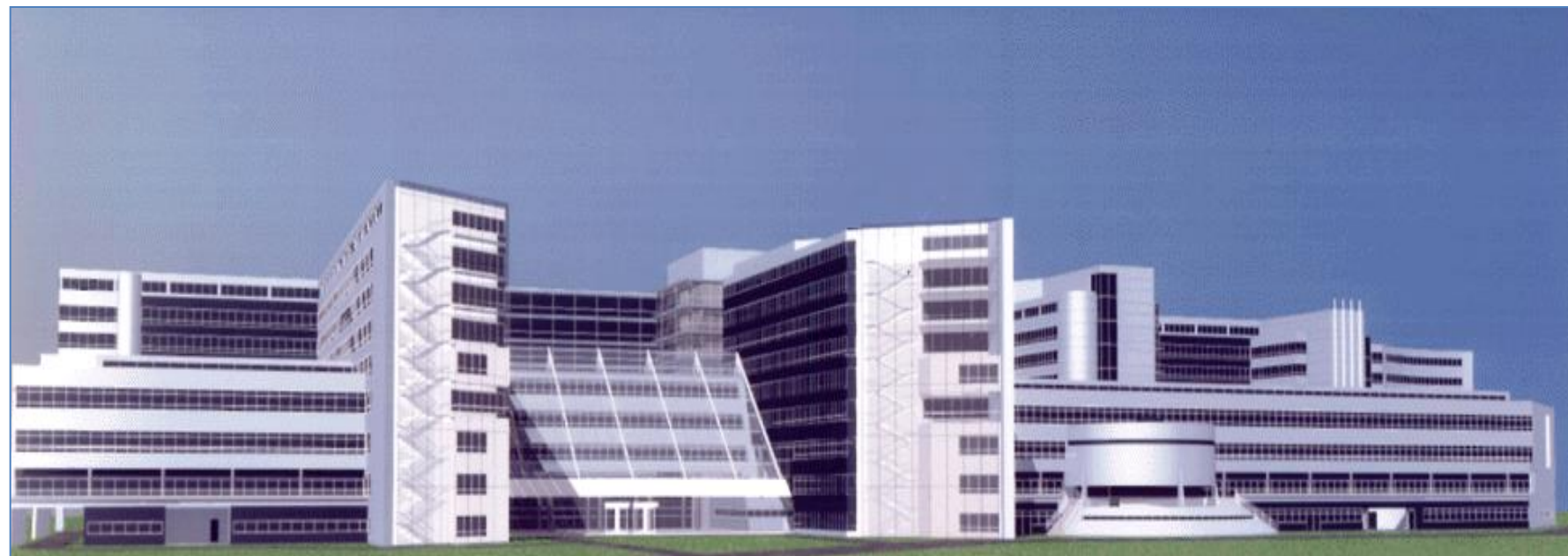


5 Thoughts on Anatomy and Morphology of the Mitral Valve

A. Berrebi, M.D.



HEGP – University of Paris Cité



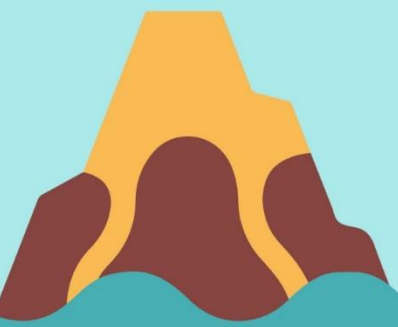
Institut Mutualiste Montsouris, Paris



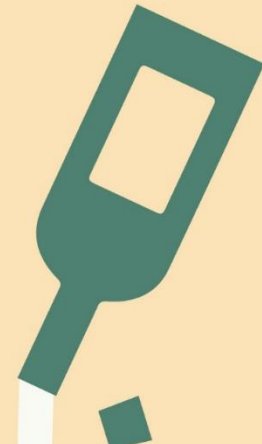
EUROVALVE

& STRUCTURAL CARDIOMYOPATHIES

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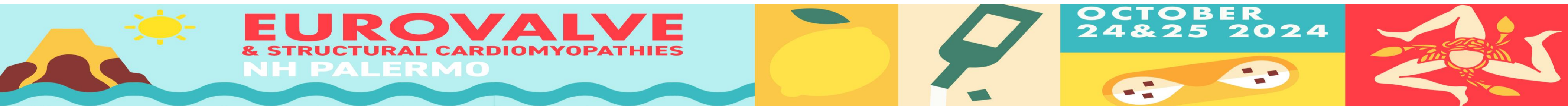
LOCAL HOST

Khalil Fattouch, Italy

No Disclosure

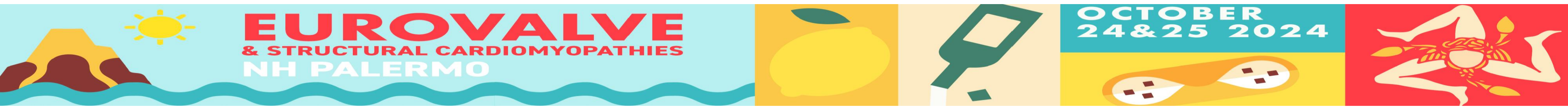
Anatomy and Morphology of the Mitral Valve

- **Mitral Valve Anatomy: the essentials**
- **Functional anatomy and Surgeon's needs**

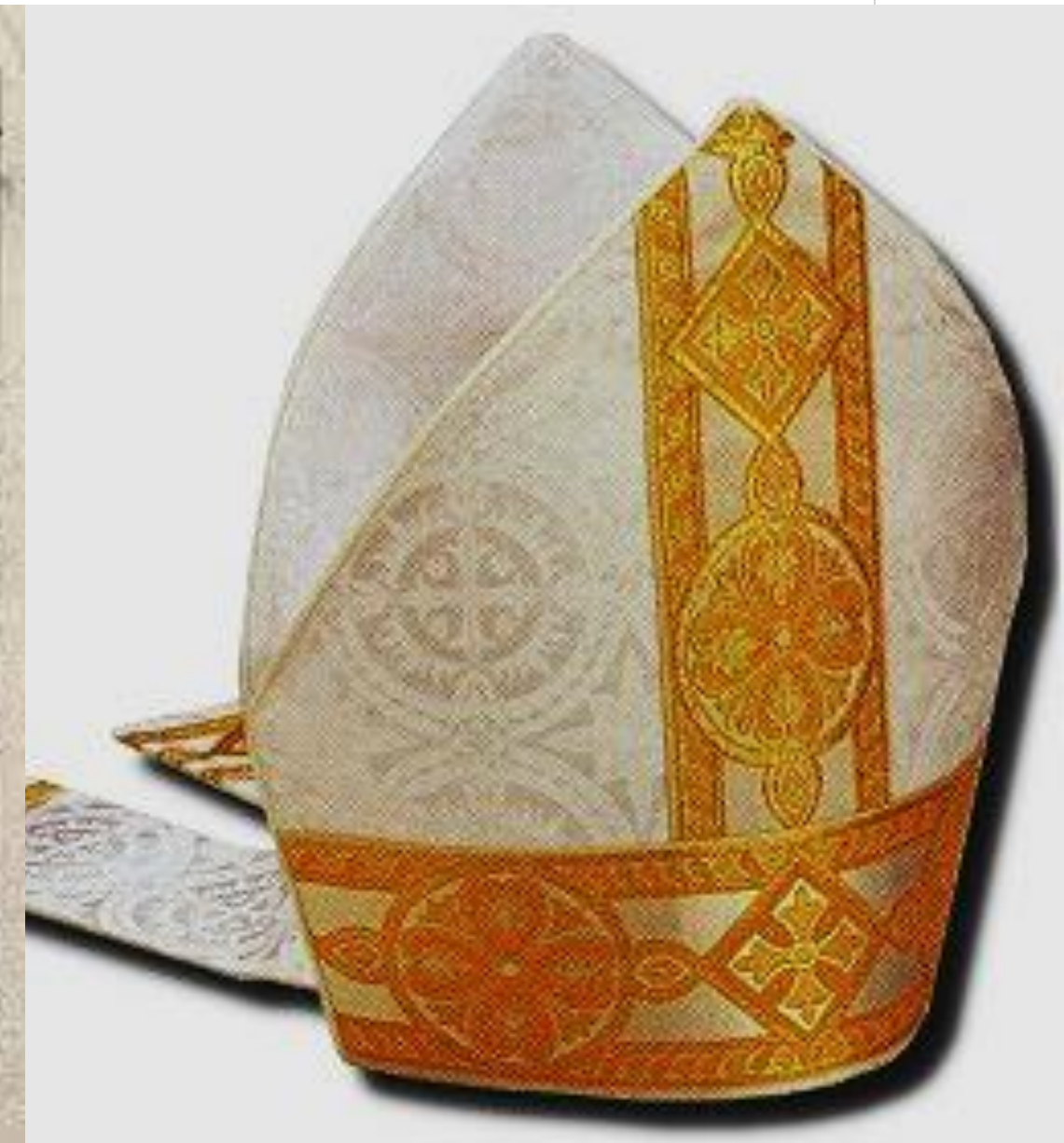
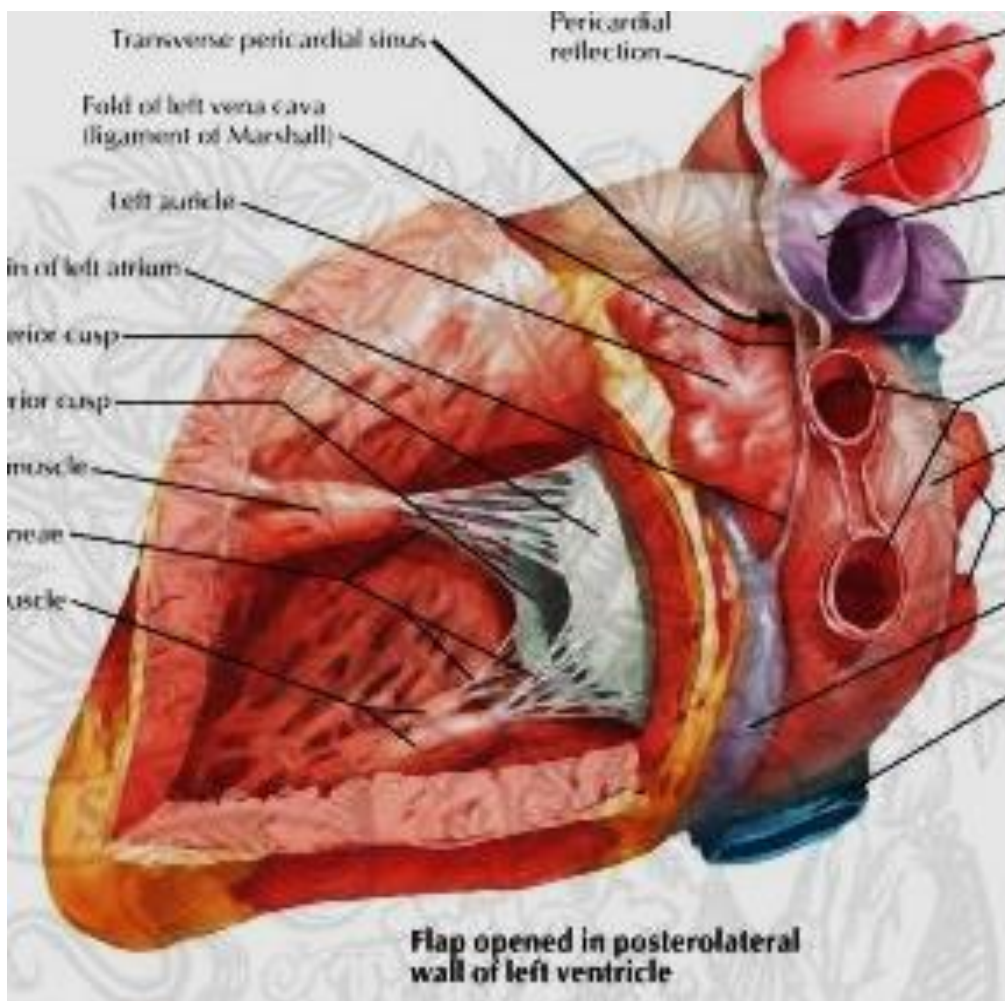


Anatomy and Morphology of the Mitral Valve

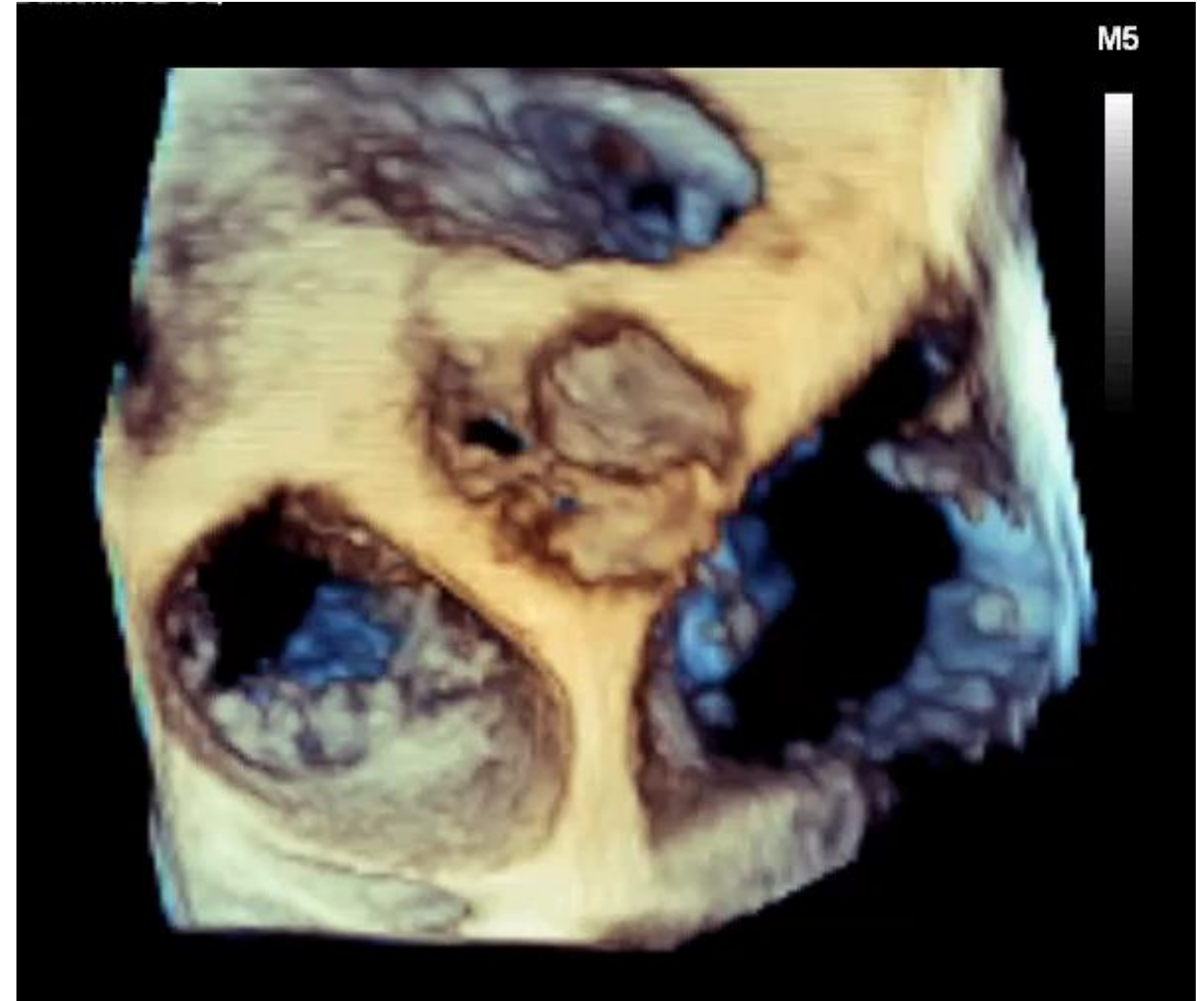
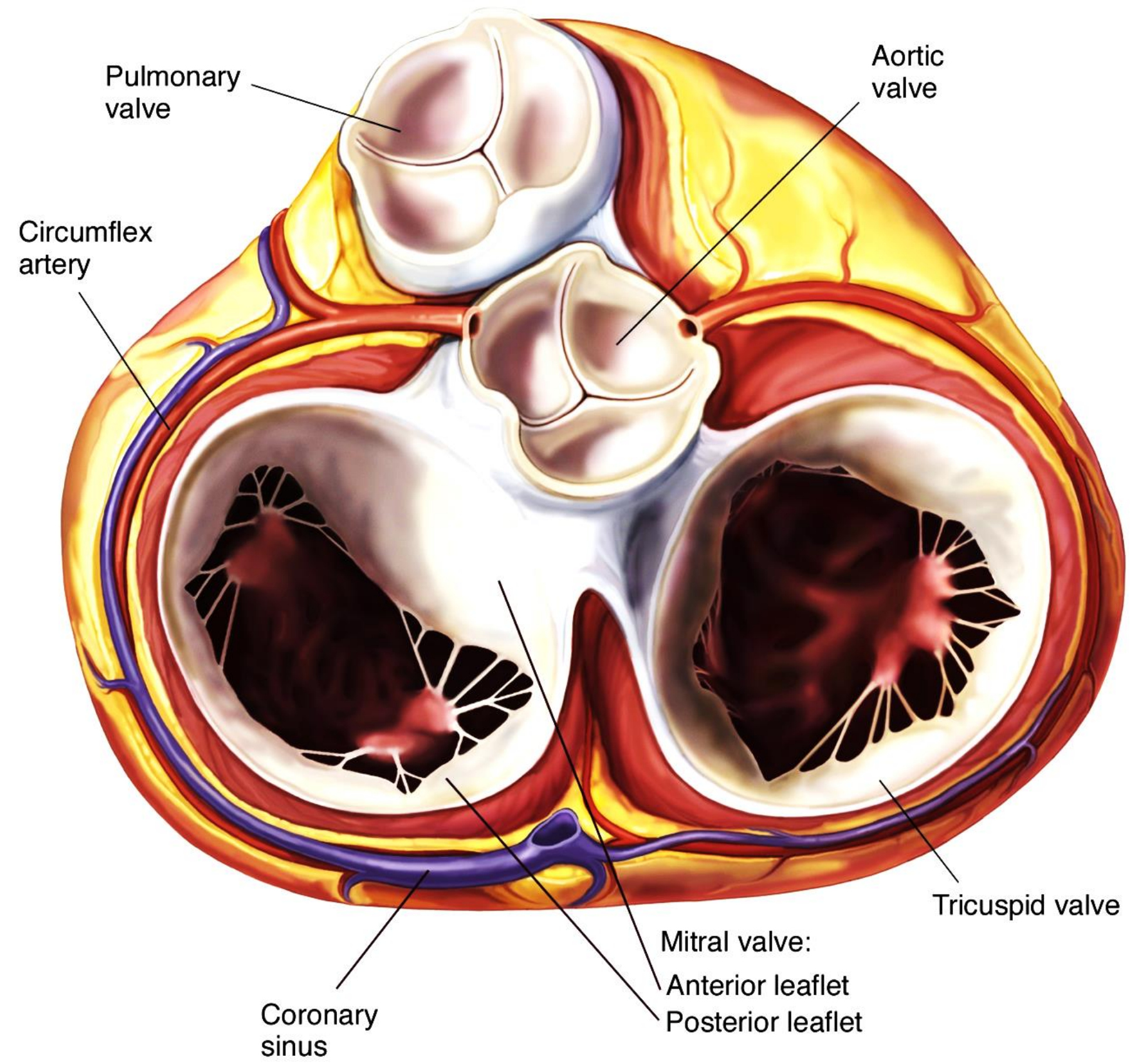
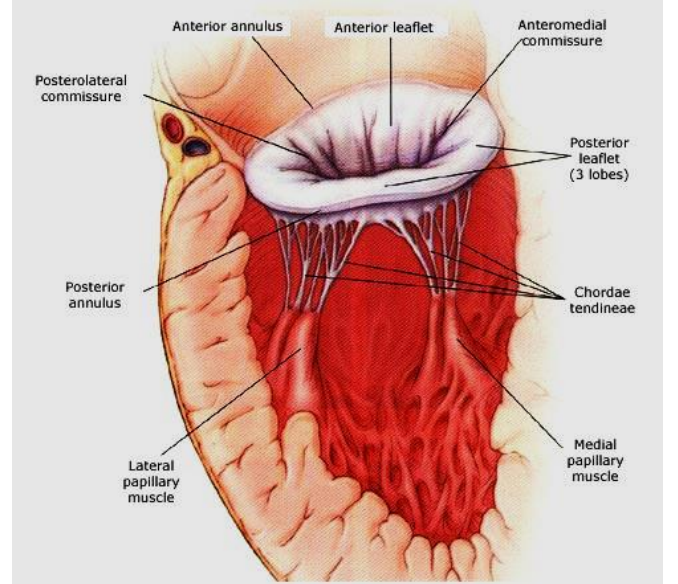
- **Mitral Valve Anatomy: the essentials**
- Functional anatomy and Surgeon's needs



Historical terminology

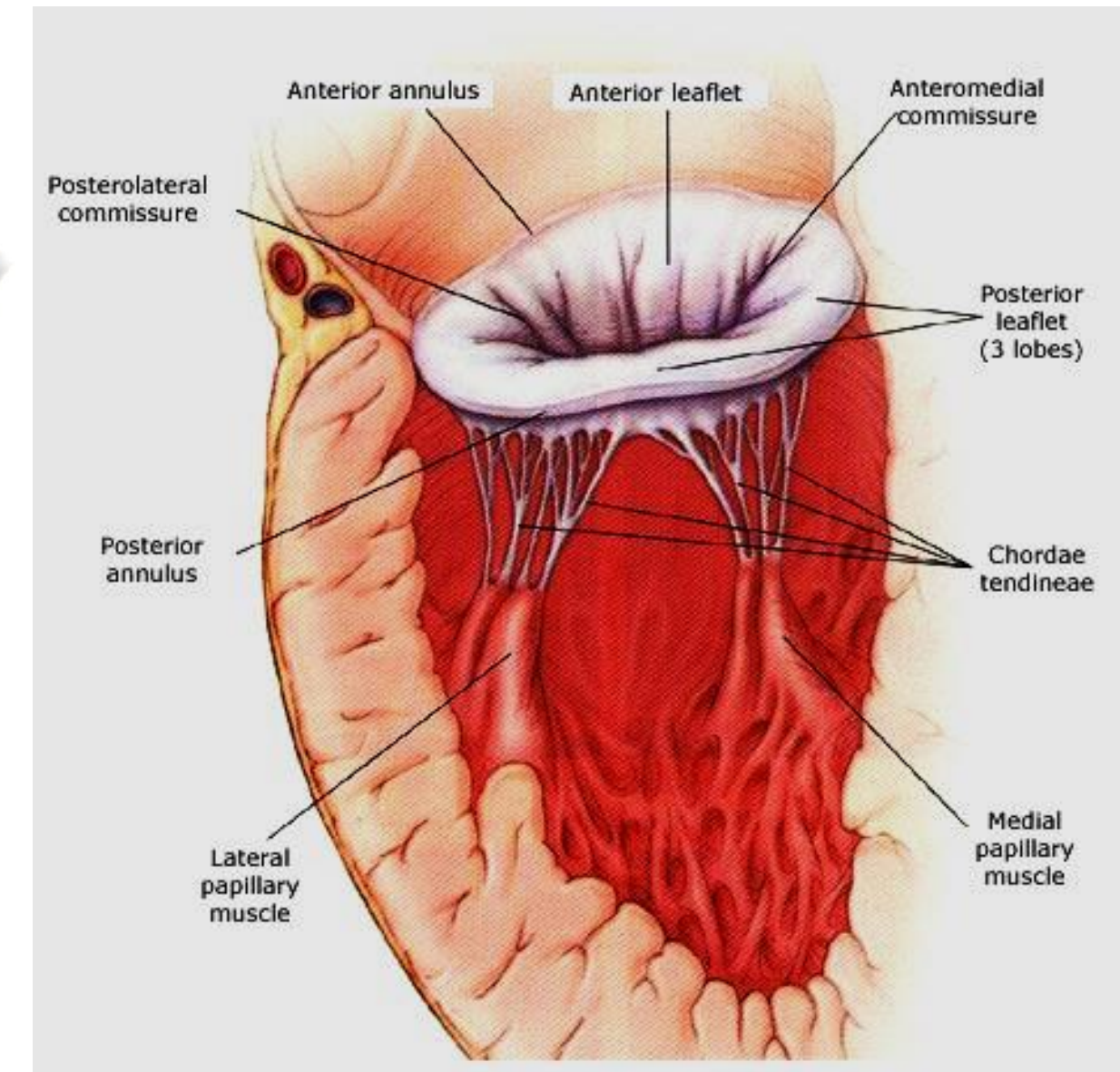
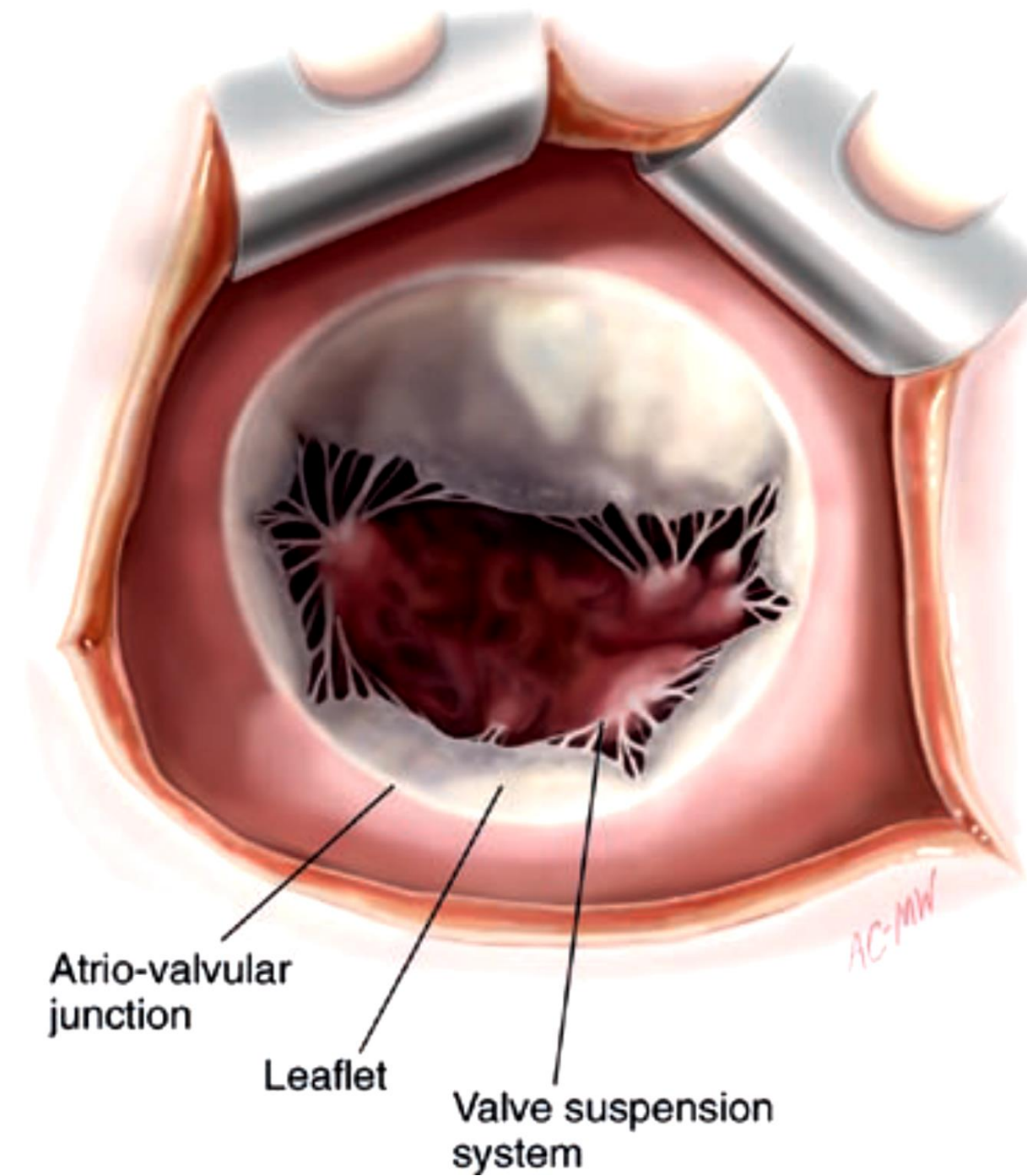


Mitral: an A-V Valve



Normal Mitral Valve Anatomy

- **A-V Junction**
- **The Leaflets**
- **The suspension system and LV**

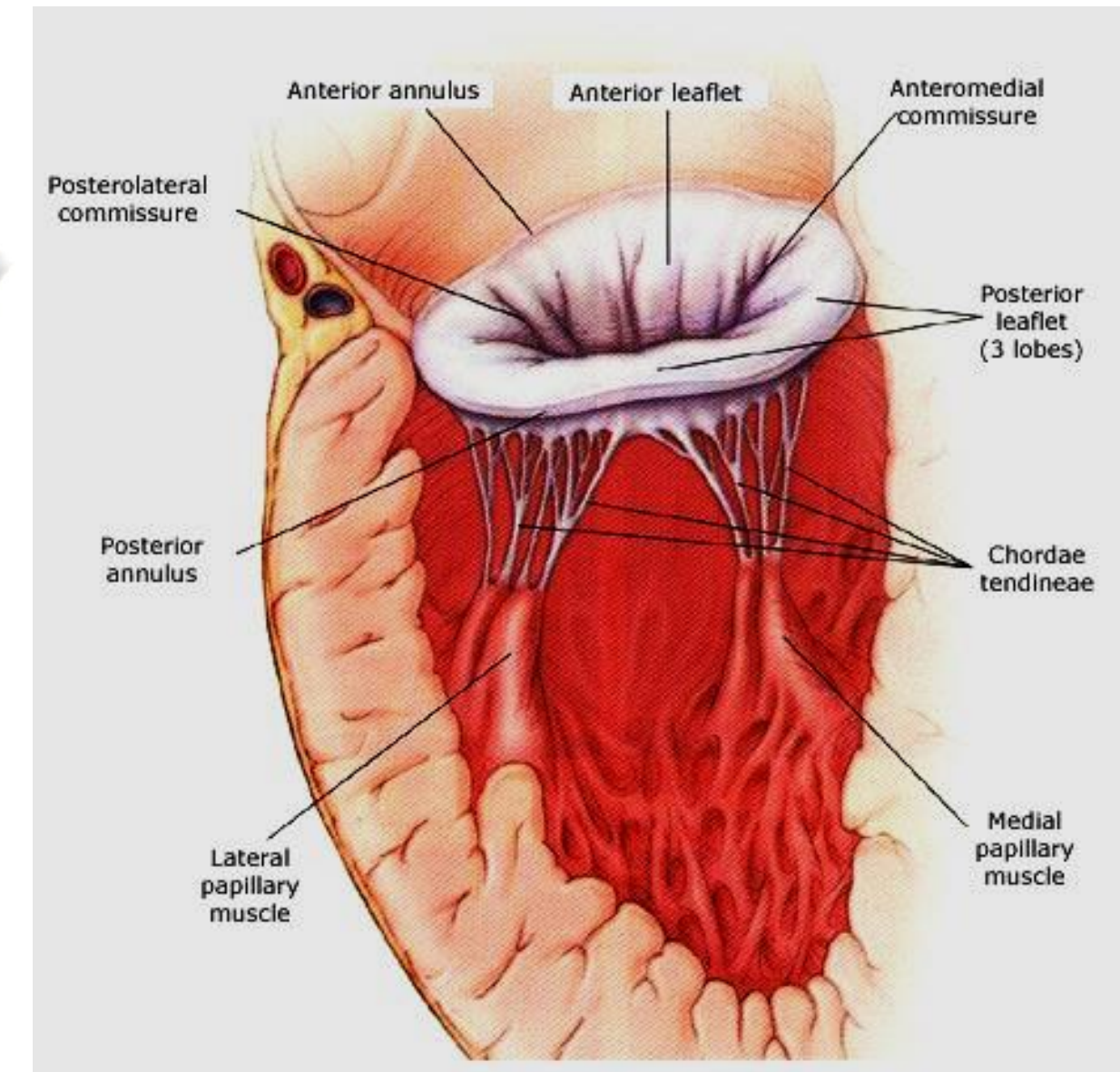
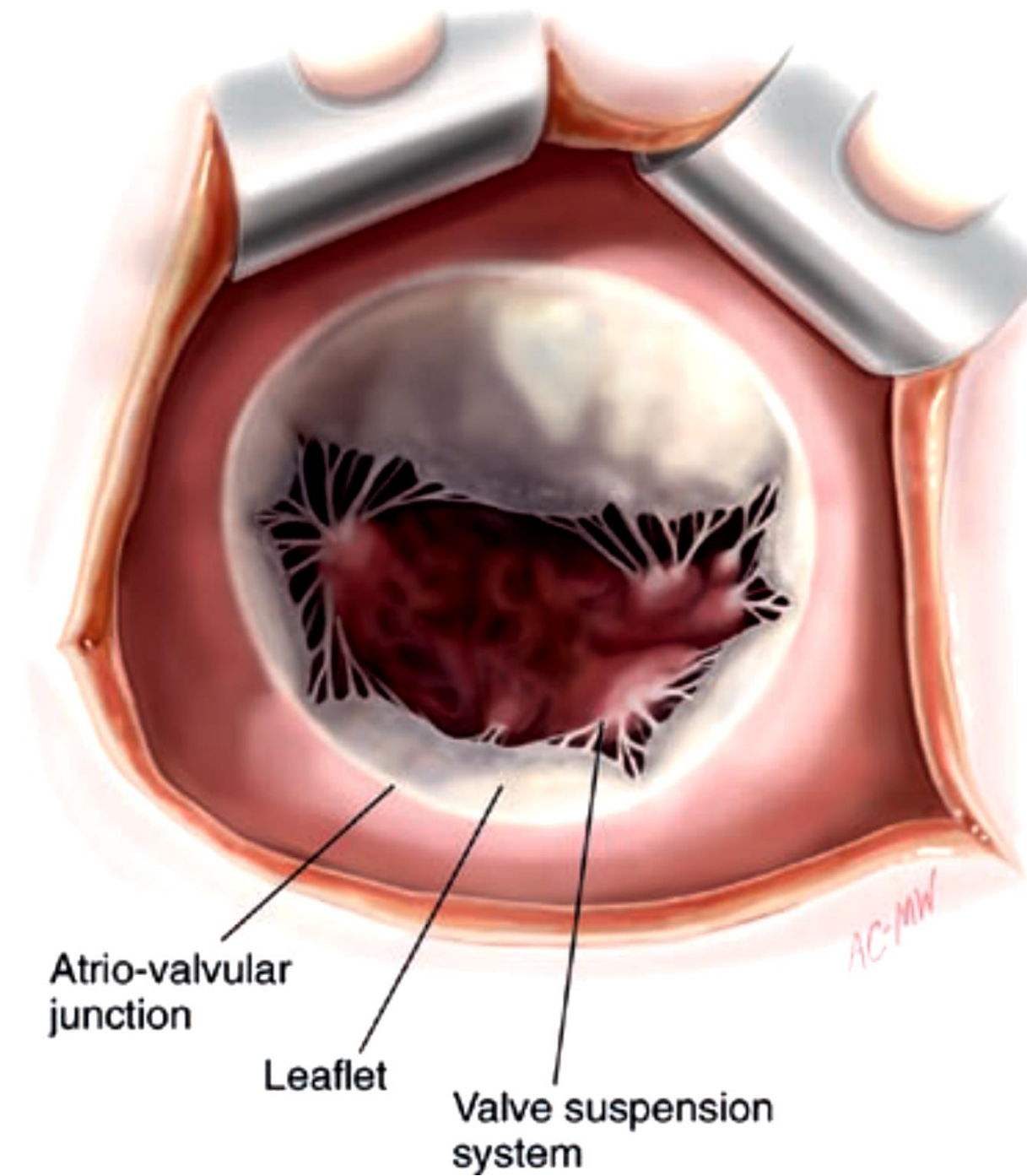


Normal Mitral Valve Anatomy

- **A-V Junction**

- The Leaflets

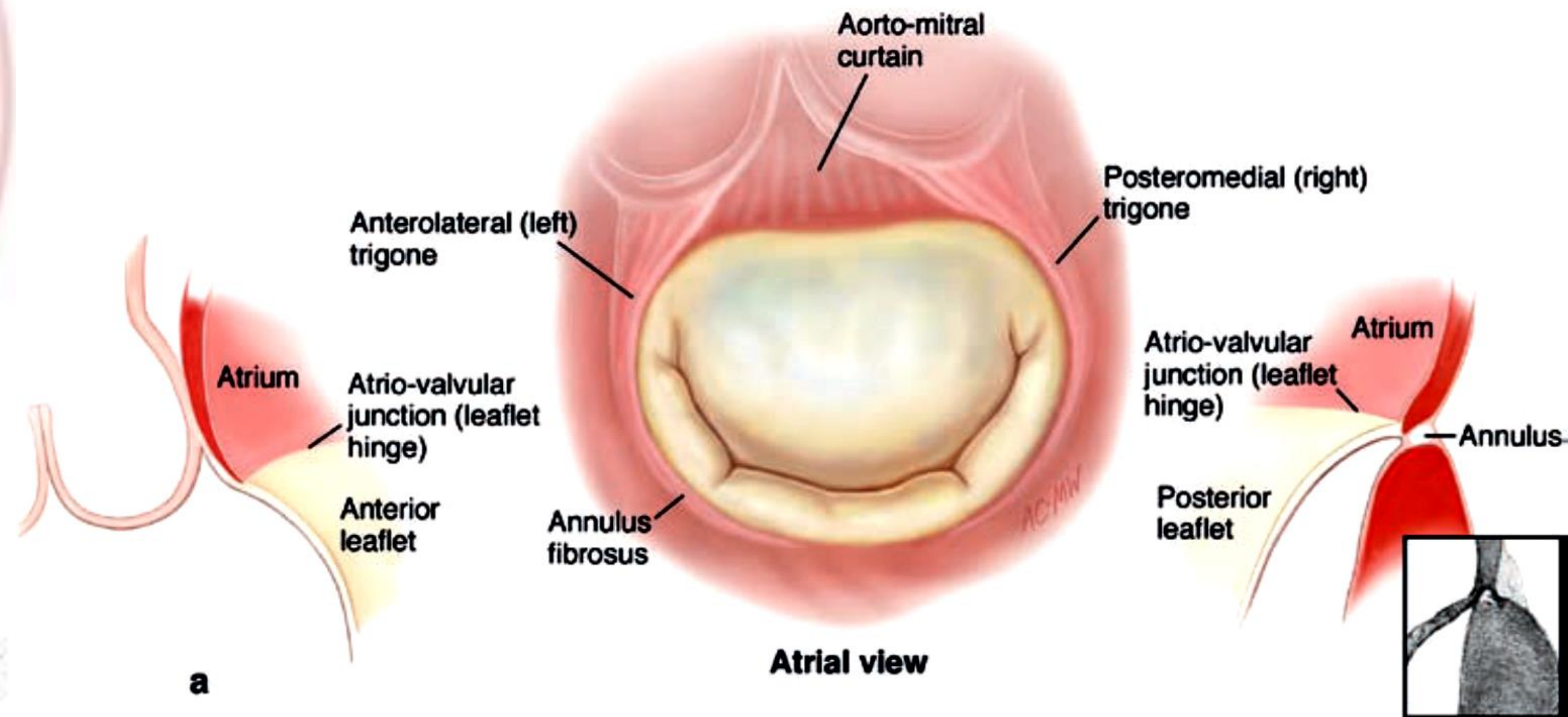
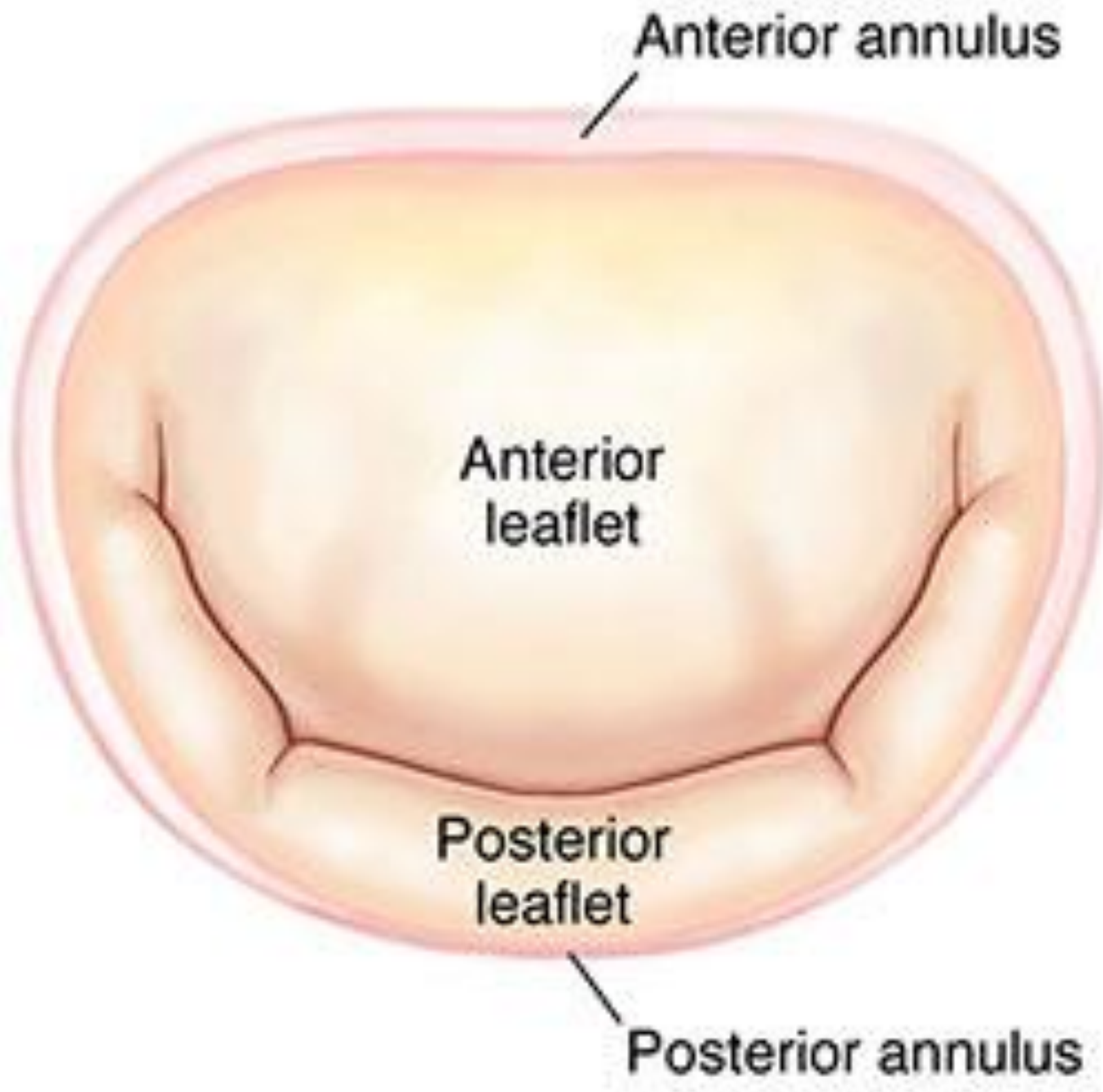
- The suspension system and LV



A-V Junction

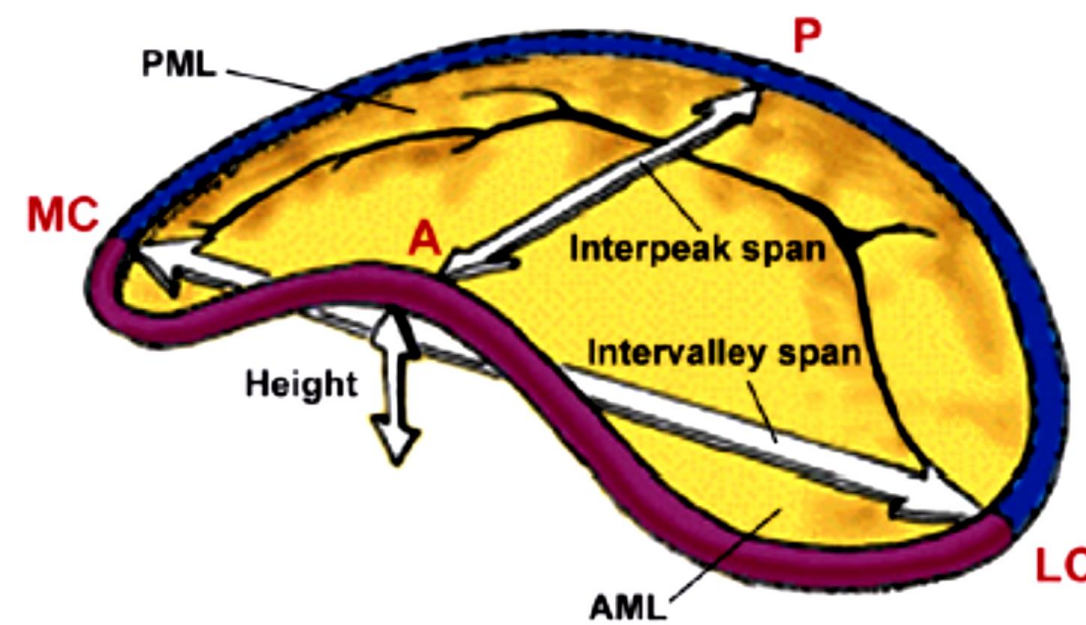
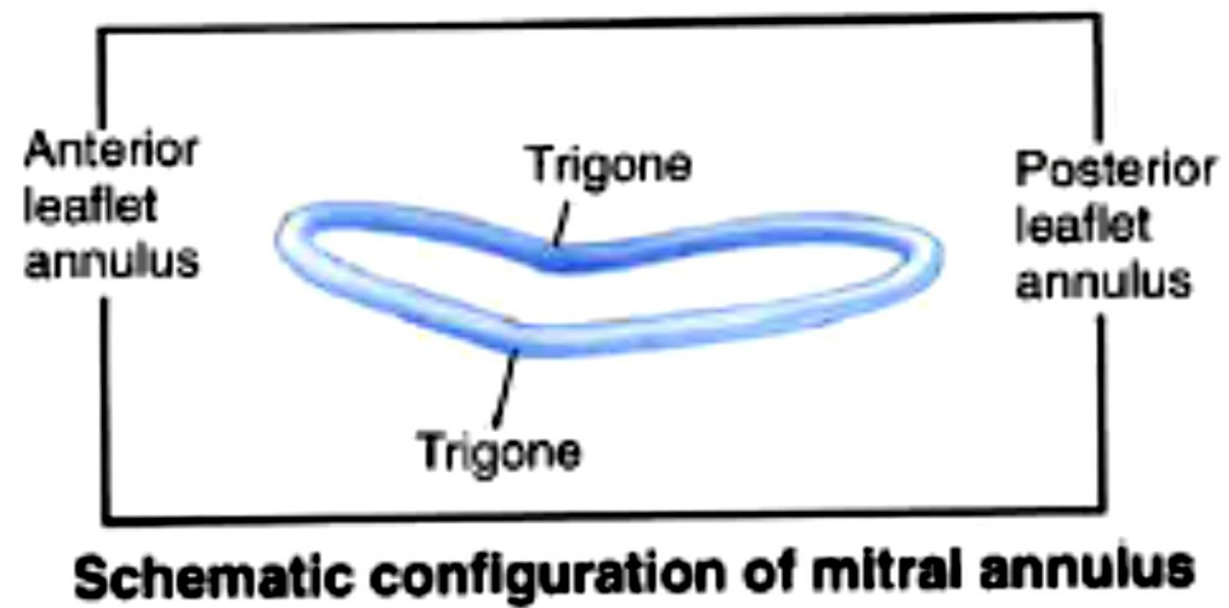
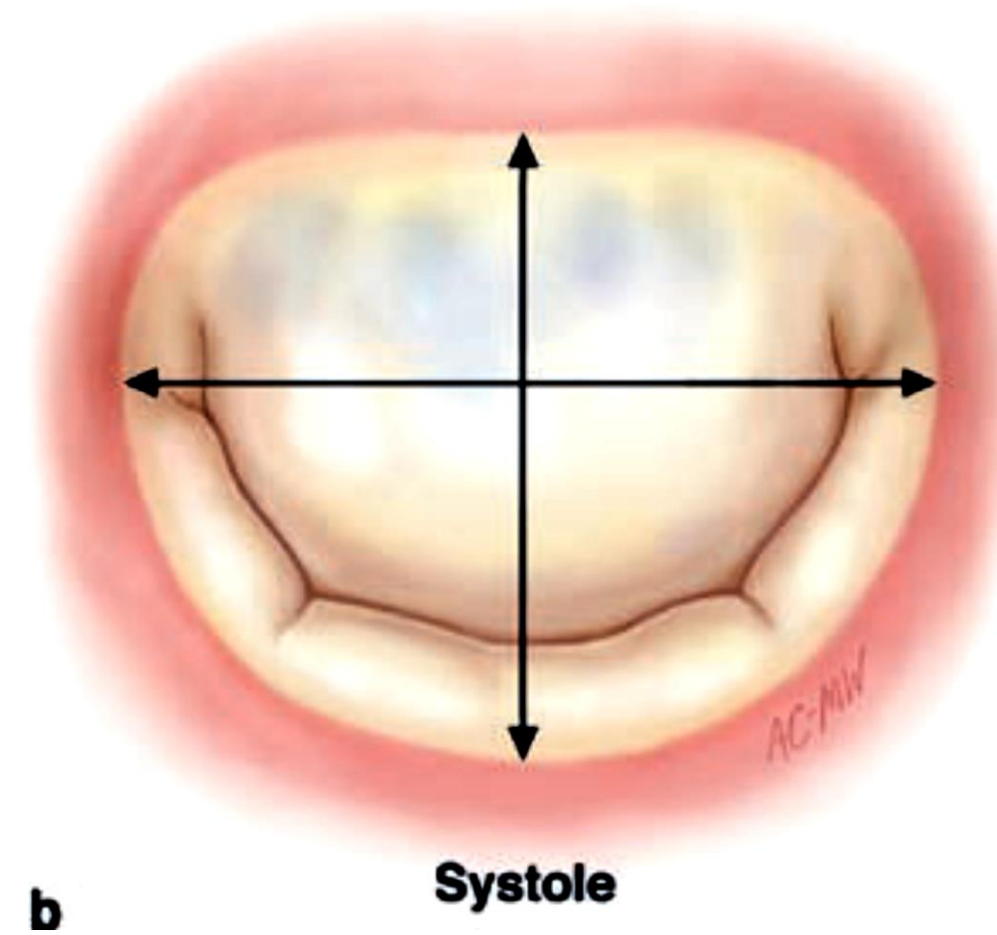
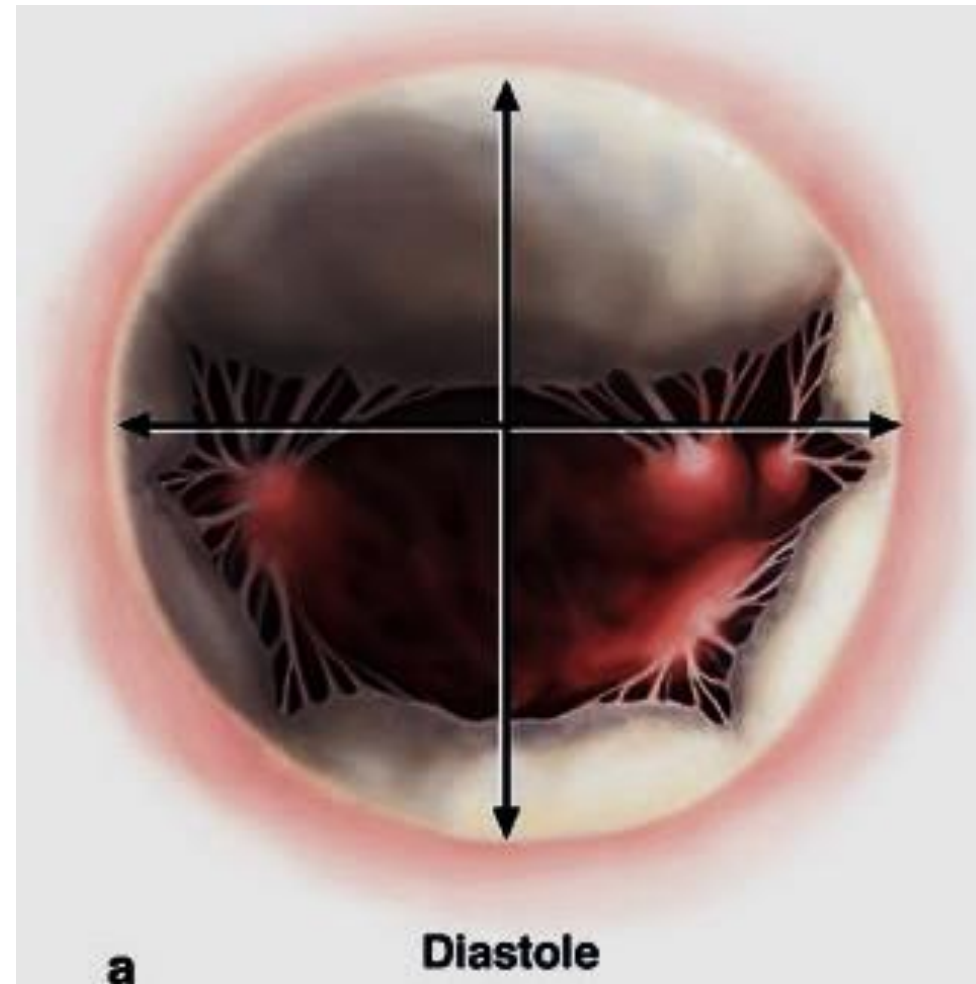
Annulus of the mitral valve is not visible from the atrium.

It is deeper and 2 mm external to the visible hinge of the leaflets



Annulus

Saddle Shape and Functional Ratio

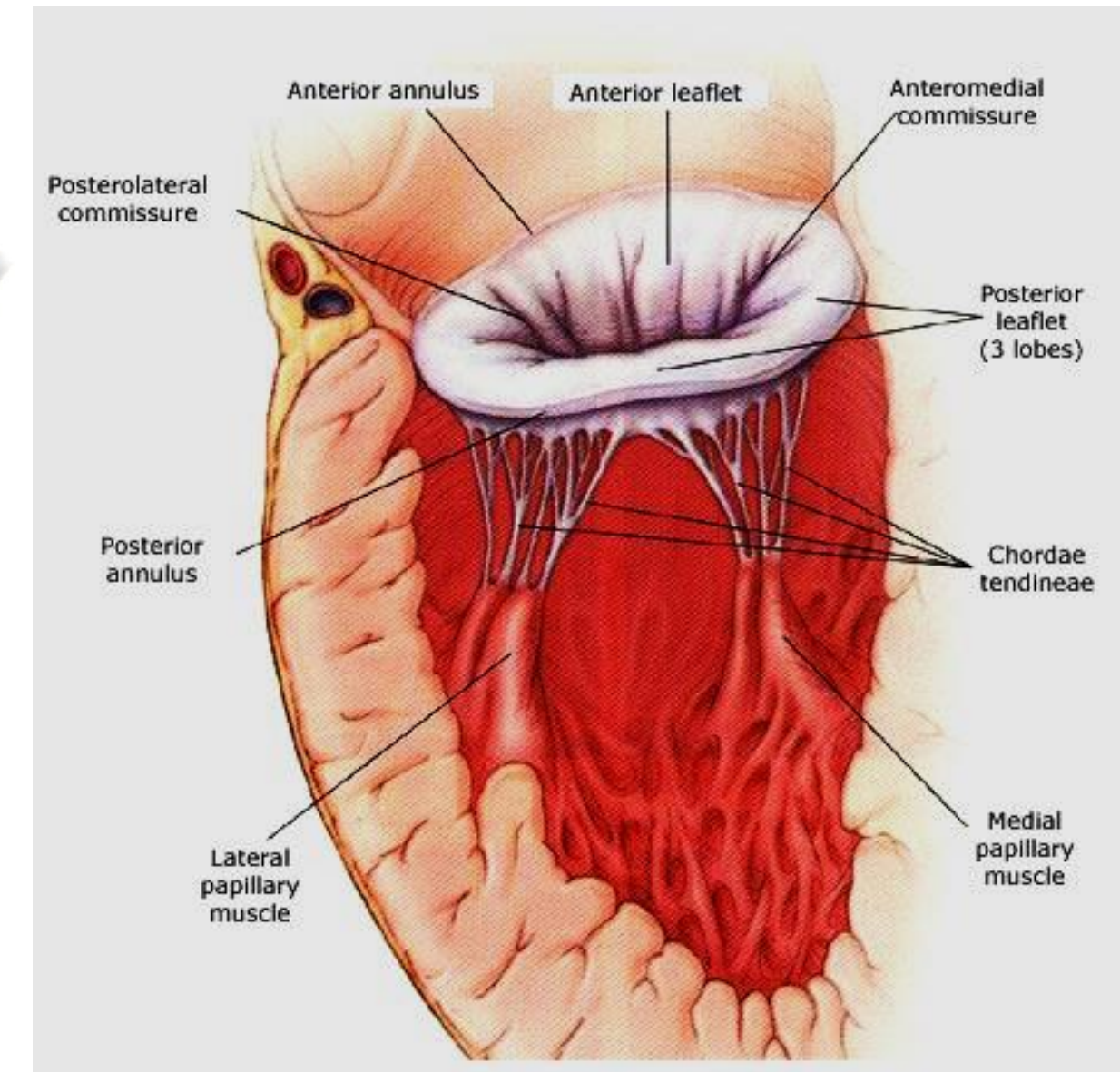
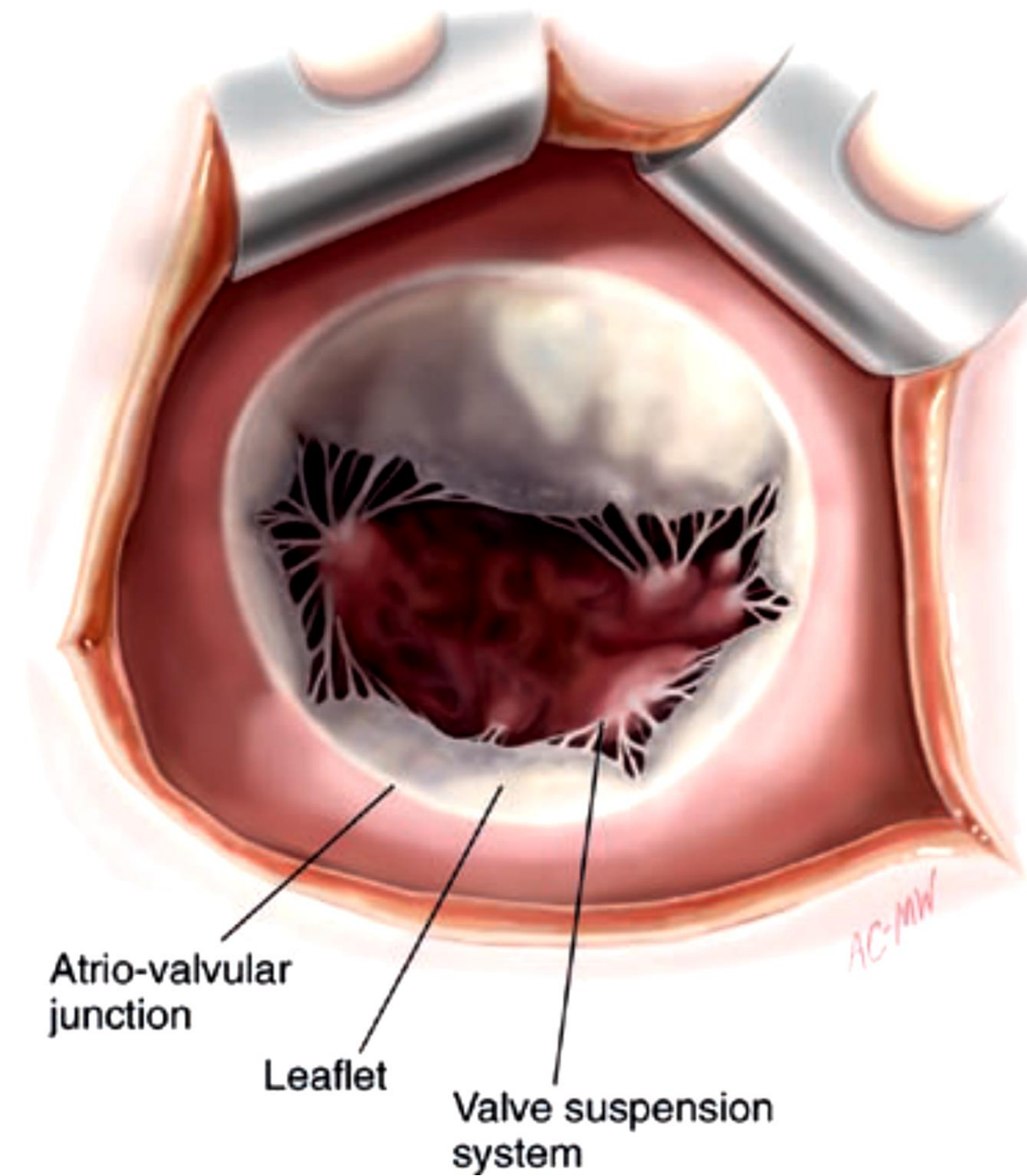


Normal Mitral Valve Anatomy

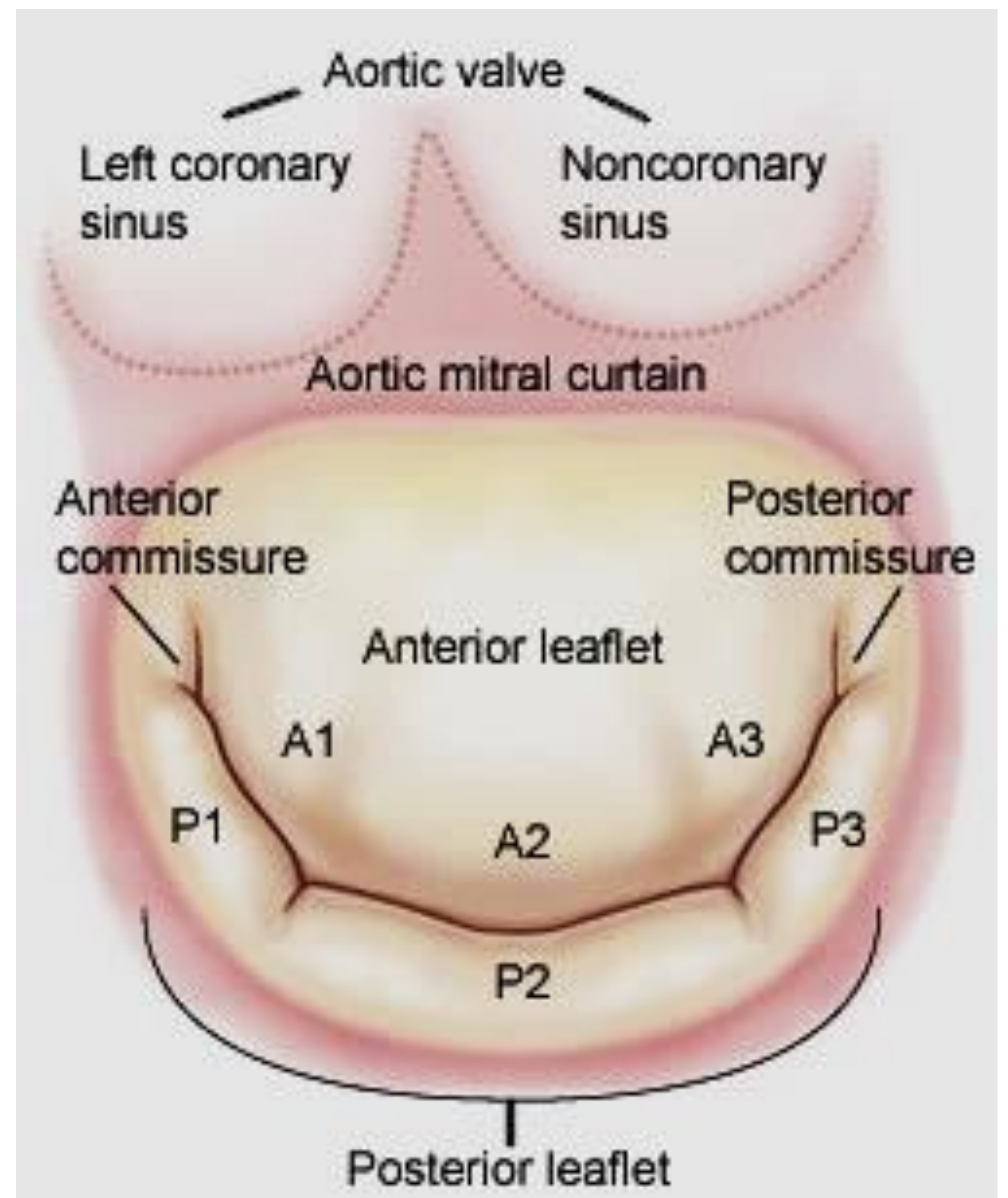
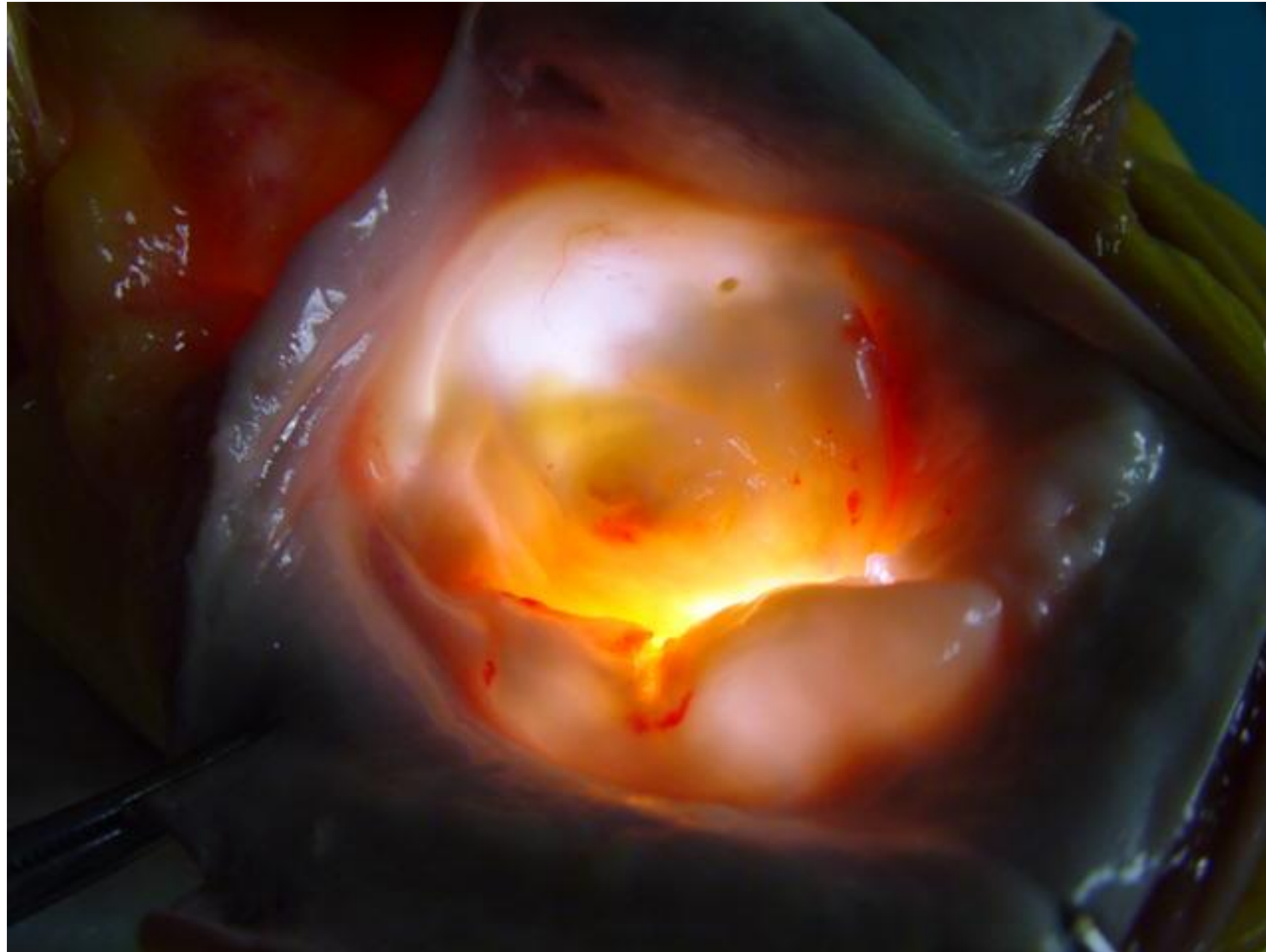
- A-V Junction

- The Leaflets

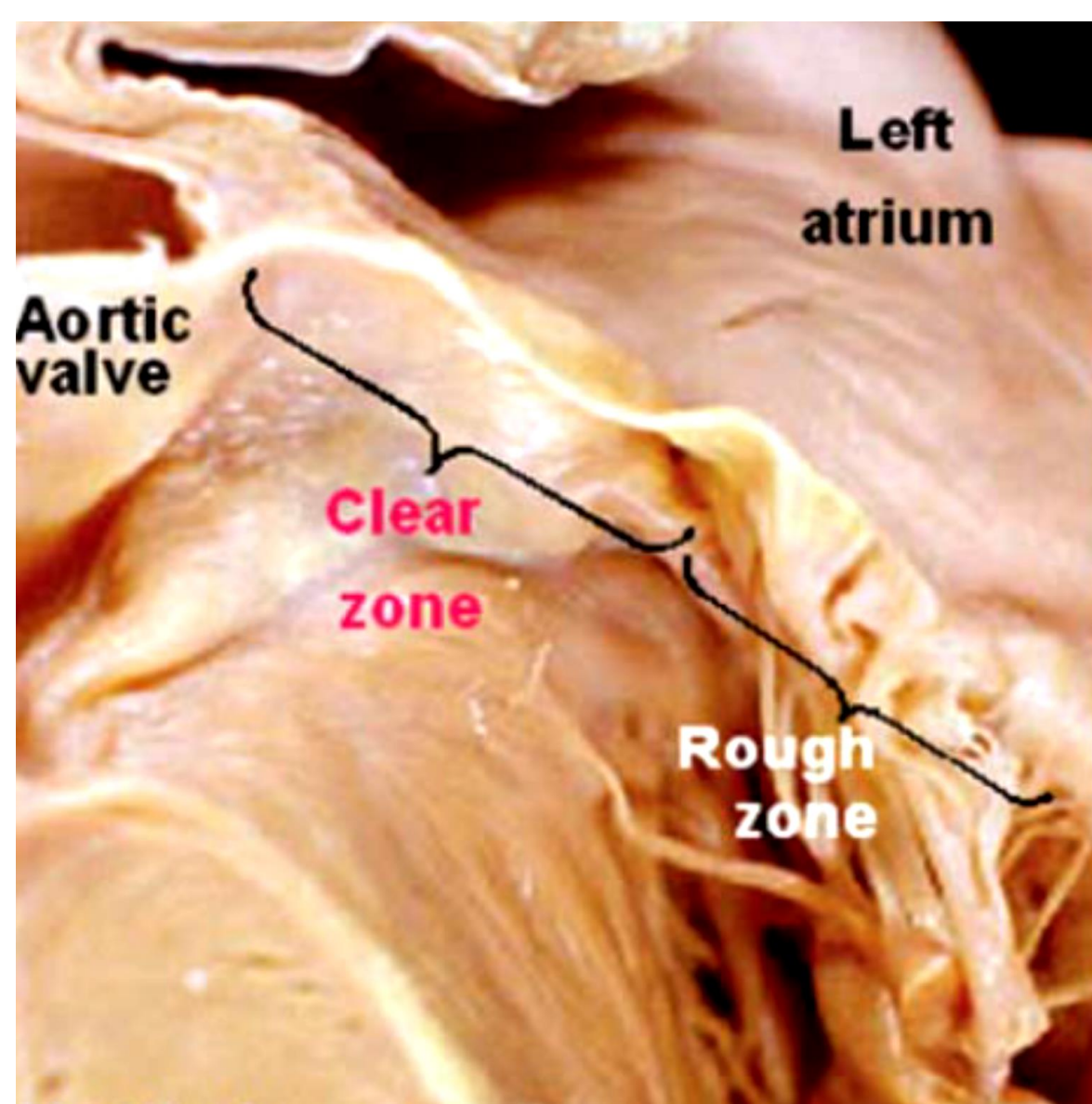
- The suspension system and LV



Mitral Leaflets

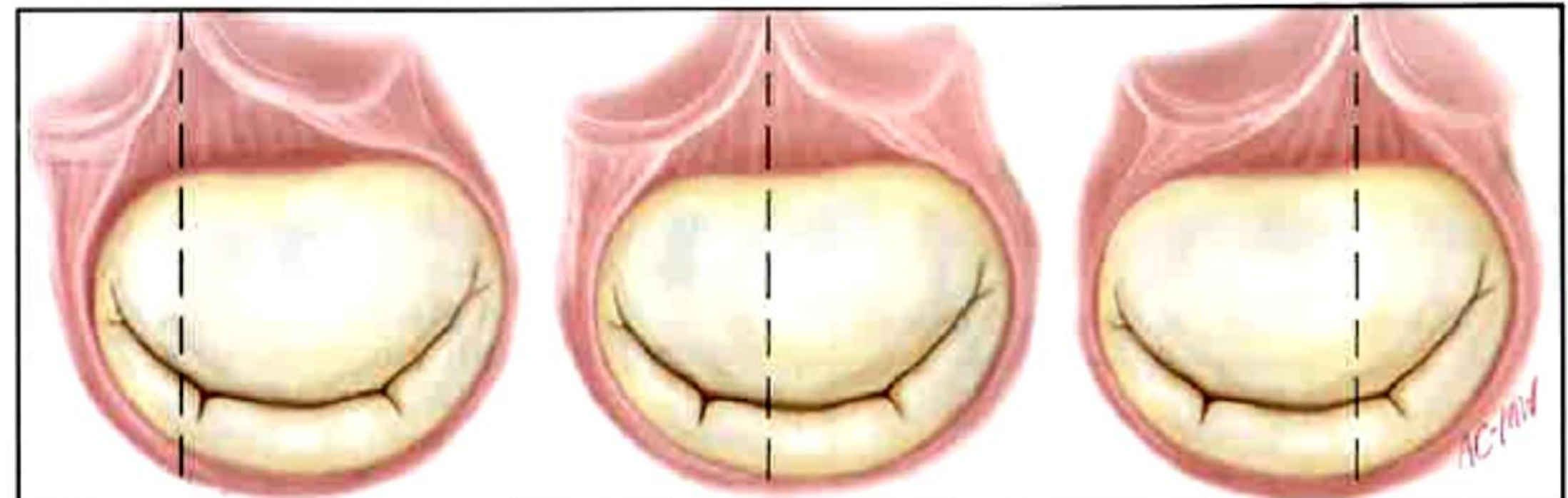


Leaflets



Dimensions of Leaflets, from Carpentier⁶

	Anterolateral Commissure	Anterior Leaflet	Posteromedial Commissure	Posterior Leaflet
Insertion length (mm)	12 ± 3.3	32 ± 1.3	17 ± 0.8	55 ± 2.2
Height (mm)	8 ± 1	23 ± 0.9	8 ± 1	P1: 9 ± 1 P2: 14 ± 0.9 P3: 10 ± 1.2
Coaptation zone height (mm)	4 ± 0.5	8 ± 1.1	4 ± 0.6	P2: 8 ± 0.9

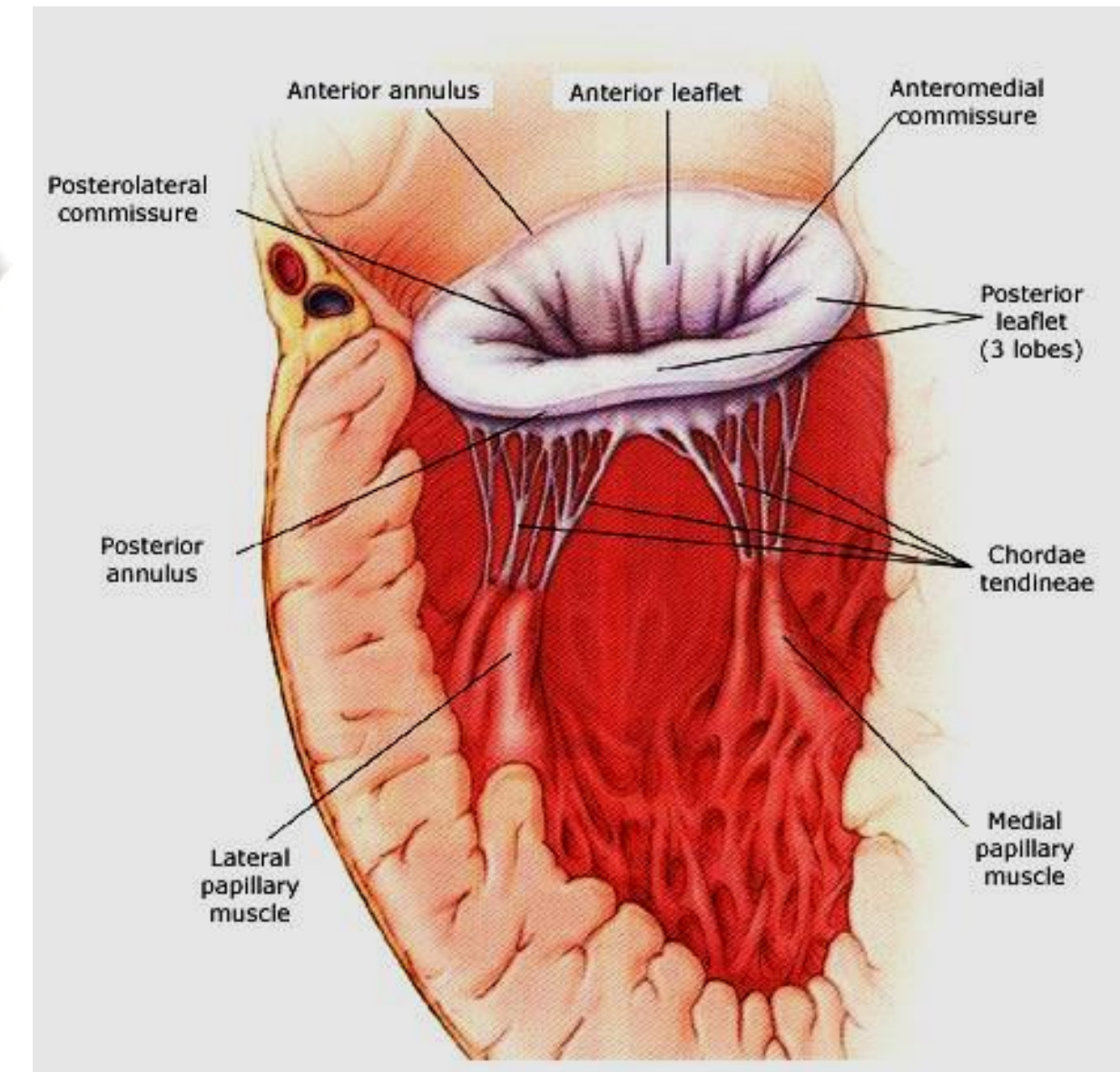
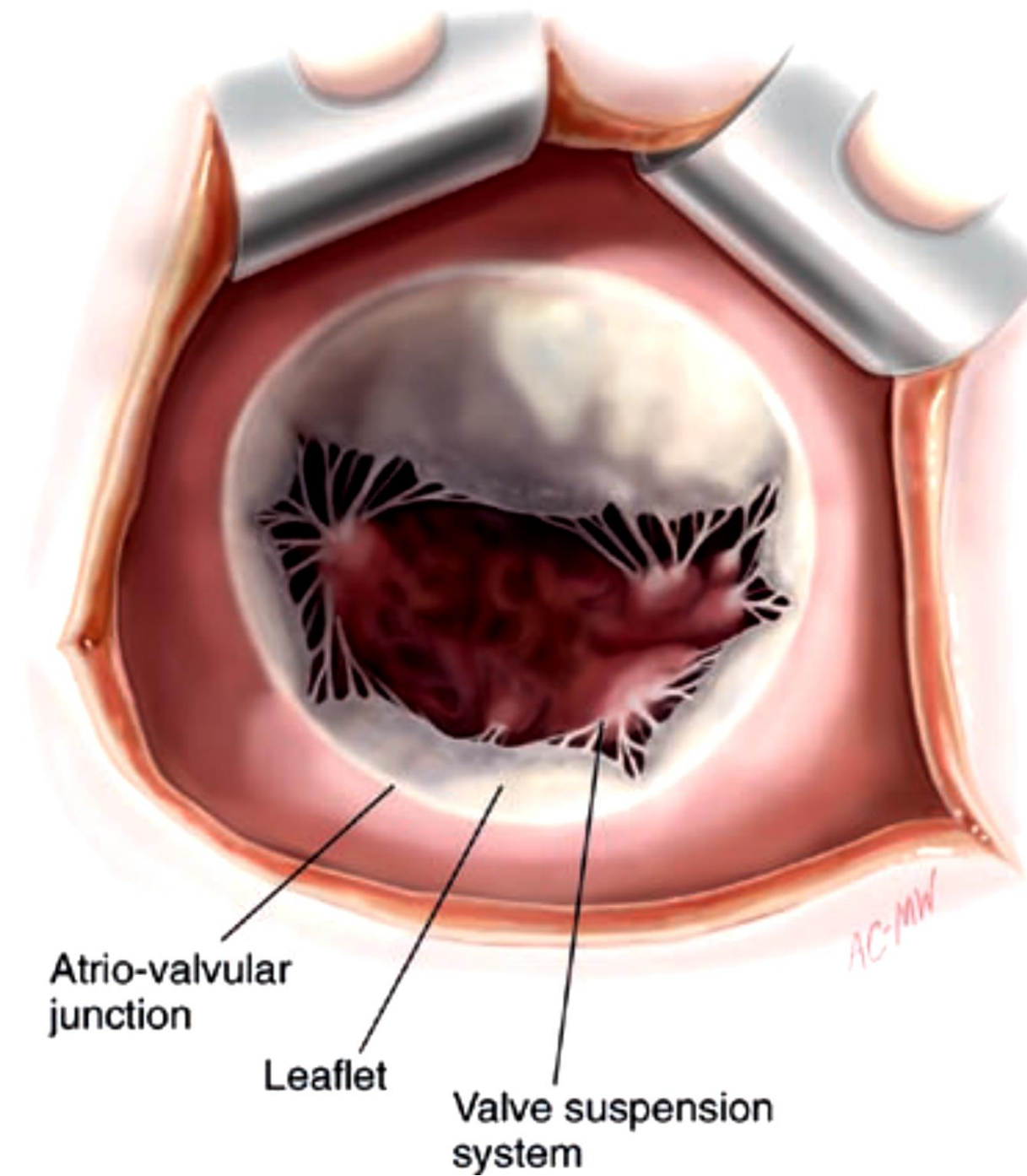


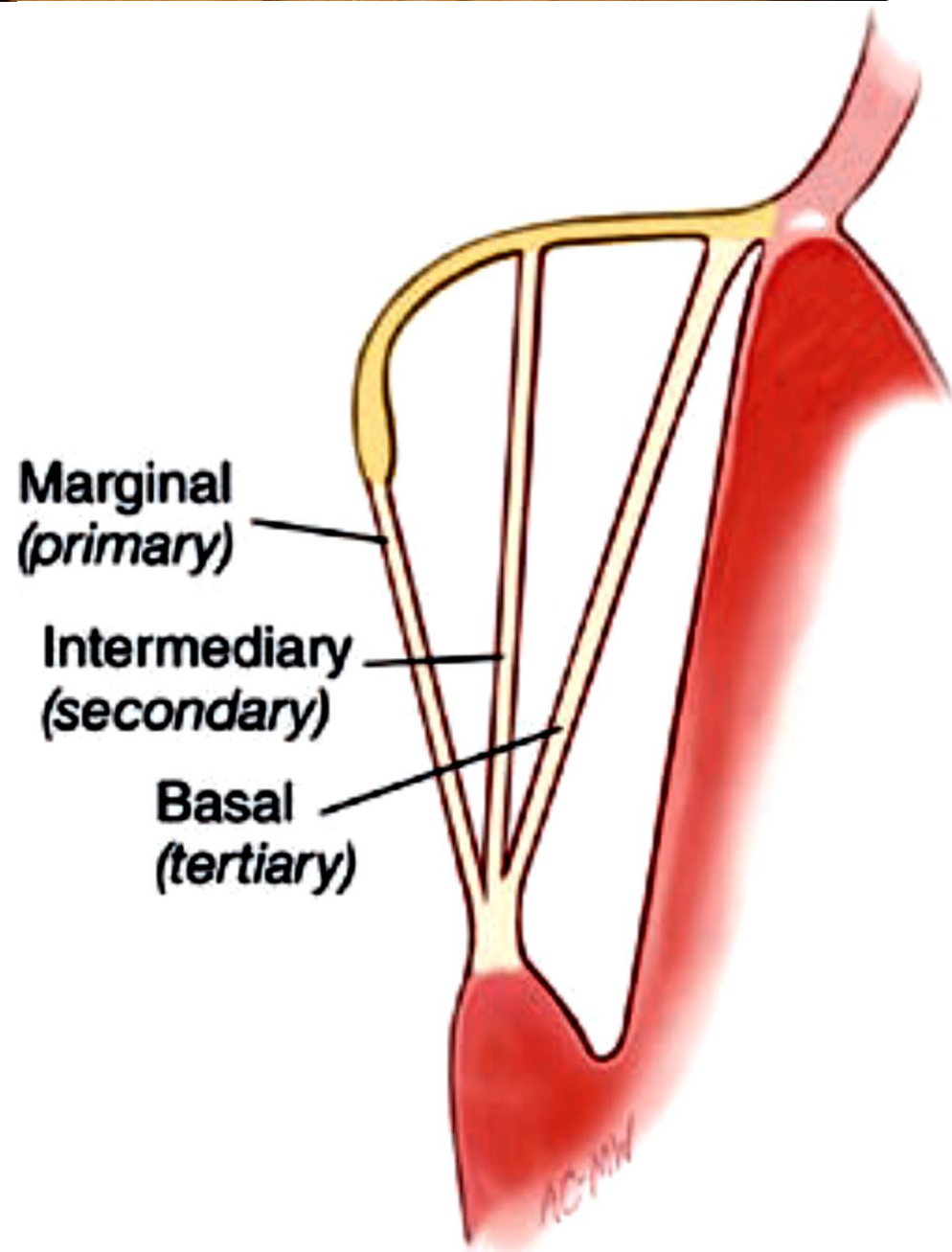
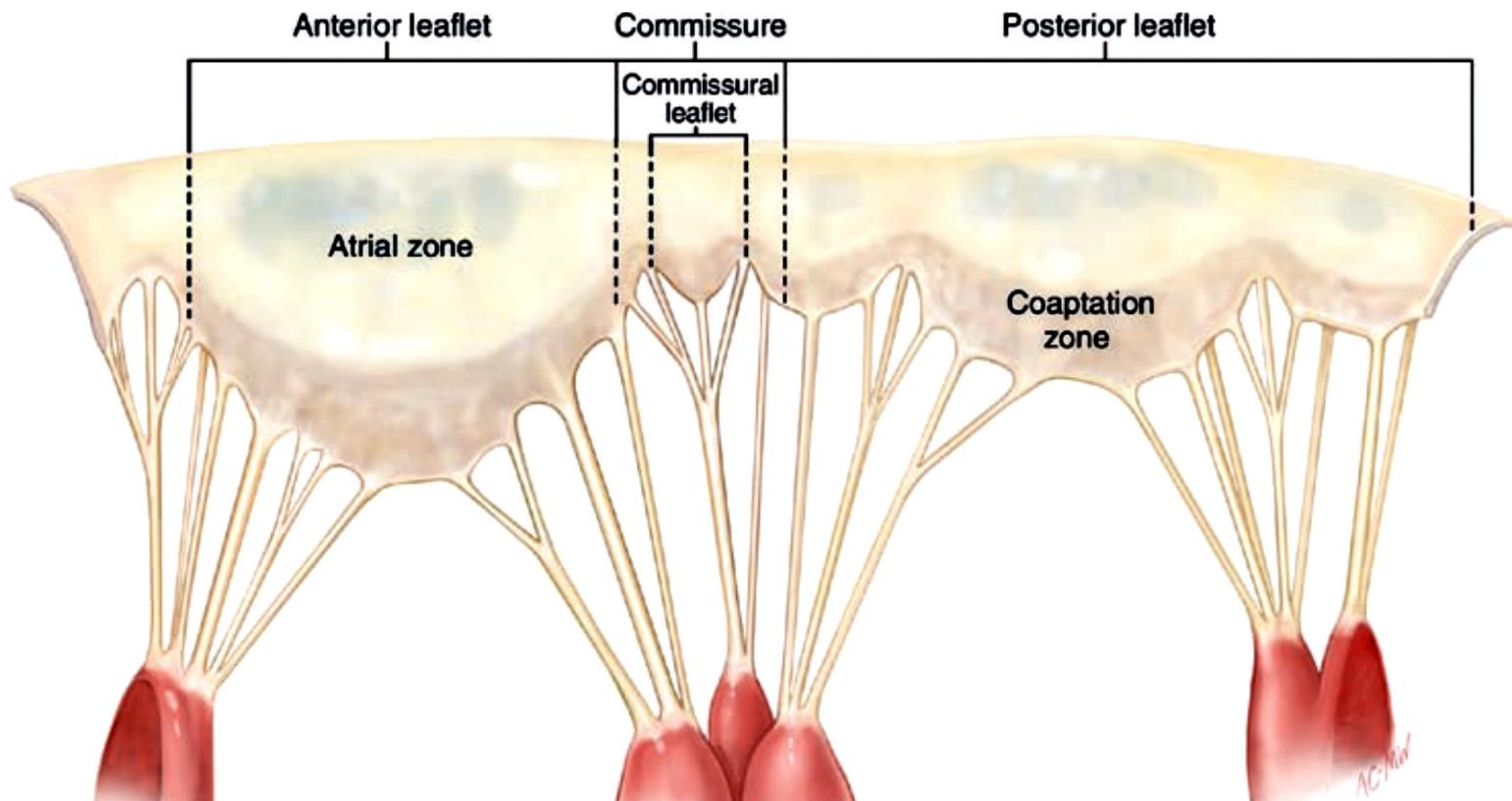
Normal Mitral Valve Anatomy

- A-V Junction

- The Leaflets

- **The suspension system and LV**

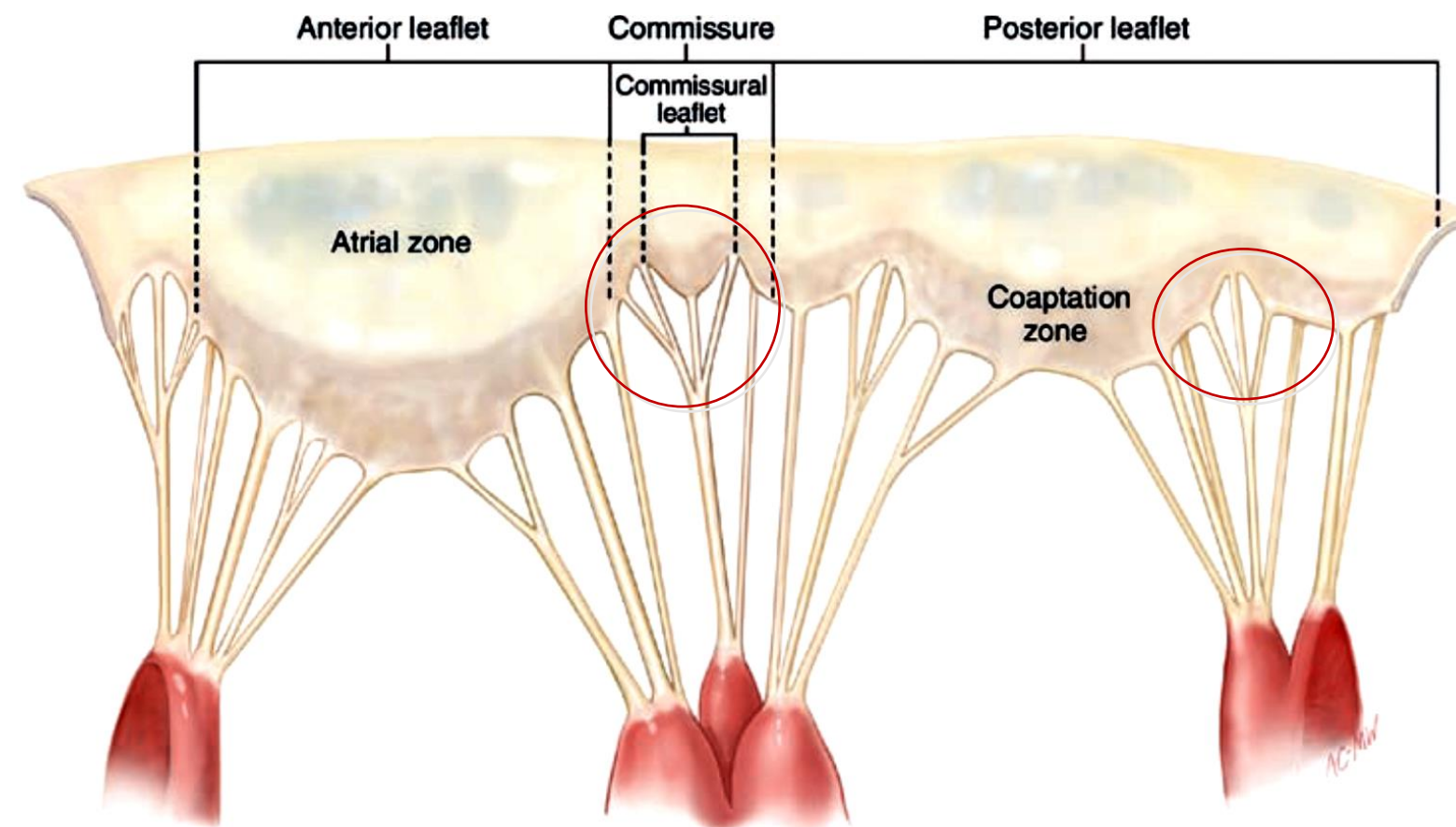
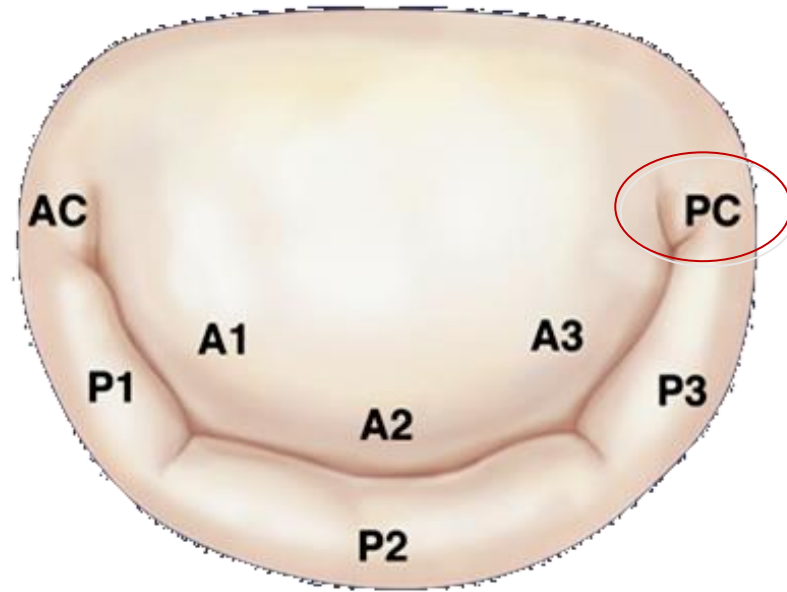




Anterior Leaflet	
Paramedial chordae	15 ± 0.5 mm
Main postero-medial chordae	17 ± 0.2 mm
Main antero-lateral chordae	19 ± 0.4 mm
Para-commissural chordae	17 ± 0.5 mm
Posterior Leaflet (P2)	
Marginal chordae	14 ± 2.9 mm
Intermediary chordae	14 to 8 mm
Basal chordae	8 ± 1.7 mm
Commissures	
Antero-lateral	13 ± 0.2 mm
Postero-medial	15 ± 0.1 mm

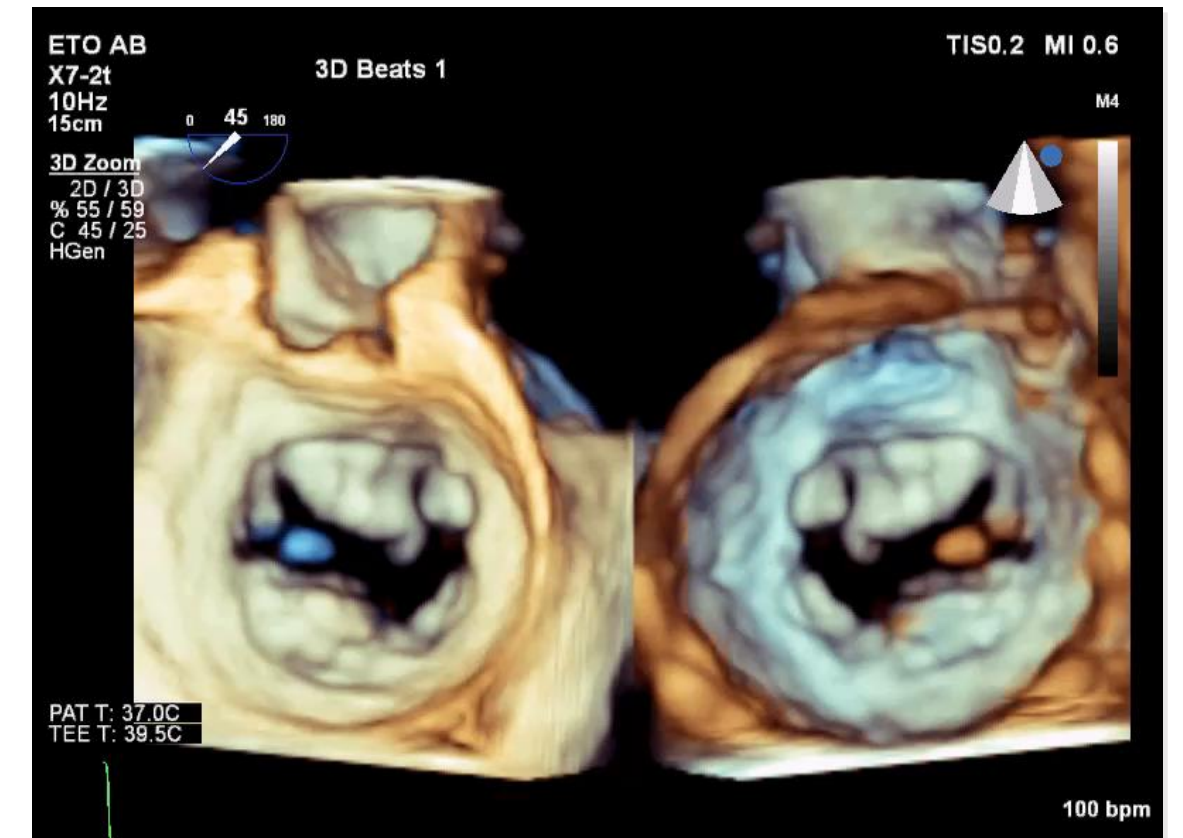
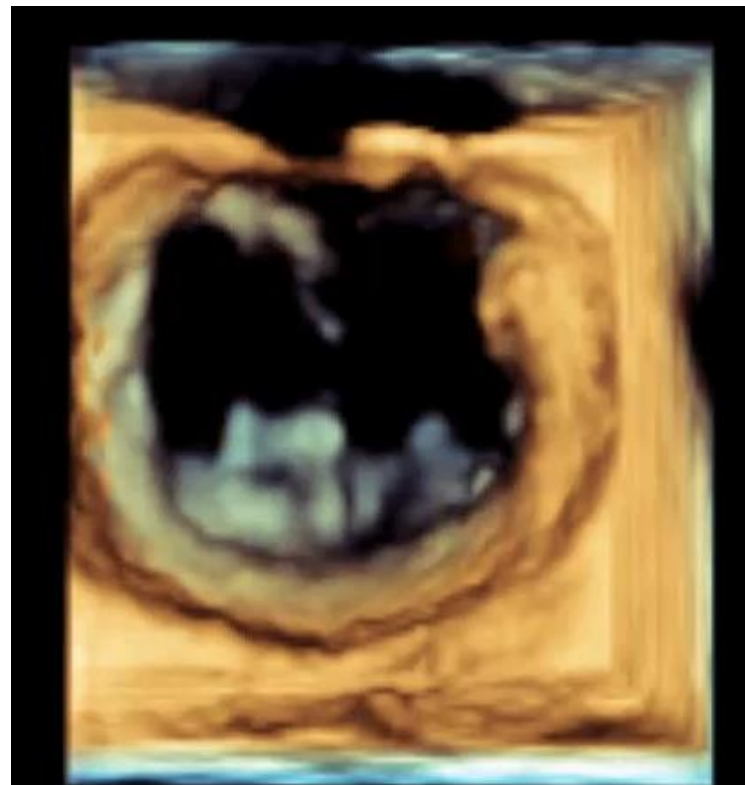
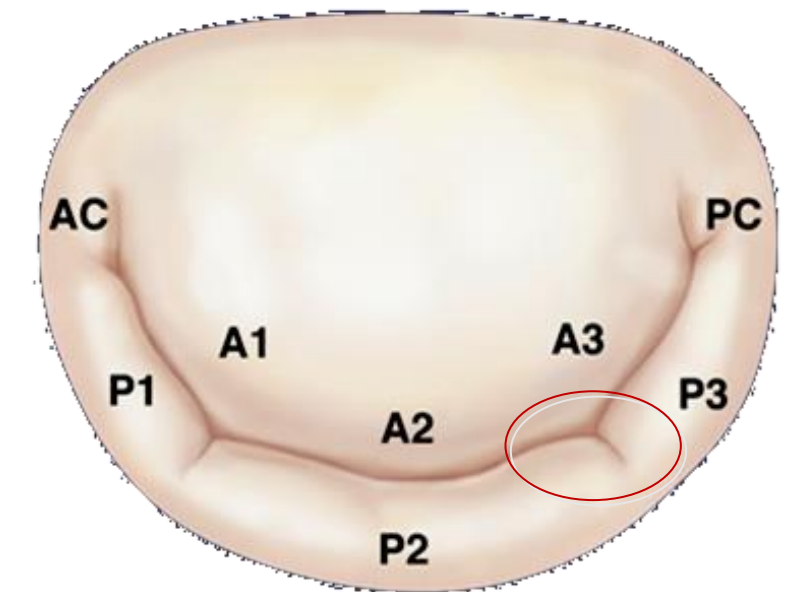
« Fan Shape » chordae: to optimize a full opening motion

Commissure

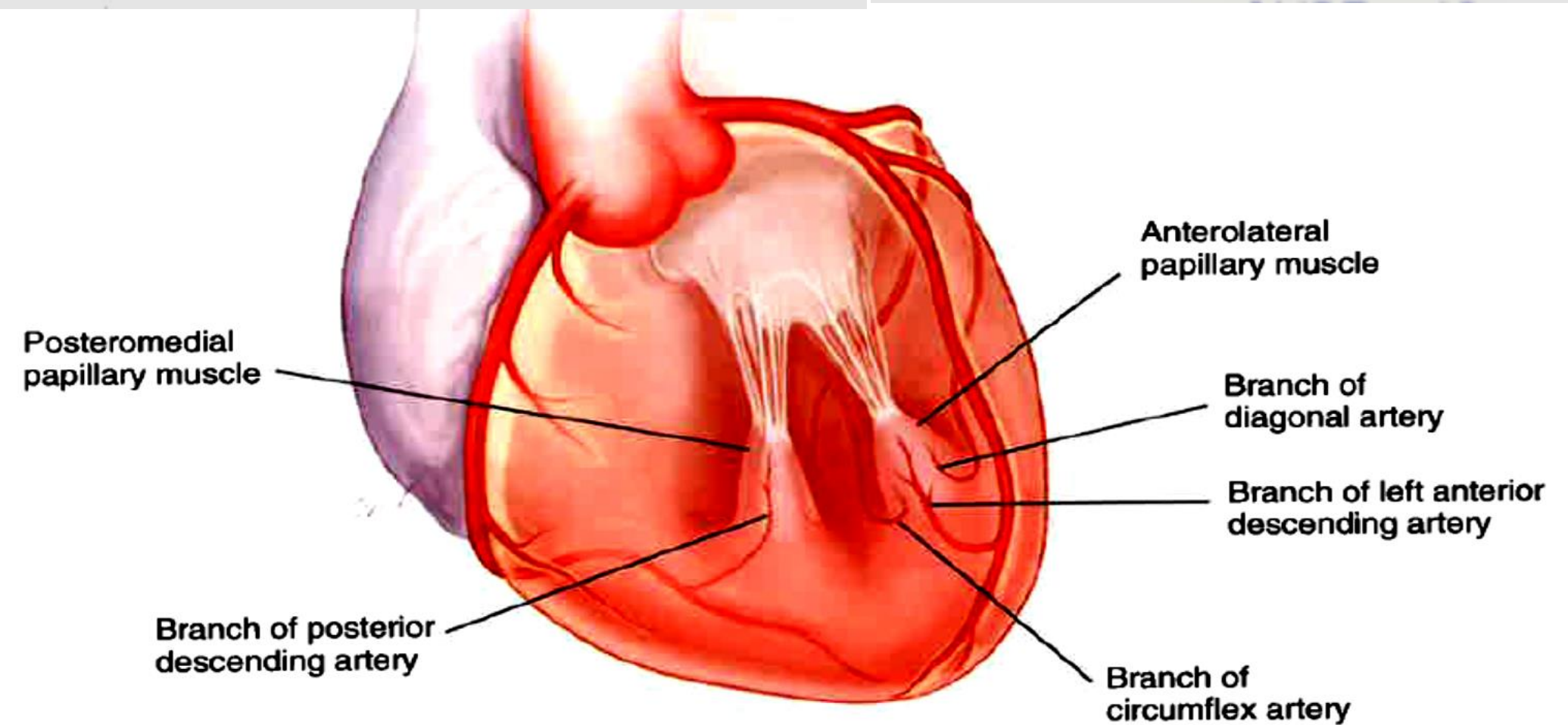
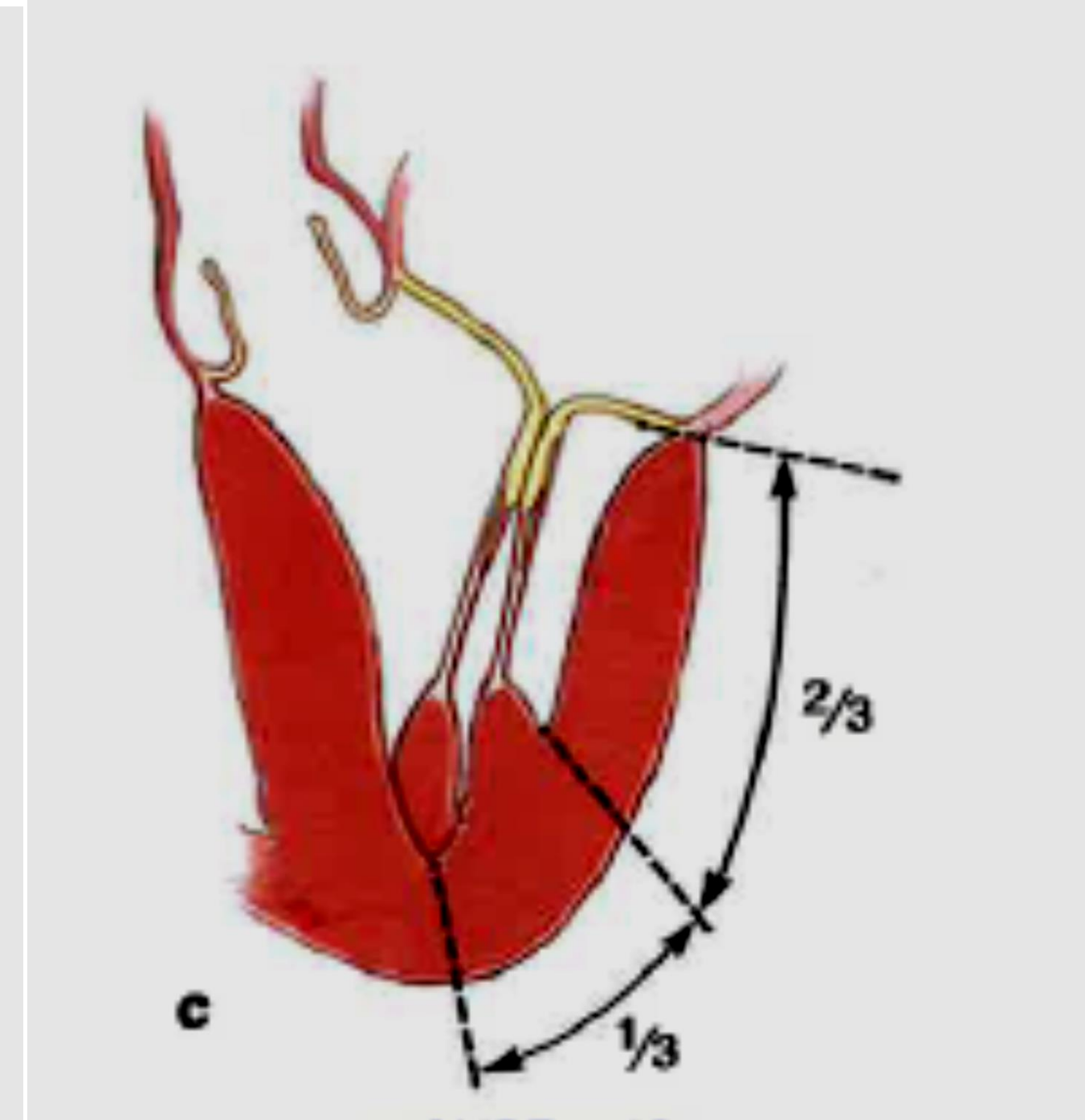
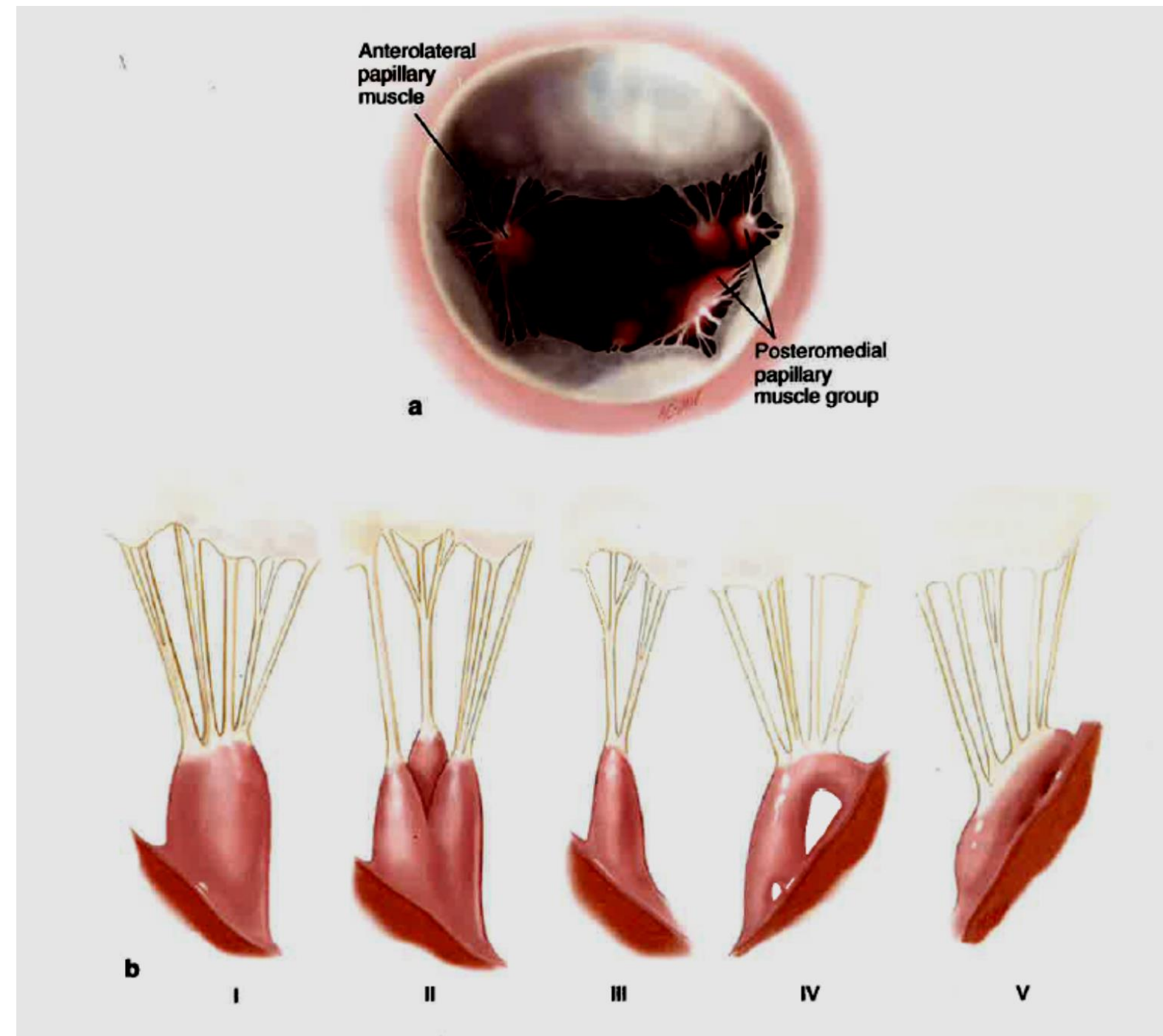
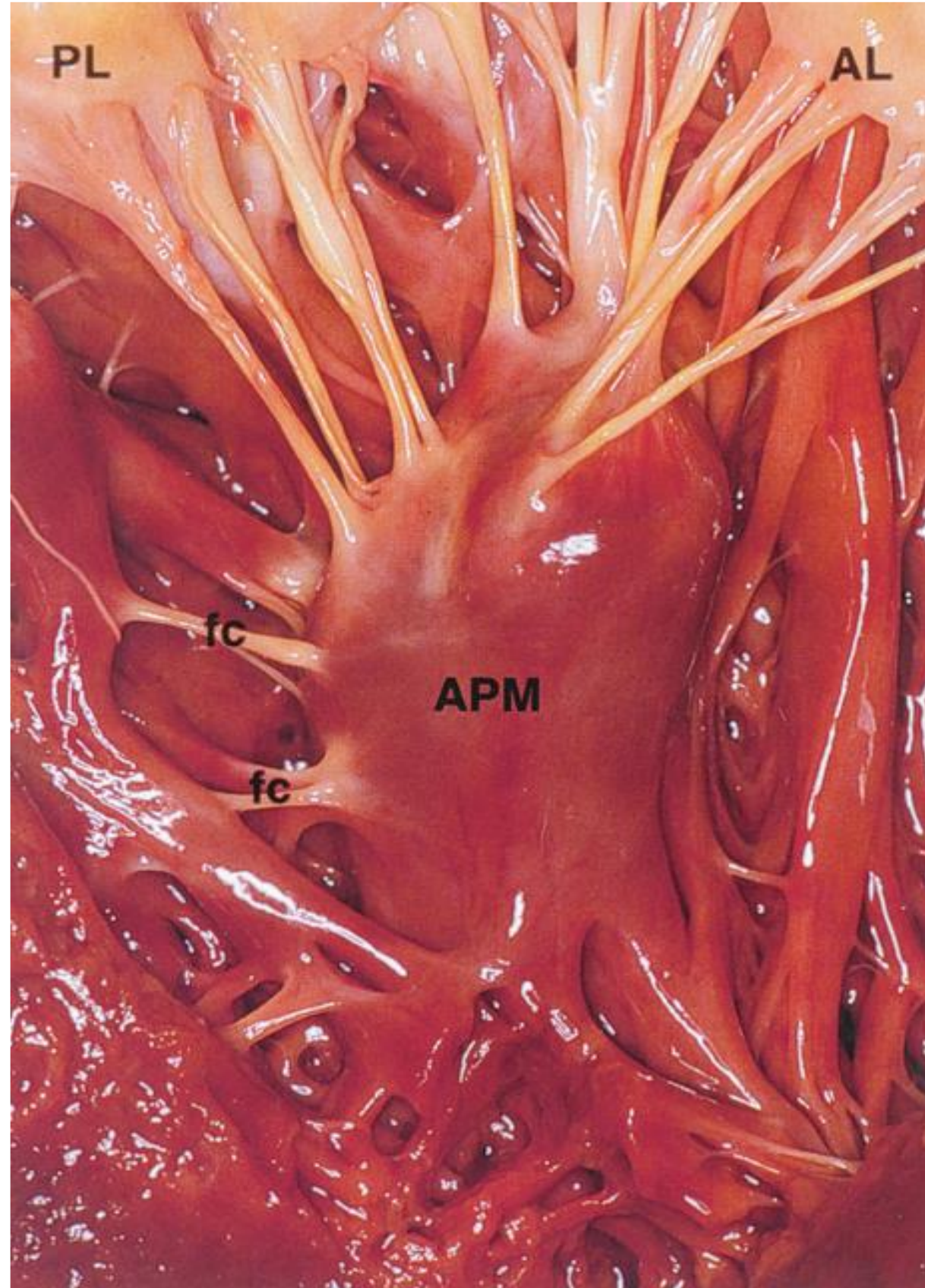


From Carpentier's Reconstructive Valve Surgery Elsevier Inc. © 2010

Indentation



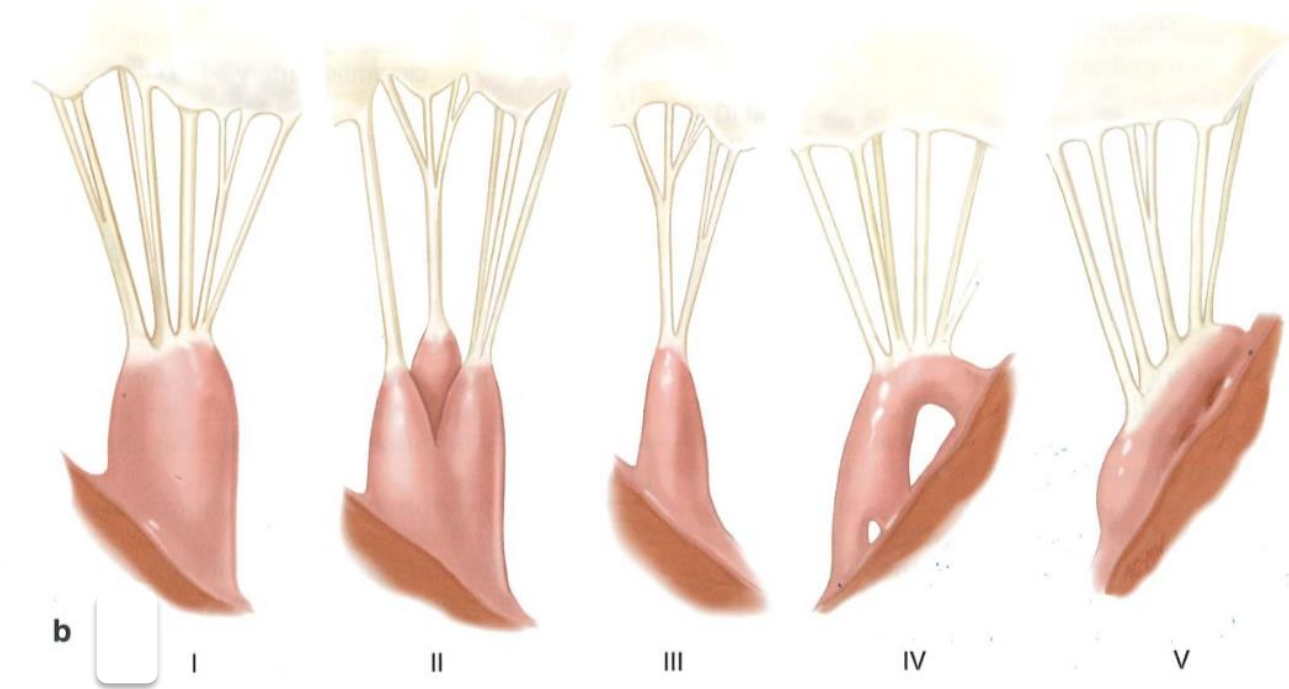
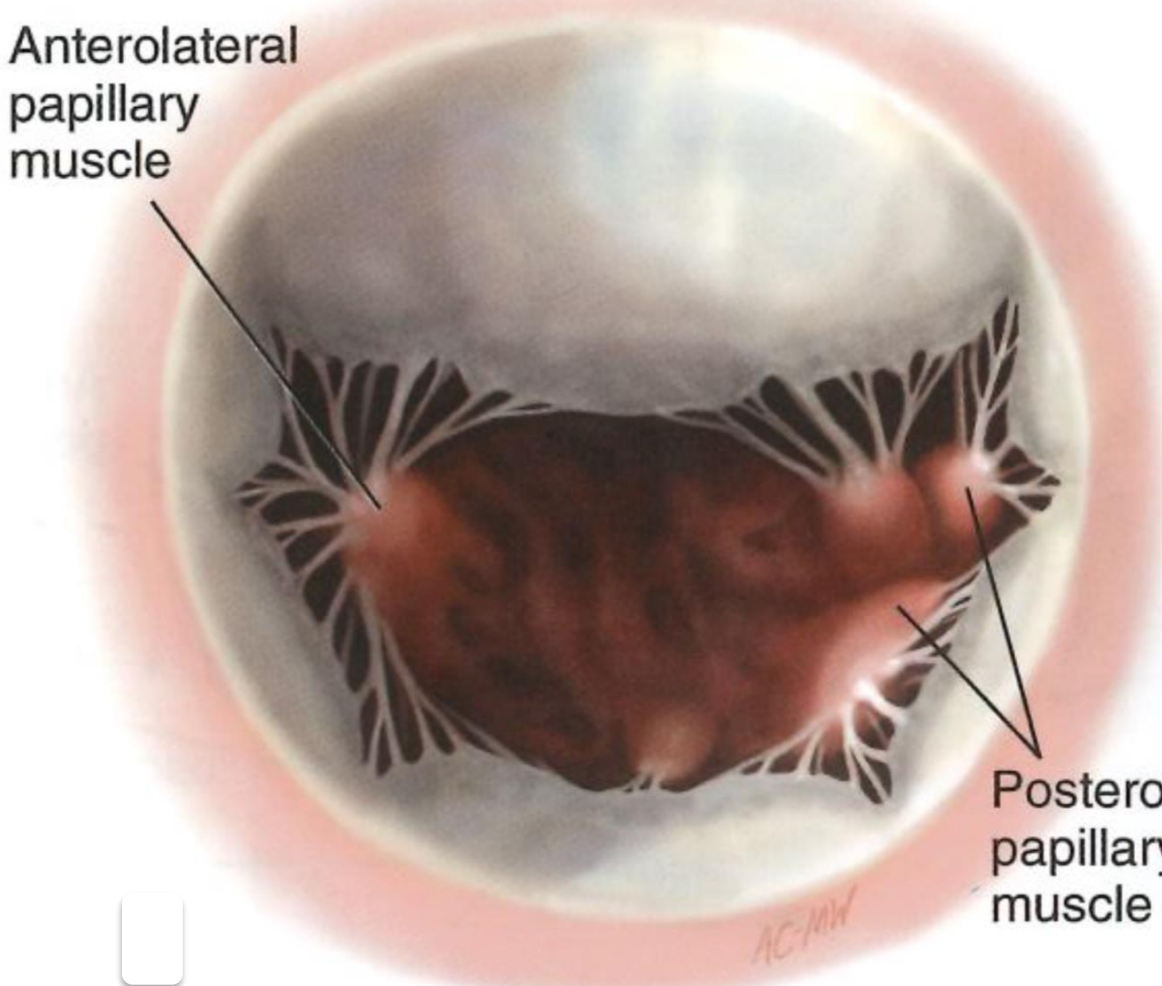
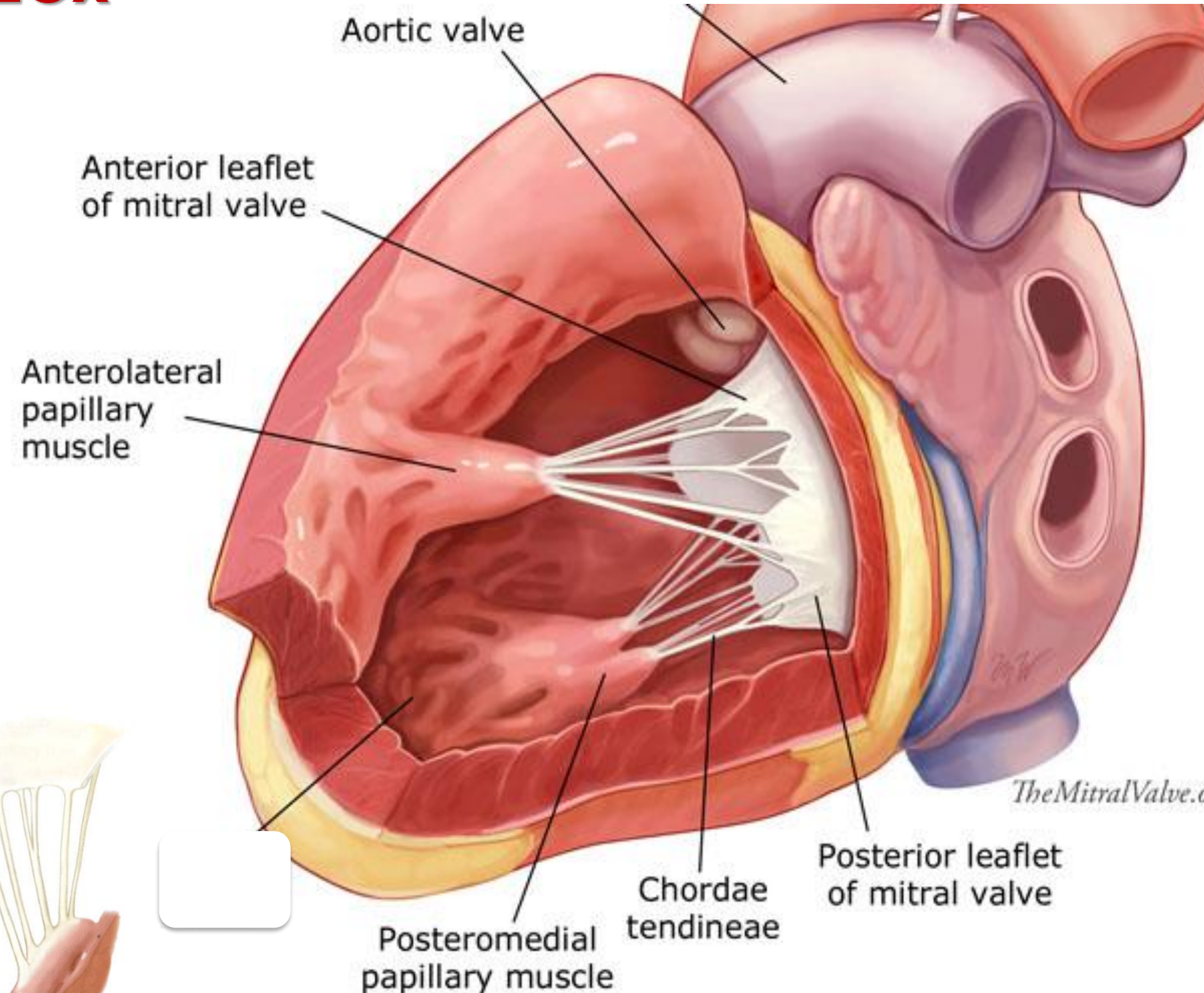
Papillary muscle



Anterolateral muscle : LAD + LCx

Papillary muscle rupture

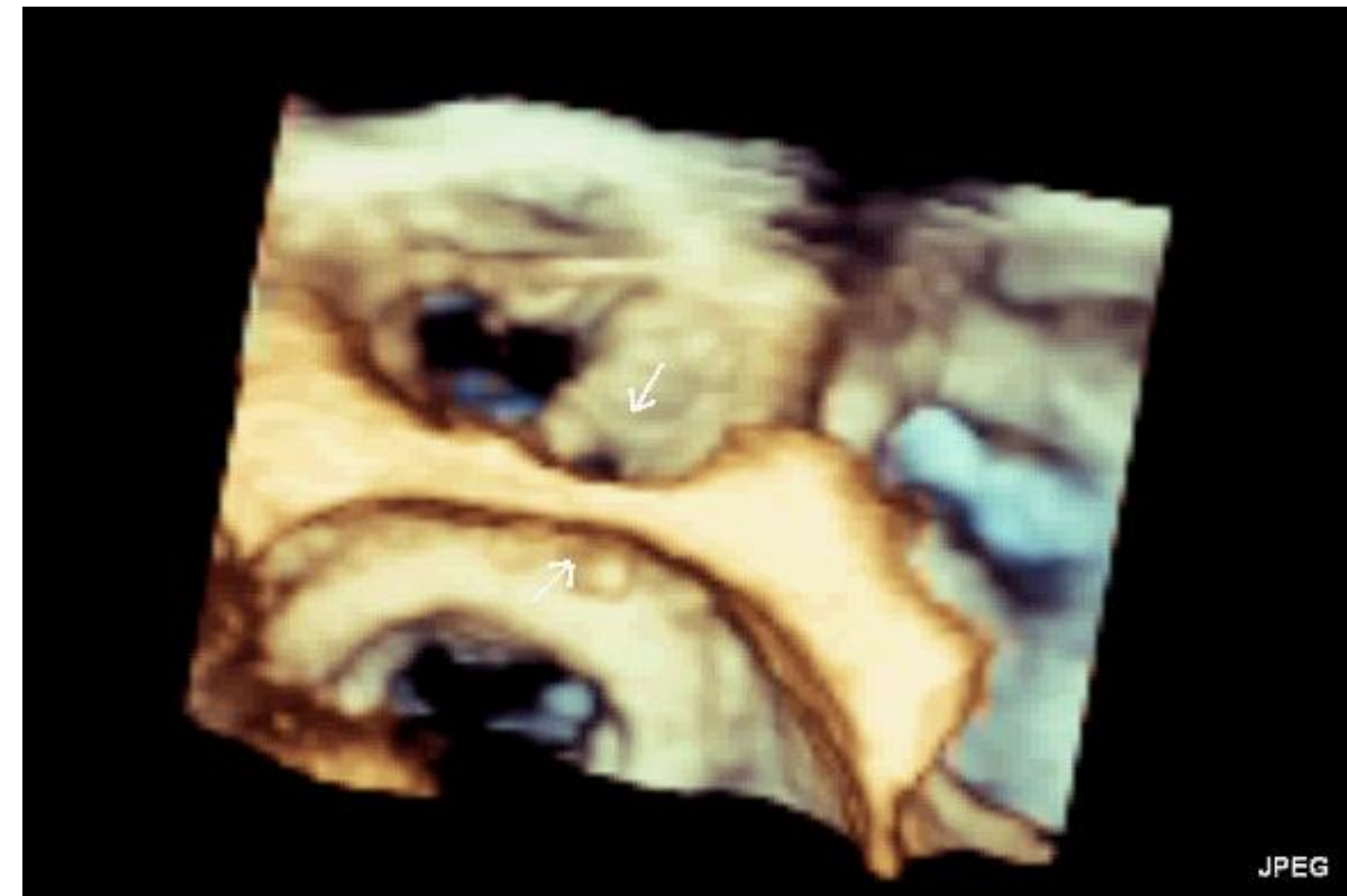
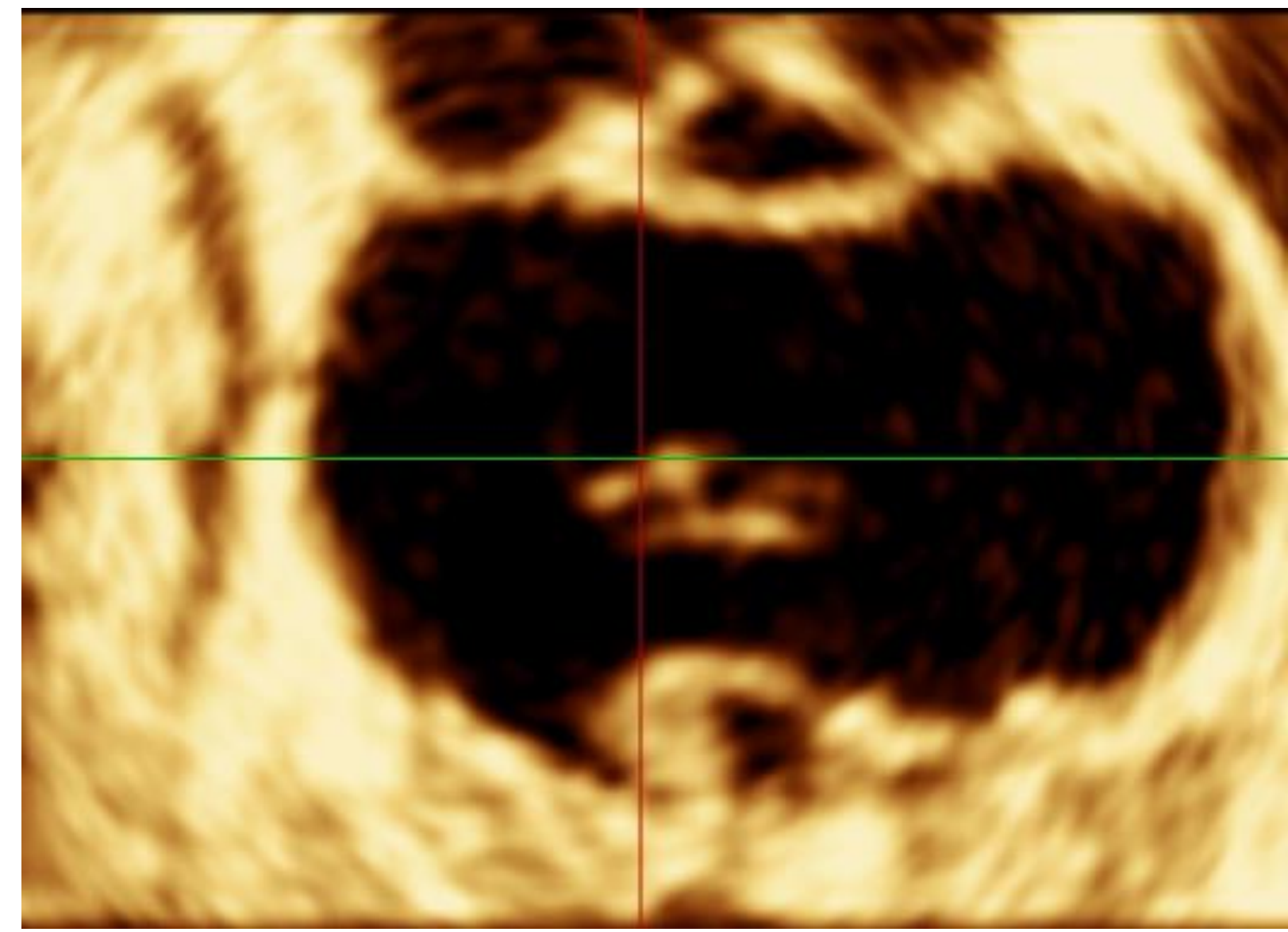
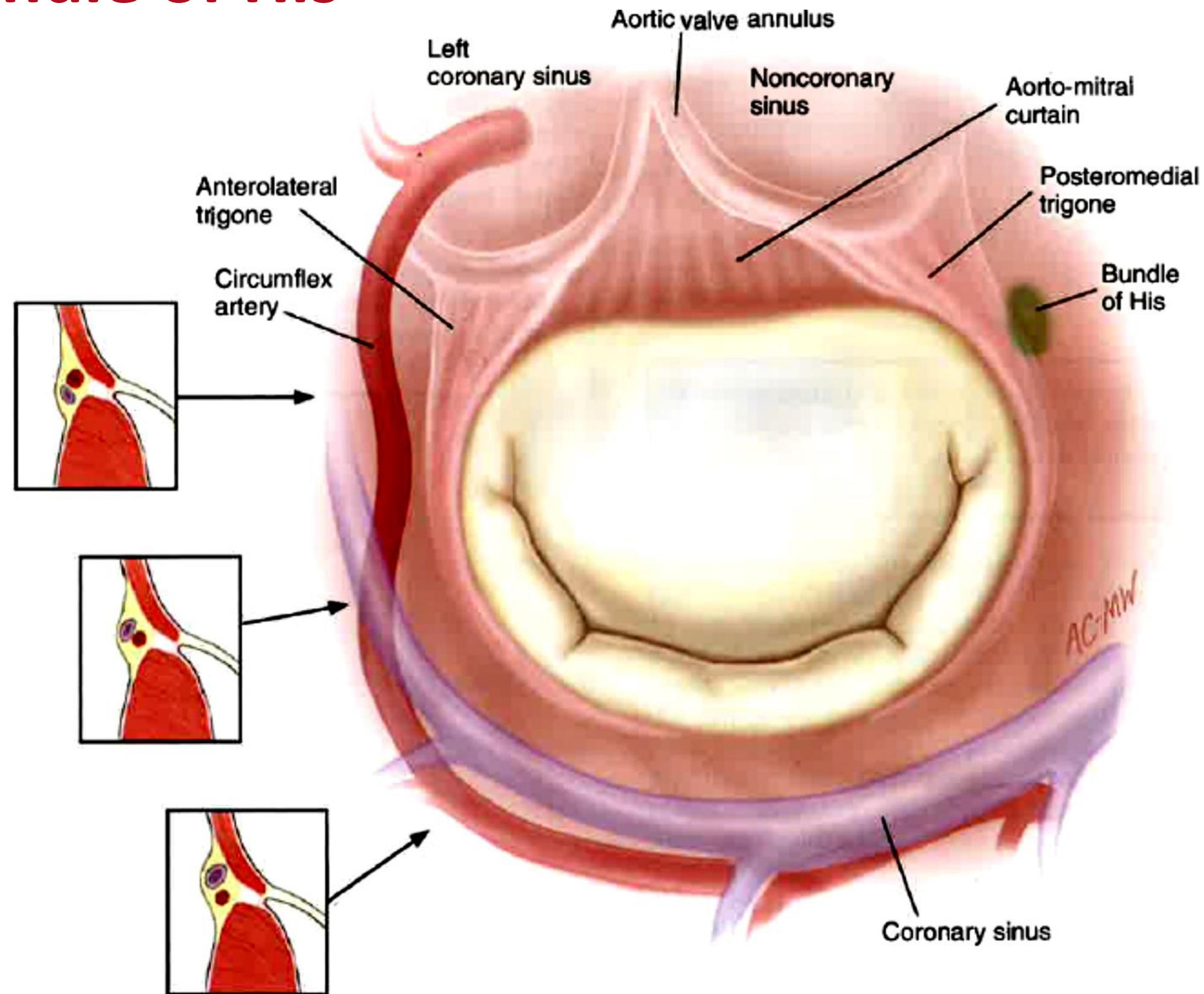
- 2 papillar muscles
- Partial or complete rupture.
- Posteromedial rupture = 5 à 10 x more common since vascularized by posterior descending artery only



Posteromedial muscle :
Posterior descending artery
= from dominant artery , (RC > LCx)

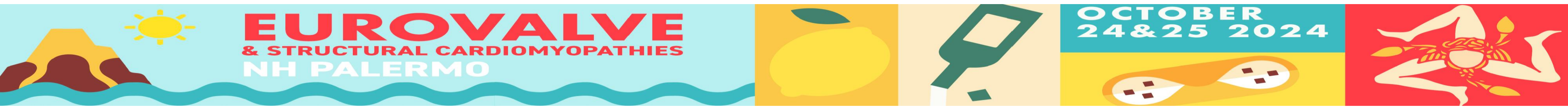
3 Areas at risk in Interventions:

- 1) Circumflex artery
- 2) Aortic valve
- 3) Bundle of His

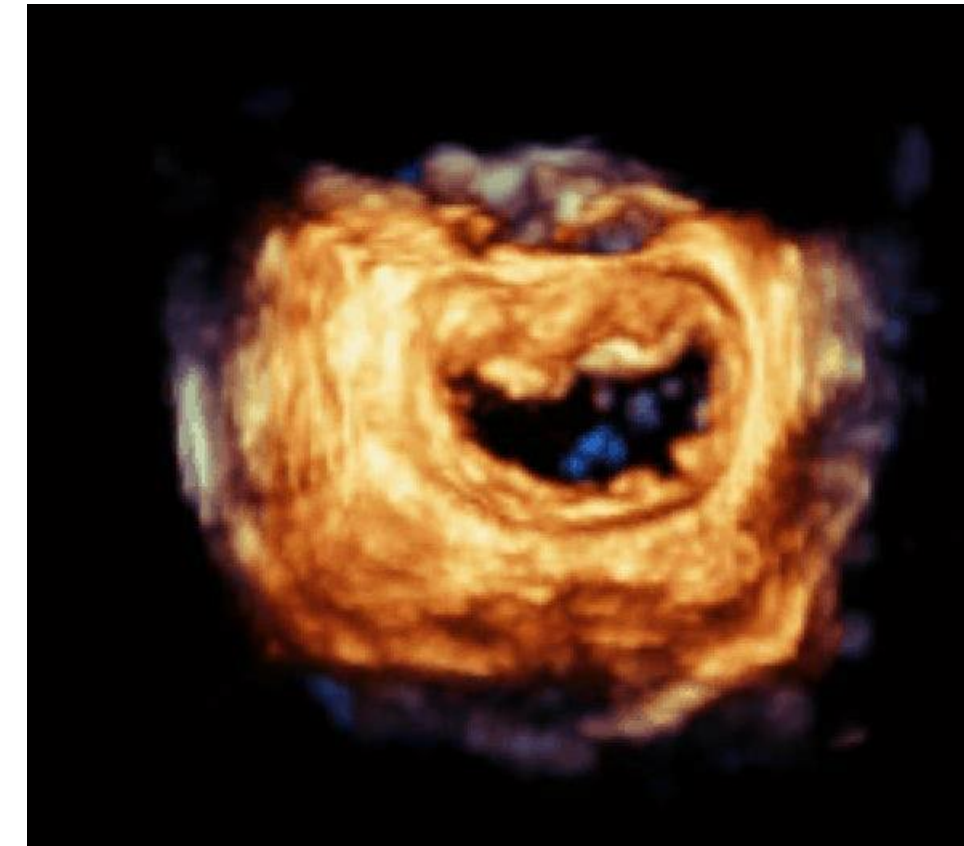
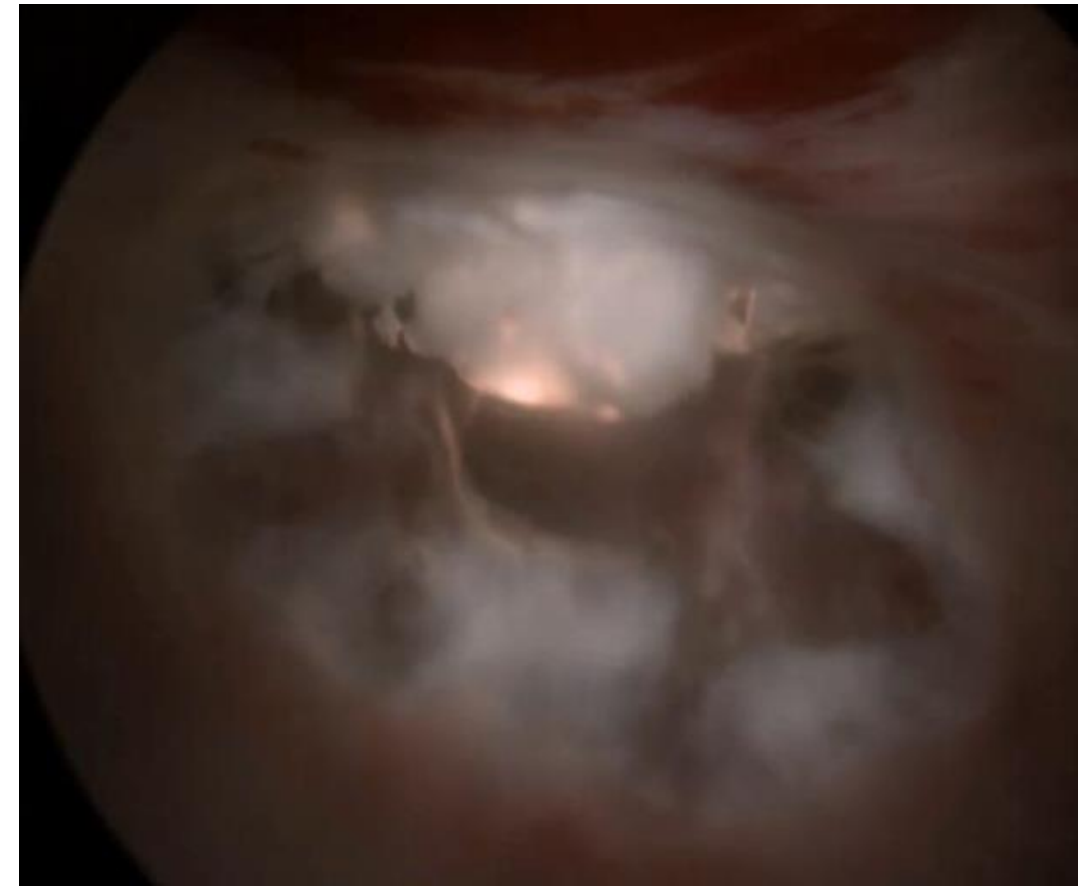
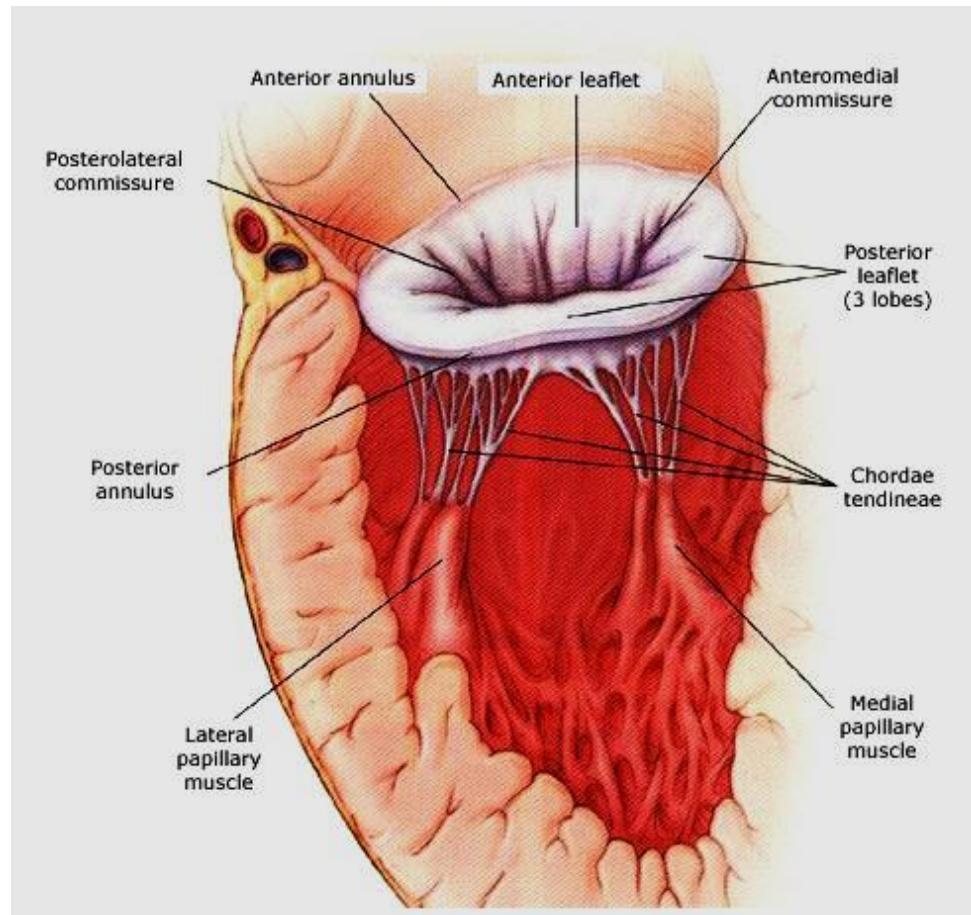


Anatomy and Morphology of the Mitral Valve

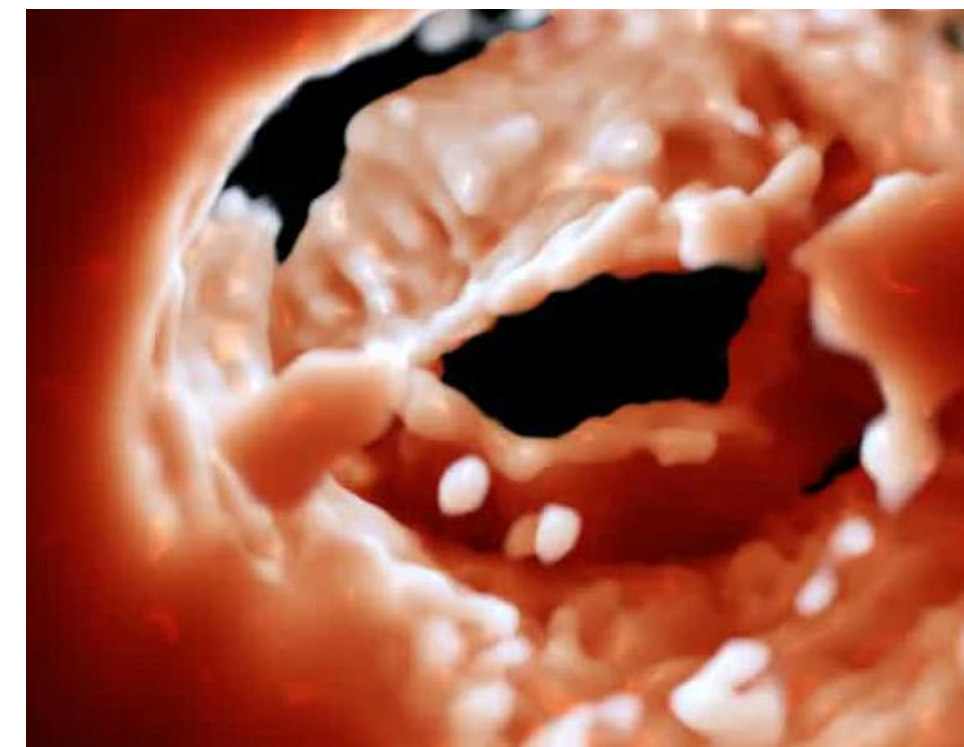
- Mitral Valve Anatomy: the essentials
- **Functional anatomy and Surgeon's needs**



A complex functional unit



Atrial



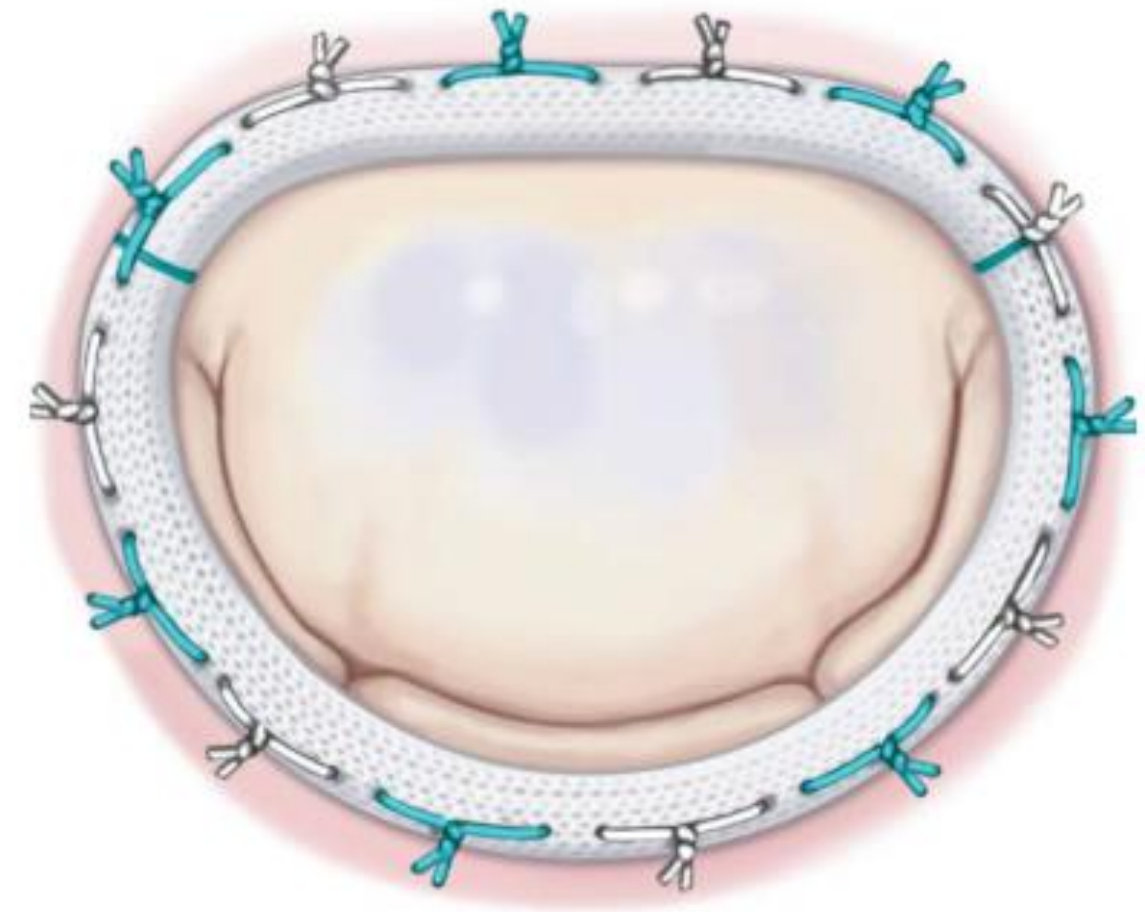
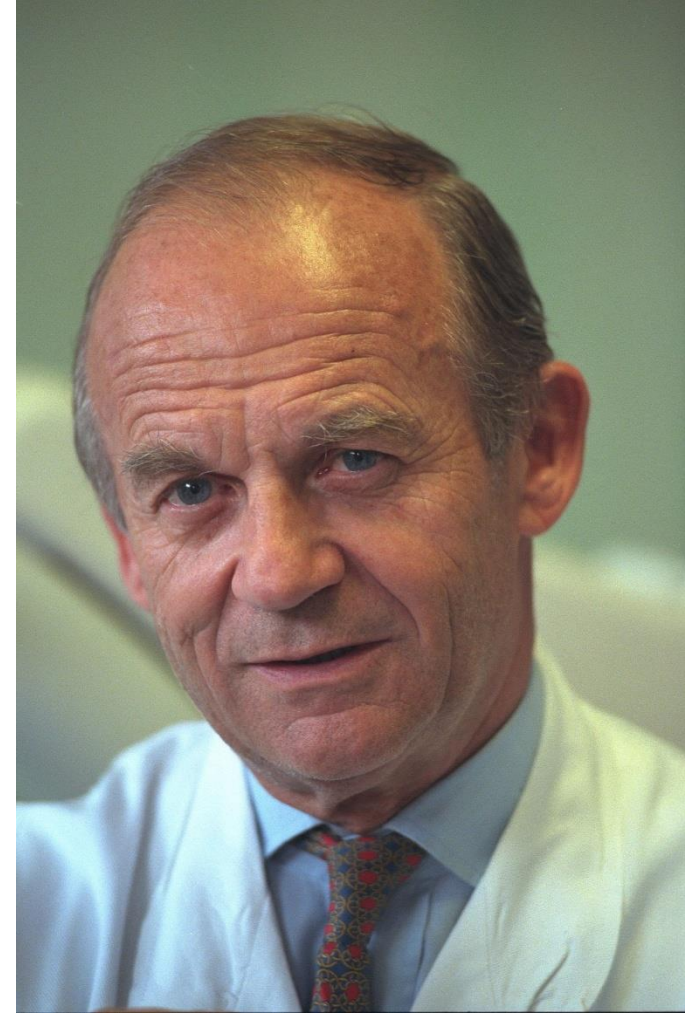
Ventricular



« Anatomy is a destiny » (B.Lytle)

The 3 « Golden Rules » of durable mitral valve reconstruction

- Restore a large surface of coaptation
- Preserve full leaflet motion
- Remodeling annuloplasty +++



A common language with the « triad »

A.Carpentier:J Thorac Cardiovasc Surg 86 (3):323-37, 1983



Myxomatous Disease, Flail Leaflet, Partial-Flail, Valve Prolapse Syndrome, Billowing, Floppy valve

Etiology

The Cause of Valve Disease

Lesions

The Result of the Disease Process

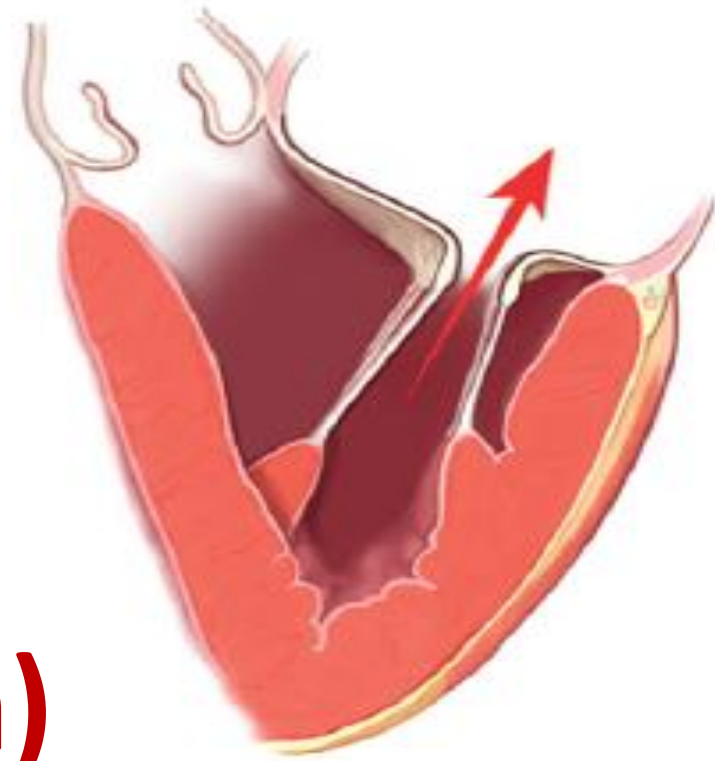
Dysfunction

The Result of the Lesions

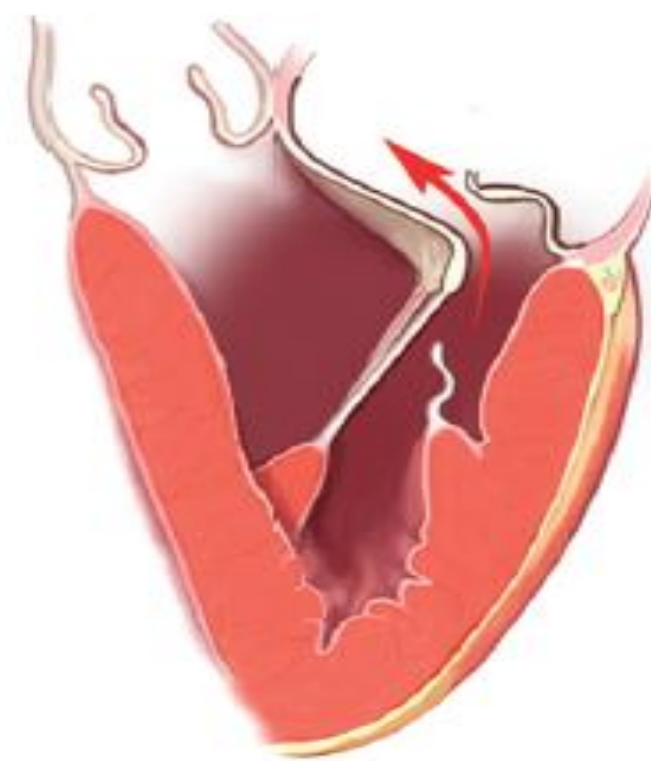
	Etiology	Lesion	Dysfunction
Echo	++	+	+++
Surgeon	++	+++	+

Dysfunction

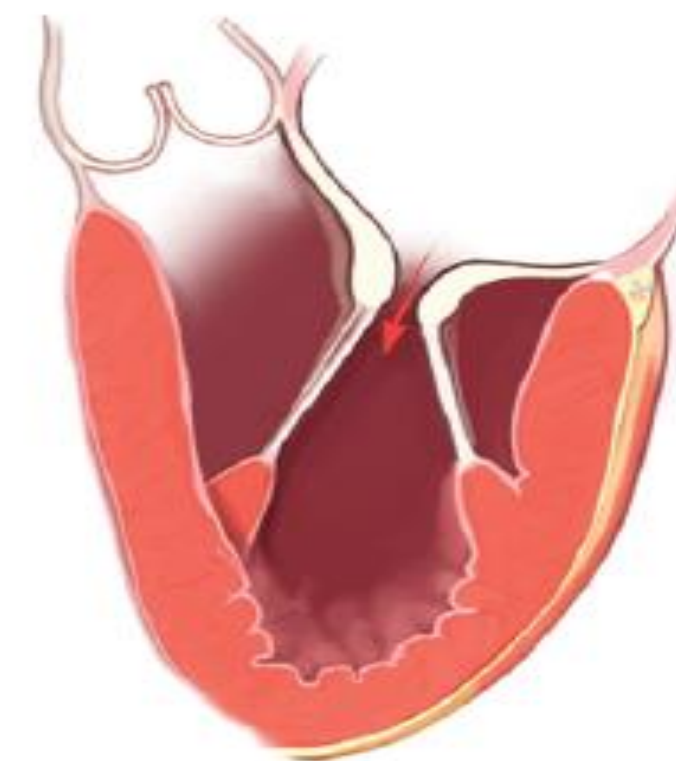
**2D for
Carpentier's
classification
(leaflet motion)**



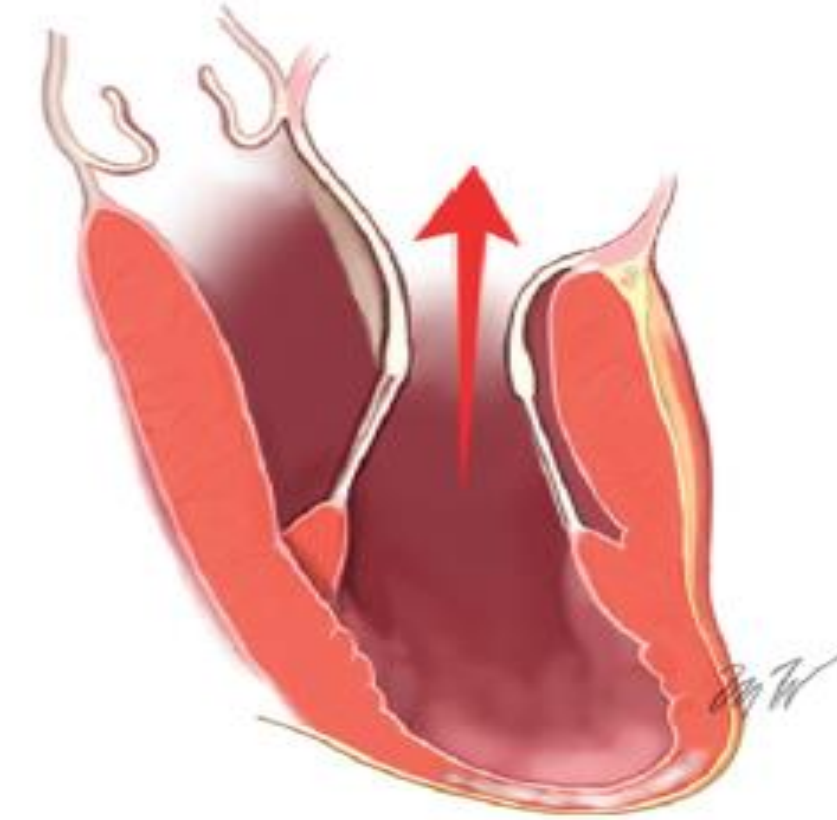
Type I
Normal leaflet
motion



Type II
Increased leaflet
motion

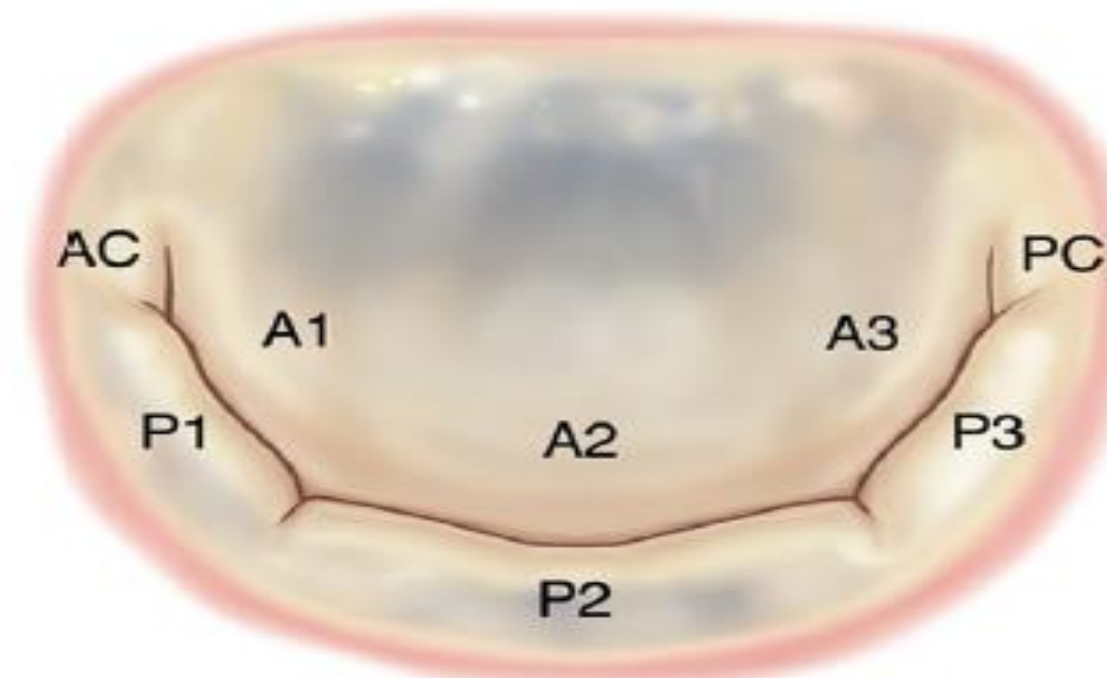


Type IIIa
Restricted leaflet
motion
(systole and diastole)



Type IIIb
Restricted leaflet
motion
(systole)

**3D for segmental analysis
(location of dysfunction)**

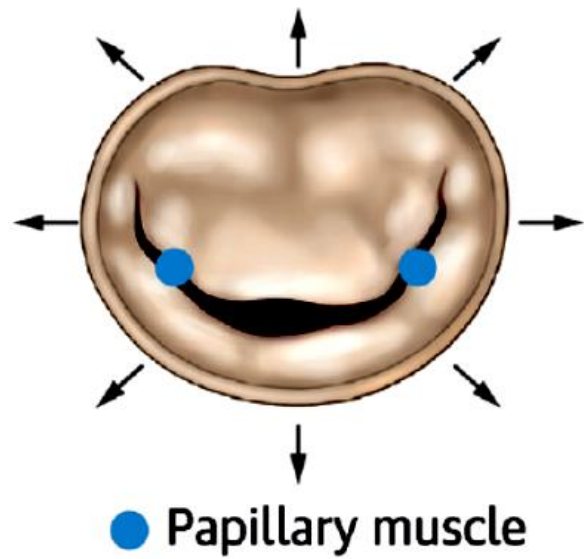


Secondary MR: different phenotypes

Type I

AFMR

Pure annular dilation



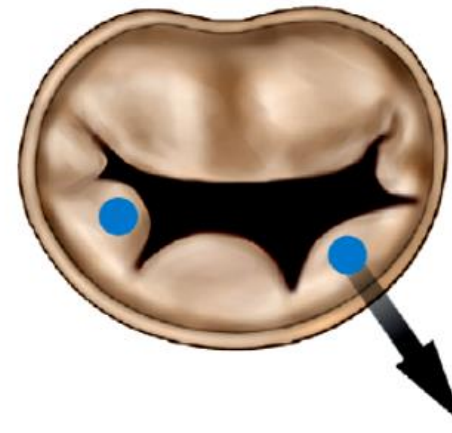
Type IIIb (++)

VFMR

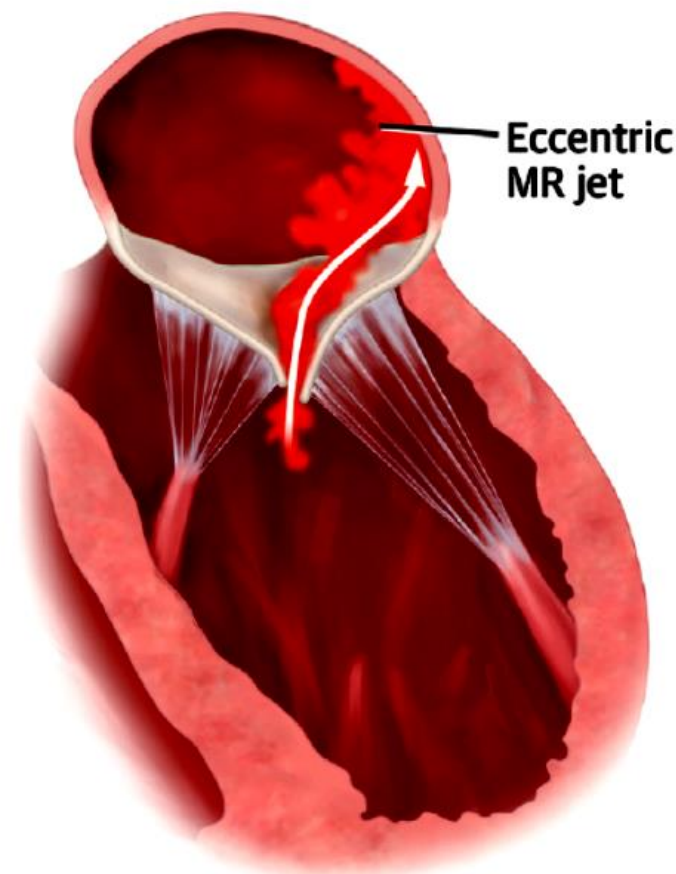
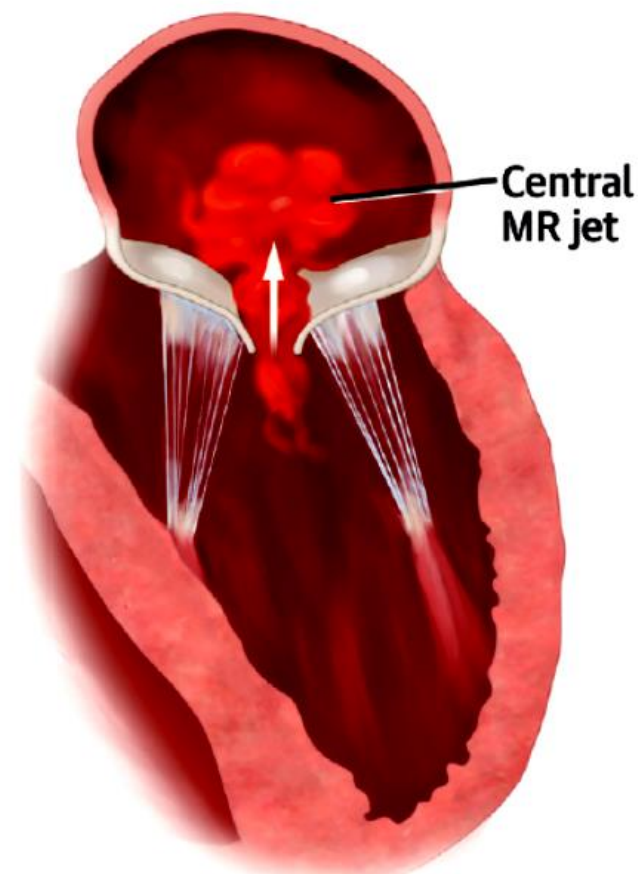
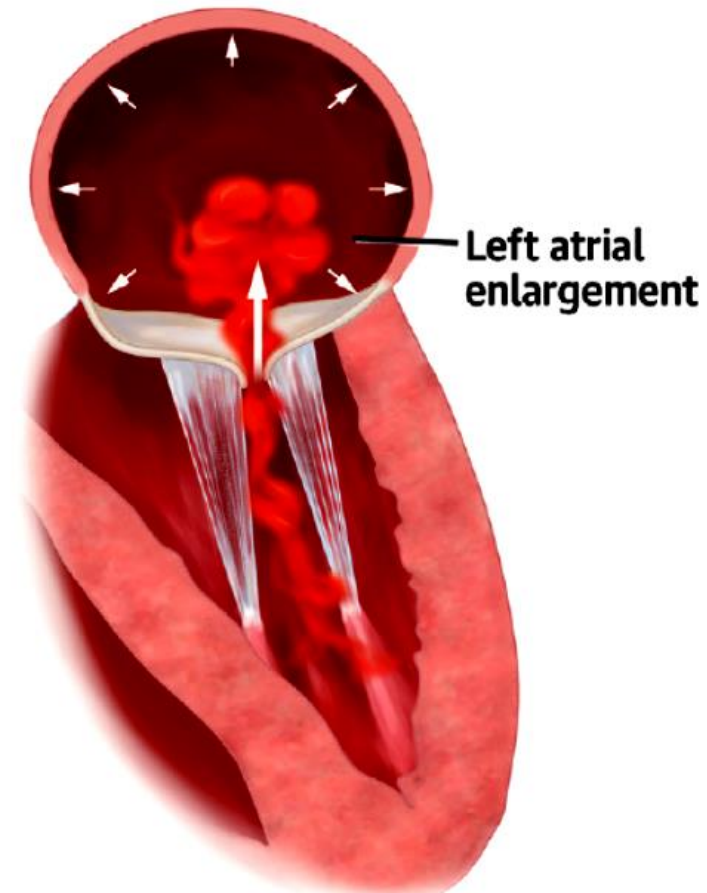
Symmetric papillary muscle displacement



Asymmetric papillary muscle displacement



Agricola classification



MR jet direction is often central but may be eccentric.

MR jet direction is central or eccentric.

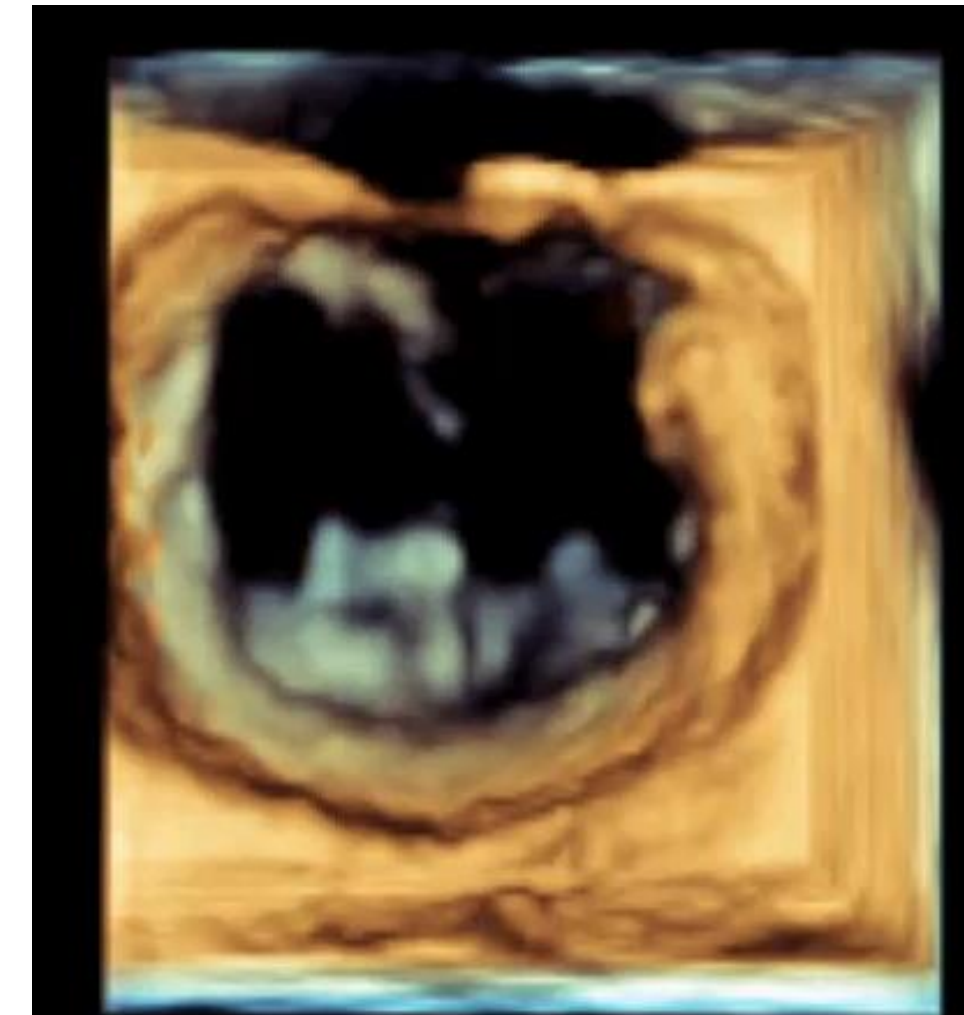
Type II

VFMR

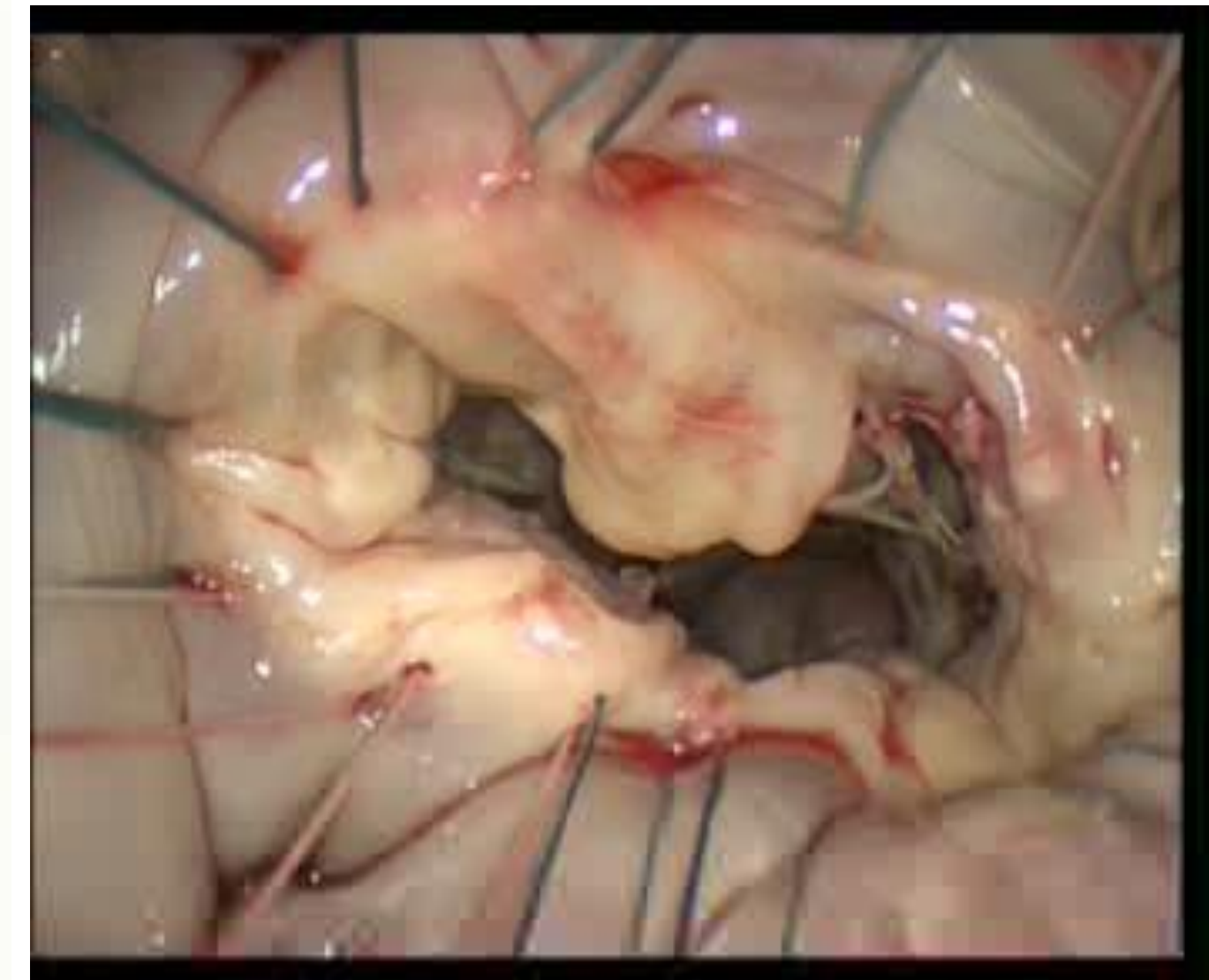
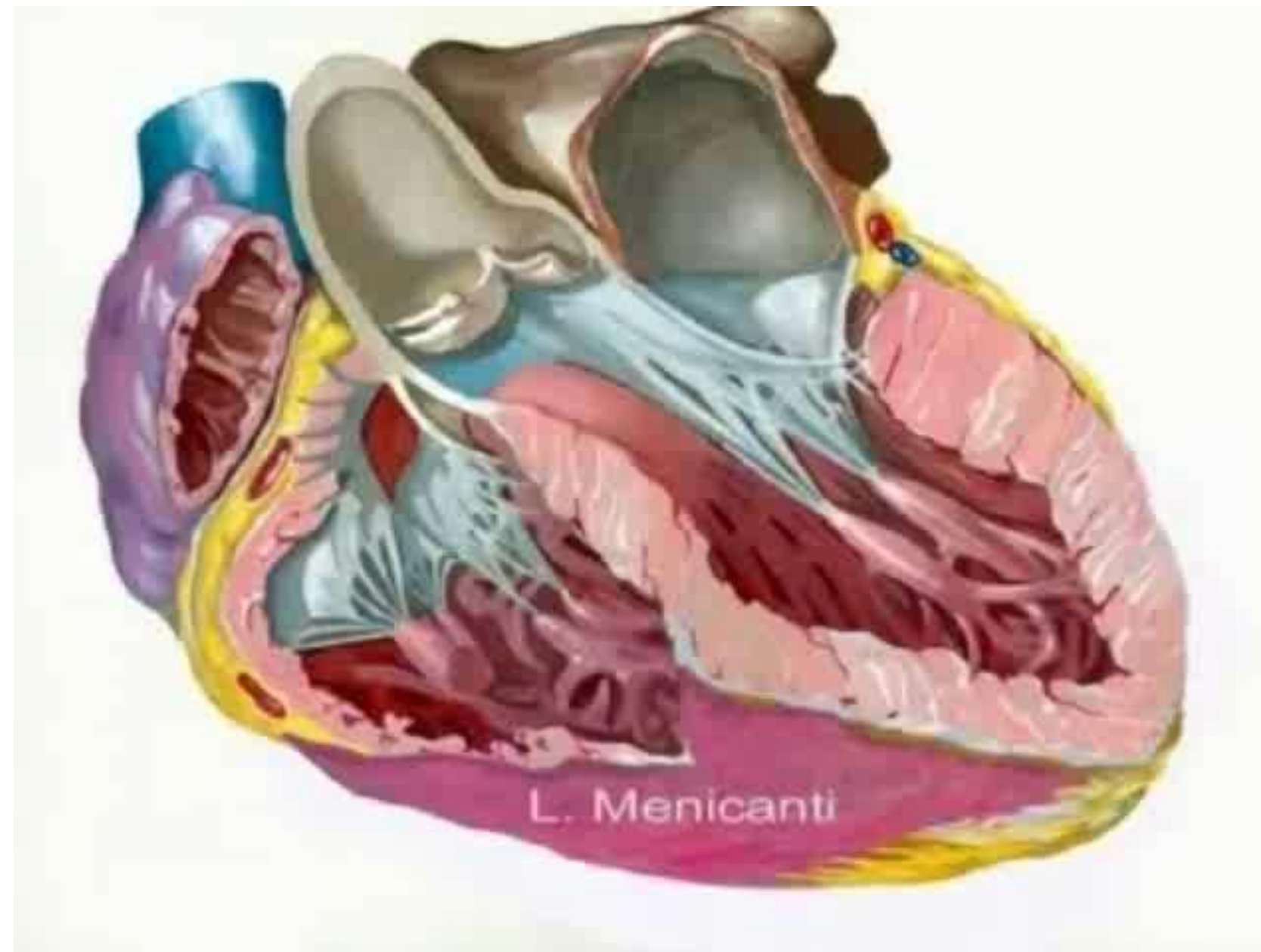
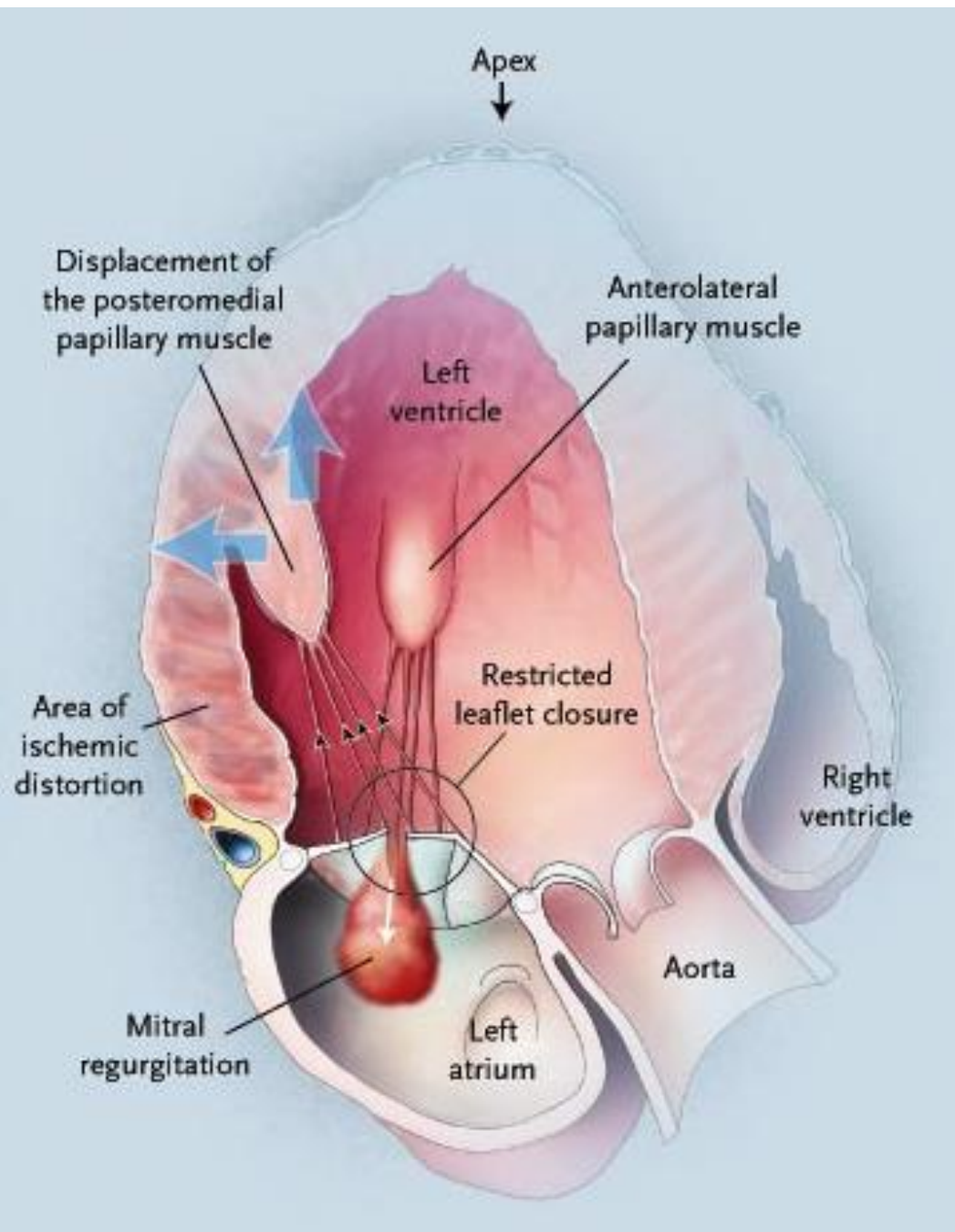
Acute
PPM Rupture



Chronic
PPM Elongation



Type IIIb: from a ventricular disease to a valvular dysfunction



Type IIIb P3 (courtesy of D.Adams)

Conclusion : 5 thoughts on mitral anatomy and morphology

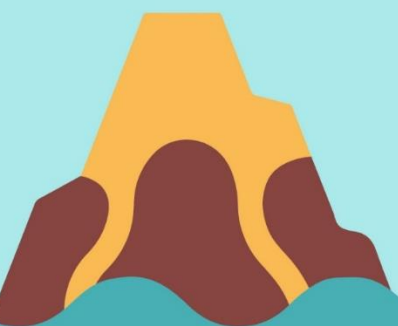
- 1** Anatomy is critical to understand for **imagers** (landmarks for proper 3D orientations)
- 2** Anatomy is critical to understand for **surgeons and interventional cardiologists** (areas at risk)
- 3** Mitral valve is a complex **functional unit** +++
- 4** Functional anatomy is essential to share with surgeons and interventional cardiologists in a **common language**
- 5** Secondary MR is not a valvular disease but a **ventricular (or atrial) one**



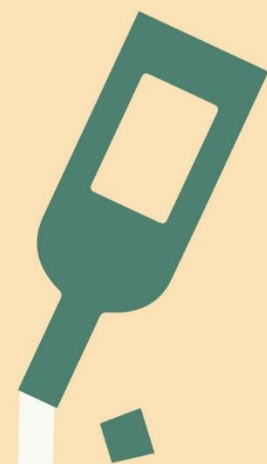


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