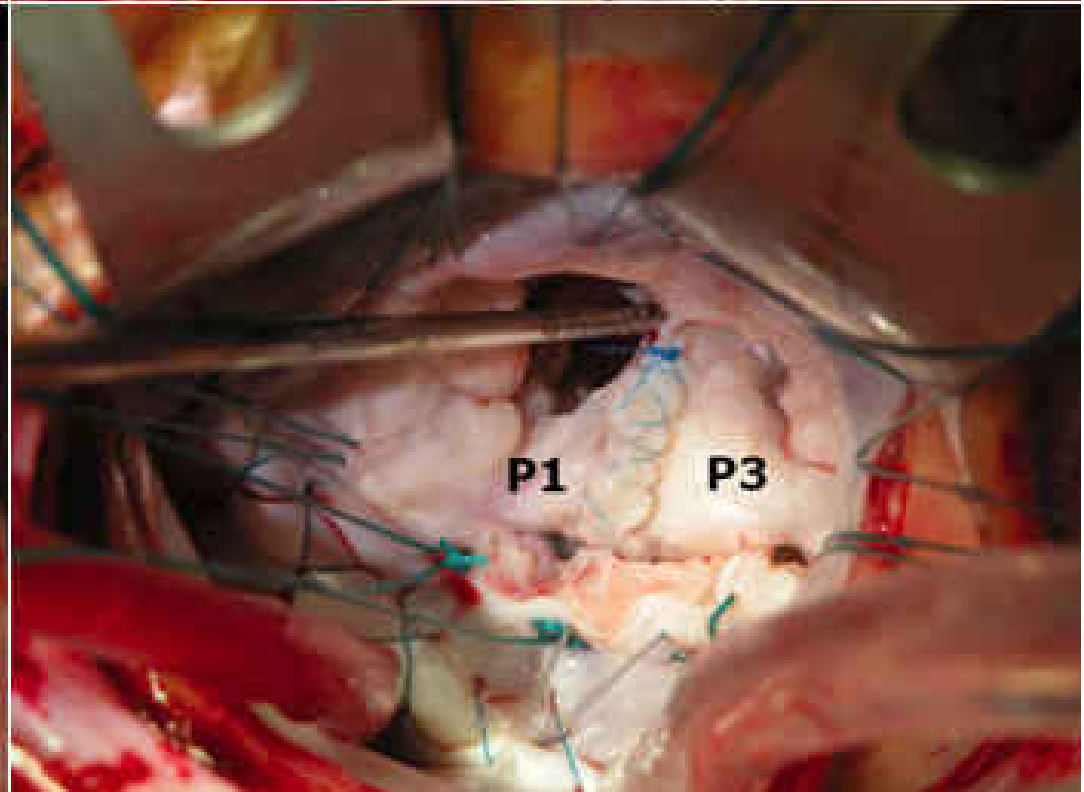
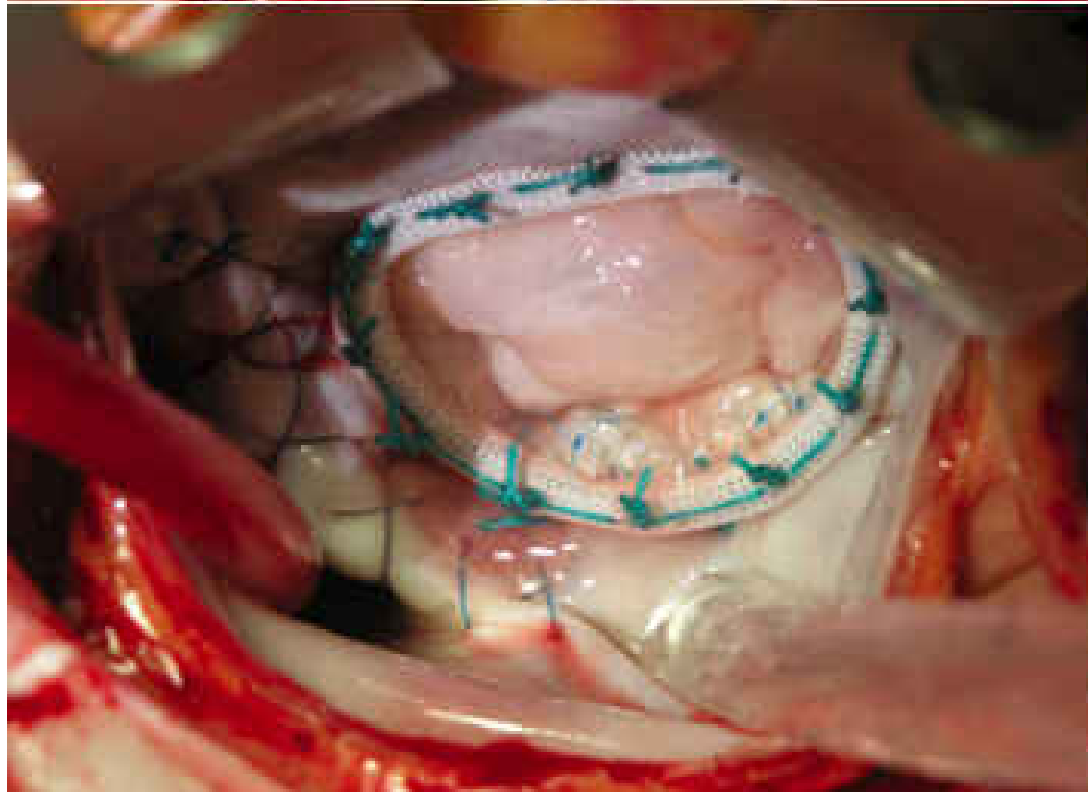
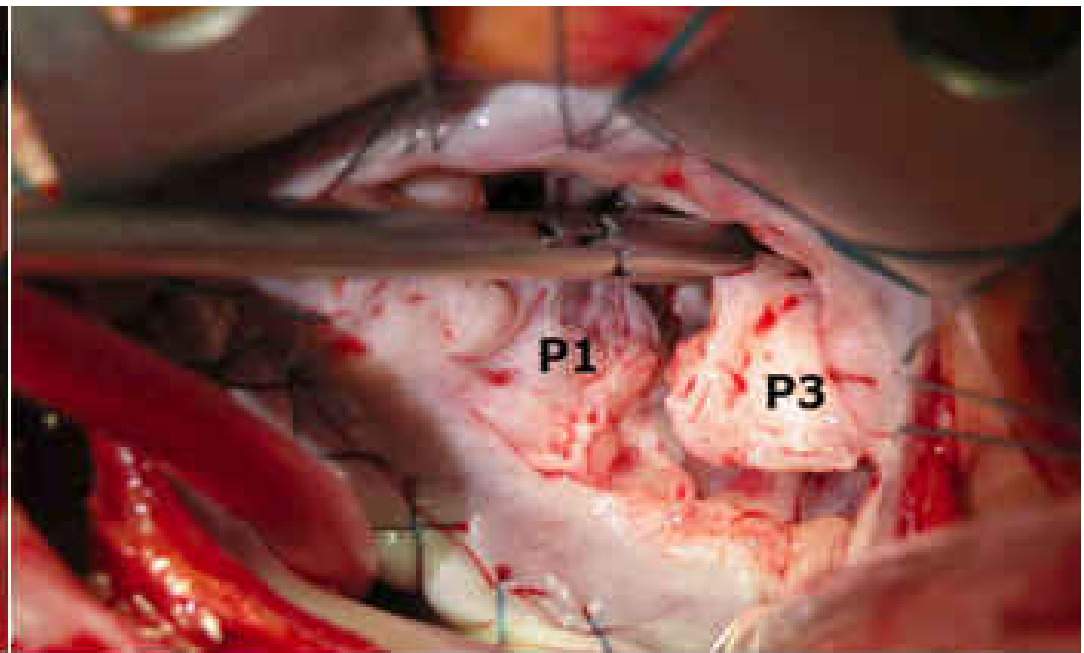
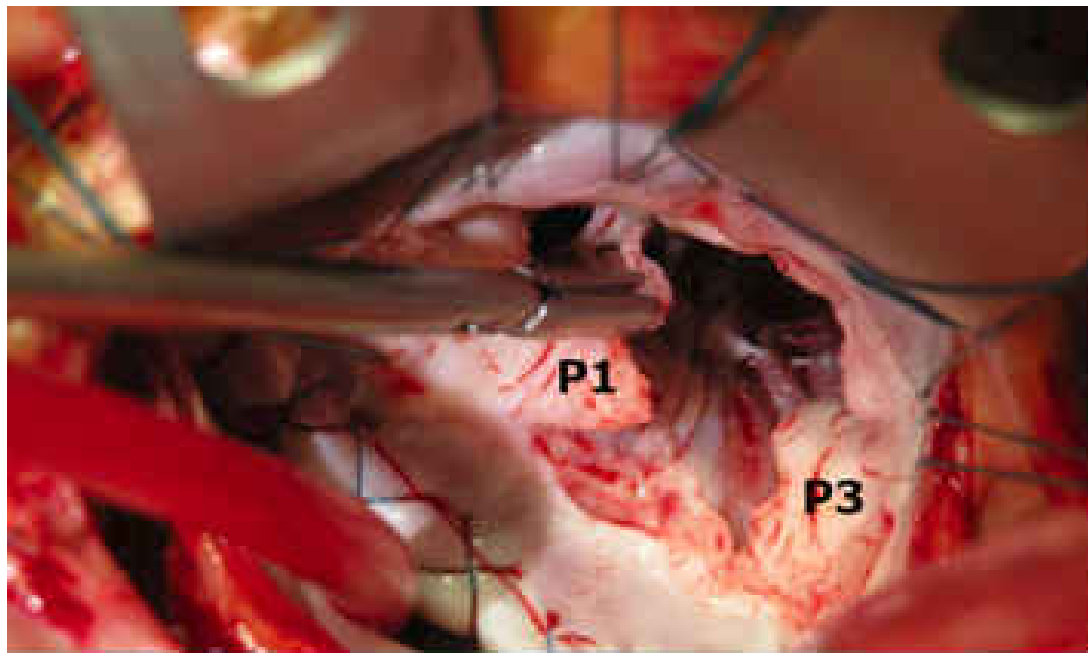


Assessment of Mitral Valve Disease Prior to Transcatheter Therapy: TEE, 3-D TEE, MR/CT, and Beyond

Samir Kapadia, MD, FACC
Director, Interventional Cardiology Fellowship
Director, Sones Catheterization Laboratories
Cleveland Clinic

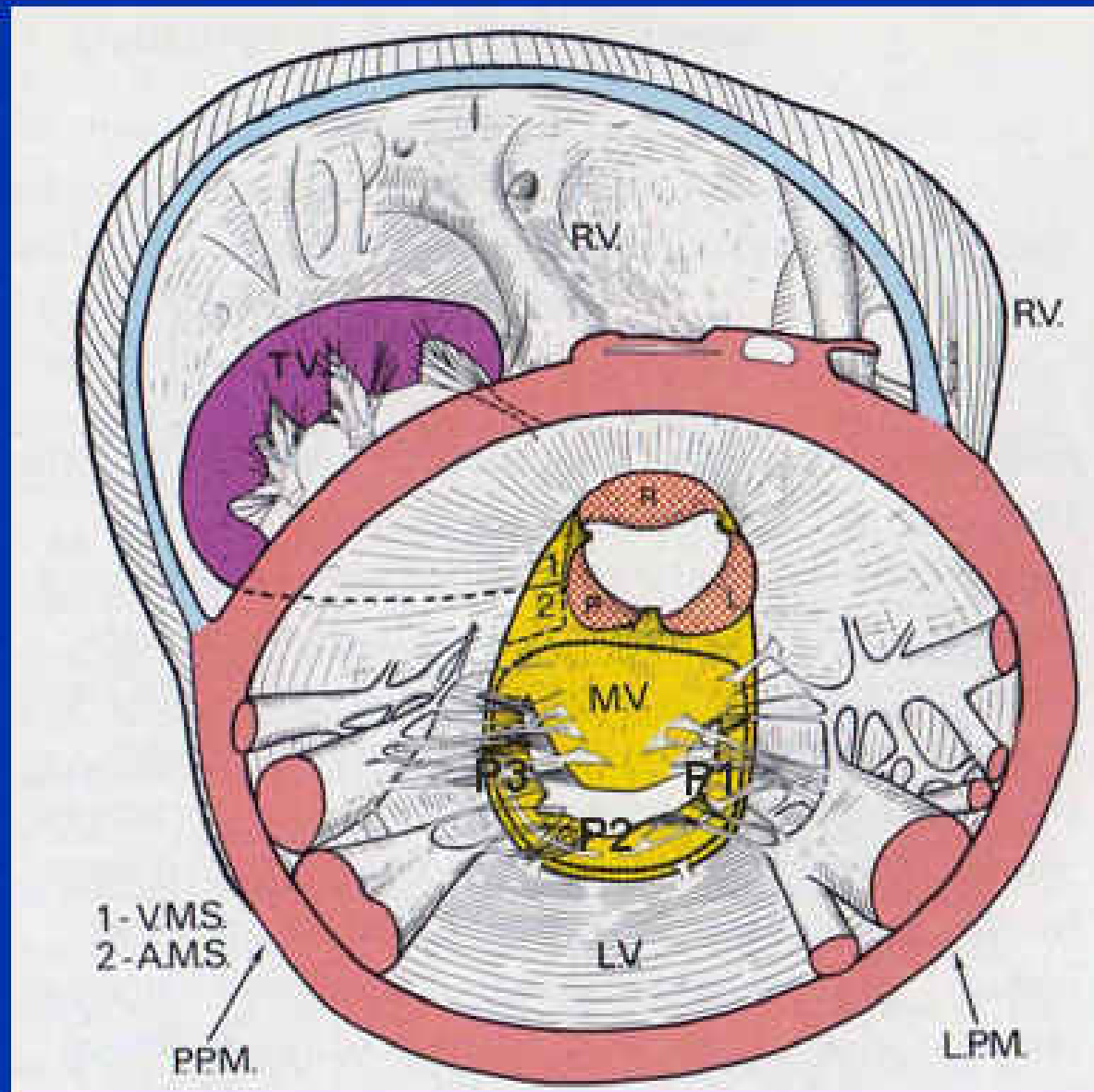
Disclosures: None



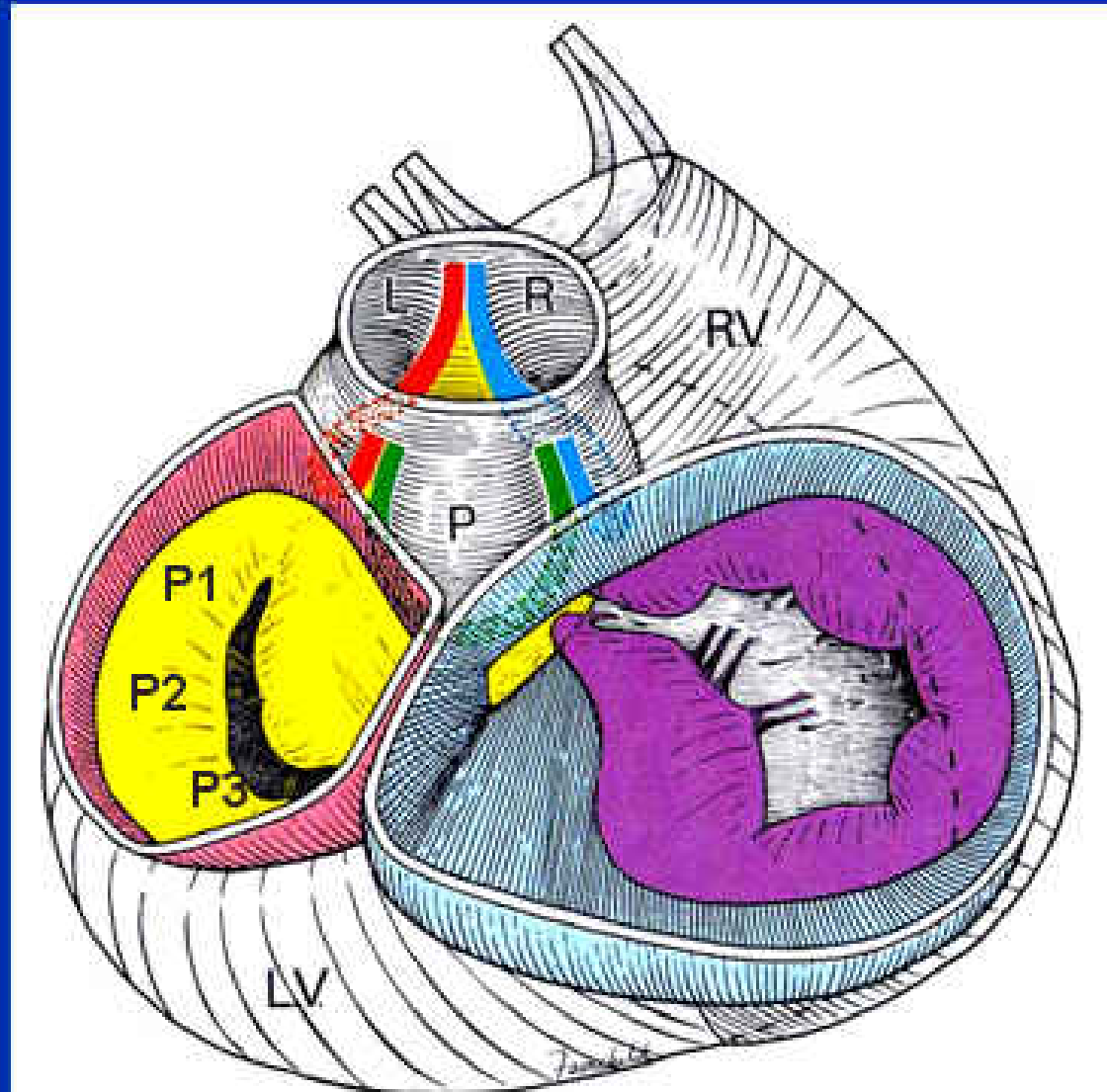
Percutaneous Mitral Valve Repair Devices

Approach	Device (Company)	Description	Testing Phase
Edge-Edge	Mitraclip (Evalve)	Clip for e-e repair	EVEREST
	Mobius (Edwards)	Suture based e-e repair	Phase I
	St Jude	Edge-edge repair	Preclinical
Coronary Sinus	Carillon (CarDimension)	Anchor, cinching	Phase I
	Monarch (Edwards)	Anchor, tensioning	Phase I
	PTMA (Viacor)	Reversible, adjustable	Phase I
Other	Coapsys (Myocor)	Epicardial remodeling	Phase I
	Mitralign	CS guided suture	Phase I
	PS3	Septal to CS anchoring	Phase I

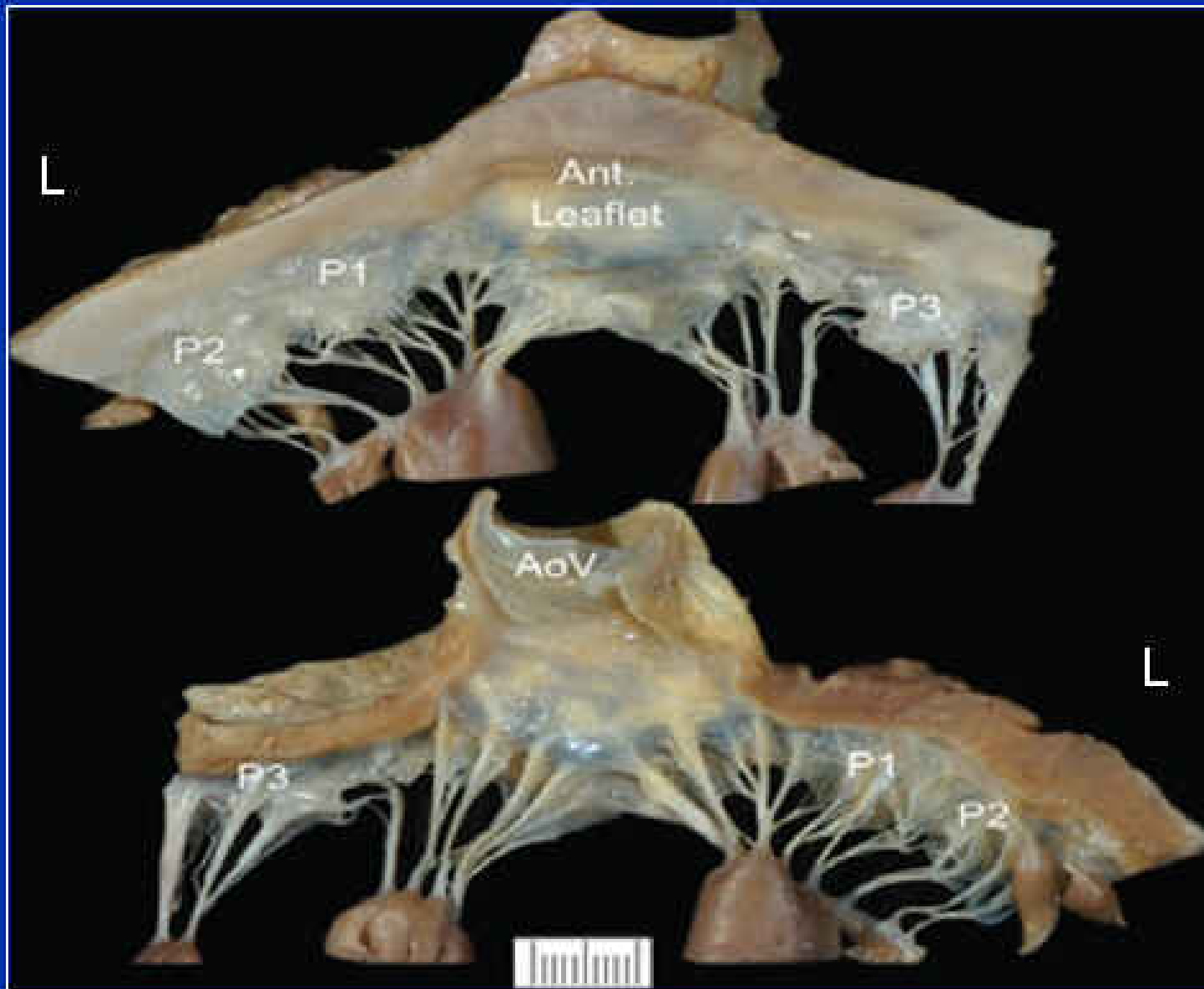
Mitral Valve : “Ventricular View”



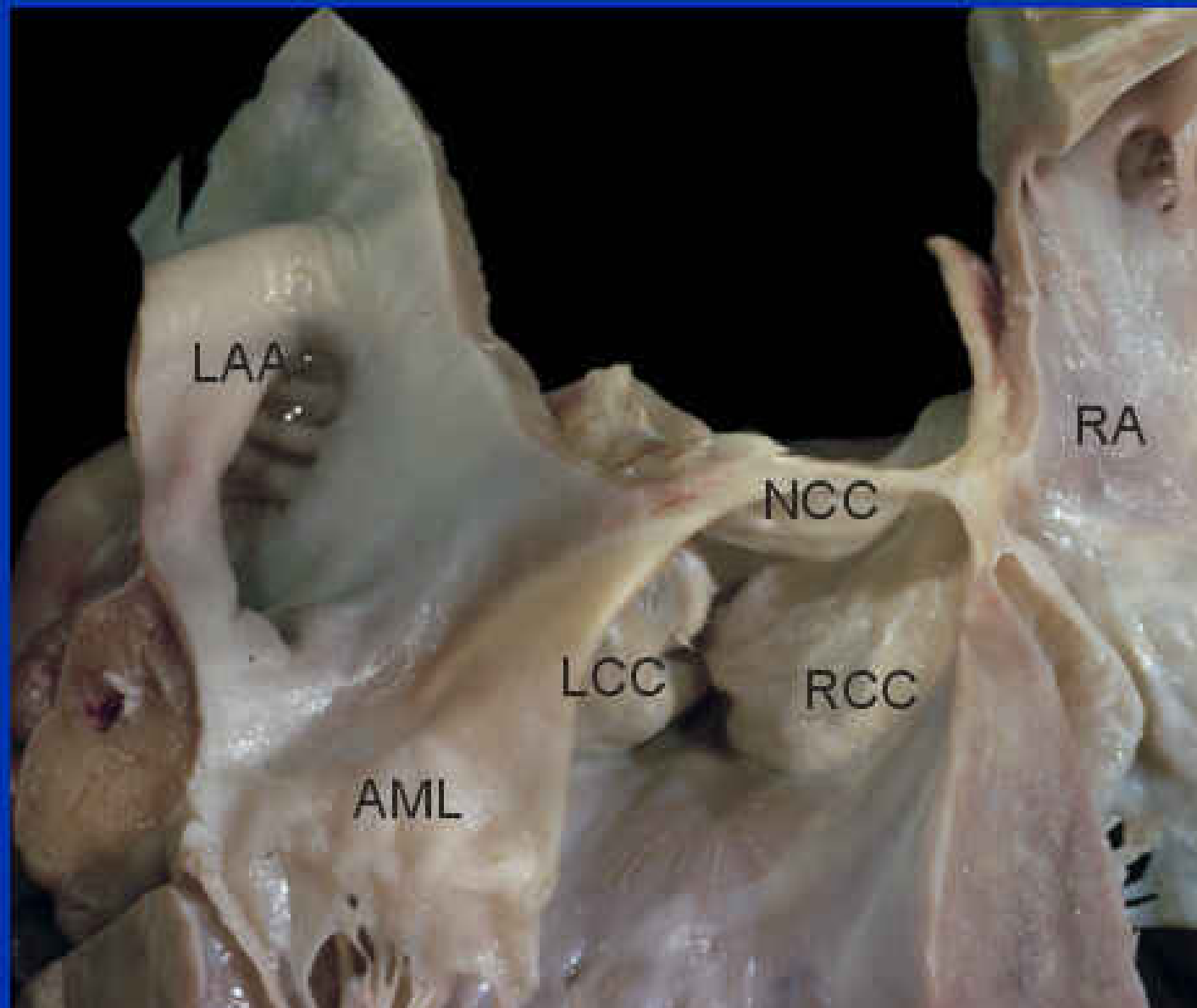
Mitral Valve: "Atrial View"



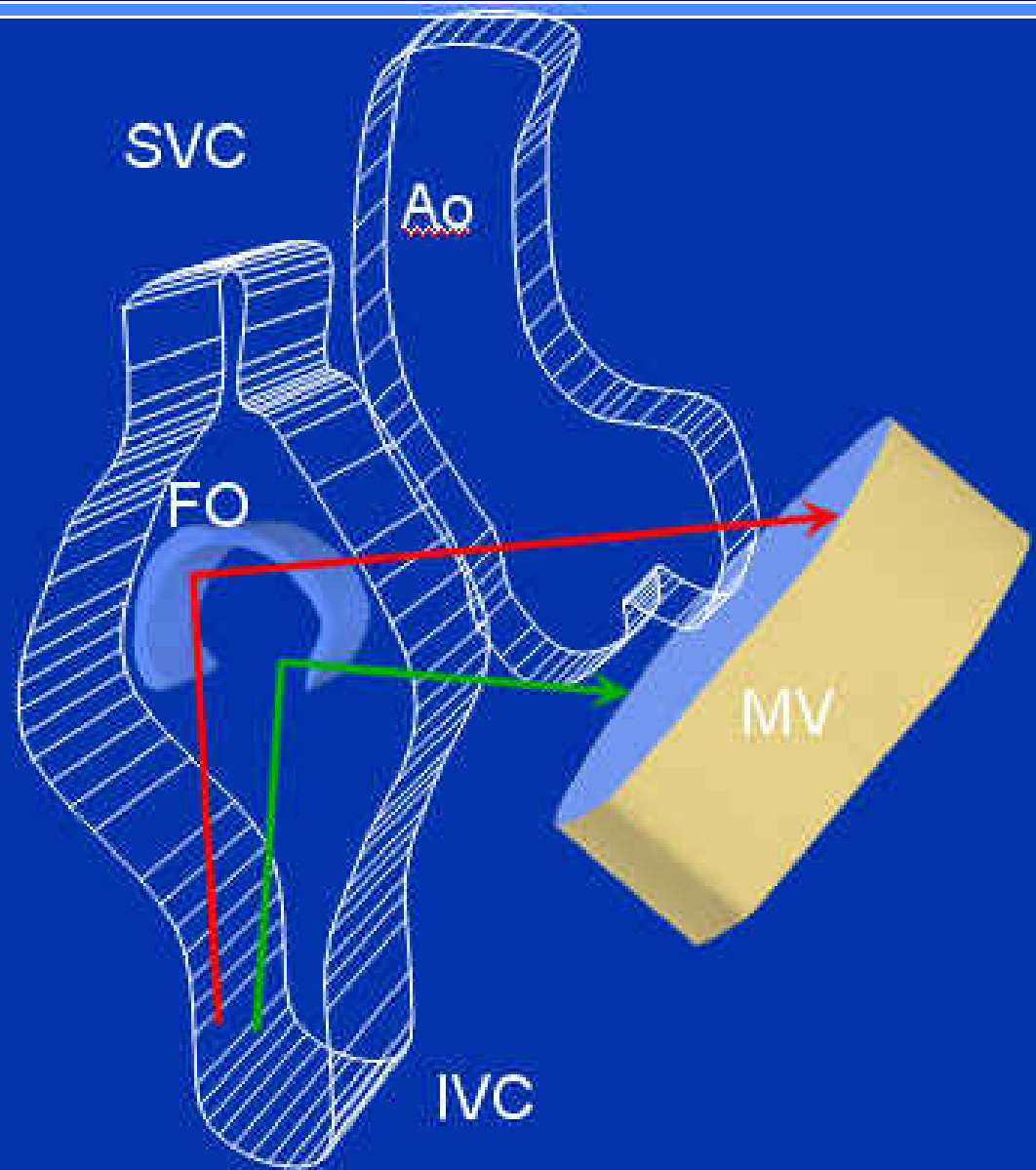
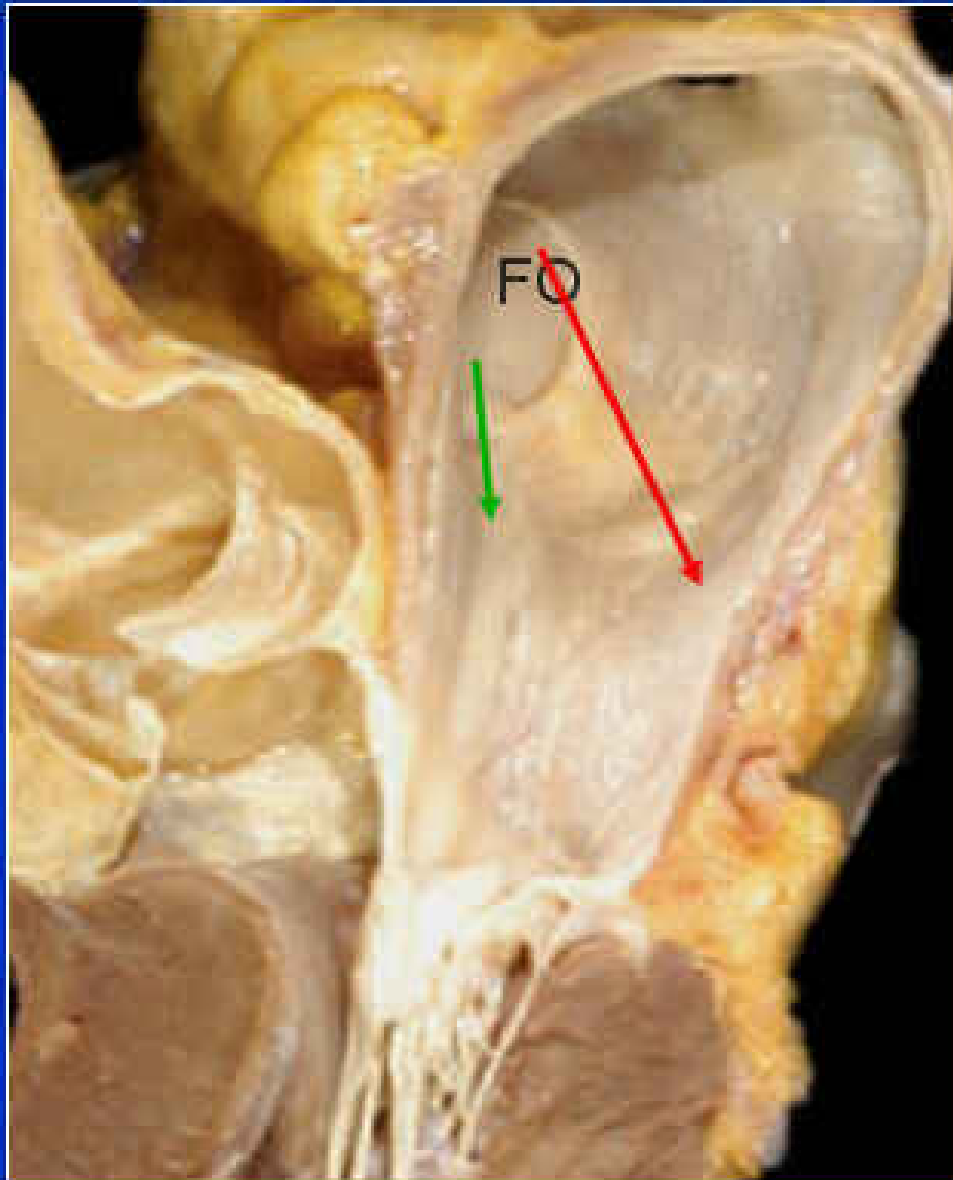
Mitral Valve Leaflet Anatomy



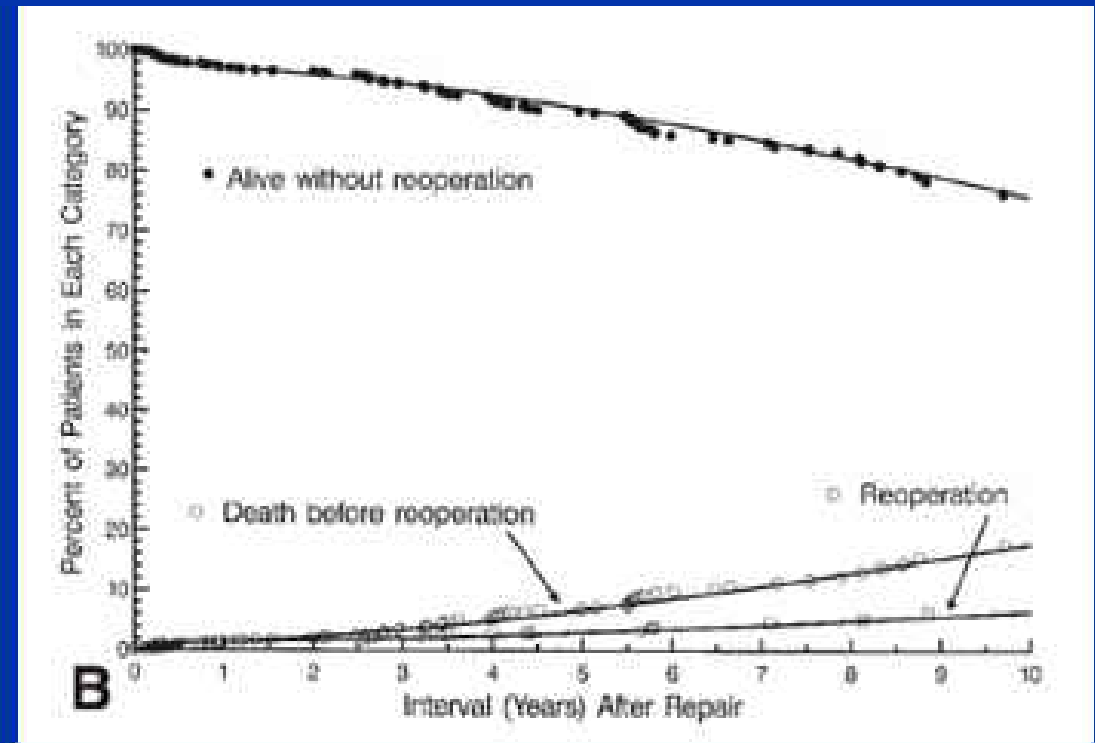
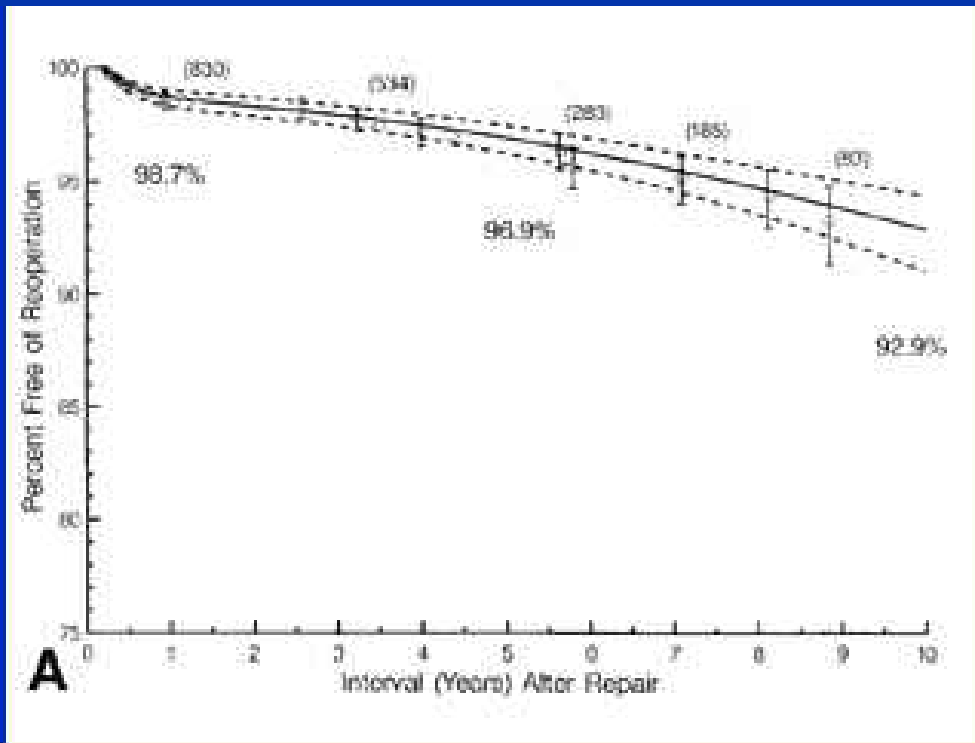
Relation to AV, LAA and AML



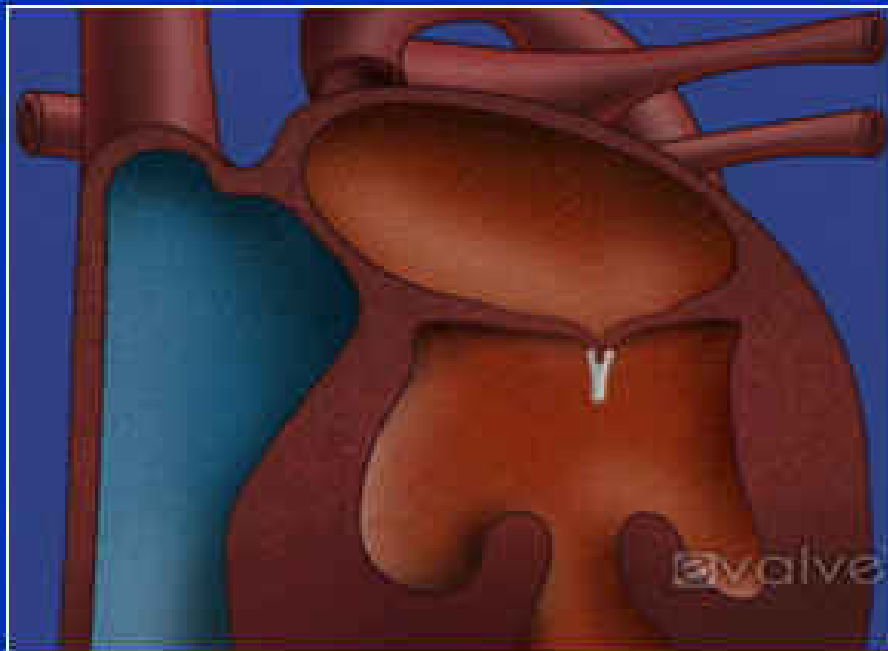
MV and IAS



Degenerative Mitral Valve Disease

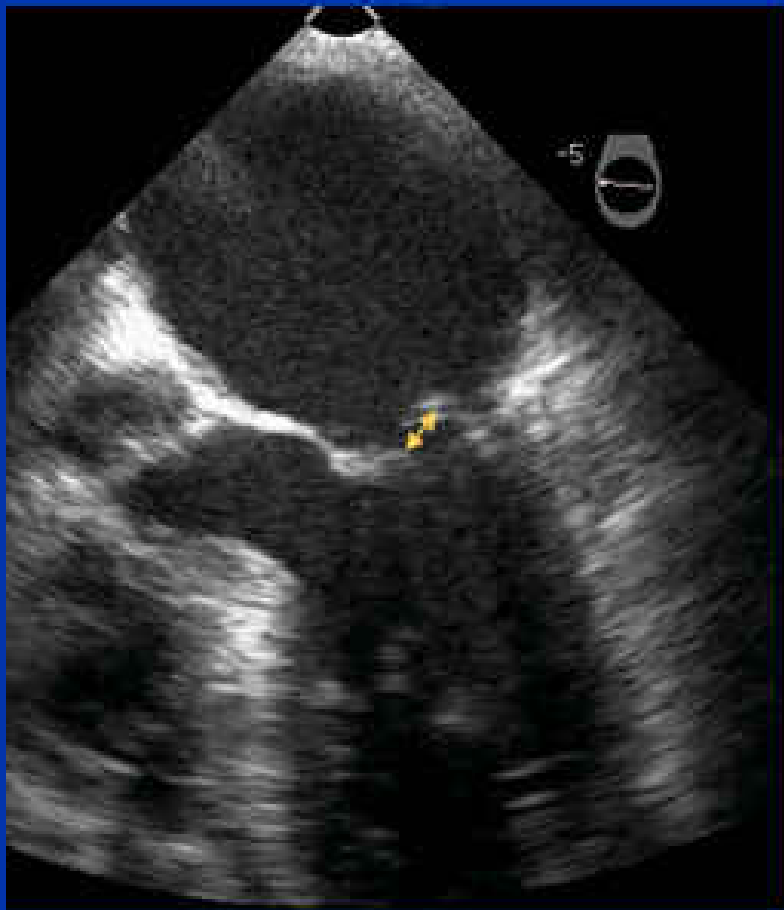


E-Valve

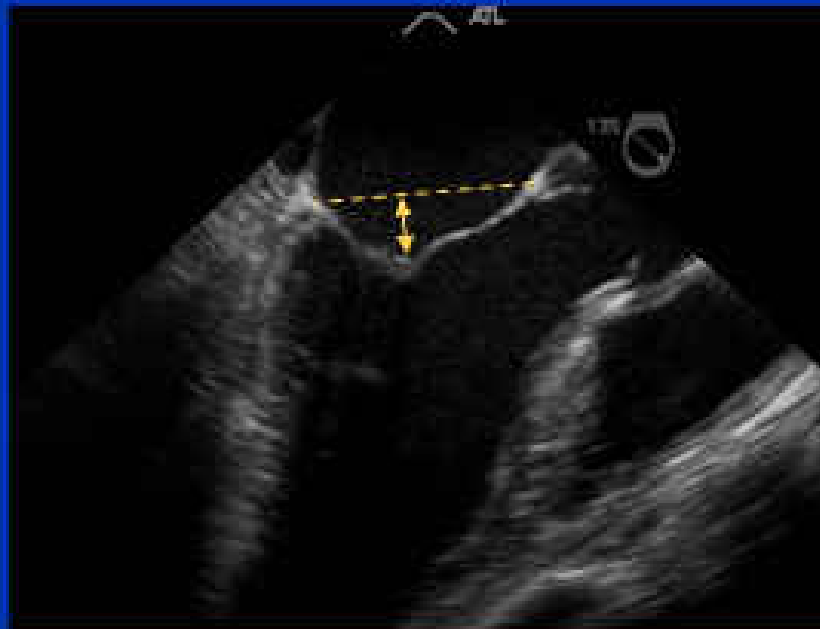


Measurements

Flail Gap = 6 mm



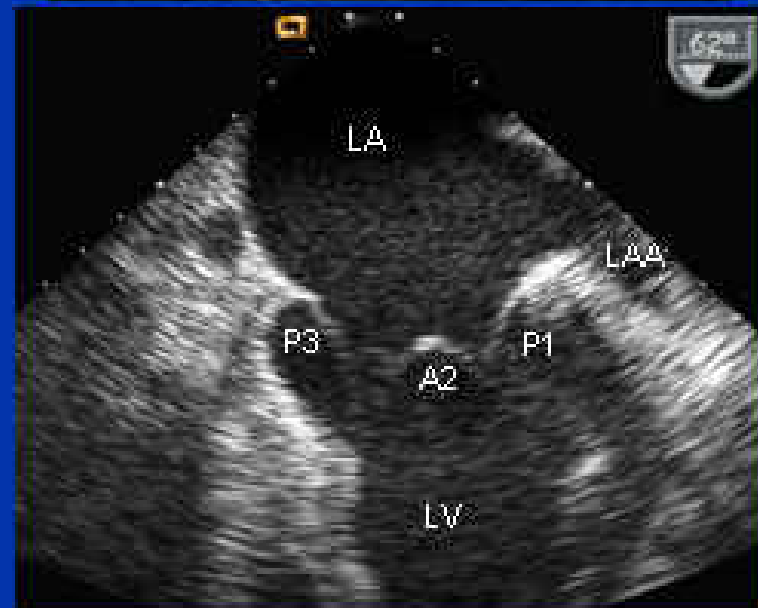
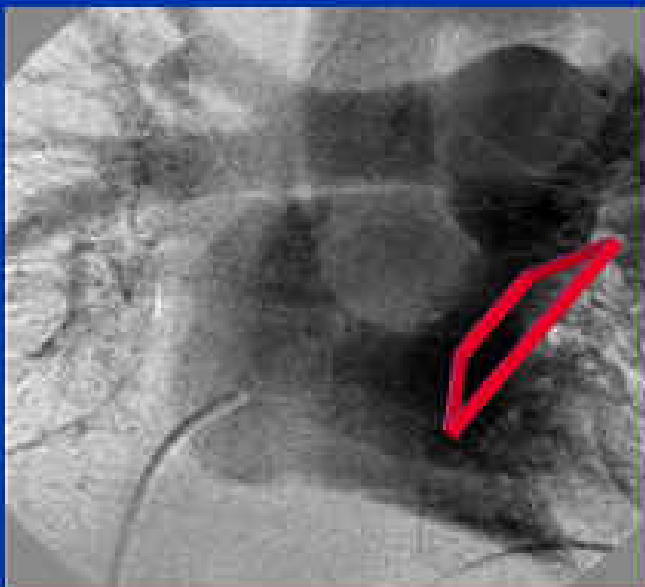
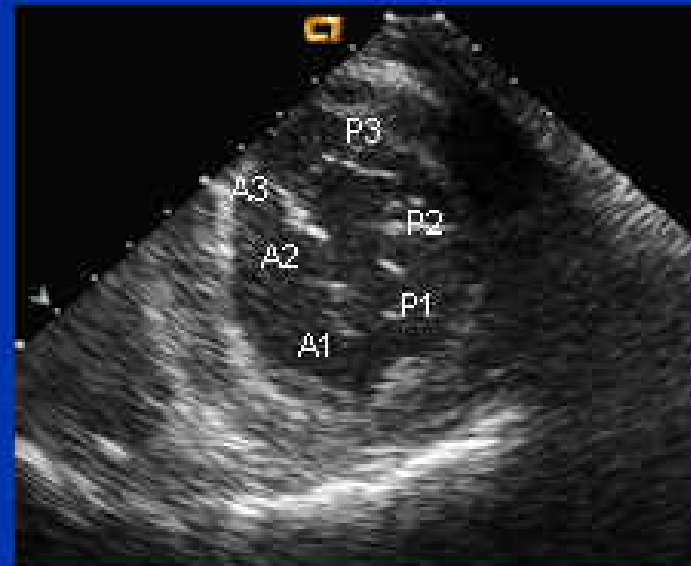
Coaptation Depth = 9 mm



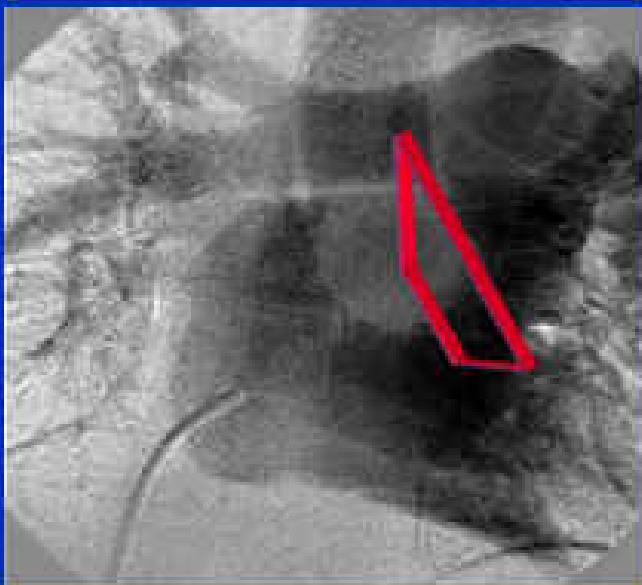
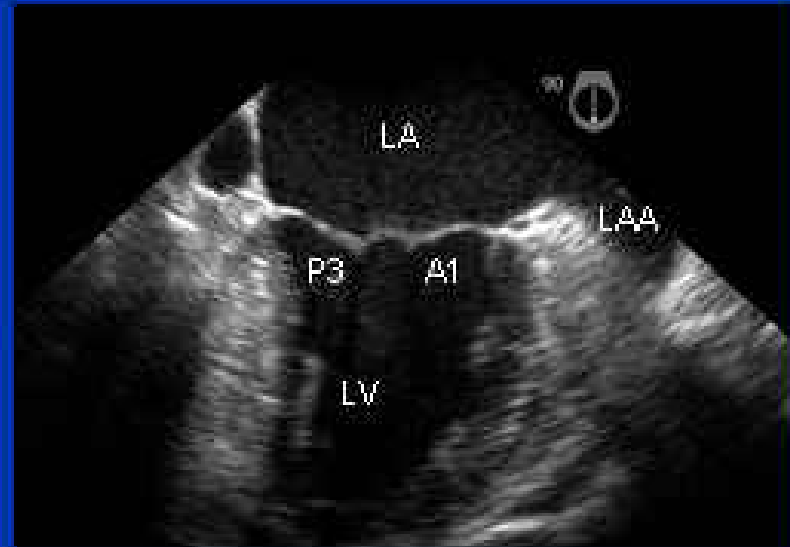
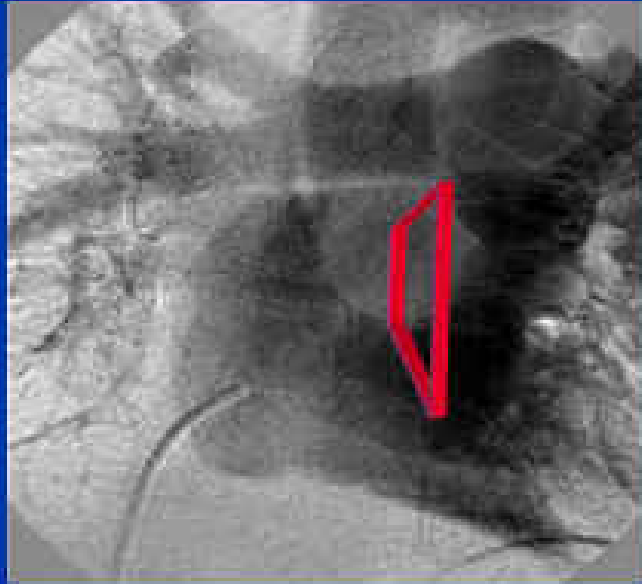
Flail Width
15 mm



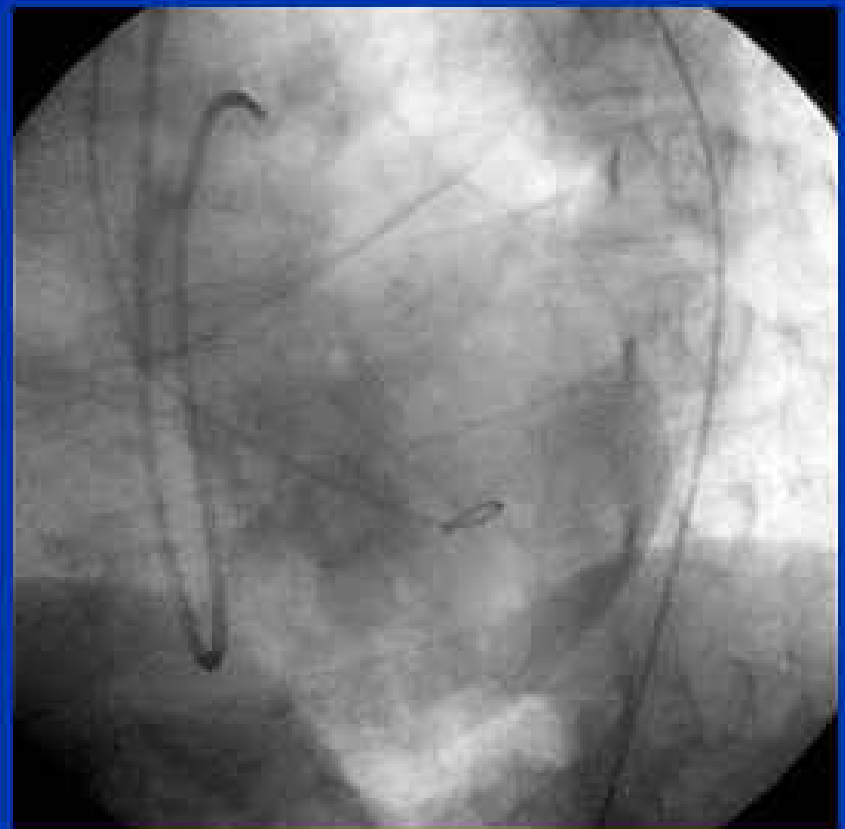
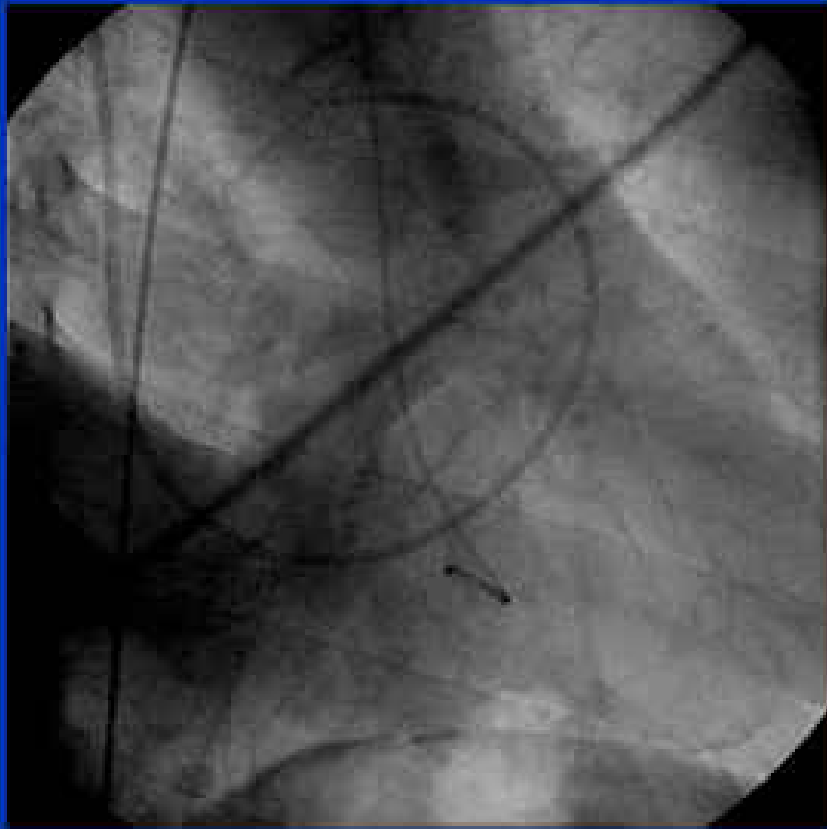
TEE Views: Transgastric and Commissural



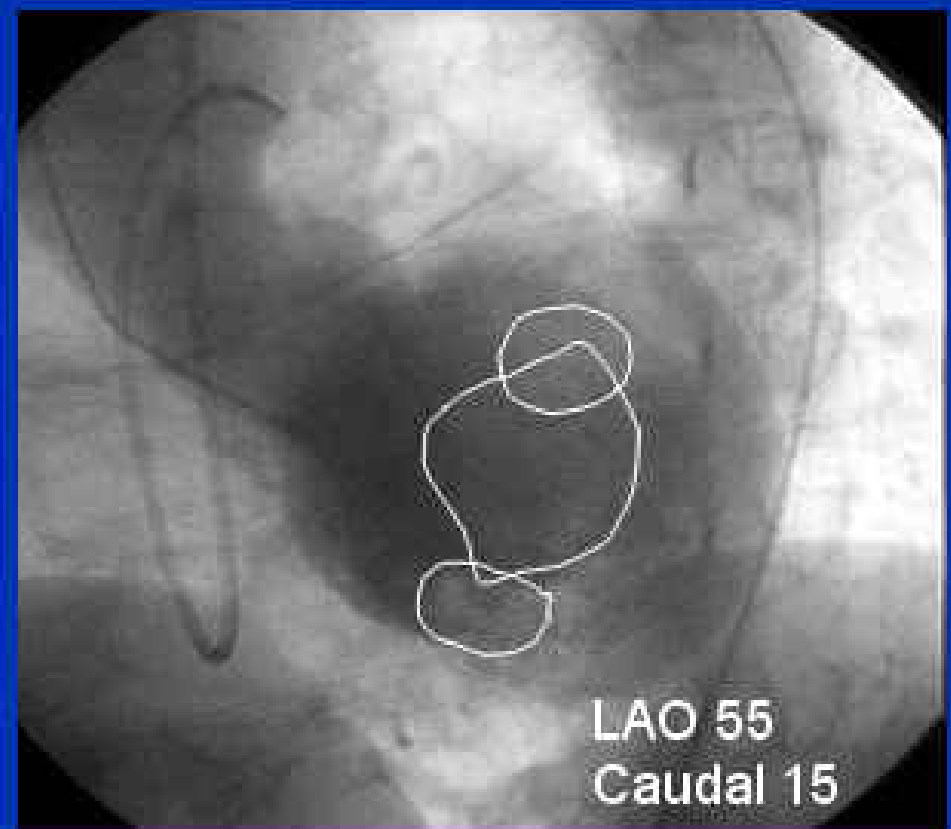
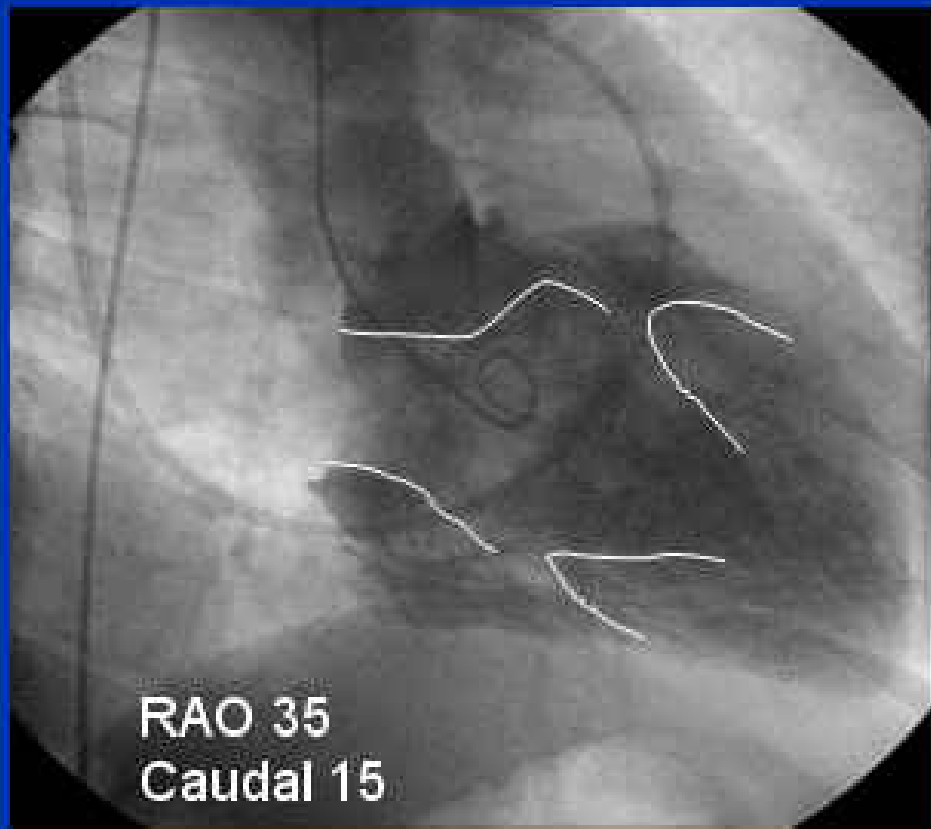
TEE Views: Two Chamber and Long Axis



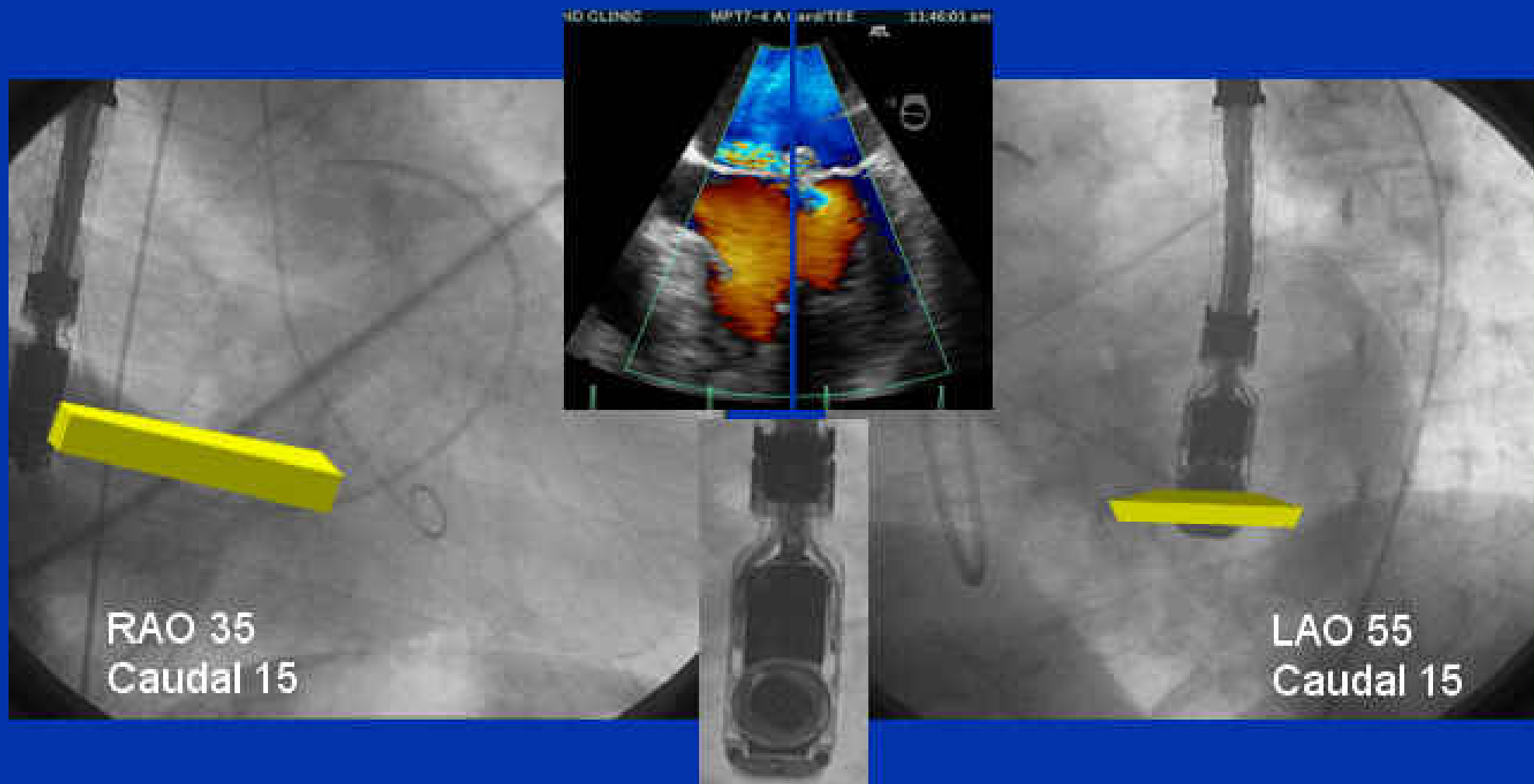
Ventriculogram and MV Anatomy



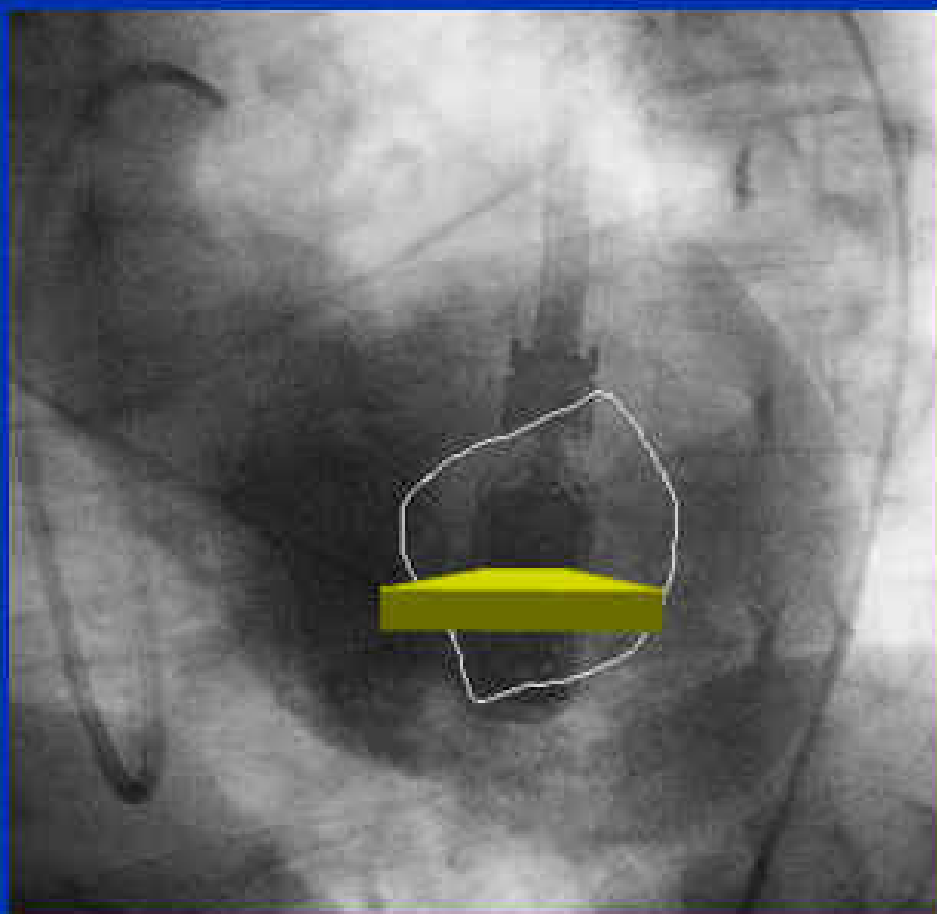
Ventriculogram and MV Anatomy



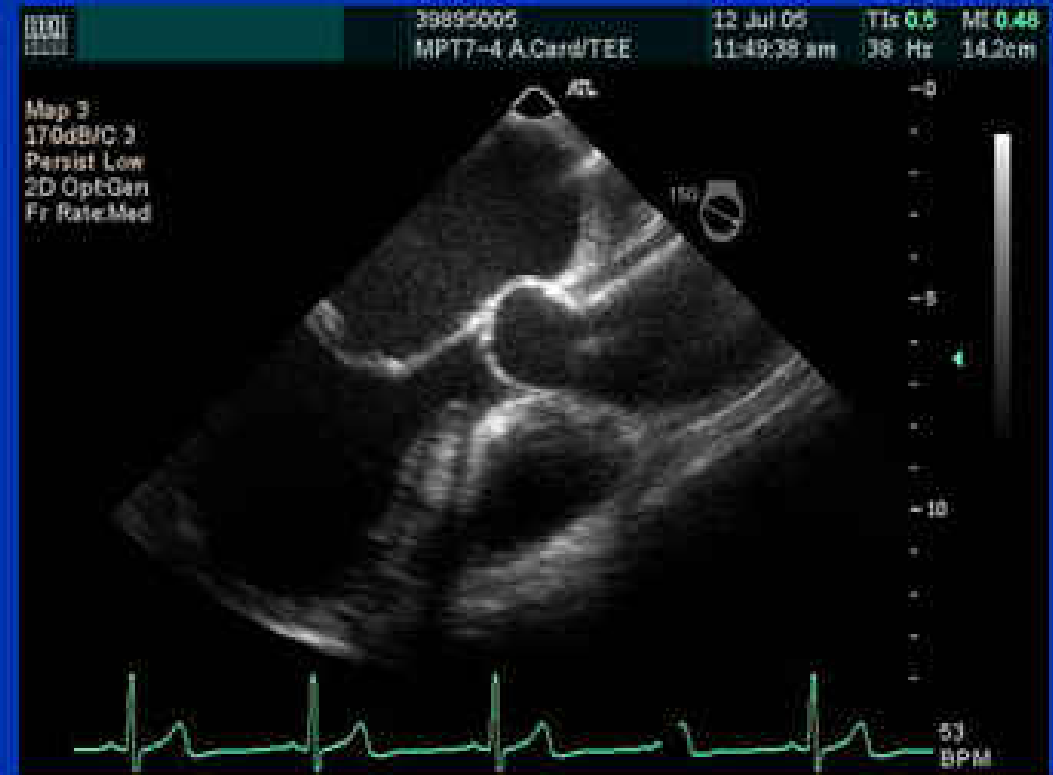
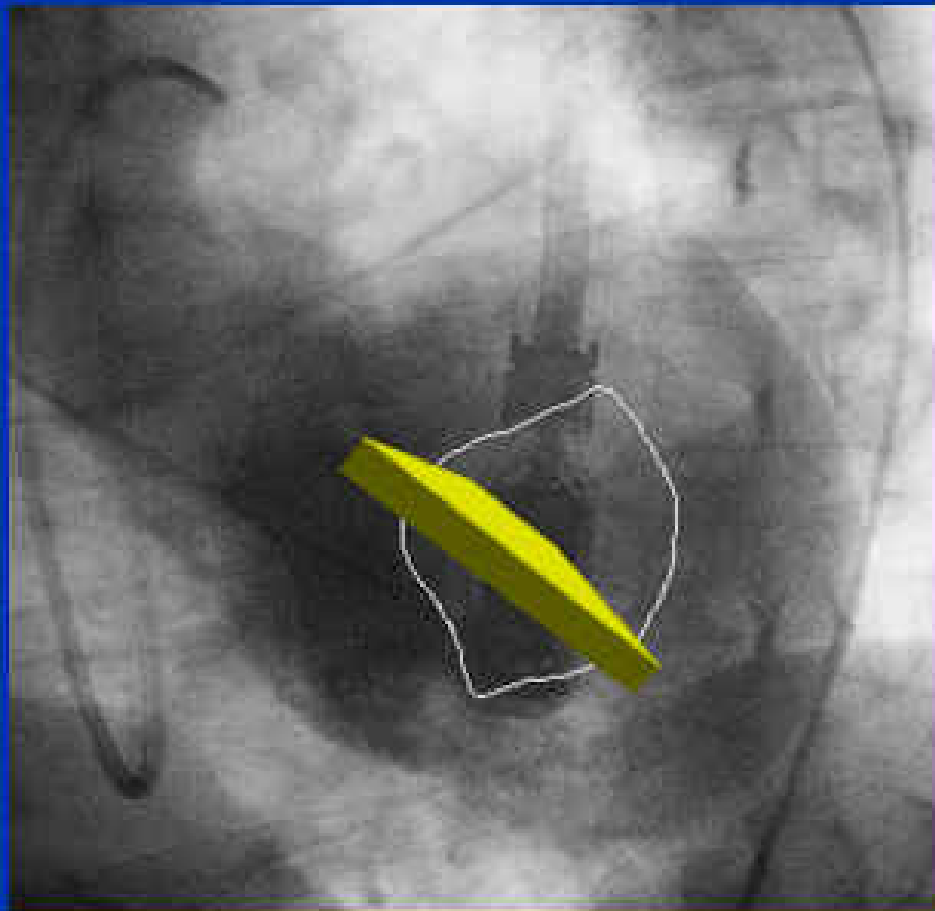
TEE and Fluoro Alignment



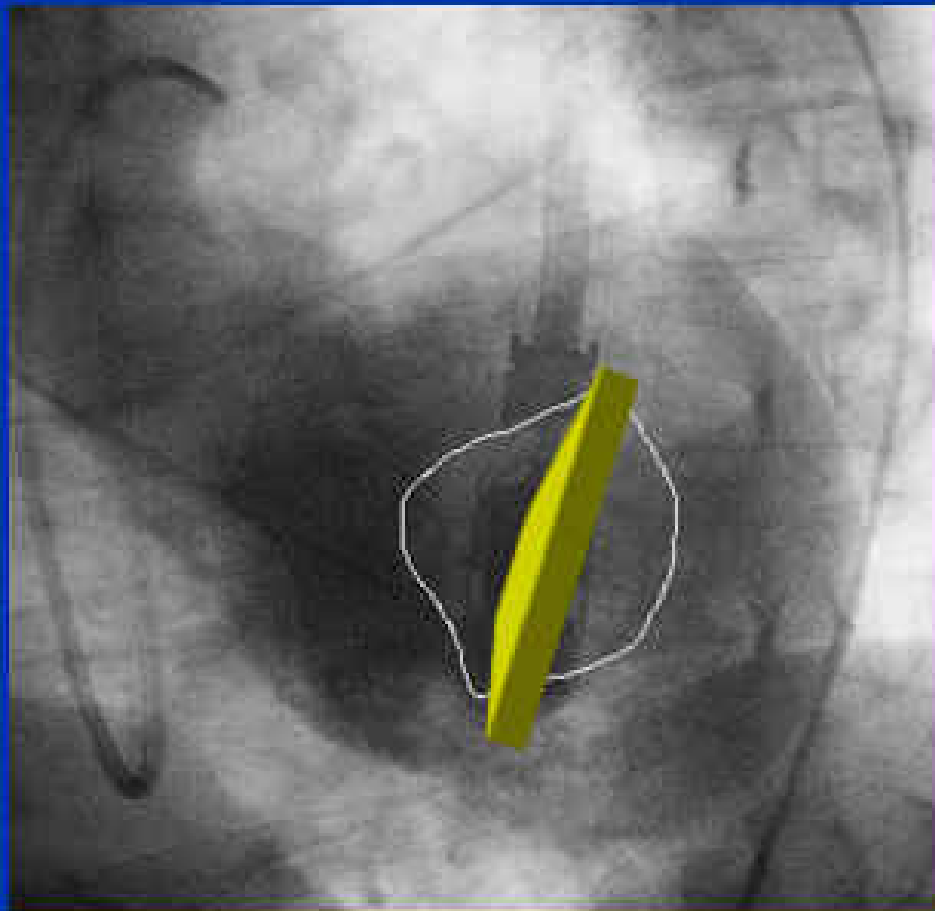
TEE and Fluoro Anatomy: 4 chamber



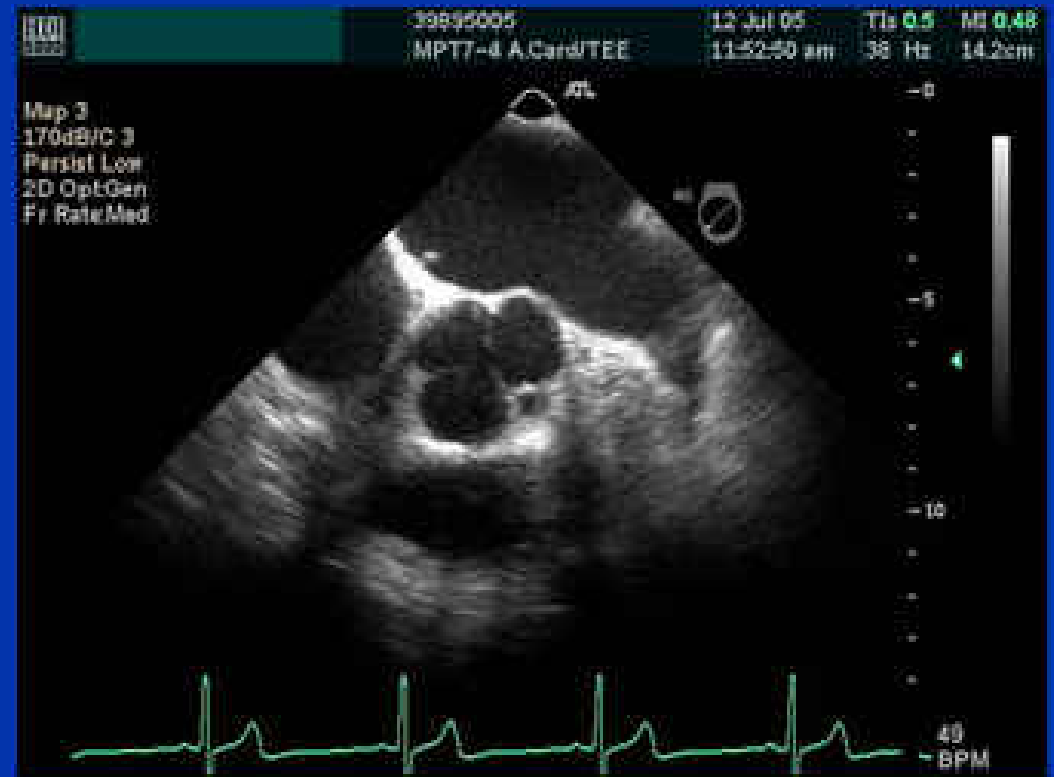
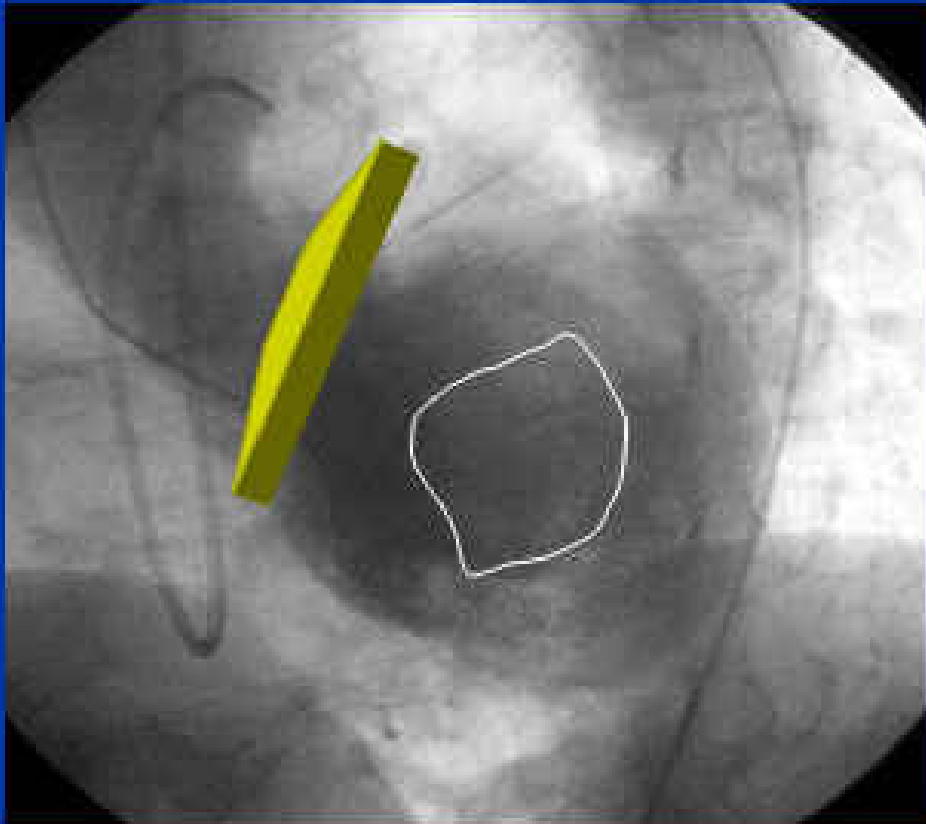
TEE and Fluoro Anatomy: Long axis



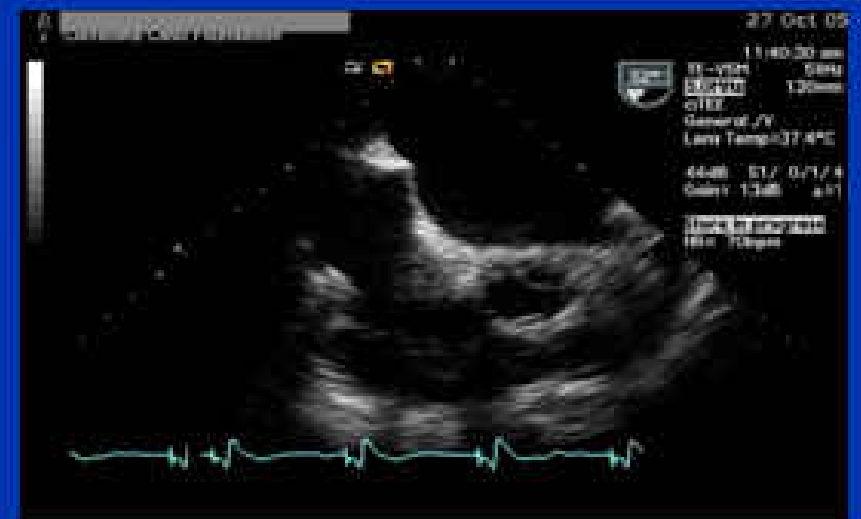
TEE and Fluoro Anatomy: Commissural



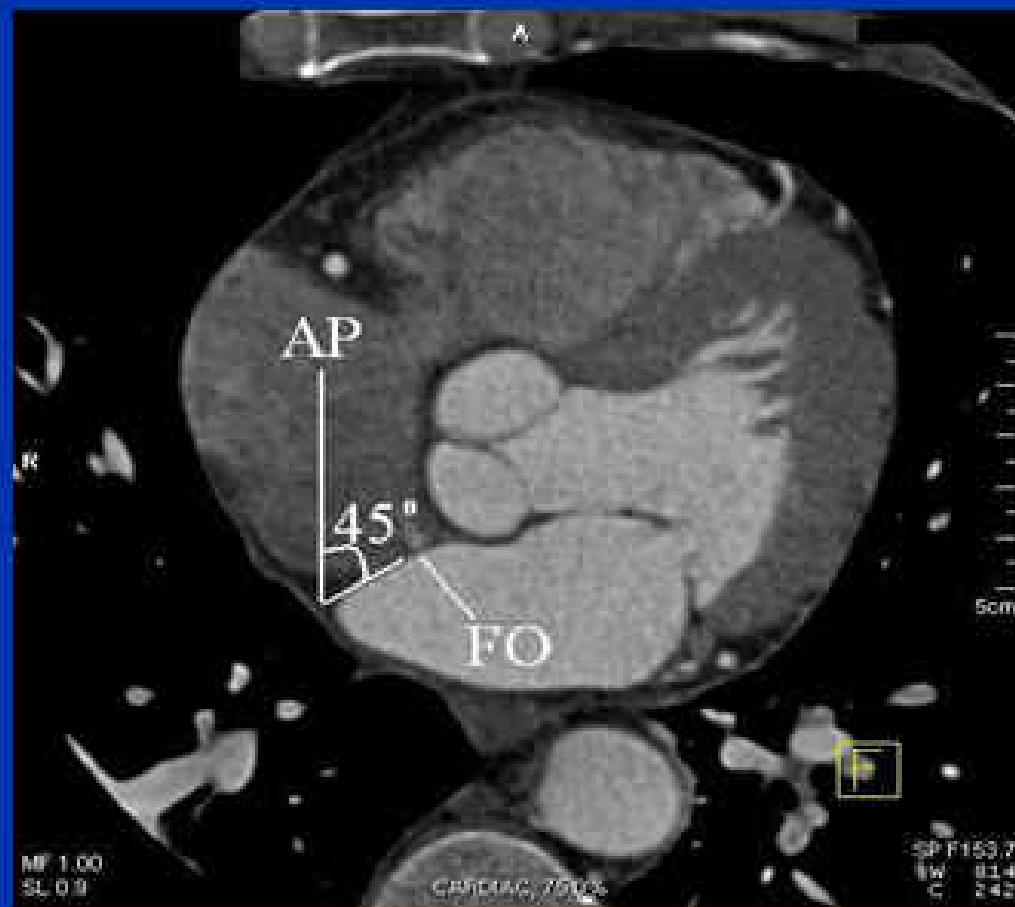
TEE and Fluoro Anatomy: Aortic Short Axis



Transseptal Approach

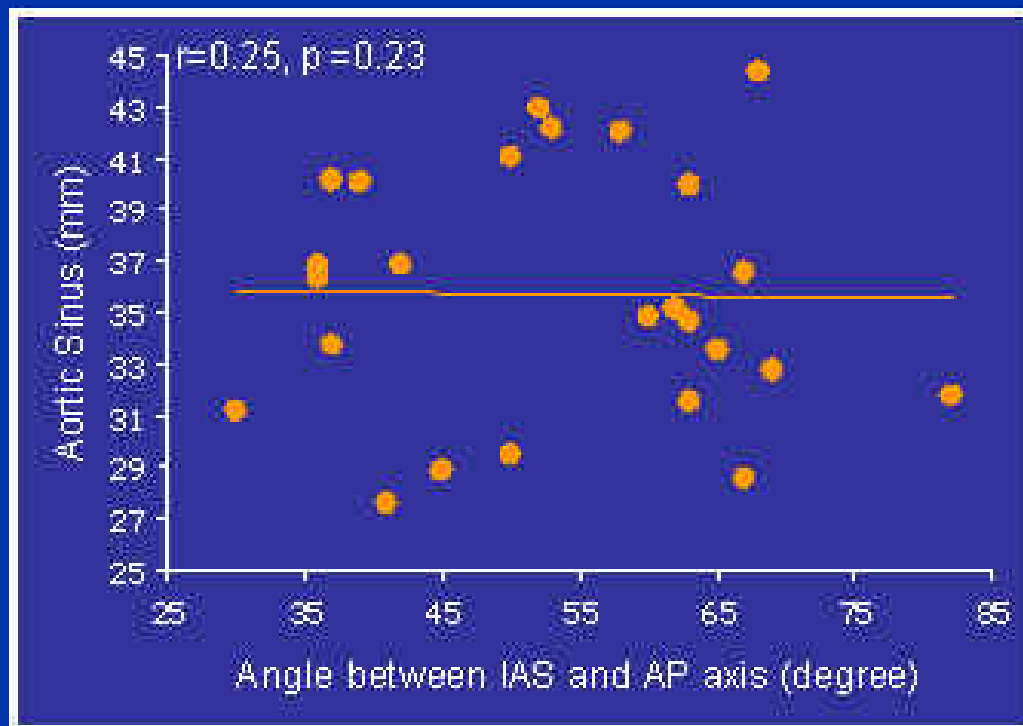


Relation of IAS to MV

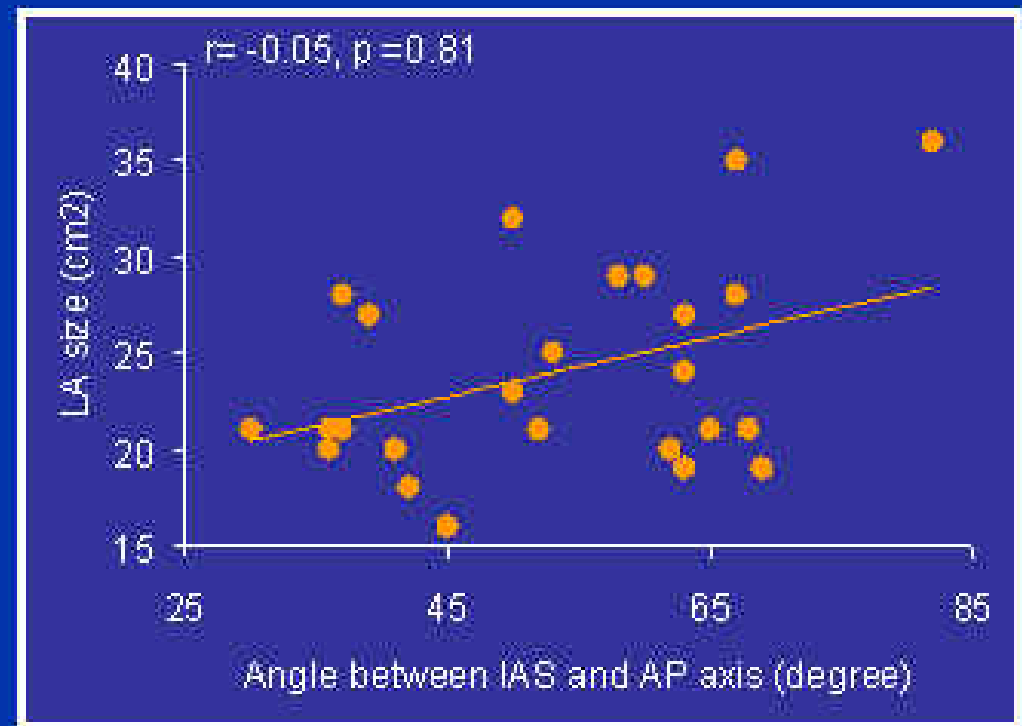


Determinants of Septal Orientation

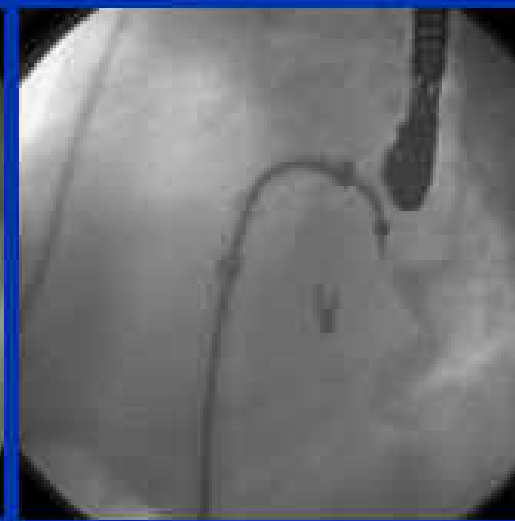
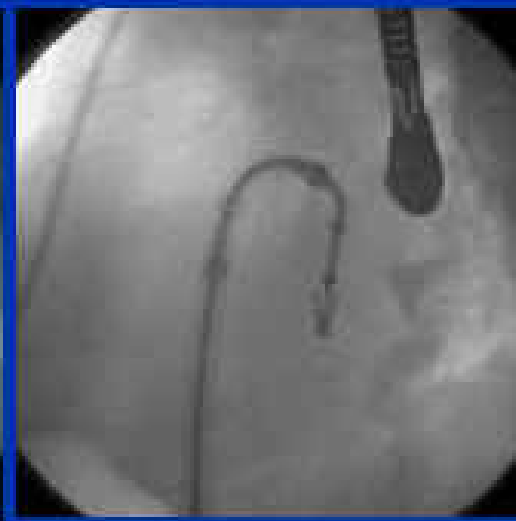
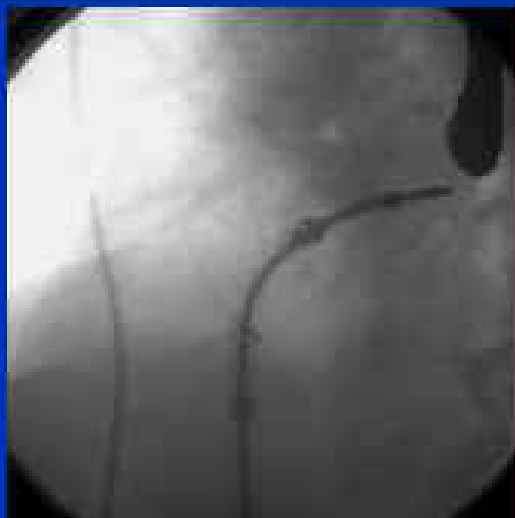
Aortic Sinus Diameter



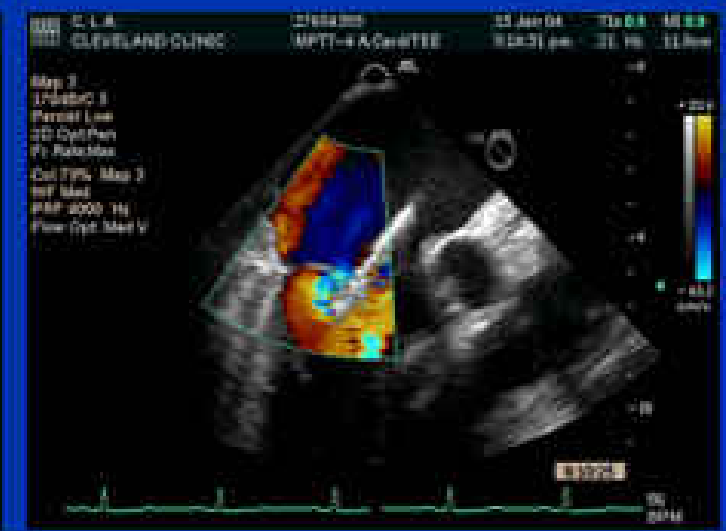
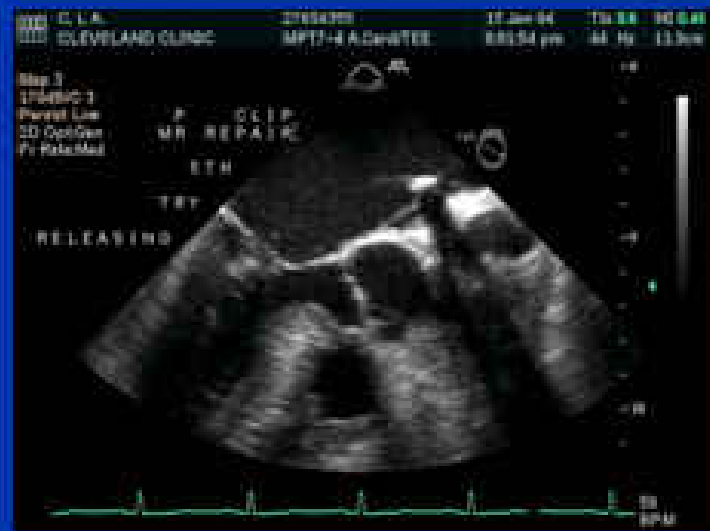
LA Size



Procedure

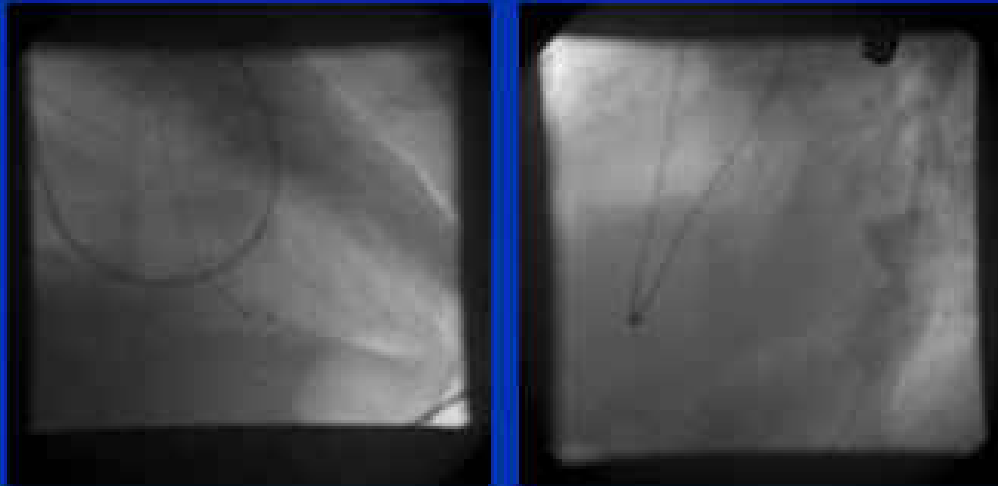


Echo Guidance

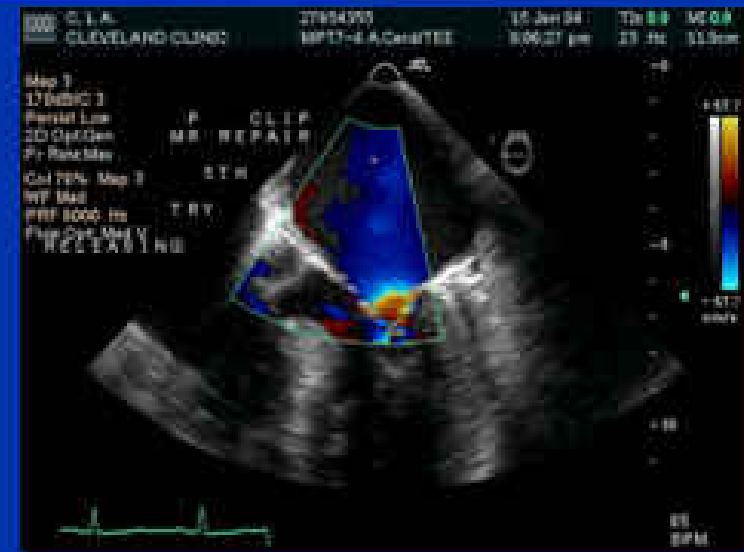
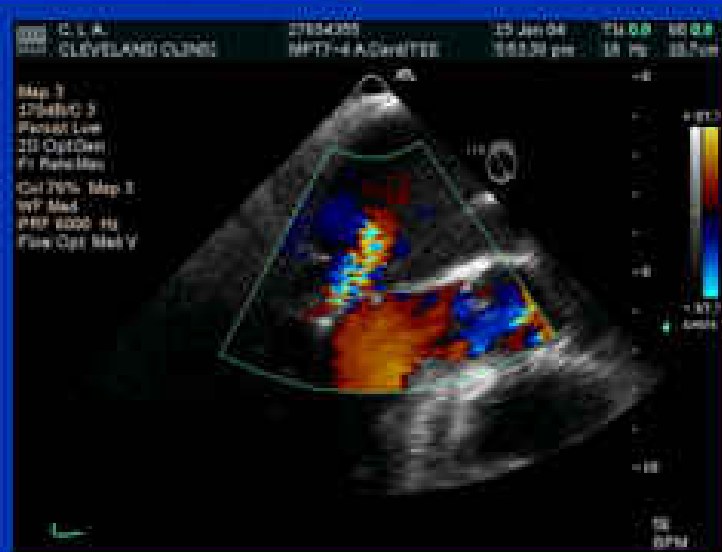
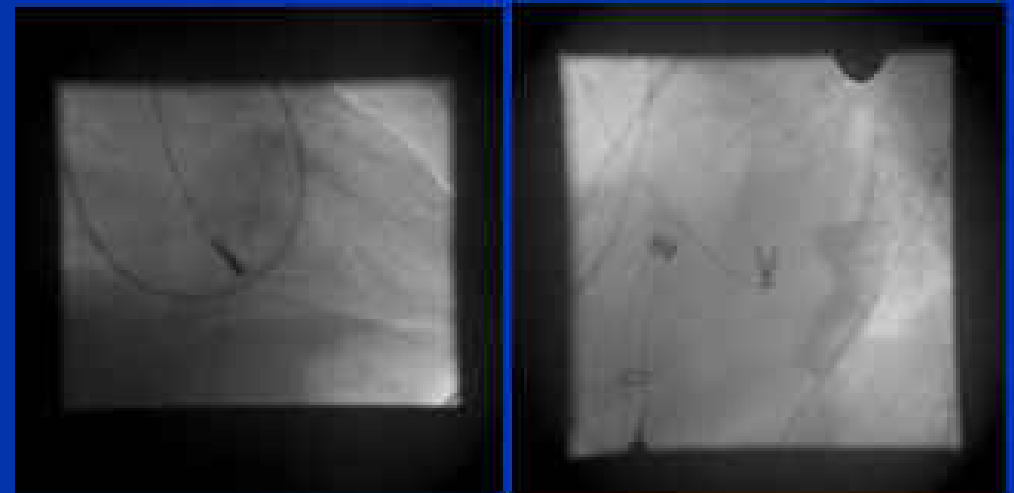


Result

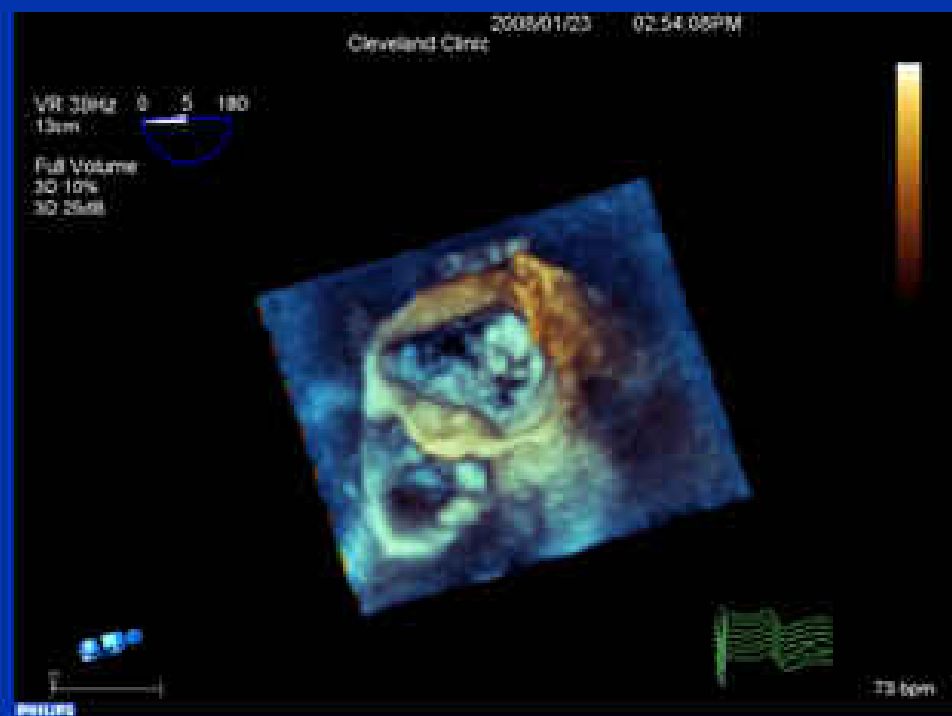
Pre



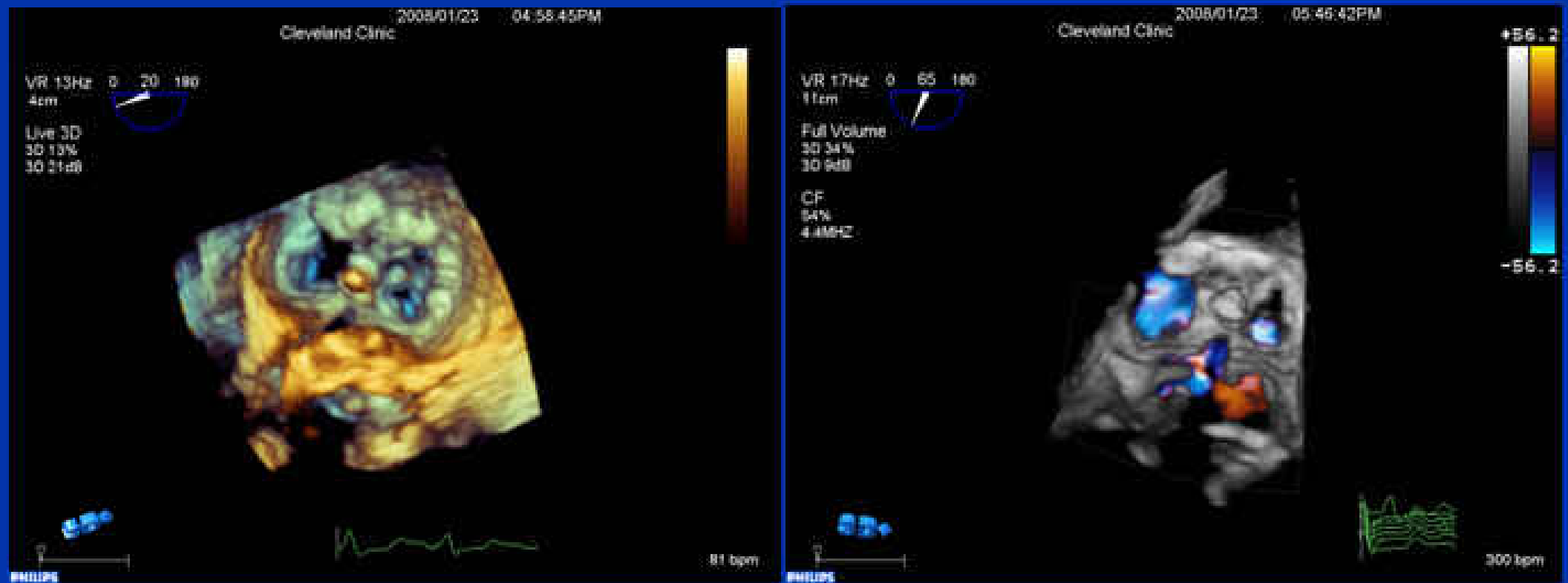
Post



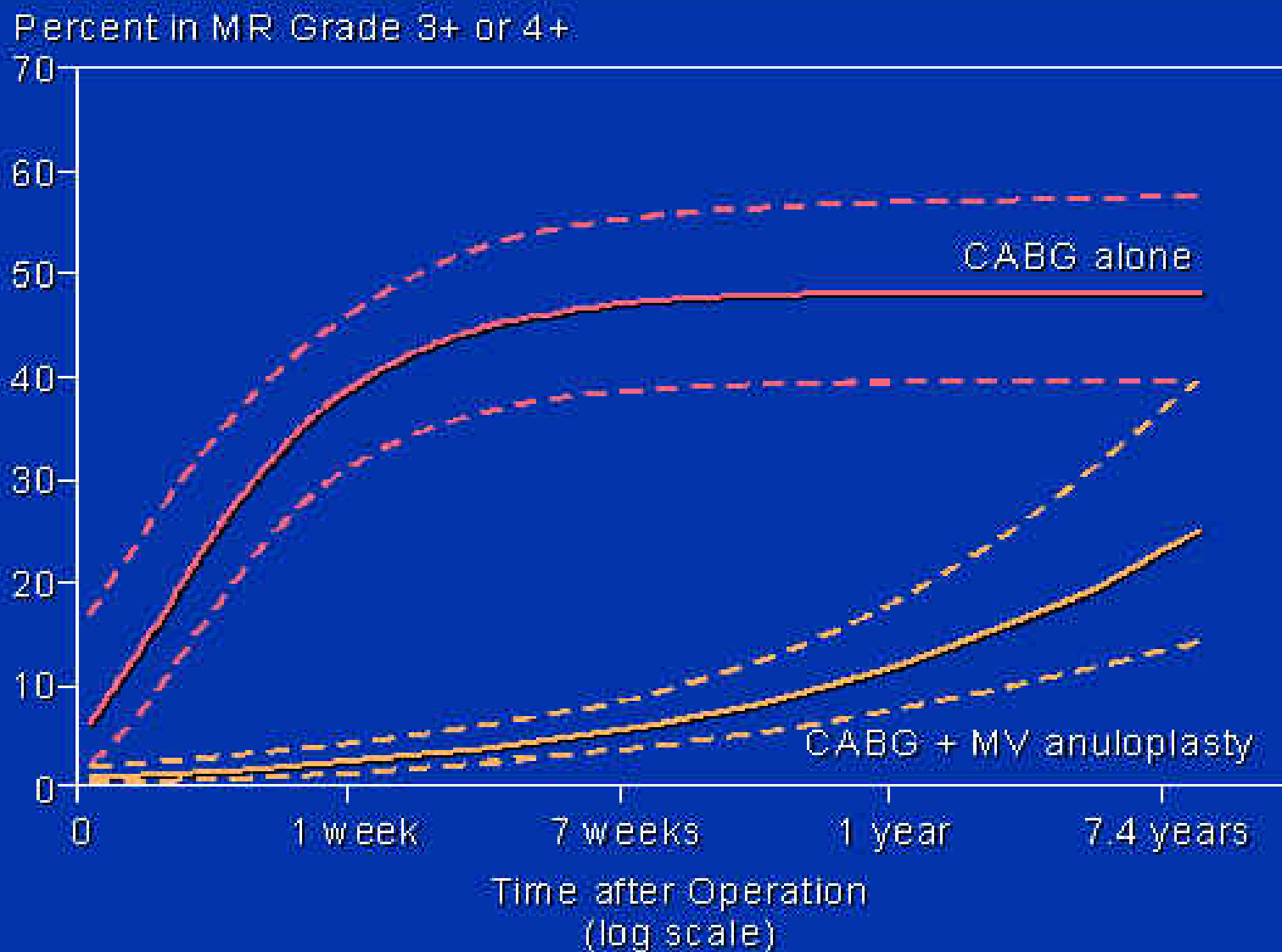
3D TEE: Pre Procedure



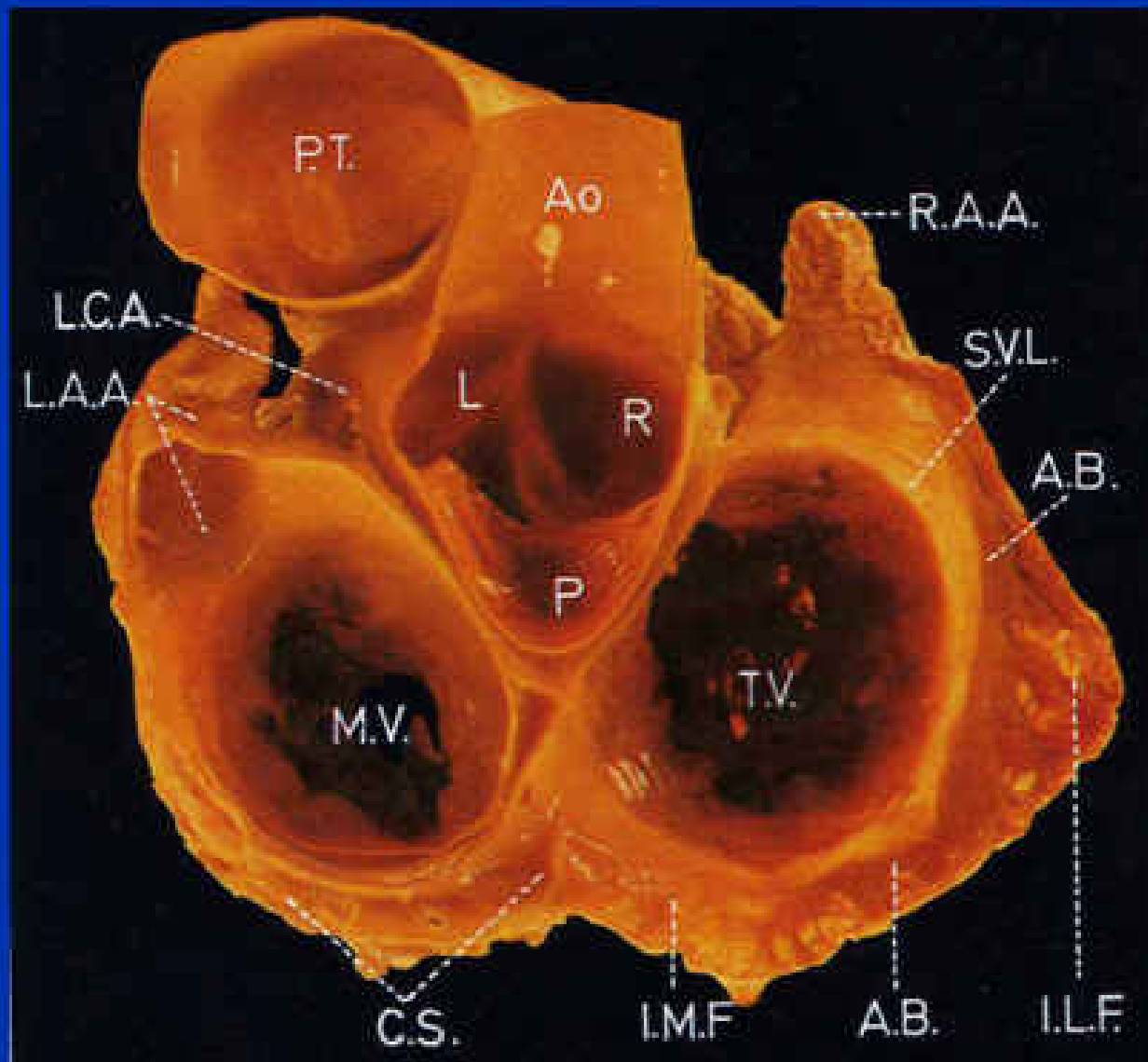
3D TEE: Post Procedure



Recurrence of MR After Repair



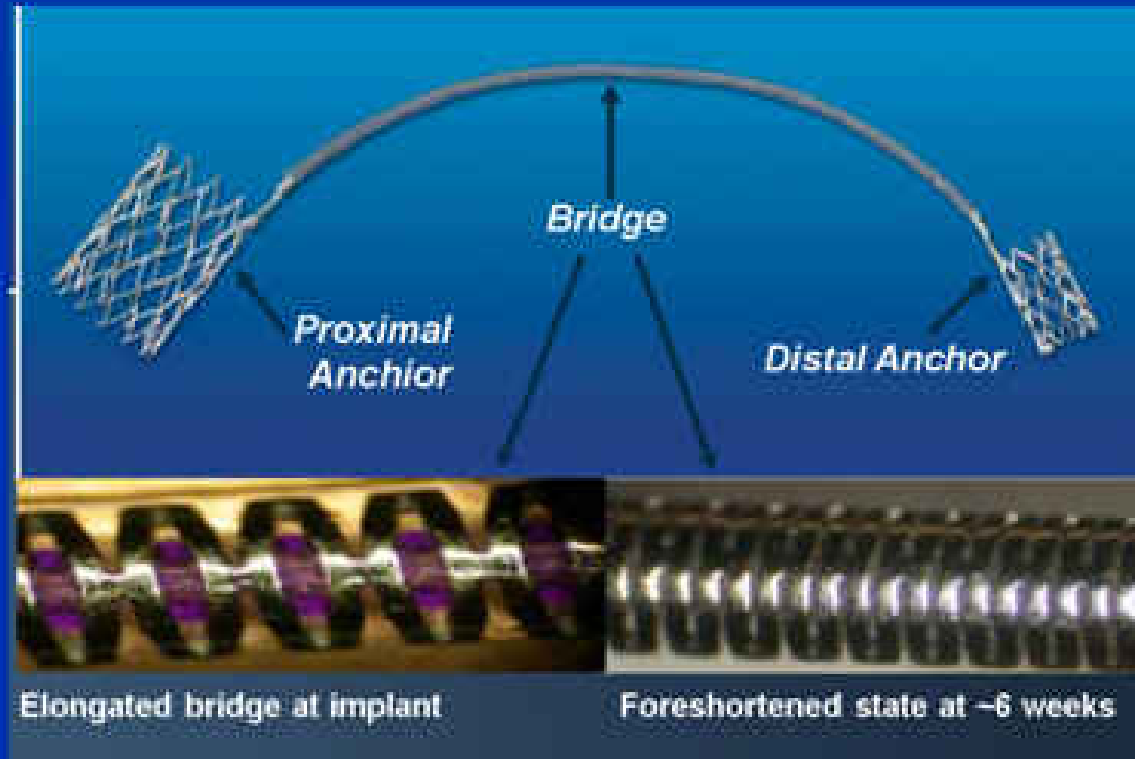
Mitral Valve : Relation to the CS



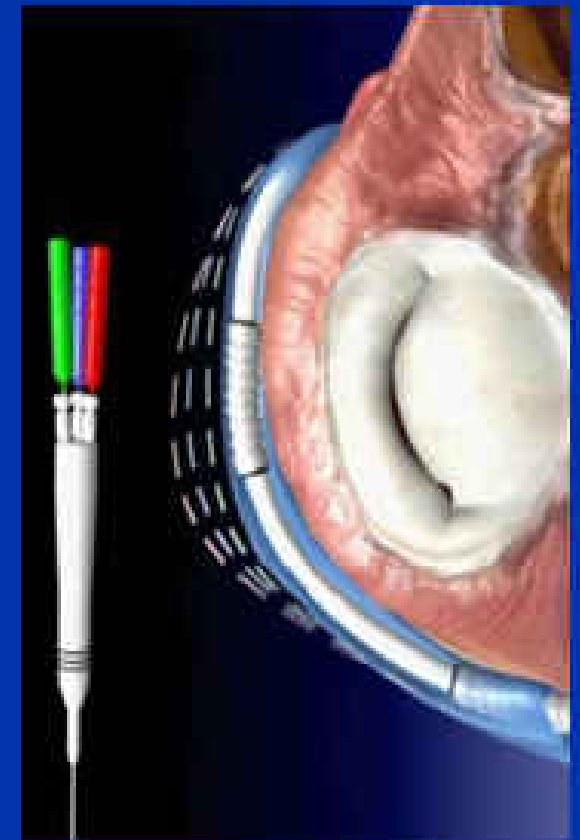
CS Devices



Carillon

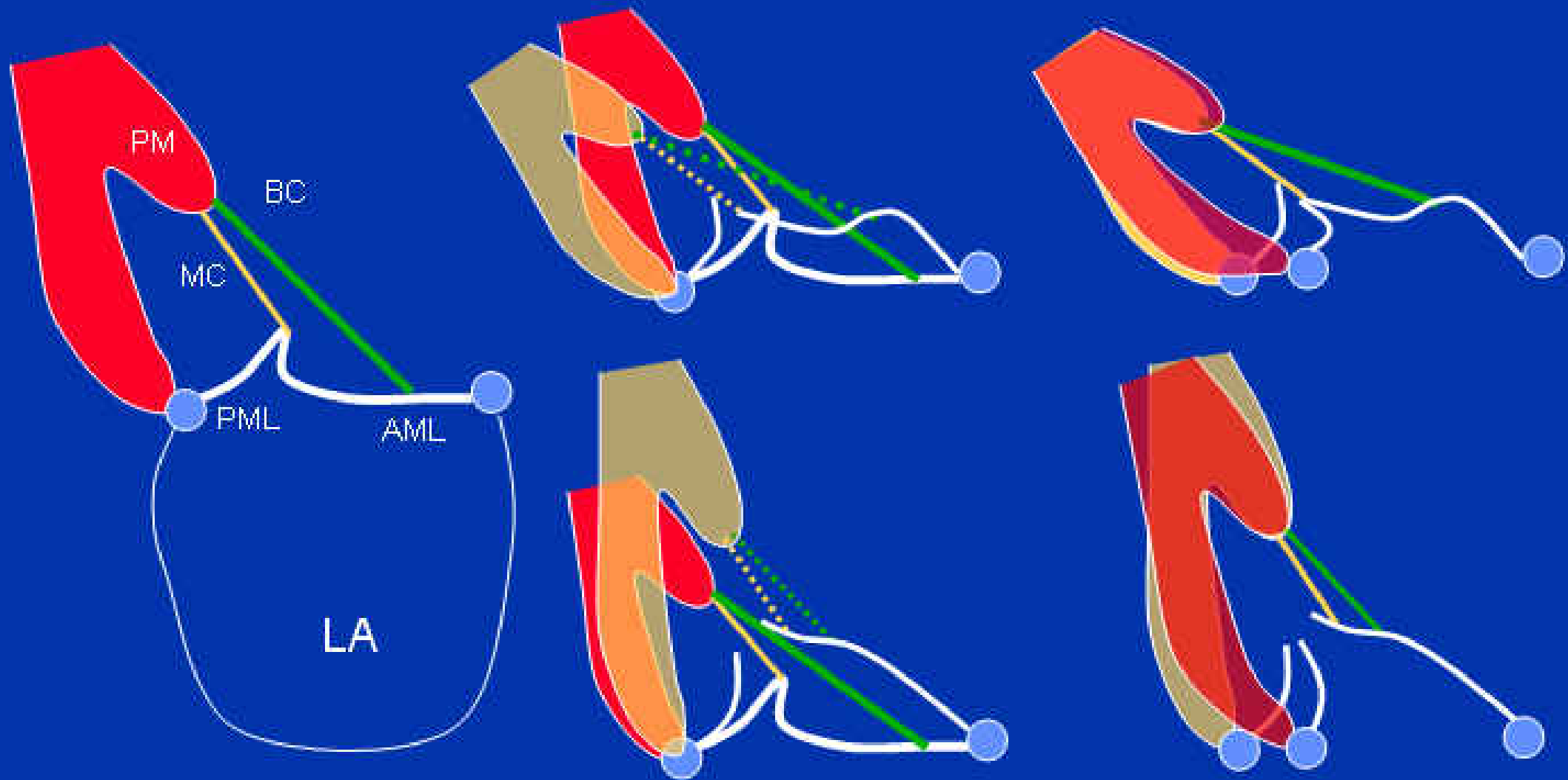


Monarc



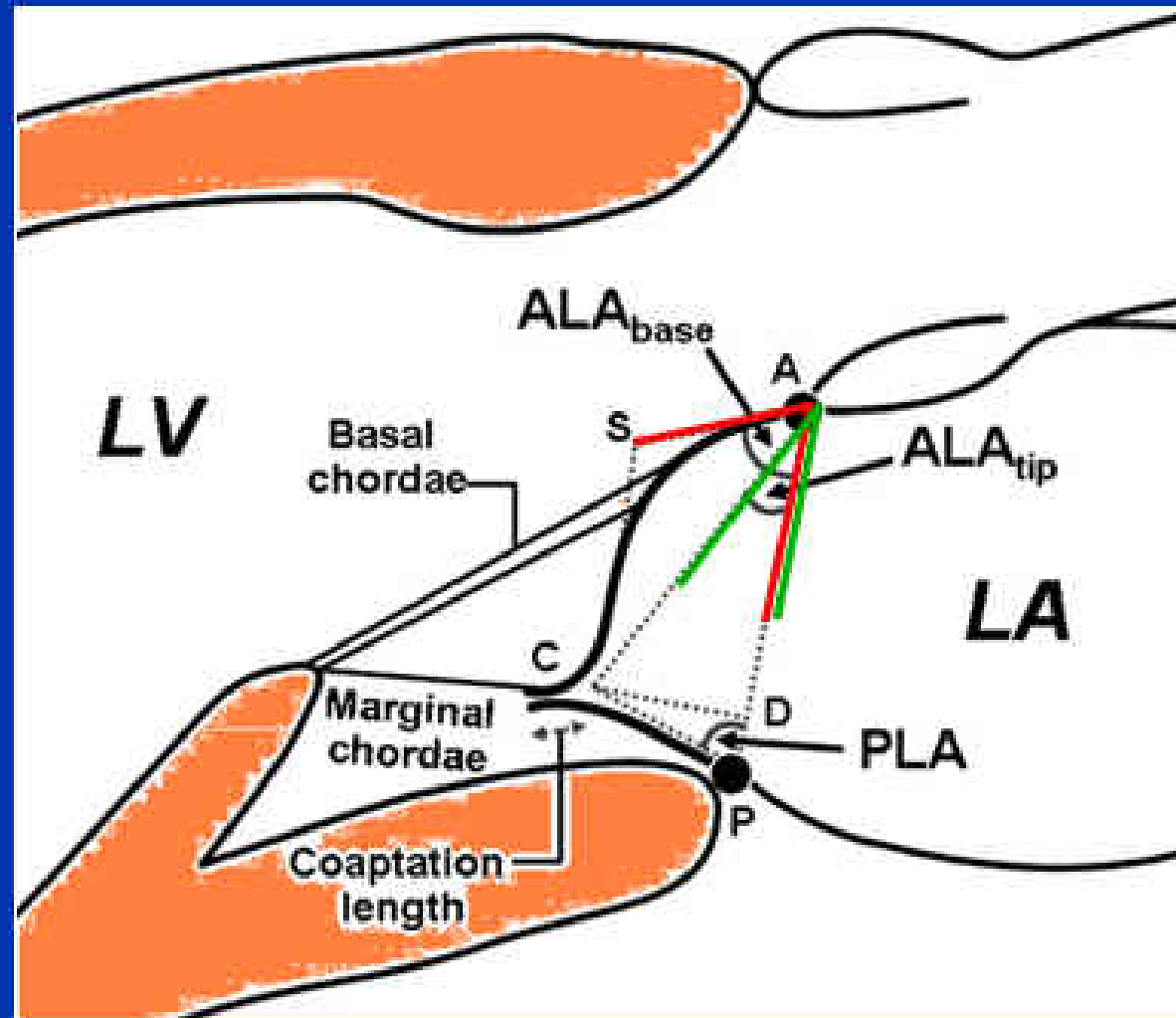
Viacor

Mechanism of FMR and Annuloplasty

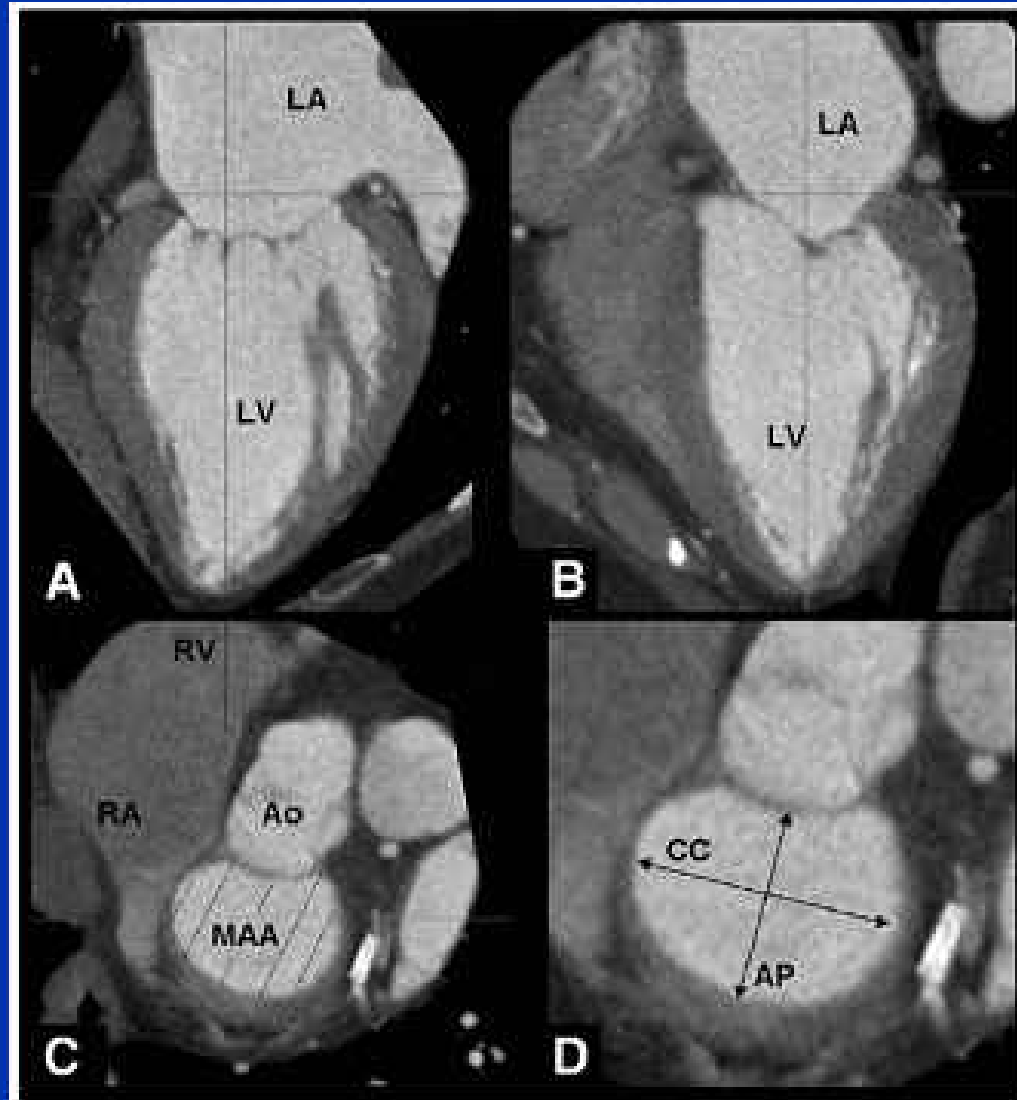


Lee et al, Circulation 2009, Volume 119(19), 19 May 2009, pp 2606-2614

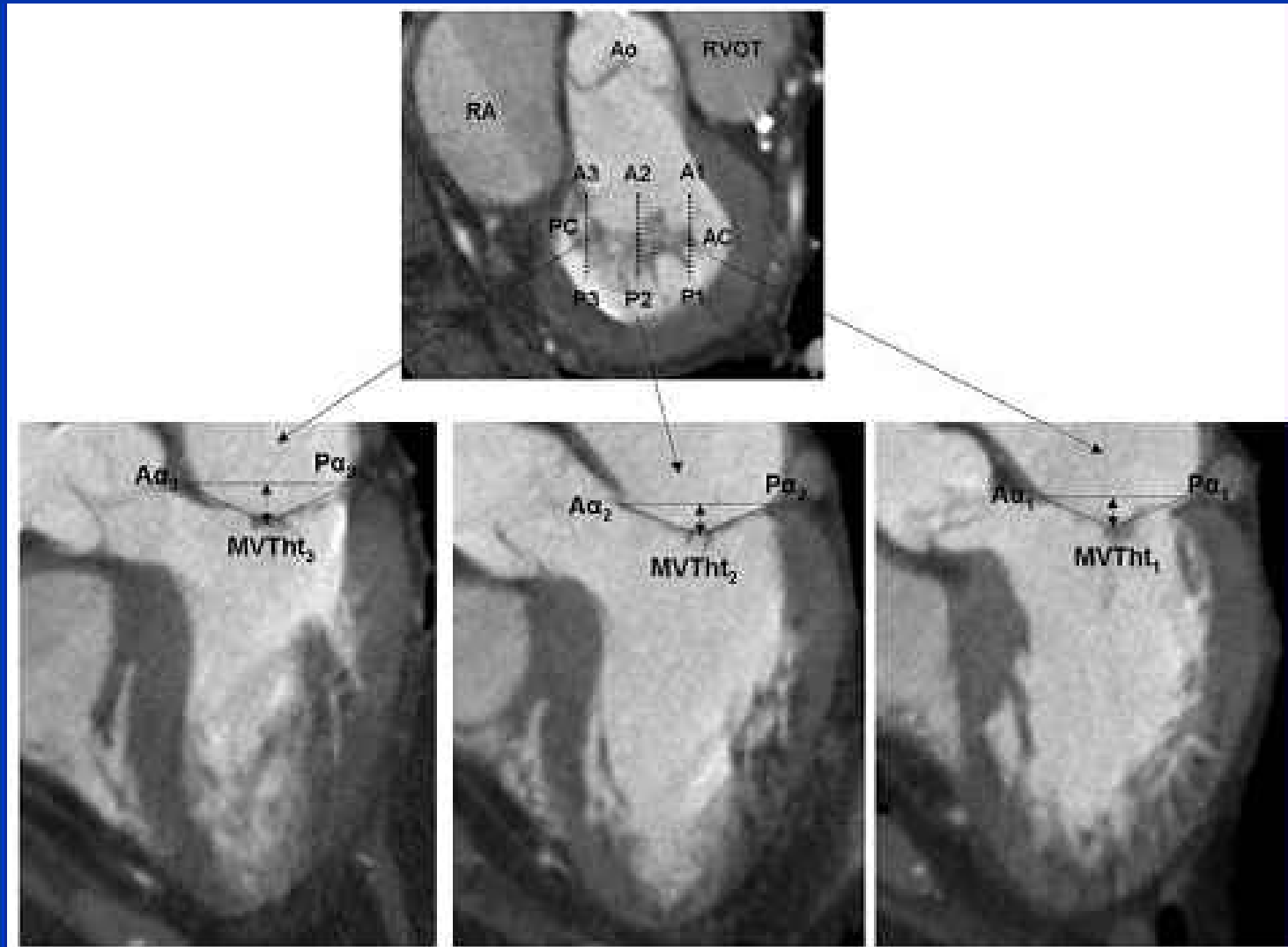
Tenting Angle at Base and Tips



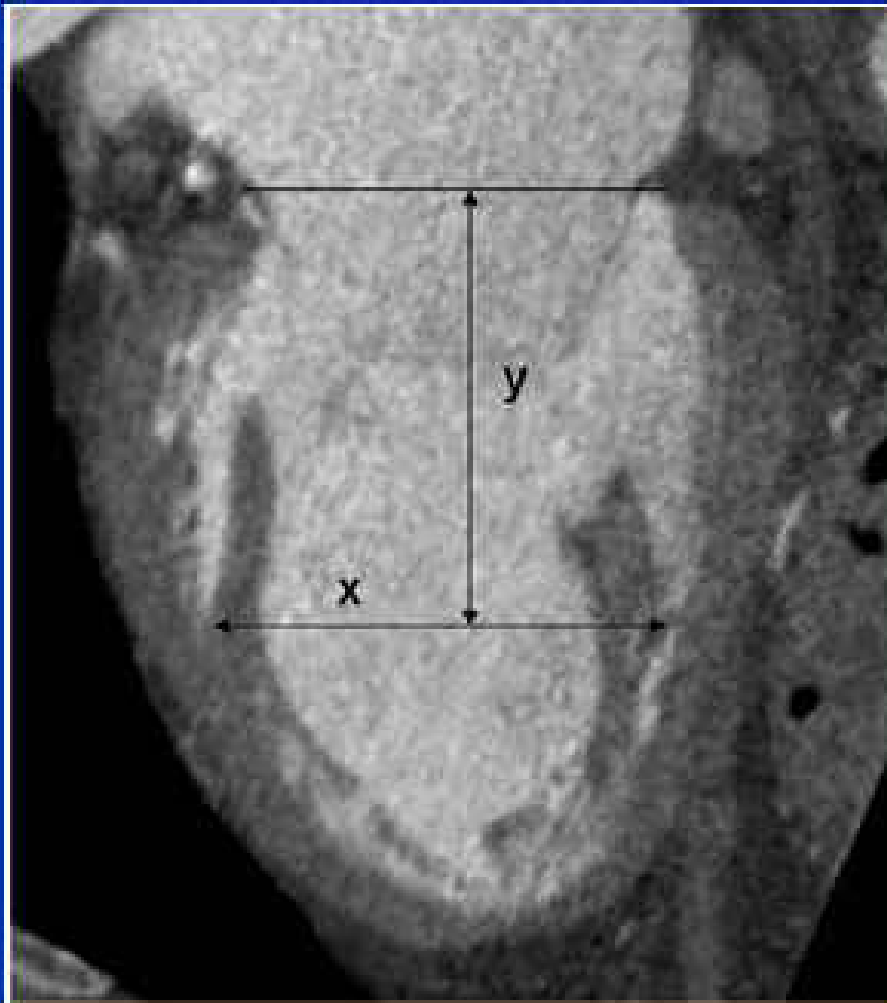
MSCT: Assessment of MV Geometry



Tenting Angles of the Leaflets in Segments



Sphericity Index of “MV”: LV Remodelling



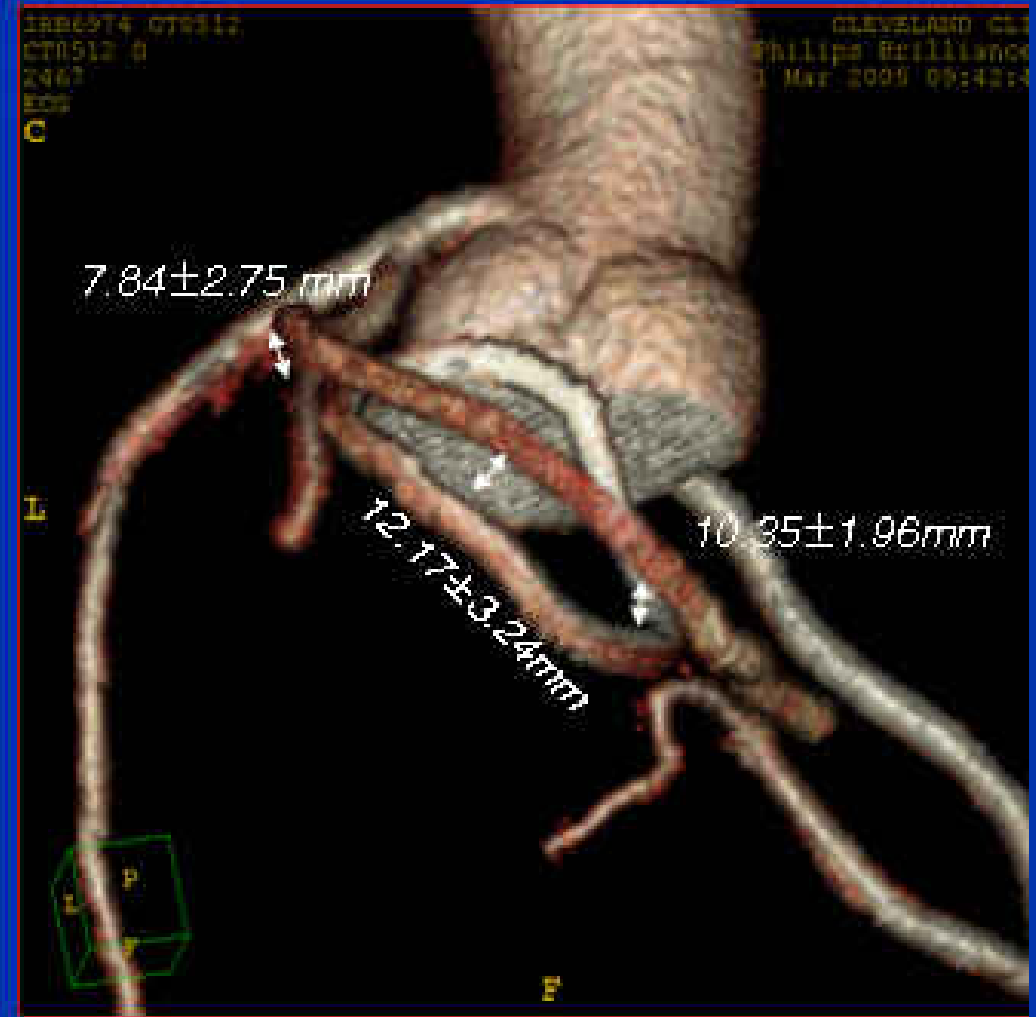
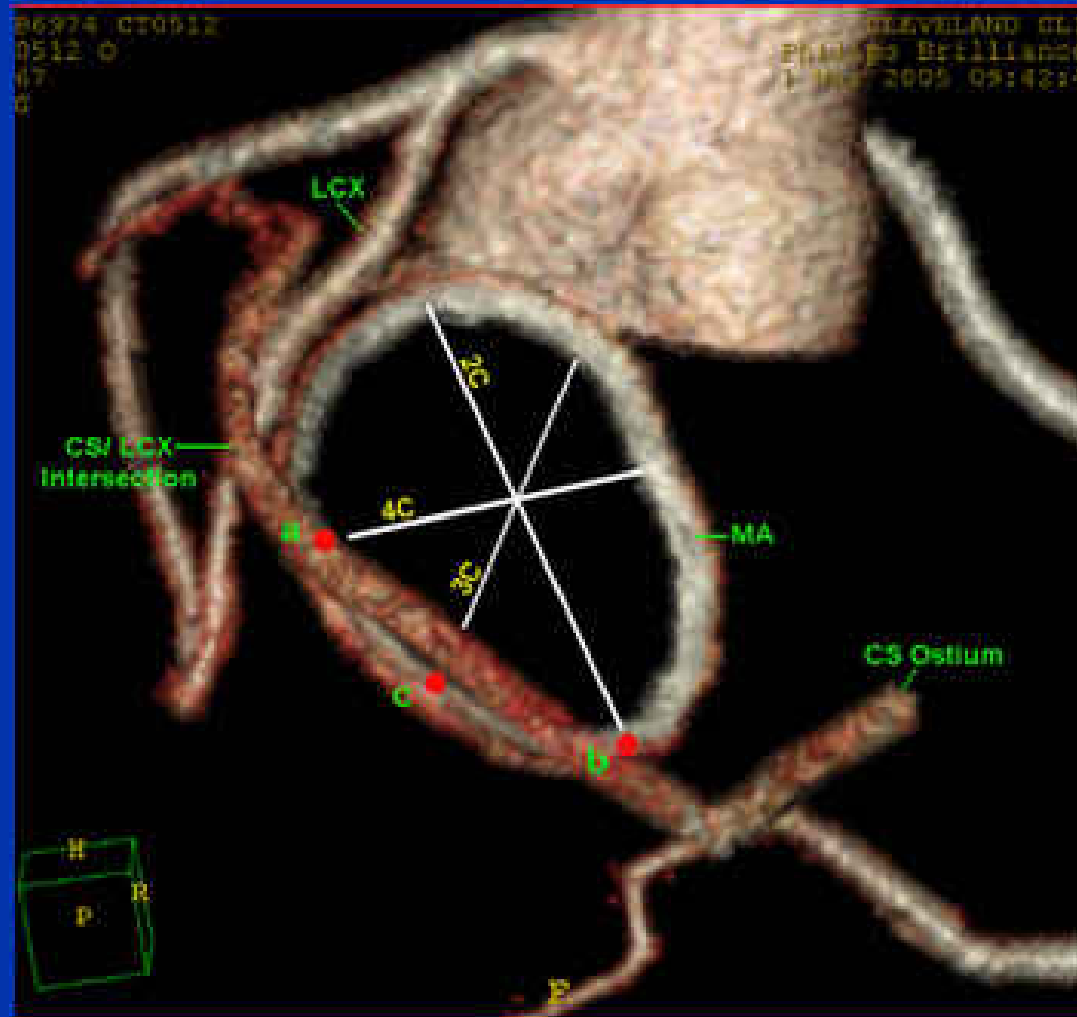
Sphericity index mitral valve

=

LV diameter at the level of the
pap muscles basis (x)

Distance of pap muscle base to
mitral annulus (y)

Mitral Annulus - Coronary Sinus Relationship



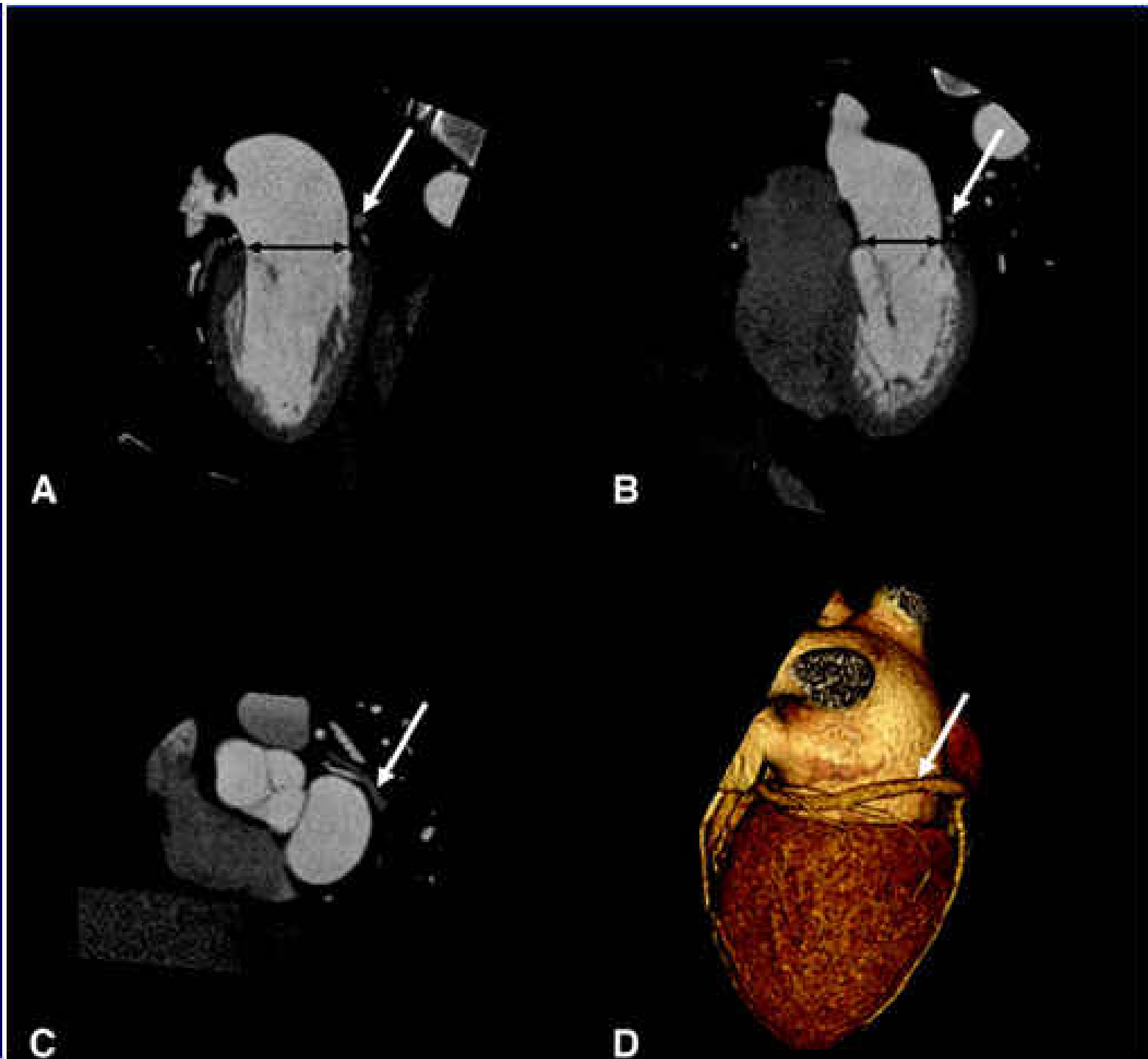
Vertical distance between CS and MA at different sites.

- Variable $p < 0.001$
- Shorter near to commissures

Vertical Distance between Coronary Sinus and Mitral Annulus

- Variable
- Increases with MR and Heart Failure

Tops et al. *Circulation*
2007;115:1426-1432



CS - MA Relationship in CHF and MR

		Without MR (n=25)	With MR (n=11)	p
Minimal distance between CS and MA (mm)	4 - Chamber	7.8 ± 2.8	11.2 ± 4.5	0.01
	2 - Chamber	10.4 ± 1.9	8.2 ± 4.1	0.04
	3 - Chamber	12.2 ± 3.2	12.7 ± 3.4	0.64

Choune et al. JACC 2006;48:1938-45

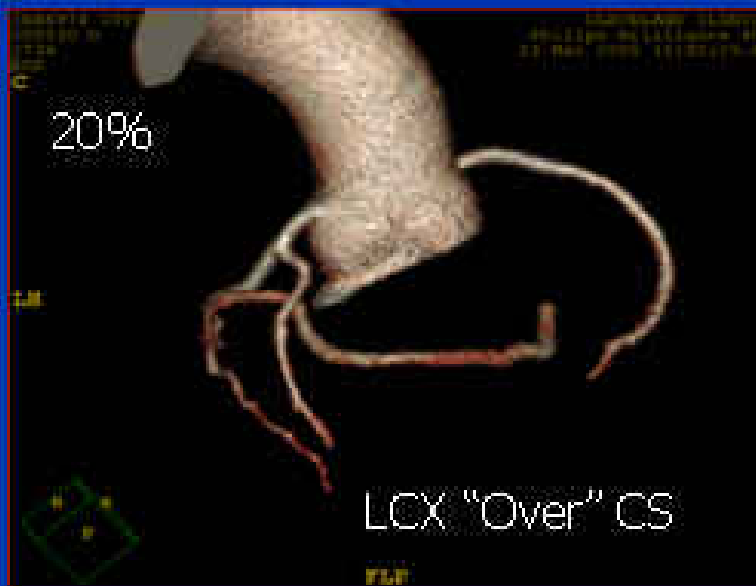
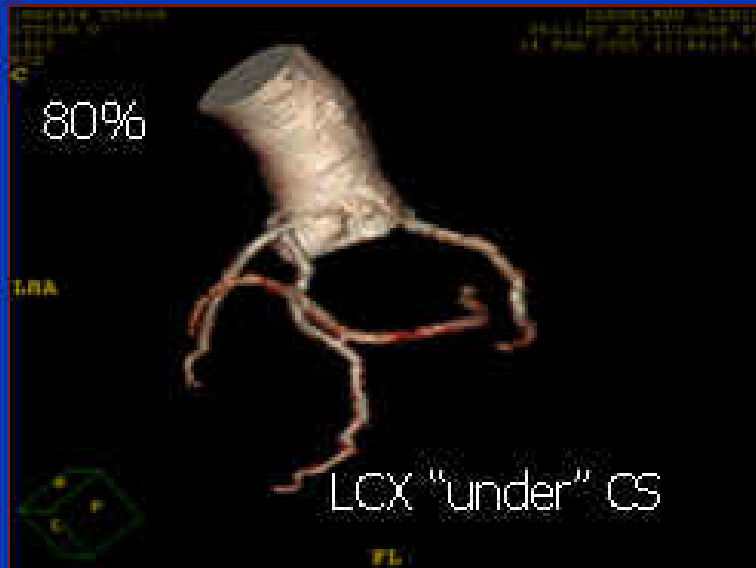
		Without MR (n=90)	With MR (n=15)	p
Distance between CS and MA (mm)	MVA Level	4.8 ± 2.5	7.3 ± 3.9	0.005
	Prox CS	8.1 ± 2.4	9.3 ± 1.9	0.019
	Distal CS	8.3 ± 3.1	12.1 ± 3.6	< 0.001

Tops et al. Circ 2007;115:1426-32

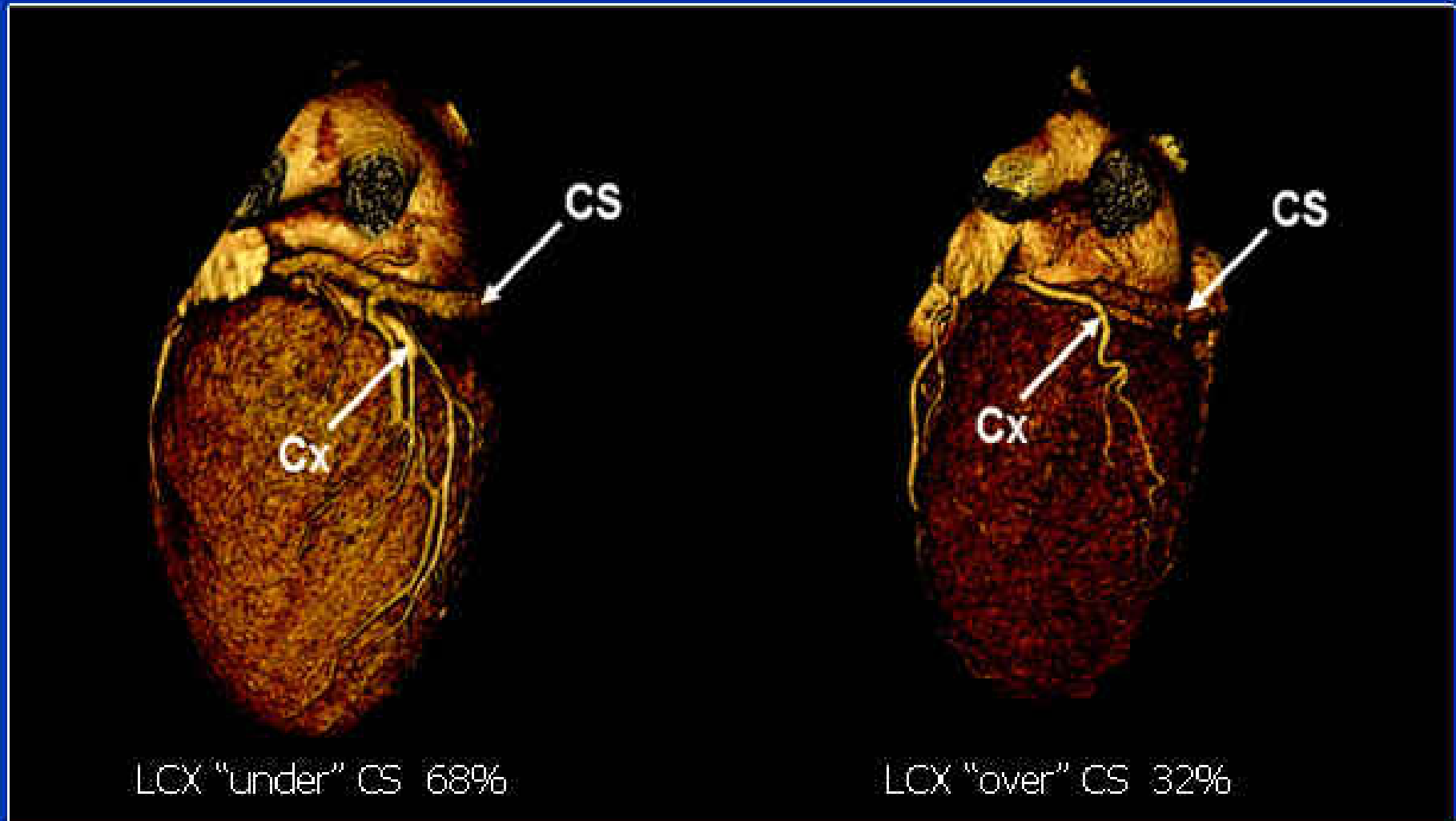
Is It More than The Vertical Distance

- Mechanism
 - Part of “deformed valve”
 - Basal versus tip restriction
- Anatomy of “displacement”
 - Angle of planes between CS and MA
 - Motion of annulus and CS (role of a-fib, MAC)
 - Relation of CS OS to PM commissure

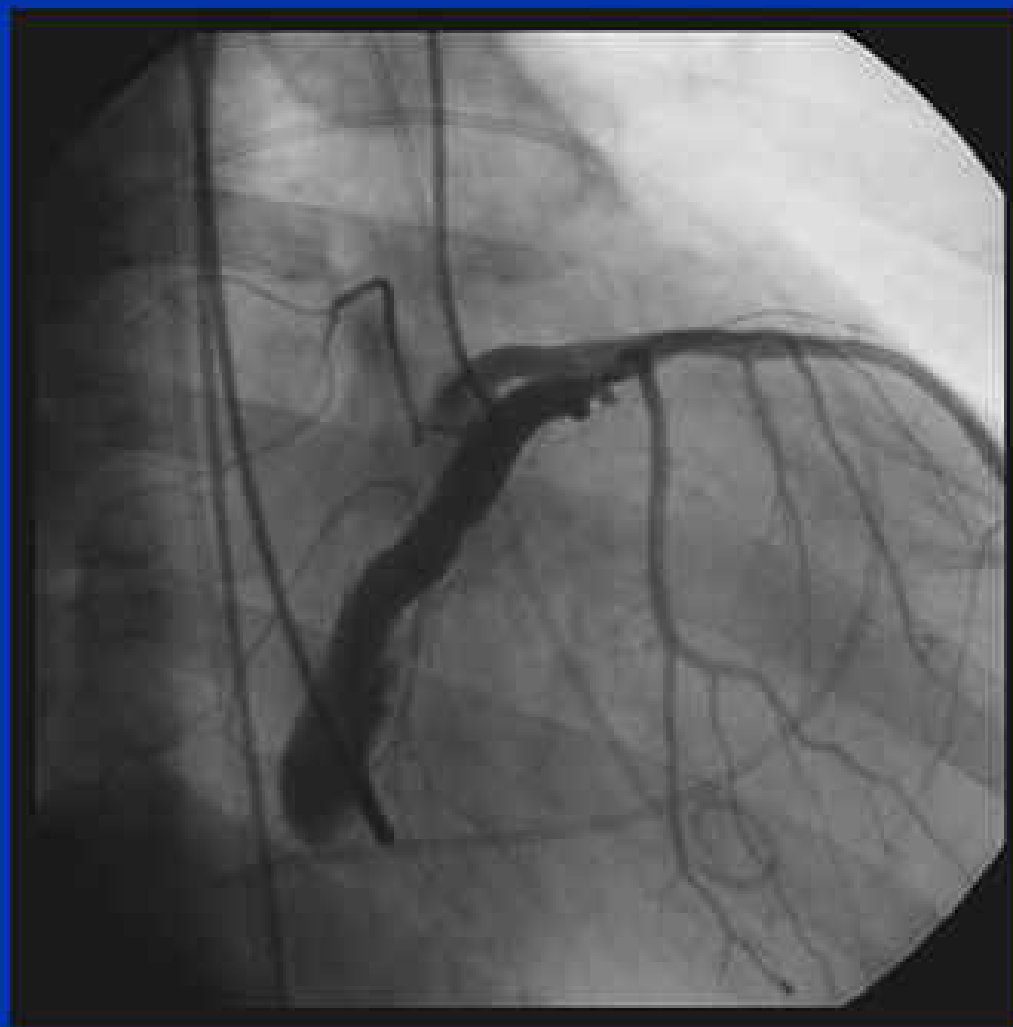
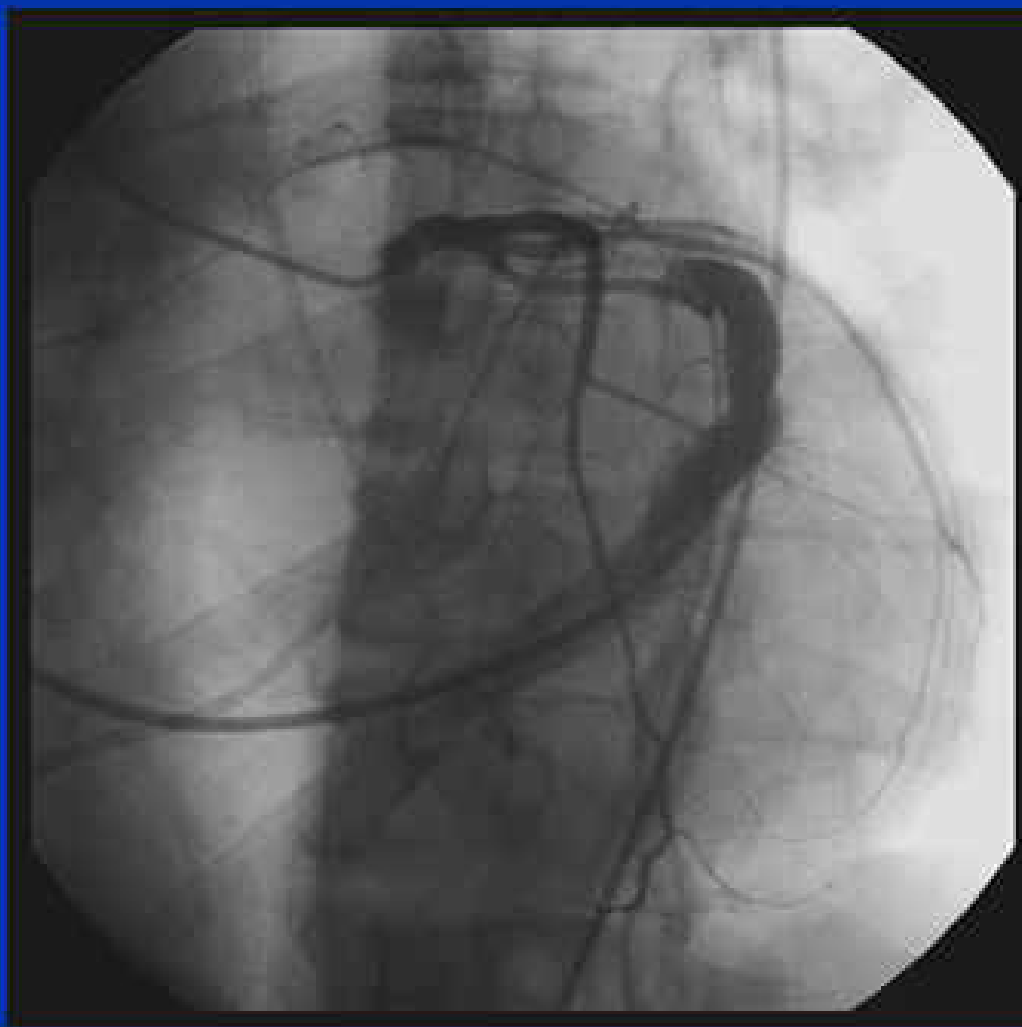
Coronary Sinus - Circumflex Relationship



Coronary Sinus - Circumflex Relationship



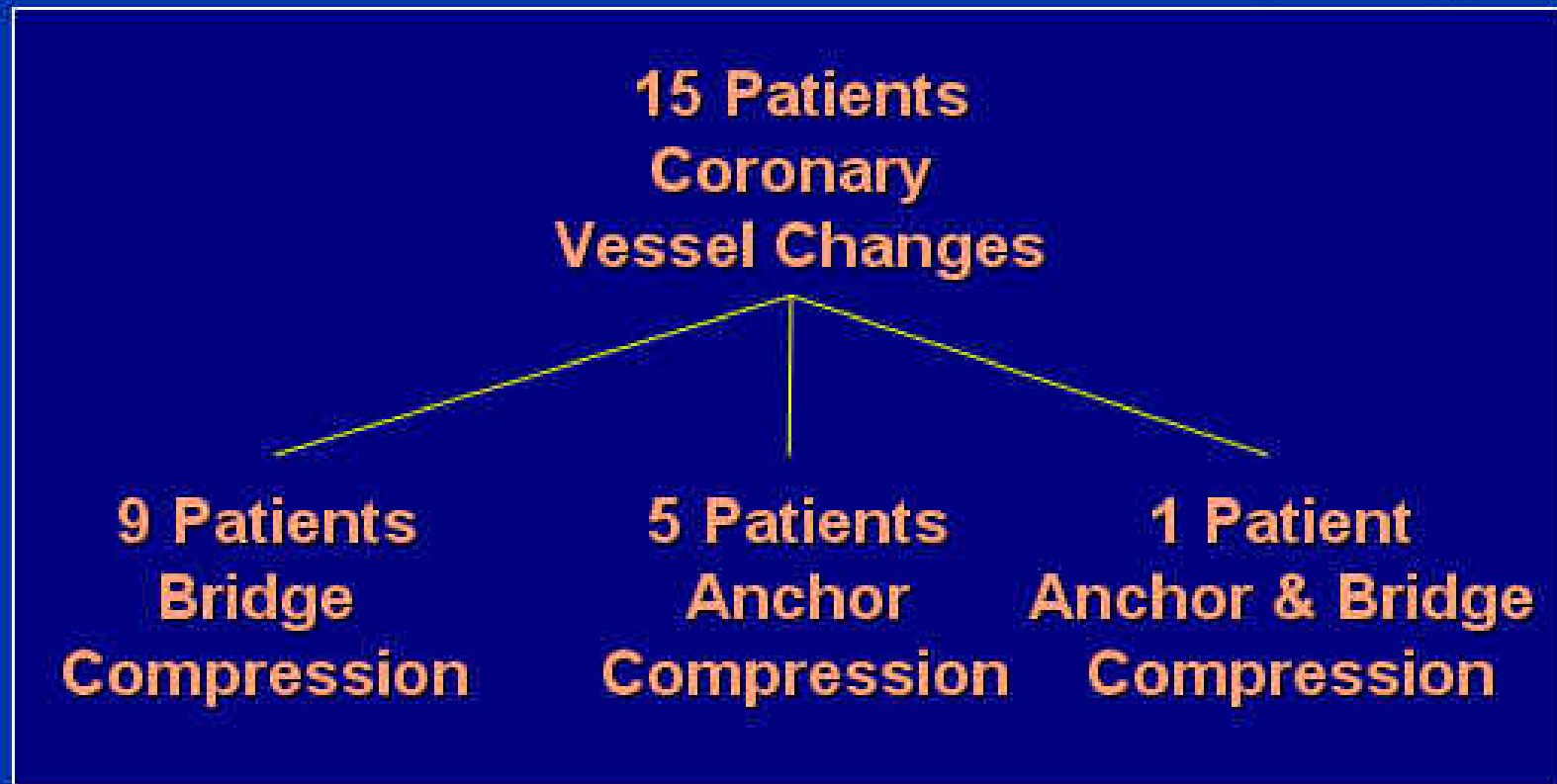
CS Angiogram with Angiogram



Impact of Coronary Sinus Device on the Coronary Arteries

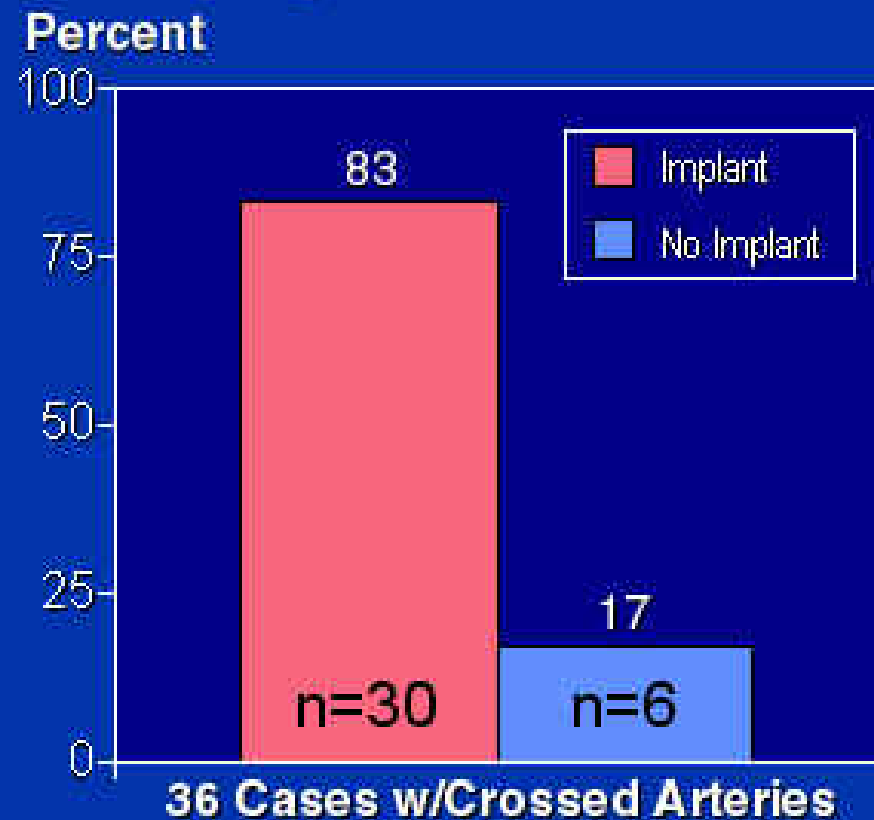
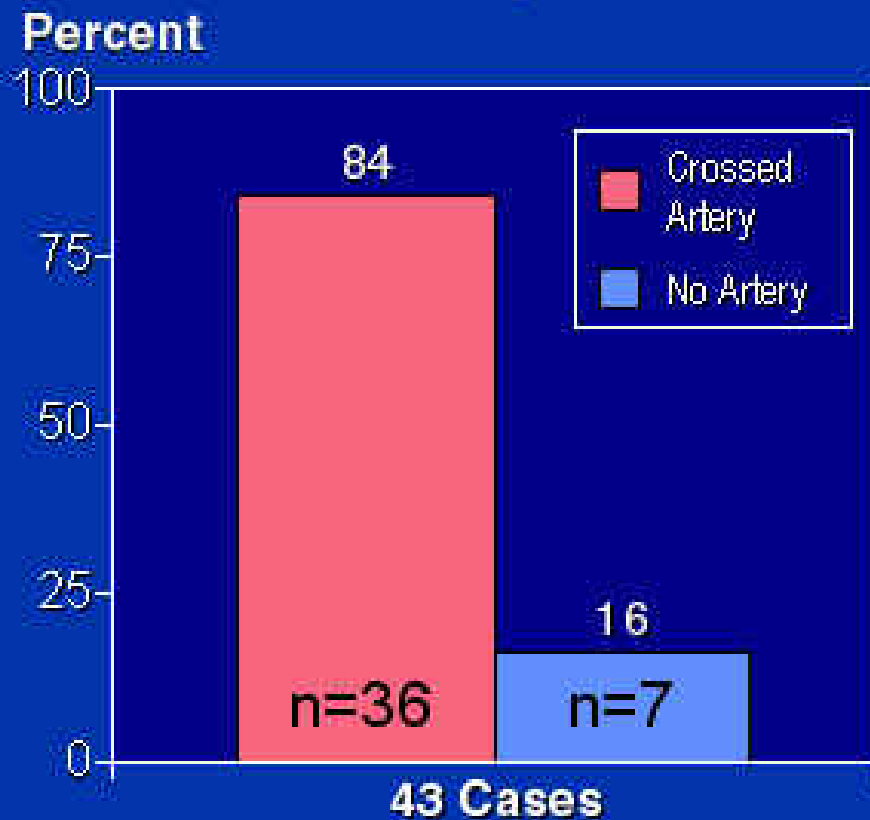
MONARC System

50 Patients: Baseline and 90-Day Angio



Impact of Coronary Sinus Device on the Coronary Arteries

CARILLION System 43 patients, baseline angiogram



- 11 cases of crossed arteries required "recapture"
 - 5 recaptured devices were successfully replaced with a second device proximal to artery

Summary

- CT and US imaging is the soul of percutaneous mitral valve intervention (any 'percutaneous' intervention)
- Challenges for imaging in mitral intervention are more compared to aortic interventions due to more complex anatomy, different mechanisms for regurgitation, and load dependent severity.