Atrioventricular Junction

Normal (and Abnormal) Morphology

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Hospital for Sick Children

Disclosure

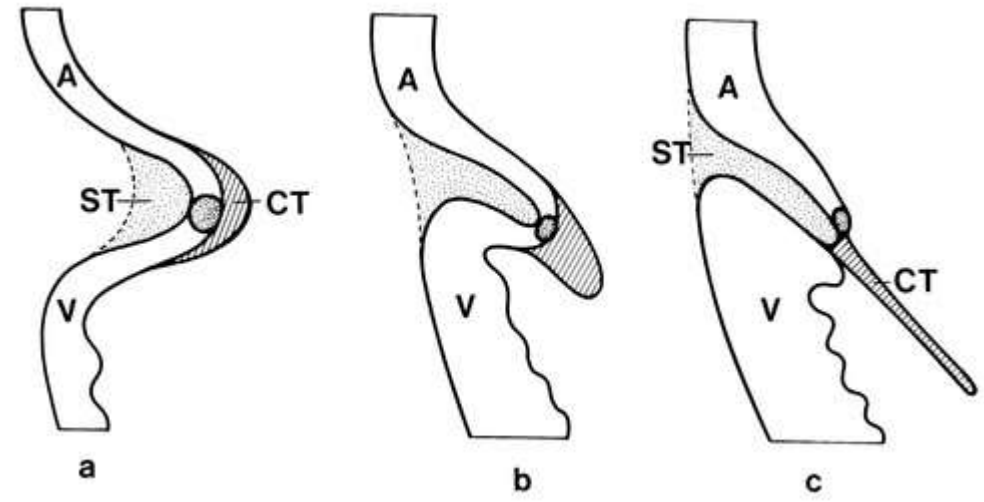
I am not a cardiac anatomist / morphologist.

Dr. Robert Anderson

Dr. Andrew Cook

Stages of the development of the atrioventricular junction in the human

- a, ……atrial myocardium is continuous with the ventricular myocardium through the myocardium of the atrioventricular canal. At the epicardial side, the myocardium of the atrioventricular canal is characterized by the presence of sulcus tissue, while at the endocardial side it is covered by atrioventricular cushion tissue.
- b …….shape of the atrioventricular junction already resembles that of the adult heart. However, atrial myocardium and ventricular myocardium still form a continuous entity.
- c. …separation between atrium and ventricle becomes established when sulcus tissue and cushion tissue fuse at the ventricular margin of the atrioventricular canal, resulting in the incorporation of the myocardium of the atrioventricular canal in the myocardium of the atrium…..
- **Note** …….leaflets of the atrioventricular valves are composed of material derived from the atrioventricular cushions …..

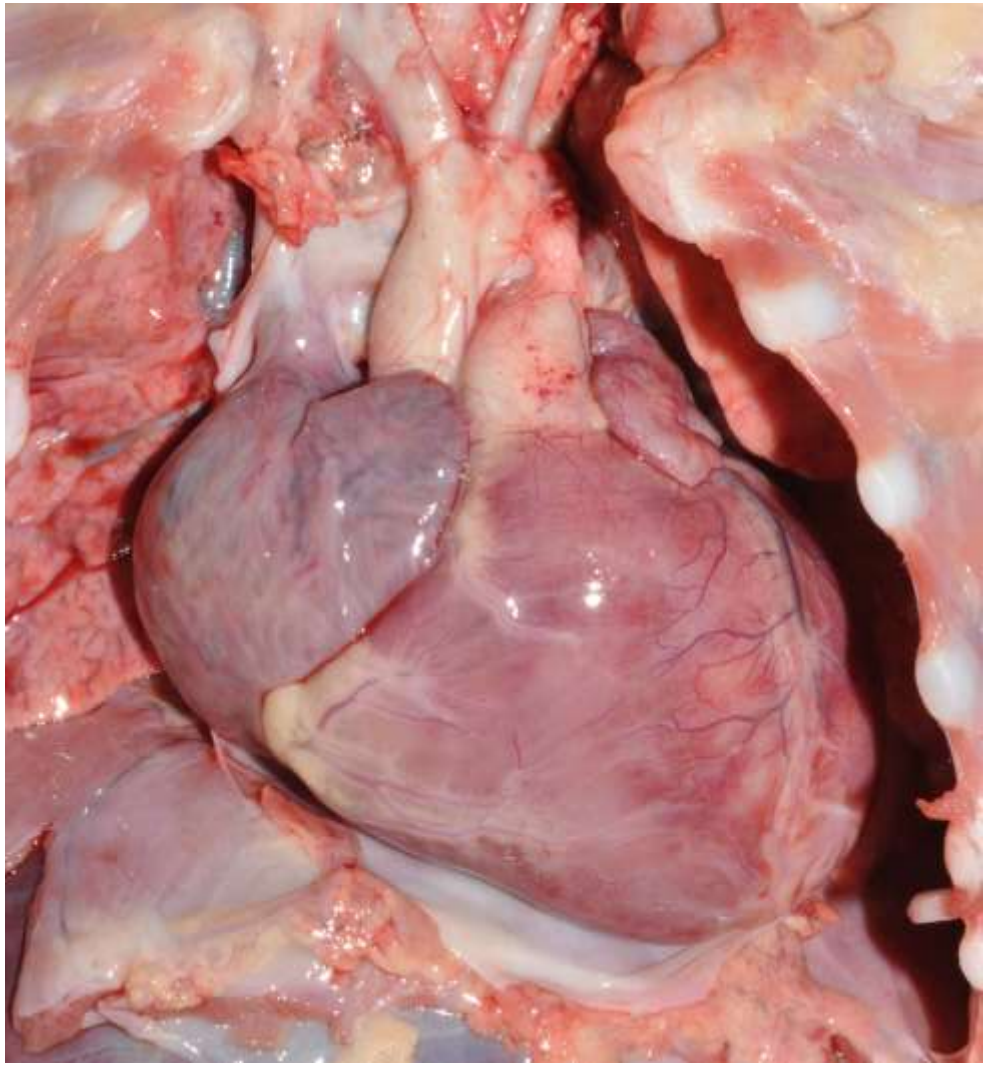


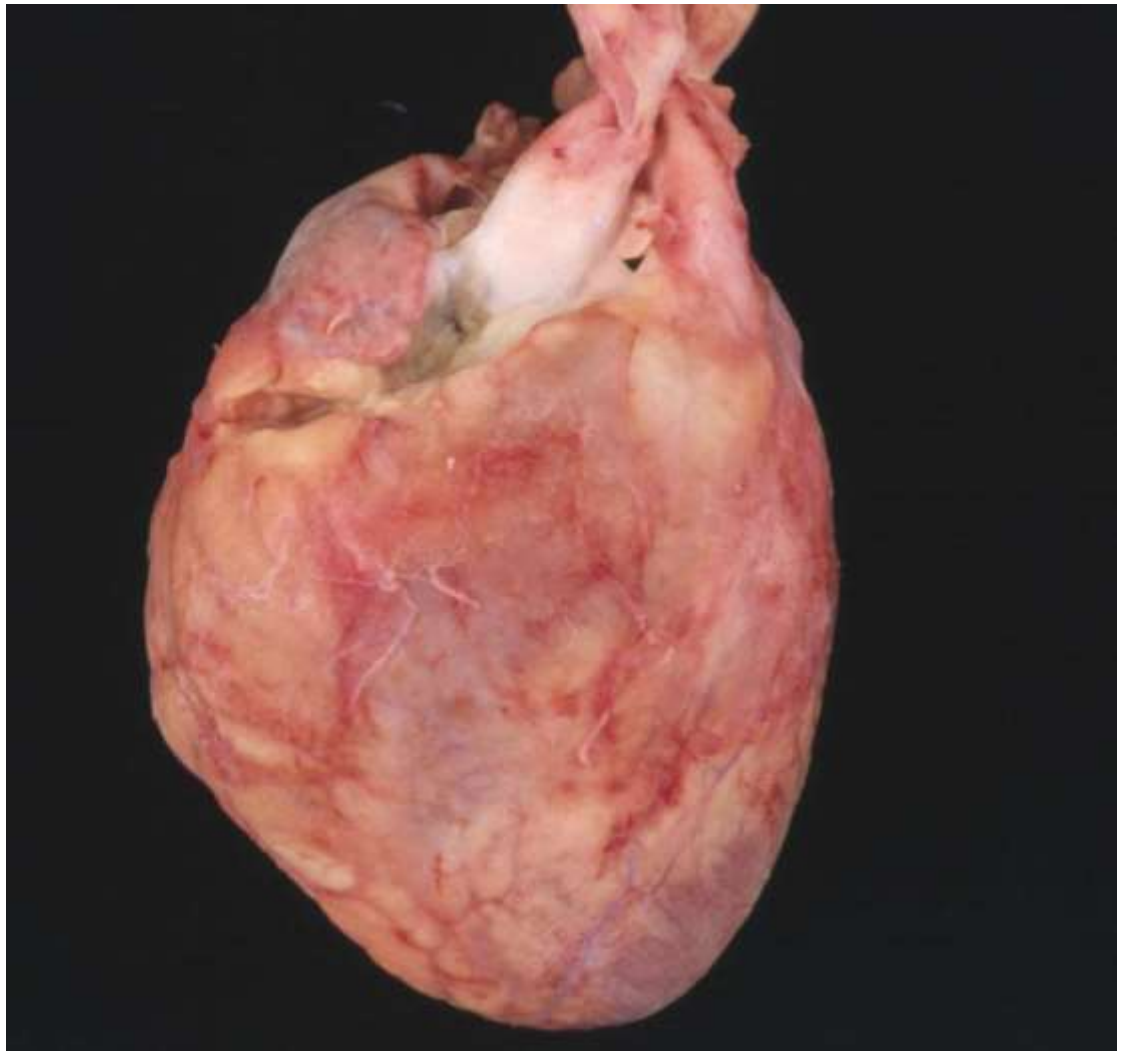
Week 4-5 Week 5-7 Week 12

A indicates atrial myocardium; ST, sulcus tissue; CT, cushion tissue; and V, ventricular myocardium.

A. Wessels. Circulation Research. The Development of the Atrioventricular Junction in the Human Heart, Volume: 78, Issue: 1, Pages: 110-117, DOI: (10.1161/01.RES.78.1.110)

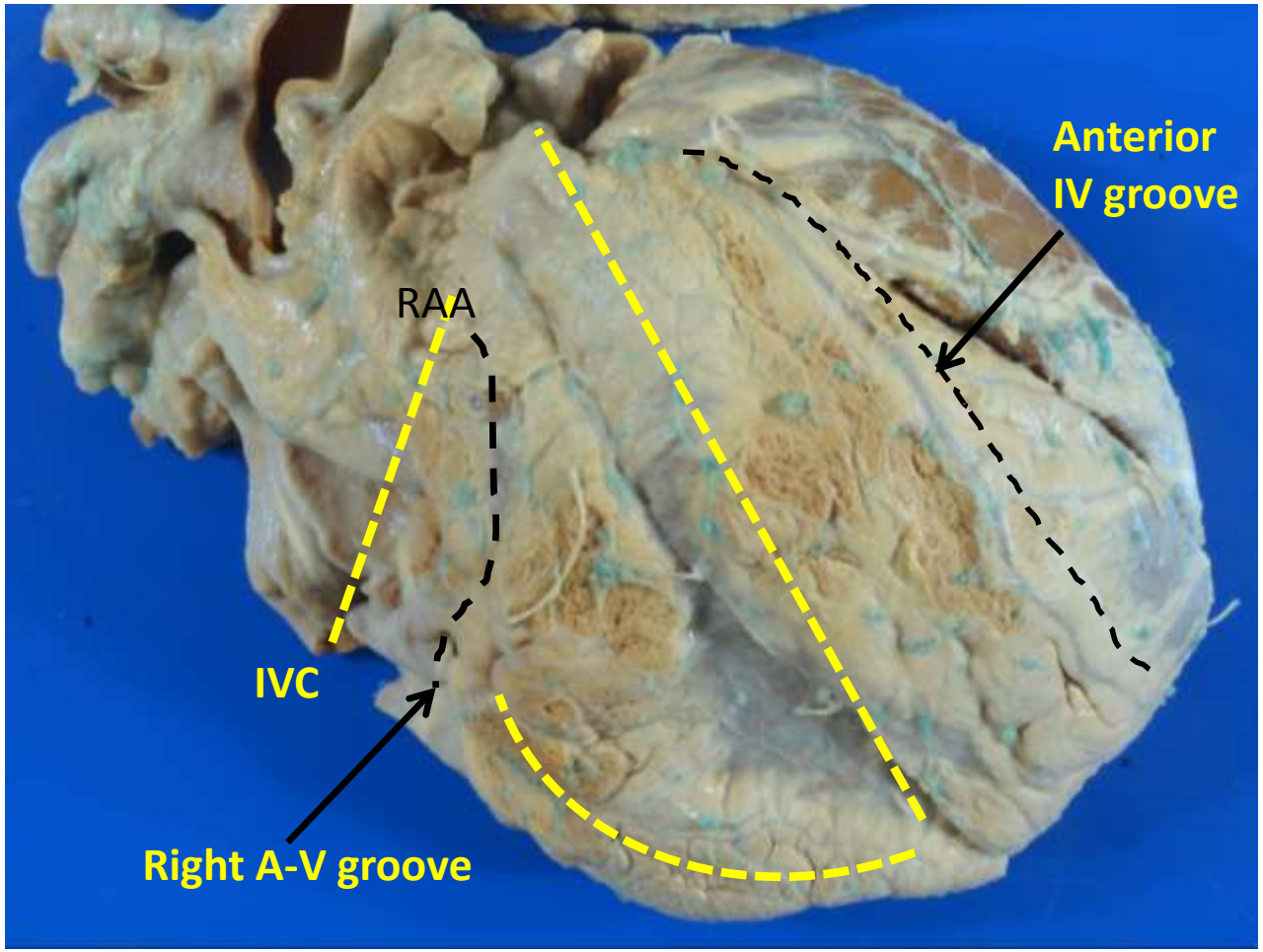
Examination of Heart Specimens
Terminology





Anterior / Posterior vs. Superior / Inferior

Pathological Opening of Heart – Right Side

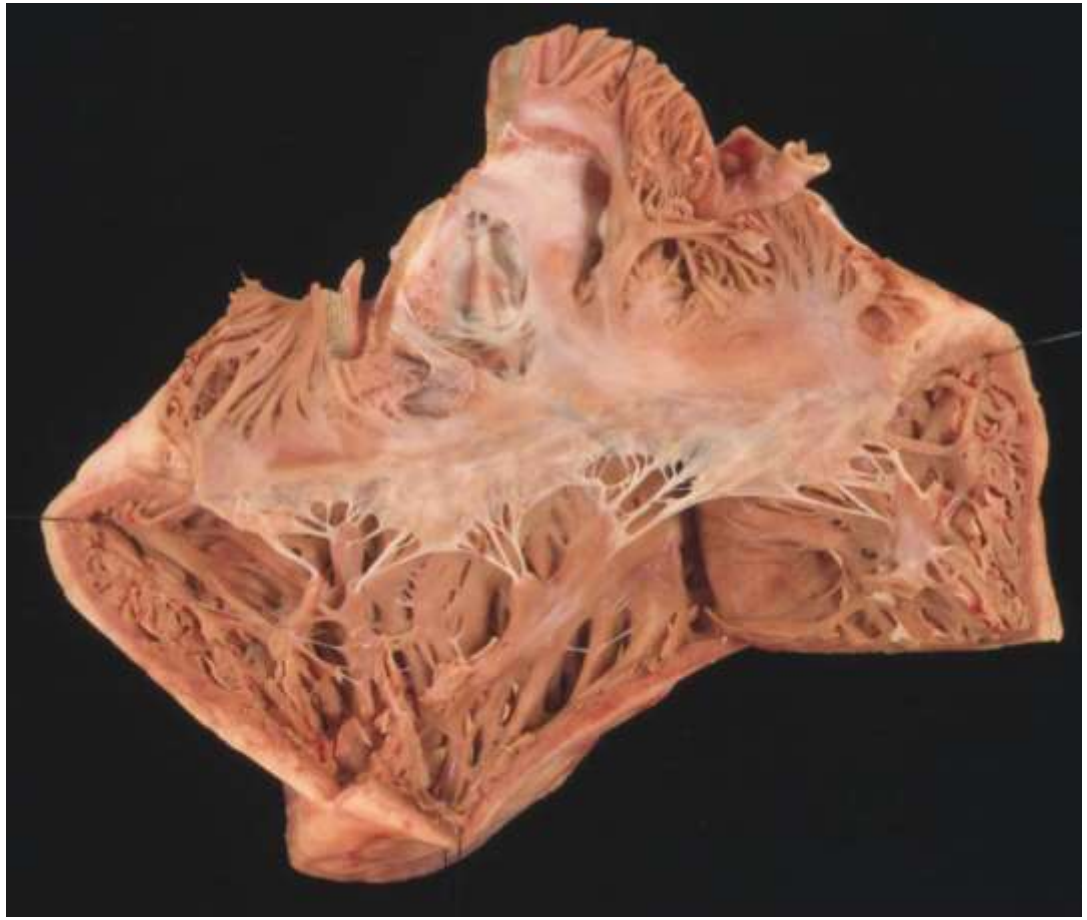


1. IVC and extend cut from IVC orifice along the anterior wall of the RA appendage

2. Cut through right atrio-ventricular junction along RV lateral wall to apex

3. Cut along para-septal anterior wall of RV / RVOT through PV into main PA

Normal Heart
Internal Examination of Right Side



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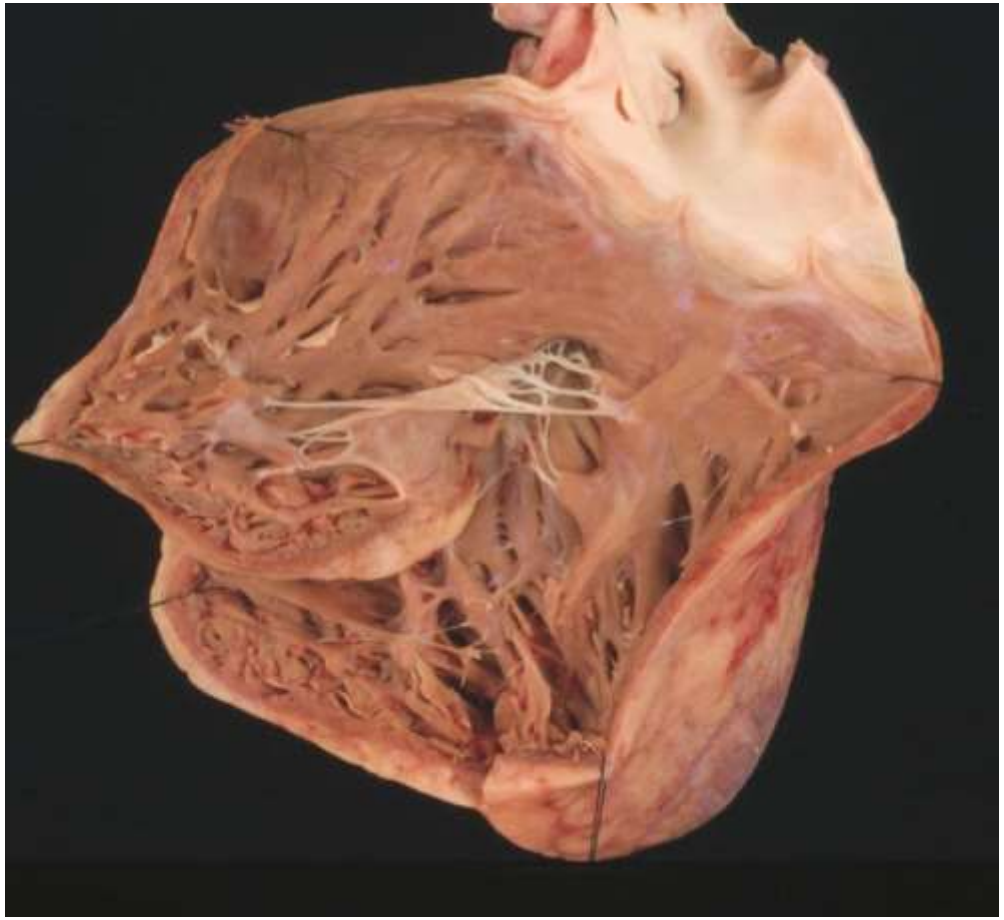

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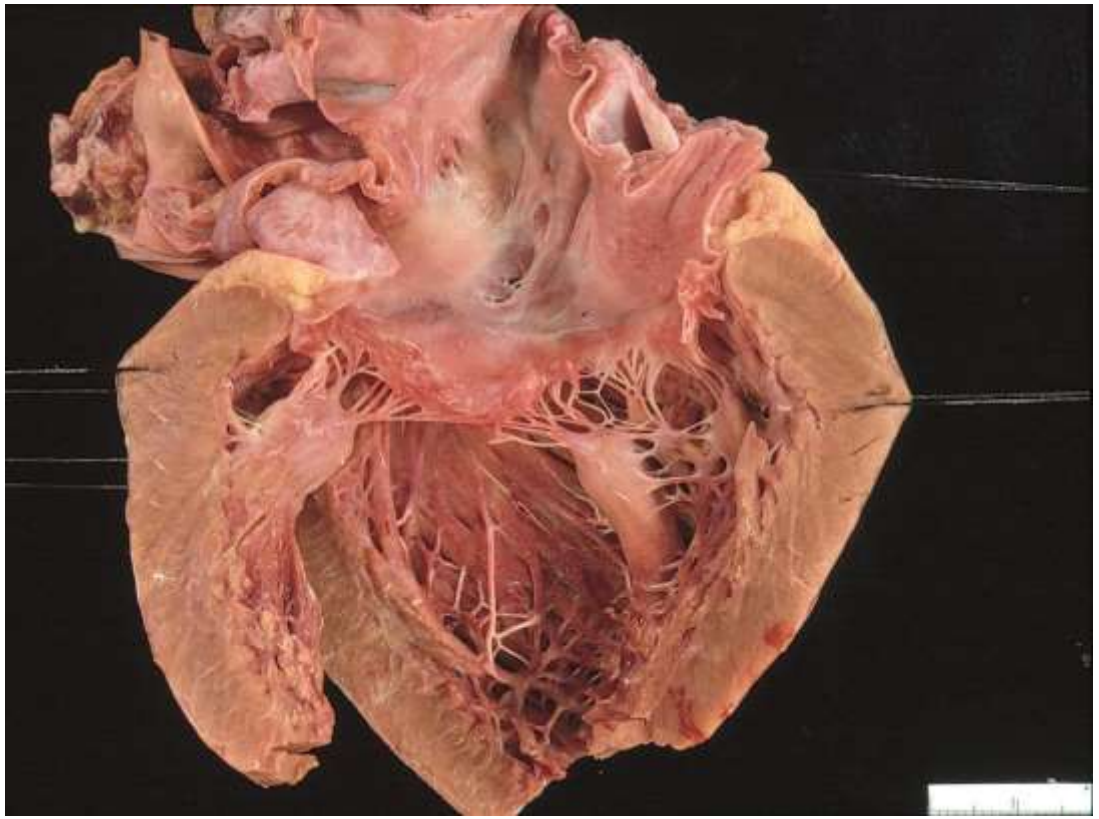
Normal Heart
Internal Examination of Left Side



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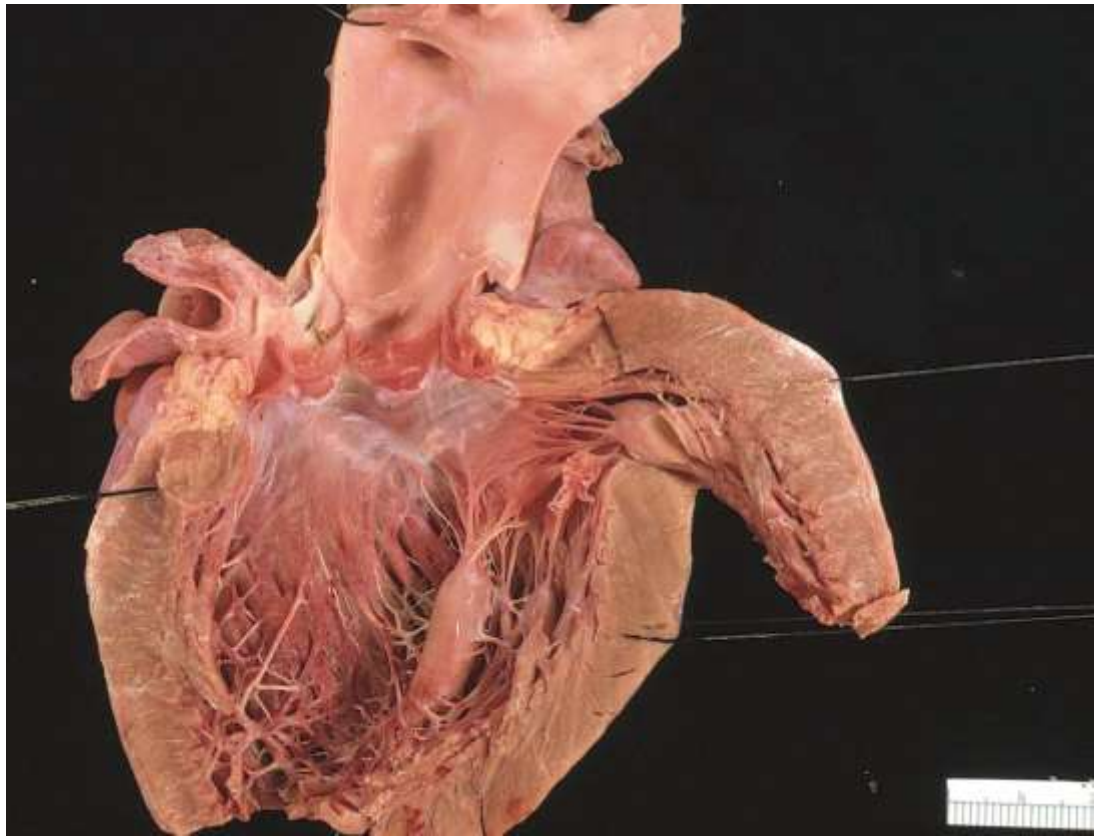

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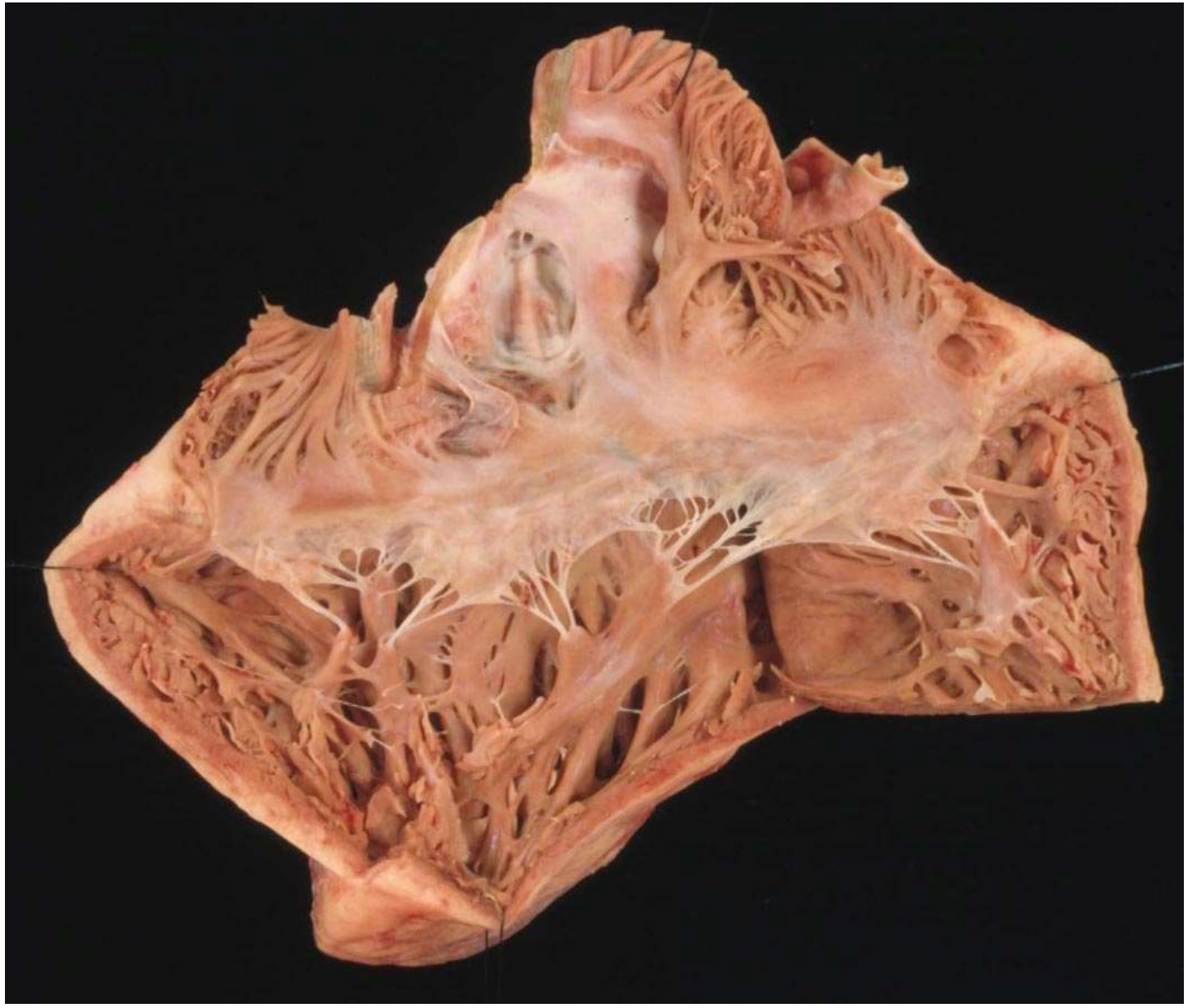
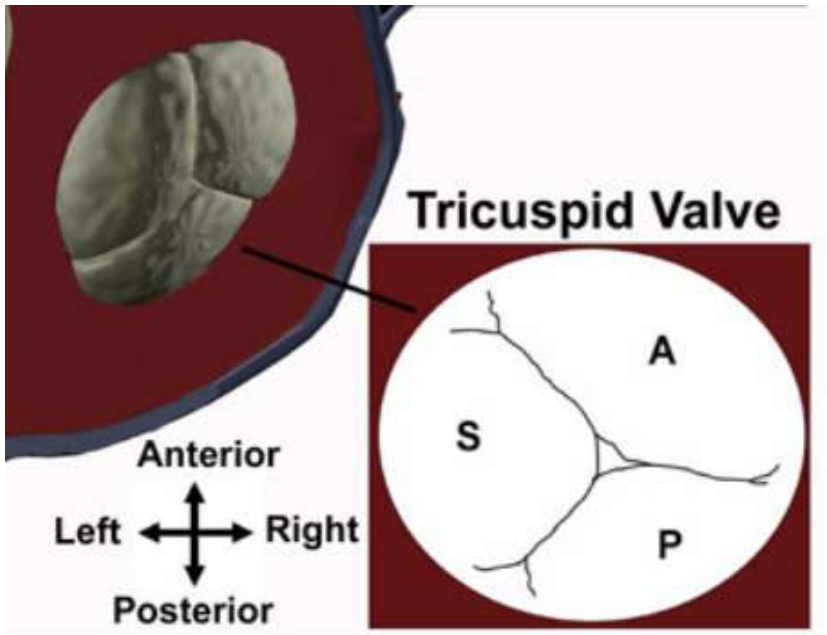
Right A-V Junction



A27-89



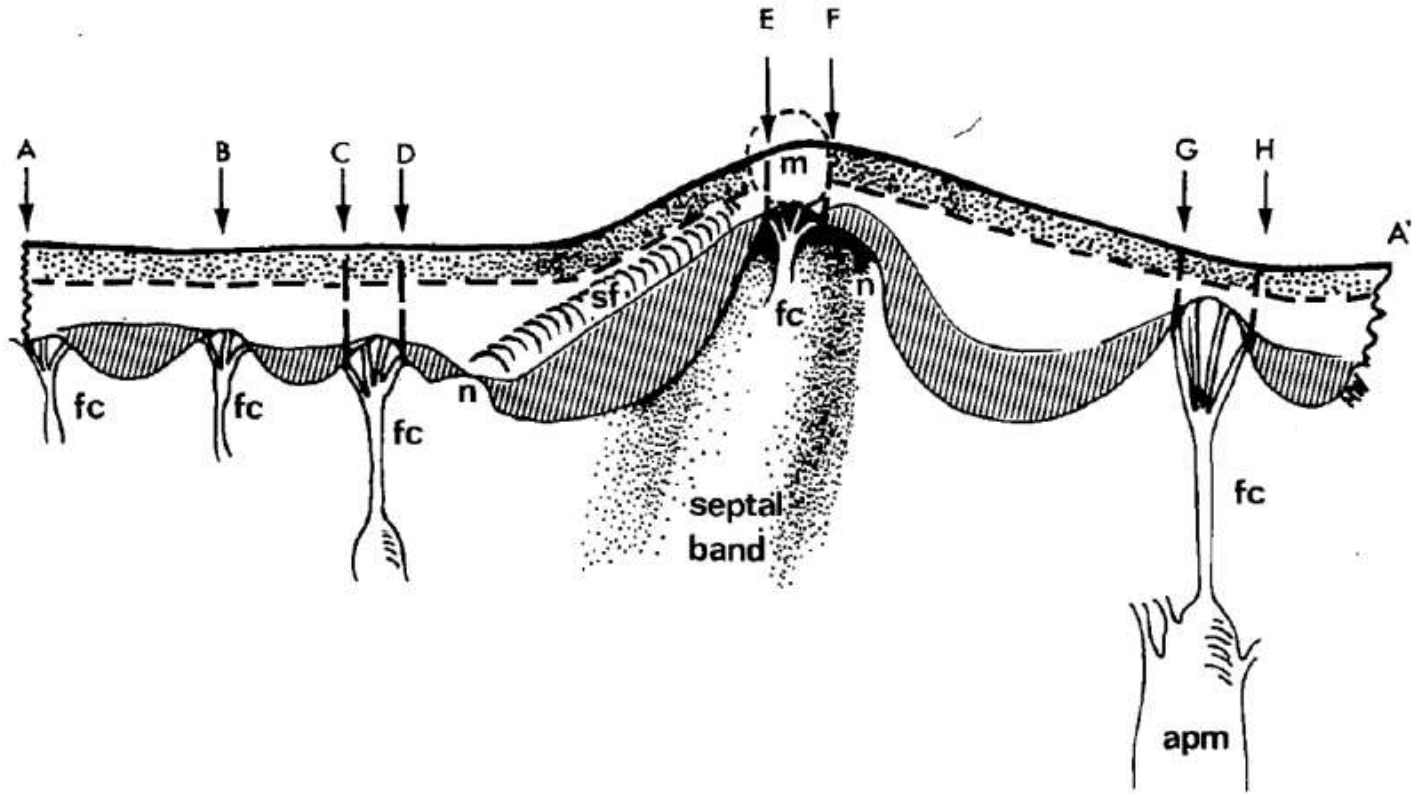
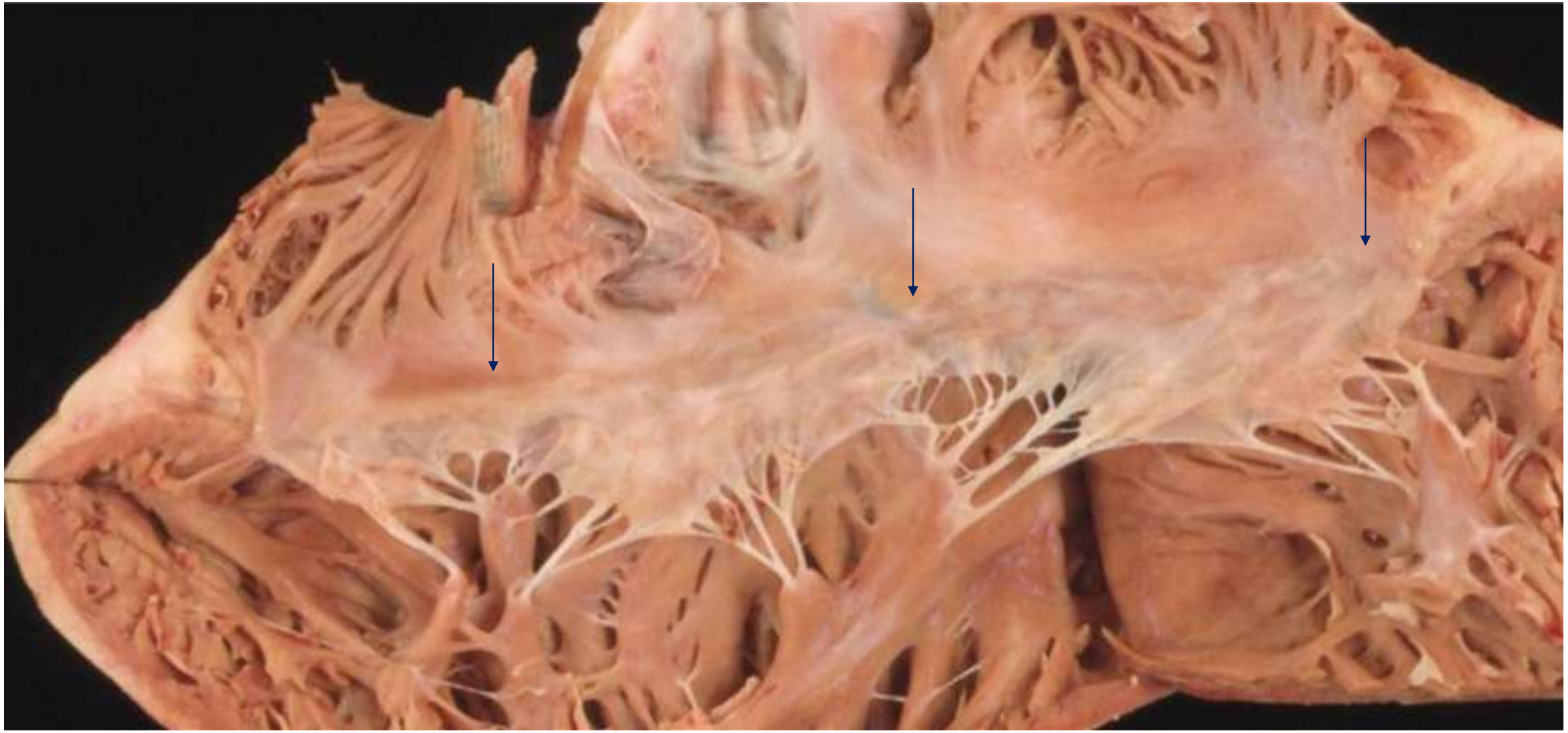


Figure 1-11 • Diagrammatic representation of the tricuspid valve opened through the acute margin of the right ventricle. Abbreviations: A-B, B-C, and H-A′, middle, posteroseptal commissural, and anteroposterior

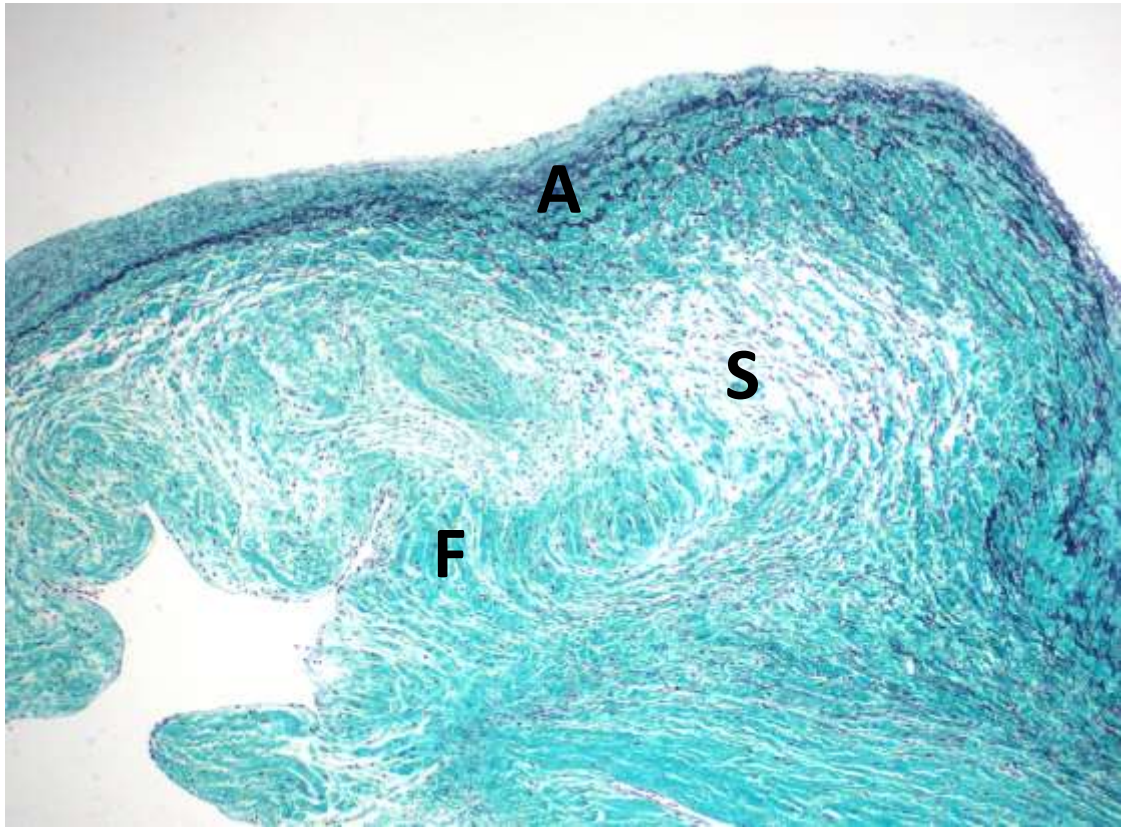
(From Silver MD, Lam JHC, Ranganathan N, Wigle ED: Morphology of the human tricuspid valve. Circulation 43:333, 1975.)

Normal “Tri-Leaflet” Tricuspid Valve

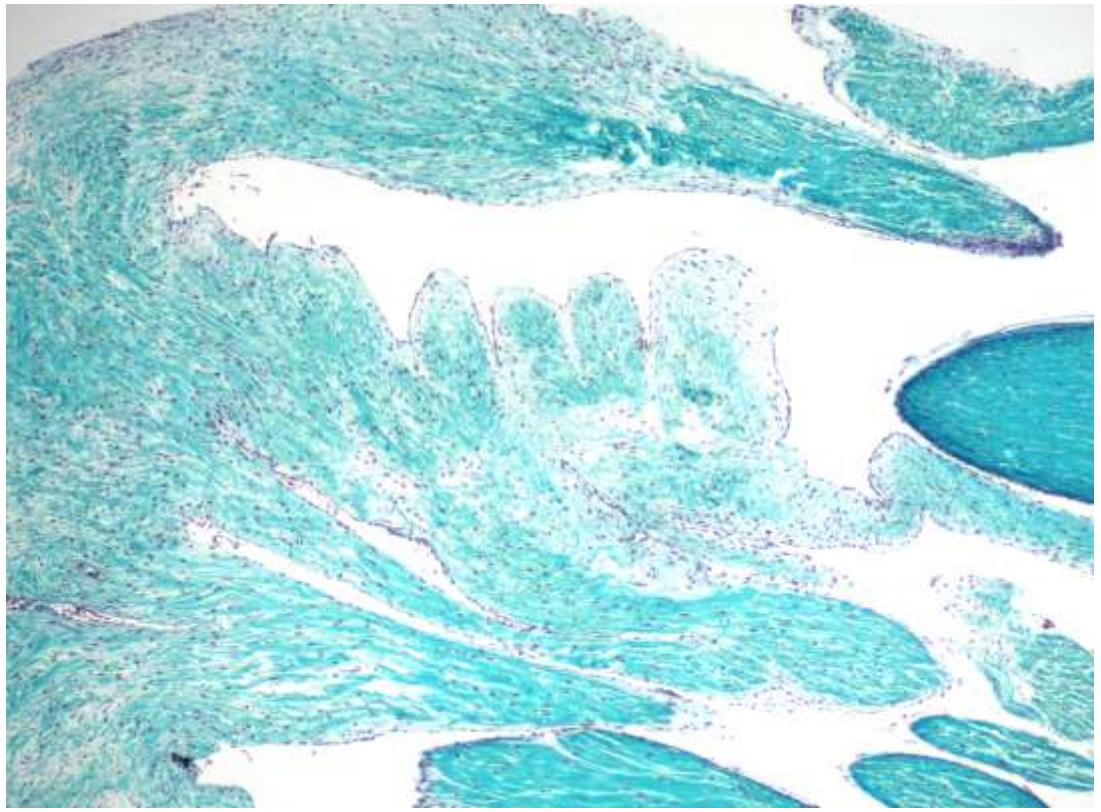


A – Atrialis
S- Spongiosa
F- Fibrosa

A-V Leaflet Histology



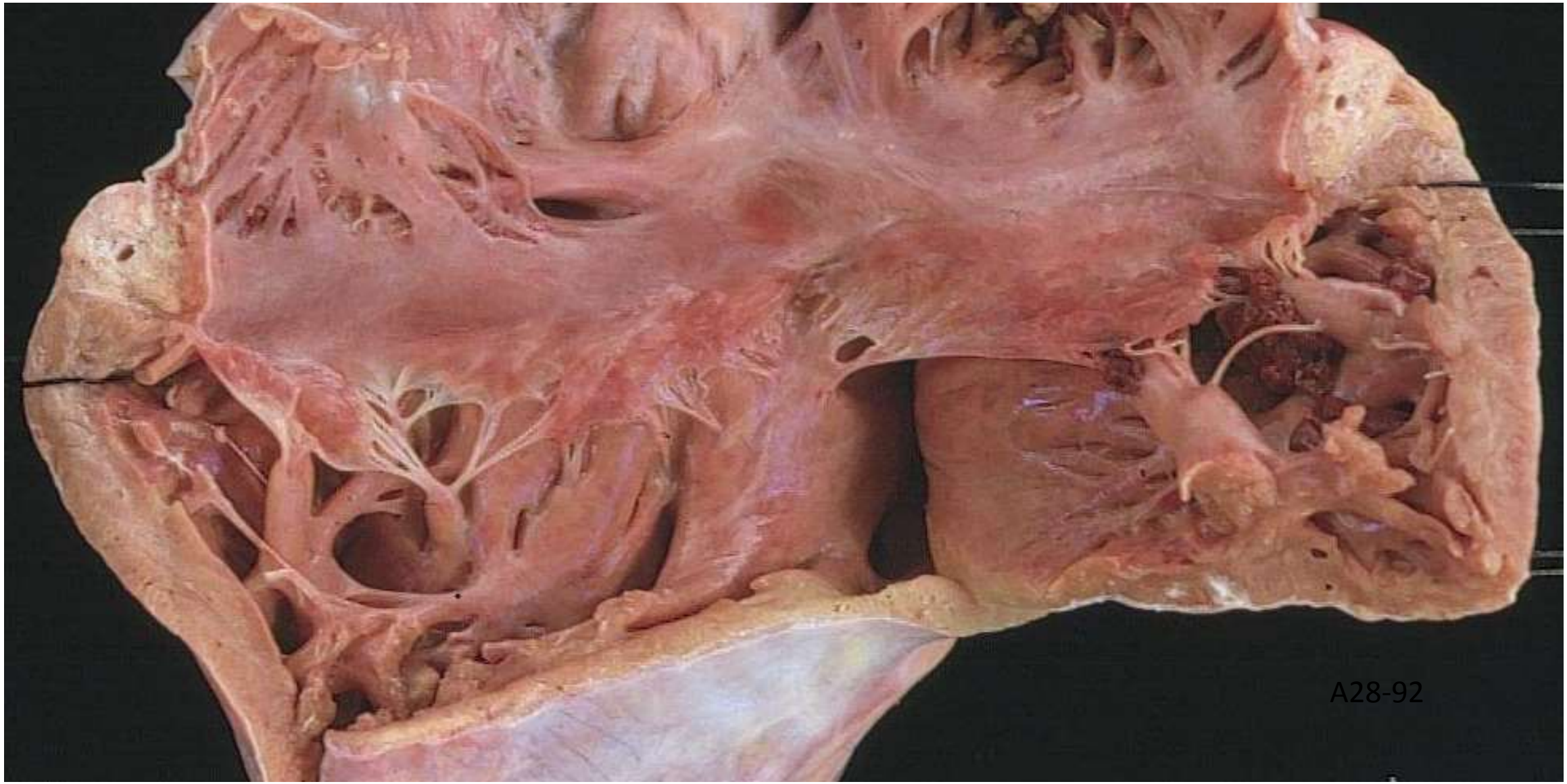
Basal



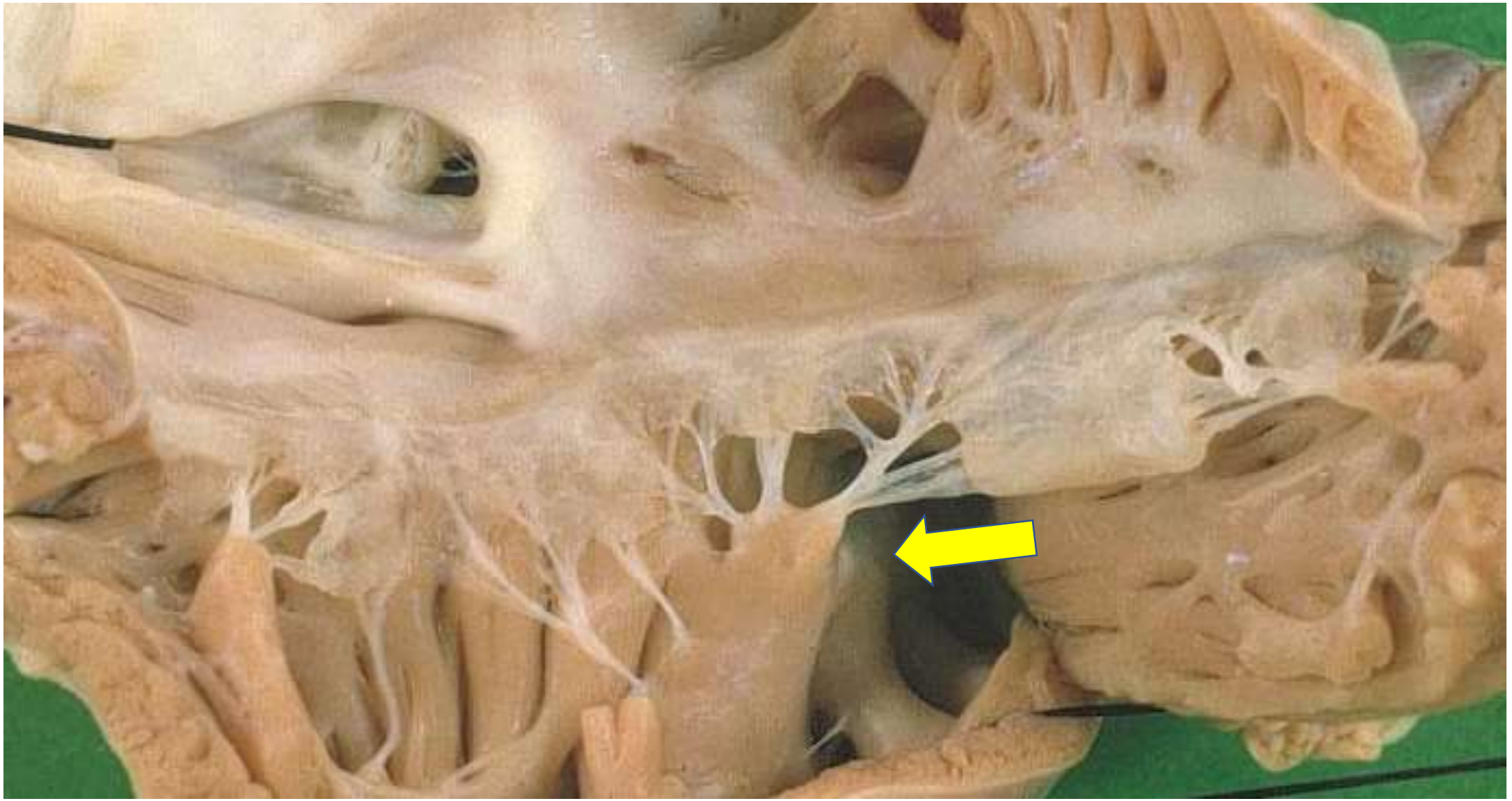
Chordae

Free Margin

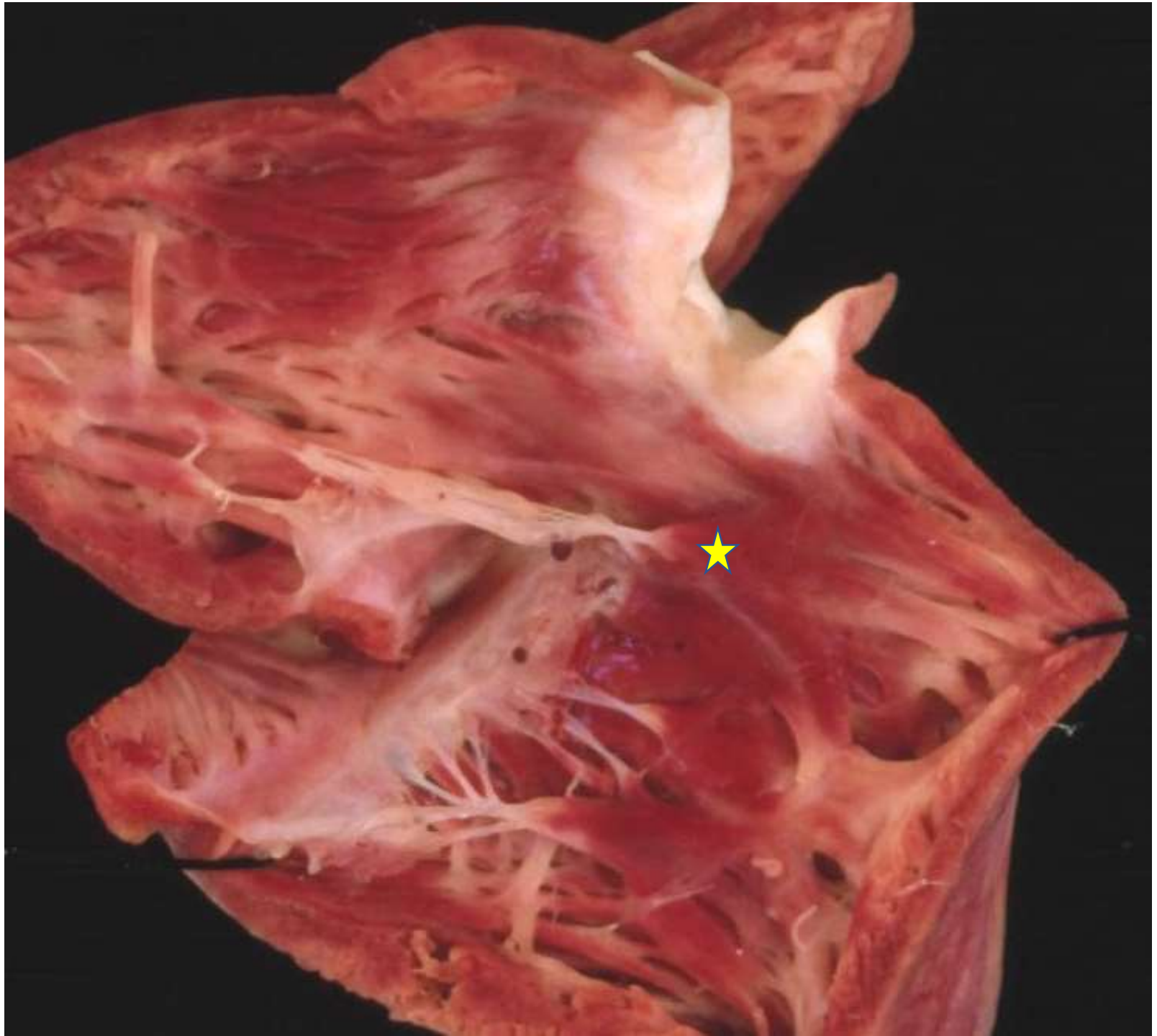
TV PM Variability



Medial Papillary Muscle of Lancisi



A28-92



Inlet vs. Outlet IVS

Giovanni Maria Lancisi

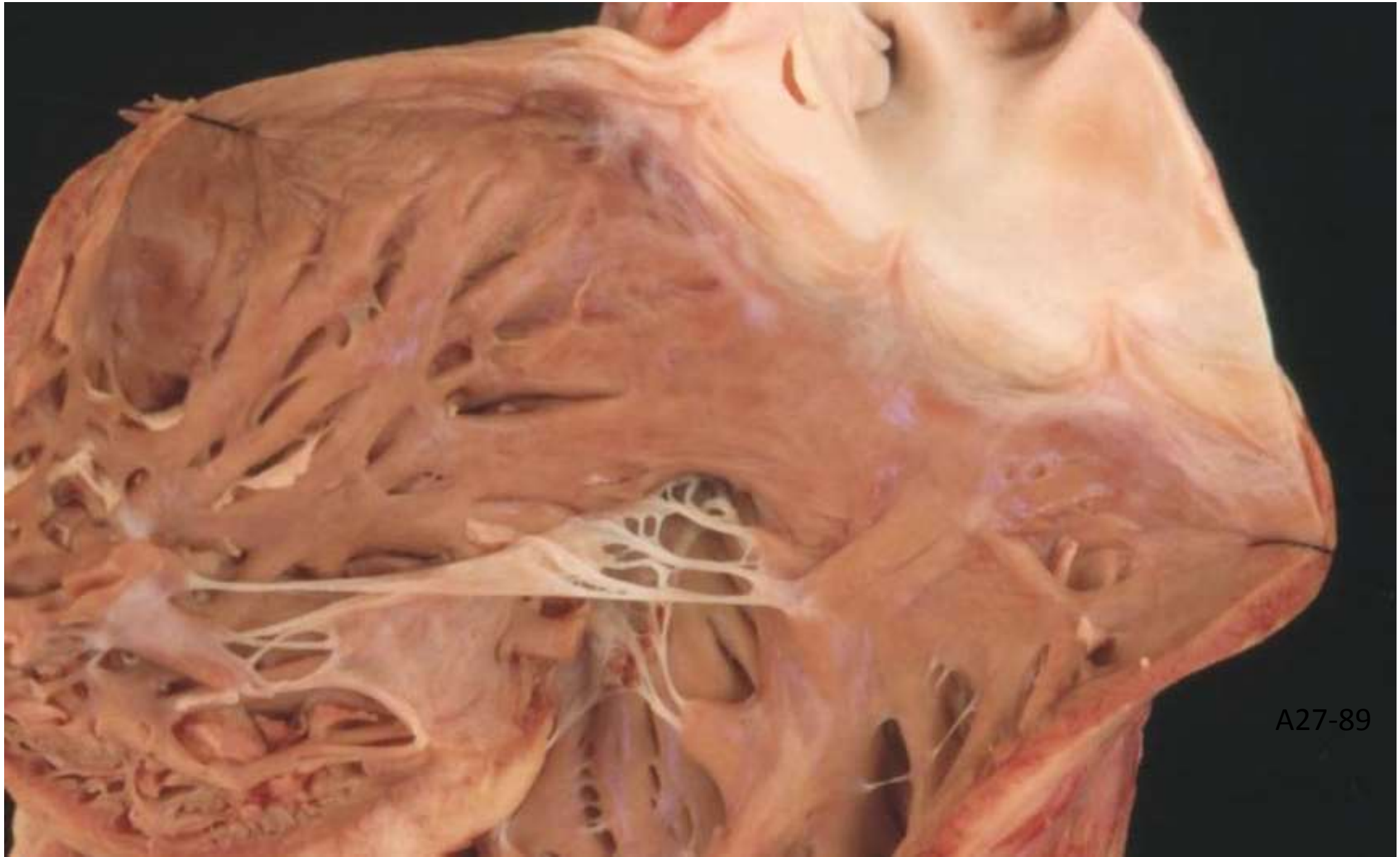
(26 October 1654 – 20 January 1720)

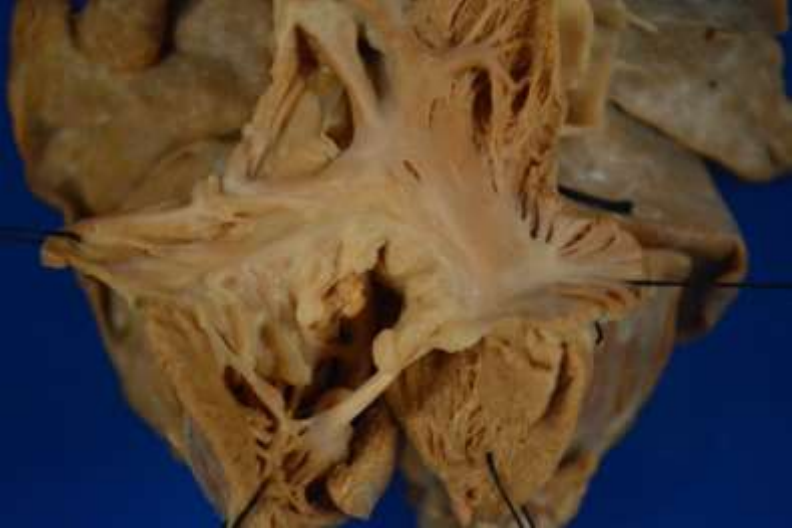
Italian physician, epidemiologist and anatomist

Cardiological contributions

- described:
  - vegetations on heart valves,
  - cardiac syphilis
  - aneurysms
- classification of heart disease
- published *De Motu Cordis et Aneurysmatibus* posthumously (1728)

TV – PV Muscular Separation

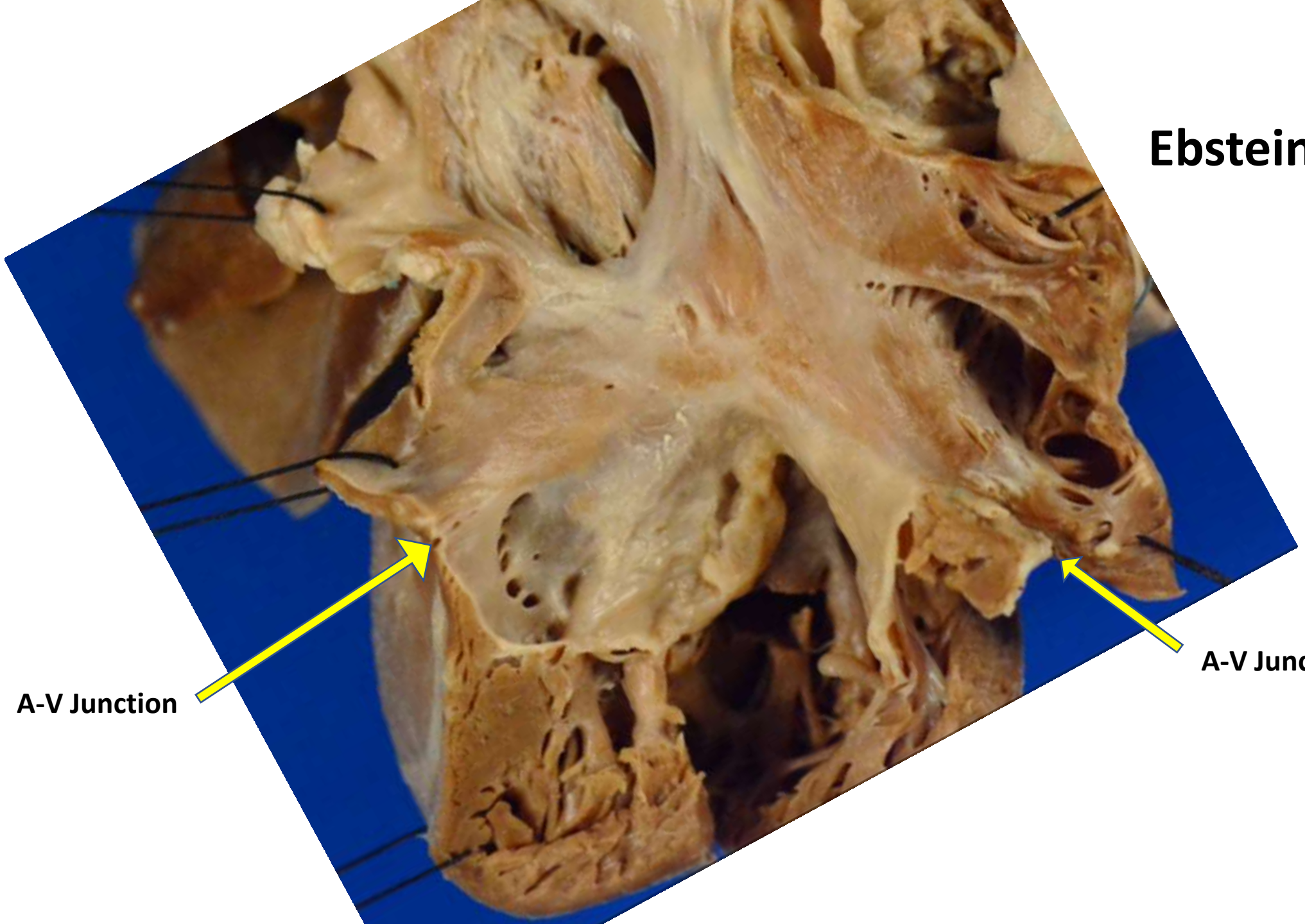




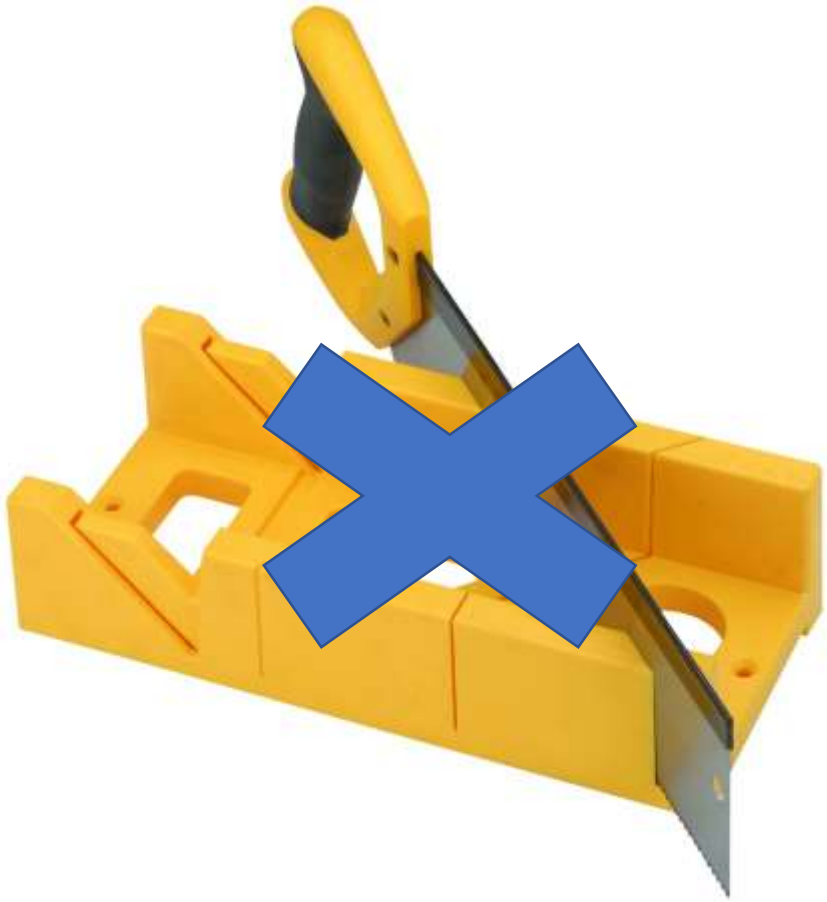
Tricuspid Valve Dysplasia

1529

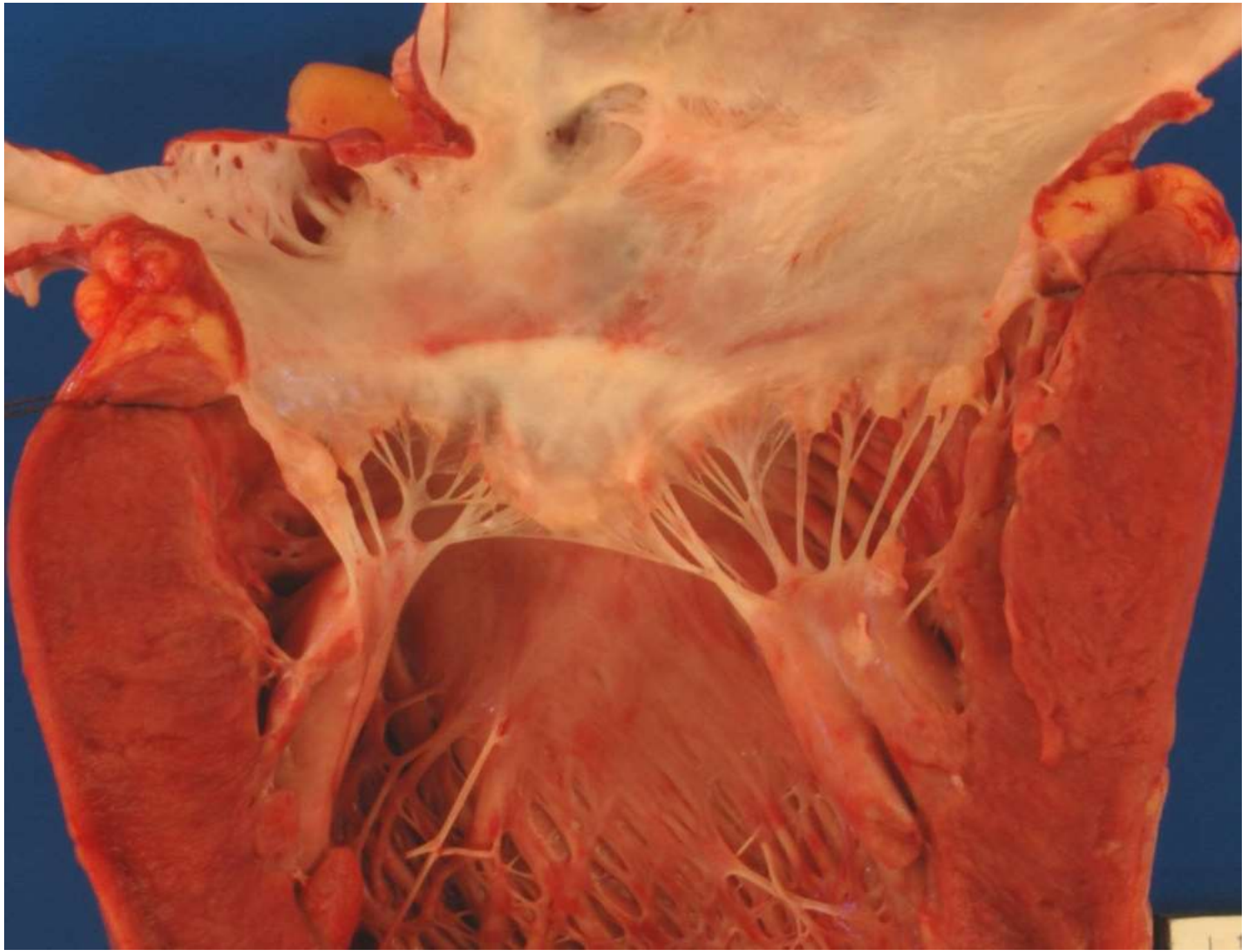
Ebstein anomaly

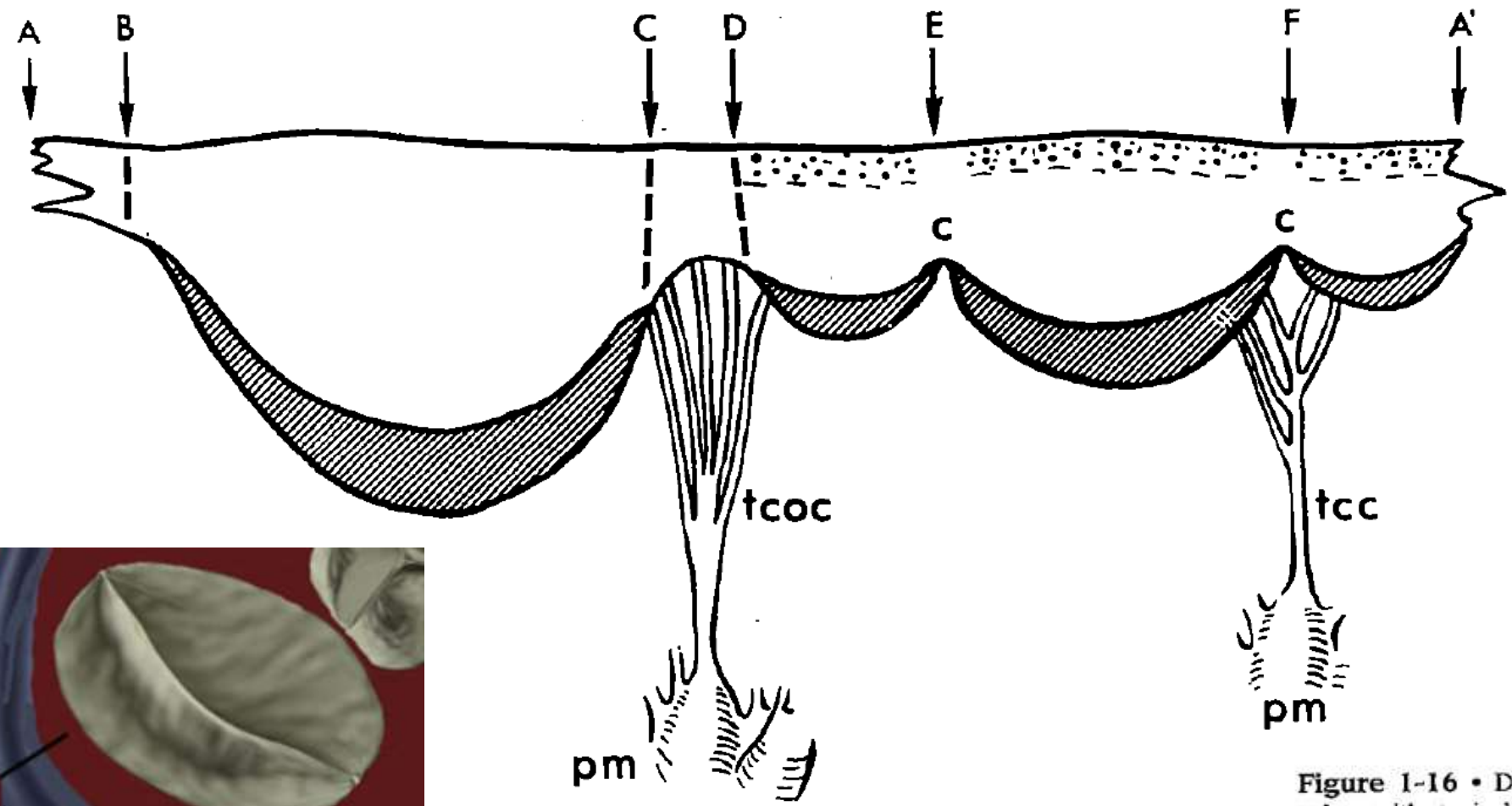


Left A-V Junction



Mitral Valve





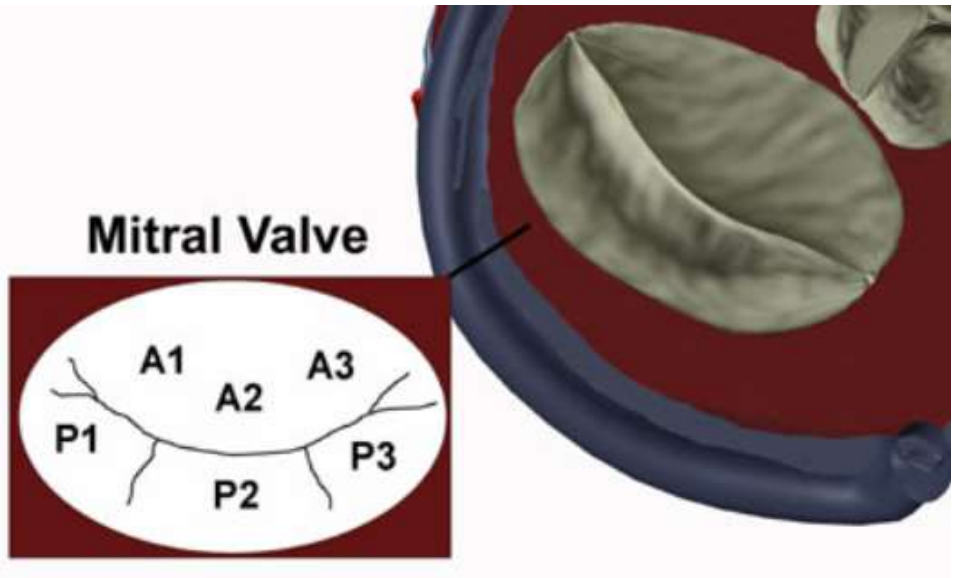
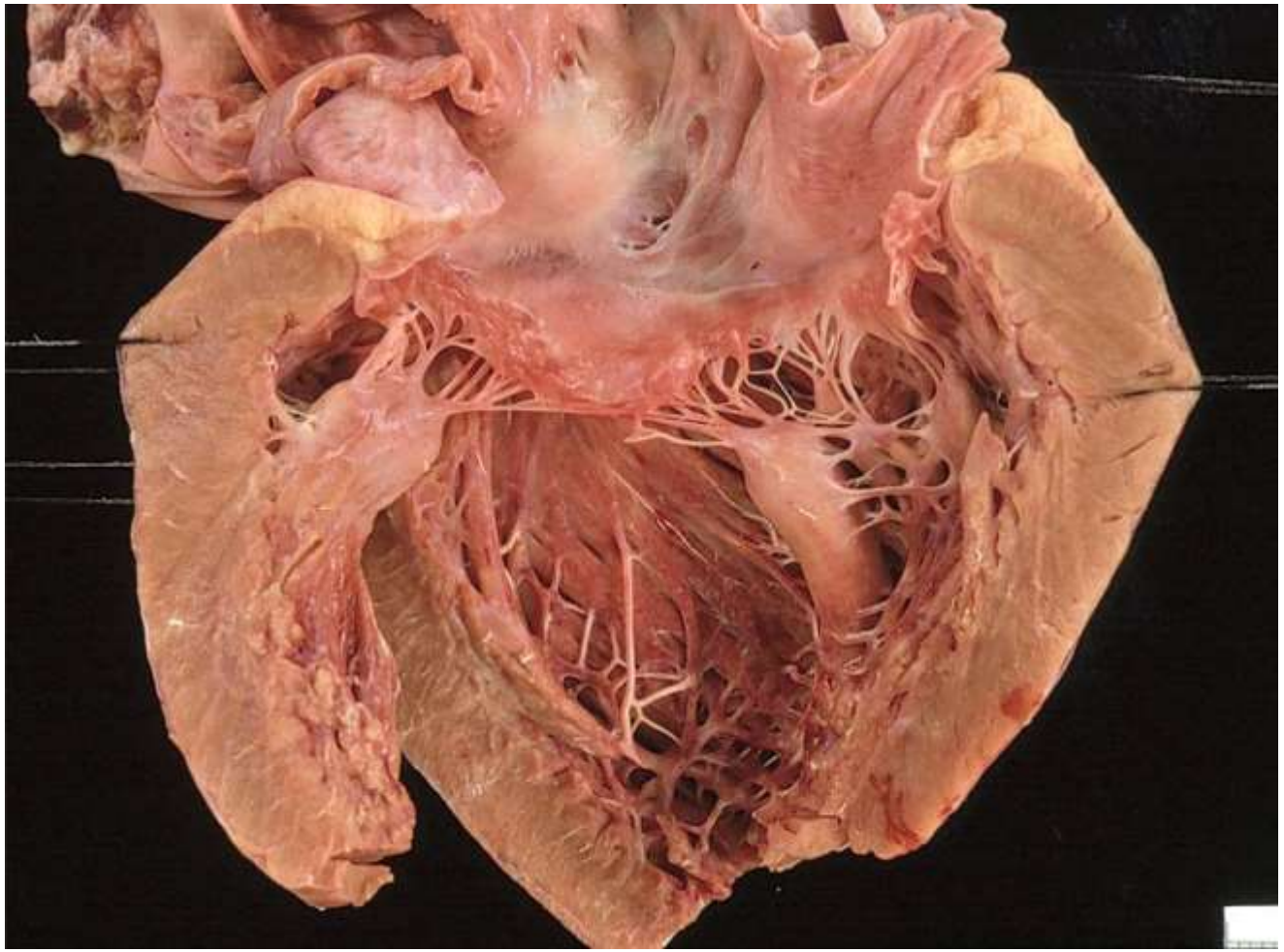


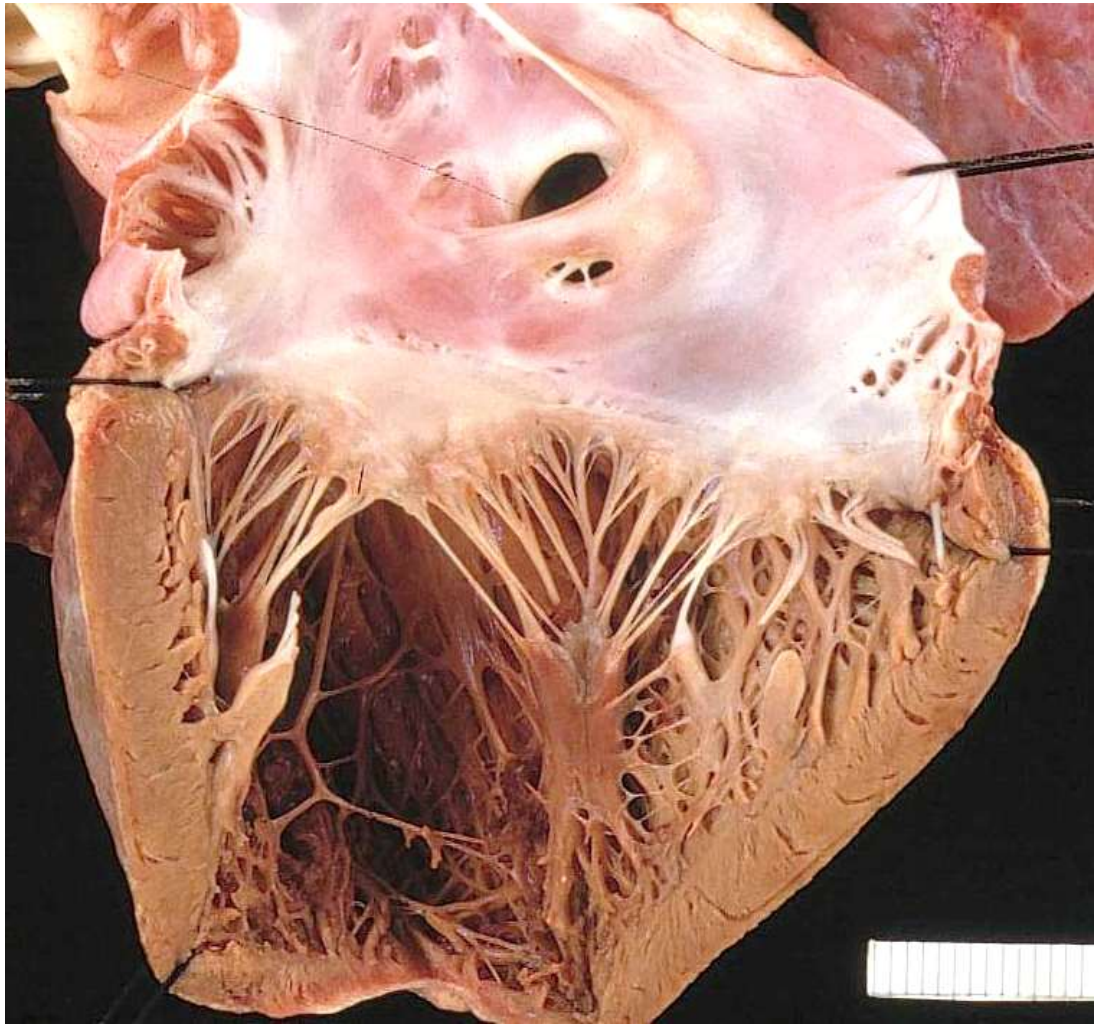
Figure 1-16 • Diagram of a mitral valve with typical commissural and cleft chordae tendineae attached. A-B,

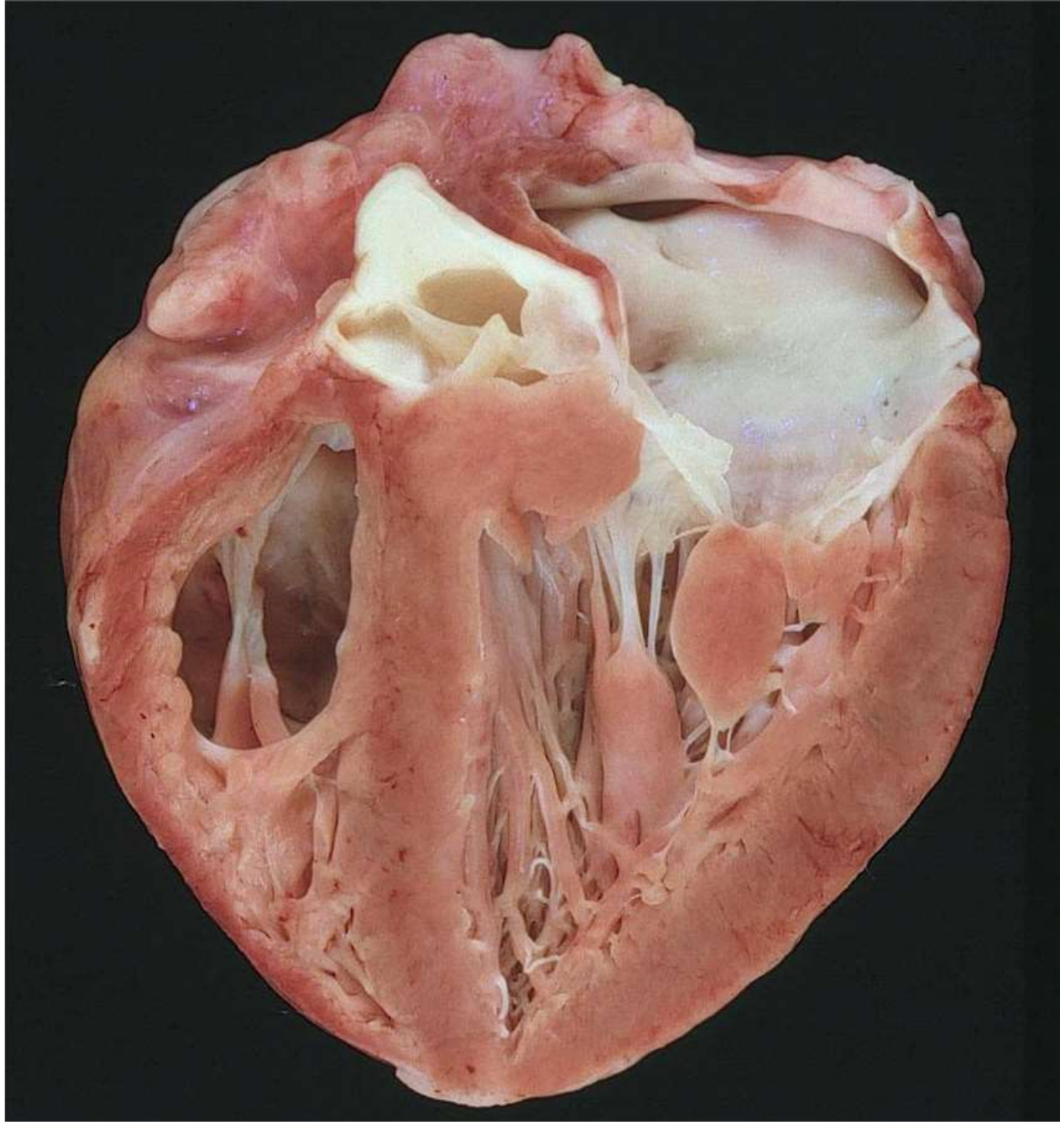
(From Rangarathan N, Lam JHC, Wigle ED, Silver MD: Morphology of human mitral valve. II. The valve leaflets. Circulation 41:459, 1970.

A06-283

MV Papillary Muscle Architecture

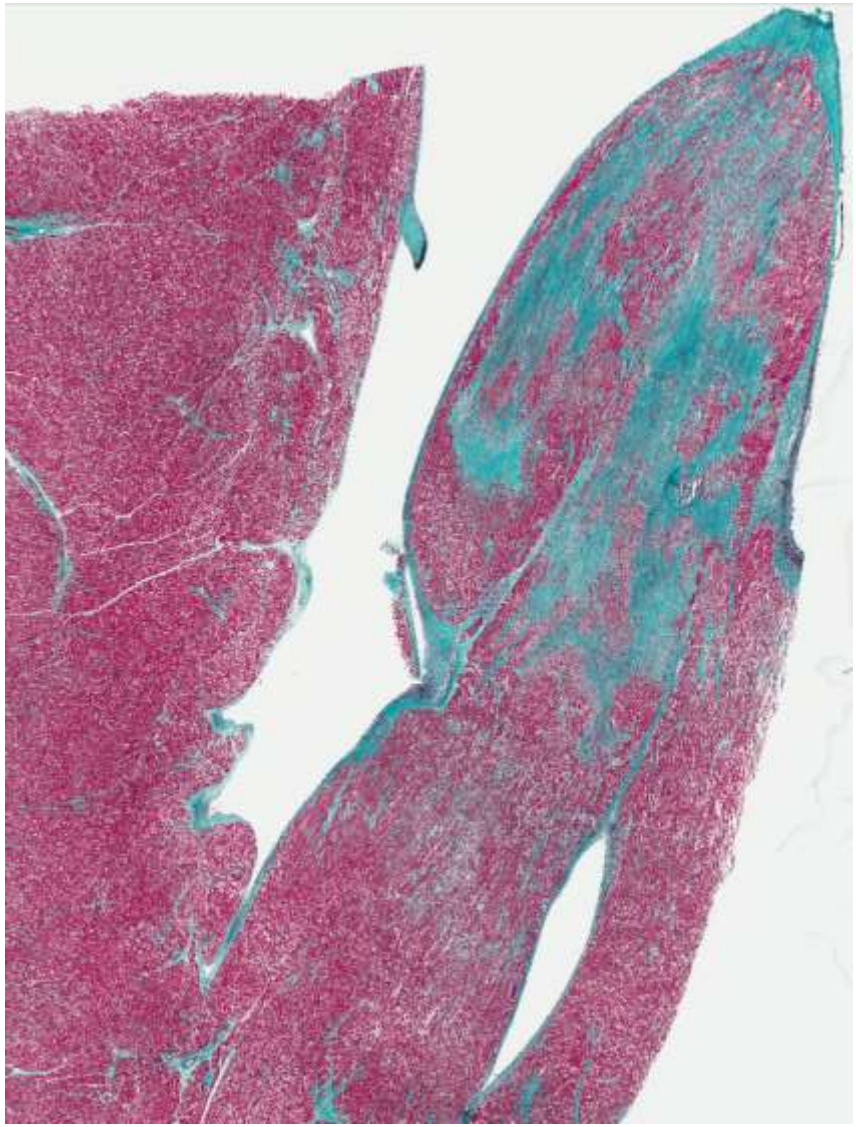




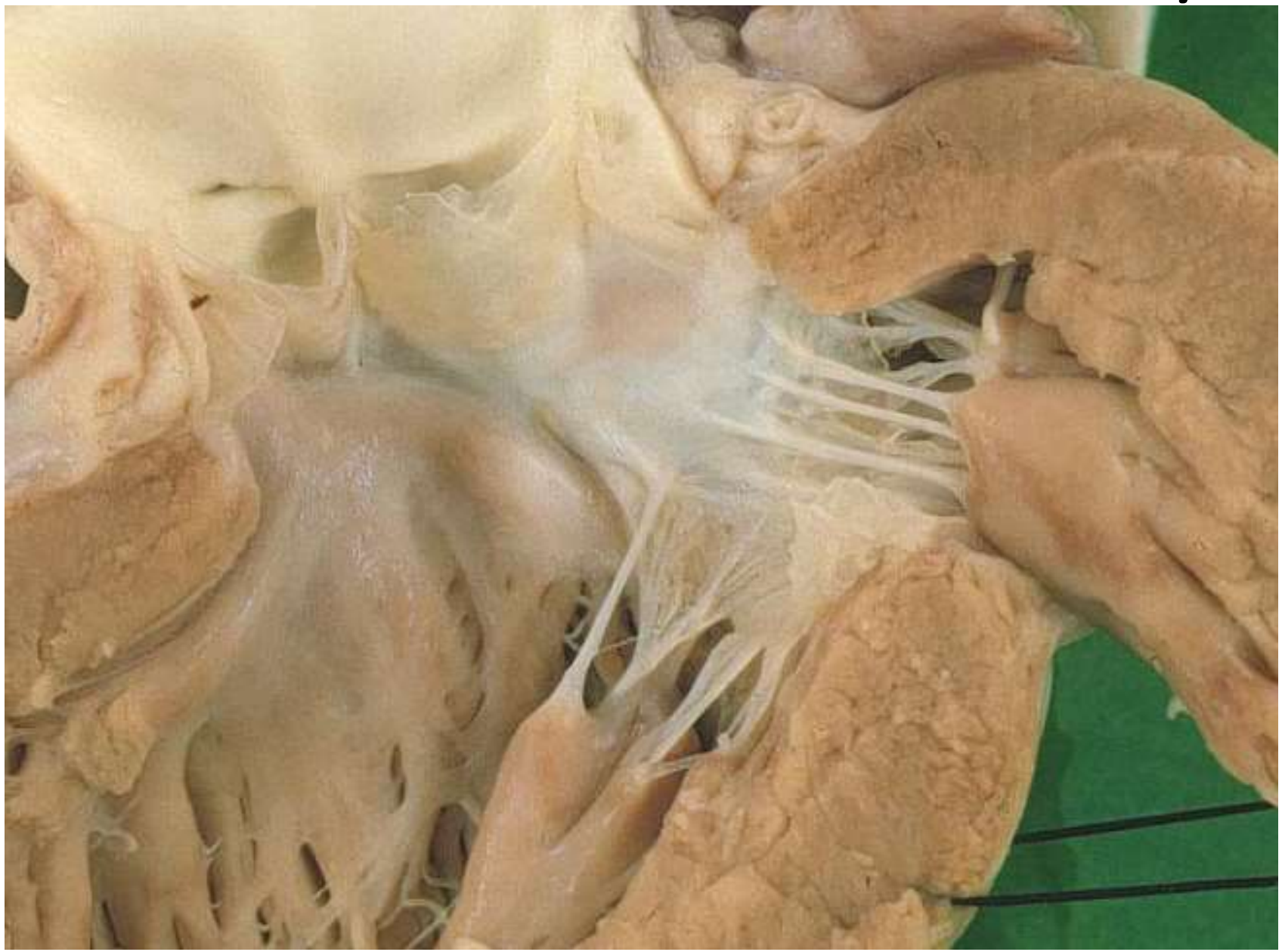


DGP

LV AnteriorPapillary Muscle



MV – AV Fibrous Continuity



A141-89

Mitral Valve Dysplasia

Shone JD, Sellers RD, Anderson RC, Adams P, Lillehei CW, Edwards, JE (1963). "The Developmental Complex of "Parachute Mitral Valve," Supravalvular Ring of Left Atrium, Subaortic Stenosis and Coarctation of Aorta.". *Am J Cardiol*. **11**: 714–25

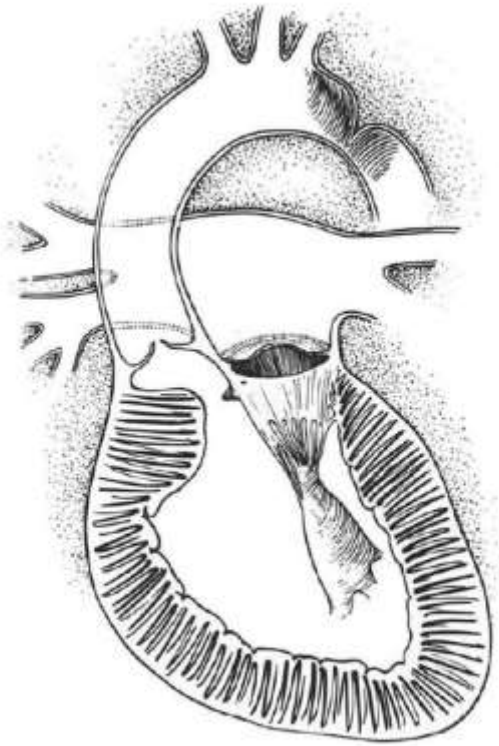


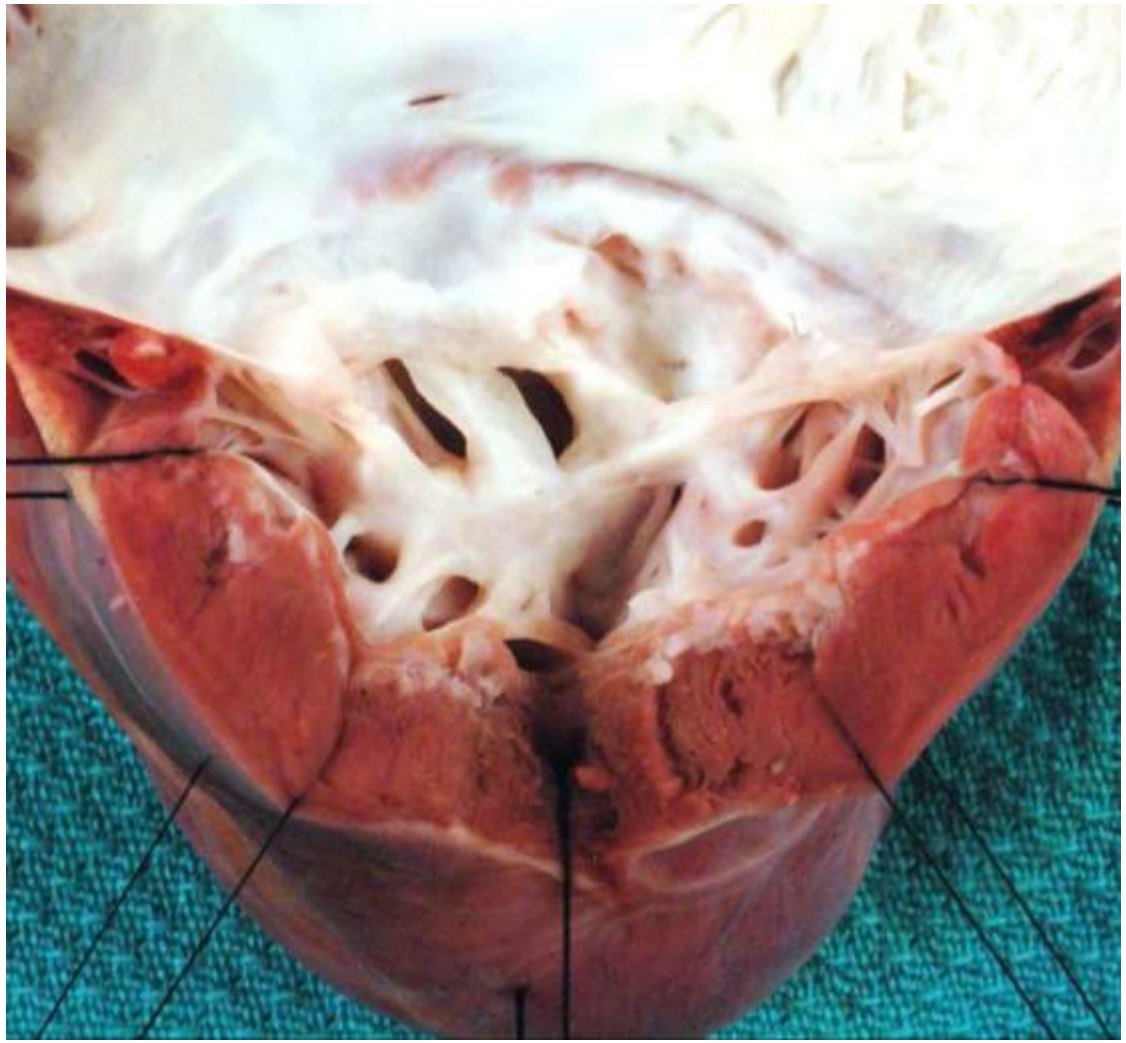
Figure 1. Diagram from the initial report of Shone complex illustrating the 4 obstructive anomalies: supravalvular ring of left atrium, parachute mitral valve, subaortic stenosis, and coarctation of aorta. Reproduced from Shone et al.[1] with permission from Elsevier.

Canadian Journal of Cardiology 33 (2017) 214–219

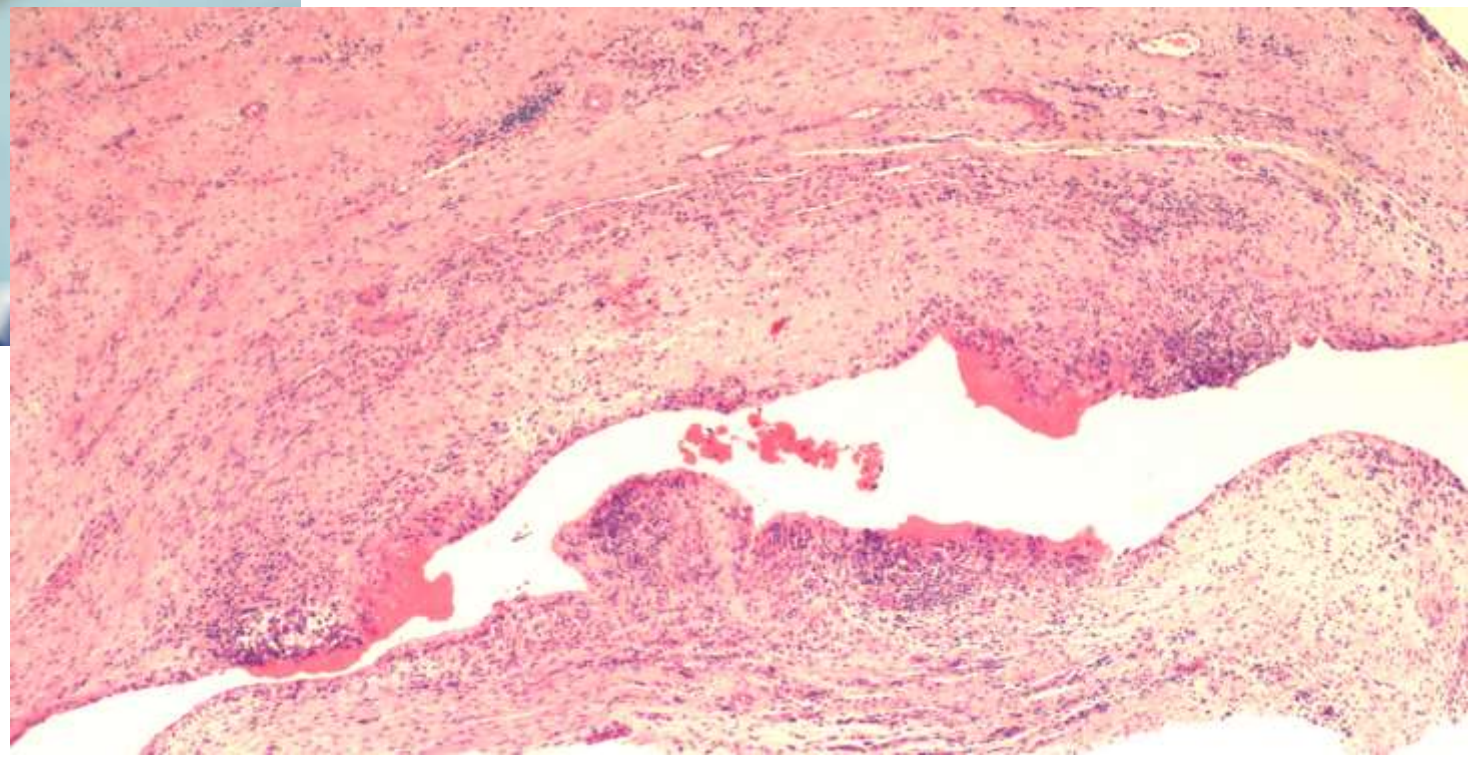
Editorial

Evolving Understanding of Shone Complex Through the Lifespan: What's in an Eponym?

Alexander R. Opotowsky, MD, MMSc,[a,b] and Gary D. Webb, MD



A06-53



Active Rheumatic
Mitral Valvular Disease

TV vs MV Morphology

Tricuspid ANNULUS

- Attached to only 1trigone (PM)
- Easily distensible with thinner and almost virtual fibrous structures
- Largest orifice of all valves (7–9 cm)
- Contiguity with the Koch triangle, RCA (anteroposterior) and aortic cusps

Tricuspid LEAFLETS and COMMISSURES

- 3 leaflets (A-P-S) and 3 commissures
- Thinner, translucent and more fragile

Tricuspid CHORDAE TENDINAE

- Thinner and more fragile
- Single attachment at the free edge
- Originating from various level of PMs and can attach directly to the RV wall

Tricuspid PAPILLARY MUSCLES

- 3 papillary muscles (ANT dominant- POST-SEPT, multiple and thinner heads)
- Can originate from the septum

Right VENTRICLE and RVOT

- Thinner and more distensible walls (1:3)
- Presence of Moderator Band
- TV and PV are widely separated
- Crescentic cavity

Mitral ANNULUS

- Attached to 2 fibrous trigones (AL-PM)
- Saddle-shaped in systole
- Fibrous structure is thick
- Contiguity with the His bundle (PM commissure), the coronary sinus and the Cx artery (posterolateral region)

Mitral LEAFLETS and COMMISSURES

- 2 leaflets (A-P) and 2 commissures
- Thicker and more resistant than TL

Mitral CHORDAE TENDINAE

- Thicker and more resistant.
- Bifurcated/trifurcated at the free edge
- Extend directly from the heads of PMs

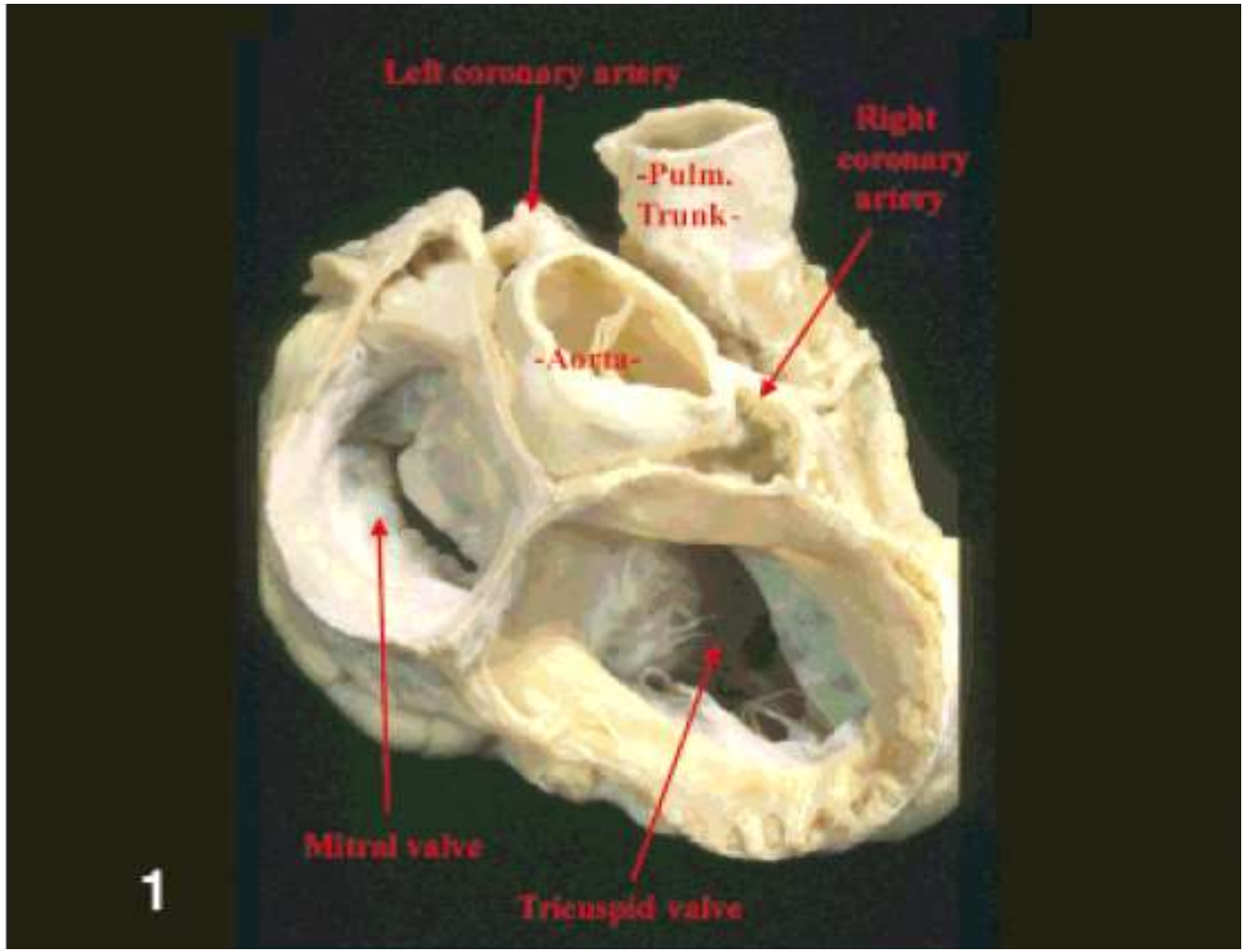
Mitral PAPILLARY MUSCLES

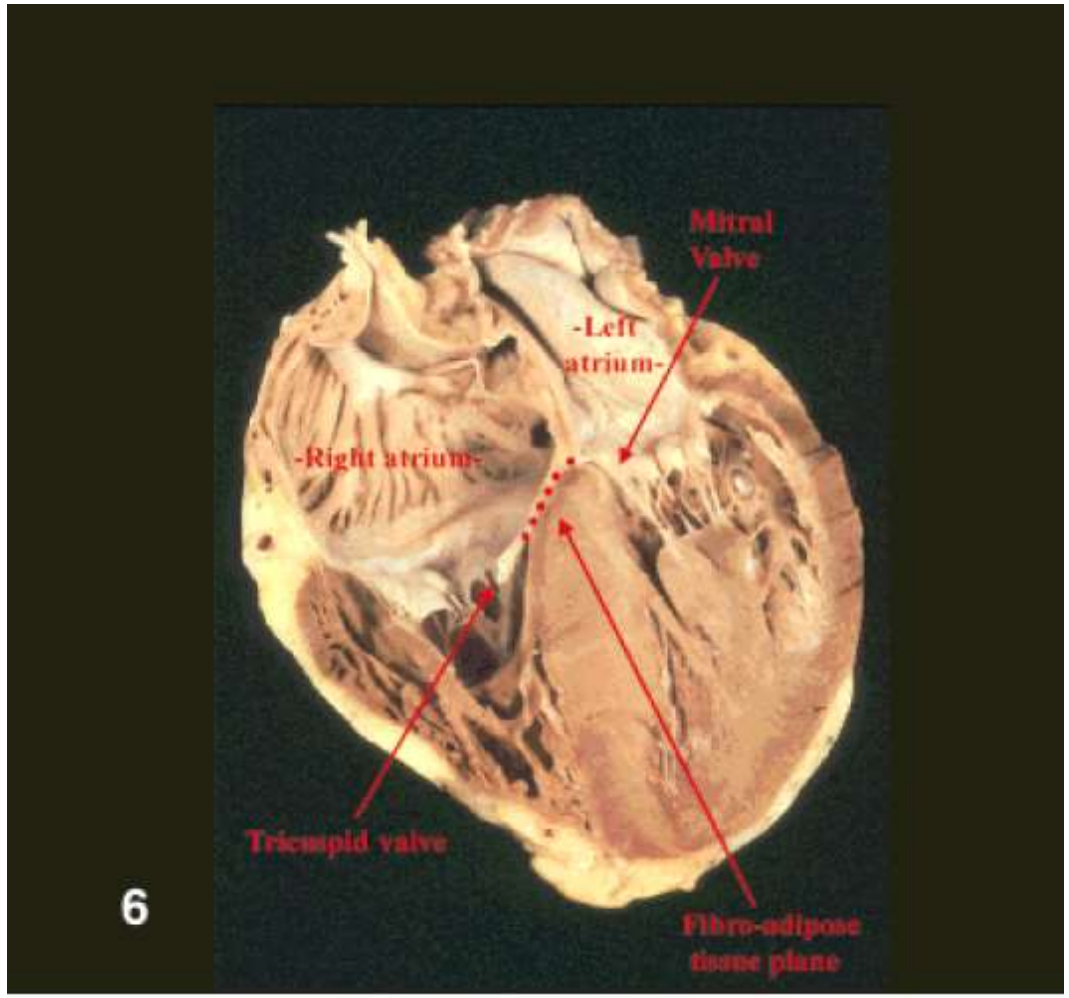
- 2 papillary muscles (AL-PM)
- Single bulky or multiple heads
- No PMs is attached to the septum

Left VENTRICLE and LVOT

- Thicker walls than the RV (3:1)
- Absence of Moderator Band
- MV is in continuity with the AV through the mitro-aortic curtain cohoctic cavity

TV – MV Relationship

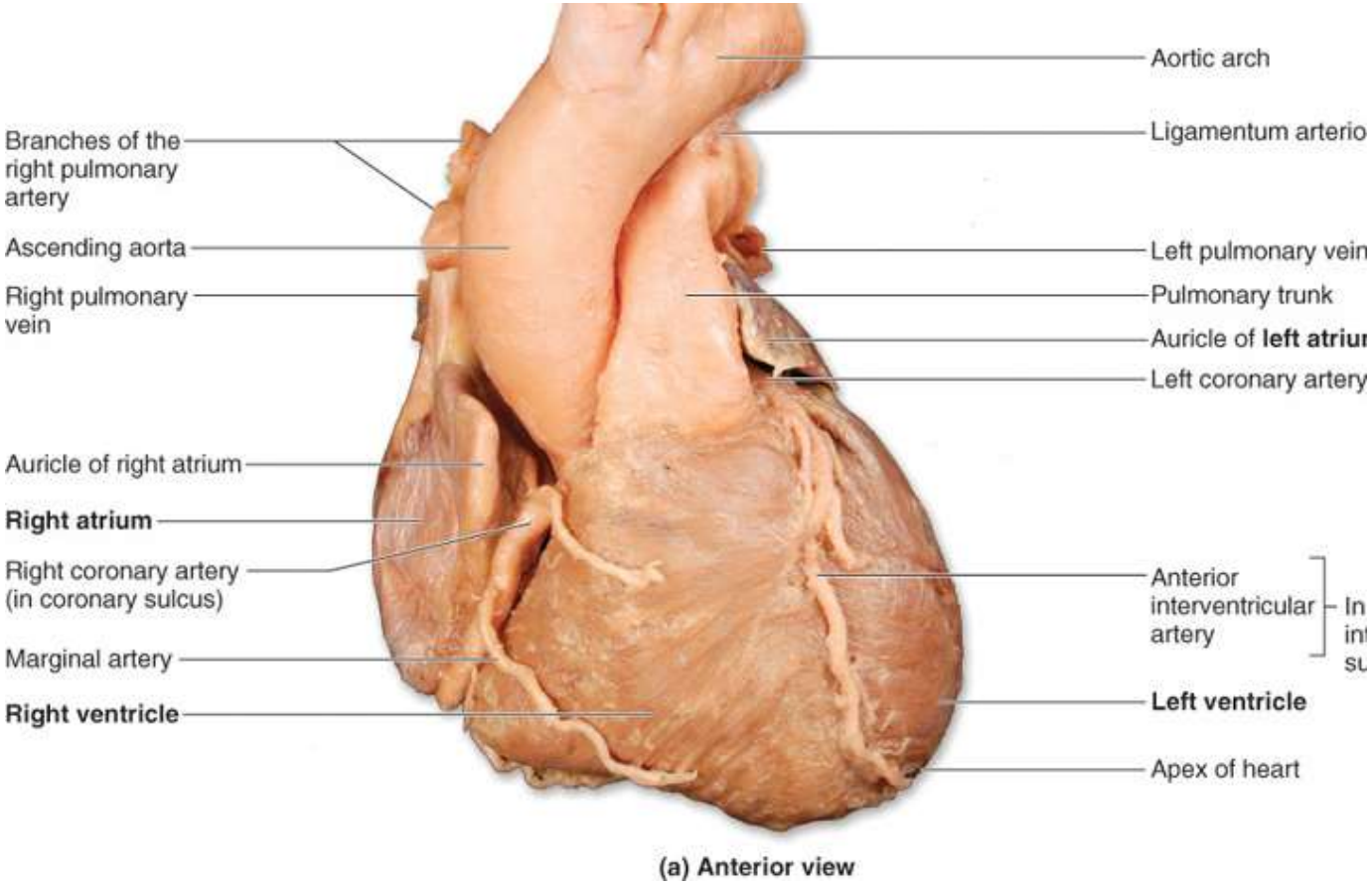




Anatomy of the Human Atrioventricular Junctions Revisited

ROBERT H. ANDERSON,[1*] SIEW YEN HO,[2] AND ANTON E. BECKER[3]

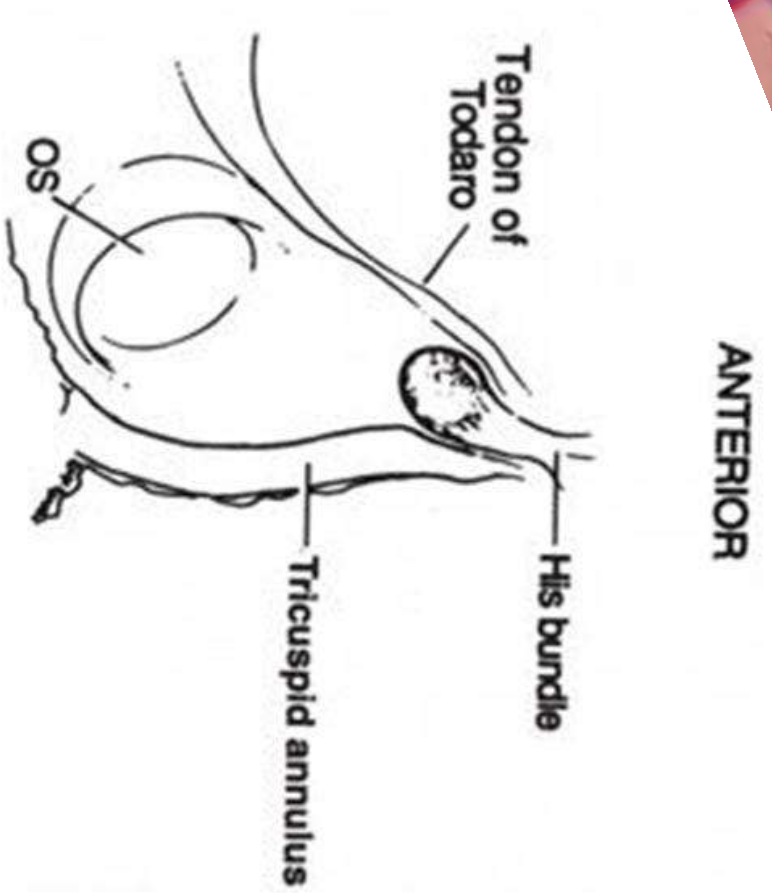
A-V Junction / Coronary Artery Relationship

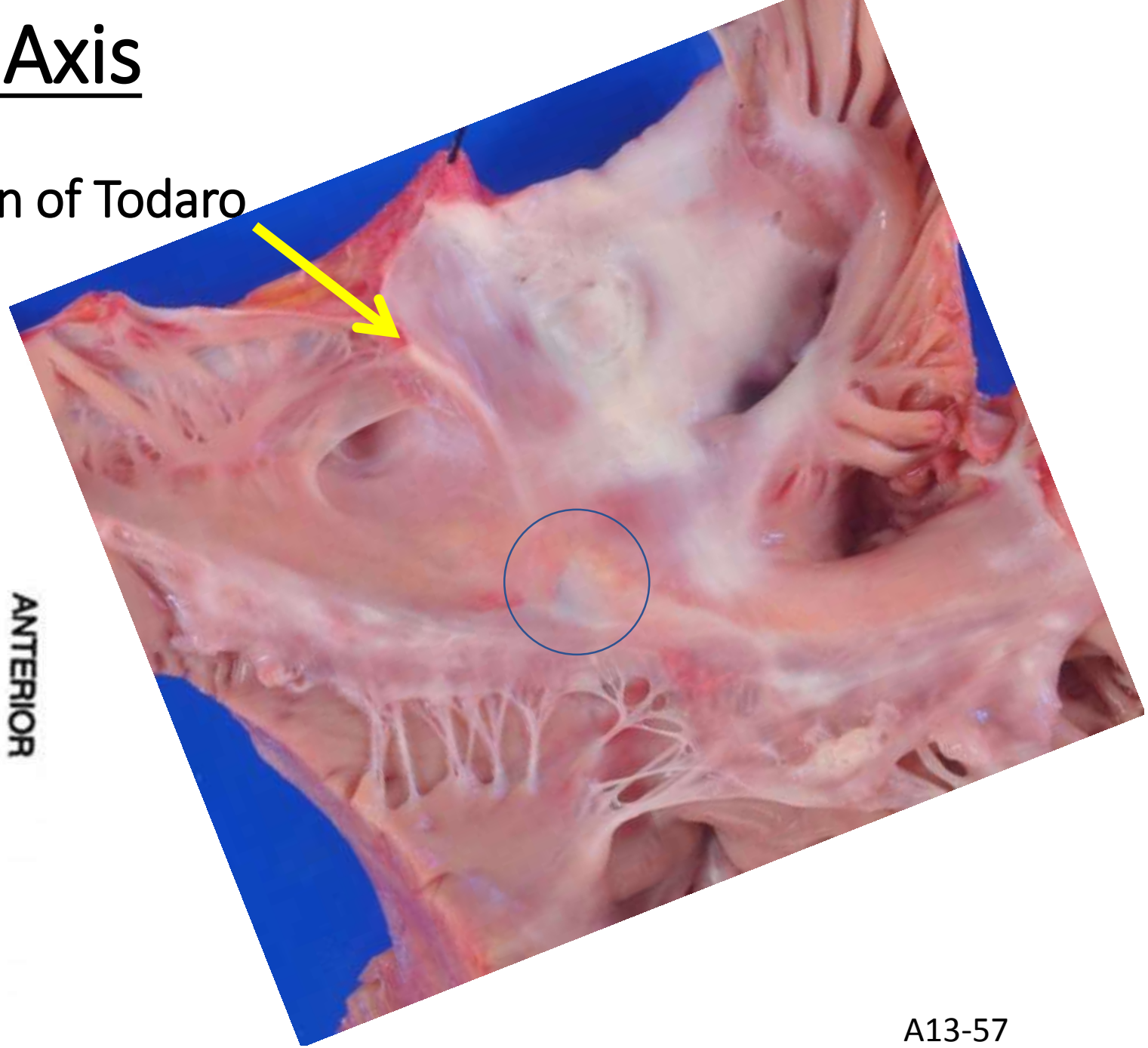


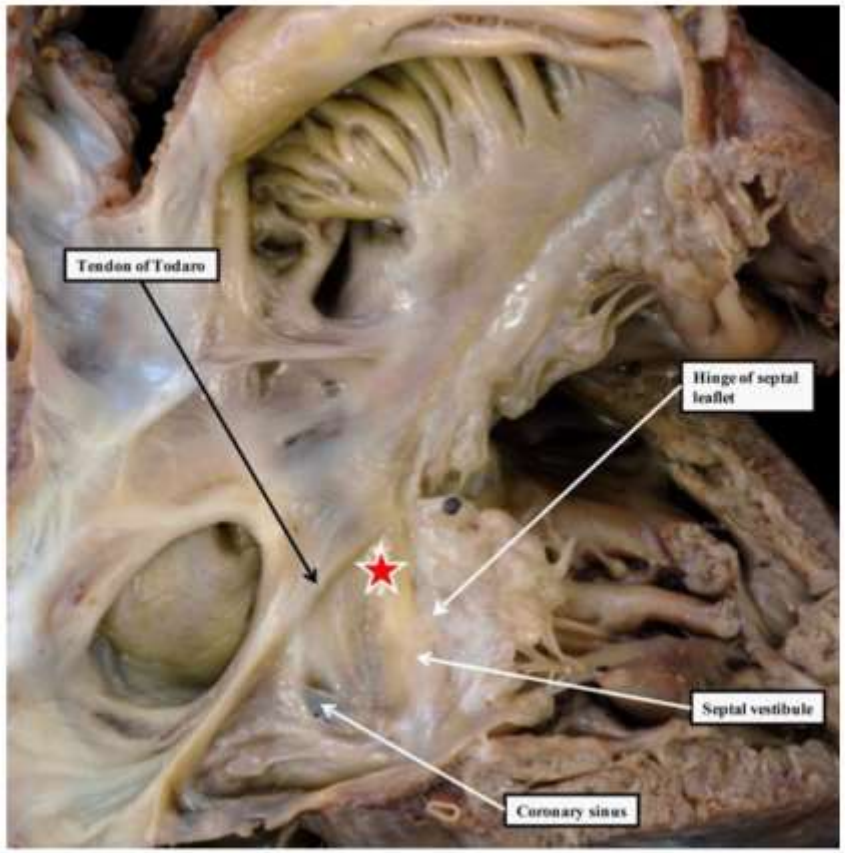
(a) Anterior view

A-V Conduction Axis

Tendon of Todaro







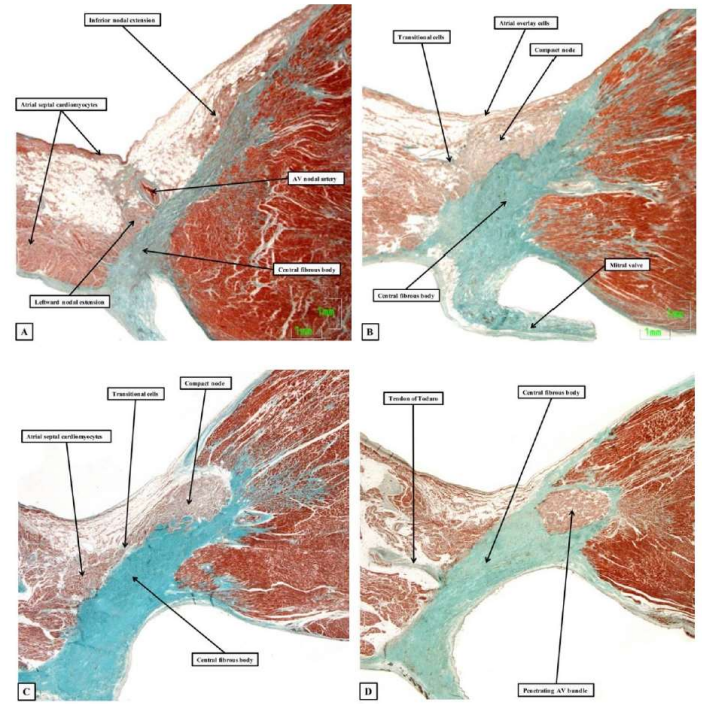


Figure 2. *Cont.*

Journal of *Cardiovascular Development and Disease*

J. Cardiovasc. Dev. Dis. **2018**, *5*, 44

MDPI

Review

The Anatomy, Development, and Evolution of the Atrioventricular Conduction Axis

Robert H. Anderson [1], Shumpei Mori [2], Diane E. Spicer [3], Damian Sanchez-Quintana [4] and Bjarke Jensen [5,*]

THE ANATOMICAL RECORD 260:81–91 (2000)

Anatomy of the Human Atrioventricular Junctions Revisited

ROBERT H. ANDERSON,[1]* SIEW YEN HO,[2] AND ANTON E. BECKER[3]
[1]Cardiac Unit, Institute of Child Health, University College, London WC1N 1EH, United Kingdom
[2]Paediatrics, National Heart & Lung Institute, Imperial College School of Medicine, London SW3 6L4, United Kingdom
[3]Cardiovascular Pathology, Academic Medical Centre, University of Amsterdam, 1105 A2 Amsterdam, The Netherlands

Dr. Jesse E. Edwards reviewed a heart specimen in about 1985
with medical students and advanced fellows in cardiology