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Echocardiography in cath lab and operative room

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Introduction:

- Typically, guidance of catheter-based procedures is performed using fluoroscopy and 2-dimensional (2D) TEE.
- Both are limited by its 2D projections of a complex 3D of the heart.



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Introduction:

- 3D TEE is able to view cardiac structures as they are in reality.
- Moreover, because of its 3D nature, long segments of catheters, tips, and the devices can easily be displayed without excessive probe manipulations.



Advantages of Echo:

- Live !!!
- Very safe with very rare complications.
- Portable.
- 3D and ICE offer direct visualization with interpretable resolution.



Cath Lab



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Coronary intervention complications

**Transspetal
 puncture**

PFO/ASD closure

**Balloon mitral
 valvuloplasty**

LAA occlusion

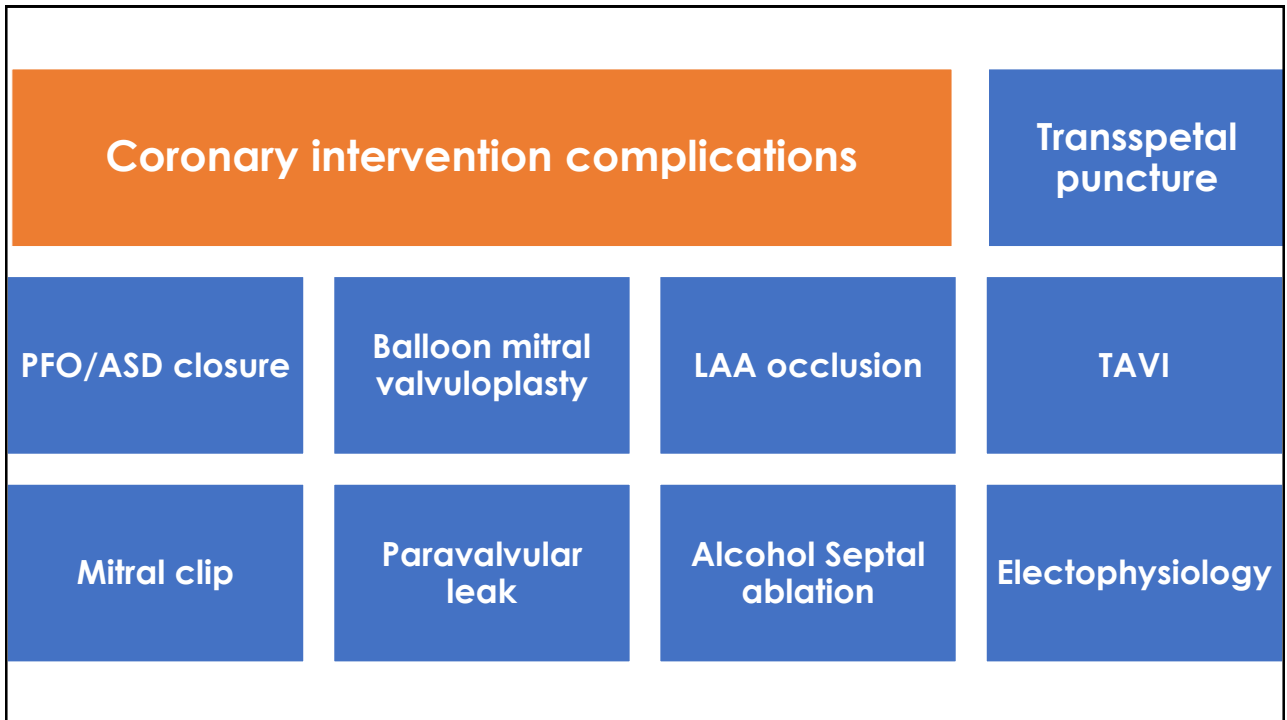
TAVI

Mitral clip

**Paravalvular
 leak**

**Alcohol Septal
 ablation**

Electrophysiology



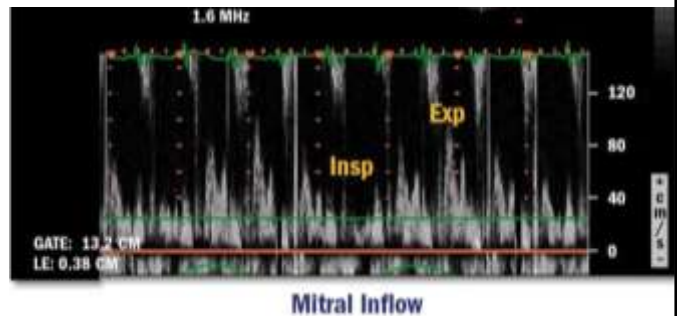
Coronary intervention complications:

- When a patient develops signs of cardiogenic shock after coronary intervention:
 - Pericardial tamponade
 - Left ventricular function change and new regional wall motion.



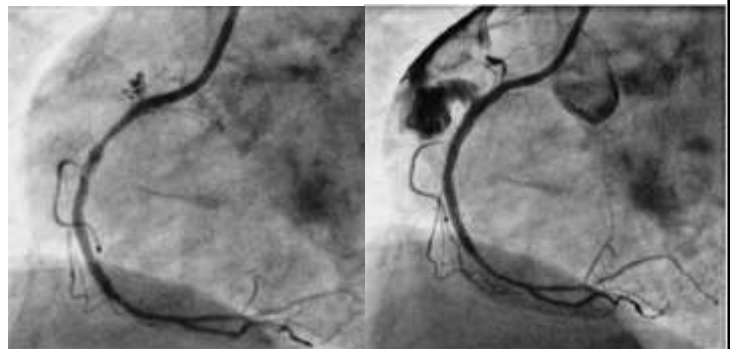
Coronary intervention complications:

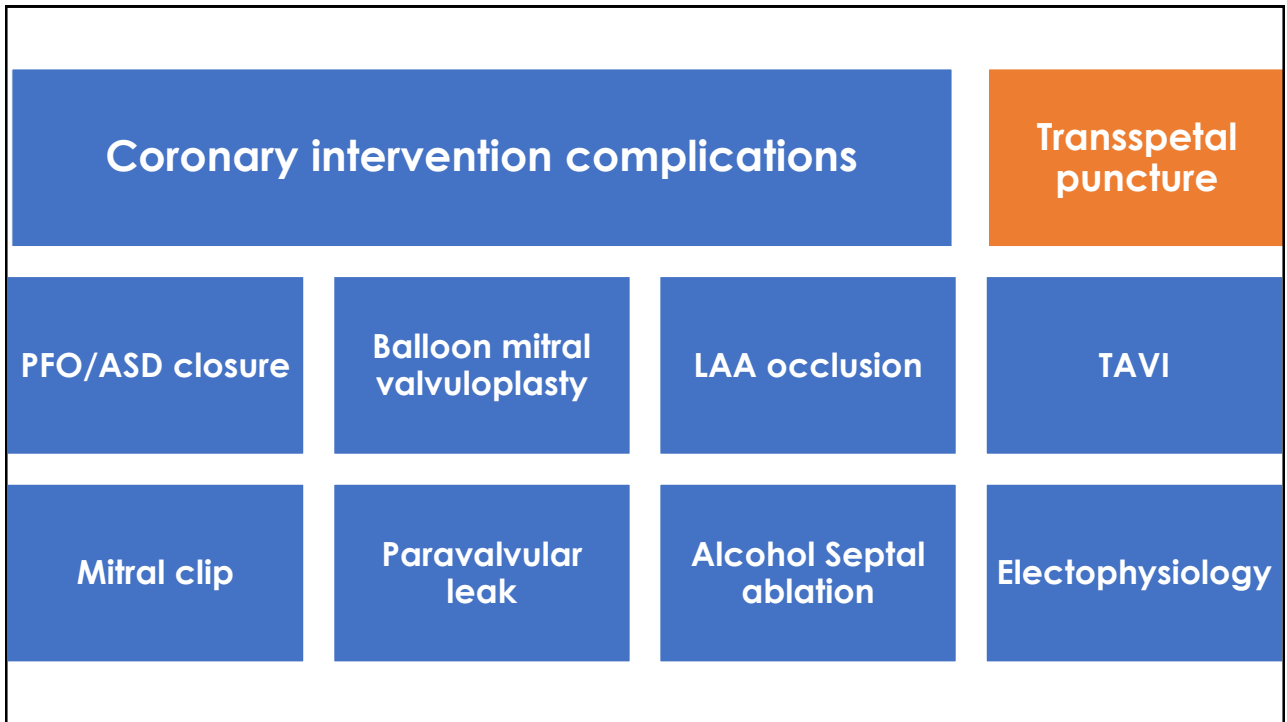
- Pericardial effusion will be small with tamponade (rapid accumulation).
- Define best access site.



Coronary intervention complications:

- Coronary perforation.





Transseptal puncture:

1

Define fossa ovalis.

2

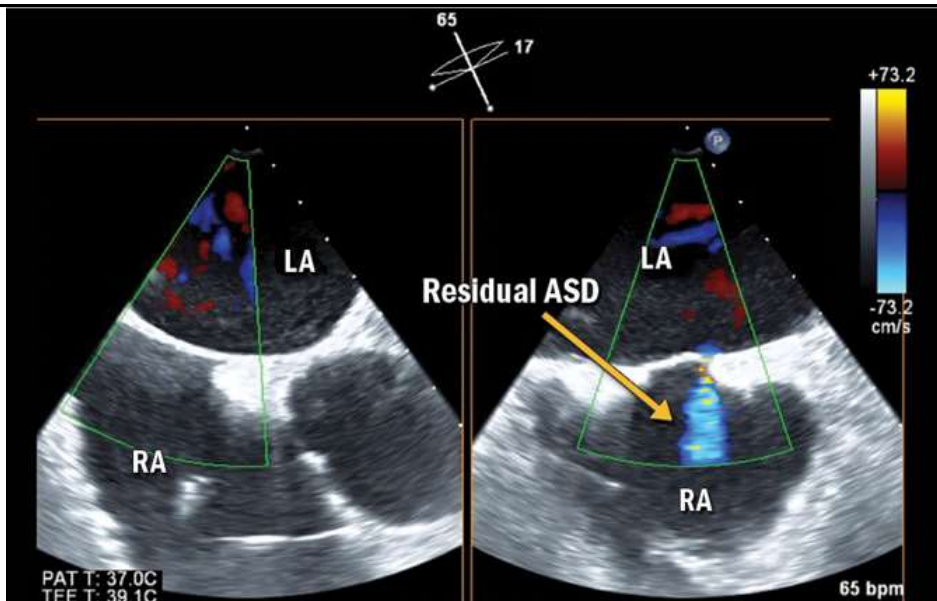
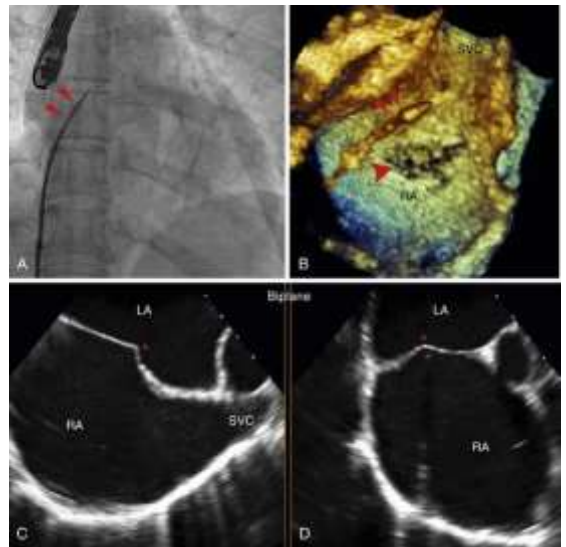
Optimal positioning of the transseptal needle is confirmed.

3

IAS tenting to identify location of the transseptal sheath prior to puncture.



Transseptal puncture



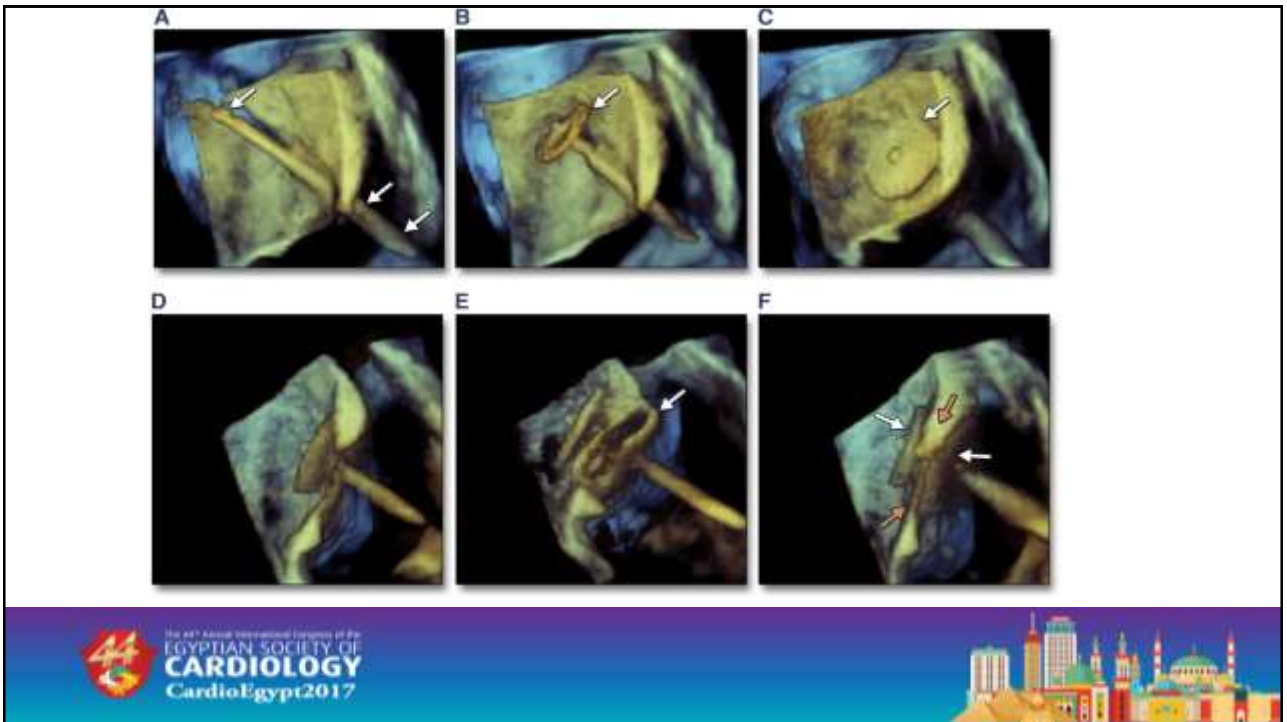
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PFO closure



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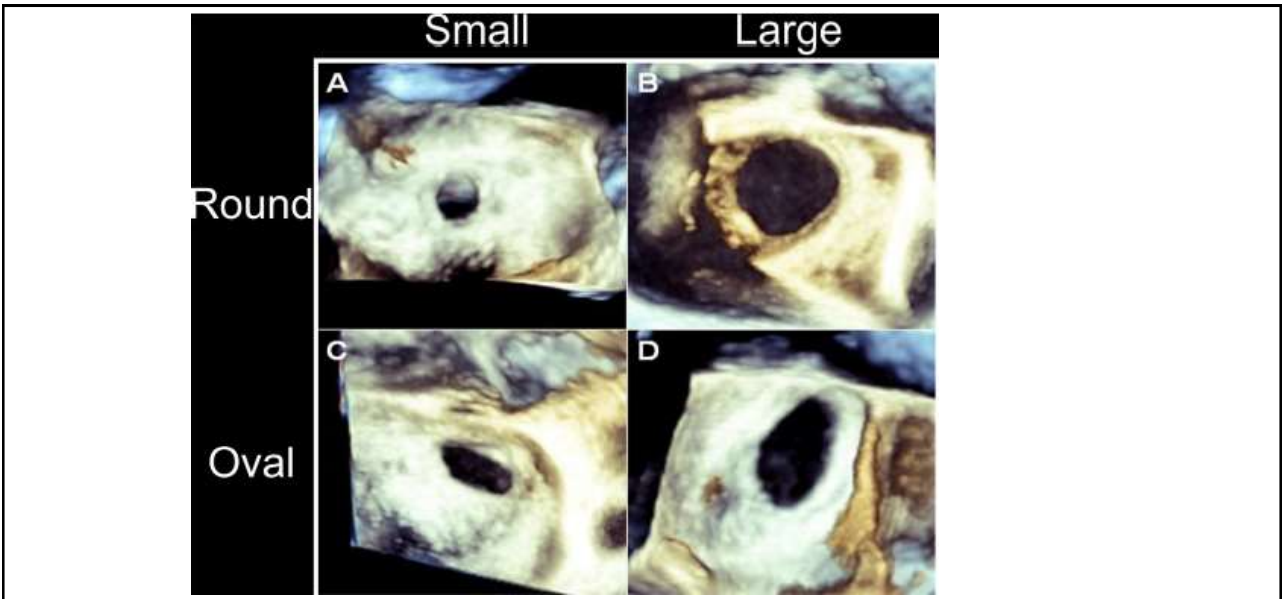
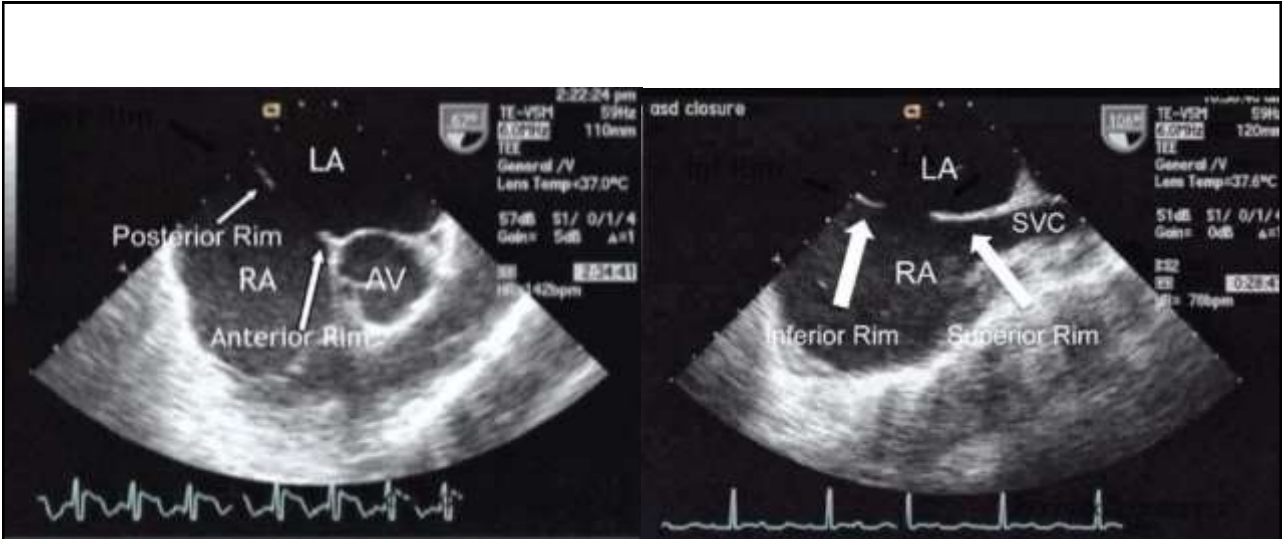




ASD closure:

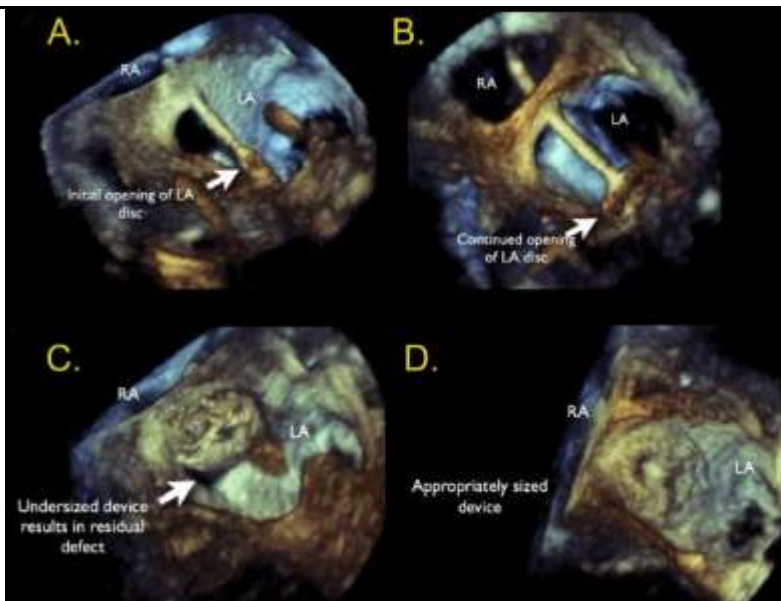
- Secundum ASD (<35 mm in widest diameter).
- Adequate rims all around.
- Septal redundancy reaching roof of atria (risk of embolization and residual shunt).
- No significant Rt-to-Lt shunting.
- No other findings requiring open heart surgery.

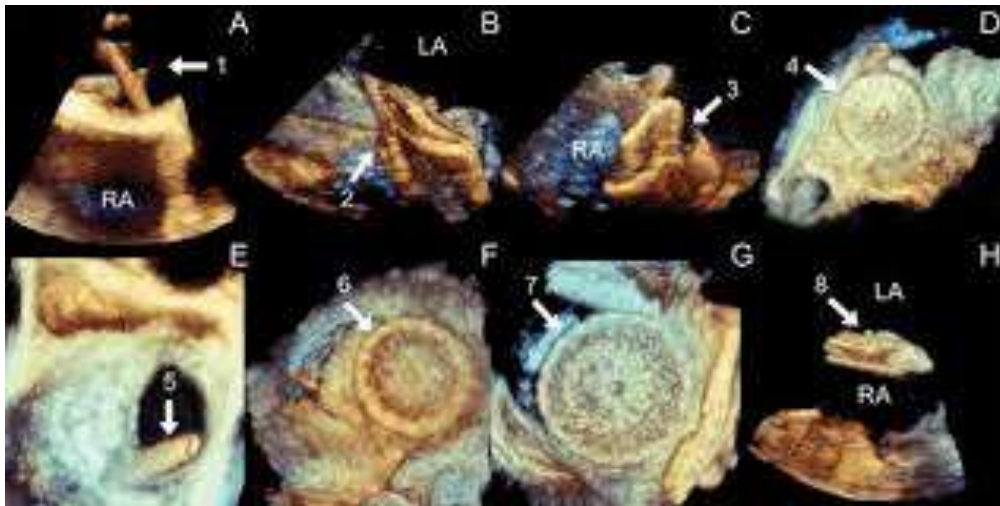




ASD closure:

- Proper position & well sealed?
- Any residual shunt?
- Any pericardial effusion?





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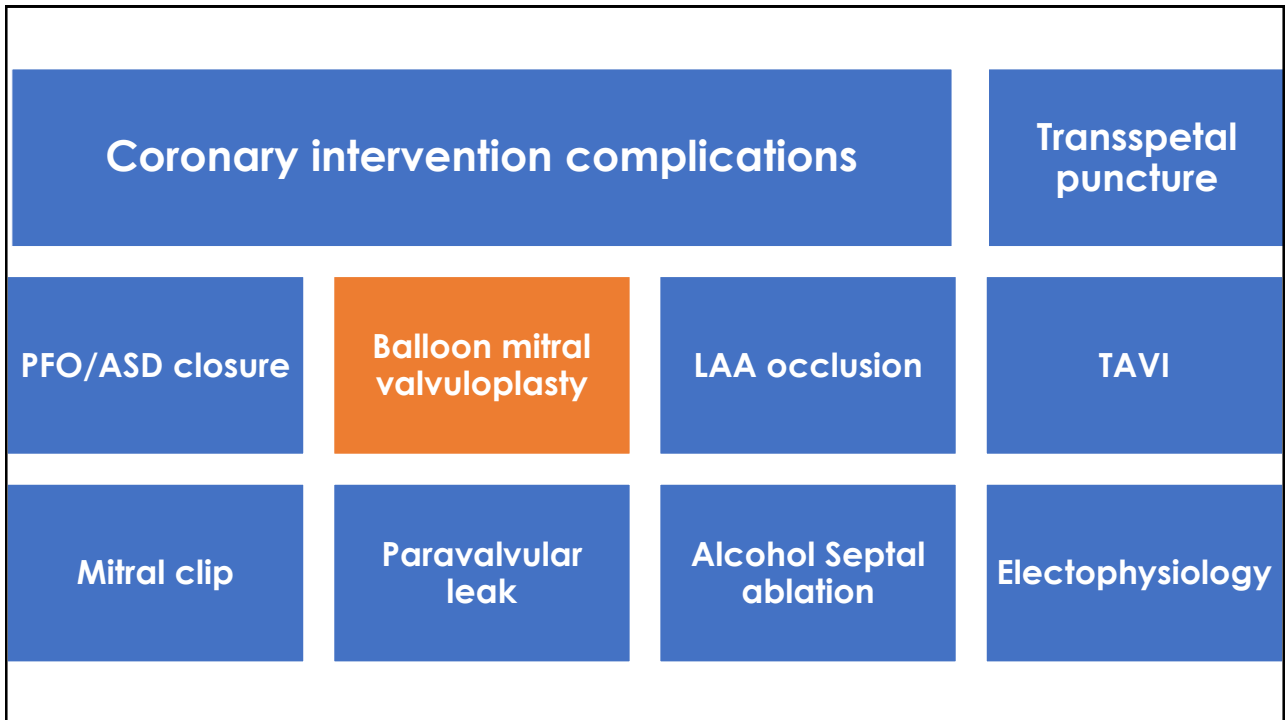


No interference with mitral or aortic valve functions



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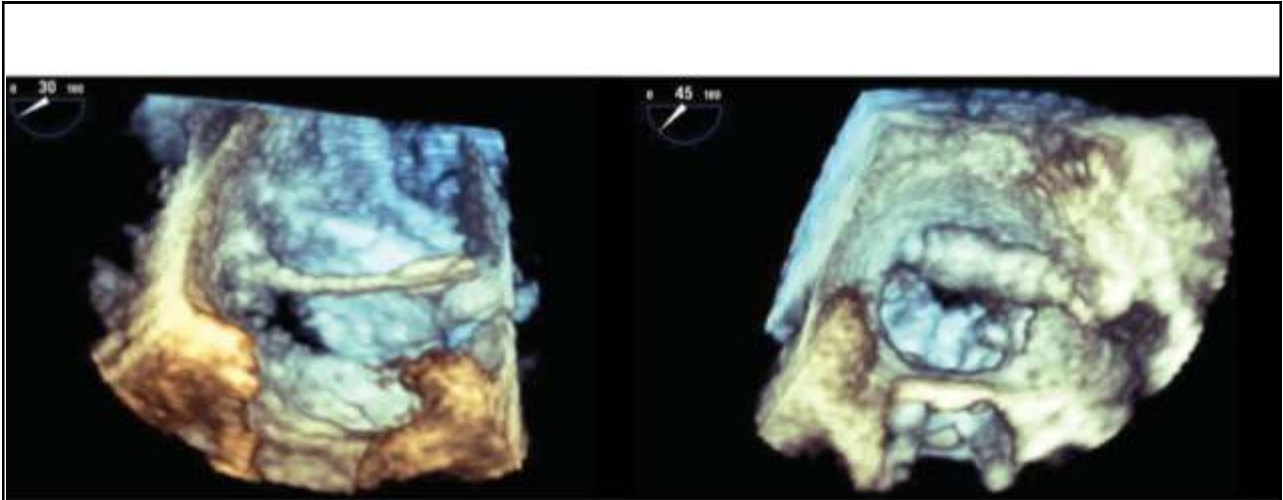




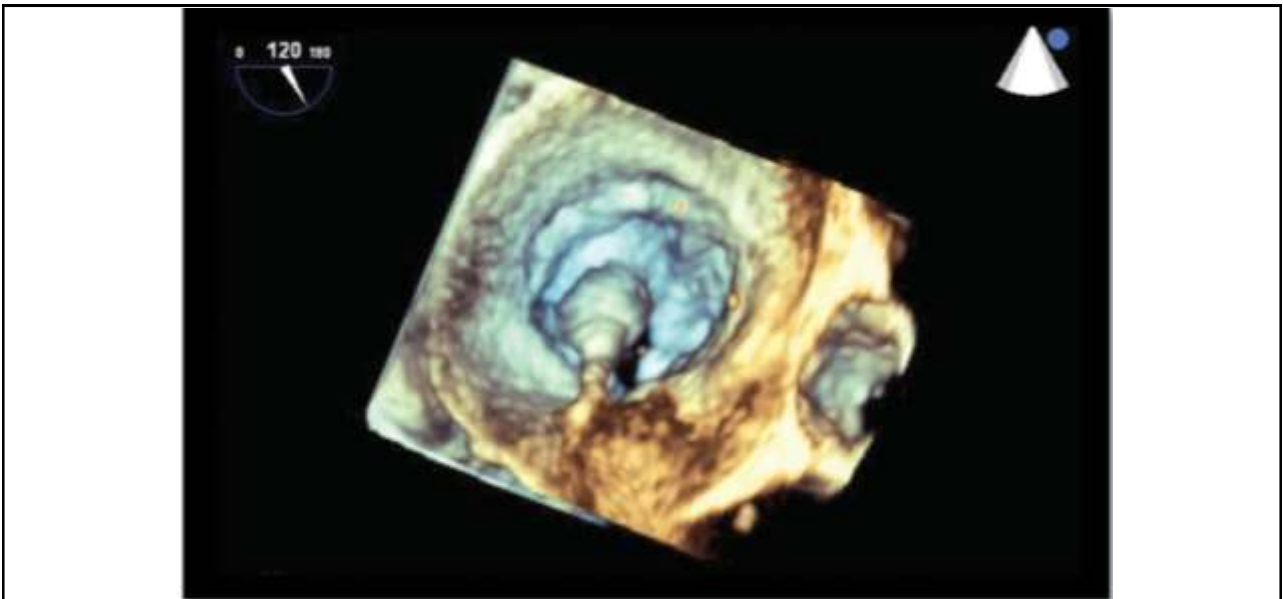
Balloon mitral valvuloplasty

- Septal Puncture.
- The balloon catheter is then advanced through IAS, positioned above the MV
- Advance balloon across the MV into the left ventricle.





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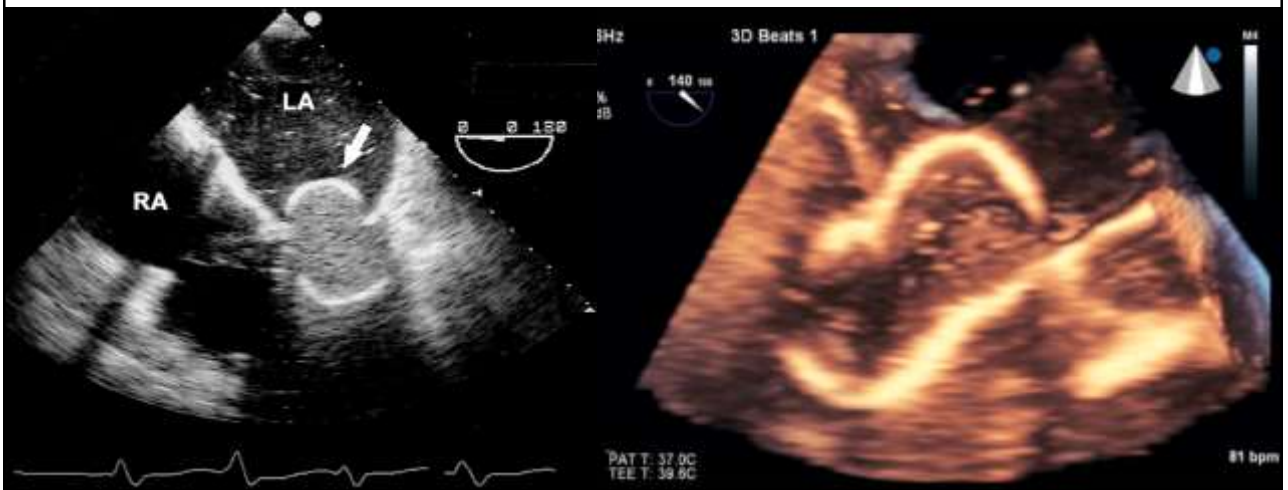


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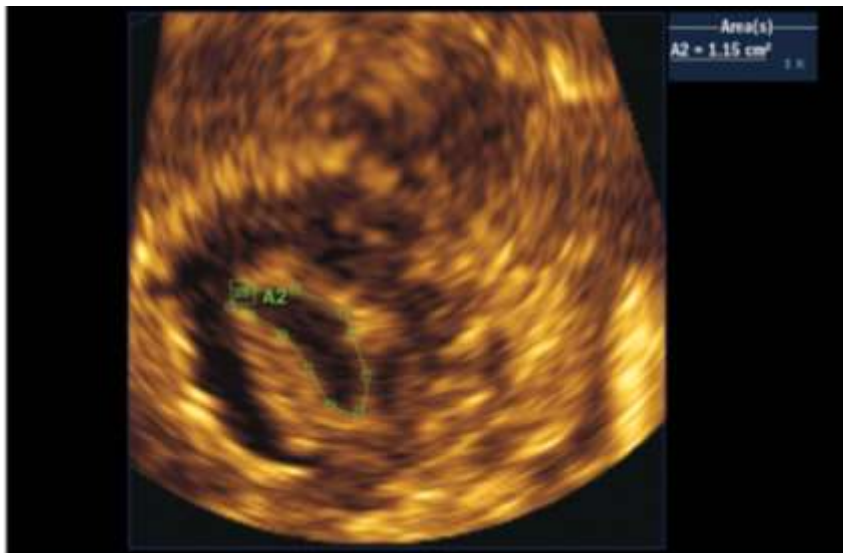
Balloon mitral valvuloplasty

- The distal portion of the balloon is inflated and then pulled back until resistance is against the valve.
- The proximal portion and then the waist of the balloon are inflated and quickly deflated.



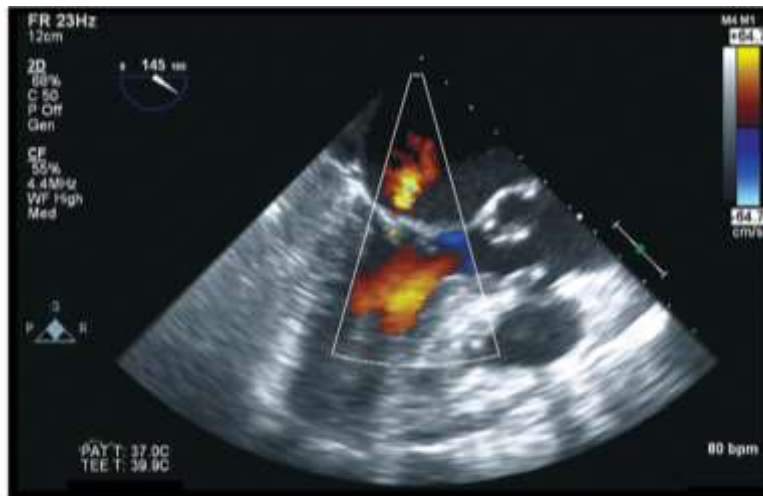
Balloon mitral valvuloplasty

- After each inflation, echocardiography is used to assess the mean gradient.
- Planimetry of the valve (TG SAX or 3D).



Balloon mitral valvuloplasty

- The degree of MR is assessed.
- No further balloon inflations should be performed if $\geq 1+$ increase in MR following a balloon inflation.



Balloon mitral valvuloplasty

- Early Detection of Complications:
 - Severe MR (tear / rupture of the mitral leaflets or ruptured chordae tendineae).
 - Cardiac perforation and tamponade.
 - Hemodynamically significant ASDs.



Coronary intervention complications

Transspetal puncture

PFO/ASD closure

Balloon mitral valvuloplasty

LAA occlusion

TAVI

Mitral clip

Paravalvular leak

Alcohol Septal ablation

Electrophysiology

LAA occlusion

Device sizing by determining the maximum LAA diameter.

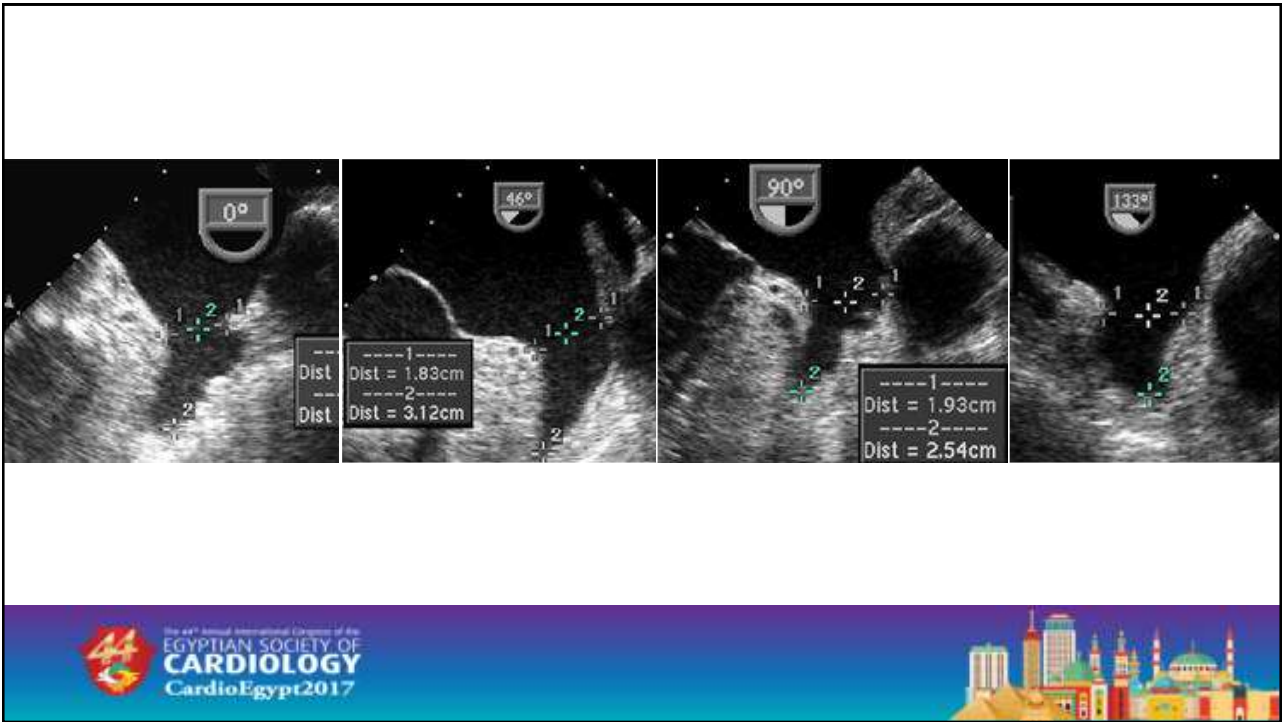


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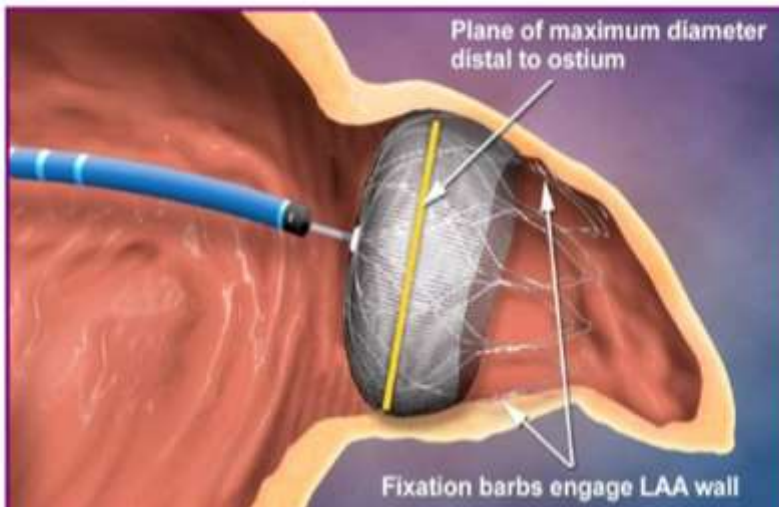


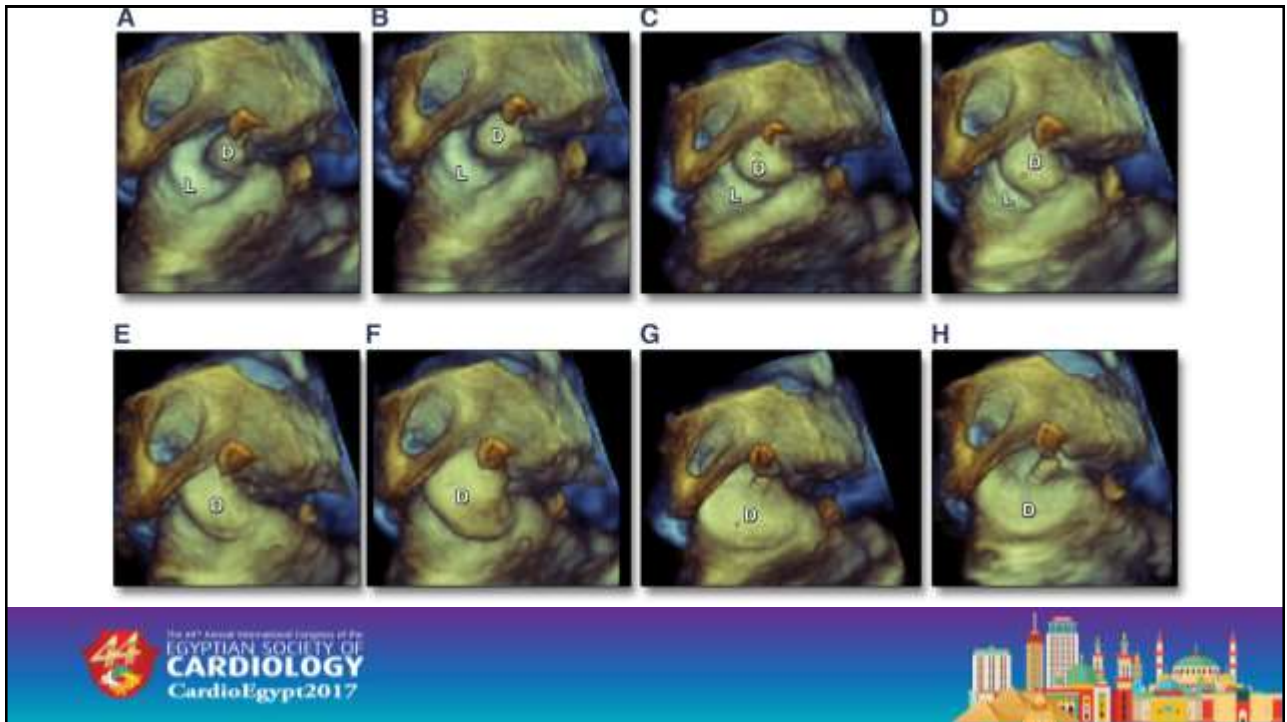
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WATCHMAN LAA Closure Device in situ

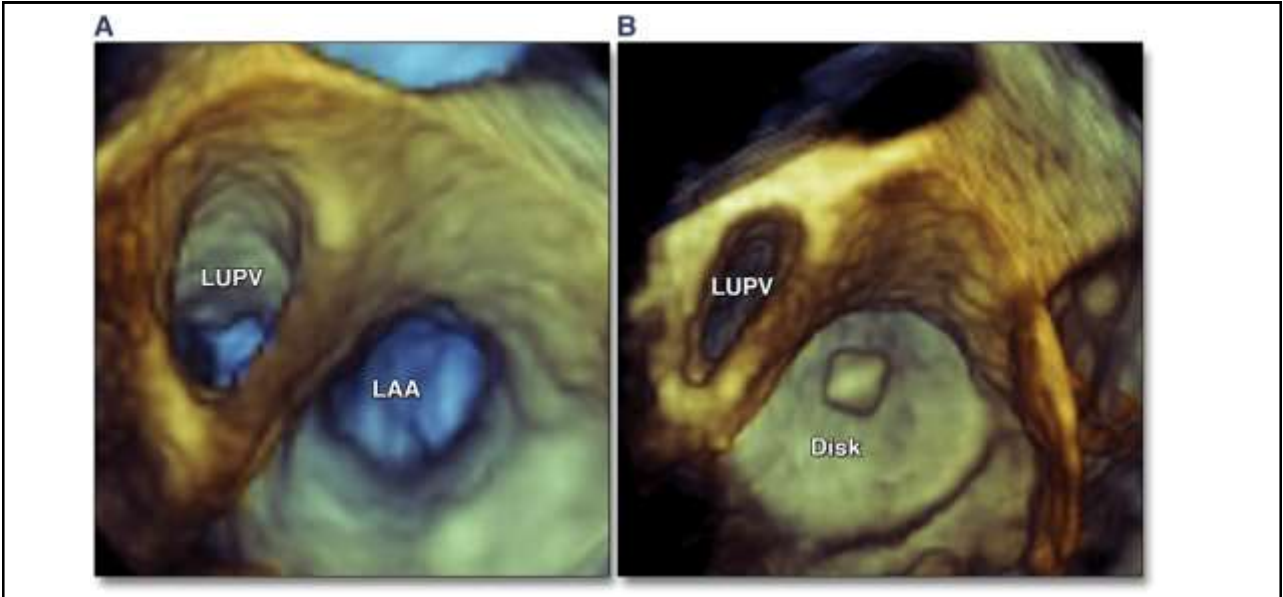




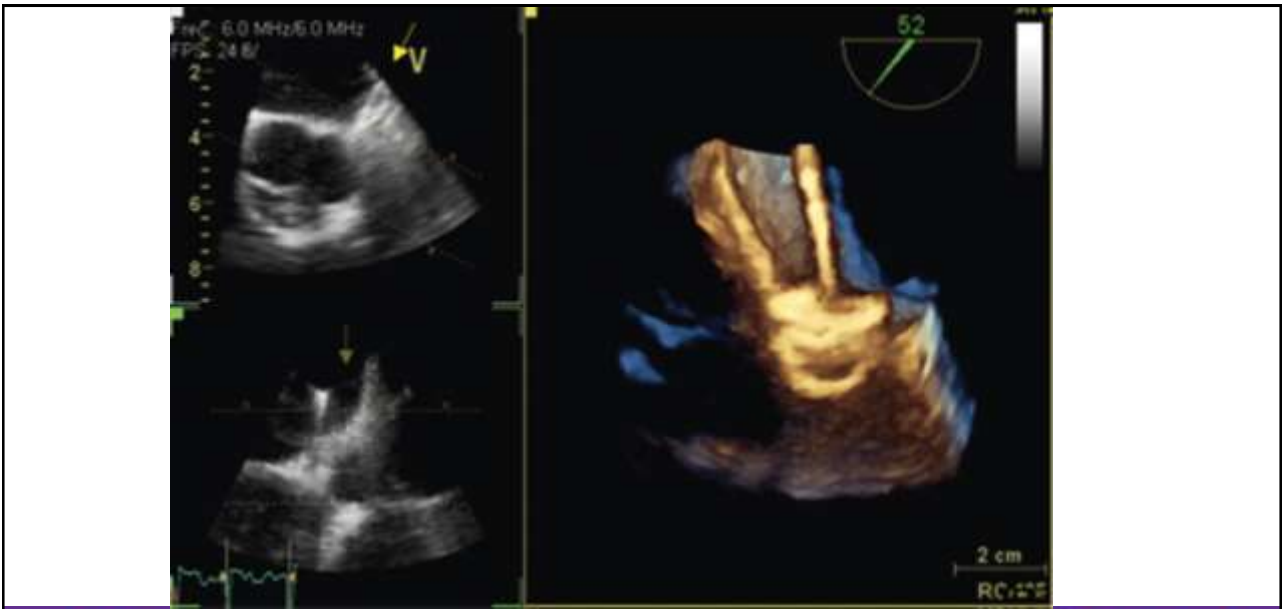
LAA occlusion

- Confirm that the device is in a good position.
- Proximal part is well cupped.
- No color flow in LAA.
- LUPV flow is normal.
- no pericardial effusion seen.





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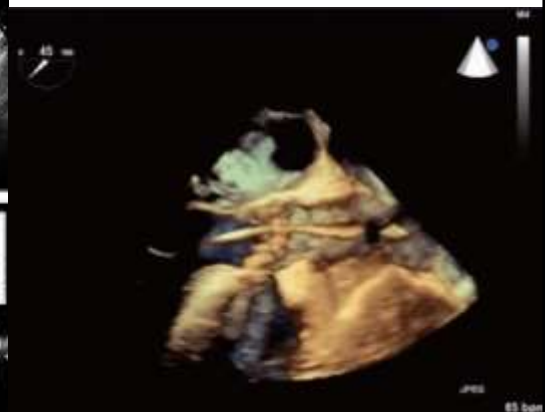
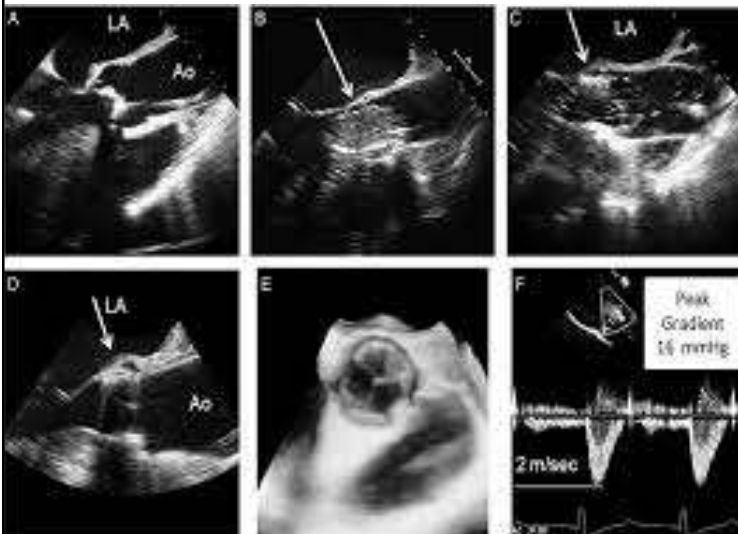




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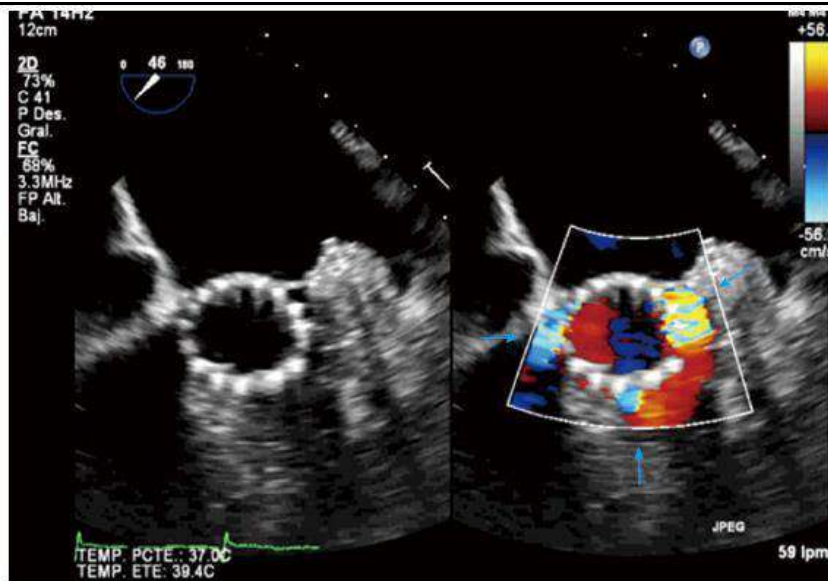
TAVI

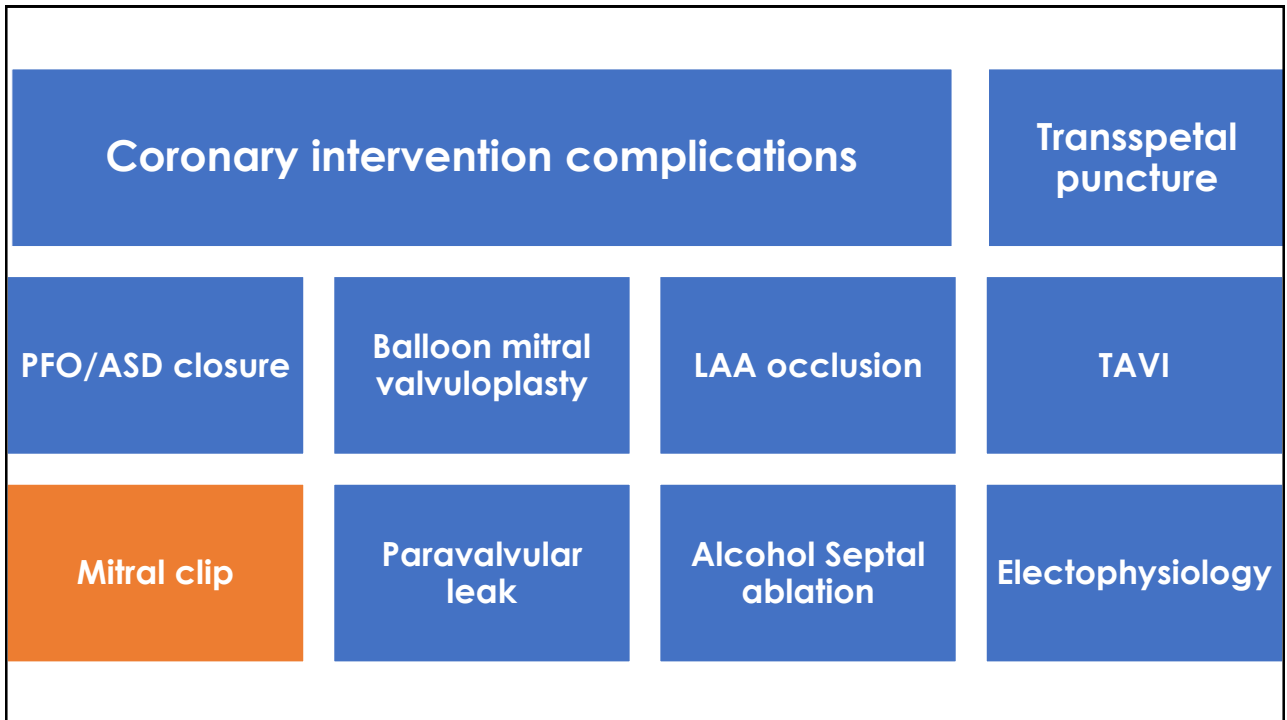
- Planimetry of aortic annulus by 3D TEE.
- Monitor delivery of the mounted valve on a balloon delivery catheter within the LVOT tract.
- Position the valve so the aortic end can be aligned with the tips of the native aortic valve leaflets.



TAVI

- Evaluate for valvular and paravalvular aortic regurgitation post-deployment.
- Detect and assist in dealing with possible complications such as valve embolization.



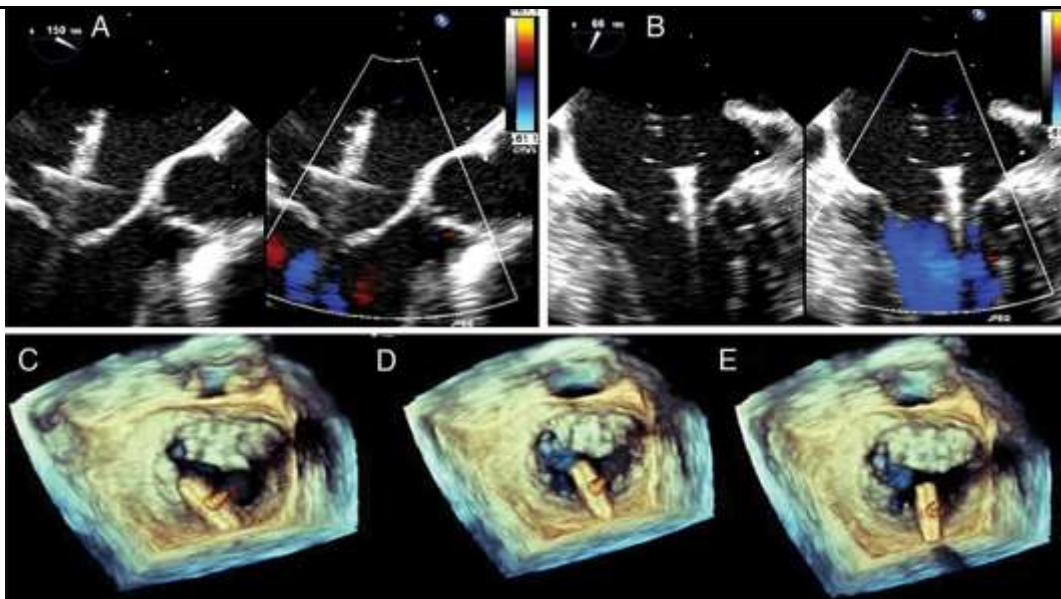


Mitral Clip

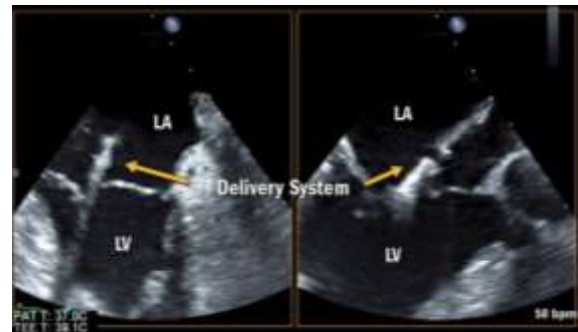
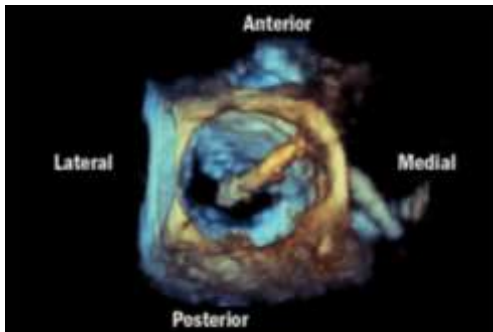


Mitral Clip

- Positioning:
 - Immediately above the regurgitant orifice.
 - Parallel to the direction of mitral inflow.
 - Above the area of maximal regurgitation, as assessed by color Doppler.



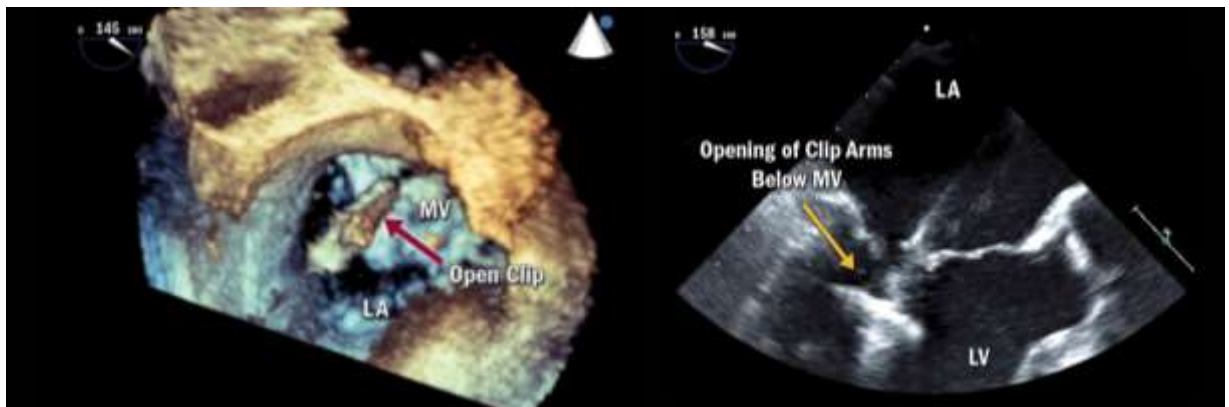
- Once the clip is positioned and aligned, the clip arms are opened and oriented so they are perpendicular to the line of coaptation.



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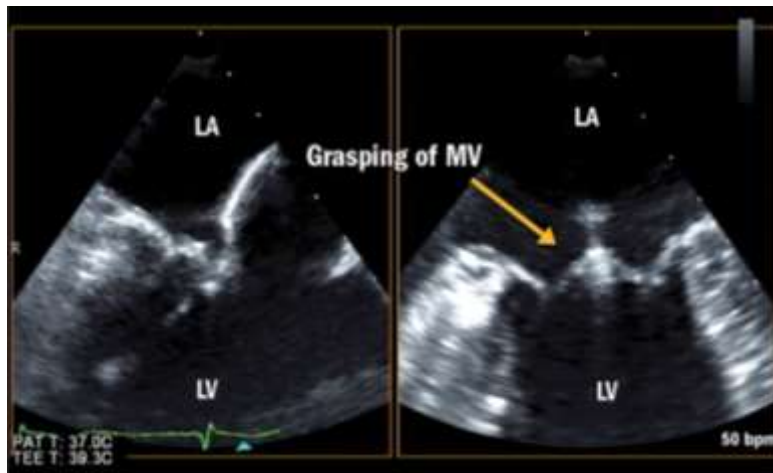
- Advance the system through the MV into the LV just below the edges of the leaflets.



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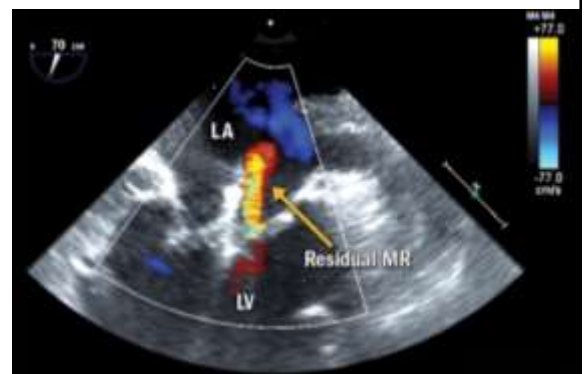
- Deploy and Grasp the valve leaflets.



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- Confirm that both leaflets are adequately captured by the device.
- Residual MR is then assessed



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- Achievement of the double orifice is confirmed.



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Electrophysiology

Paravalvular leak

- Prior to the procedure, the PVR size and areas of valve dehiscence should be reassessed.
- If the area of dehiscence is large (>25% of the valve circumference), a single closure device may not suffice.

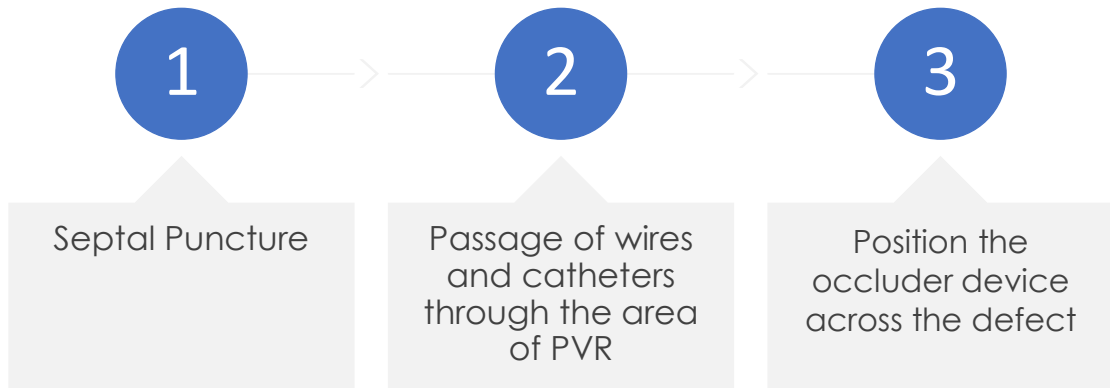


Paravalvular leak

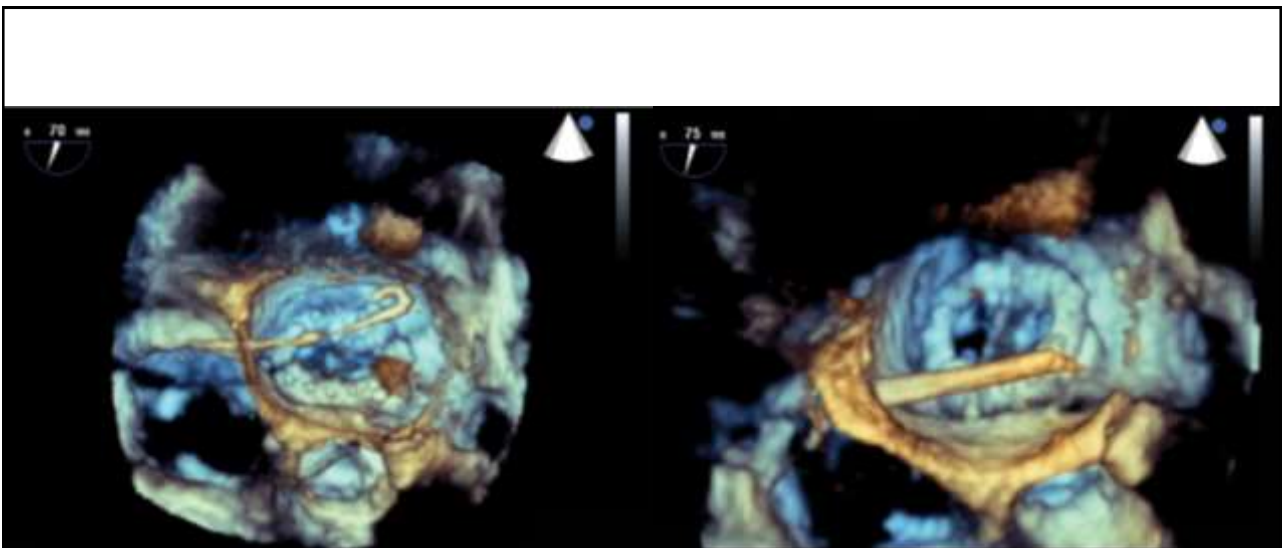
- If significant rocking of the valve due to a large area of dehiscence, there is increased risk of device embolization.
- Intracardiac thrombi or valve thrombi/vegetations must be excluded.



Paravalvular leak



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Paravalvular leak

- Prior to deployment; reassess MR.
- Valve function should be noted. Suboptimal occluder positioning can interfere with leaflet function in mechanical valves.
- Following deployment, PVR is reassessed



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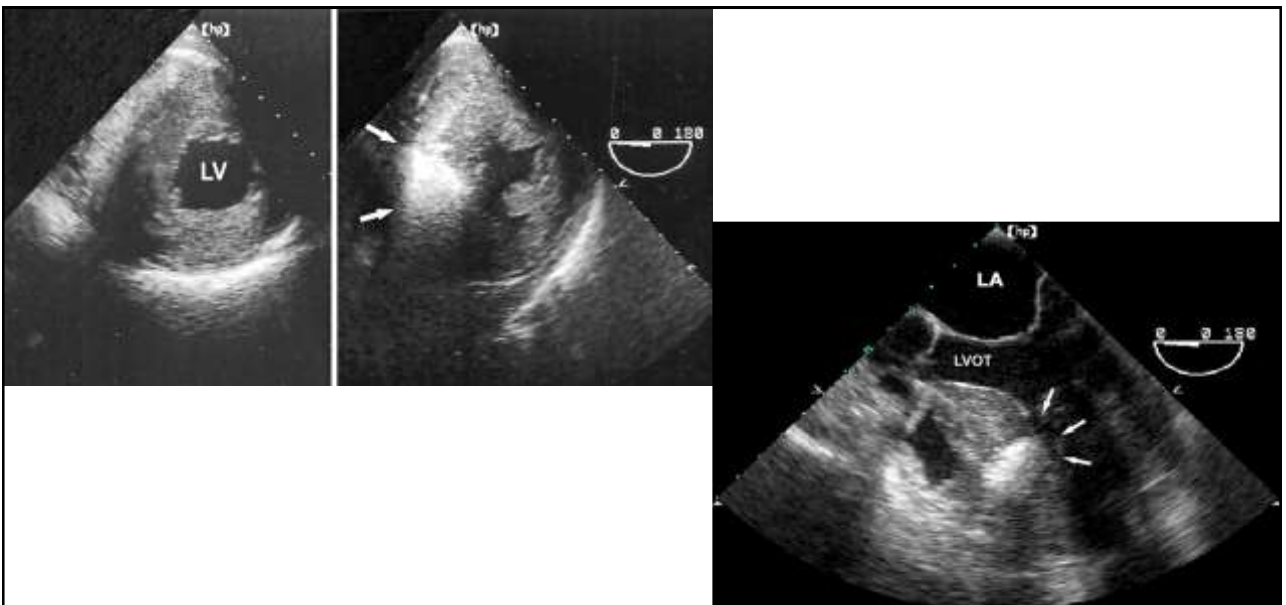
Paravalvular leak

Alcohol Septal ablation

Electrophysiology

Alcohol septal ablation

- Use of myocardial contrast to delineate the vascular distribution of the individual septal perforator branches of LAD.



Alcohol septal ablation

Immediate Assessment of Results:

- Septum shows reduced thickening and contractility.
- Improvement of the degree of SAM and usually reduction in the degree of MR.
- Reduction of LVOT gradient.



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Electrophysiology

Electrophysiology:

- Cardiac catheter ablation:
 - AF Ablation.
 - Other EP ablation procedures.
- Cardiac resynchronization therapy.



AF ablation:

- TEE and ICE.
- Identification of pulmonary venous ostia is a key feature in AF catheter ablation.
- Ensure adequate contact between the tip of the catheter and the tissue.



AF ablation:

- Detecting tissue injury, thrombus formation, or potential complications such as pulmonary veins stenosis, perforation or thromboembolic events.

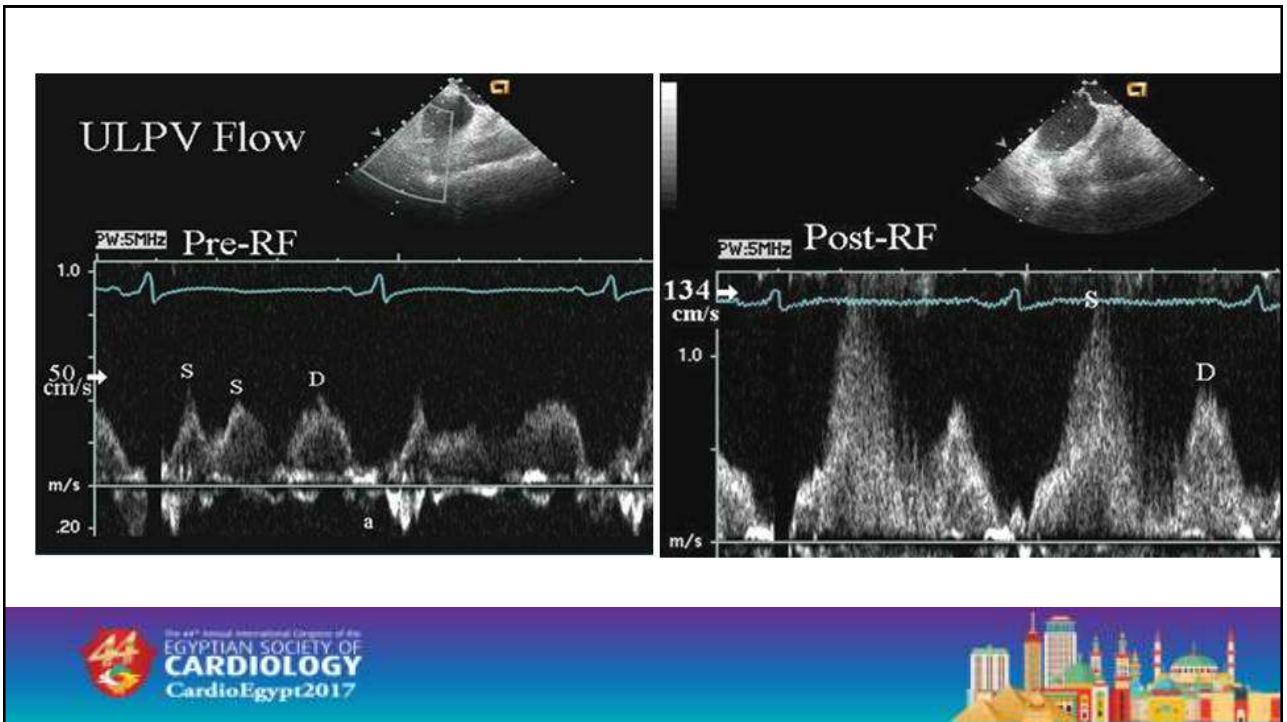


Thrombus post ablation



Pericardial effusion post ablation.





Intraoperative



- Mitral Valve Repair Surgery.
- Valve Replacement:
 - Paravalvular Regurgitation.
 - Outflow Tract Obstruction.
- HOCM.
- Surgery in Infective Endocarditis.
- Revascularization-LV function, adequacy of revascularization, need for MV surgery, VSD



Mitral valve repair surgery:

- IOTEE permits inspection of the entire mitral valve apparatus including the anterior and posterior leaflet, its scallops and the commissures.
- Extent of valvular, annular calcification and thickening.



Mitral valve repair surgery:

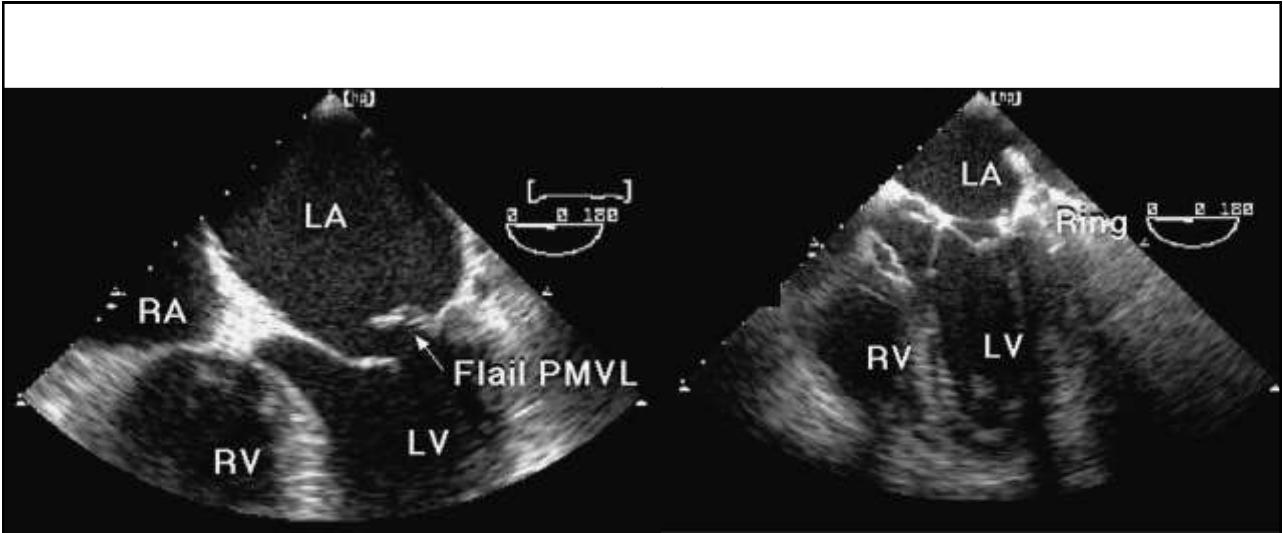
- Based on these findings the operative strategy (repair vs. replacement) and technique (annuloplasty, quadrangular resection or chordal transfer) can be determined.



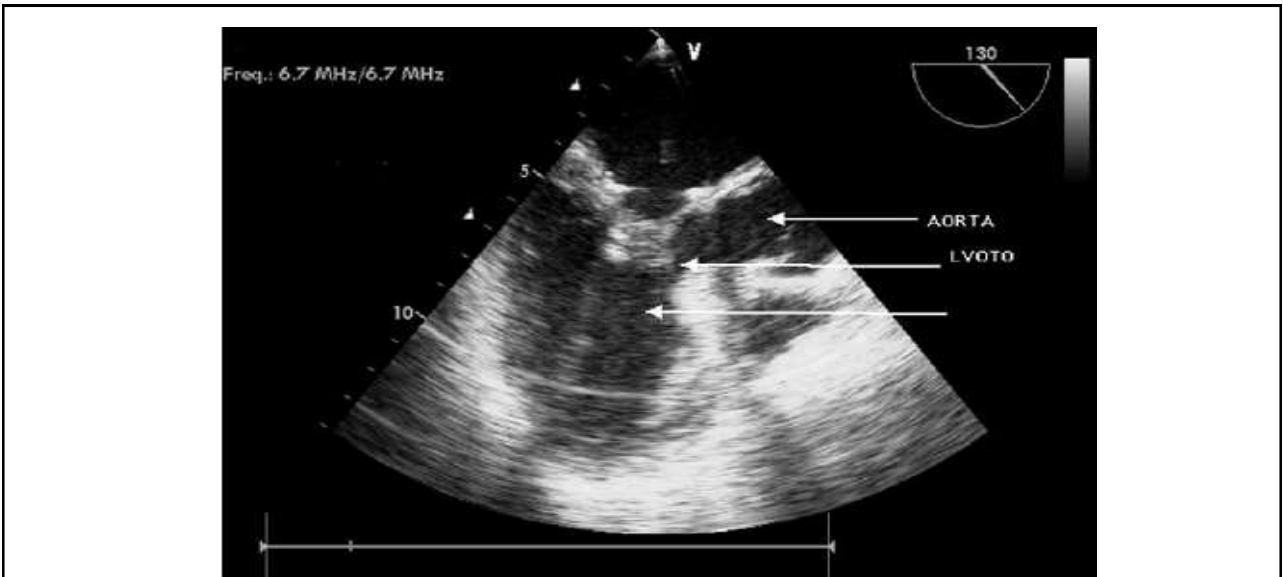
Mitral valve repair surgery:

- TEE allows evaluation of the immediate operative result:
 - Assessment of residual regurgitation.
 - LVOT obstruction, which may occur after mitral valve reconstruction when AMVL protrudes into LVOT.





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Paravalvular regurgitation

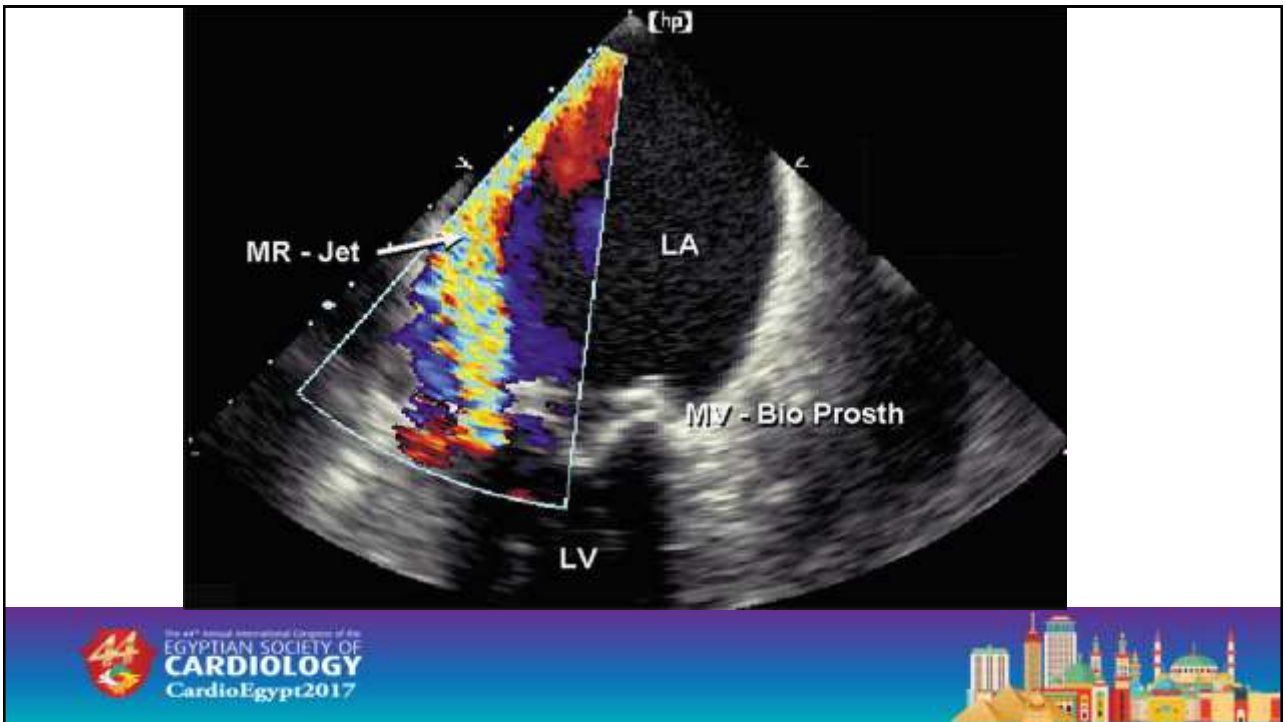
- Paravalvular regurgitation must be distinguished from normal "functional" regurgitation of mechanical prosthetic valves.
- Quantification of paravalvular regurgitation is performed using color Doppler under off-pump conditions.



Paravalvular regurgitation

- The degree of valvular regurgitation may be underestimated by intraoperative TEE due to the effects of general anaesthesia and altered loading conditions.
- Localization of the leak(s) allows rapid correction by the surgeon.





Outflow obstruction

- Inappropriate anterior mitral leaflet preservation during mitral valve replacement may cause LVOT obstruction.
- LVOT obstruction is also related to the strut height and orientation of the prosthesis



HOCM

- Define:
 - Location of the maximal septal thickness.
 - Point of mitral-septal contact
 - Distance from this point to the aortic valve.
- LVOT gradients intraoperatively (pre/post).



HOCM

- A successful myectomy:
 - No mitral-septal contact.
 - Provoked gradients <50 mmHg.
 - No significant mitral regurgitation



HOCM

- 18% of the patients will need a second pump run for a more extensive myectomy.
- Look for ventricular septal defects that are a known complication in cases of a too generous myectomy



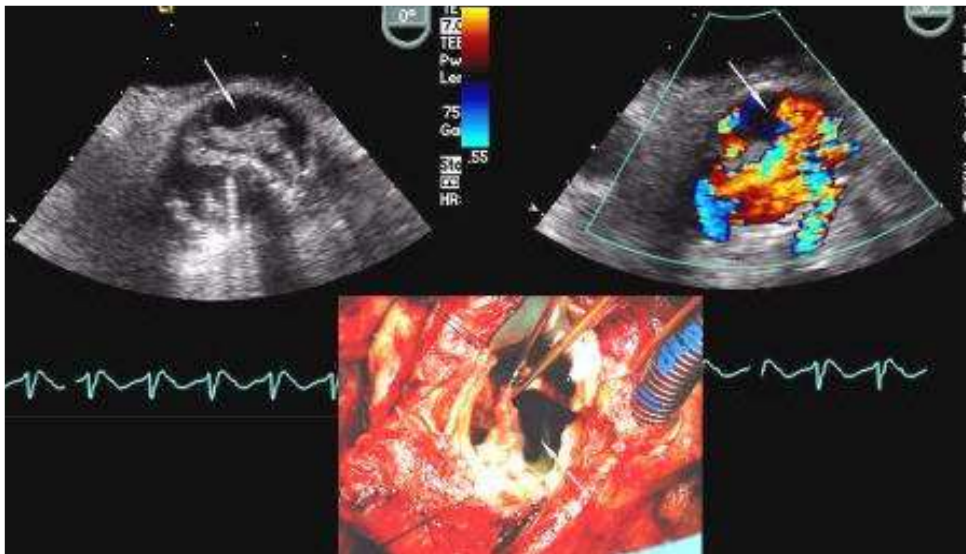
Surgery for infective endocarditis:

- Severe IE can be associated with major destruction of the annulus, the presence of abscesses, pseudoaneurysms, valve perforations, periannular distention
- IOTEE can guide surgical management, which usually requires radical resection of the abscess and inflamed tissues and reconstruction of the affected structures



Surgery for infective endocarditis:

- IOTEE permits immediate assessment of the surgical results and the detection of residual fistulous communications or paravalvular leaks.



Conclusions:

- Echocardiography add a lot of data and guidance during percutaneous intervention and intraoperatively.
- The evolution of 3D and ICE offer new and more accurate monitoring advantages.
- More and more percutaneous interventions to be invented with the guidance of new echocardiography modalities.



Thank You

