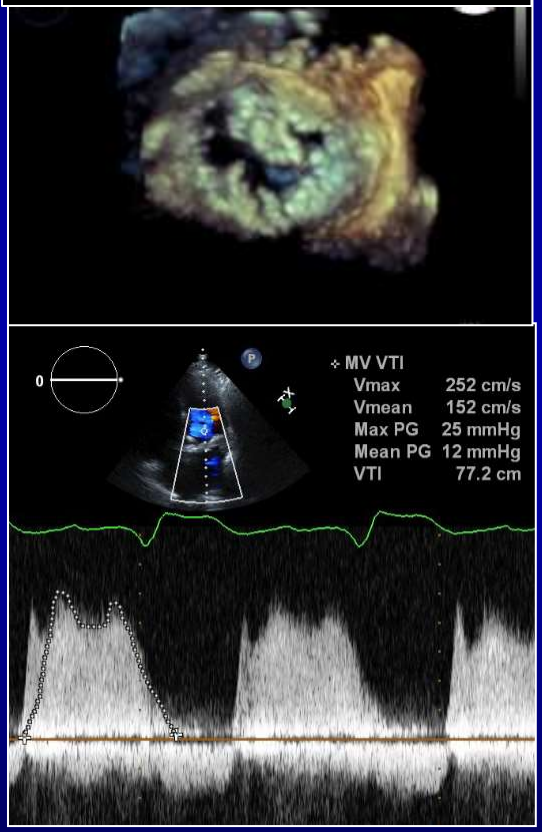
Final result s/p 26mm Sapien 3 in MAC
No significant MR



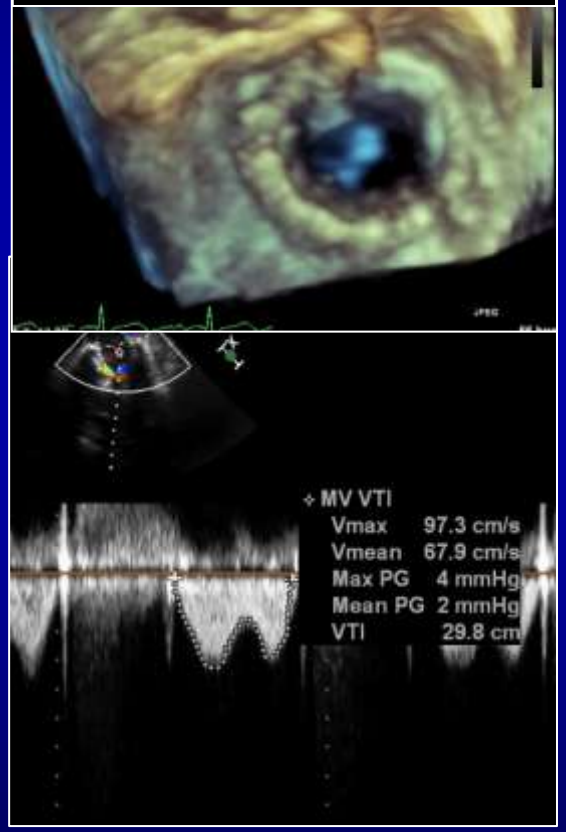


Final result

Baseline
Mean gradient 12mmHG



Final result
Mean gradient 2mmHG



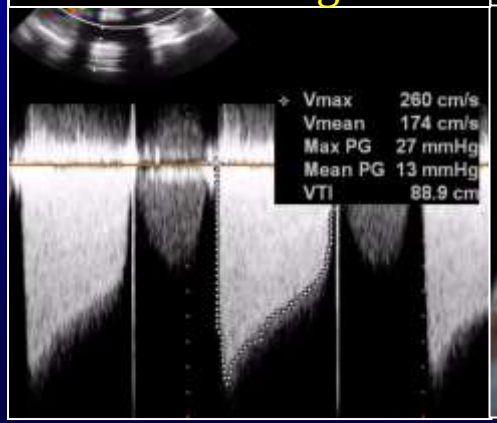
Dual valve replacement

75 y/o male presenting with heart failure

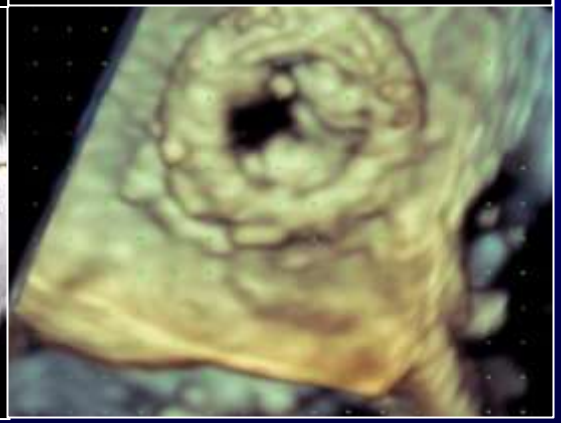
Patient evaluated for transcatheter mitral ViV implantation

Severe mitral stenosis of #25 Magna valve

Mean mitral gradient 13mmHg

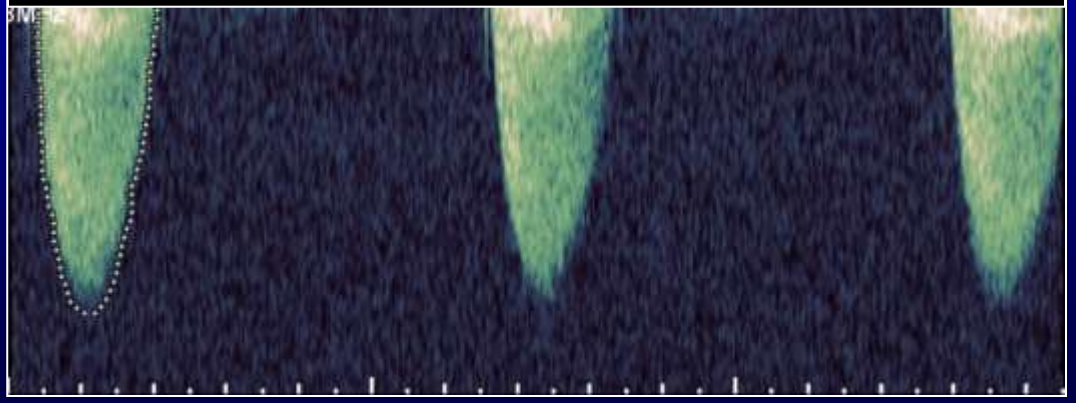


Severe restriction of mitral valve leaflets



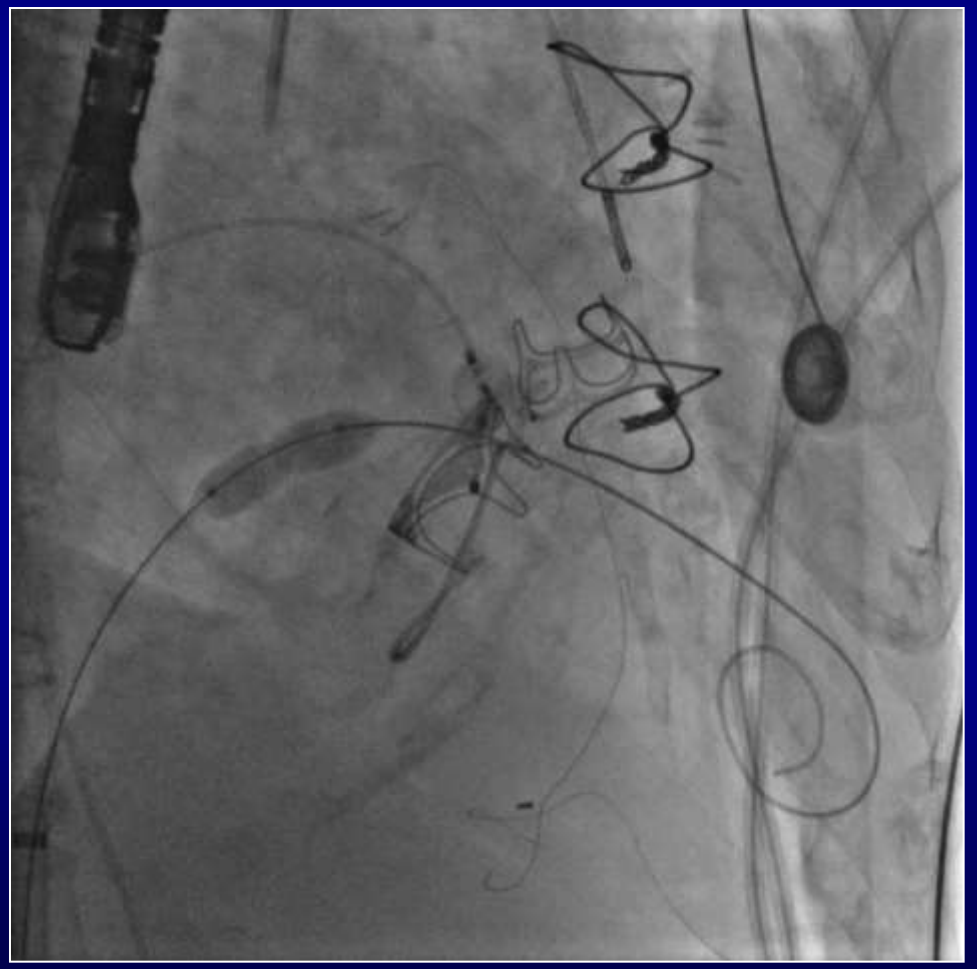
Moderate restriction of #19 Magna aortic valve and prosthesis-patient mismatch

Mean aortic valve gradient 50mmHg

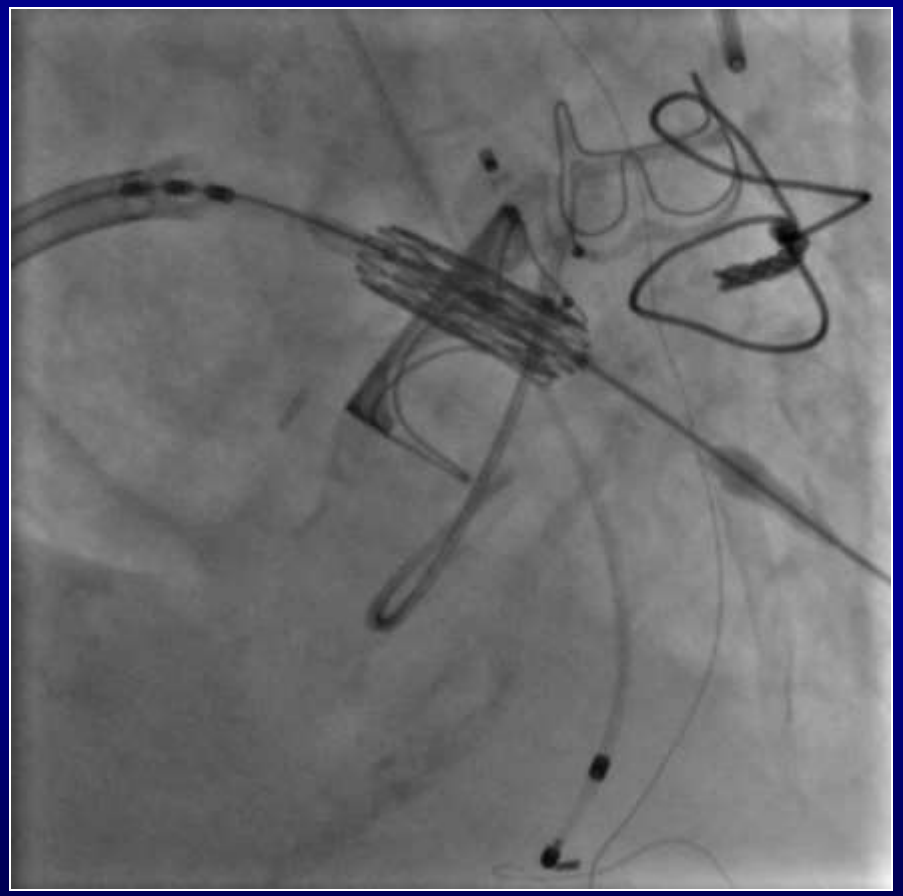


Atrial septostomy performed with a 12mm x 3cm Z Med balloon

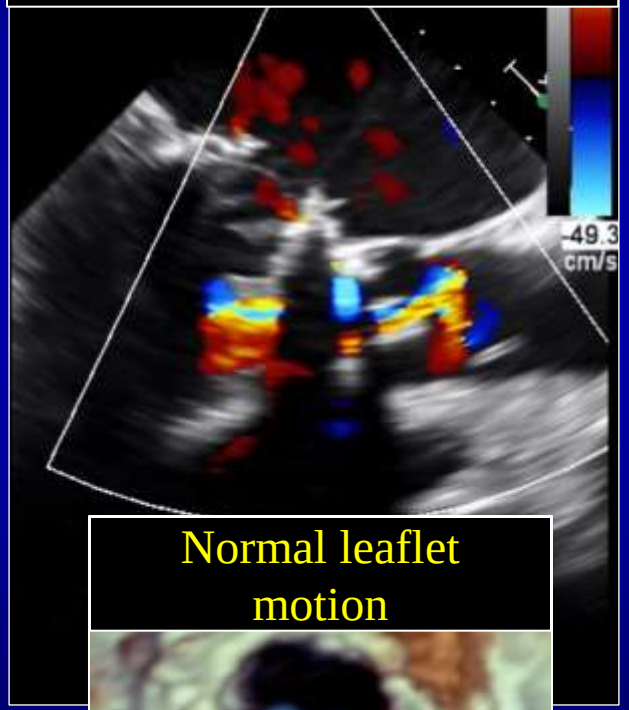
- Transseptal puncture performed with a BRK1 needle
- Mitral valve crossed with a Multipurpose catheter advanced through a Agilis catheter
- Atrial septostomy performed with a 12mm x 3cm Z Med balloon



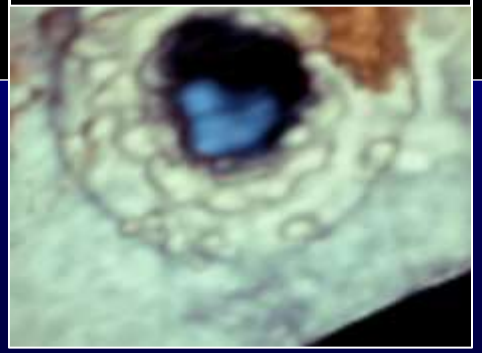
Mitral valve-in-valve performed with a 26mm Sapien 3 valve



No residual MR



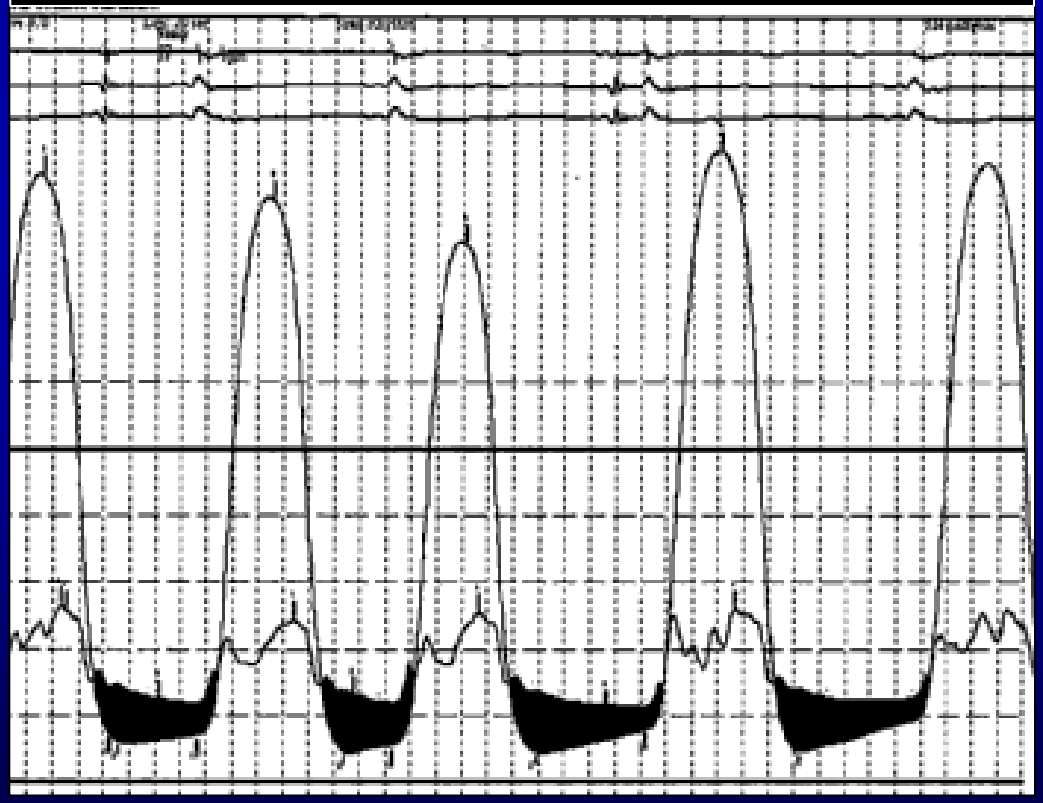
Normal leaflet motion



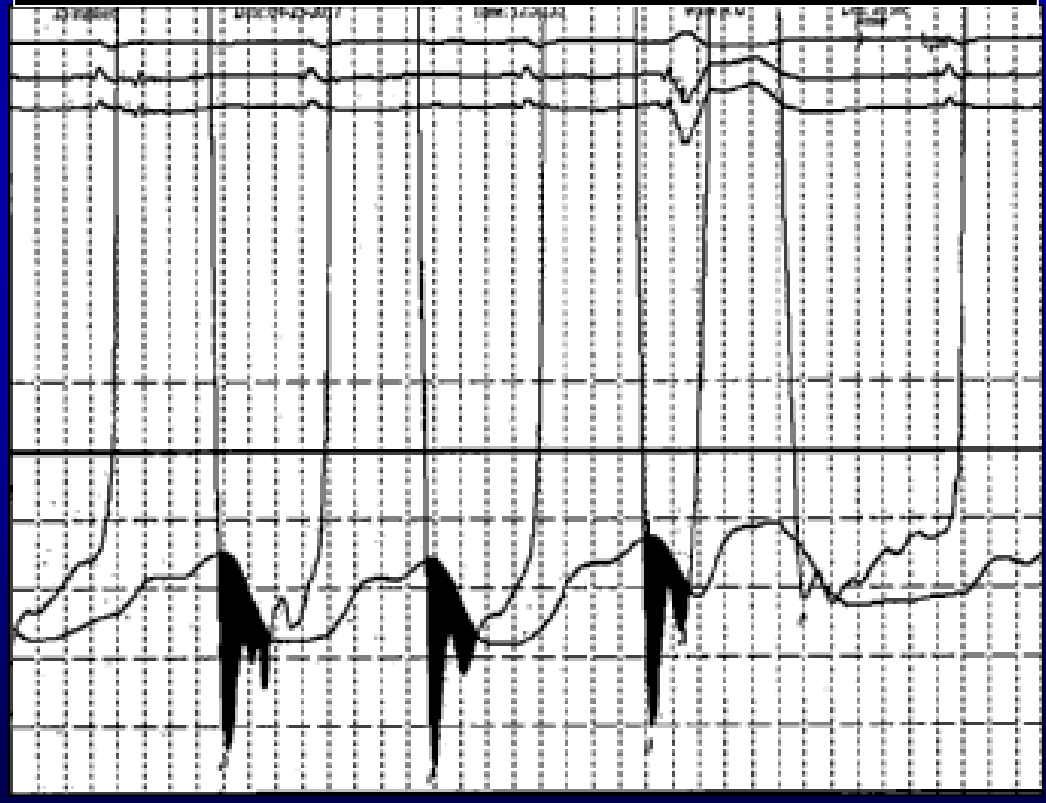
Final mitral valve gradient 4mmHg

Hemodynamics of the mitral valve

Baseline mitral valve gradient
12mmHg

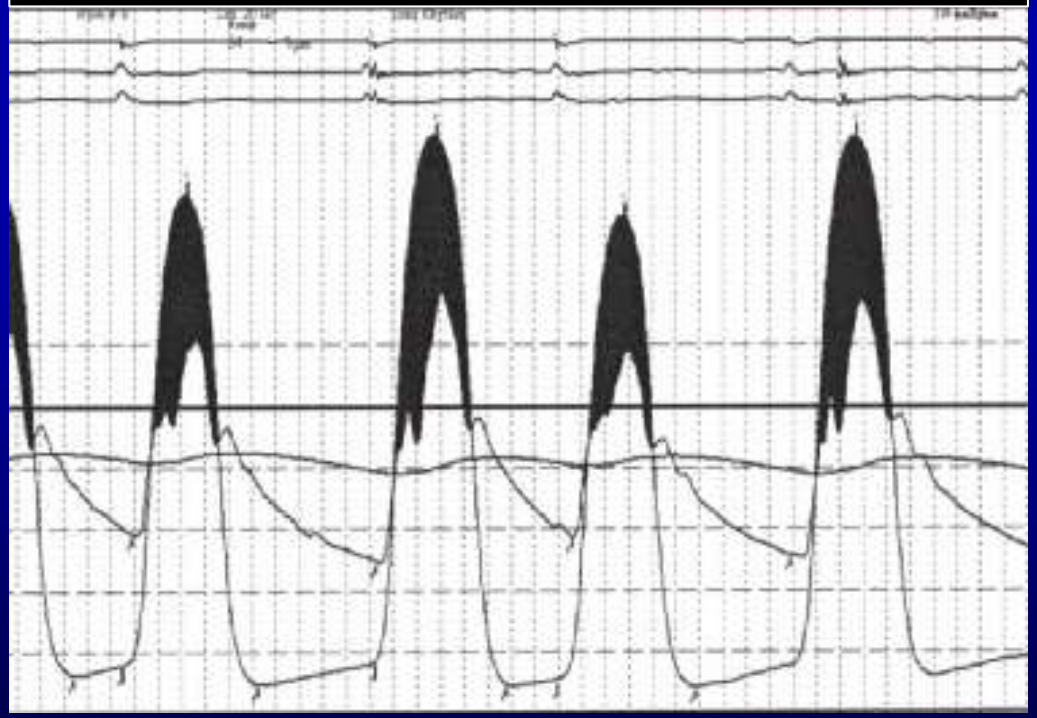


Final mitral valve gradient
4mmHg



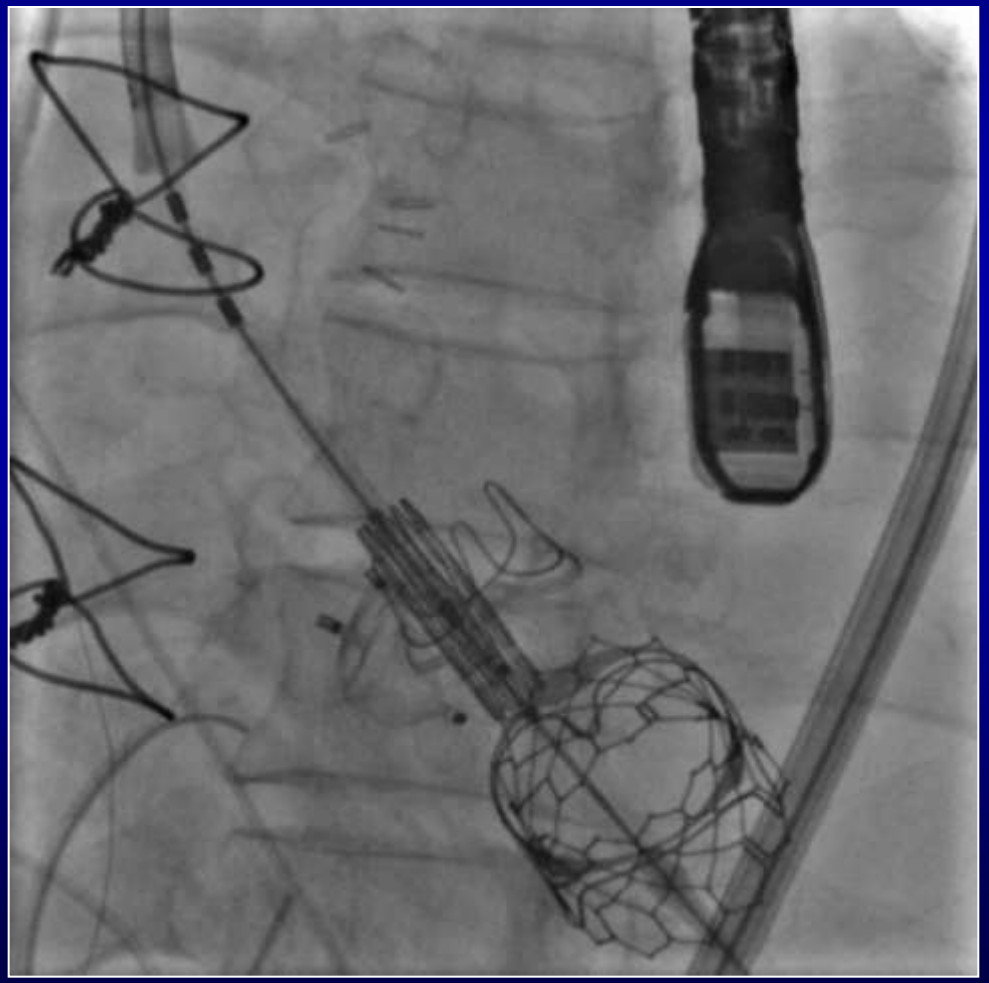
Aortic valve gradient increased following mitral valve in valve implantation

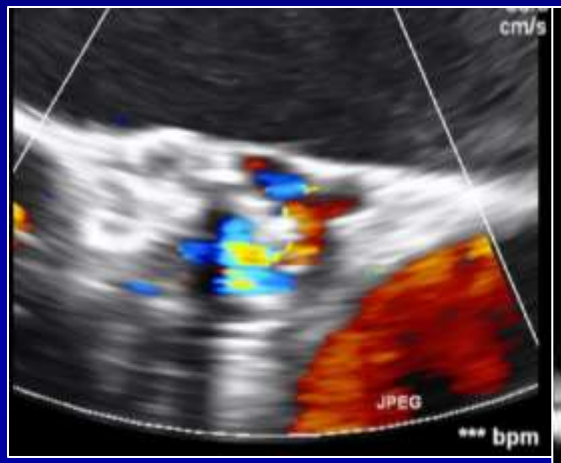
Aortic valve gradient pre-mitral
ViV: 43mmHg

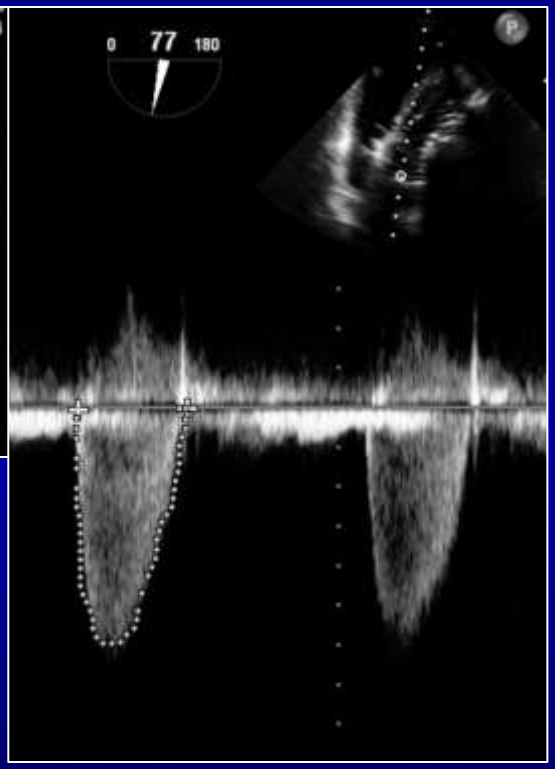


Aortic valve gradient post-mitral
ViV: 69.4mmHg

Aortic valve-in-valve performed with a 23mm Sapien 3 valve



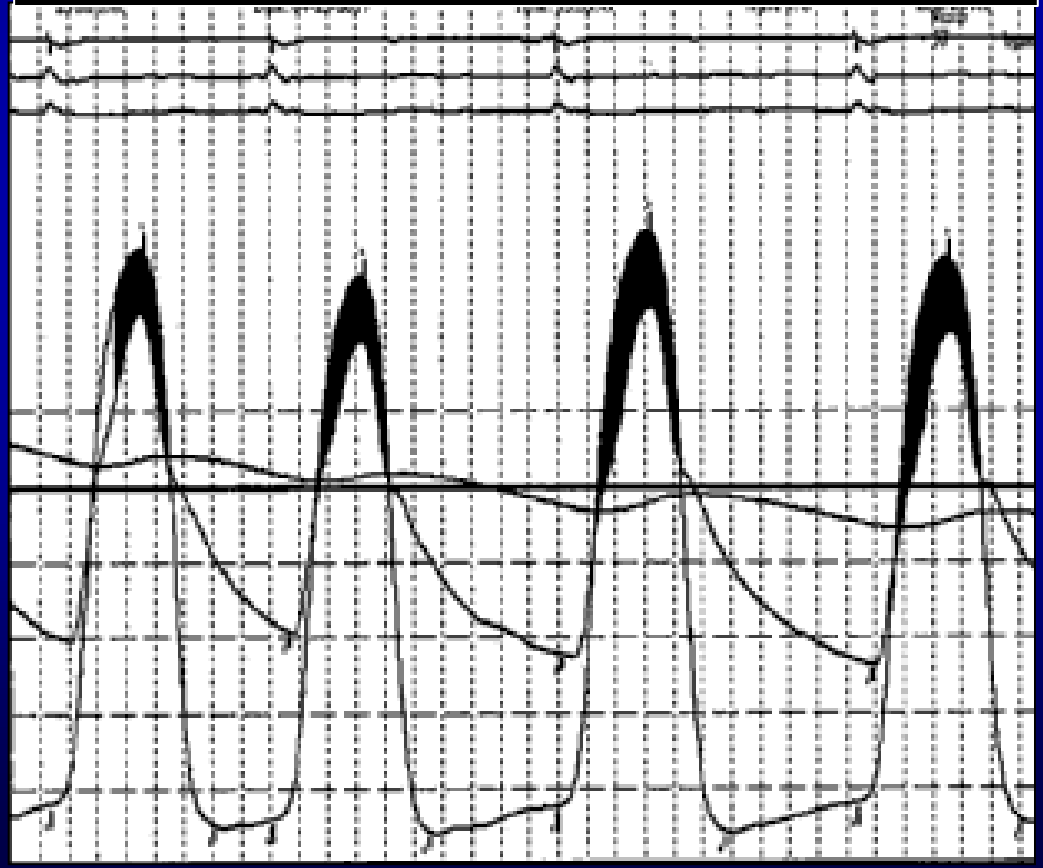




Hemodynamics of the aortic valve

Baseline aortic valve gradient
69.4mmHg

Final aortic valve gradient
20mmHg



Mitral valve replacement and PVL closure

78 y/o male referred for mitral valve in valve

Degenerative Mosaic mitral valve with flail leaflet and severe central and paravalvular MR

Past medical history

- Surgical mitral valve replacement (33mm Mosaic)
- Acute on chronic decompensated diastolic heart failure NYHA 4
- Severe frailty
- CAD s/p CABG (LIMA to LAD)
- Chronic kidney disease (Cr 2.8)
- Severe pulmonary hypertension (PA systolic pressure 67mmHg)

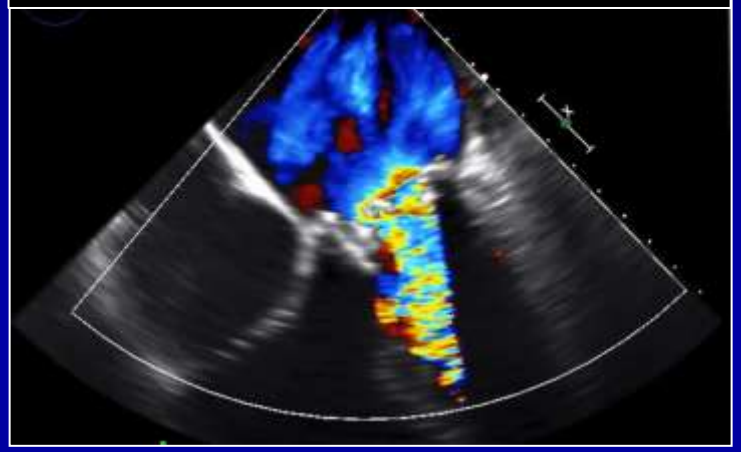
Patient determined to be inoperable by 2 CT surgeons

78 y/o male referred for mitral valve in valve

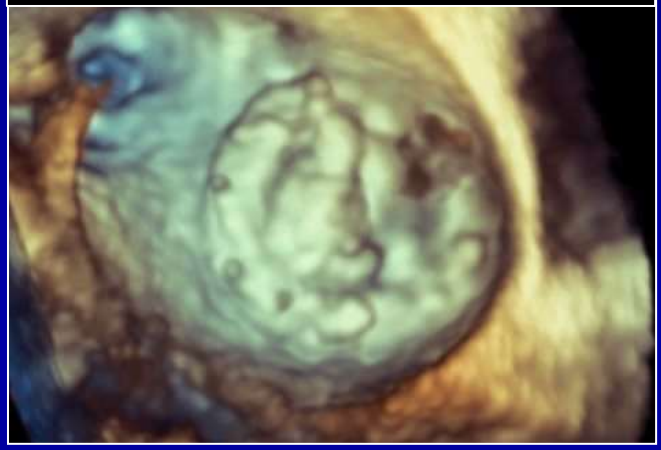
Degenerative Mosaic mitral valve with flail leaflet and severe central and paravalvular MR

Flail of Mosaic mitral valve

Severe central MR

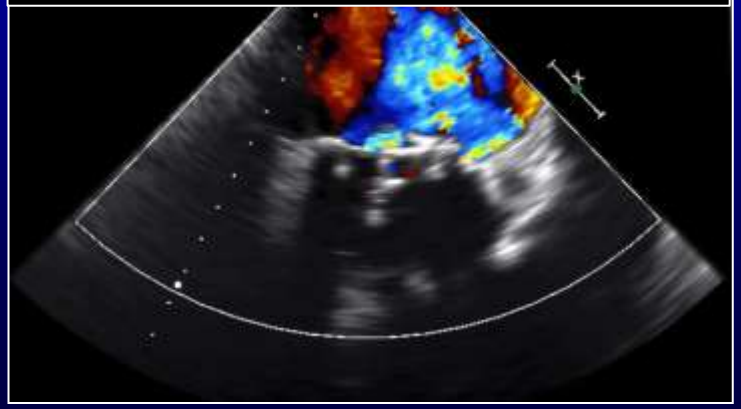


Thickened and restricted mitral valve leaflets

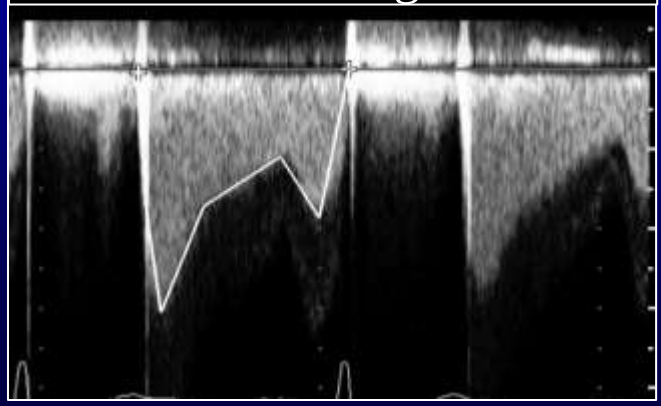


Systolic flow reversal of pulmonary veins

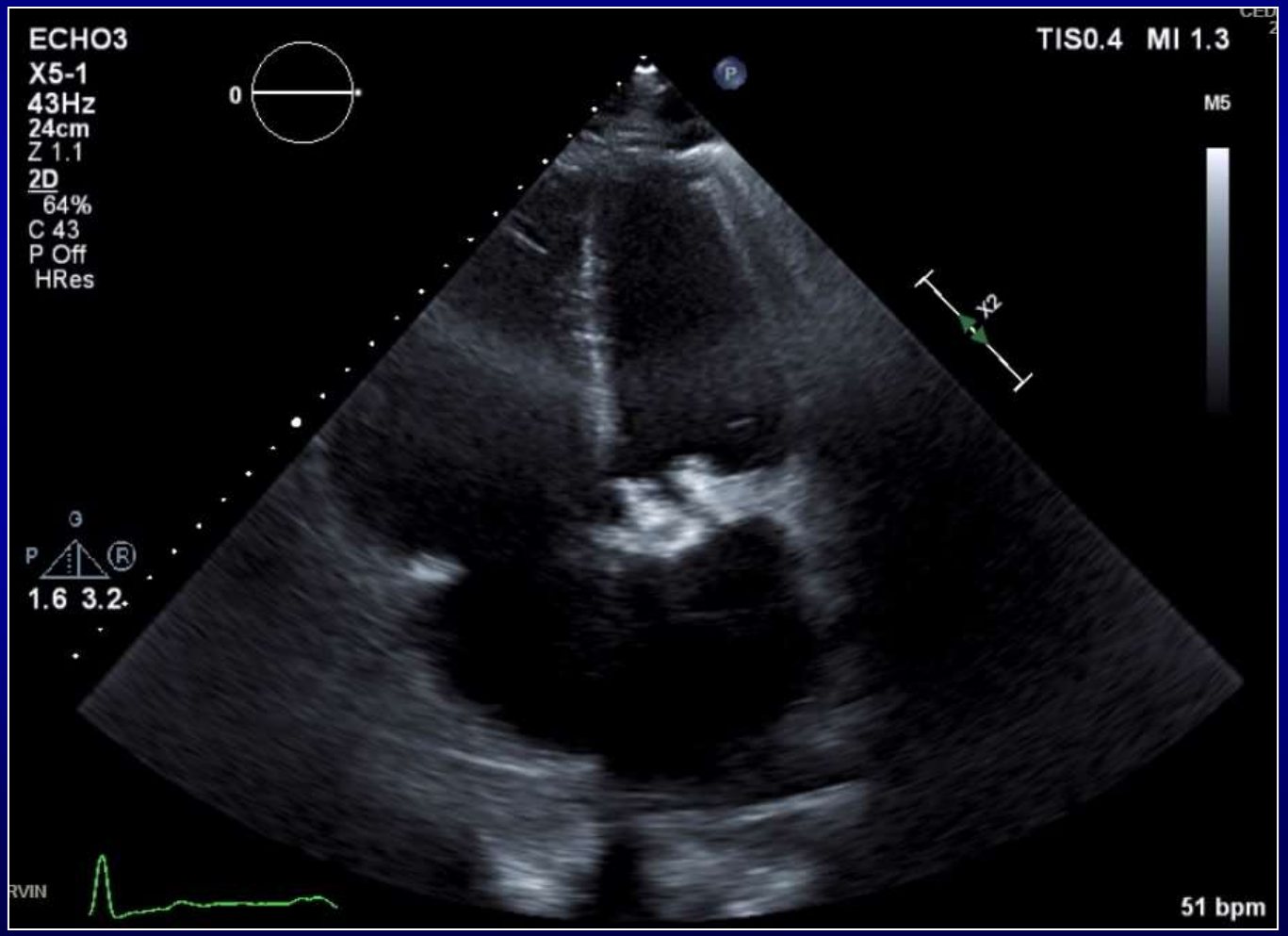
Severe paravalvular MR



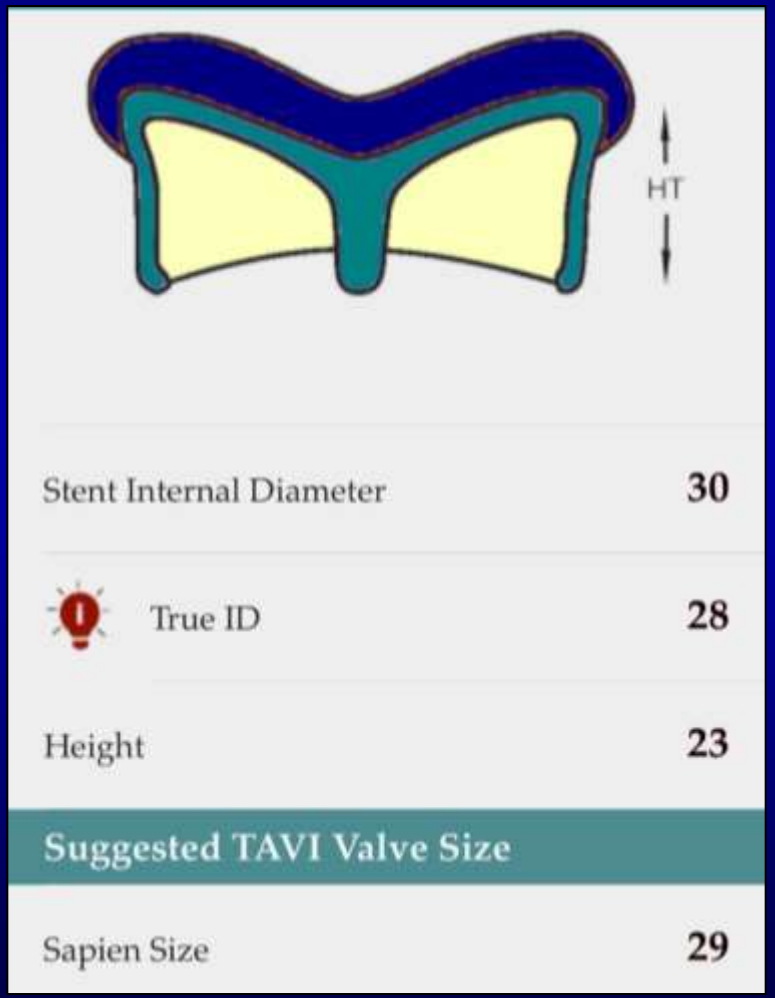
Mean mitral valve gradient 8mmHg



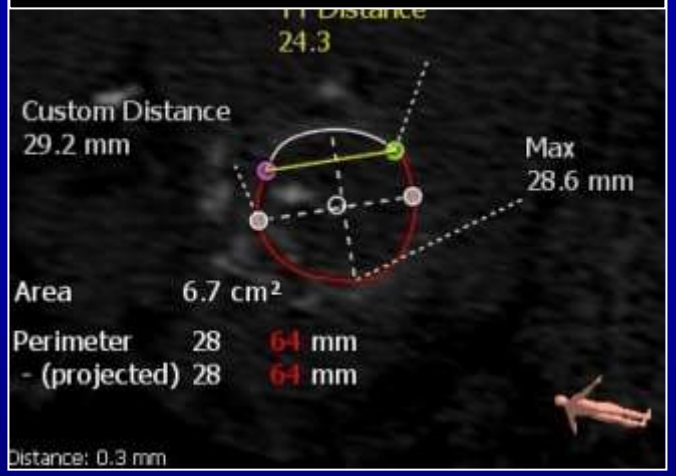
Severely dilated (6.2cm) and depressed RV



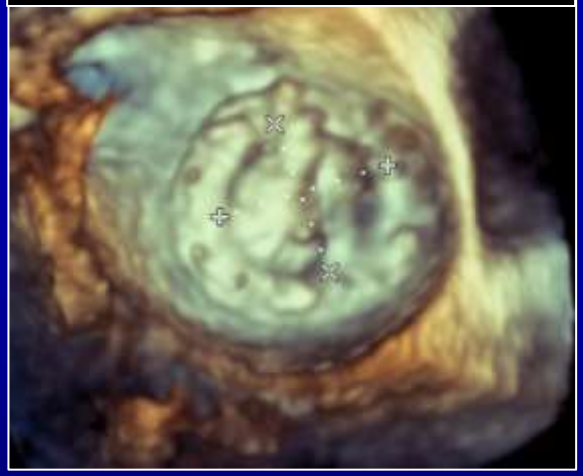
Valve internal dimensions
Stent internal diameter 30mm, True ID 28mm



Non-contrast CT
Valve dimensions 29.2x28.6mm



TEE
Valve dimensions
29.8x26.7mm



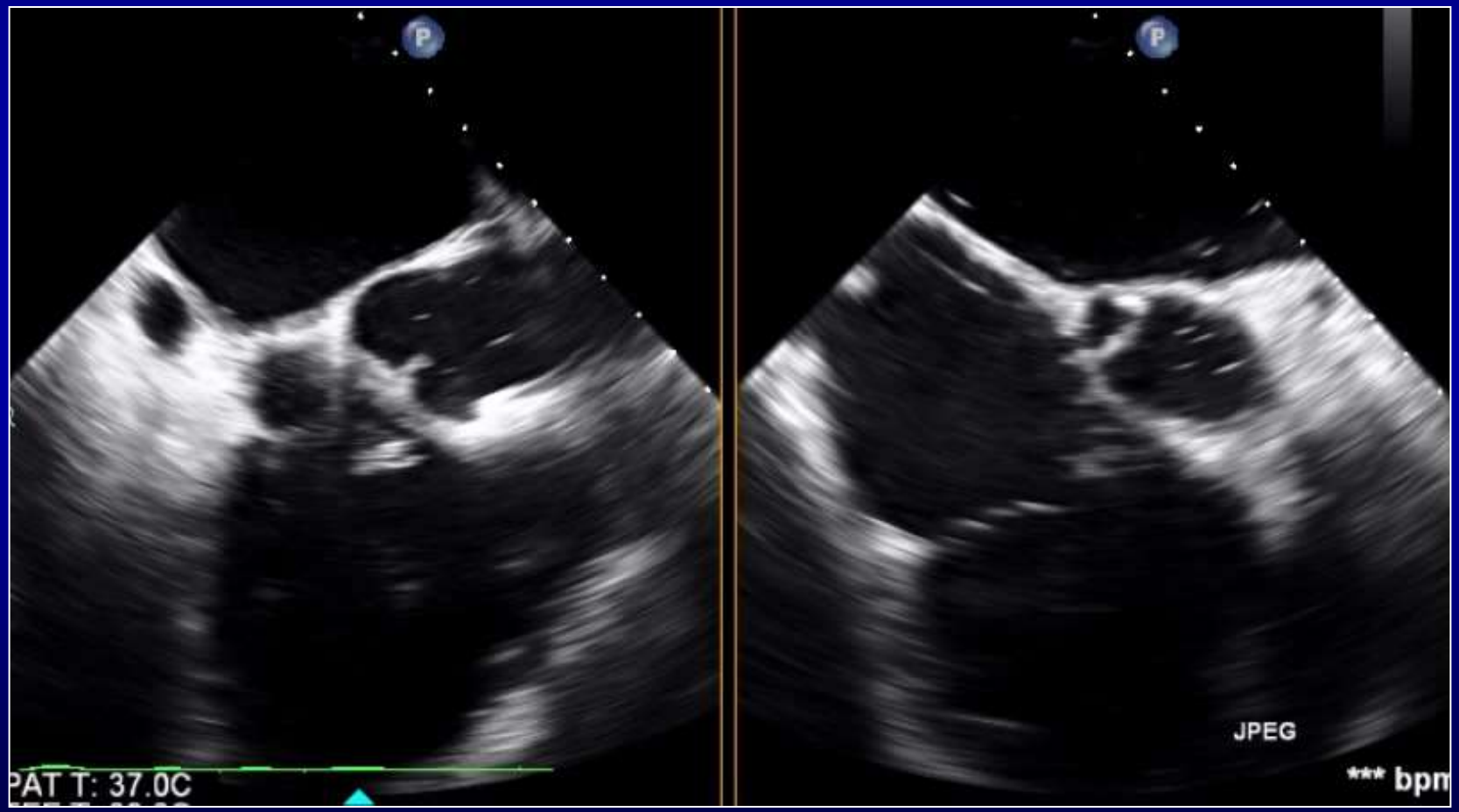
Patient brought to the cath lab for mitral valve in valve

- Drop in BP immediately following induction for intubation
- CPR performed x 5 minutes and epinephrine boluses, with return of pulsatility

Trans-septal puncture performed in mid-mid position

CPR performed again, just before transseptal puncture

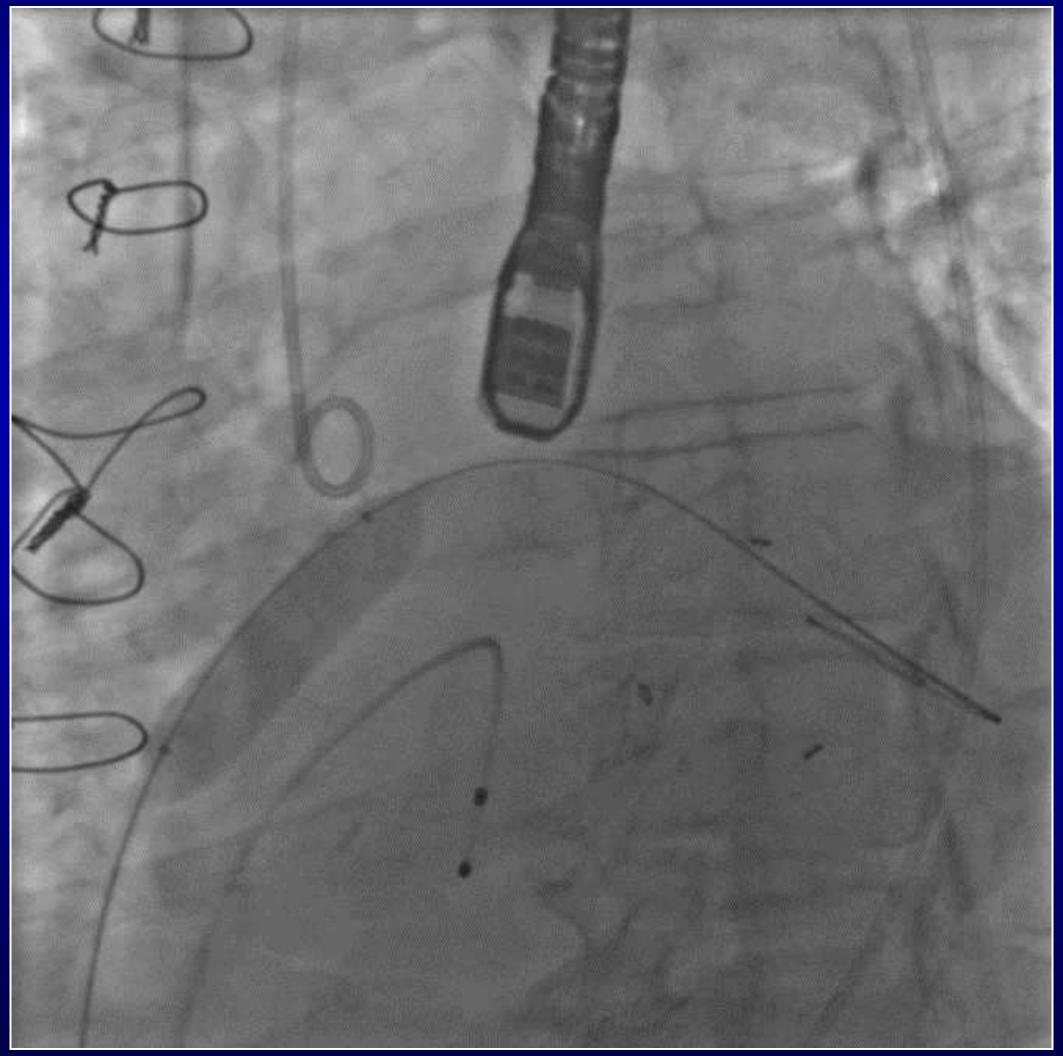
Baylis sheath and needle



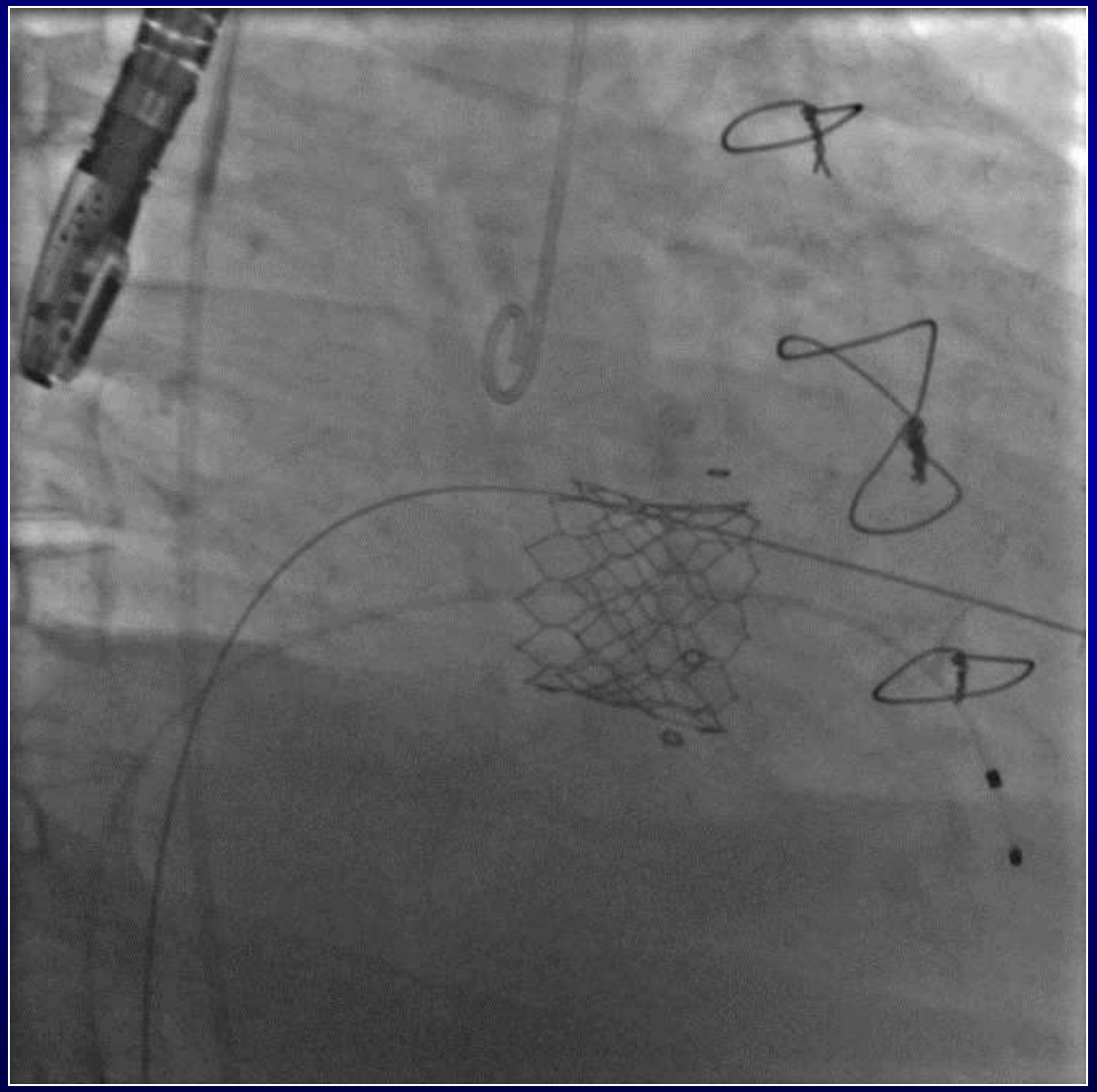
Procedural steps

- Agilis catheter advanced into the left atrium
- Mitral valve crossed with a pigtail catheter advanced through an Agilis catheter
- Baseline mitral valve gradient measured with a dual-lumen pigtail
- Confida wire advanced into the LV and pigtail catheter and Agilis catheter removed
- 16 French Edwards esheath advanced into the femoral vein

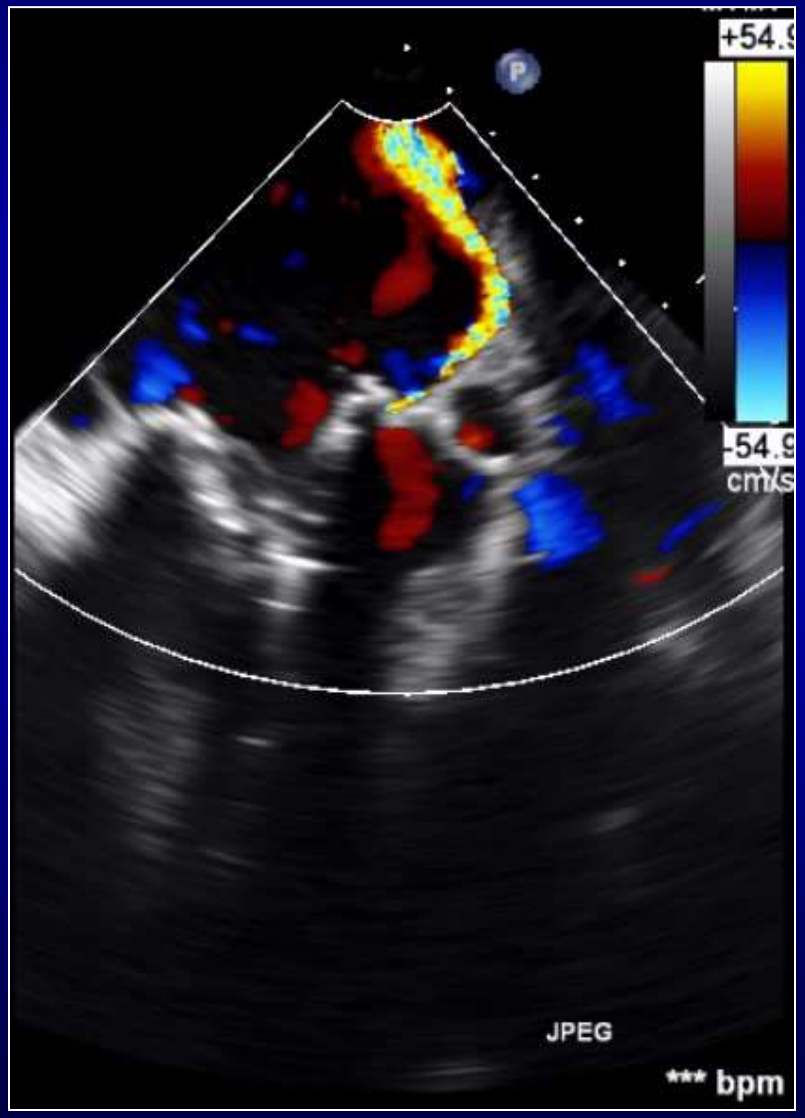
Atrial septostomy performed with a 14mm x 4cm Z-Med balloon

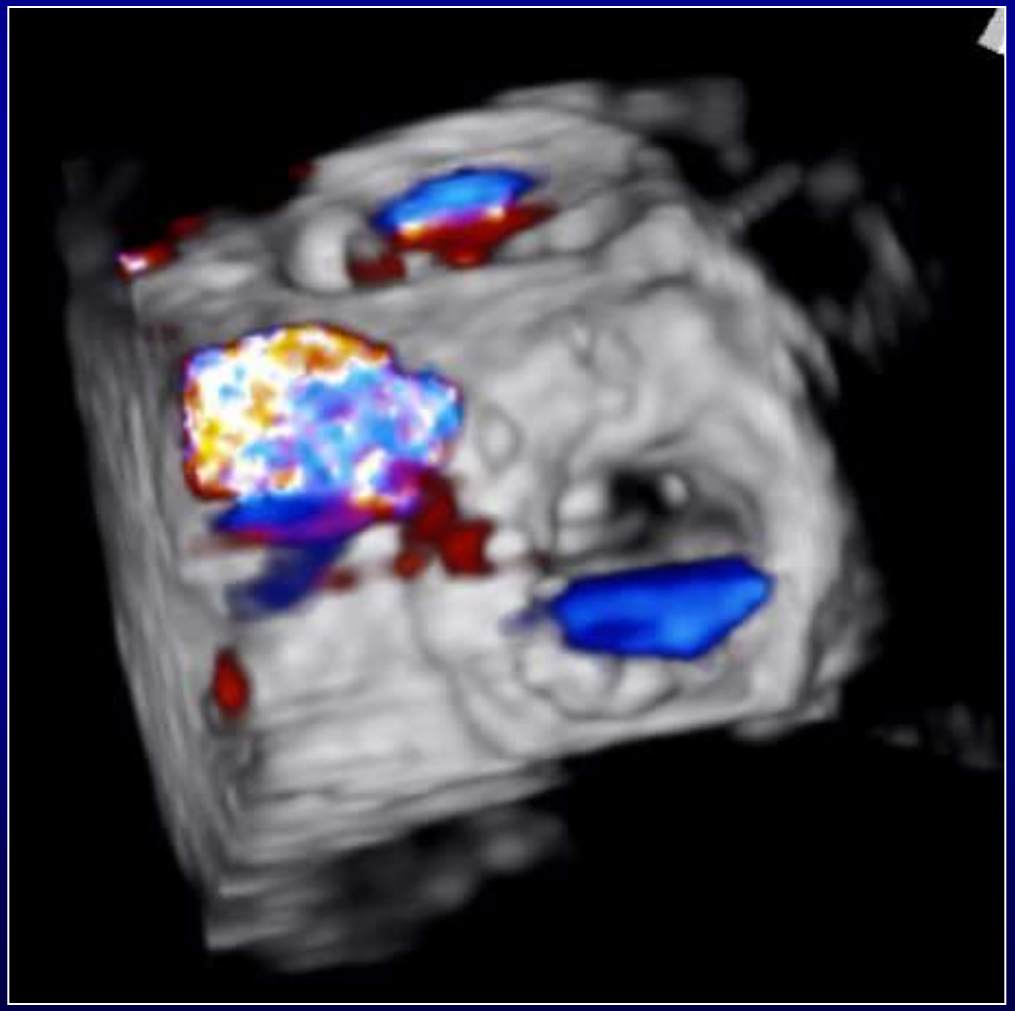


Trans-septal mitral ViV performed with a 29mm Sapien 3 valve

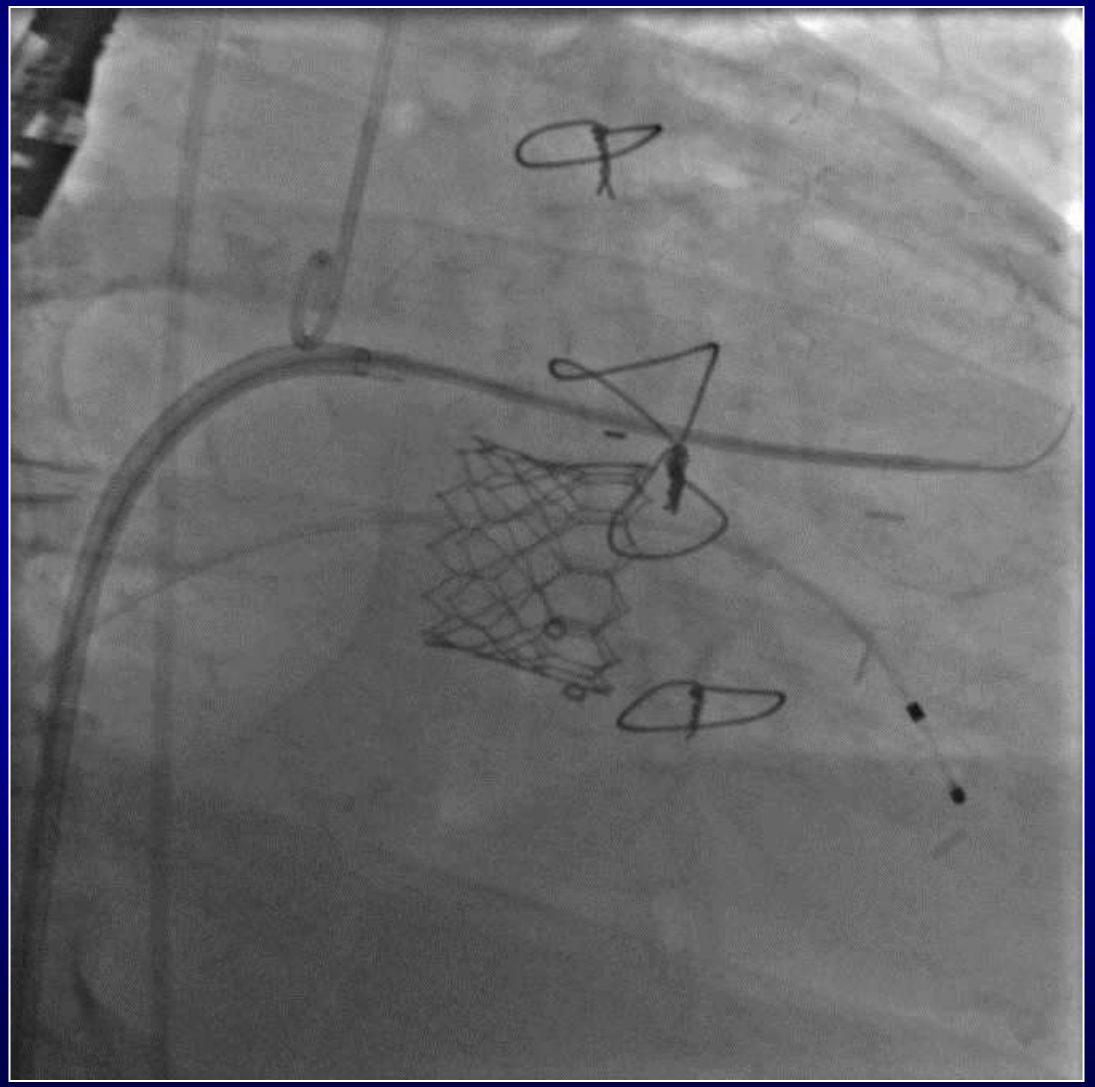


s/p mitral ViV with 29mm Sapien 3
No central MR; residual severe paravalvular MR

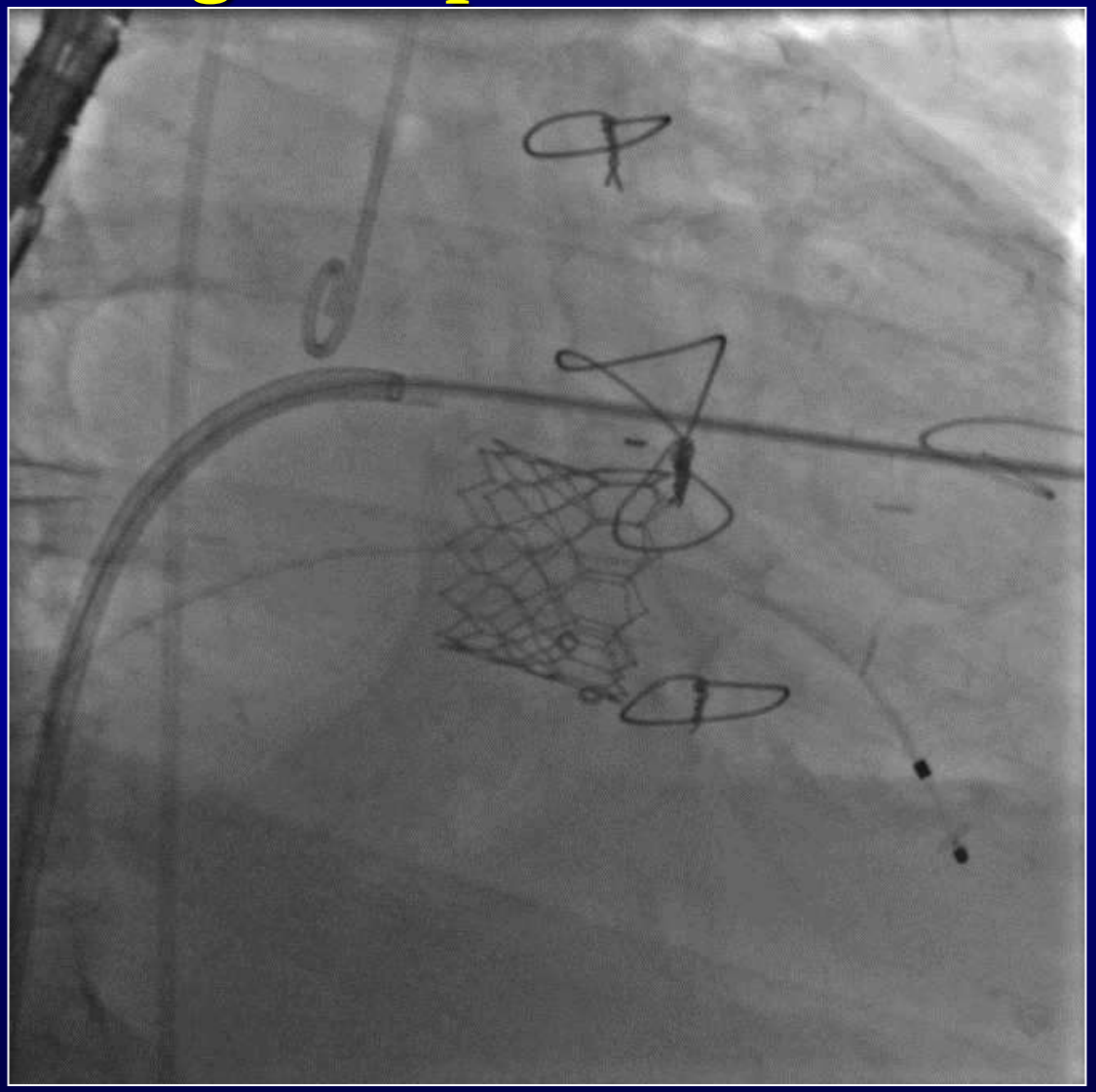




Paravalvular leak crossed with a 0.035inch Terumo glidewire and a 6 French Multipurpose catheter

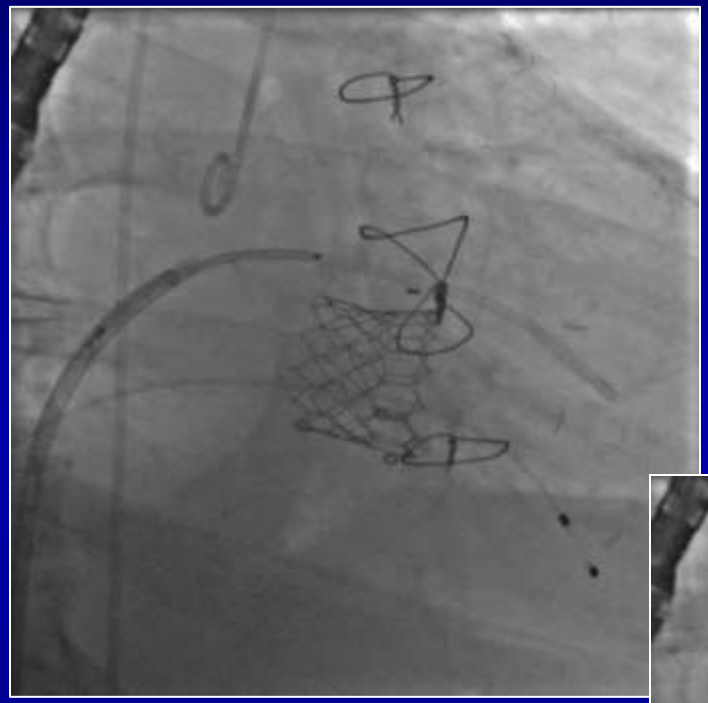


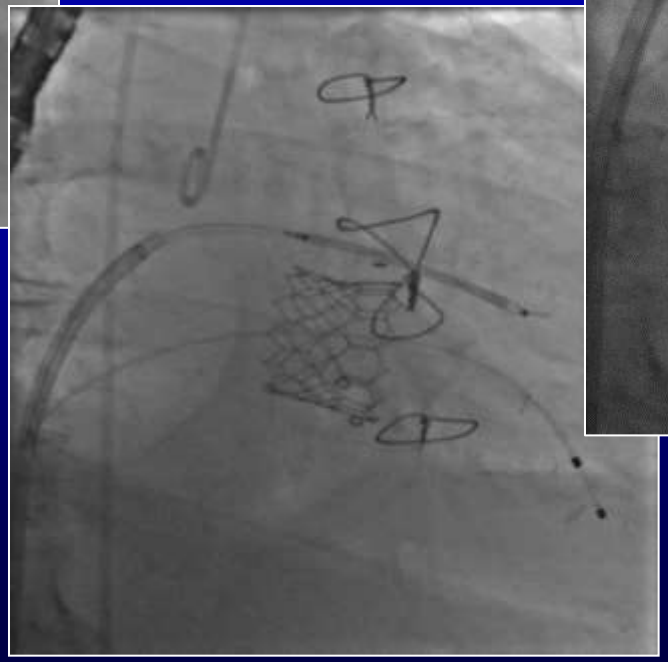
A 0.035 inch Confida wire advanced into the LV through the paravalvular leak



6 French Multipurpose diagnostic catheter exchanged for a 6 French Multipurpose guide catheter

12mm AVP2 plug deployed in the paravalvular space



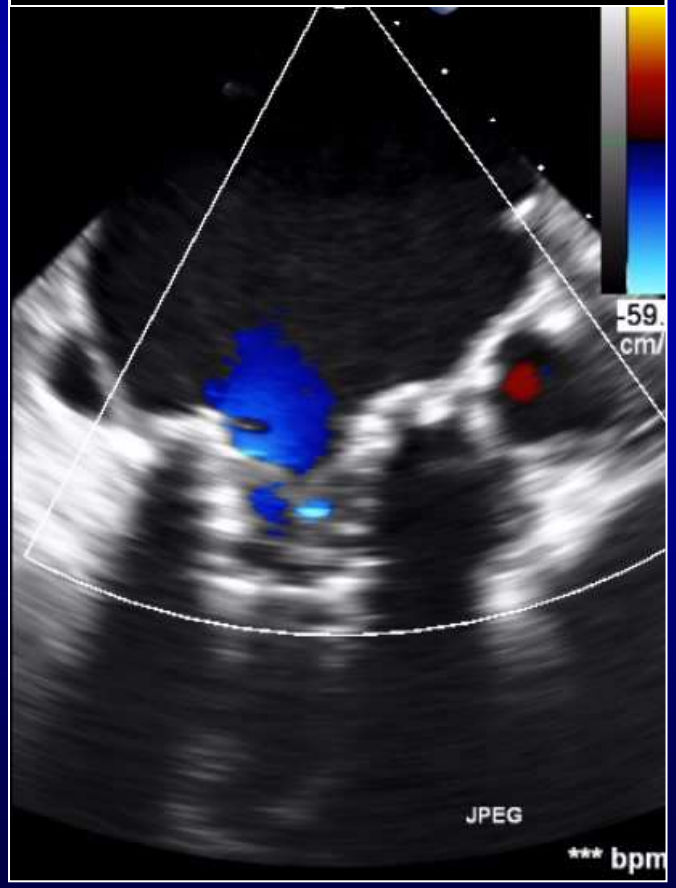


s/p paravalvular leak closure with 12mm AVP2 plug

No significant paravalvular MR

Severe PVL

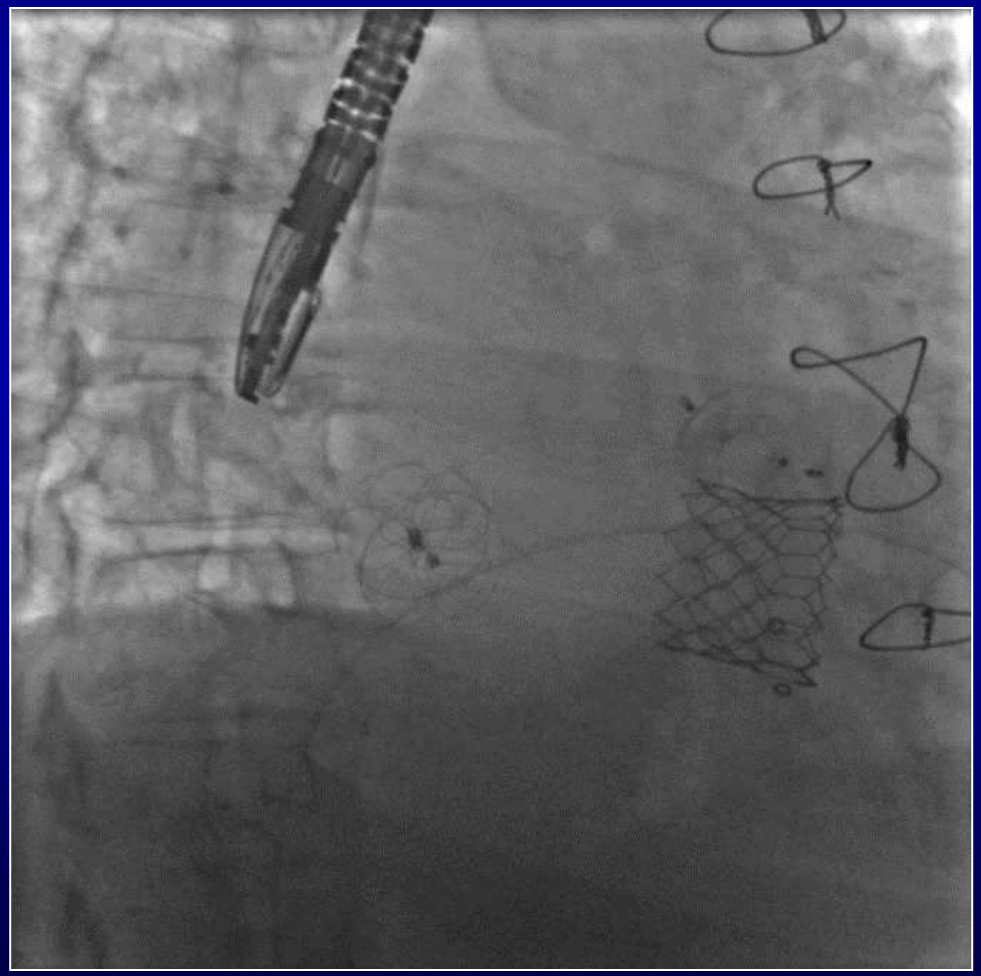
Trivial PVL after PVL closure

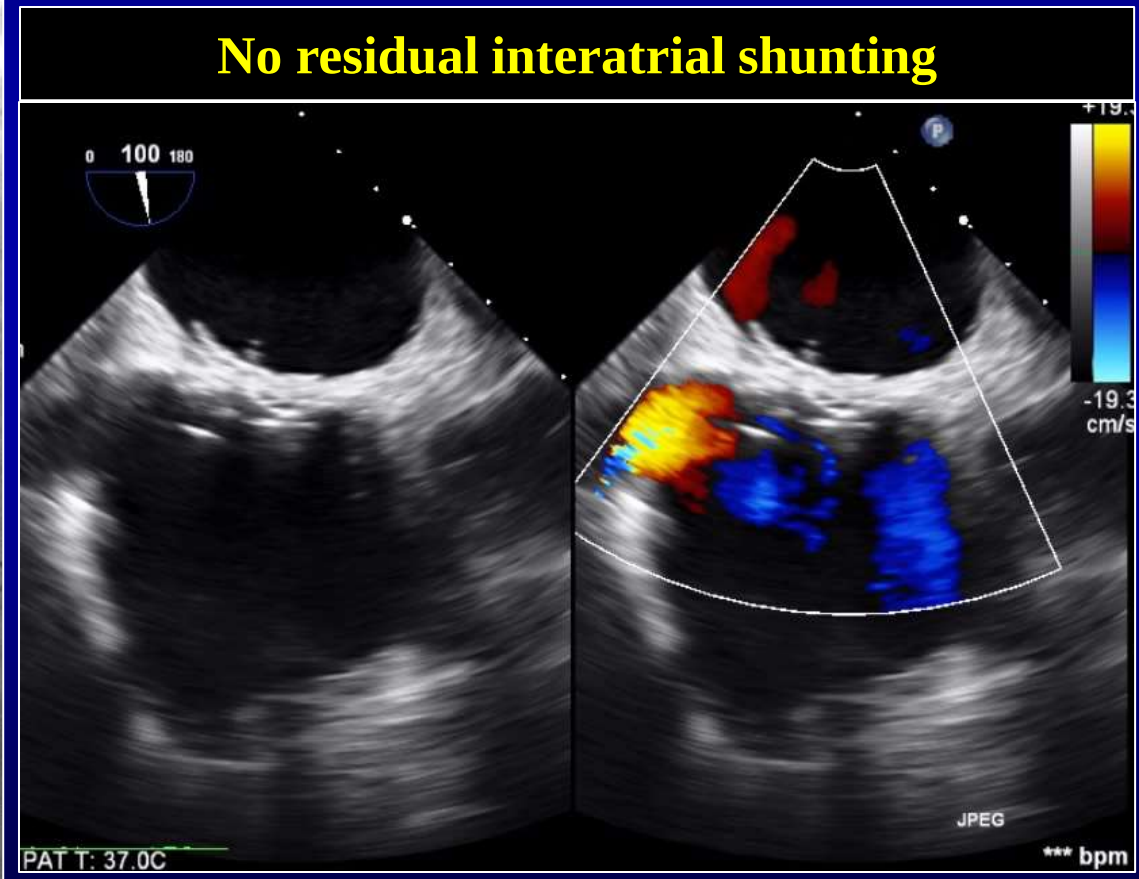


Iatrogenic ASD closed with a 25mm Cardioform

Concern for right to left shunting due to pulmonary HTN and severe RV failure

No residual interatrial shunting





Mitral valve replacement with buddy balloon

76 y/o female presenting with severe mitral stenosis due to degenerative bioprosthetic mitral valve

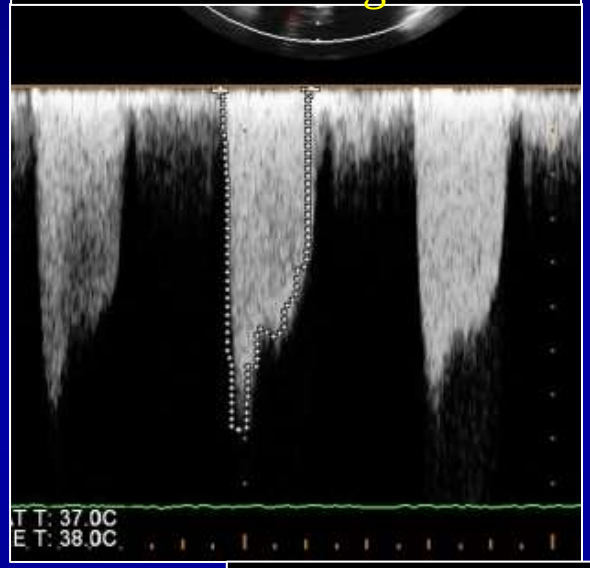
Deemed inoperable due to comorbidites

- h/o CABG
- s/p MVR with Edwards CE valve
- NYHA IV CHF
- Peripheral arterial disease s/p aortoiliac bypass
- COPD, on home oxygen
- Frailty
- Autoimmune hemolytic anemia, requiring immunosuppresion
- Pulmonary hypertension
- Non-hodgkin lymphoma

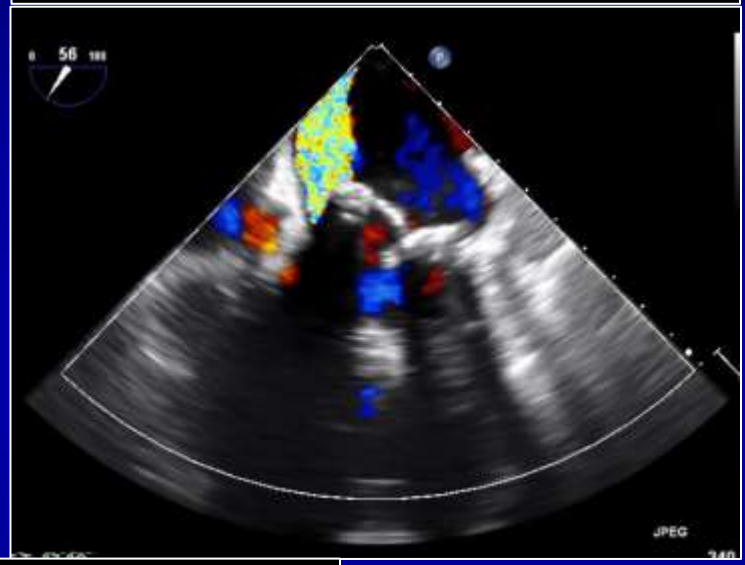
Severe mitral stenosis and severe paravalvular MR of bioprosthetic valve

Severely thickened and restricted mitral leaflets

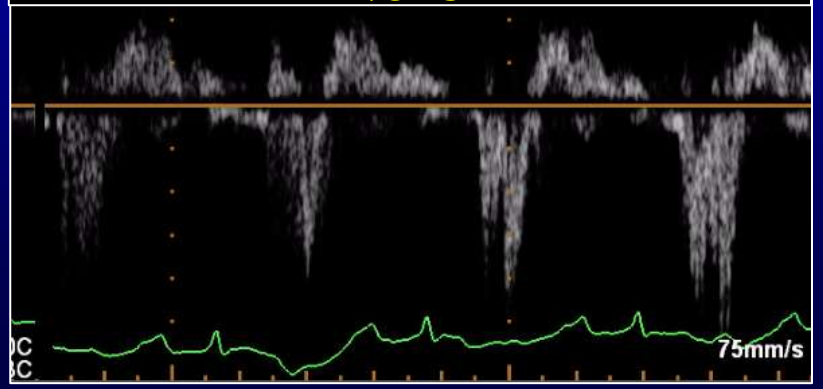
Mean transmitral gradient 20mmHg



Severe paravalvular MR

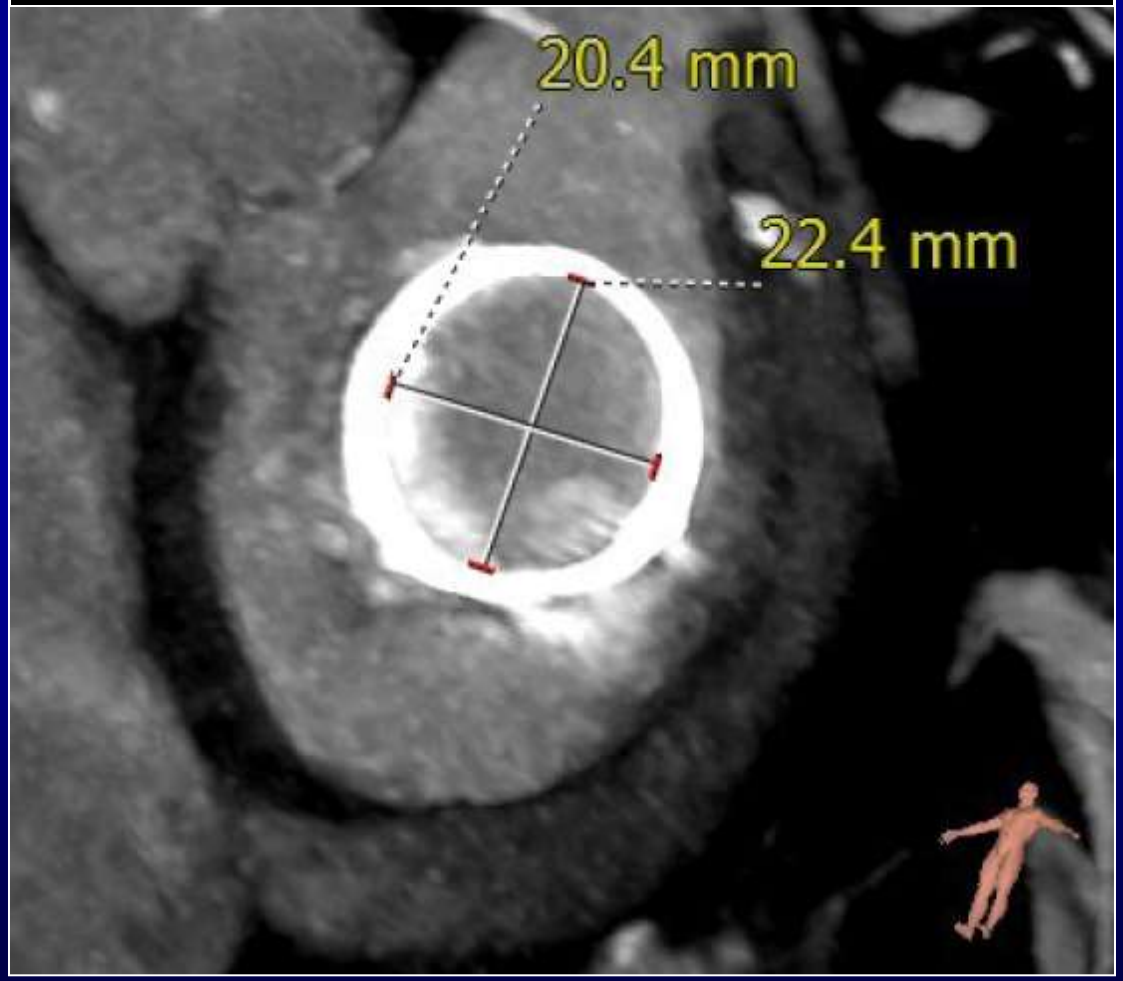


Systolic flow reversal in pulmonary veins



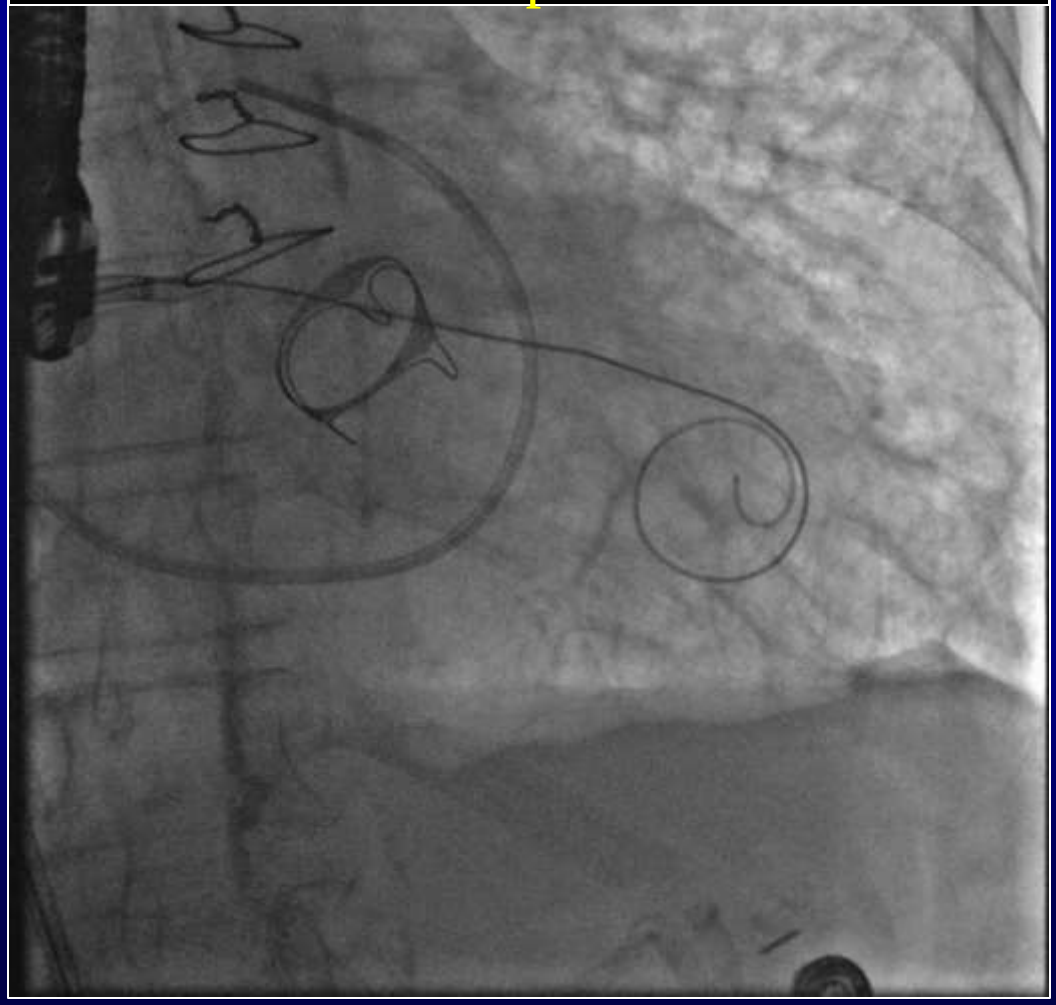
Plan for trans-septal mitral valve-in-valve implantation with Sapien-XT 26mm valve

Internal dimensions of the valve
20.4mm x 22.4mm

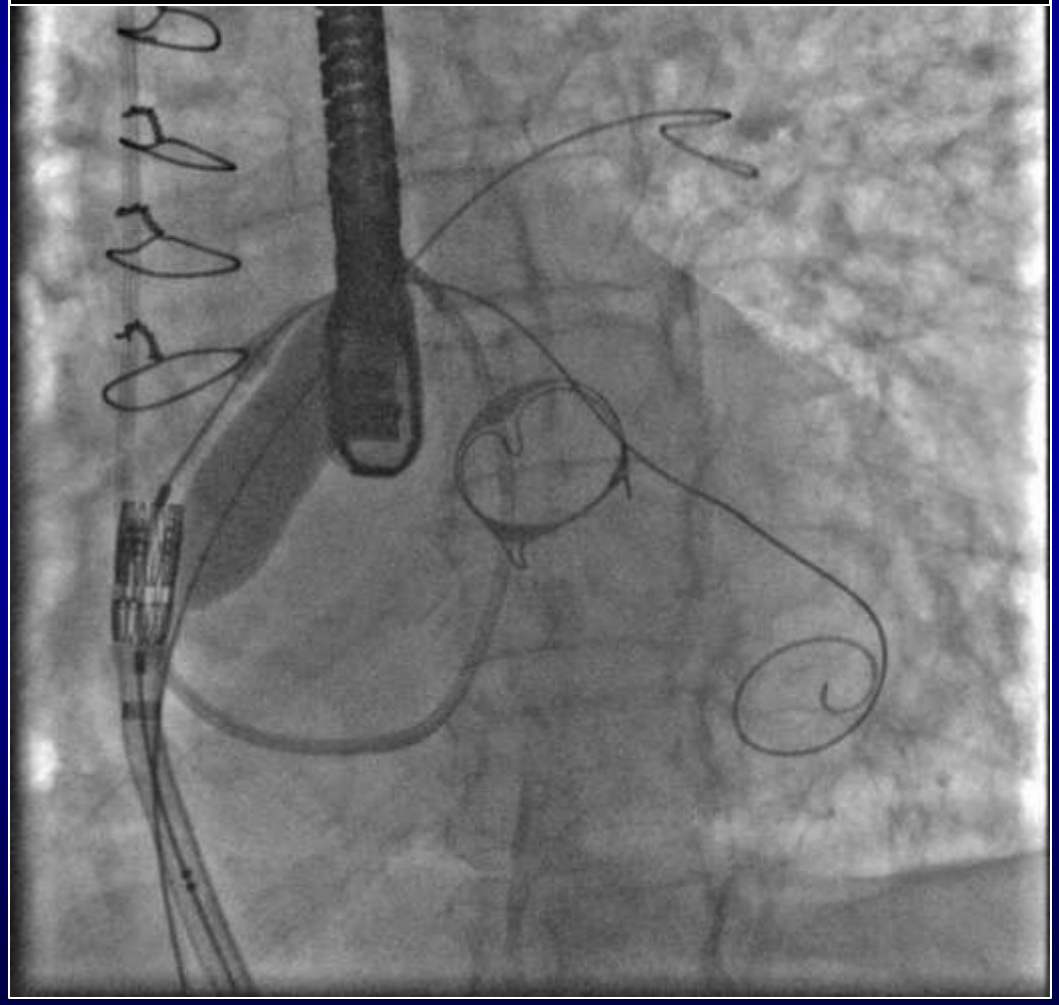


Trans-septal puncture, followed by balloon atrial septostomy with 16 x 4mm Z-med Balloon

Confida wire in the LV across the mitral bioprosthesis

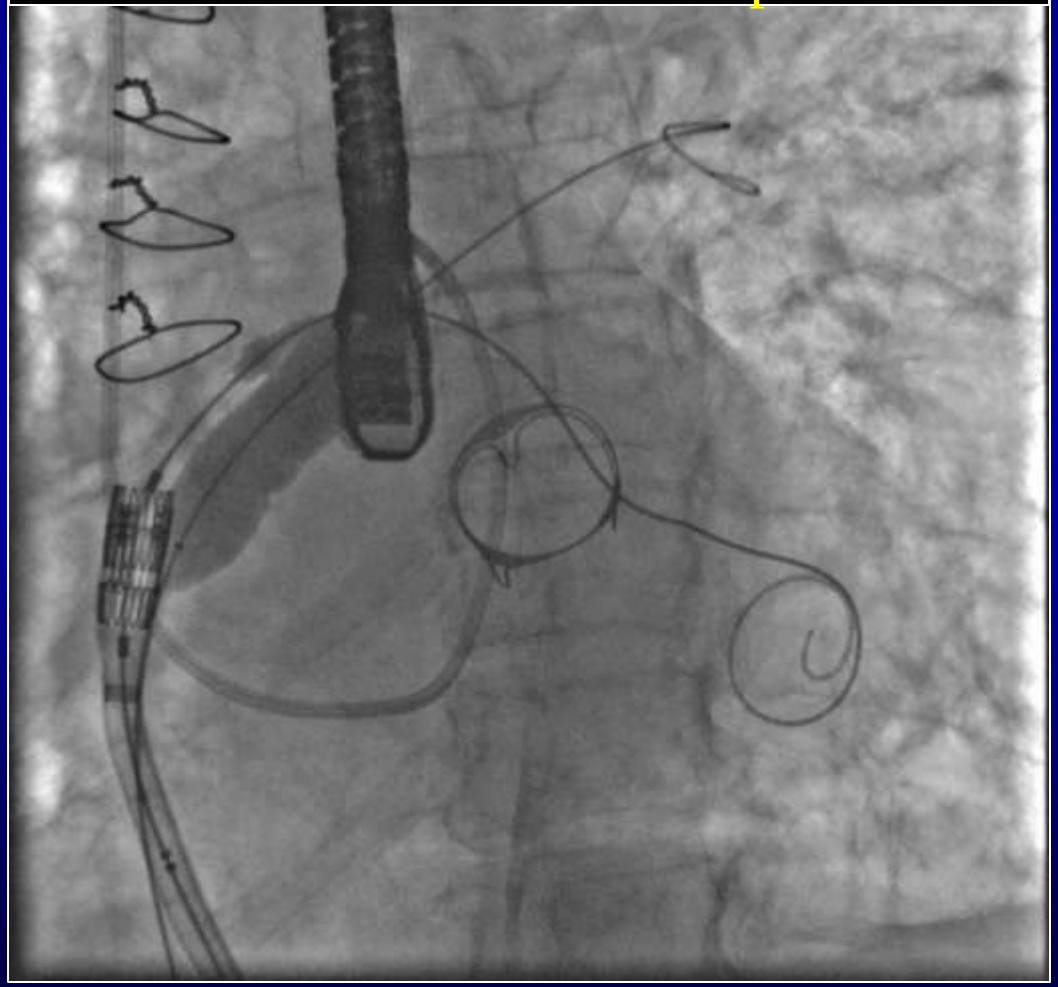


Balloon atrial septostomy



26mm Sapien-XT valve deployment by trans-septal approach

Buddy balloon technique to advance the valve across the septum



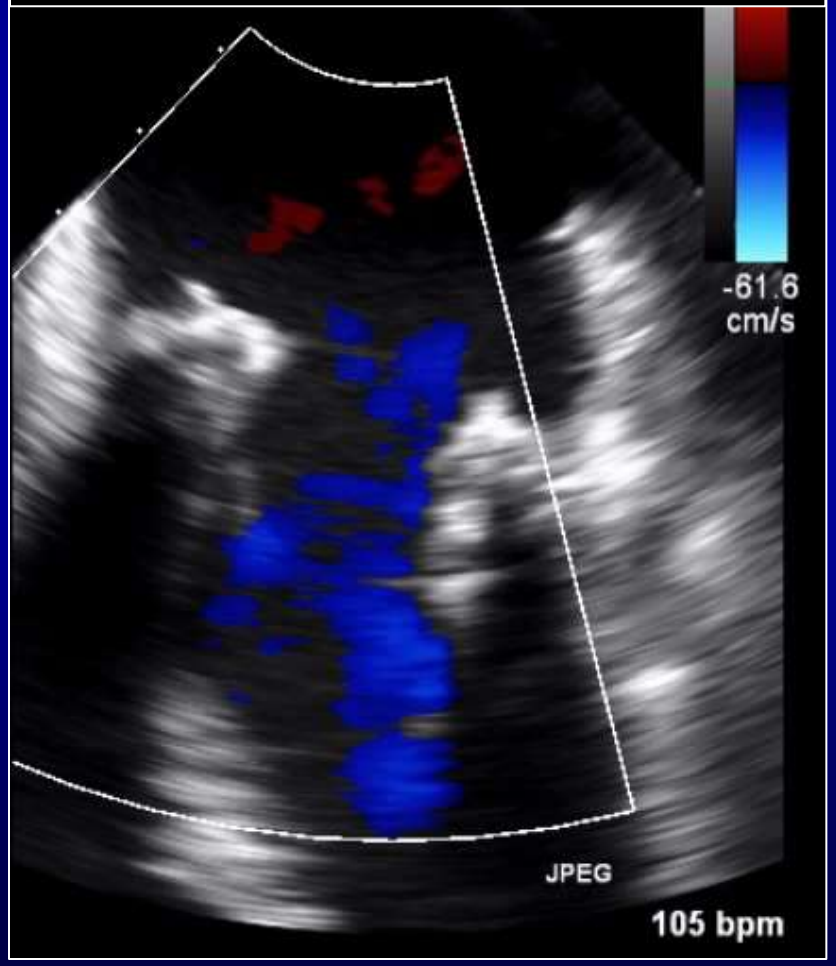
Valve deployment

Final result

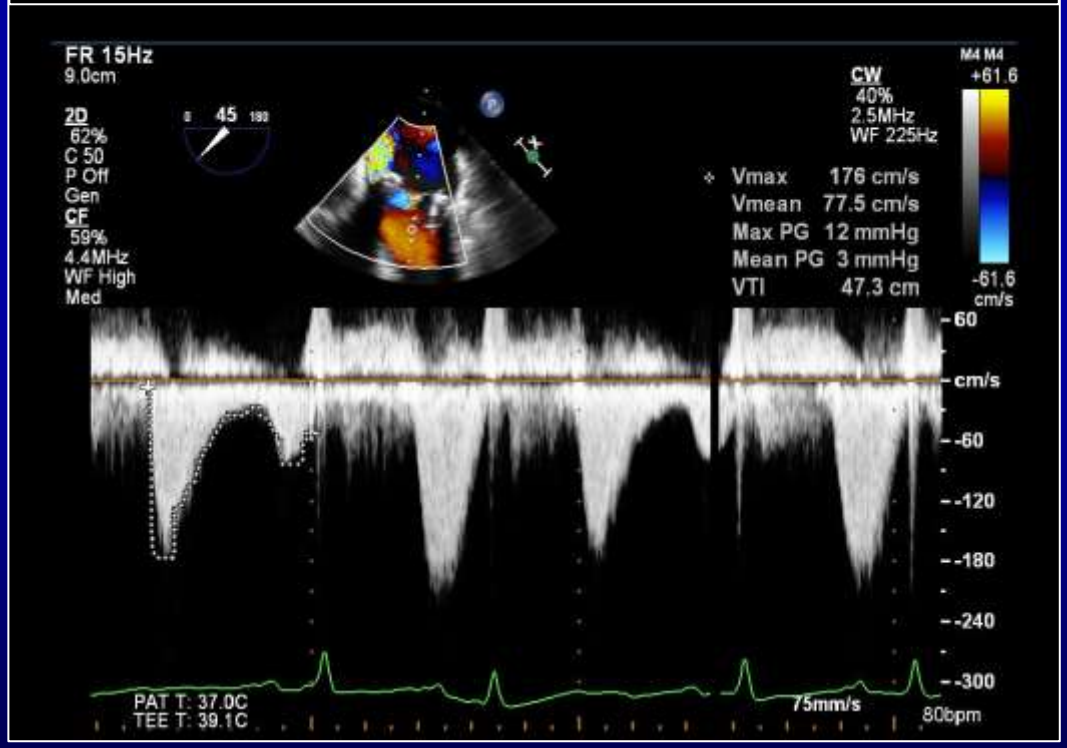
No significant central MR, persistent severe paravalvular MR

Normalization of transmitral gradient

Normal transcatheter valve function
Persistent severe PV MR

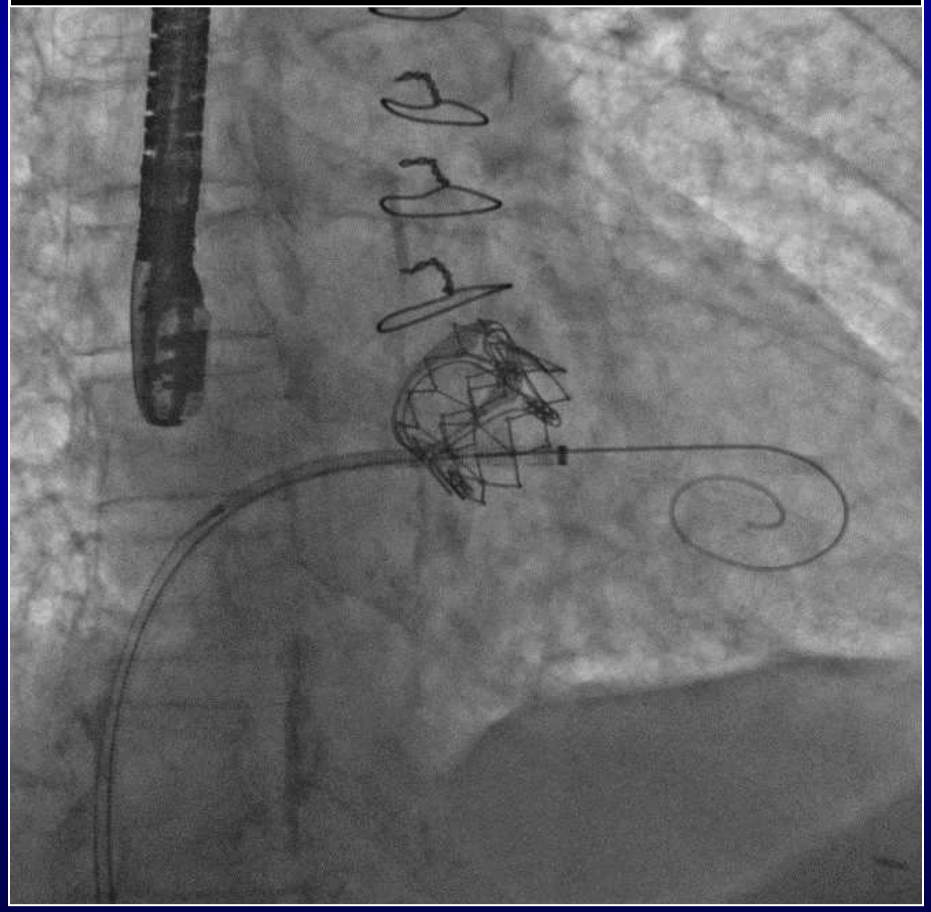


Mean transmitral gradient
3 mmHg

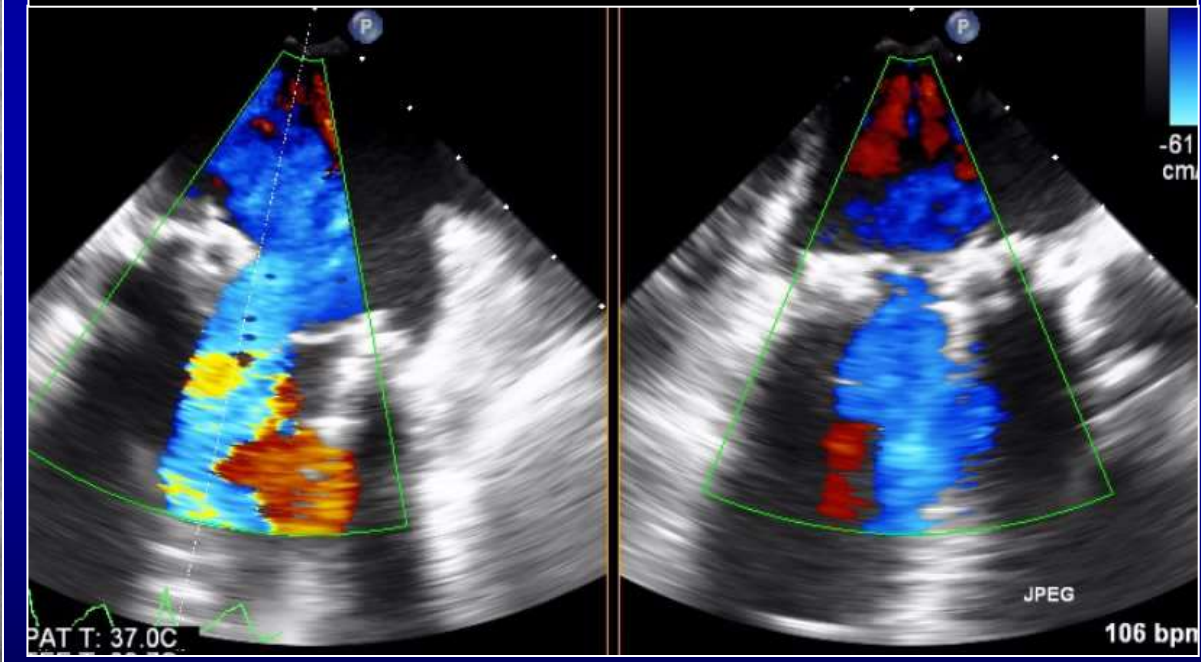


Patient brought back to the cath lab 1 month later for mitral PVL closure

14mm AVP2 plug



Trivial residual mitral PVL



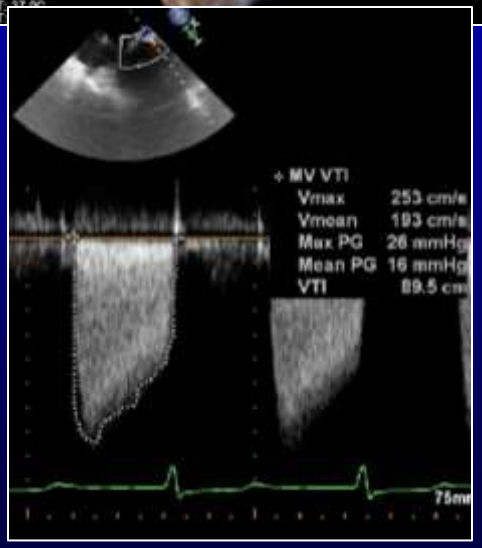
Transcatheter mitral and aortic ViV

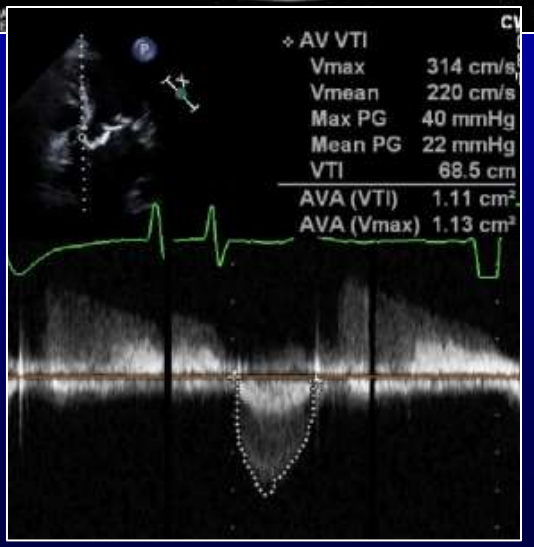
72 y/o female presenting with NYHA III heart failure

Severe bioprosthetic mitral stenosis
29mm Bovine Edwards

Severe bioprosthetic aortic stenosis
23mm Bovine Edwards

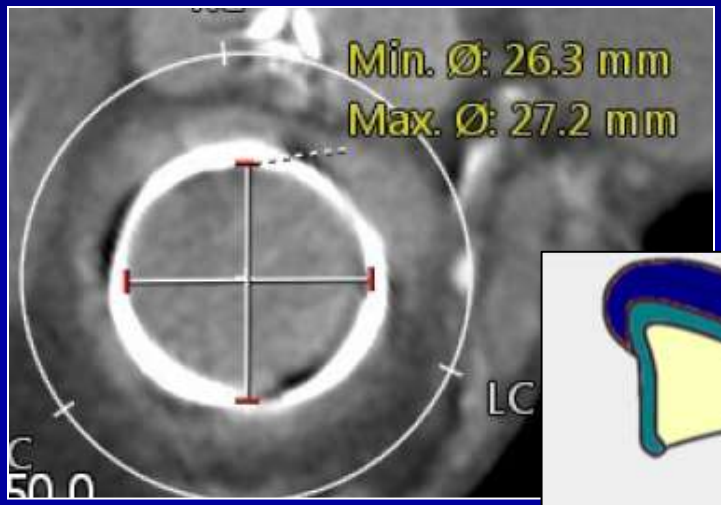
Deemed inoperable due to critical pulmonary hypertension

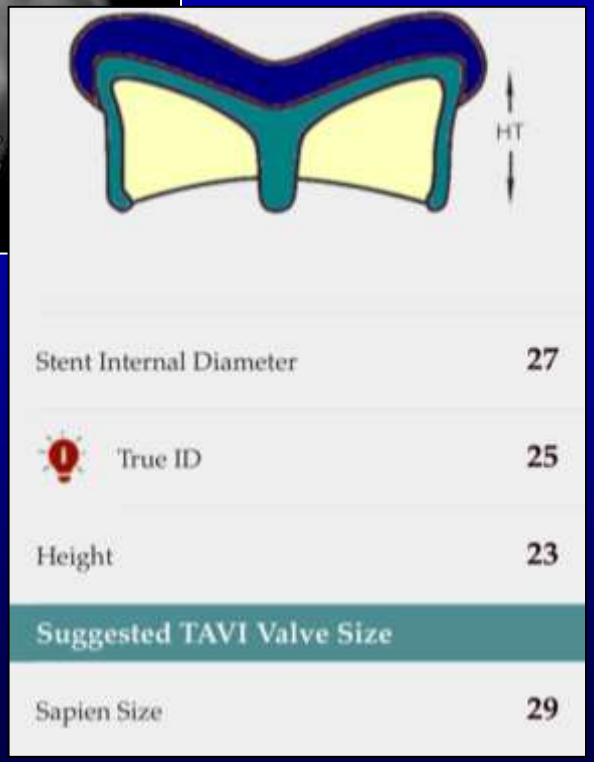


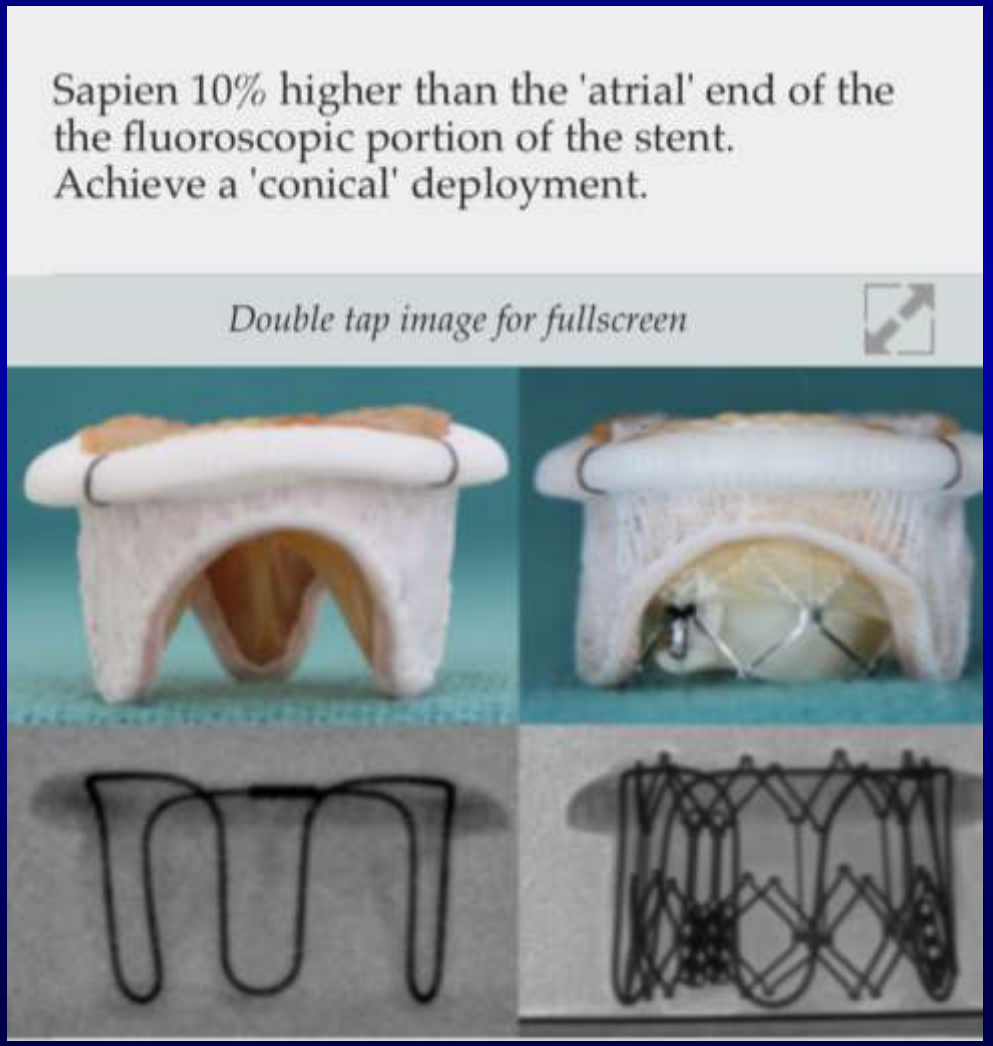


Patient worked-up for transcatheter aortic and mitral ViV implantation

Plan for 29mm Sapien 3 for mitral ViV

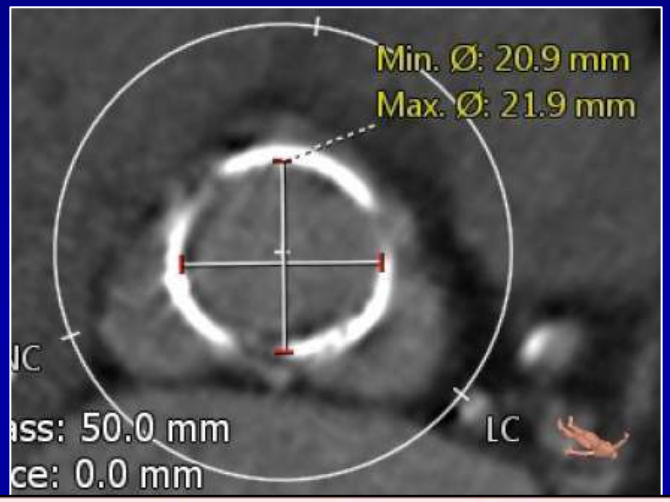


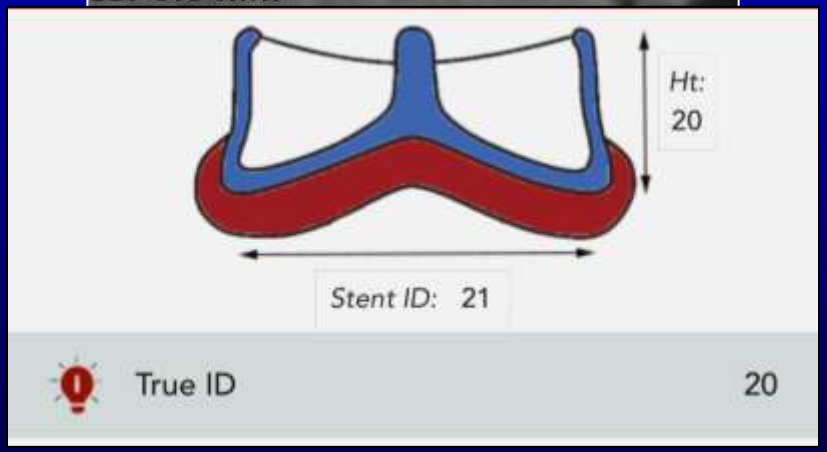


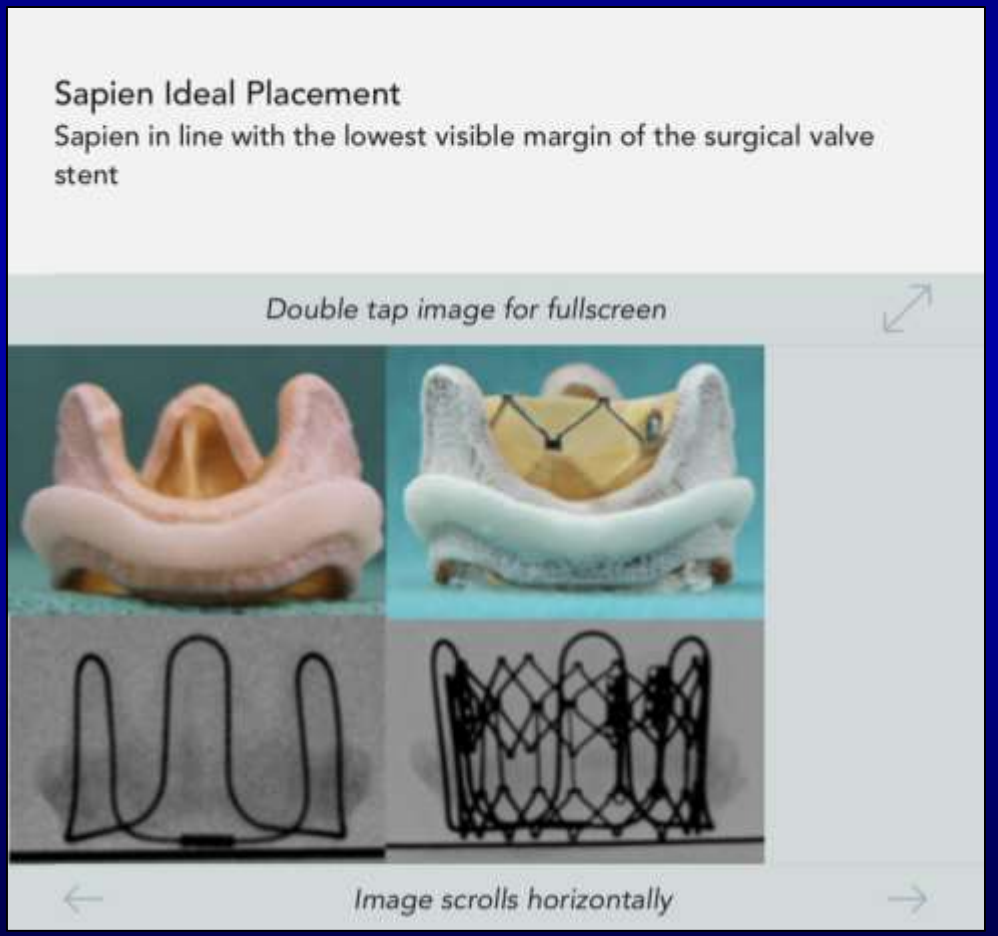


Patient worked-up for transcatheter aortic and mitral ViV implantation

Plan for 23mm Sapien 3 for aortic ViV

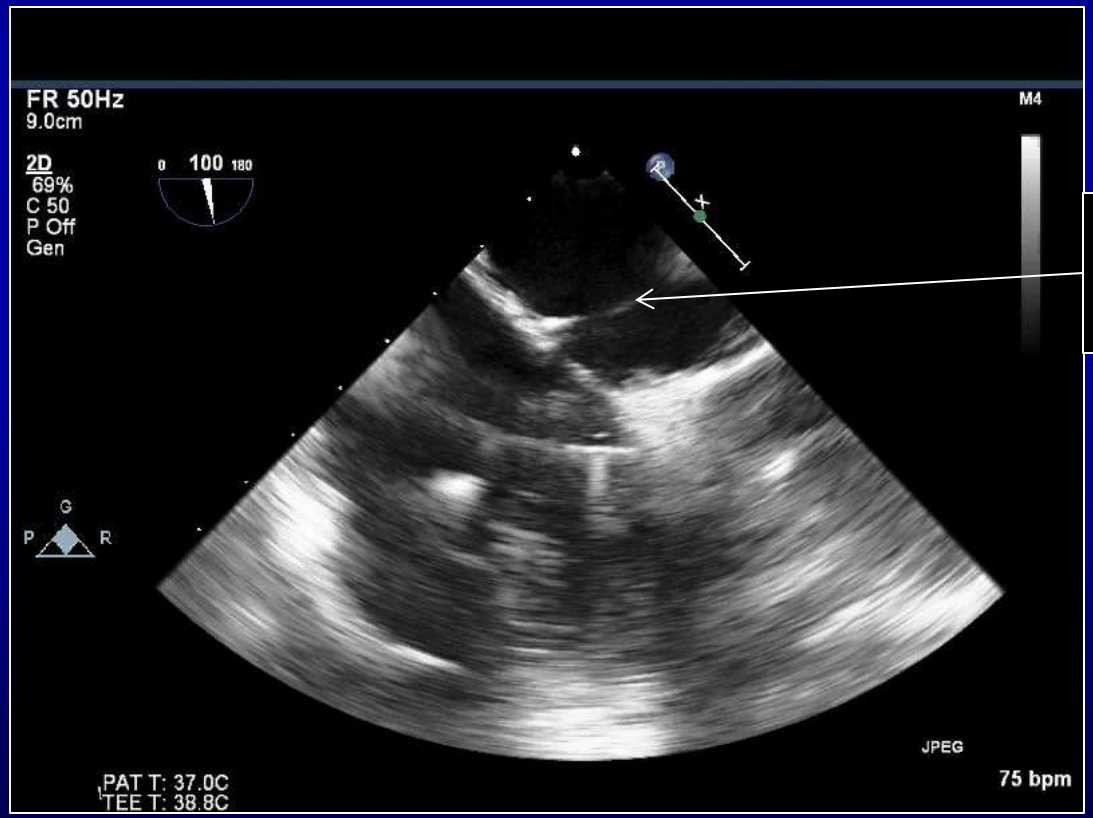


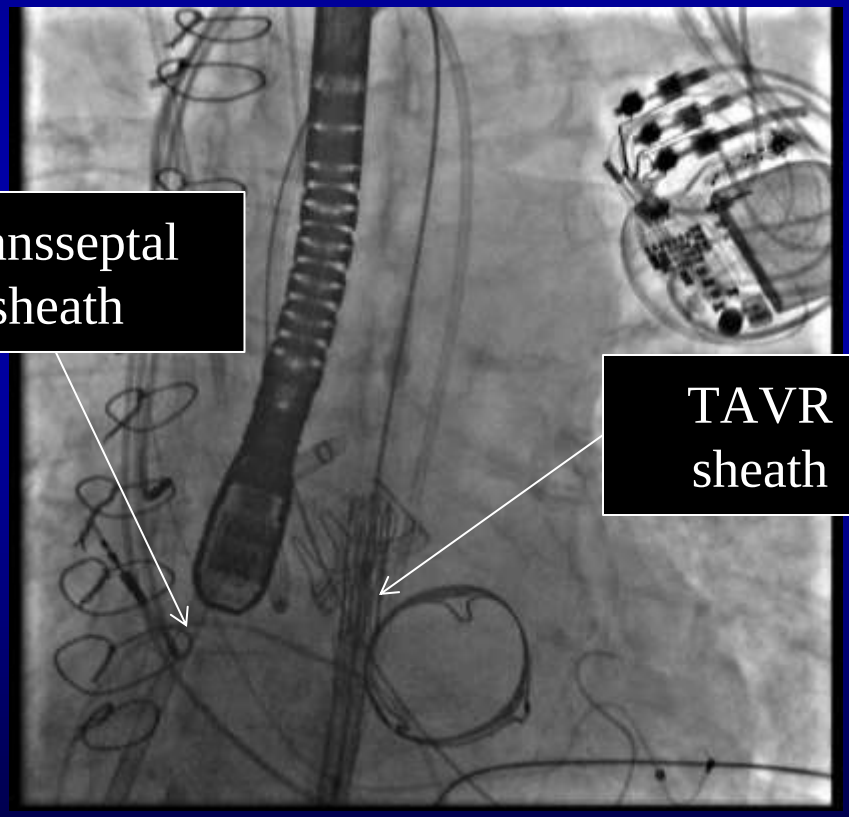




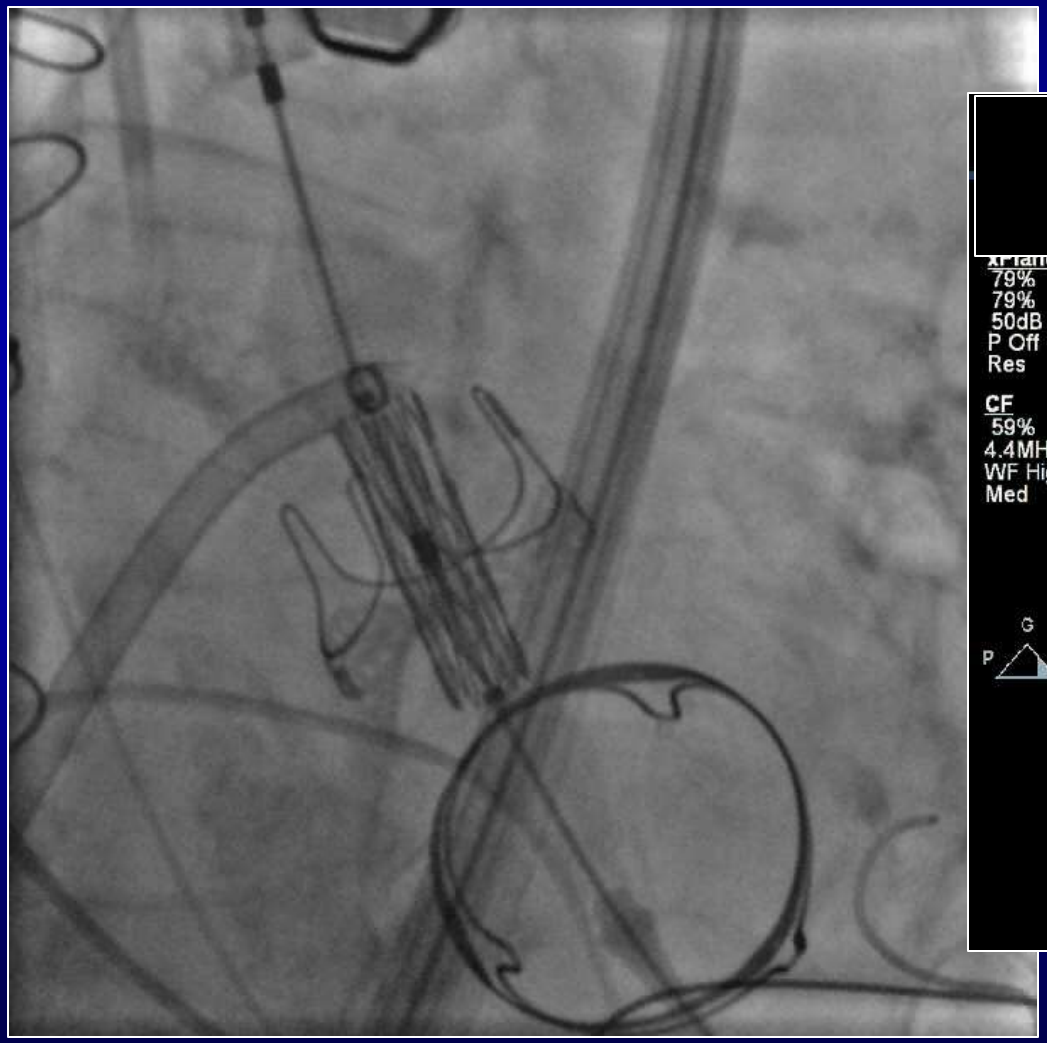
Patient brought to the cath lab for transcatheter aortic and mitral valve replacement

Trans-septal puncture for Transcatheter mitral ViV performed at the time of arterial access for Transcatheter aortic ViV

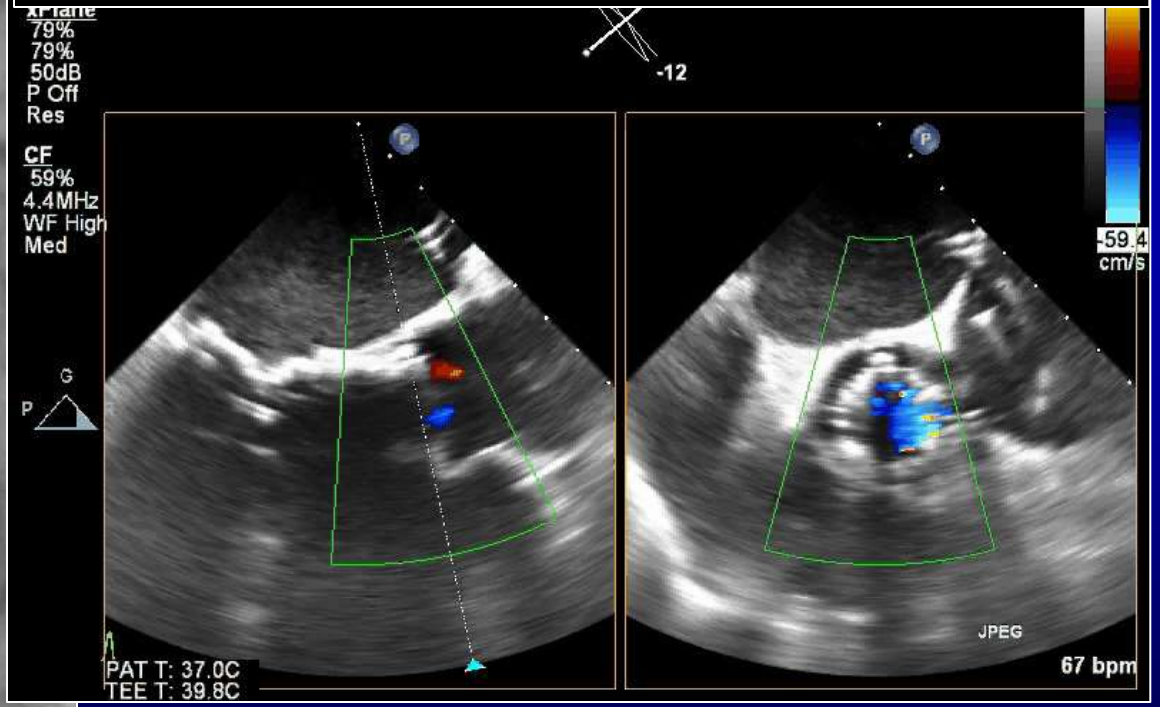




Transcatheter aortic ViV with 23mm Sapien 3 valve



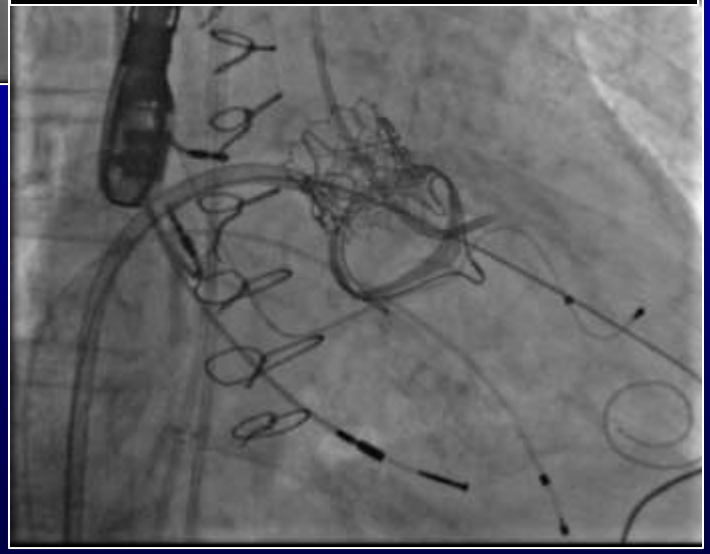
No significant AR



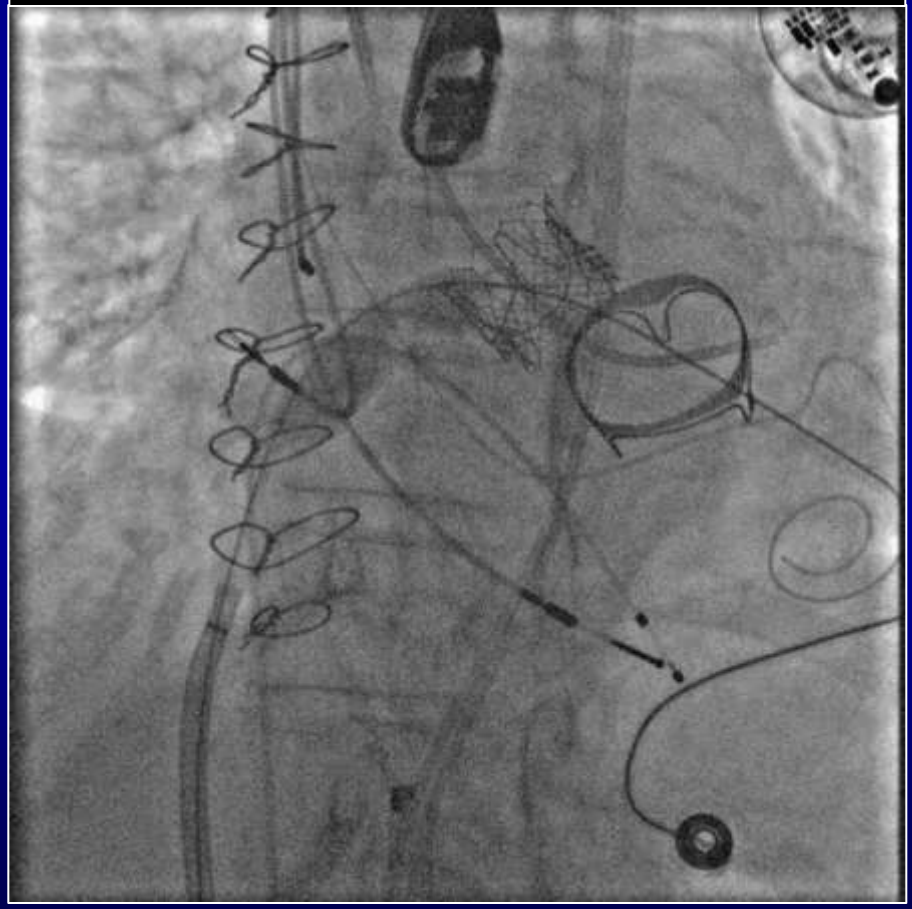
Immediately after aortic ViV, Preparation for transcatheter mitral ViV

Pigtail across the mitral valve

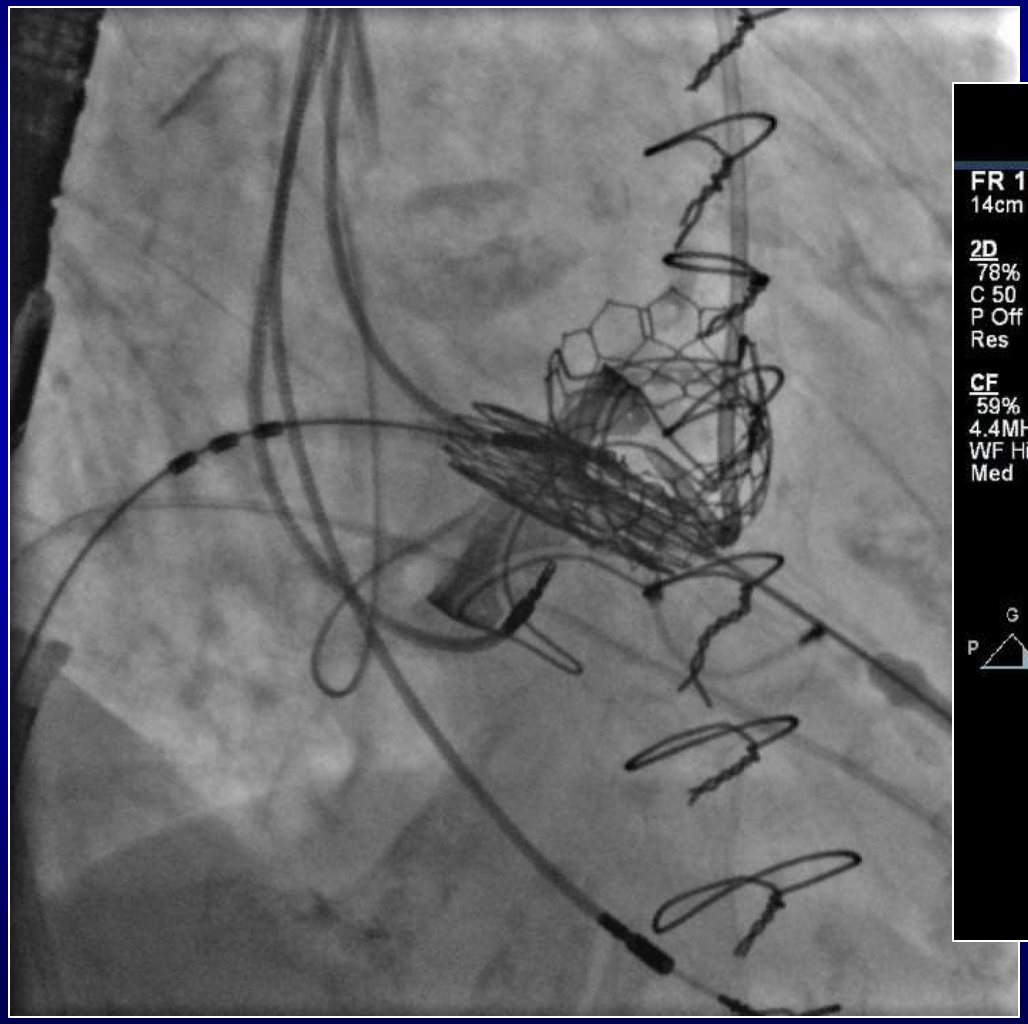
Safari across the mitral valve

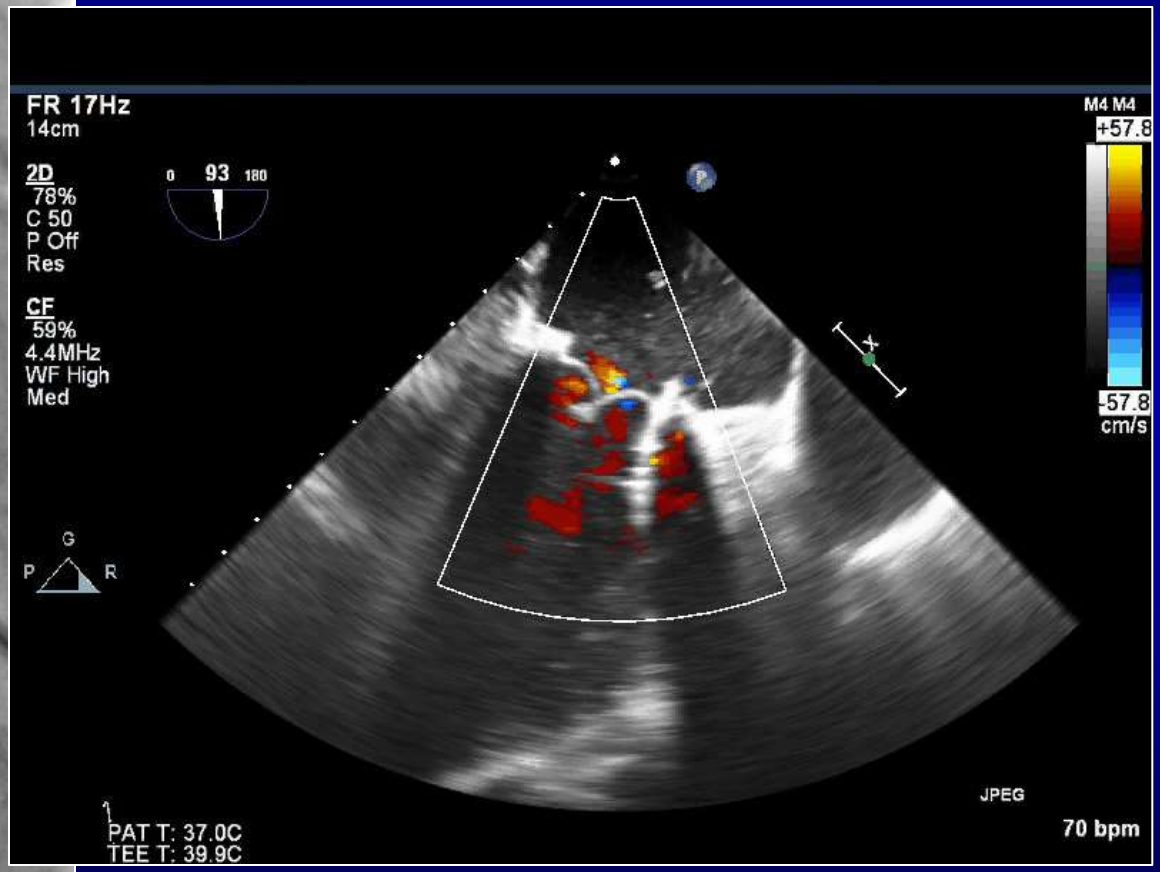


Atrial septostomy with Z-med II 15 x 4 cm



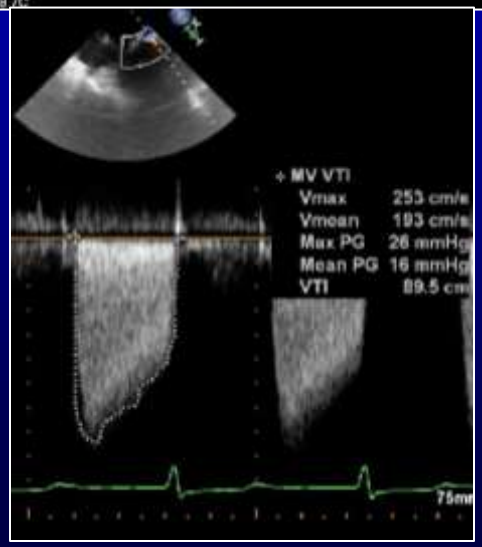
Trans-septal transcatheter Mitral ViV implantation with a 29mm Sapien 3 valve





Final result s/p simultaneous transfemoral aortic and mitral ViV implantation

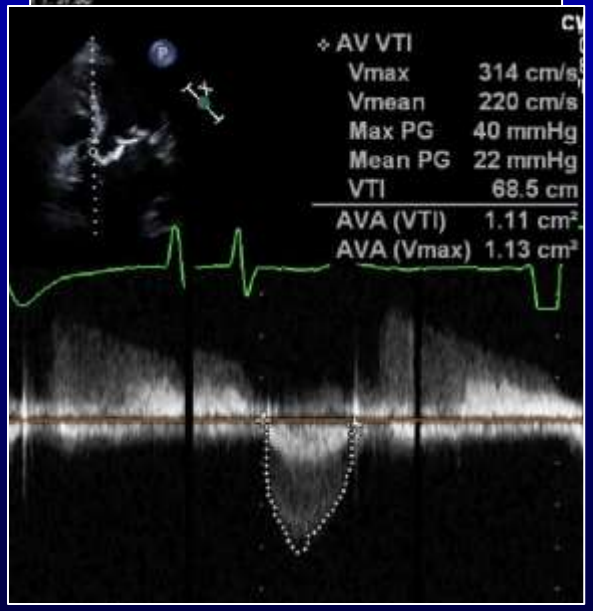
Pre-Mitral ViV



Post-Mitral ViV

Final result s/p simultaneous transfemoral aortic and mitral ViV implantation

Pre-Aortic ViV



Post-Aortic ViV