Hospices Civils de Lyon

Mitral valve anatomy for Transcatheter techniques

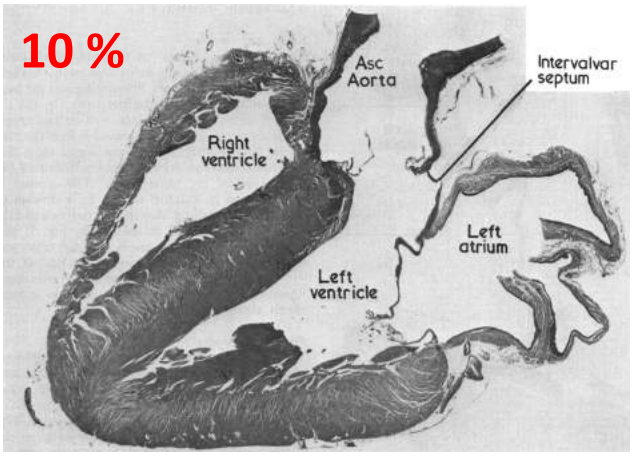
Cardiothoracic and Vascular Surgery Department
Hôpital Louis Pradel
LYON - France

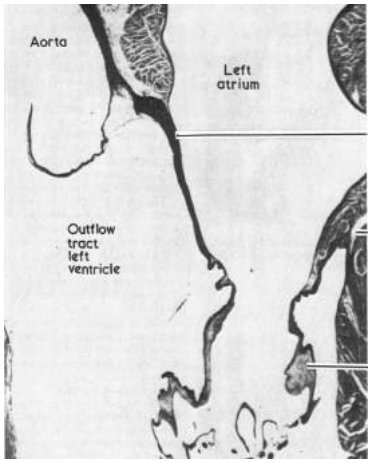
1) Ring
2) Leaflets + Atrium + Ventricle
3) Subvalvular apparatus

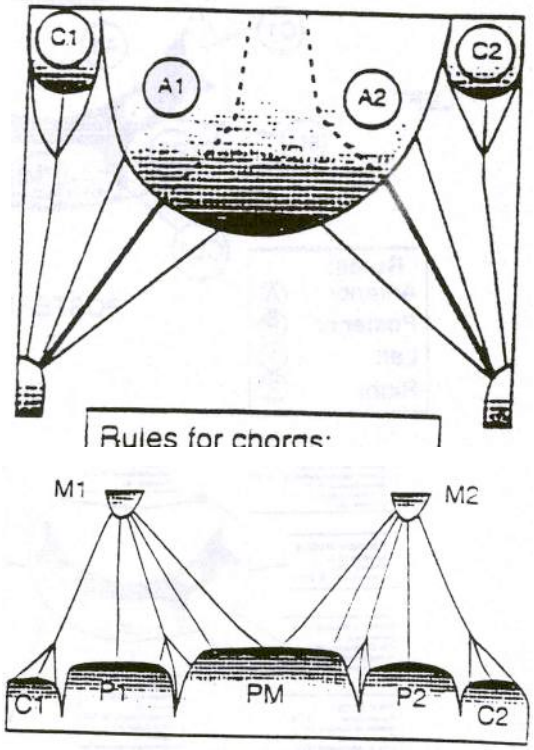
Anatomy of human mitral valve in adult cadaver and comparative anatomy of the valve

ROBERT WALMSLEY *British Heart Journal*, 1978, **40**, 351-366

From The Department of Anatomy and Experimental Pathology, The University, St Andrews, Scotland







The Ring is not a Ring

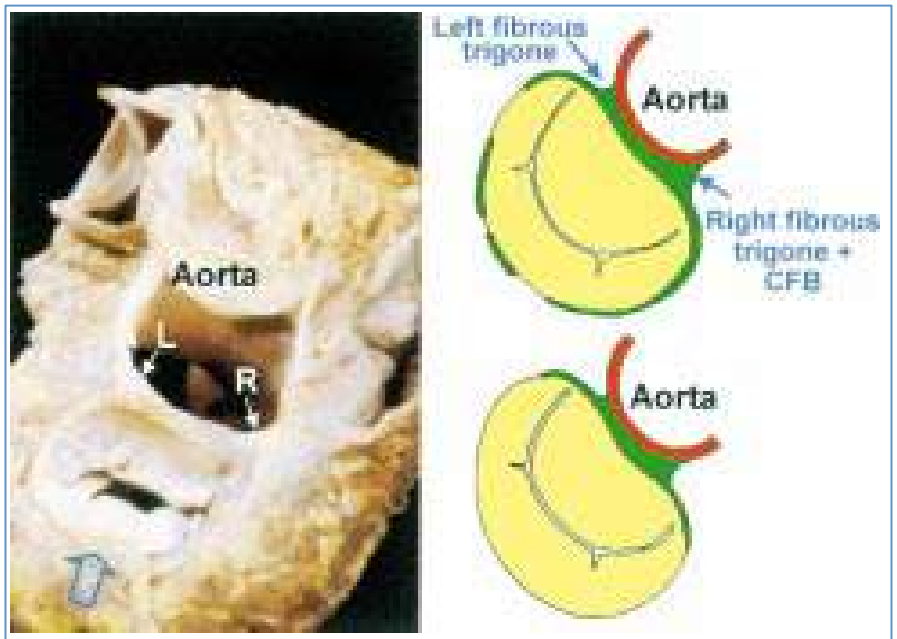
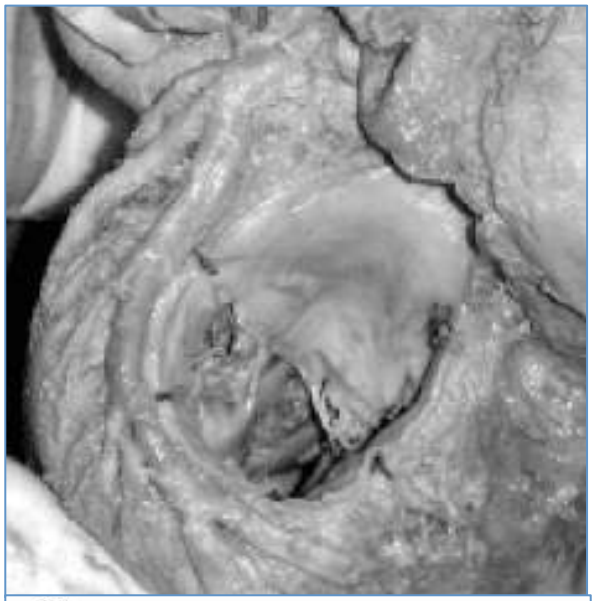
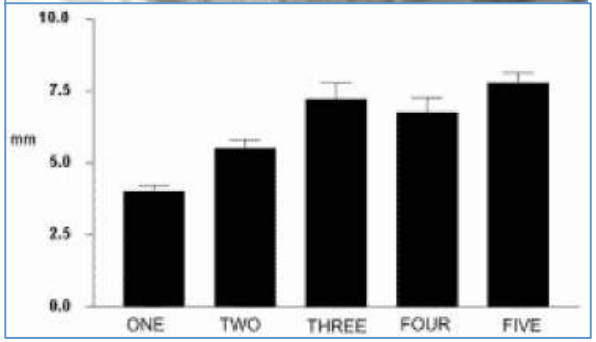
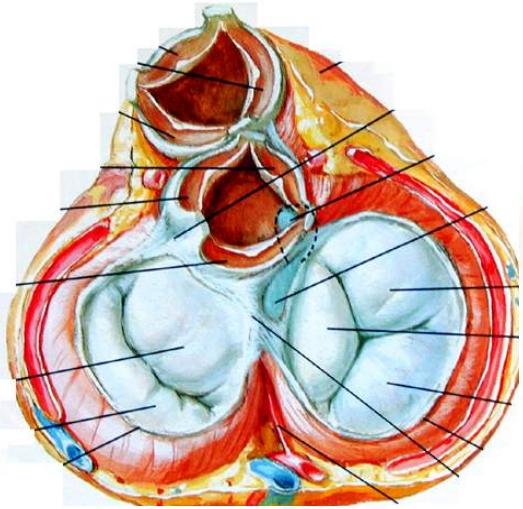
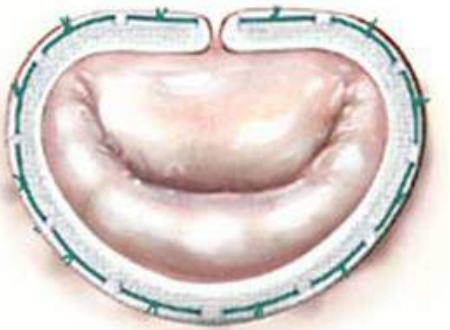


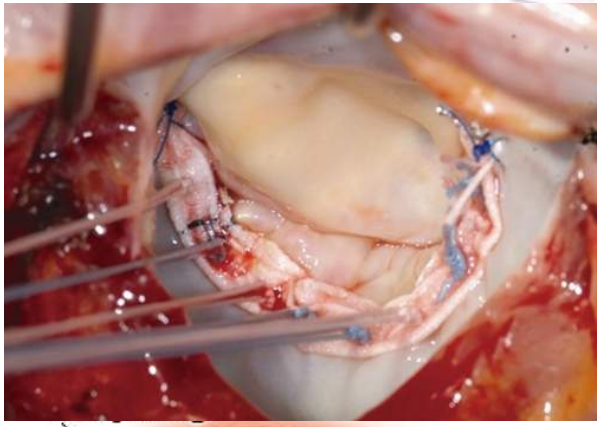
Figure 3 A dissection showing the left (L) and right (R) fibrous trigones revealed by removing the left and non-coronary aortic sinuses. The trigones are expansions of fibrous tissue at either end of the area of aortic–mitral valvar continuity. The right fibrous trigone together with the membranous septum forms the central fibrous body. The diagrams represent two of the cases reported in the work by Angelini and colleagues.[5] They show the variation in completeness of the so-called valvar annulus (green areas).

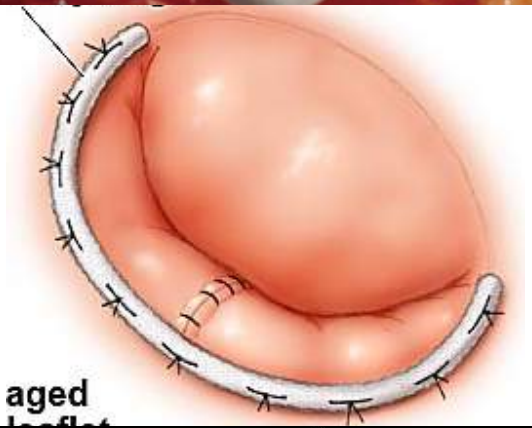








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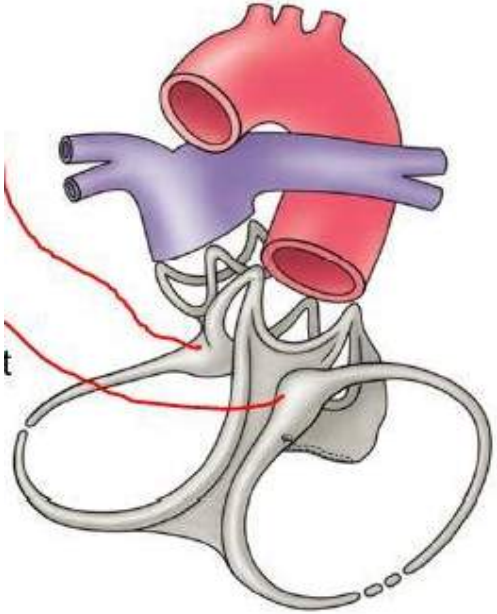
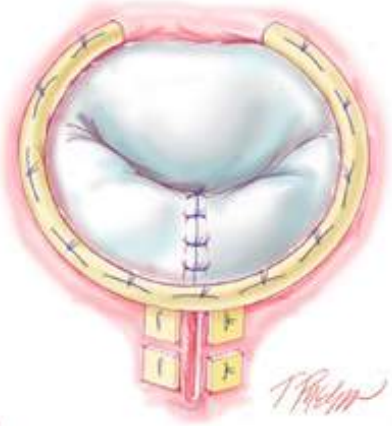
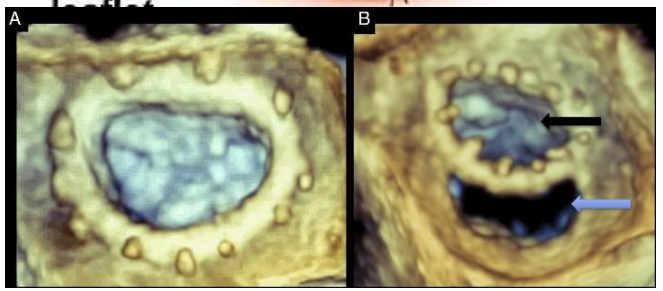


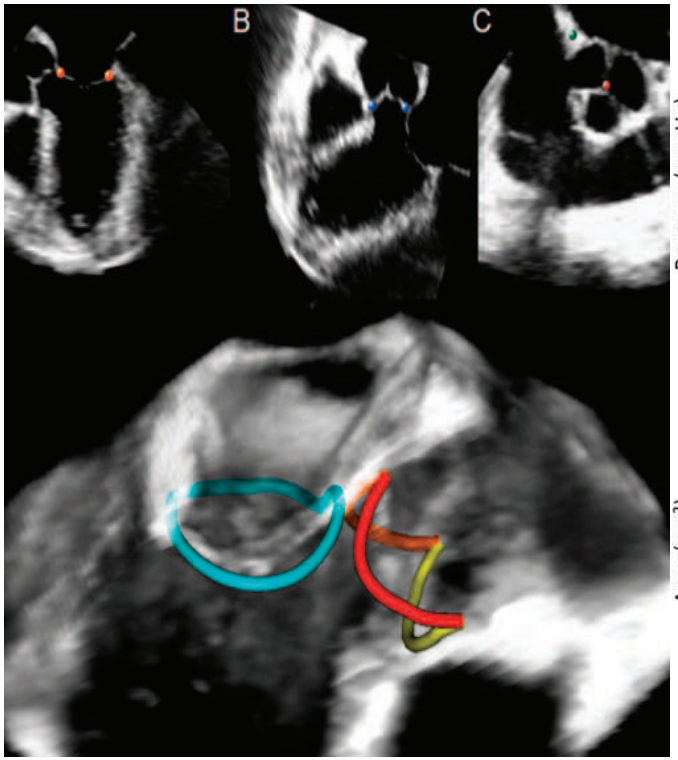


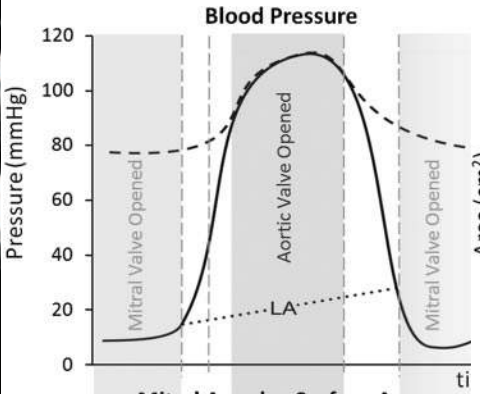

A
B

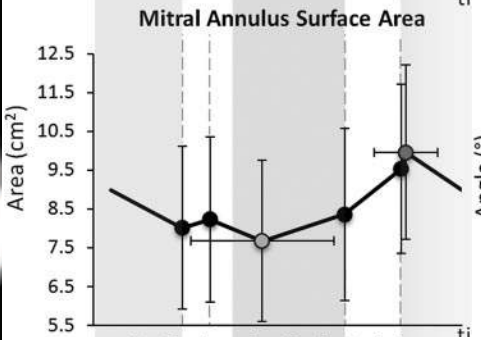
A Study of Functional Anatomy of Aortic-Mitral Valve Coupling Using 3D Matrix Transesophageal Echocardiography

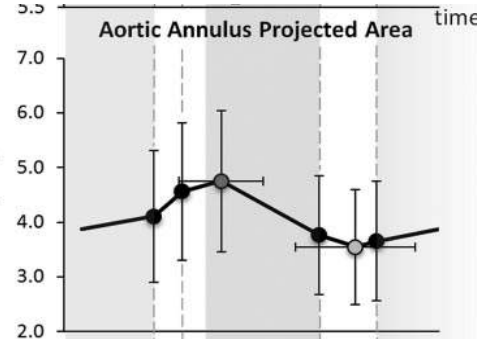
Federico Veronesi, PhD; Cristiana Corsi, PhD; Lissa Sugeng, MD, MPH; Victor Mor-Avi, PhD; Enrico G. Caiani, PhD; Lynn Weinert, BS; Claudio Lamberti, MS; Roberto M. Lang, MD

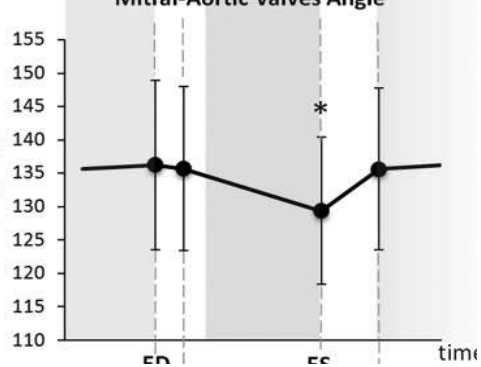
***Circ Cardiovasc Imaging*. 2009;2:24-31**







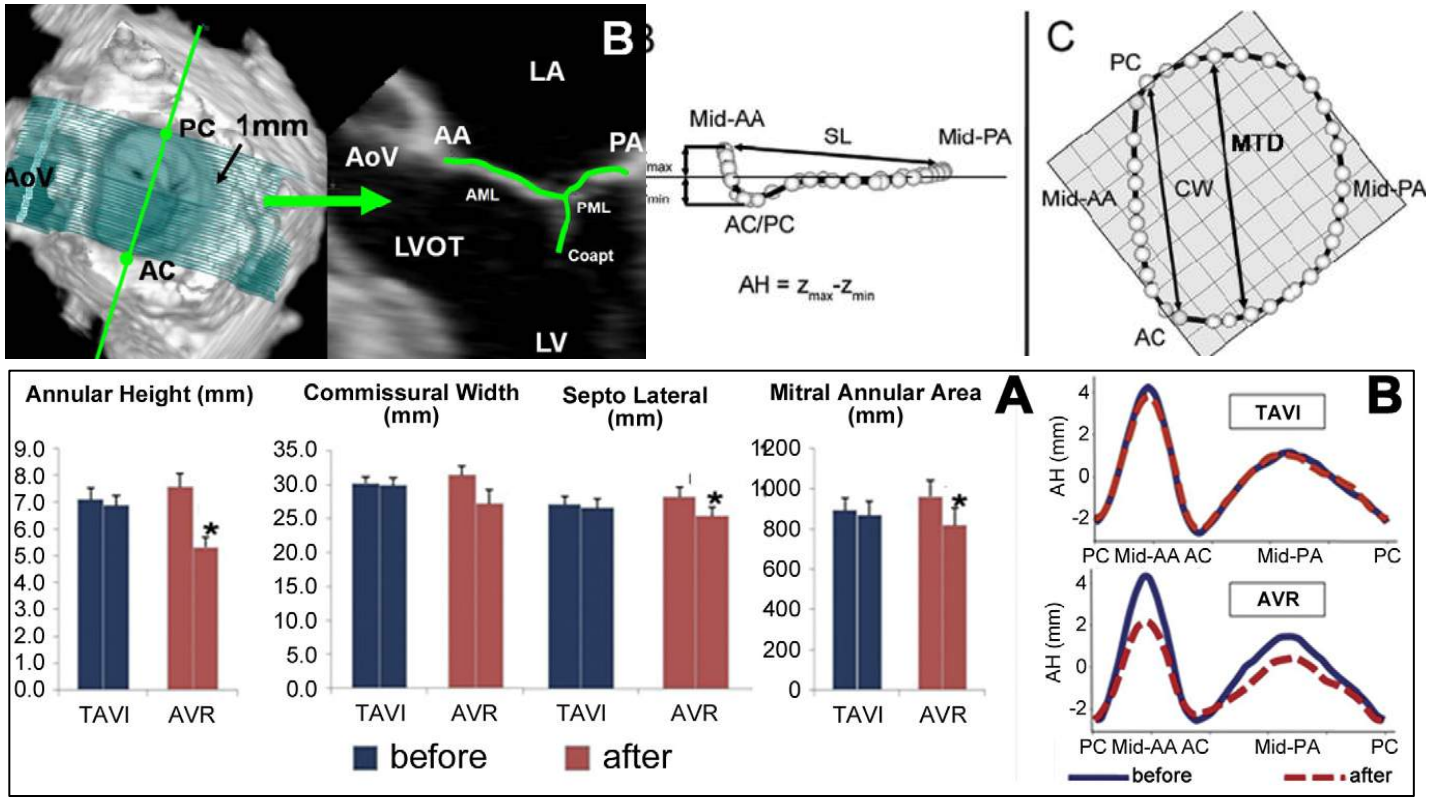




The Effect of Surgical and Transcatheter Aortic Valve Replacement on Mitral Annular Anatomy

Mathieu Vergnat, MD,* Melissa M. Levack, MD,* Benjamin M. Jackson, MD, Joseph E. Bavaria, MD, Howard C. Herrmann, MD, Albert T. Cheung, MD, Stuart J. Weiss, MD, PhD, Joseph H. Gorman III, MD, and Robert C. Gorman, MD

Ann Thorac Surg 2013;95:614–20

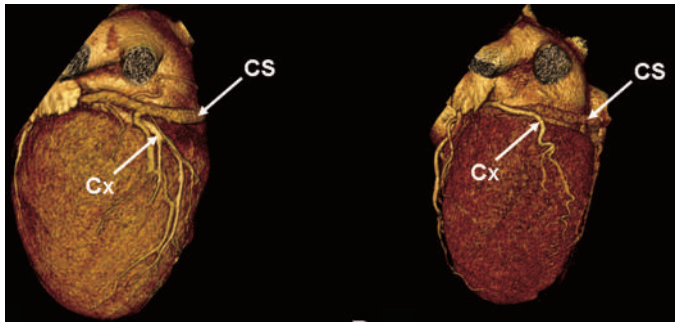


Noninvasive Evaluation of Coronary Sinus Anatomy and Its Relation to the Mitral Valve Annulus

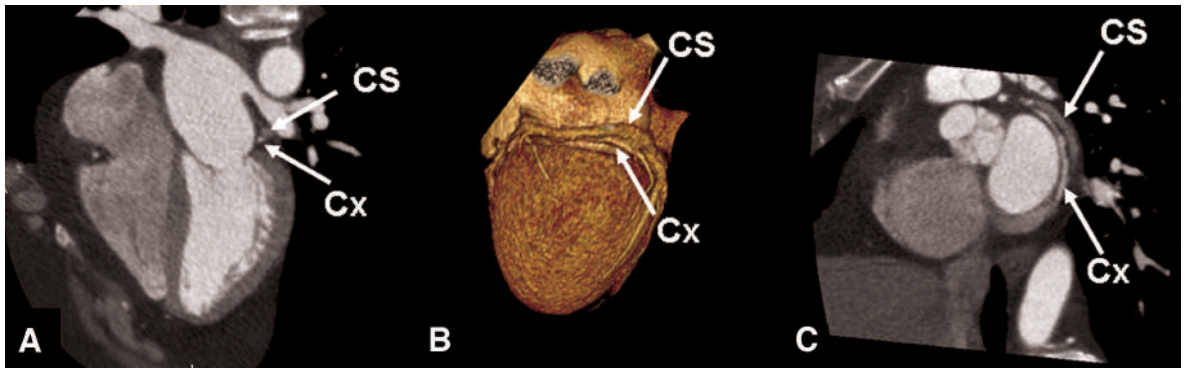
Implications for Percutaneous Mitral Annuloplasty

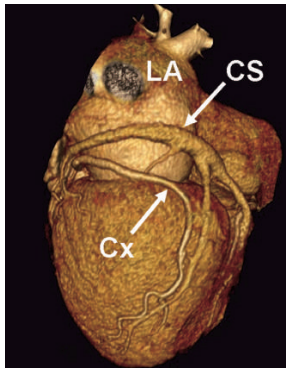
Laurens F. Tops, MD; Nico R. Van de Veire, MD, PhD; Joanne D. Schuijf, MSc; Albert de Roos,

***Circulation*. 2007;115:1426-1432**



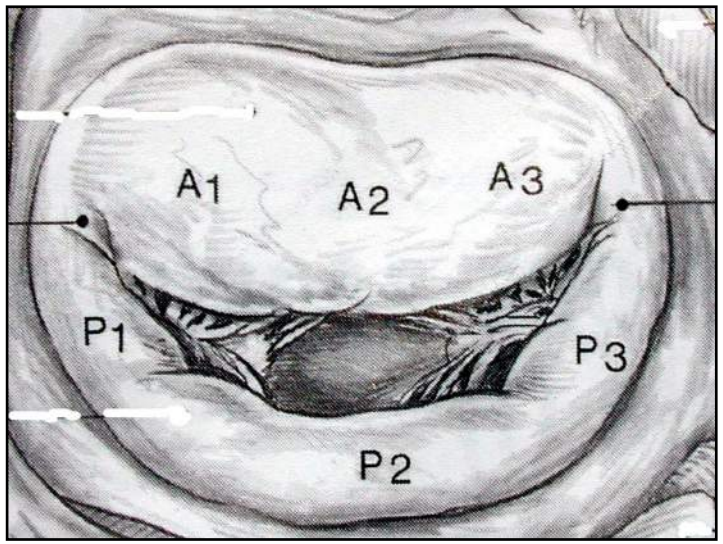
	Patients Without Severe MR (n=90)	Patients With Severe MR (n=15)	*P**
Minimal distance between CS and MVA			
At MVA level	4.8±2.5	7.3±3.9	0.005
At proximal CS	8.1±2.4	9.3±1.9	0.019
At distal CS	8.3±3.1	12.1±3.6	<0.001
MVA diameter (2-chamber view)	40.2±4.7	44.3±3.3	0.001
MVA diameter (4-chamber view)	35.8±4.4	39.9±4.4	0.002
MVA perimeter	118.1±12.6	127.6±14.7	0.020
Total CS length	110.1±16.6	128.6±14.6	<0.001

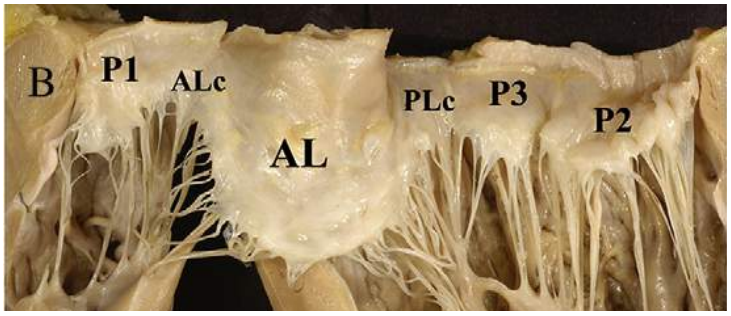


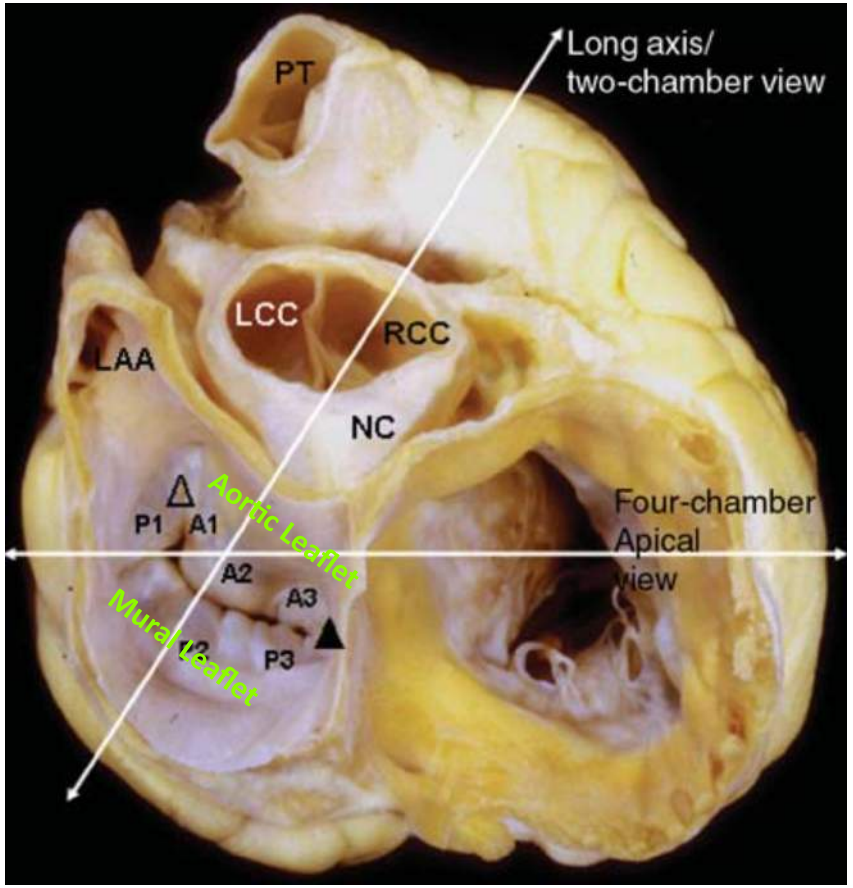


Anatomy of the mitral valve: understanding the mitral valve complex in mitral regurgitation

Karen P. McCarthy *European Journal of Echocardiography (2010) 11, i3–i9*



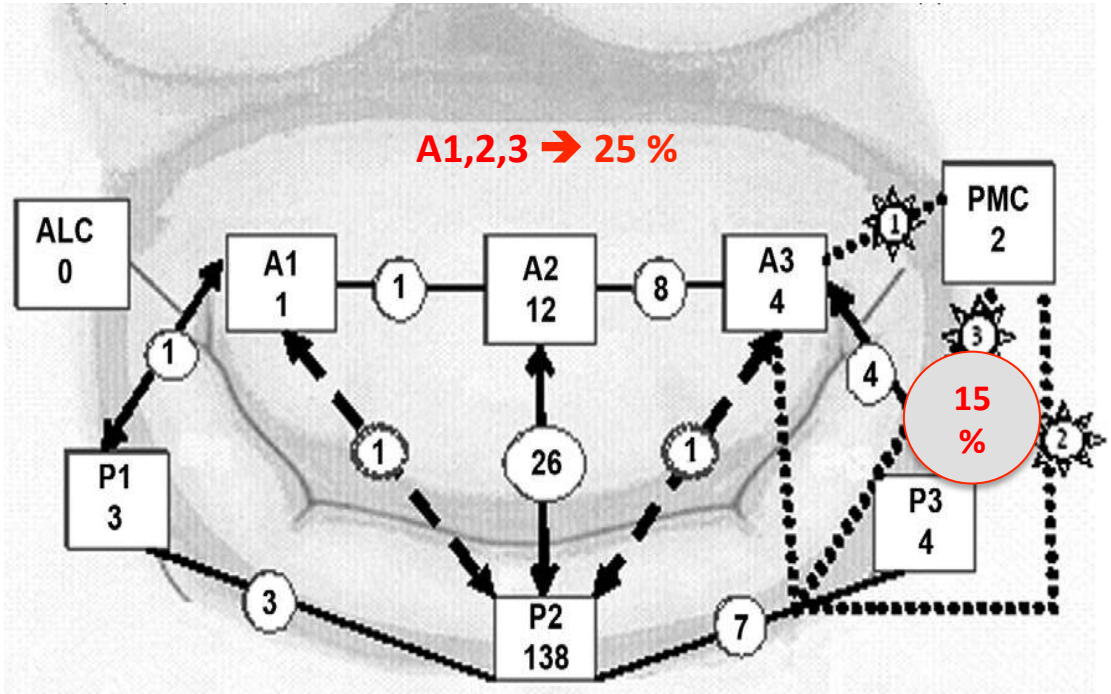


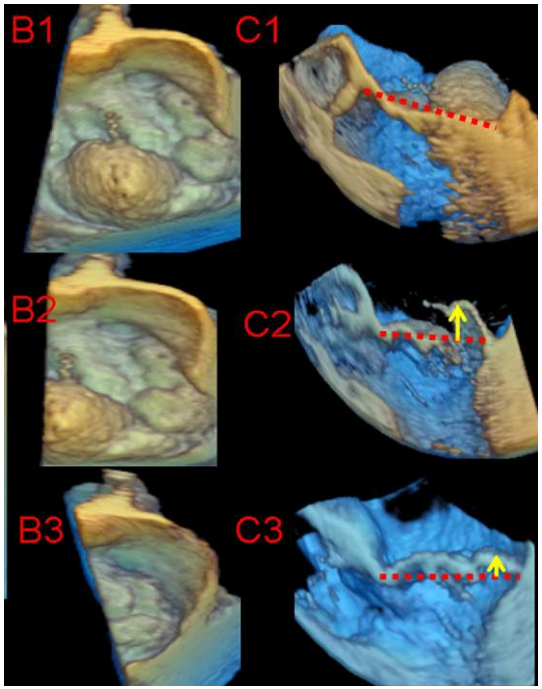


Real-Time Three-Dimensional Transesophageal Echocardiography for Assessment of Mitral Valve Functional Anatomy in Patients With Prolapse-Related Regurgitation

Giovanni La Canna, MD[a,*], Iryna Arendar, MD[a], Francesco Maisano, MD[b], Fabrizio Monaco, MD[a],

Am J Cardiol 2011;107:1365–1374





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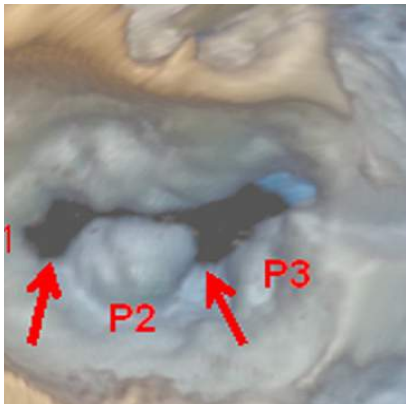
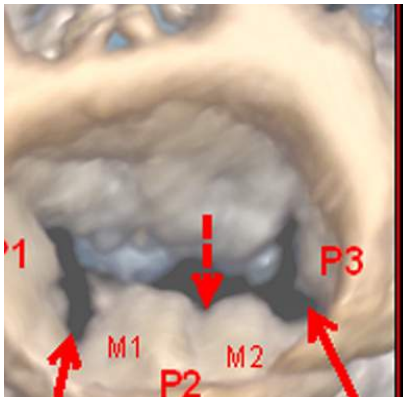
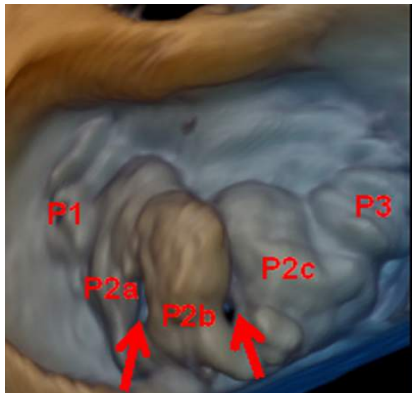
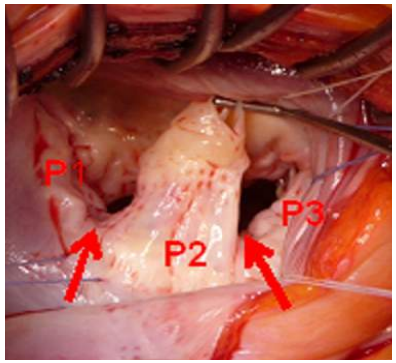
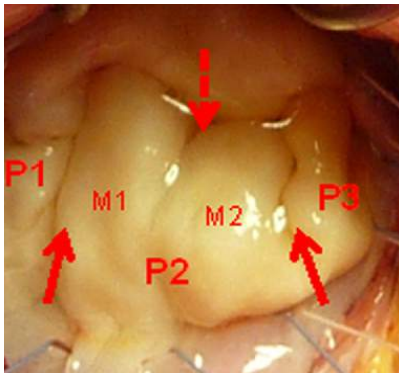
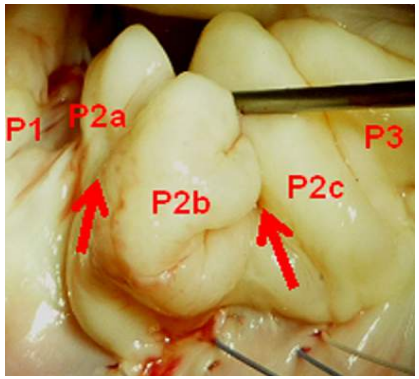


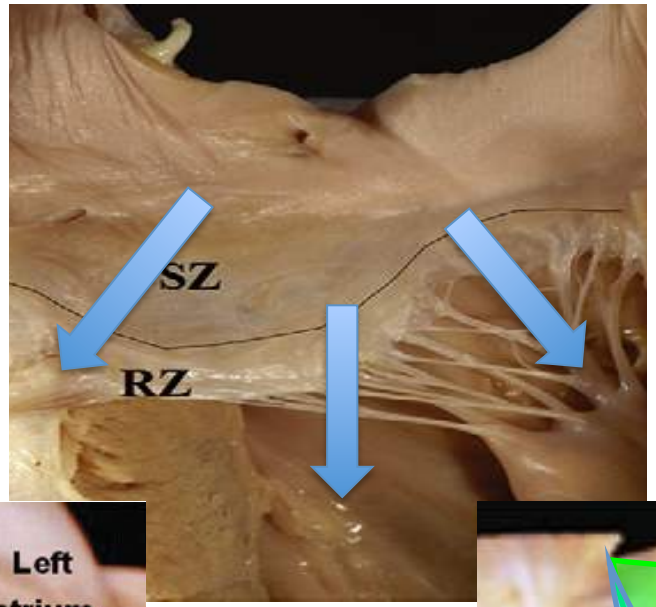


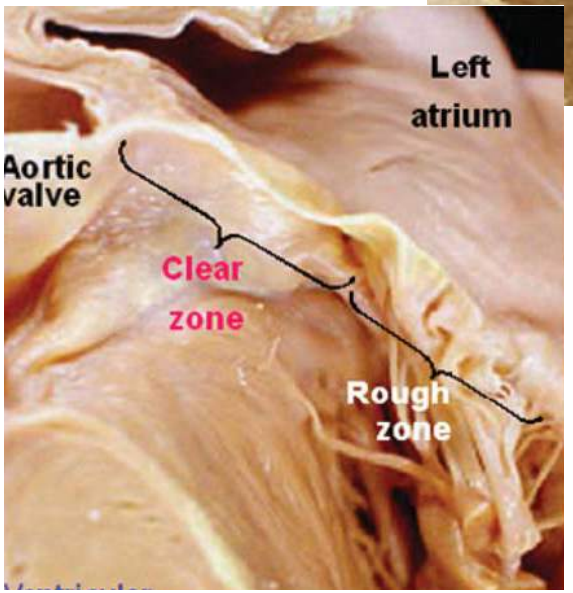


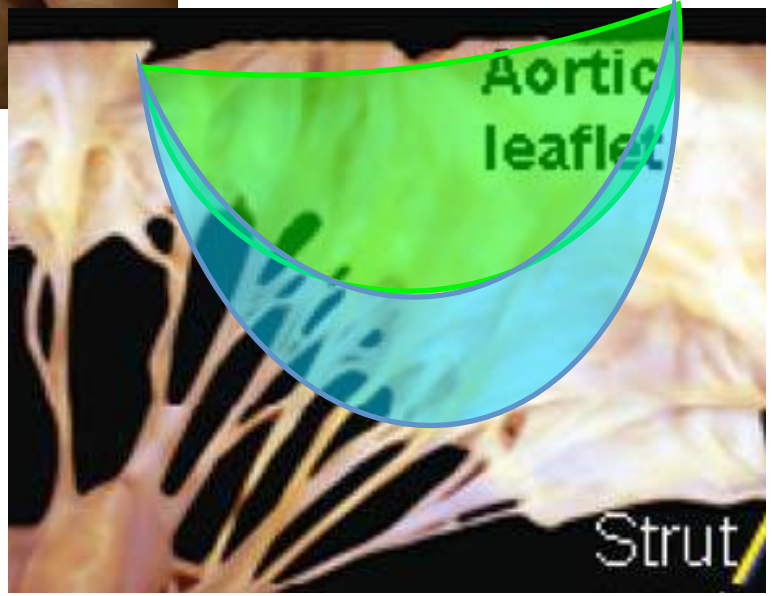


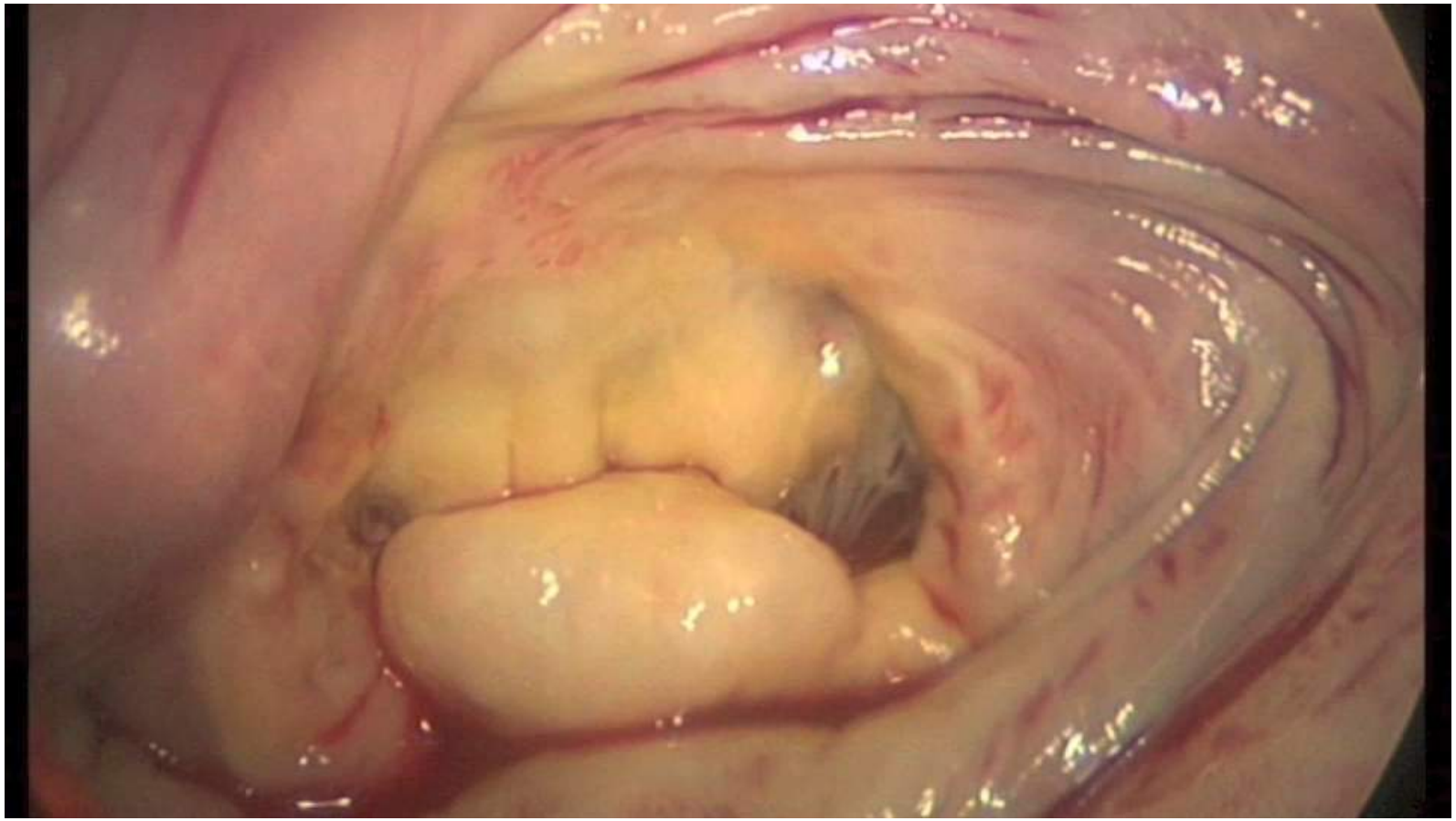





SZ
RZ

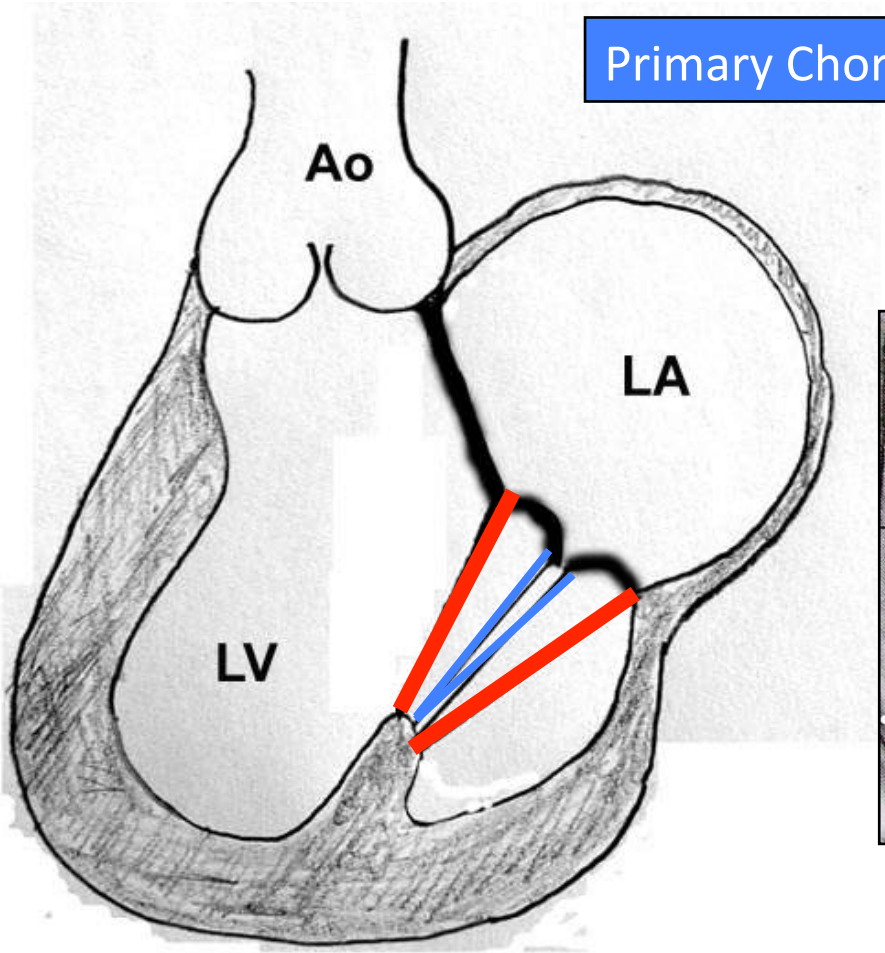

Left
atrium
Aortic
valve
Clear
zone
Rough
zone

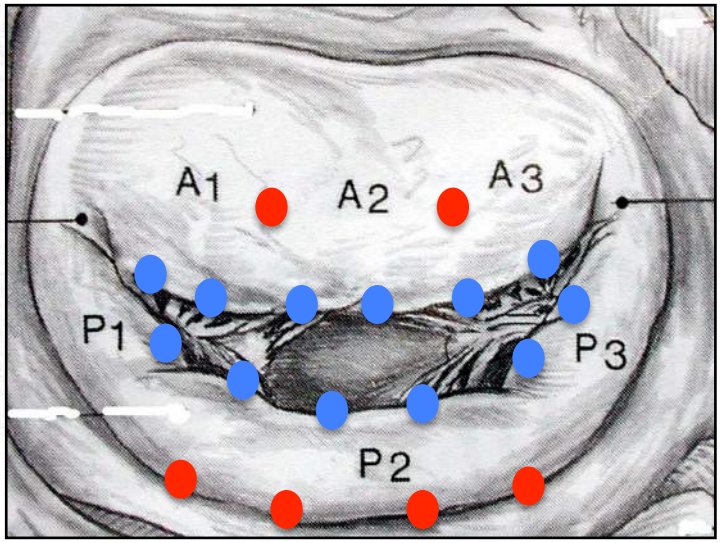

Aortic
leaflet
Strut



Secondary Chordae

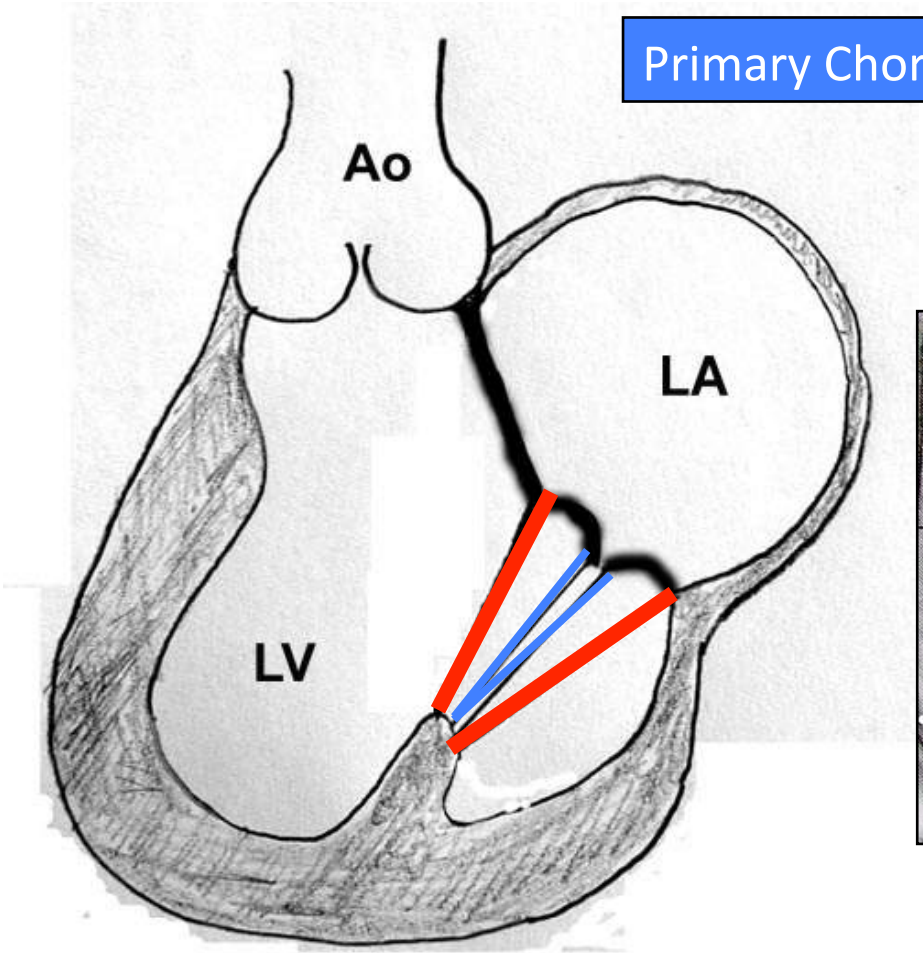
Primary Chordae

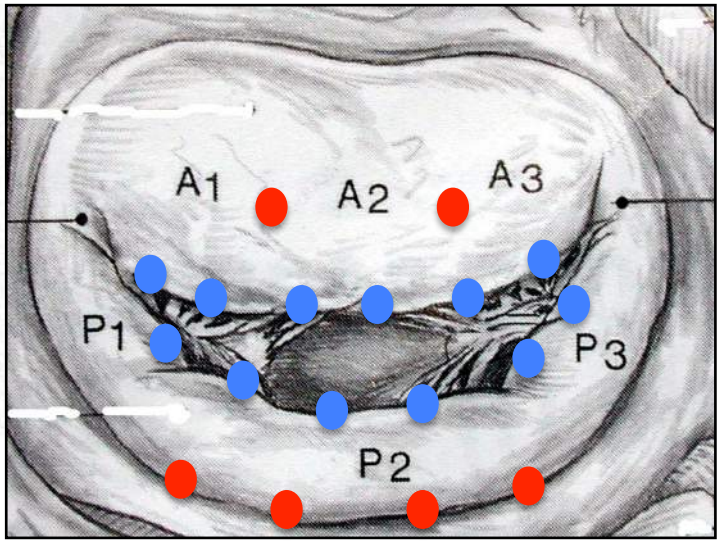


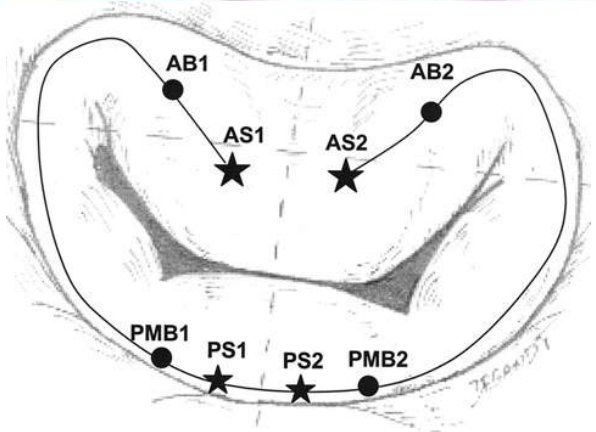


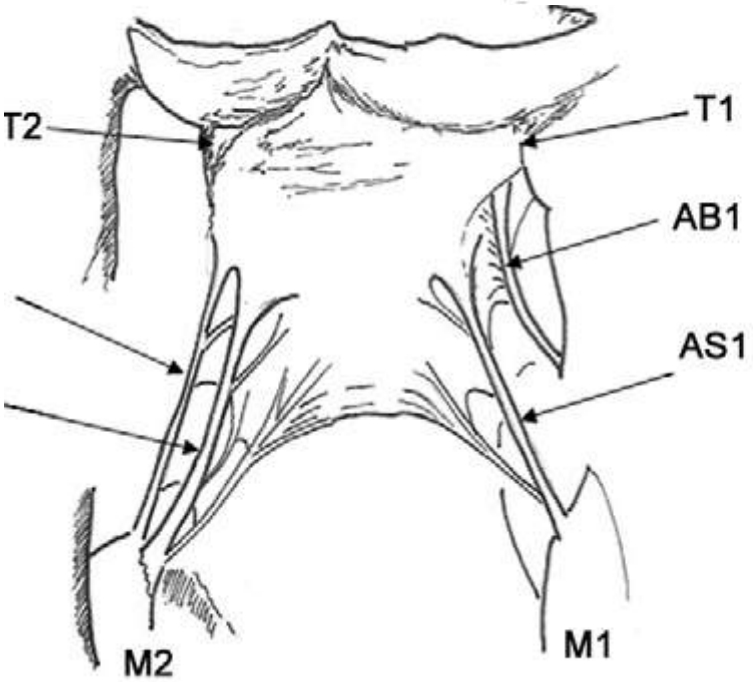
Secondary Chordae ➔ Basal Chordae

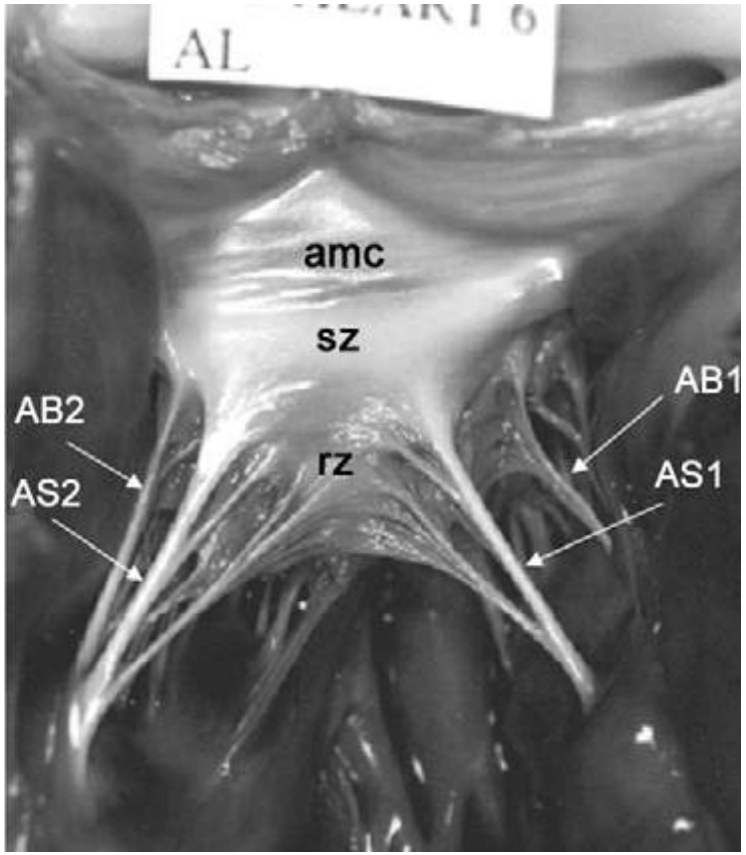
Primary Chordae ➔ Marginal Chordae






AB1
AB2
AS1
AS2
PMB1
PS1
PS2
PMB2


T2
T1
AB1
AS1
M2
M1

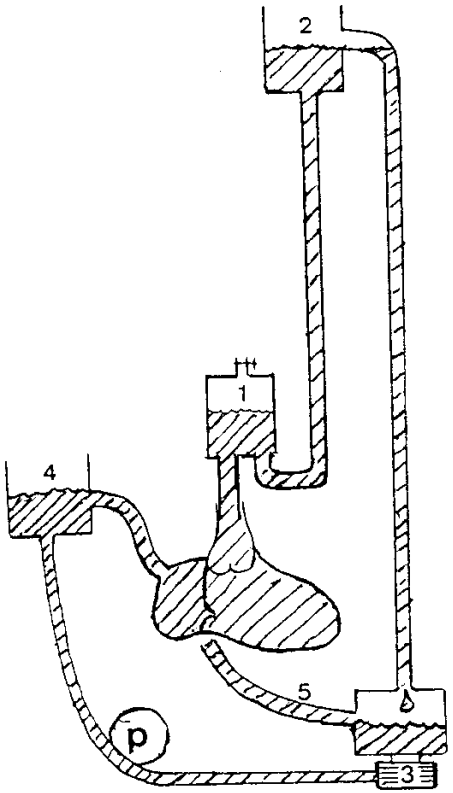

AL
amc
sz
rz
AB1
AB2
AS1
AS2

Mitral Subvalvular Apparatus

Different Functions of Primary and Secondary Chordae

Jean F. Obadia, MD, PhD; Cendrine Casali er, MD

Circulation 1997;96:3121-312



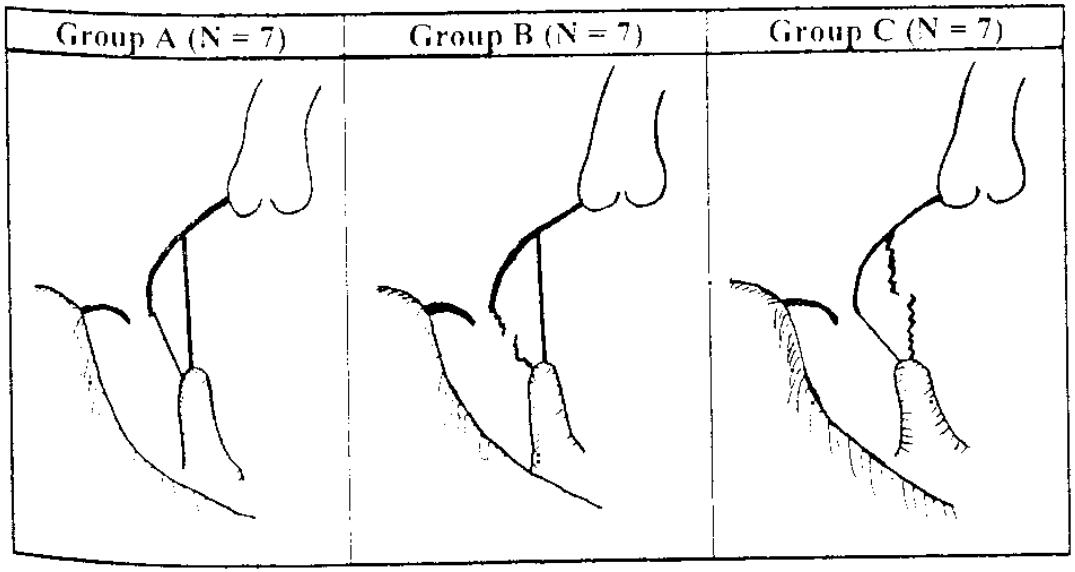
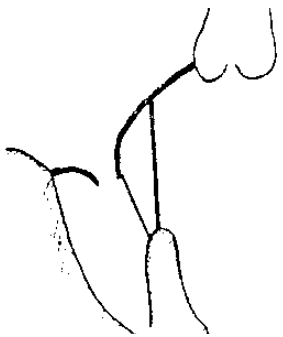


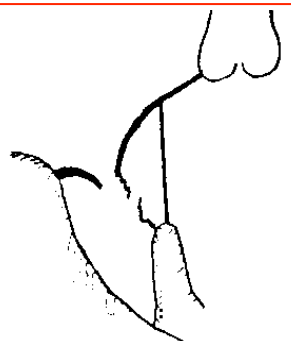
FIG 2. Experimental design in group A (control), group B (primary chordae sectioned), and group C (secondary chordae sectioned).

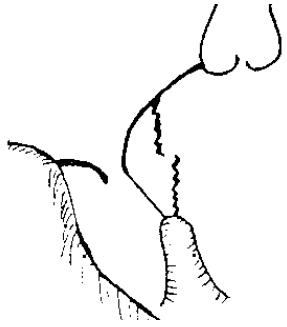
Mitral Subvalvular Apparatus

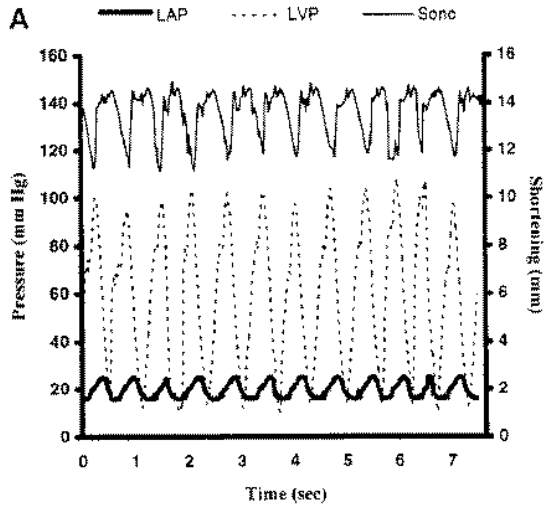
Different Functions of Primary and Secondary Chordae

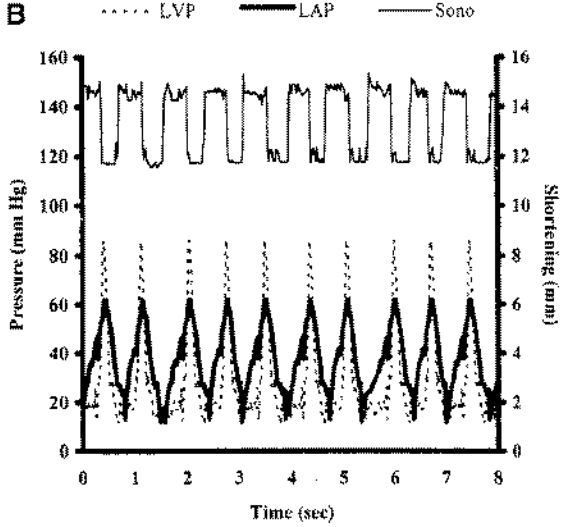
Jean F. Obadia, MD, PhD; Cendrine Casali **Circulation 1997;96:3121-312** er, MD

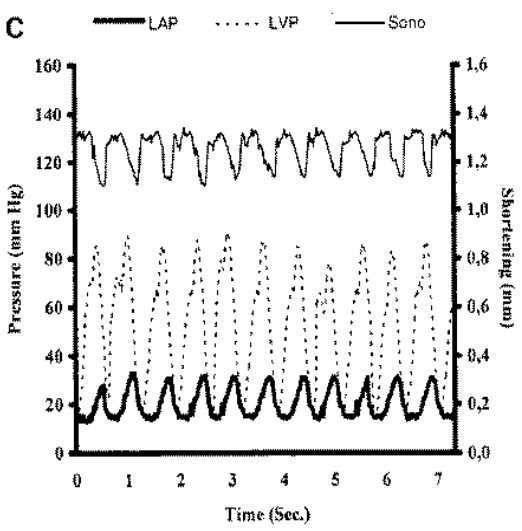






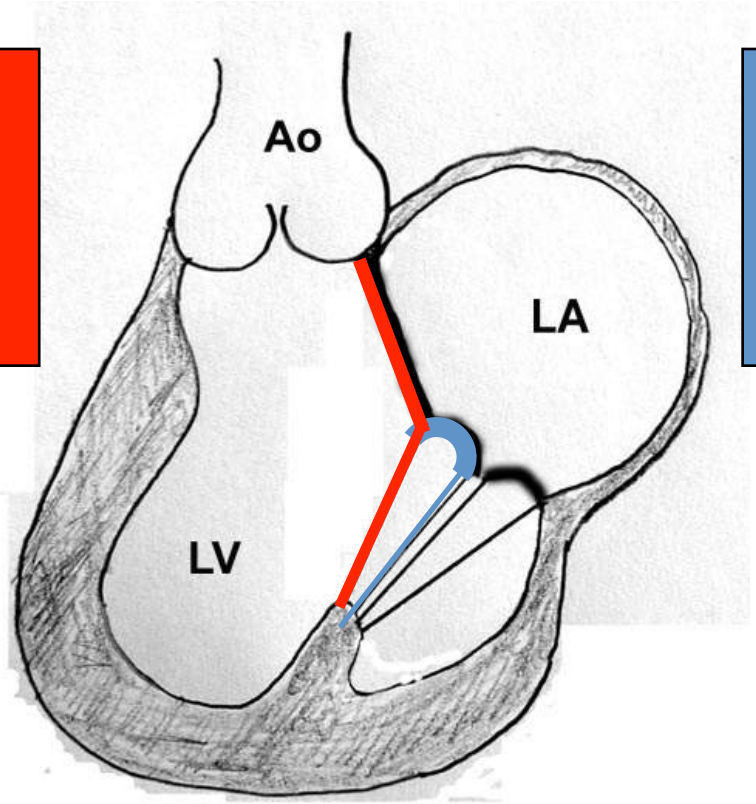






Ant. Leaf. / *Double Part* ➔ *Double Function*

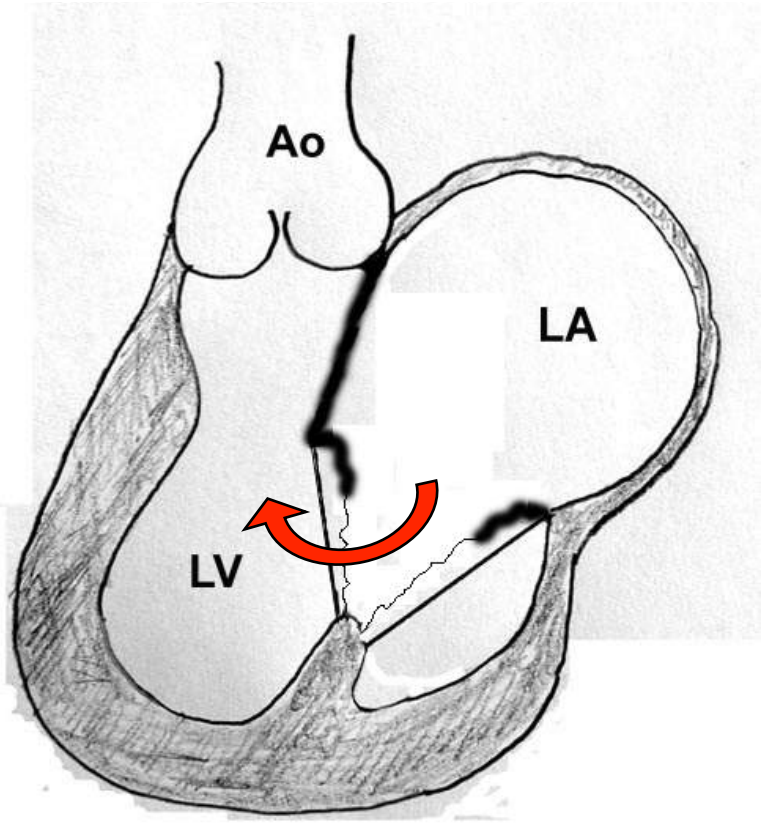
Secondary Chordae
Load Bearing
Basal Chordae
+
Basal Leaflet

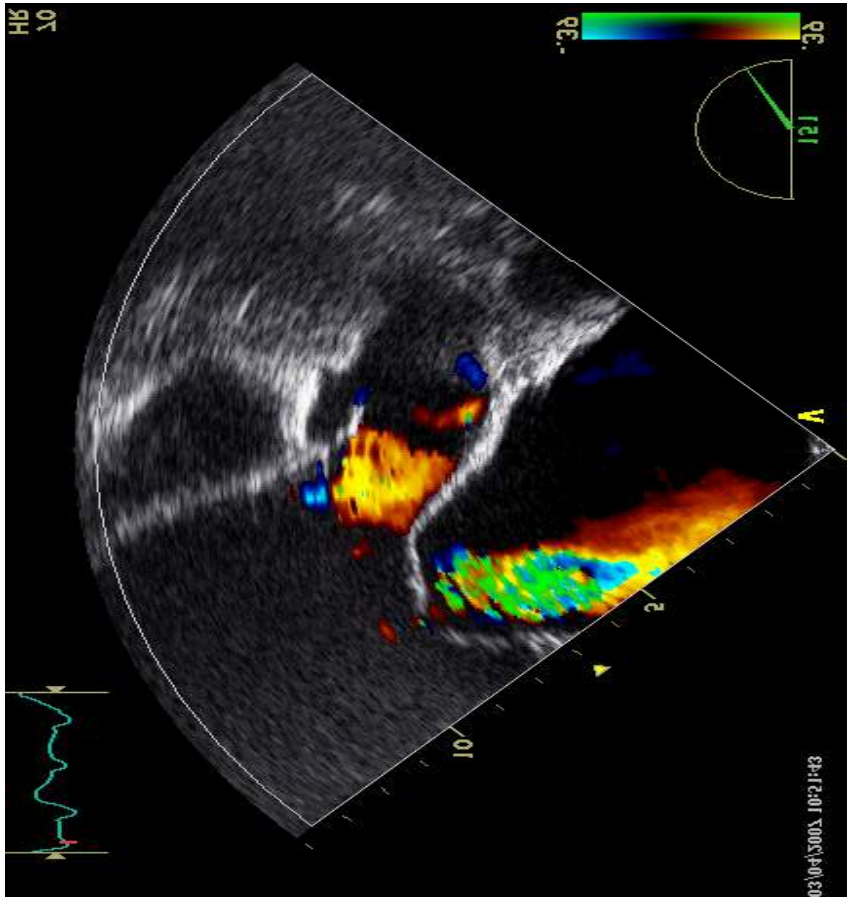


Primary Chordae
Aligning Chordae
Marginal Chordae
+
Marginal Leaflet

LV Function

Continence

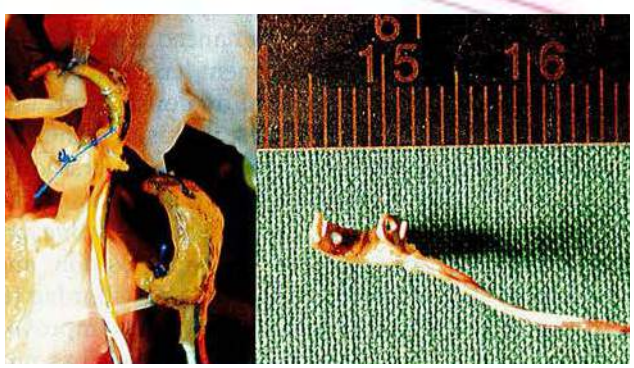

Ao
LA
LV



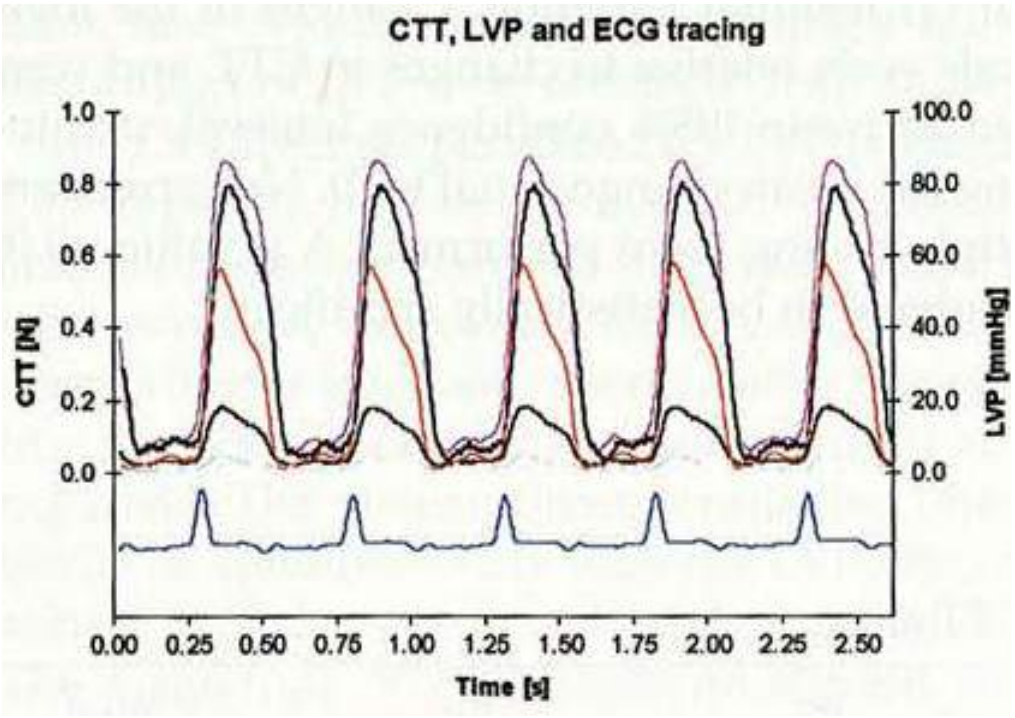
Differential Tension between Secondary and Primary Mitral Chordae in an Acute In-Vivo Porcine Model

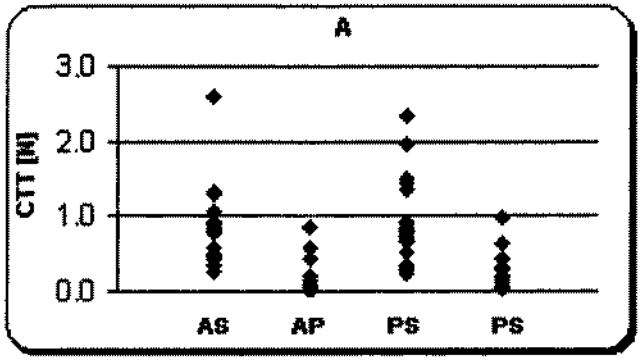
Mads Lomholt, Sten Lyager Nielsen, Søren Berndt Hansen, Niels Trolle Andersen, J. Michael Hasenkam

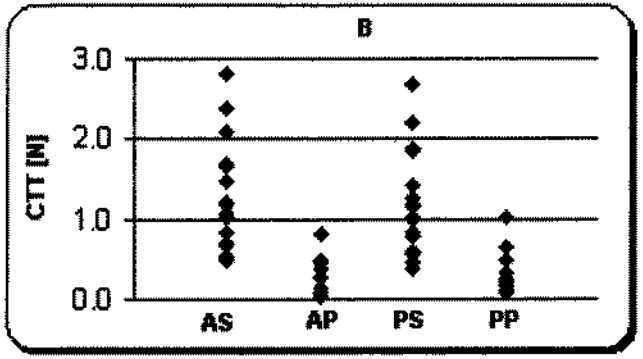
The Journal of Heart Valve Disease 2002;11:337-345



T Basal = 3 x T Marginal



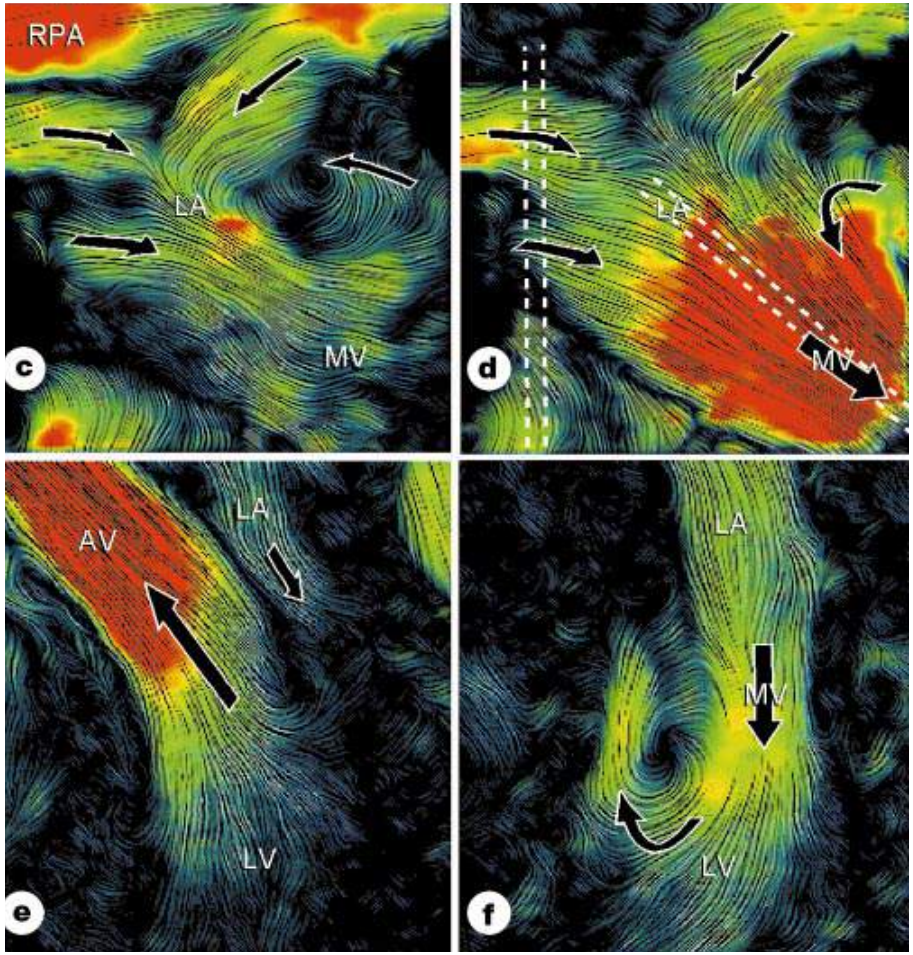




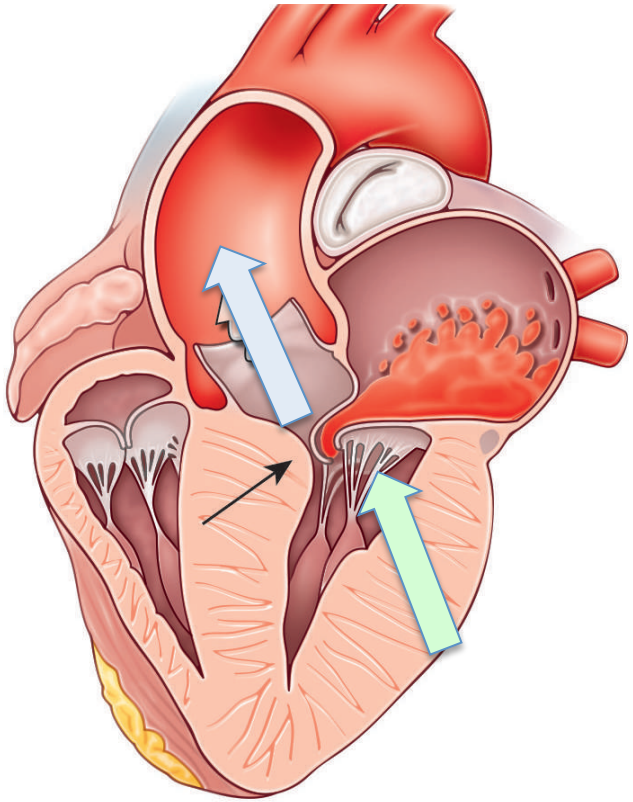
Asymmetric redirection of flow through the heart

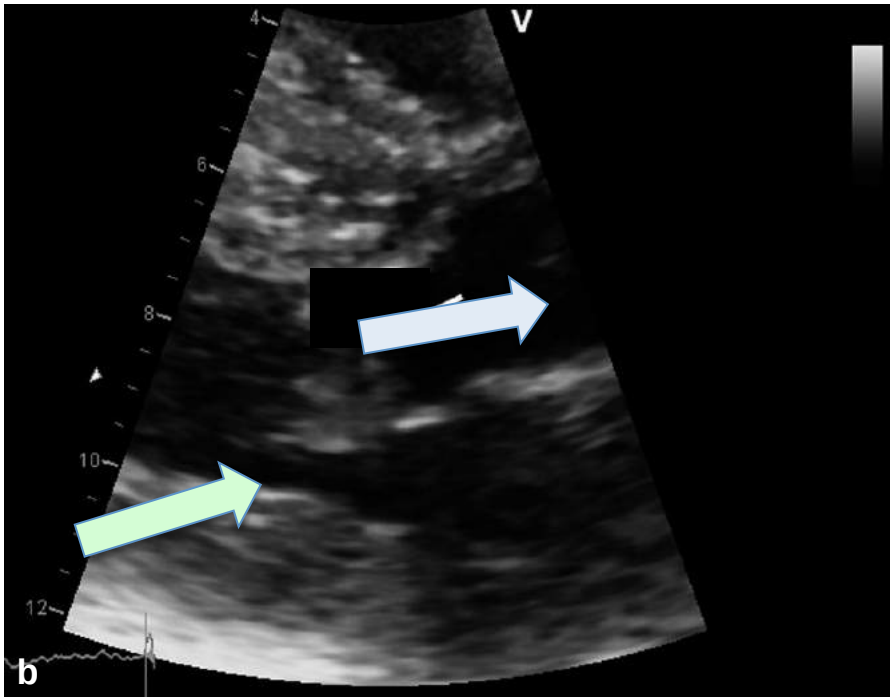
Philip J. Kilner*, Guang-Zhong Yang*†, A. John Wilkes‡, Raad H. Mohiaddin*, David N. Firmin* & Magdi H. Yacoub§

NATURE | VOL 404 | 13 APRIL 2000



MR in HCM: multiple mechanism

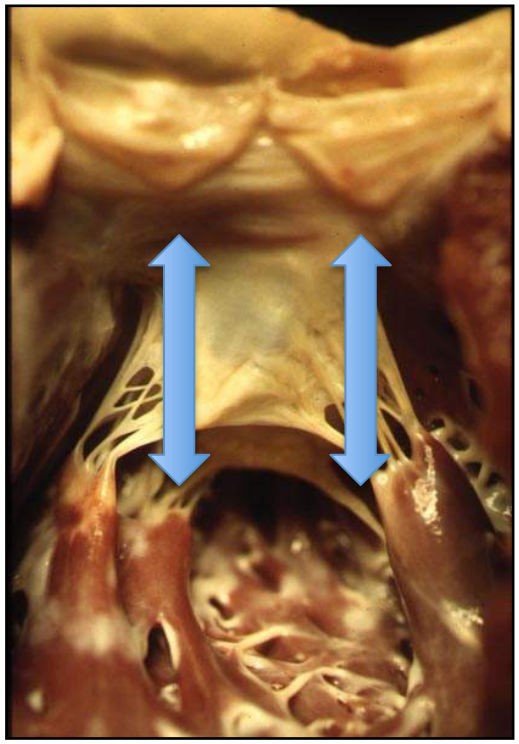


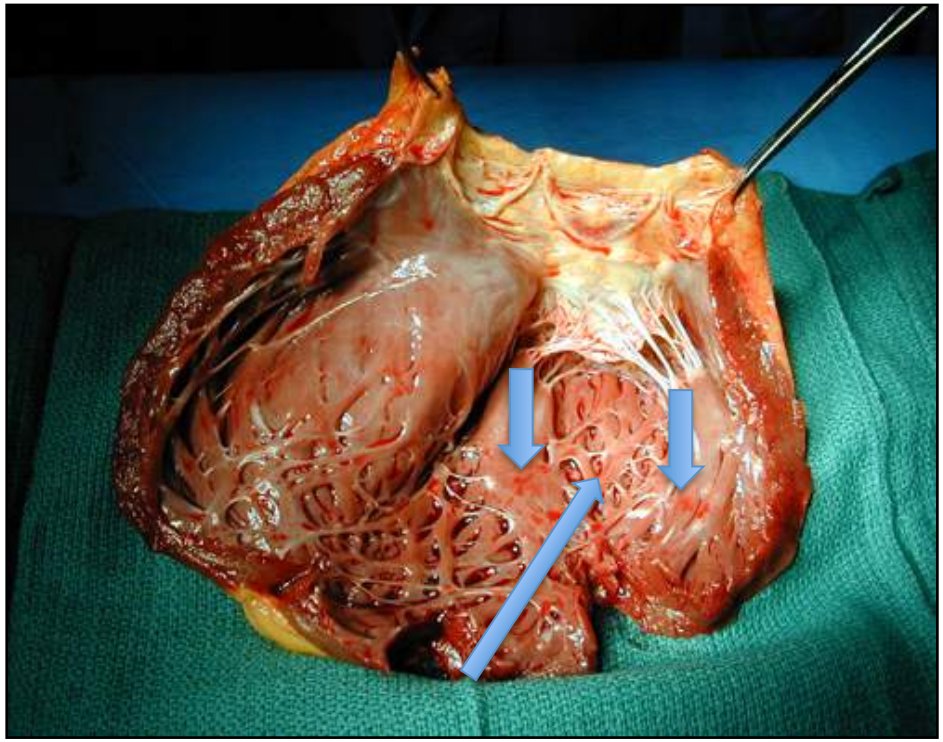


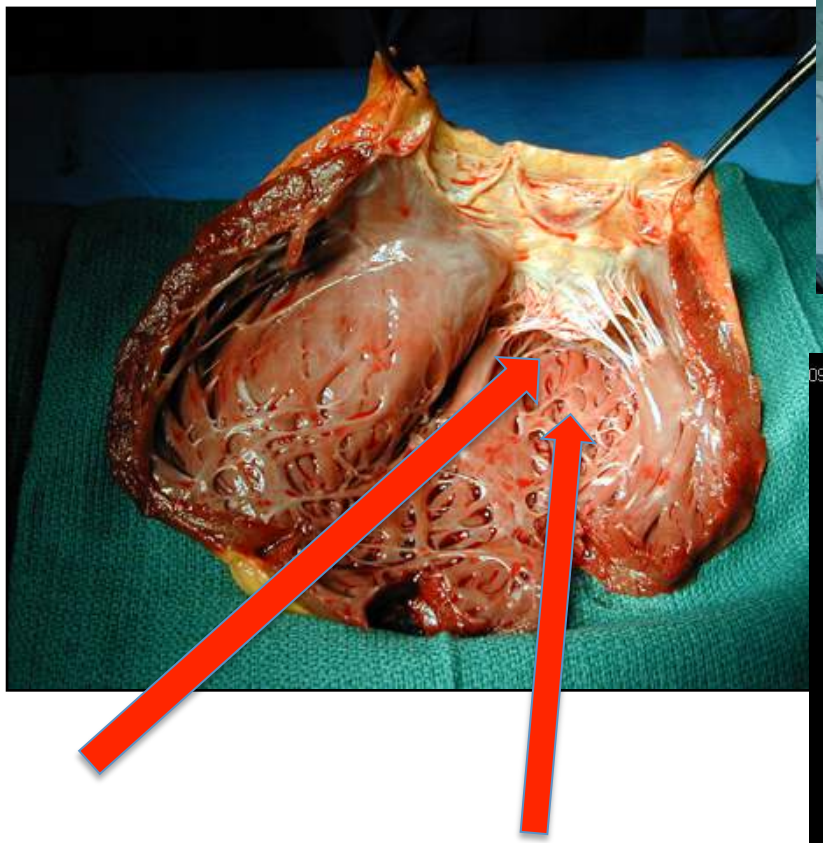
1) Pulling Mechanism ➔ Venturi effect

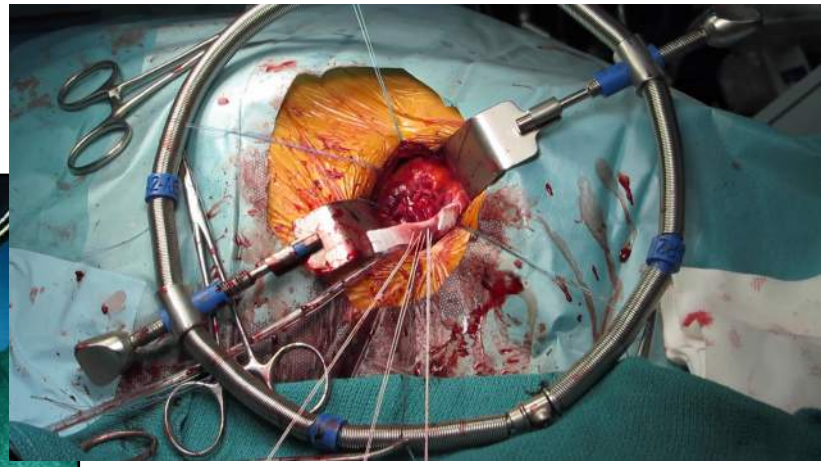
2) Pushing Mechanism ➔ Direct flow

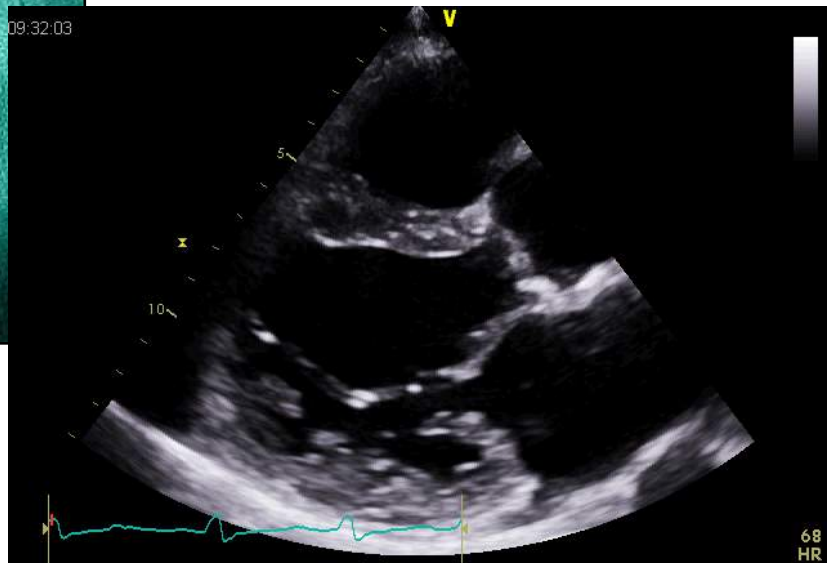

A










09:32:03
V
68
HR

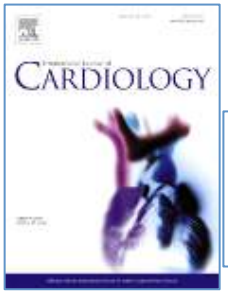
111 patients :

61 % EVEREST exclusion criteria

1 month ➔ 34% grade 3 and 4

MVA<4cm2, coaptation length < 2 mm,
Coaptation depth > 11 mm,
flail gap > 10 mm and flail width ≥ 15mm.

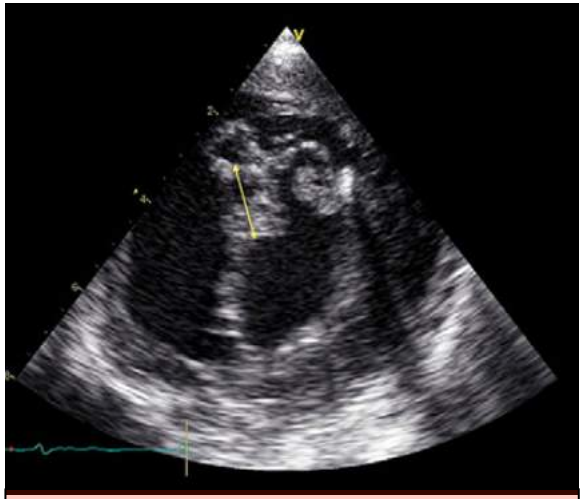
	All patients baseline n = 79		MR grade ≤2 at follow-up n = 47		MR grade ≥3 at follow-up n = 24		p-Value
MR grade ≥ 3, (%)	100		100		100		ns
MR etiology, (%)							
Functional	53		62		42		ns
Degenerative	38		30		50		ns
Mixed	9		8		8		ns
Jet origin A2–P2, (%)	70		74		71		ns
Jet direction, (%)							
Central	63		72		42		0.02
Posterolateral	19		17		25		ns
Anterior	10		4		25		0.02
Anterolateral	8		6		8		ns
Coaptation length, (mm)	3	±1	3	±1	3	±1	ns
Coaptation depth, (mm)	8	±3	7	±3	10	±2	0.01
Flail gap, (mm)	5	±3	5	±2	6	±4	ns
Flail width, (mm)	13	±4	13	±2	15	±2	ns
Length PMVL, (mm)	14	±4	14	±4	15	±4	ns
Length AMVL, (mm)	25	±5	24	±5	27	±6	0.049
Annulus diameter 0°	35	±5	35	±5	35	±4	ns
Annulus diameter 120°	34	±6	33	±6	33	±4	ns



Mitral valve anatomy predicts outcome of MitraClip implantation
Kirsten Boerlage-van Dijk, Int J of Cardiol 2014 174 (3) 724-6
Amsterdam

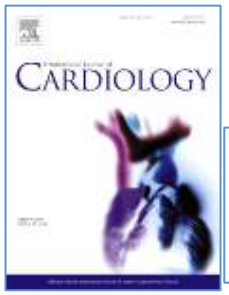
coaptation length < 2 mm,
flail gap > 10 mm
flail width ≥ 15mm.

Measurement of the flail gap where flail gap is largest



Measurement of the flail width where flail width is largest in a transgastric short axis view (0°).

Measurements of coaptation length in a 4 chamber view in 0°, Coaptation length is measured in the view where coaptation length is shortest



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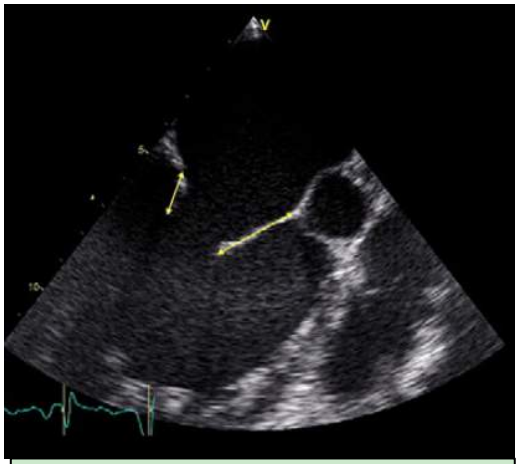
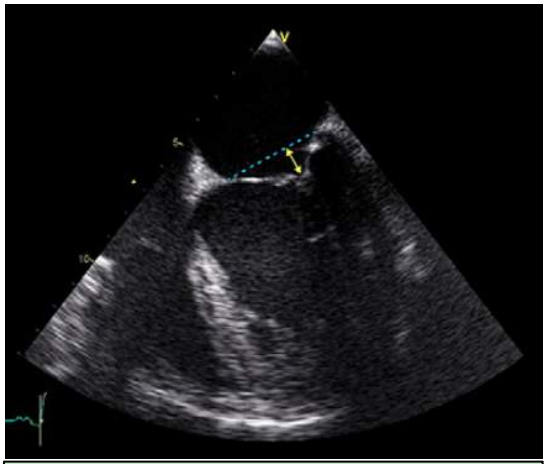


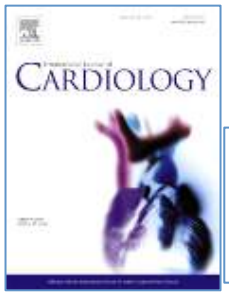
Measurements of anterior and posterior leaflets at maximum length in 120°

Cut off➔ less than 28 mm



Measurements of coaptation depth in a 4 chamber view in 0° where the coaptation depth is greatest.

Cut off ➔ less than 10 mm



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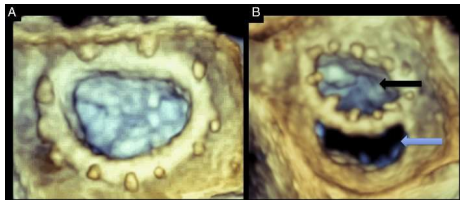
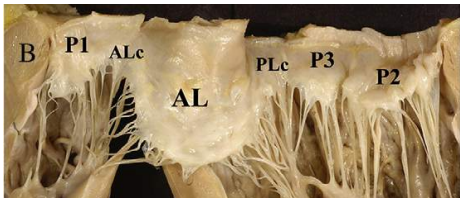
CONCLUSION

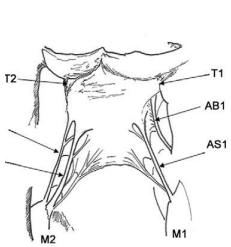
The Ring is not a ring

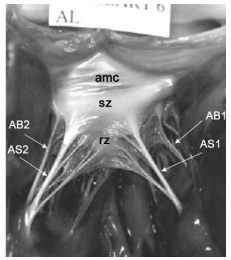


Aortic and Mural leaflet



Marginal and Basal Chords





More Complex than Aortic ➔ TMVR is not TAVI