



Imaging in Structural Heart Disease: How are we changing practice?

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Imaging in Structural Heart Disease

- No relevant financial disclosures
- PARTNER trials Imaging Committee



Structural Heart Disease: A New Era

- Transcatheter aortic valve replacement
- Transcatheter mitral valve repair
- Transcatheter mitral valve replacement
- Left atrial appendage exclusion devices
- Congenital applications: ASD/VSD closure devices, transcatheter pulmonic valves

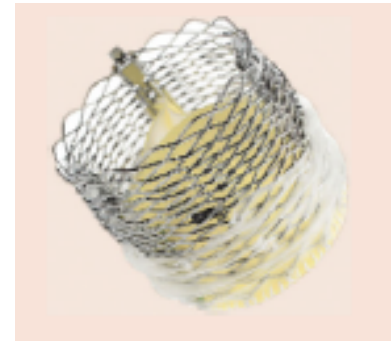
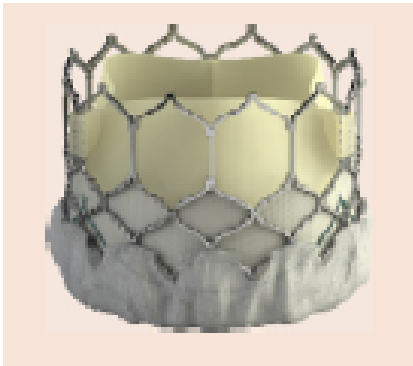


Imaging in Structural Heart Disease

- Experienced multidisciplinary team increasingly important
- Cardiac imaging/imagers are key
- Consistent, high-quality imaging and interpretation are critical to evaluation, management, and procedural guidance

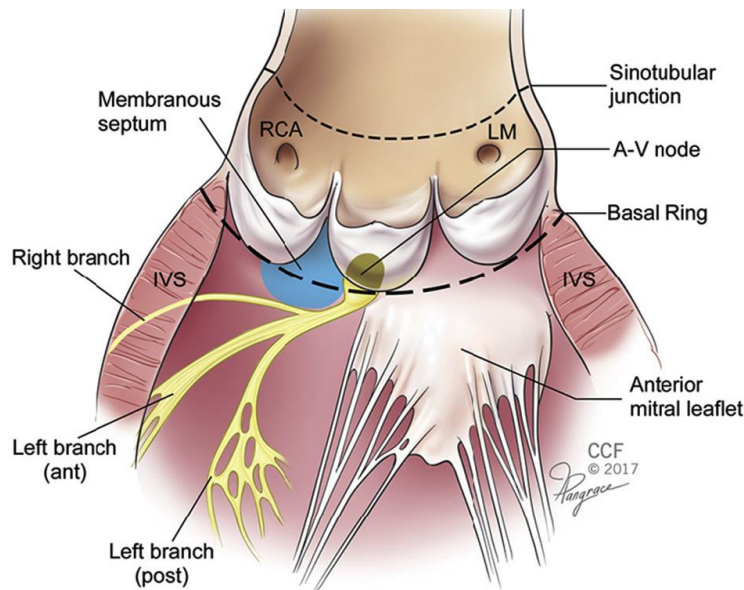
Aortic Stenosis

- Treatment of severe AS has been revolutionized by transcatheter aortic valve replacement (TAVR)



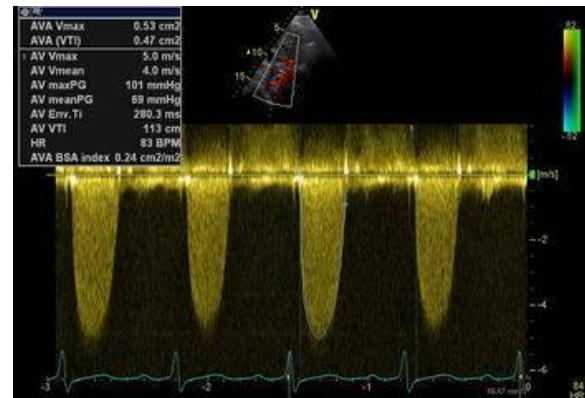
Imaging in Aortic Stenosis

- Multimodality imaging plays a pivotal role before, during, and after TAVR
- Accurate assessment of aortic valvular complex critical for optimal procedural outcomes



Imaging in Aortic Stenosis

- Echocardiography is the imaging modality of choice for the assessment of AV morphology, function and stenosis severity

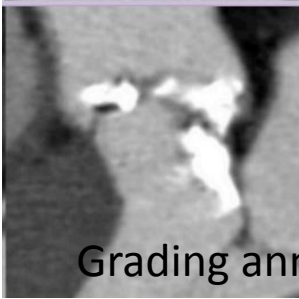
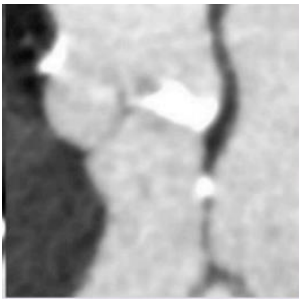




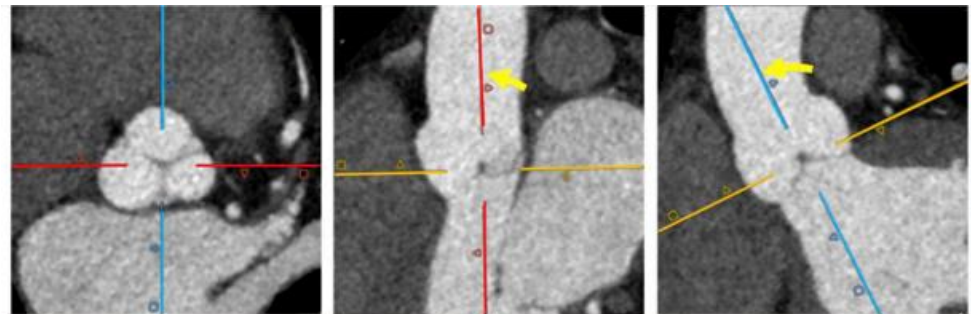
Pre-procedural Imaging in TAVR

- Cardiac CT is the gold standard pre-procedural imaging modality for TAVR
- Essential for annular sizing, assessment of annular injury and coronary occlusion risk, and co-planar fluoroscopic angle prediction in advance of the procedure

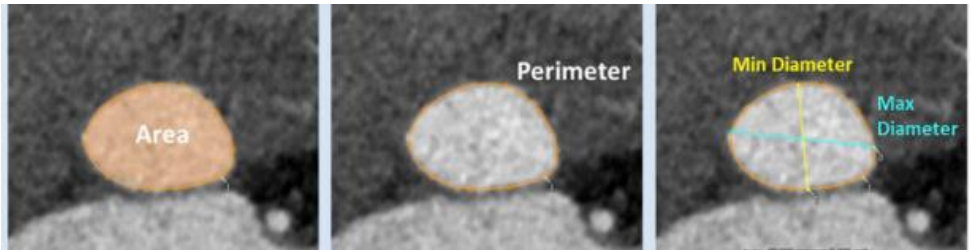
Cardiac CTA



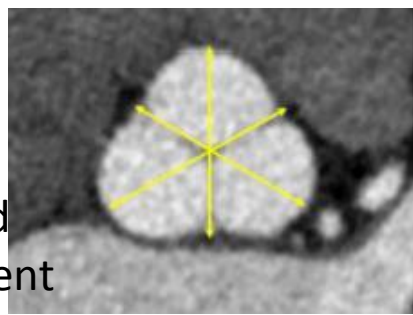
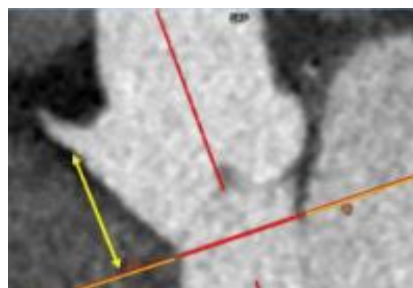
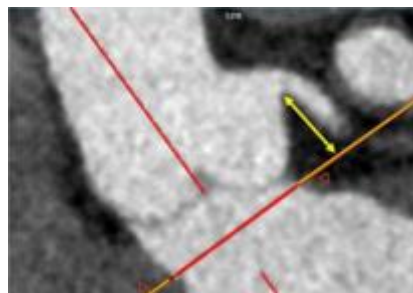
Grading annular/LVOT calcification



Measurement of annular plane



Coronary height and aortic root assessment

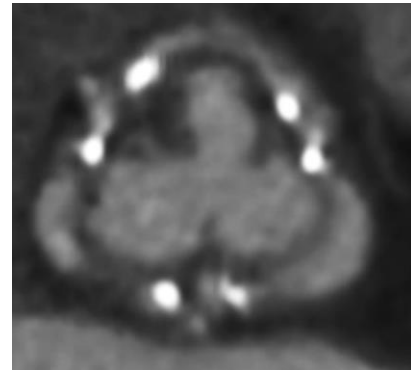
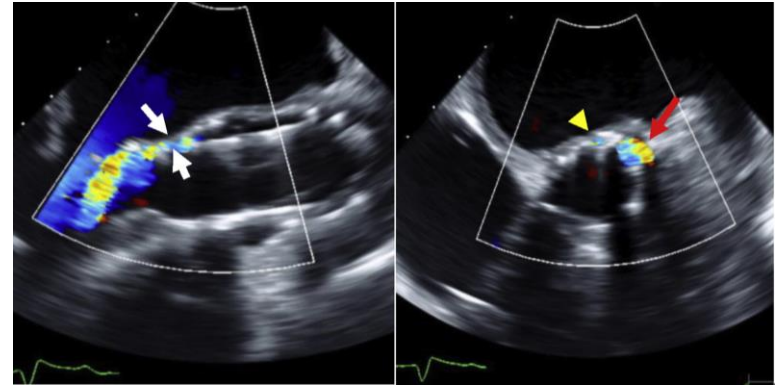




Fluoroscopic angle prediction for pre-procedural planning

Intra-procedural Imaging in TAVR

- TEE is vital for intra-procedural guidance and post-procedural assessment of TAVR
- Cardiac CT can identify post-procedural complications

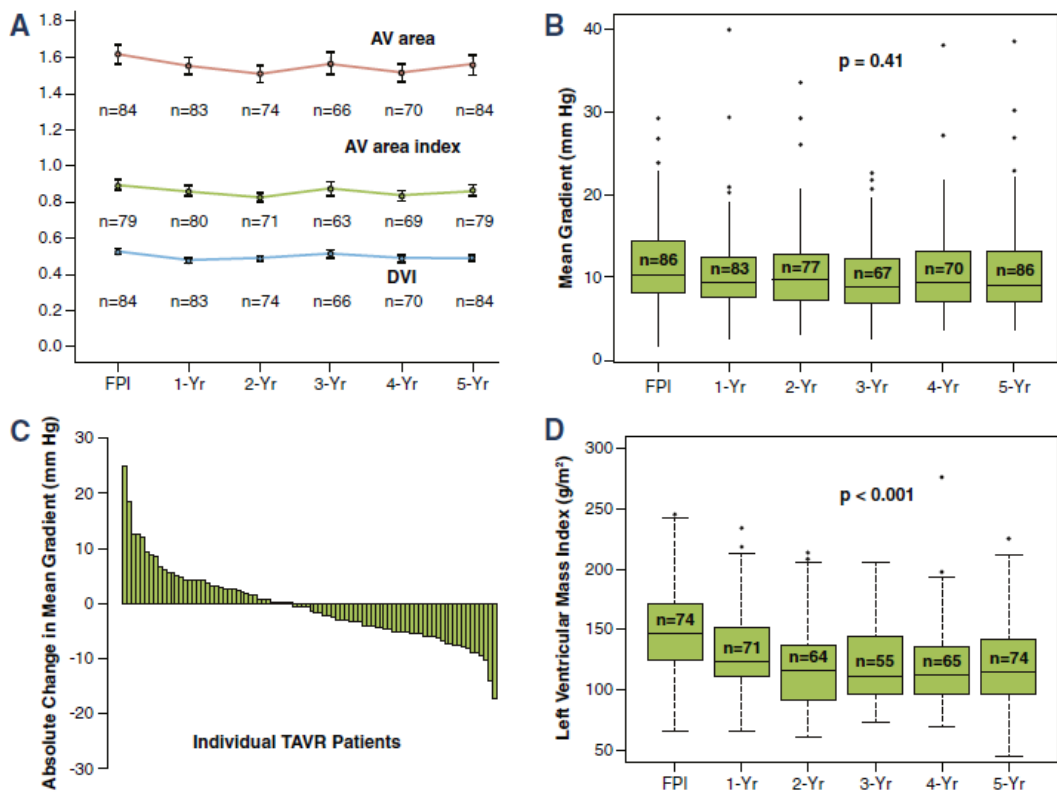




Post-procedural Imaging in TAVR

- TTE for serial assessments during long-term follow-up

FIGURE 3 Valve Hemodynamics and Left Ventricular Mass Index of TAVR



Mitral Regurgitation

- Mitral valve apparatus is complex: leaflets, annulus, chordae, pap muscles

Table 1 Expanded Carpentier classification of MV pathology

Type I: Normal leaflet motion

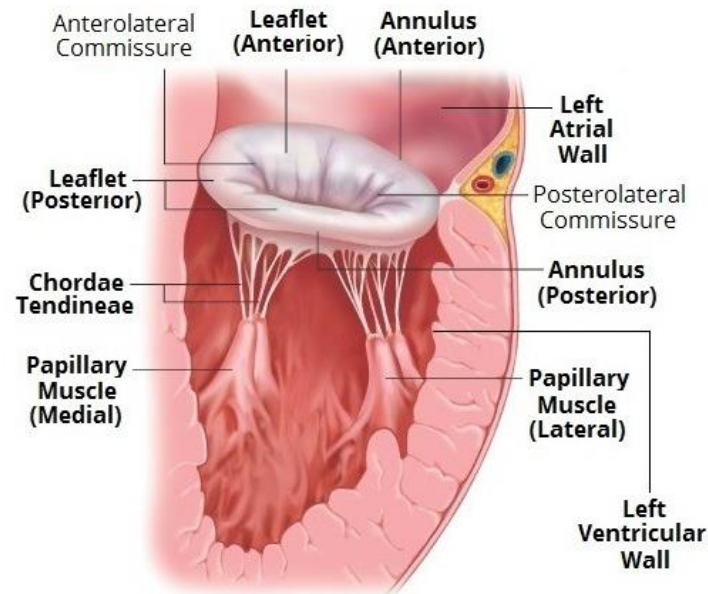
- (A) Perforation
- (B) Cleft valve
- (C) Dilated annulus (without leaflet tethering)

Type II: Excessive leaflet motion

- (A) Flail leaflet (localized to one segment)
- (B) Billowing prolapse
- (C) Bileaflet prolapse with flail segment

Type III: Restricted leaflet motion

- (A) Systolic and diastolic restriction (e.g., rheumatic)
- (B) Symmetric systolic restriction (e.g., dilated or ischemic cardiomyopathy; dilated annulus with leaflet tethering)
- (C) Asymmetric systolic restriction (e.g., segmental ischemic dysfunction resulting in focal tethering)





Mitral Regurgitation

- Primary MR: primary leaflet abnormality

→ *MV prolapse, flail leaflet*



Degenerative MR caused by mitral valve prolapse



Degenerative MR caused by flail leaflet

- Secondary MR: Structurally normal MV leaflets that are non-coapting

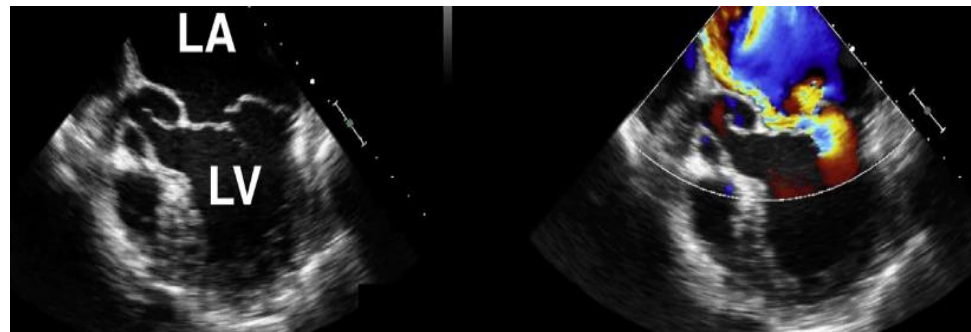
→ *due to distortion of supporting apparatus resulting from dilated or ischemic cardiomyopathy*



Functional MR

Primary Mitral Regurgitation

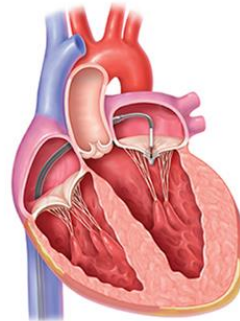
- Current guidelines recommend early surgery for severe primary MR



- Transcatheter MV repair w/ MitraClip safe in patients with degenerative MR at prohibitive risk for surgery

Transcatheter Mitral Valve Repair

- MitraClip (Abbot) is a chromium cobalt device with 2 polyester-covered clip arms designed to grasp both MV leaflets, similar to edge-to-edge surgical repair



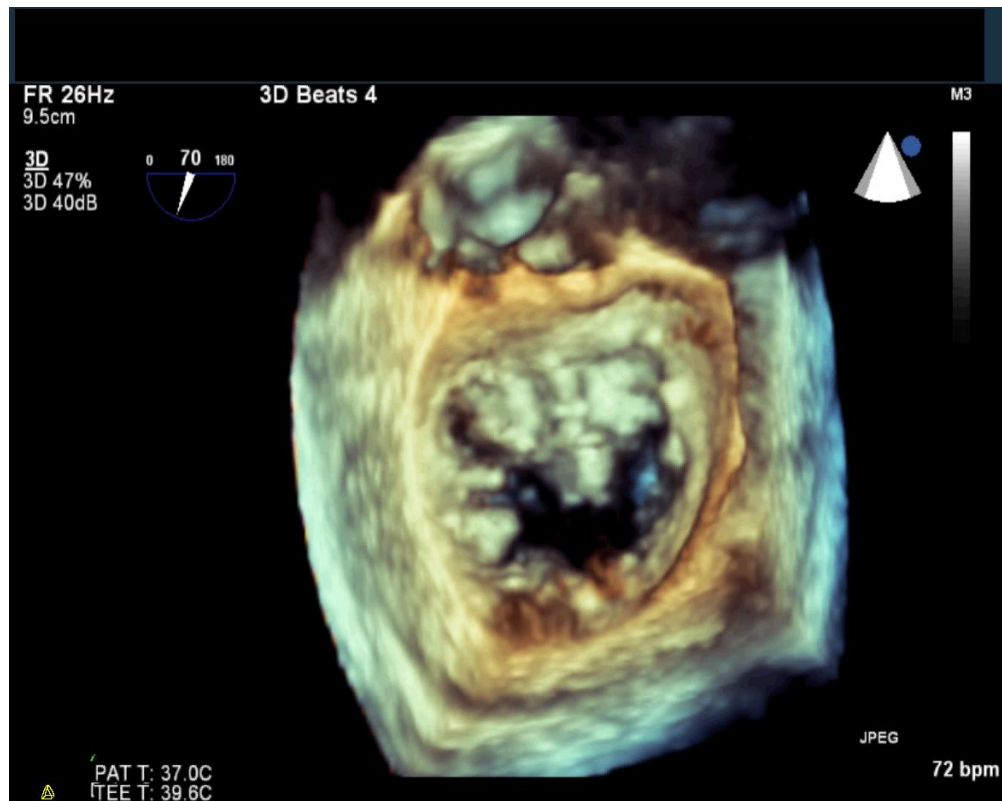
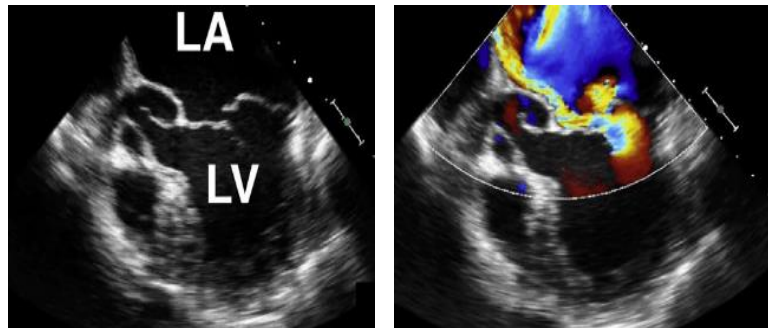


Imaging in MV Repair

- Pre-procedural Evaluation by TEE:
 - Mechanism of disease
 - Anatomic considerations
- Intra-procedural Evaluation by TEE:
 - Septostomy
 - Catheter positioning
 - Leaflet grasping
 - Post-deployment MR and MS

Pre-procedural Imaging

- Mechanism of disease





Pre-procedural Imaging

- Anatomic requirements:

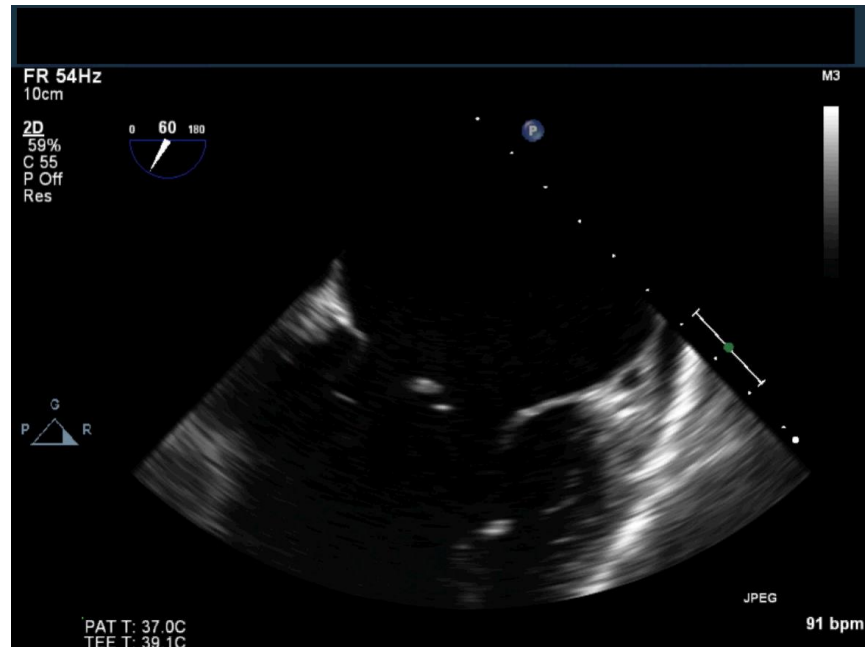
Leaflet length $> 1\text{cm}$

Flail gap $< 1\text{cm}$

Flail width $< 15\text{mm}$

MV gradient $\leq 3\text{mmHg}$

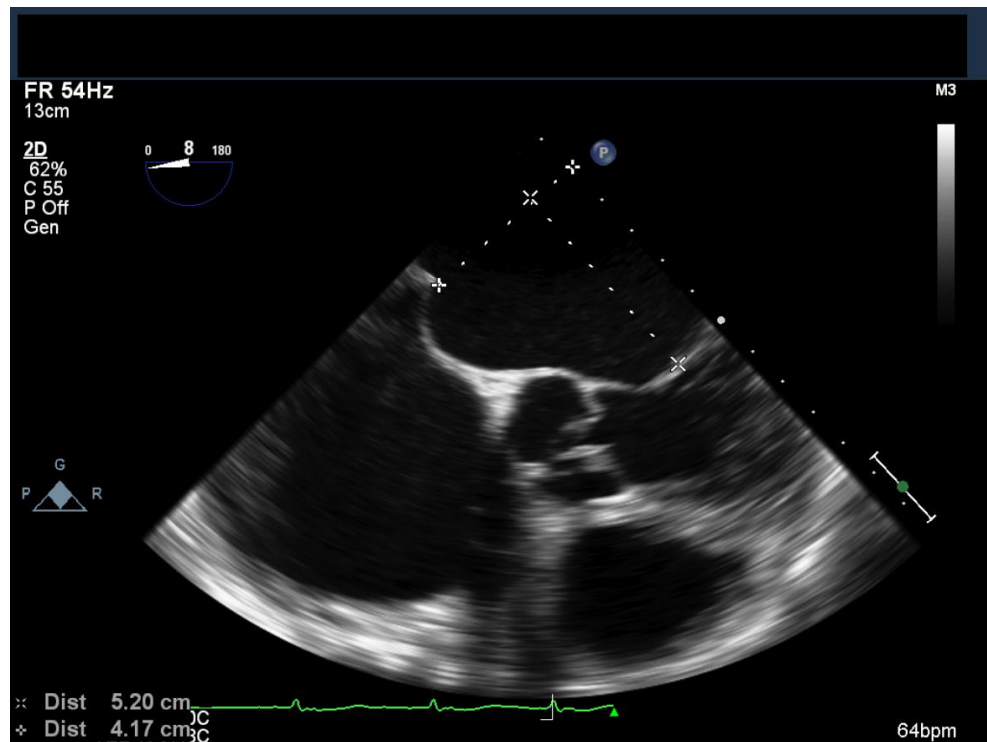
MV effective orifice $\leq 70.8\text{mm}^2$





Intra-procedural Imaging

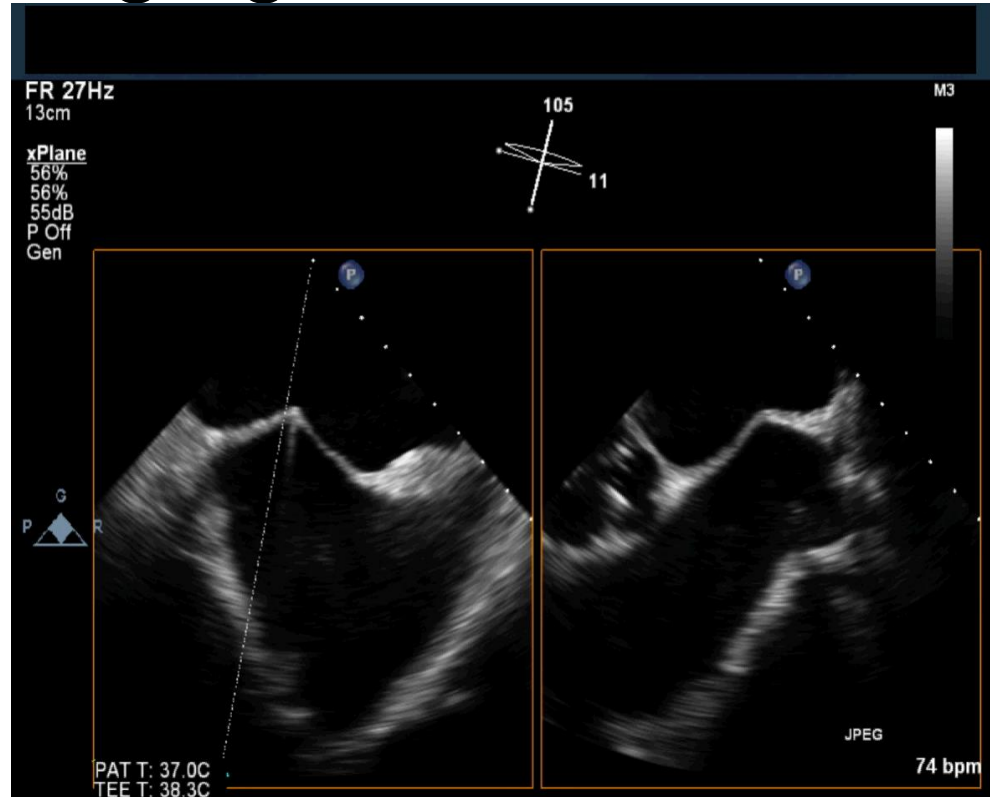
- Positioning of septostomy is key!
- Superior/posterior puncture
- 4-5cm above coaptation plane





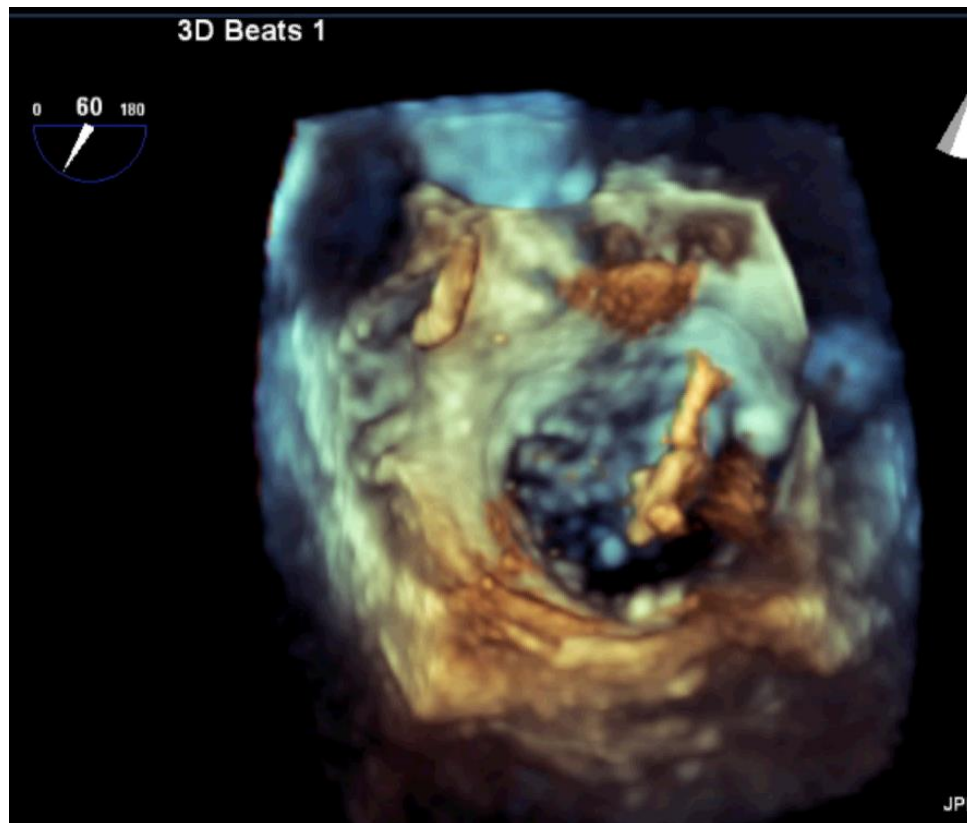
Intra-procedural Imaging

- Septostomy
 - Too low: limits maneuverability*
 - Too high: precludes successful leaflet capture*



Intra-procedural Imaging

- Catheter positioning





Echo



Select Layout ?

Select View ?

- Crarm
- Free
- Echo
- X-Ray

Annotation ?



Name Color

- Marker 1
- Marker 2

Show Names

+0



Free

Reset Cropping

CRAN 12°
RAO 35°

X-Ray

Accept Annotations

CRAN 7°
LAO 2°

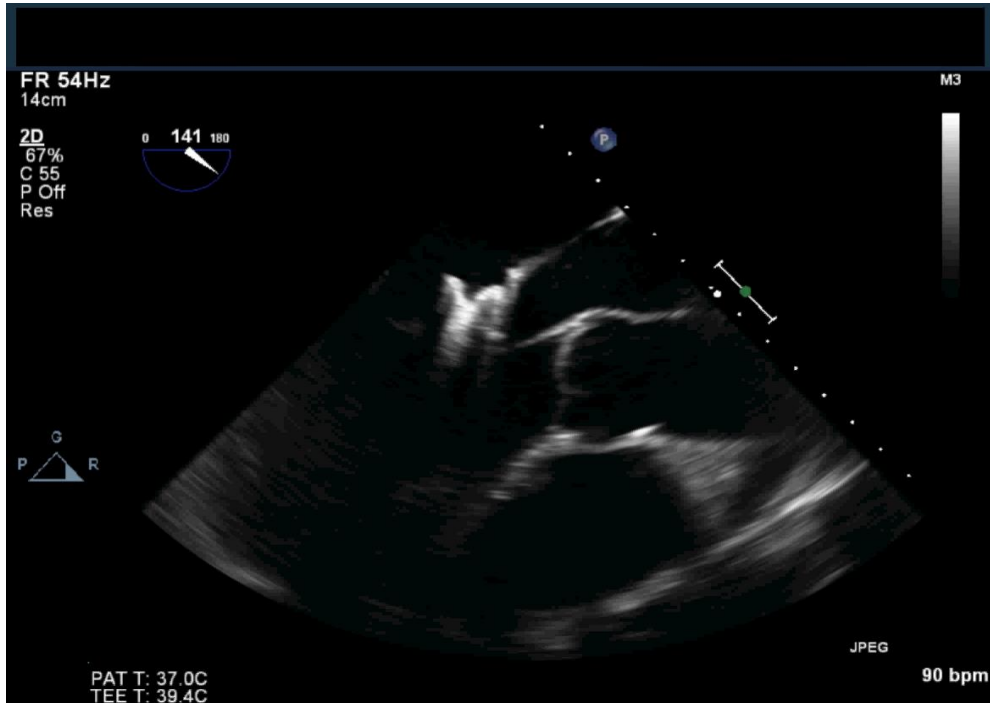
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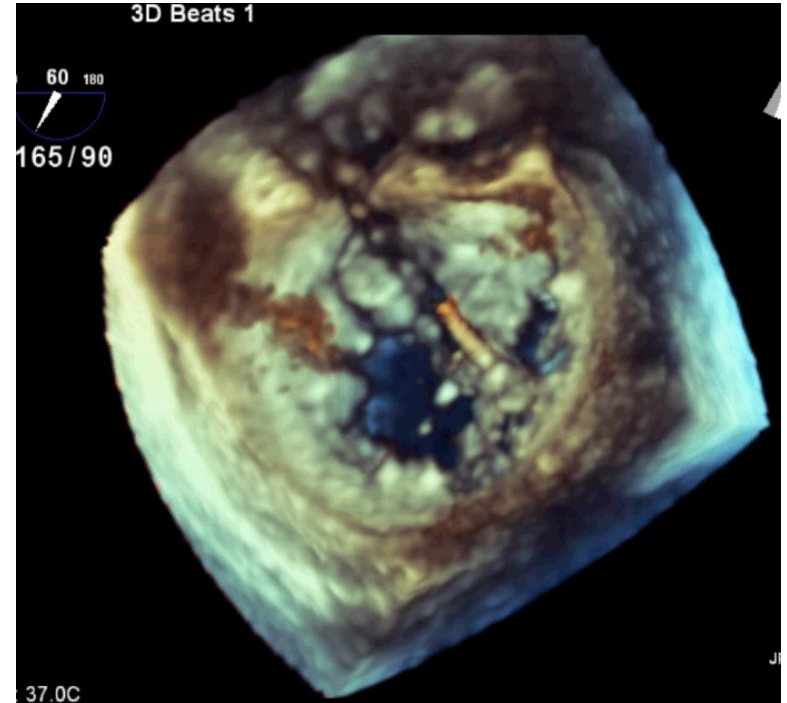


Intra-procedural Imaging

Valve crossing

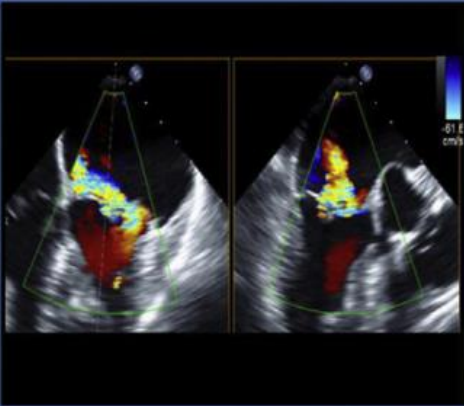
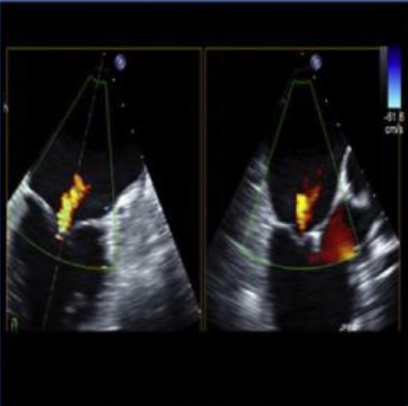


Leaflet grasping



Post-deployment Imaging

- Mitral regurgitation evaluation

Findings of \leq Mild Residual MR	Baseline	After Edge-to-edge Repair	Specific Features
Significant reduction in color Doppler jet features			<ul style="list-style-type: none"> • Small vena contracta width ($<$ 0.3 cm) of individual MR jets • Small flow convergence radius (\leq 0.3 cm) • Central MR jet with limited penetration into LA



Post-deployment Imaging

- **Second clip?**

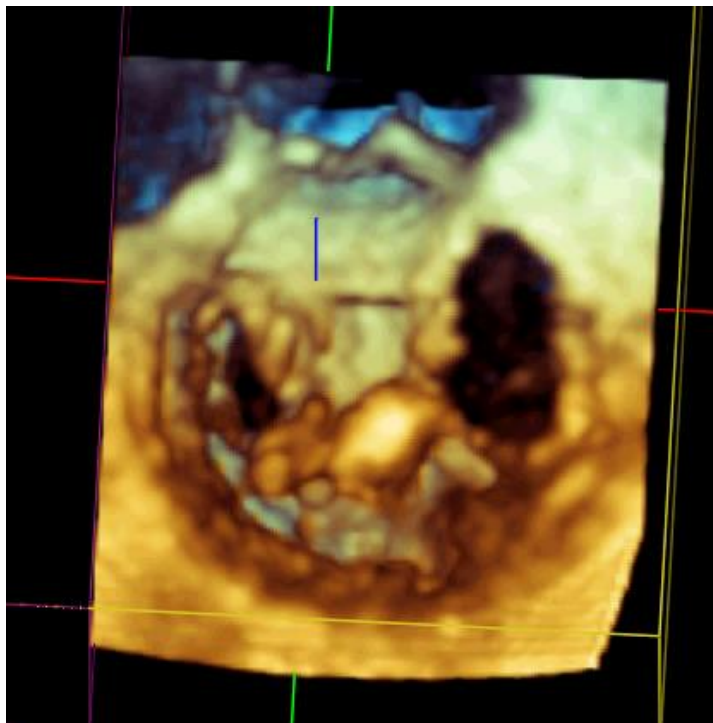
- degree of reduction of MR, residual MR, mean gradient, hemodynamics, and technical feasibility*

- Residual MR is a predictor of long-term survival. 2 clips may have superior durability as compared with a single clip.

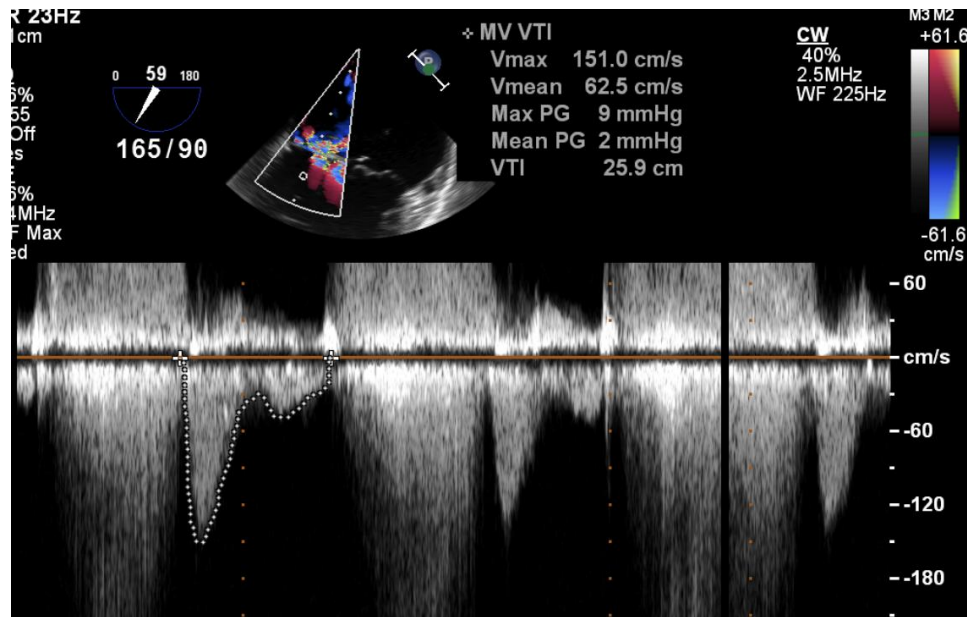


Post-deployment Imaging

Double orifice



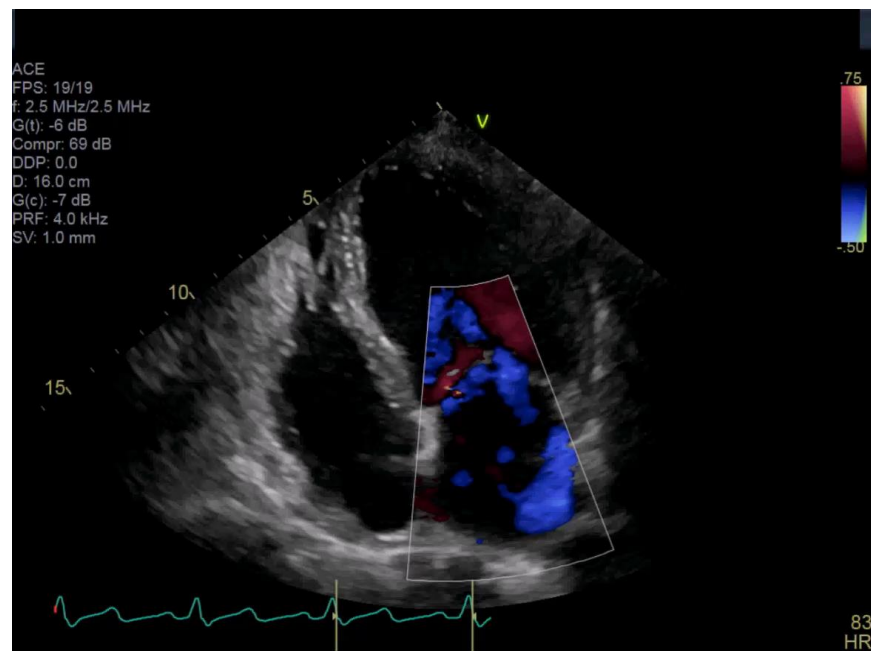
Mitral stenosis assessment



Mean gradient <5mmHg is ideal

Secondary Mitral Regurgitation

- Management of secondary MR is more controversial
- LV dysfunction and MR (any) have a worse prognosis than LV dysfunction w/out MR





Secondary Mitral Regurgitation

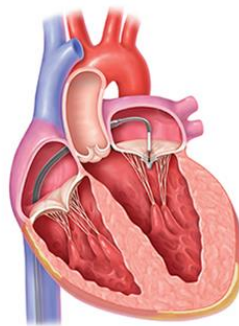
- Current guideline-directed medical therapy targeting the LV and CRT can reduce MR (class I recommendation)
- Surgical intervention does not provide a clear benefit in secondary MR



ORIGINAL ARTICLE

Transcatheter Mitral-Valve Repair in Patients with Heart Failure

G.W. Stone, J.A. Lindenfeld, W.T. Abraham, S. Kar, D.S. Lim, J.M. Mishell,
B. Whisenant, P.A. Grayburn, M. Rinaldi, S.R. Kapadia, V. Rajagopal,
I.J. Sarembock, A. Brieke, S.O. Marx, D.J. Cohen, N.J. Weissman,
and M.J. Mack, for the COAPT Investigators*





Imaging in Structural Heart Disease

How are we changing practice?

- More options for transcatheter treatment of SHD
- Interventional Echocardiography as a subspecialty
- Greater integration of multimodality imaging
- Emphasizes the need for multidisciplinary team, cardiac imagers are key, to guide and optimize outcomes in patients with SHD