

Atrioventricular Canal (Septal) Defects



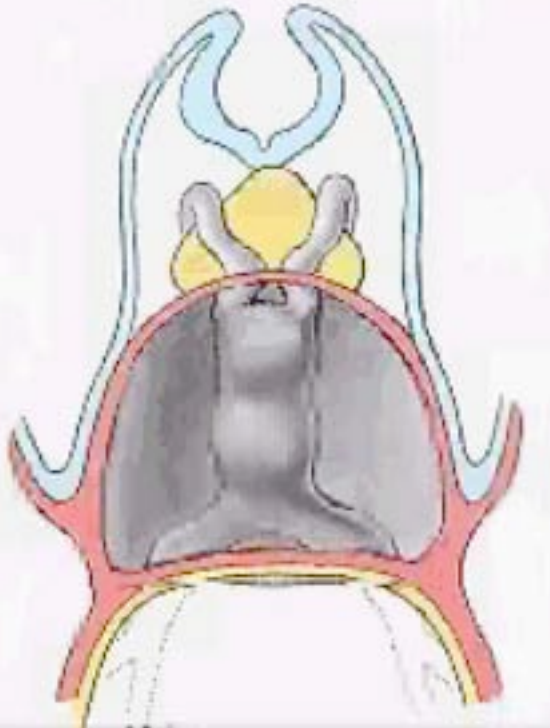
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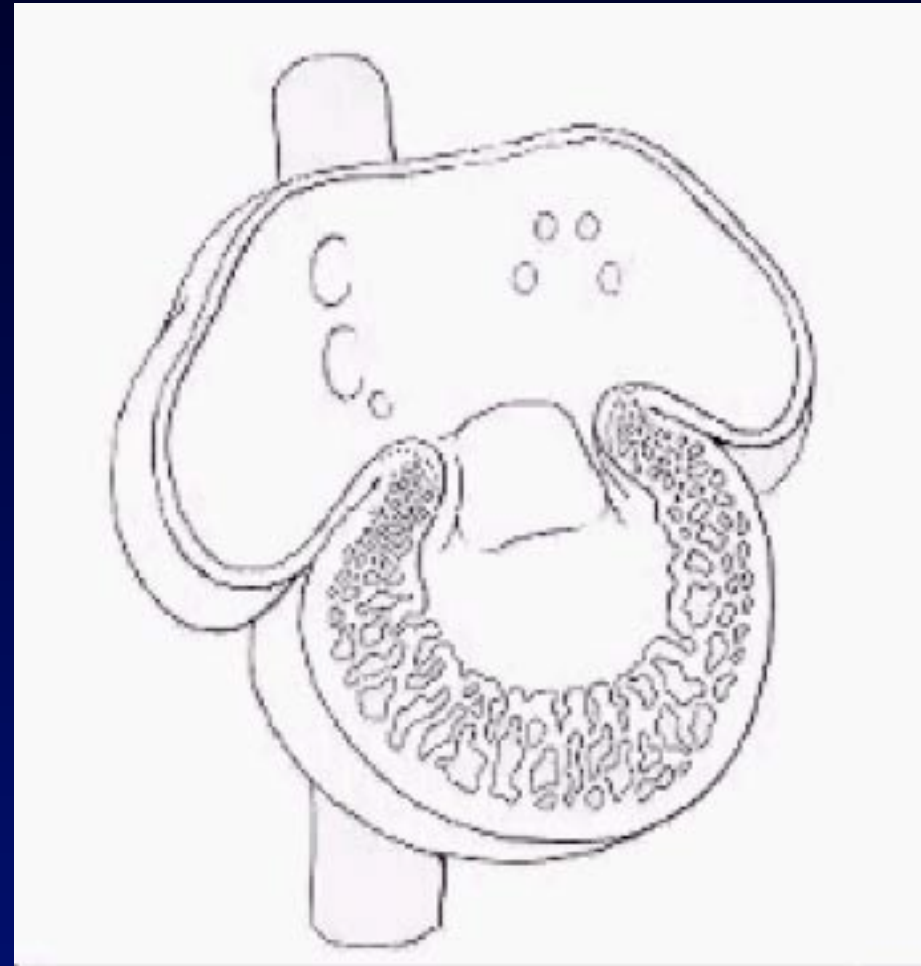
Norman H Silverman MD. D Sc (Med), FACC, FAHA



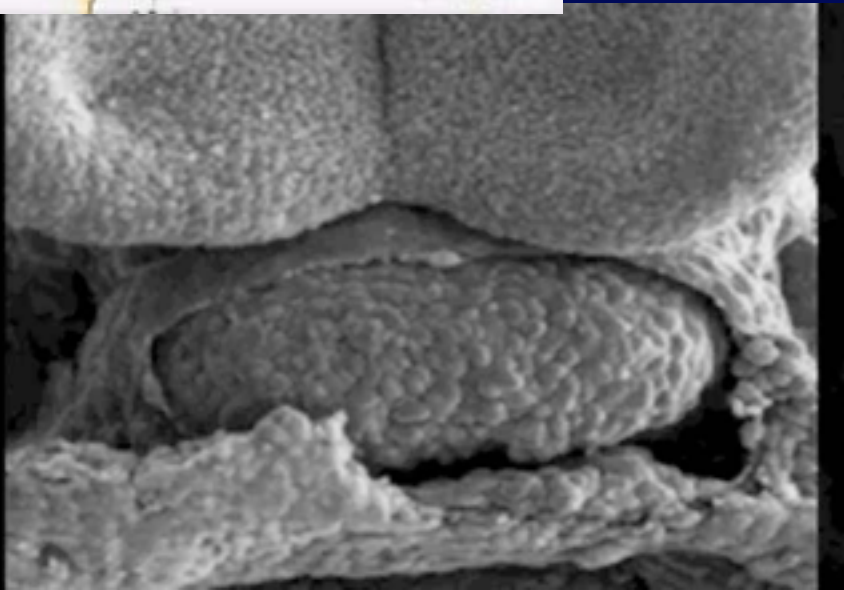
Embryology of the A-V Canal



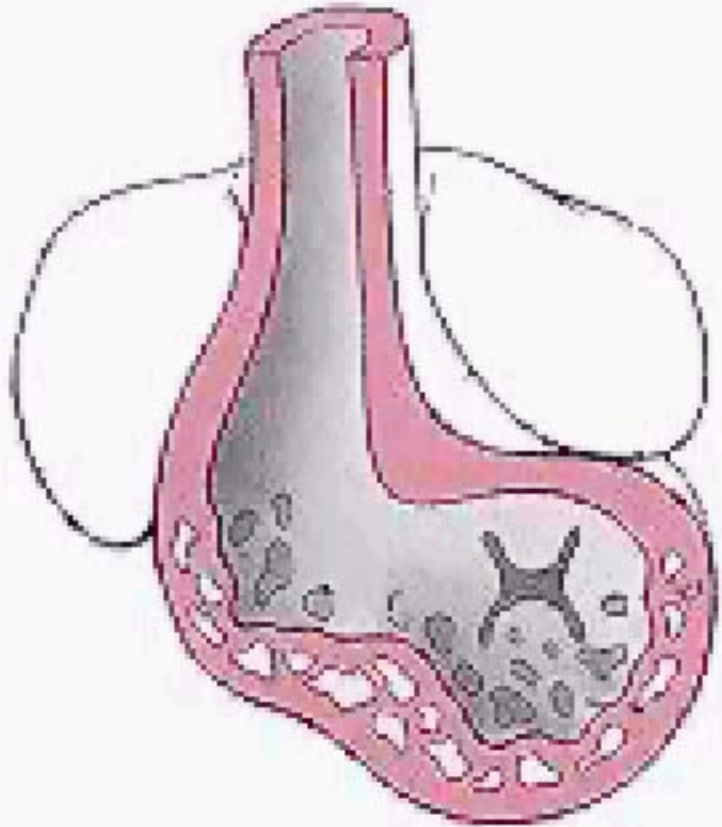
Looping



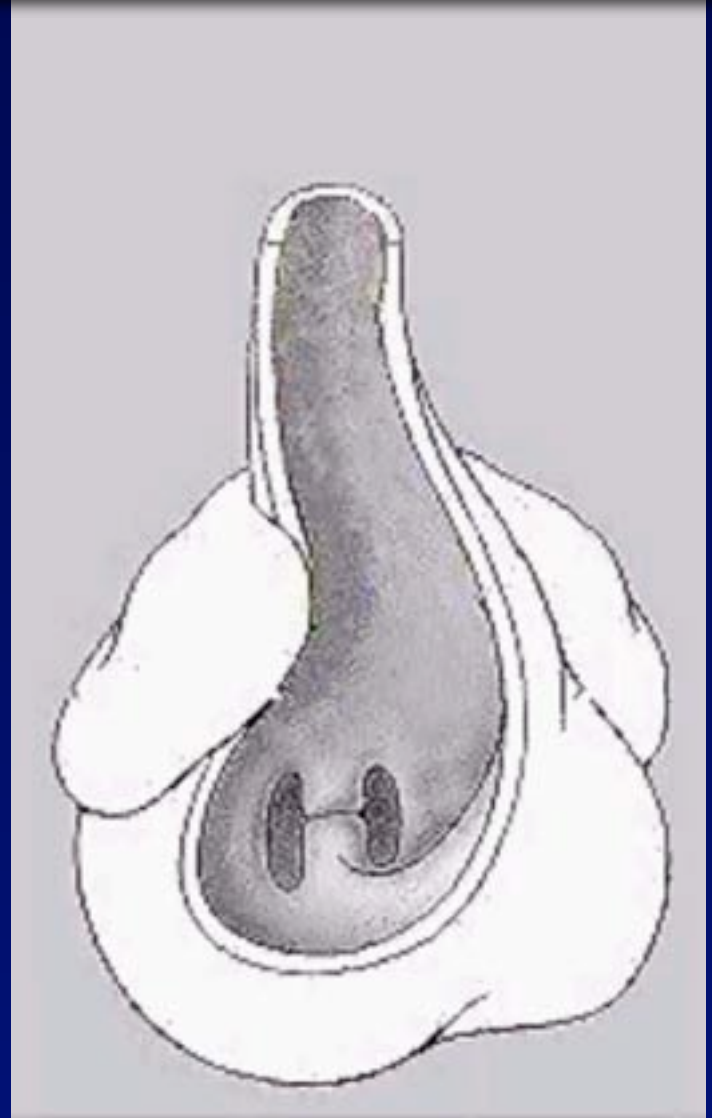
Formation of the Atrial Septum



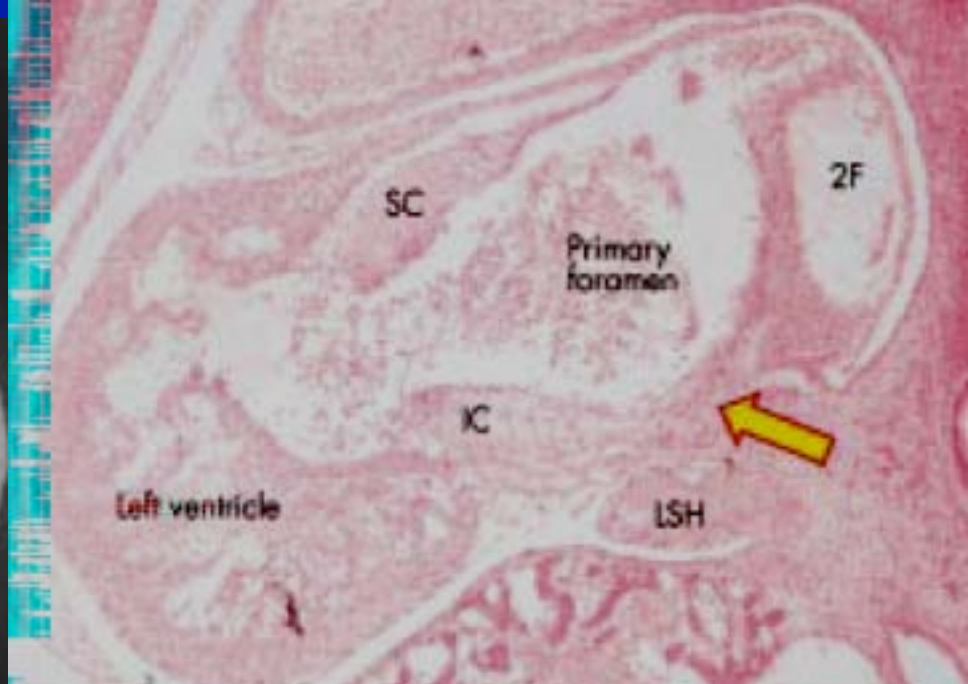
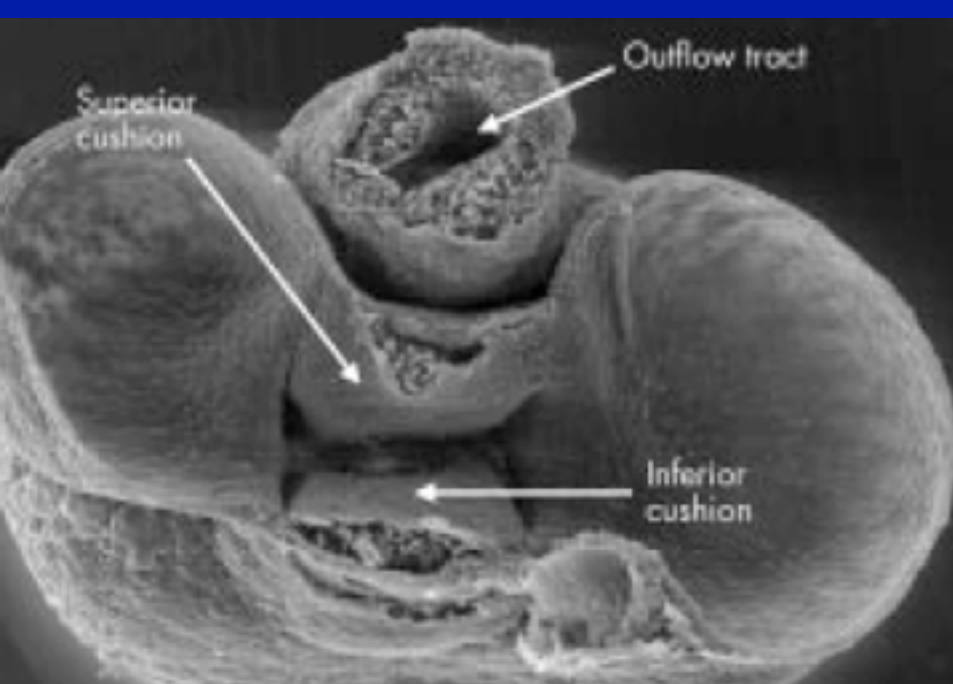
Embryology of the A-V Canal



Development of the A-V Canal

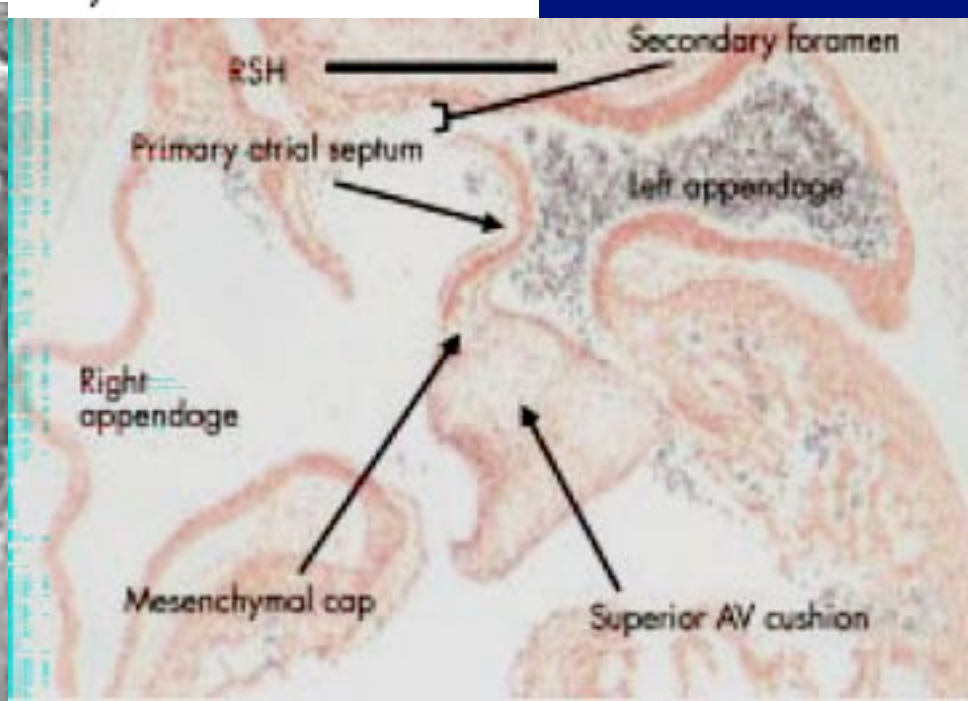
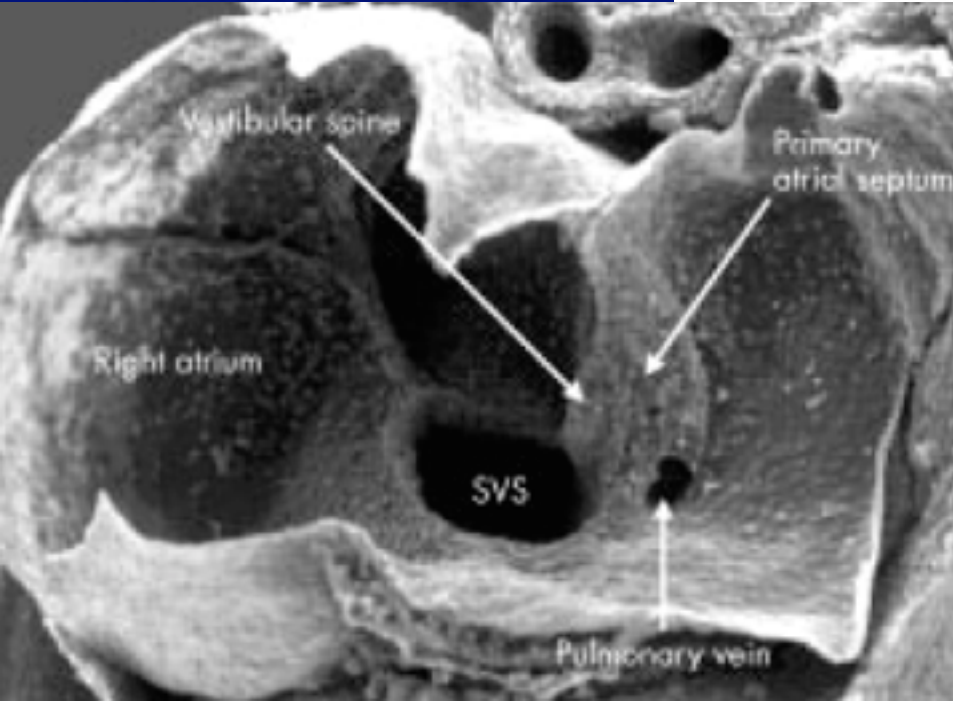


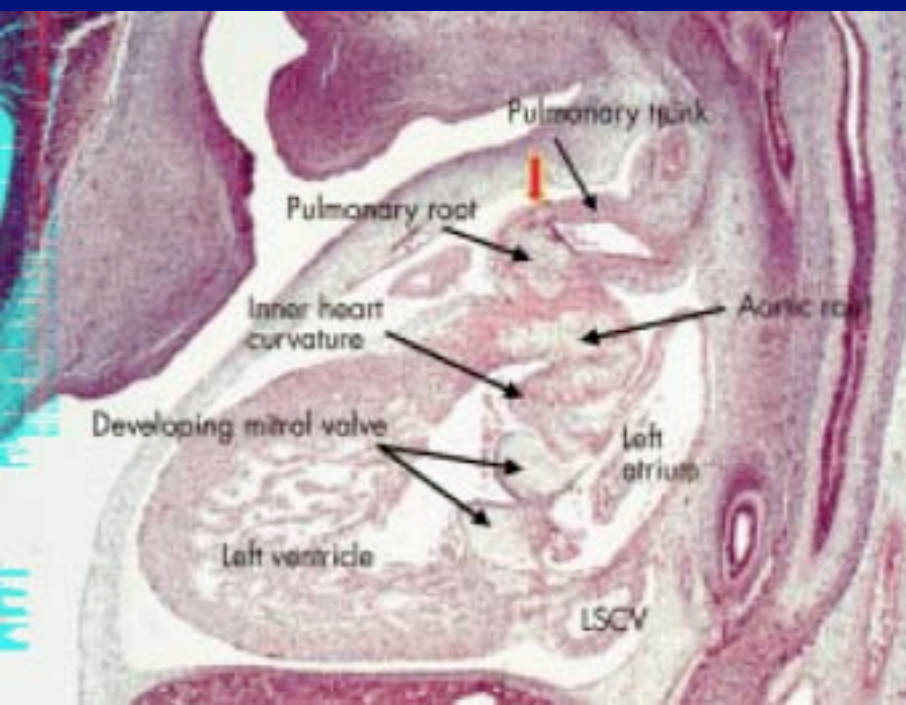
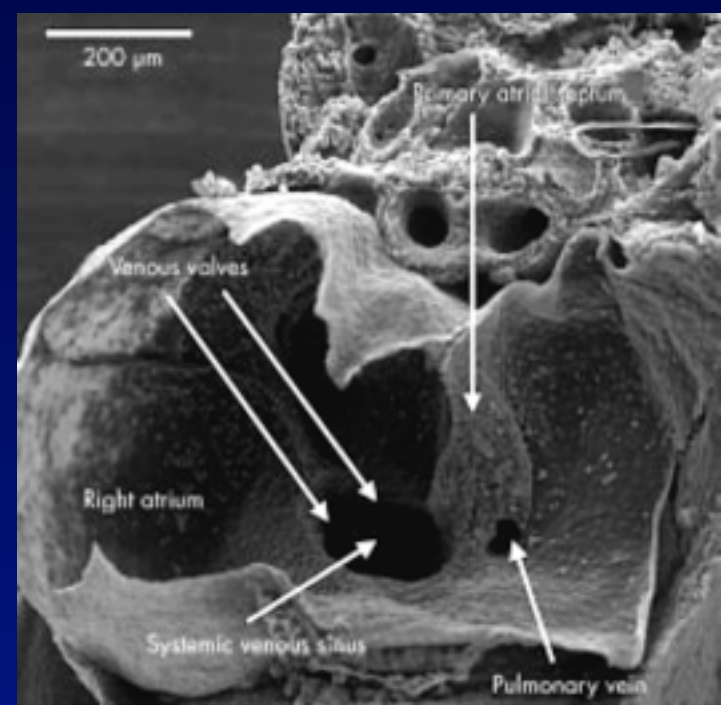
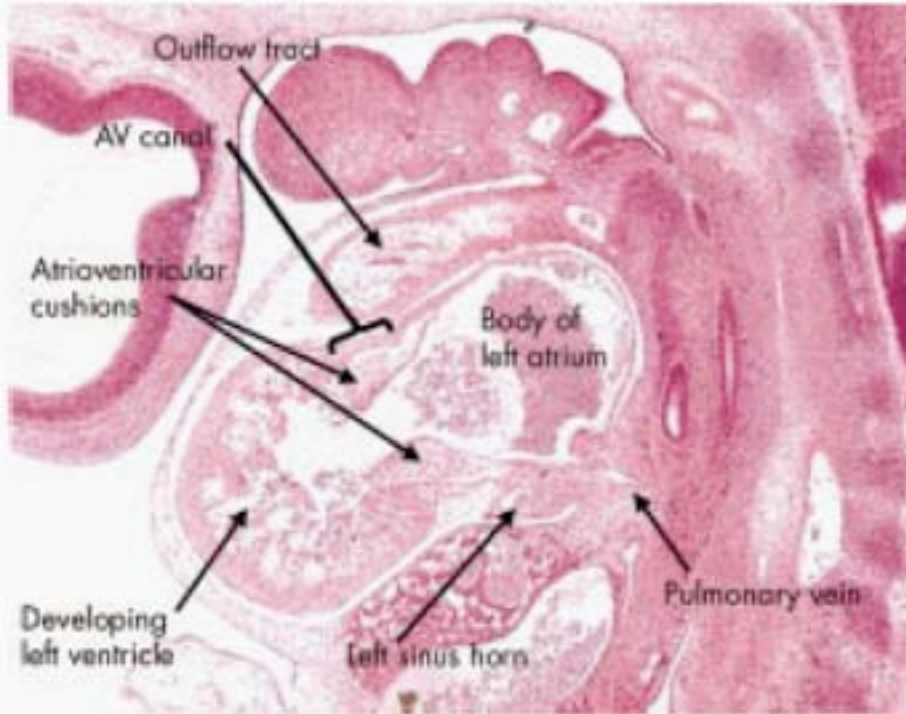
Cono-ventricular development



Moorman and Anderson

Heart 2003;89:806-814





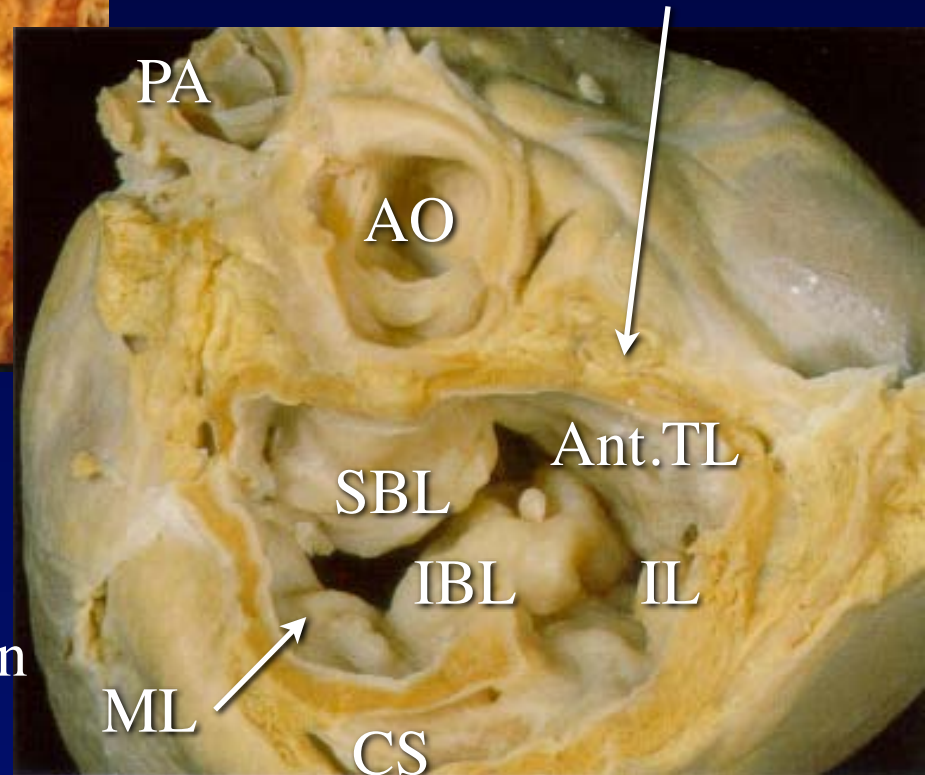
Pathology of AVSD



Courtesy of Robert Anderson

The aorta is "Sprung" out of its usual position because of the common AV Junction.

The Atrioventricular Junction is Common in all cases of AV Canal Defects



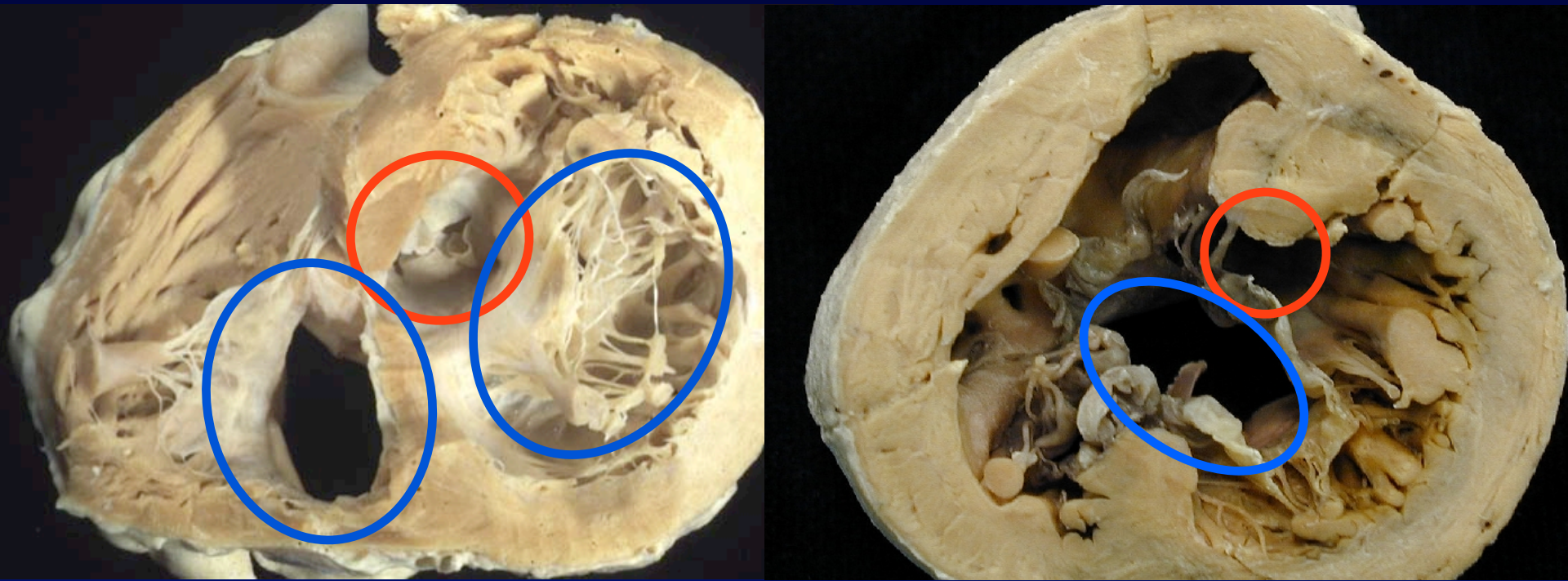
Features of AV Canal

Separate
valvar orifices
For RV & LV



Features of AV Canal

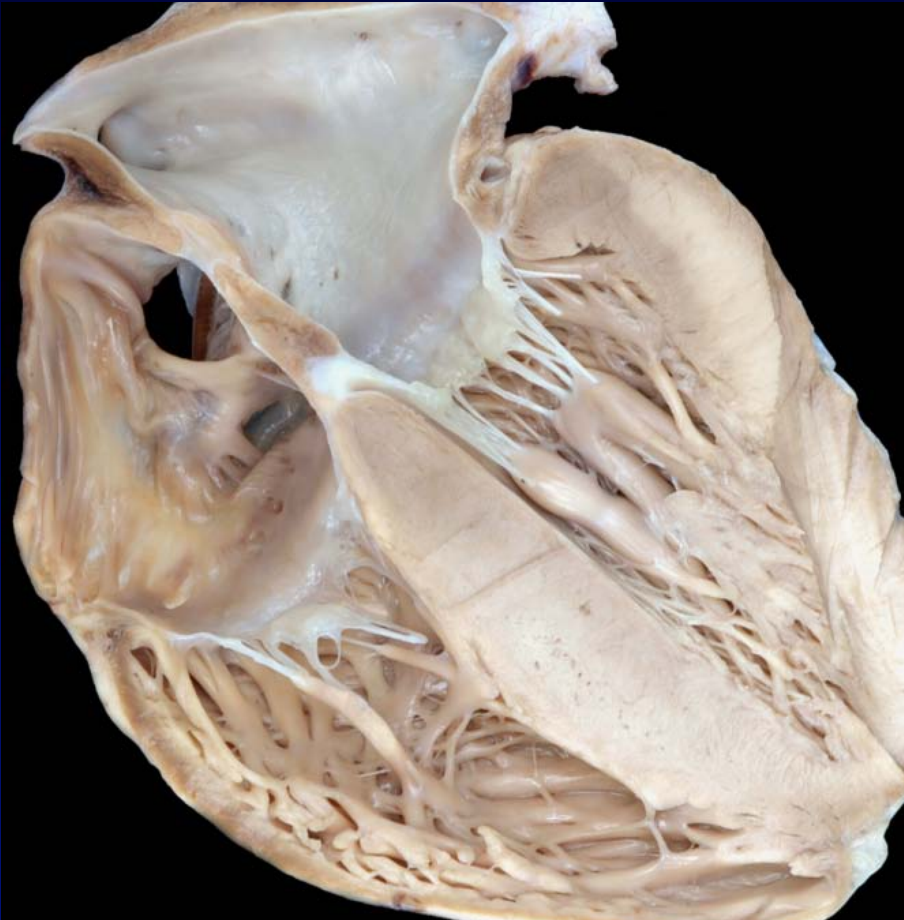
The phenotypic feature is the common atrioventricular junction



Courtesy of Diane Spicer.

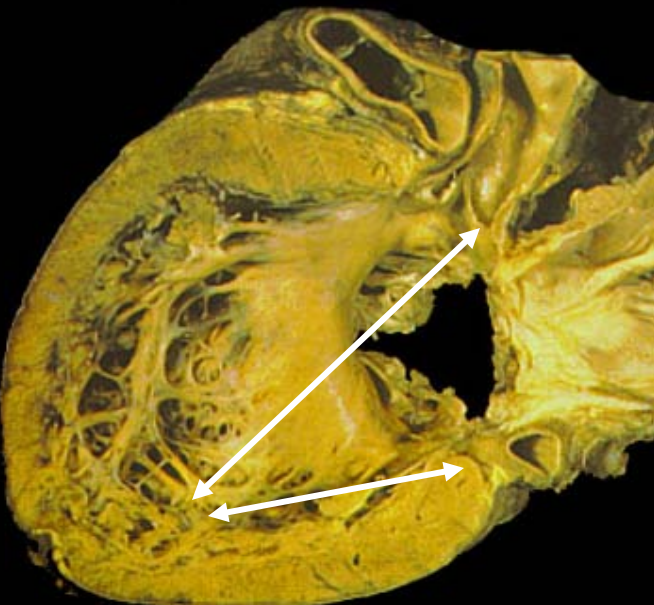
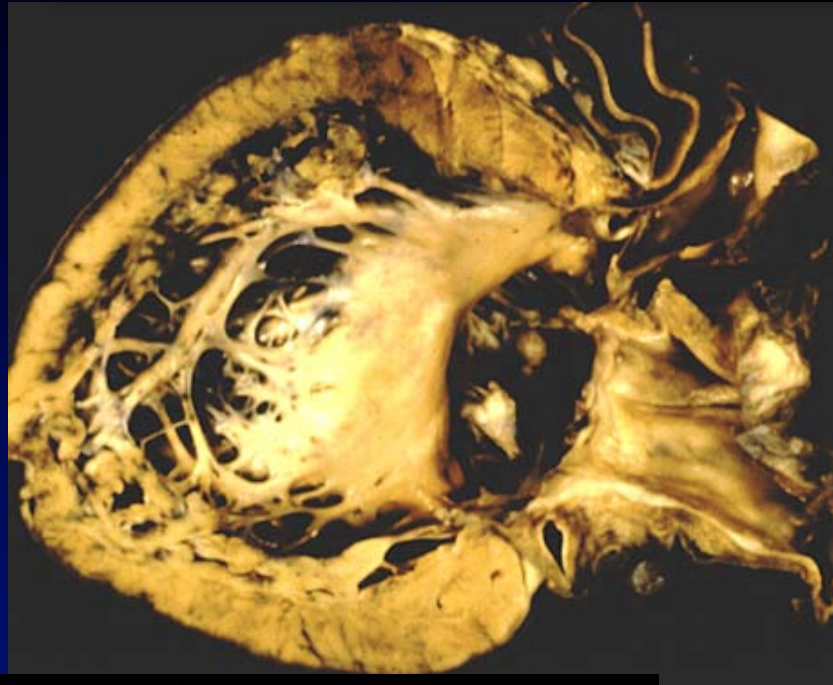
Features of AV Canal

The phenotypic feature is the common atrioventricular junction



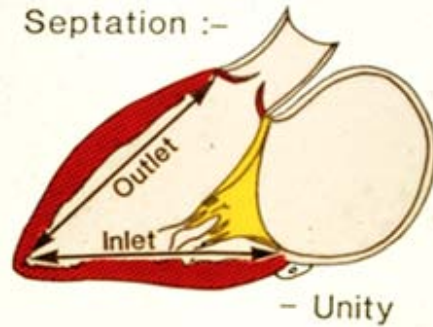
Courtesy of Diane Spicer.

The Gooseneck Deformity

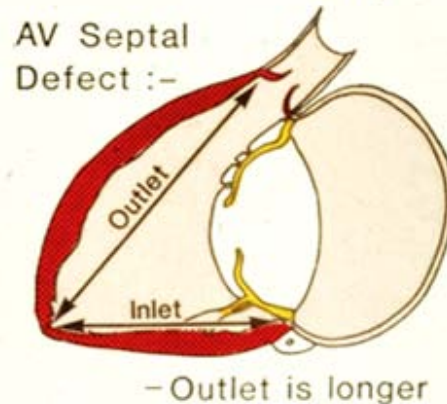


Inlet-outlet disproportion is a feature of all AV Canal Defects

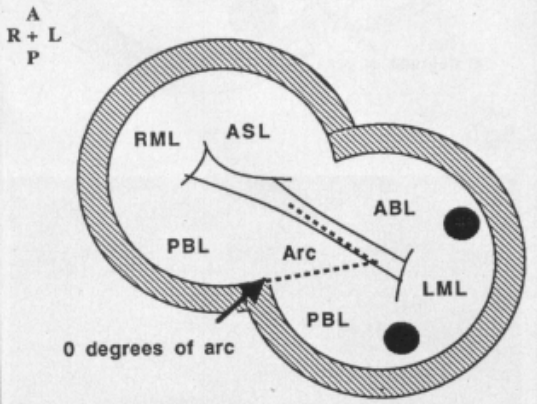
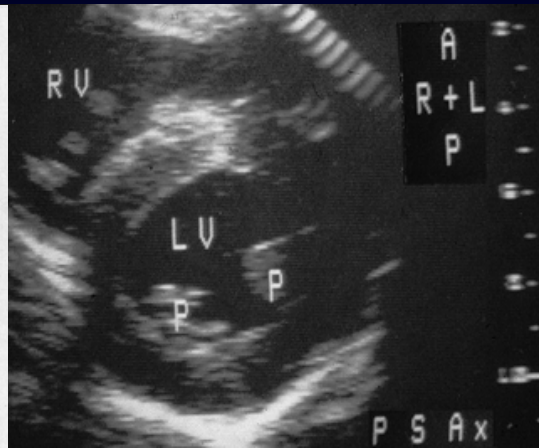
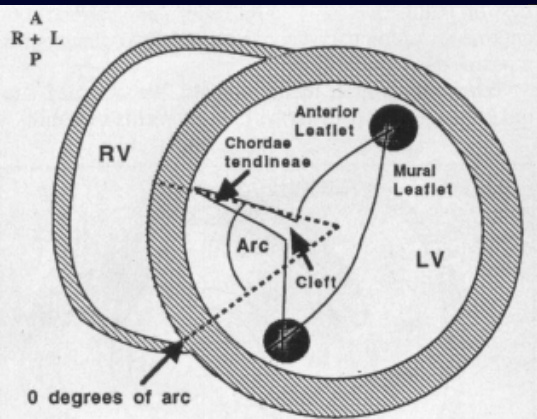
Normal AV Septation :-



AV Septal Defect :-



Cleft Valve and Papillary Muscle Position

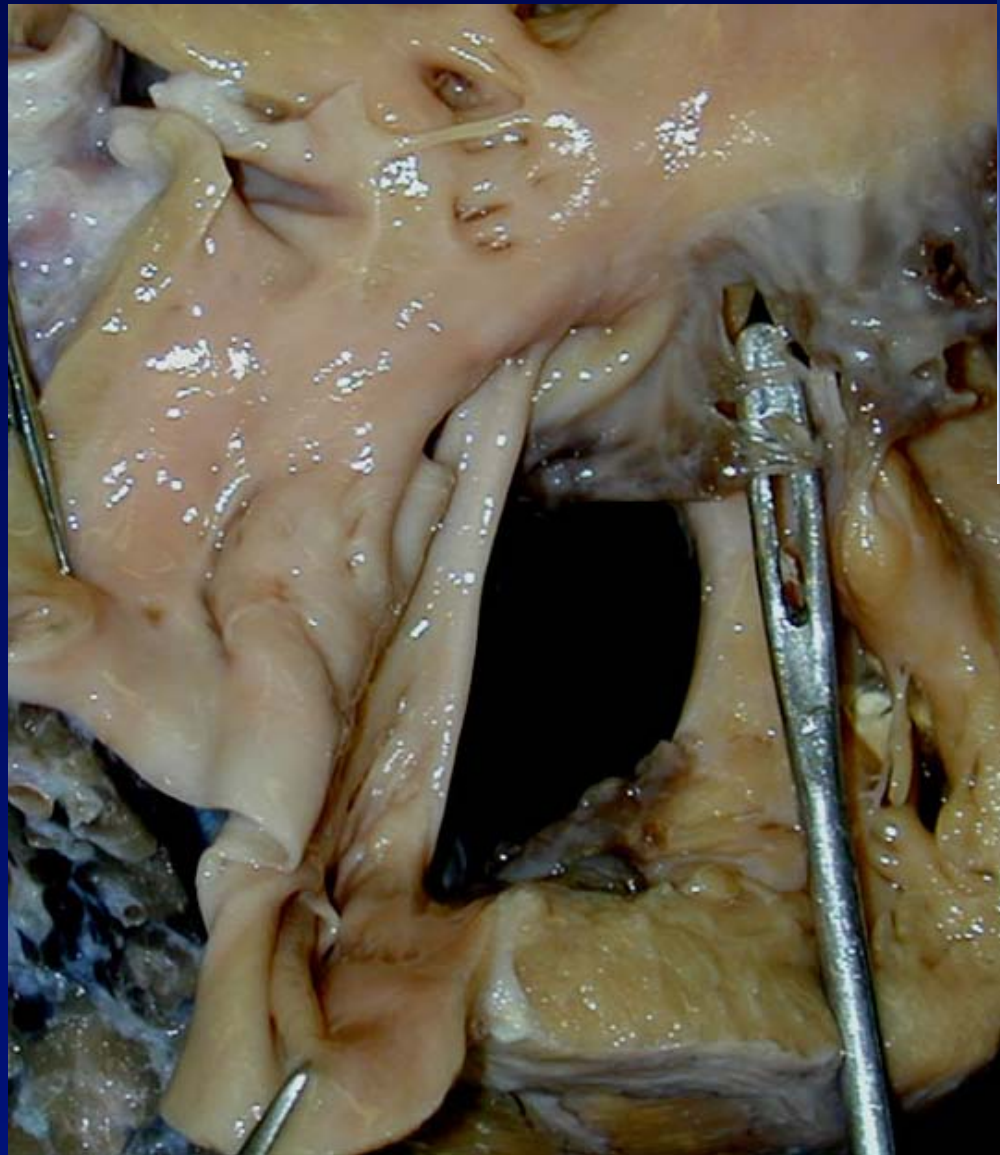


As papillary muscles support commissures

Goals of Ultrasound

- 1. Define the extent of the atrial communication.
- 2. Define the type and extent of the ventricular communications.
- 3. Demonstrate the valve morphology attachments and function.
- 4. Display the shunting patterns, the magnitude of the shunt.
- 5. Type of atrioventricular valve regurgitation, magnitude position and direction.
- 6. Assess the commitment of the atrioventricular junction to the underlying ventricular mass and the size of the underlying ventricle (balance).
- 7. Recognize associated anomalies.

Type C AVSD - UCSF



Rosangela Rastelli Zavattaro



GIANCARLO RASTELLI

Un cardiocirurgo con la passione dell'uomo

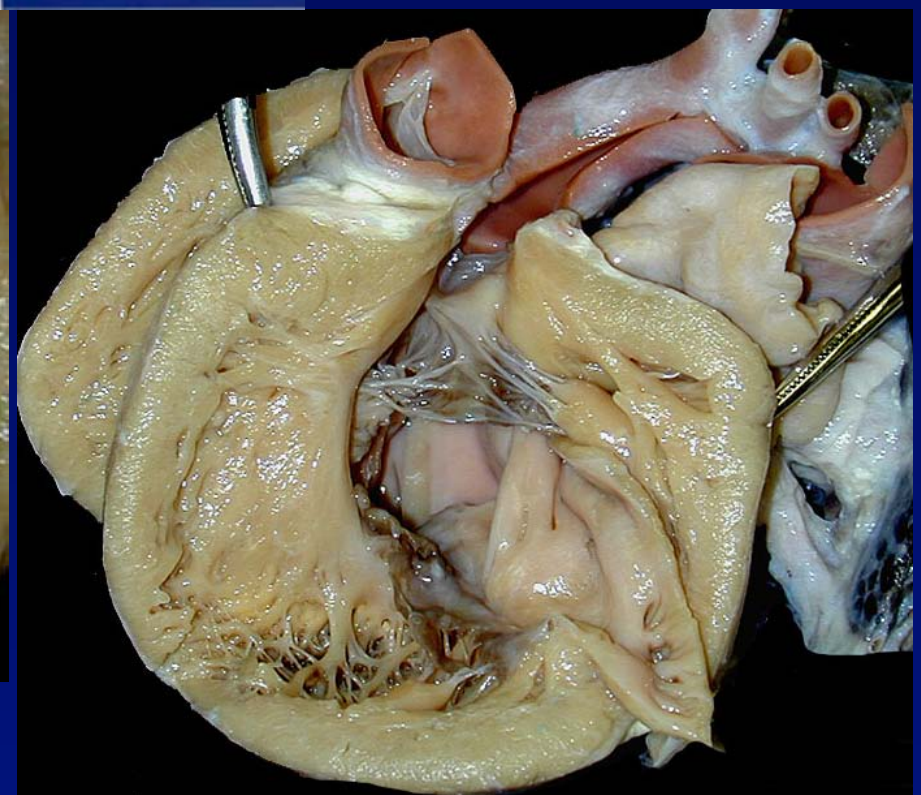
Prefazione di Giorgio Torelli

N.25-6-1933 M.2-2-1970

DR. GIANCARLO RASTELLI M.D.
CARDIOCHIRURGO E RICERCATORE
IN U.S.A.

ASS. ORD. A PARMA E CAPO DELLE
RICERCHE PER GLI INTERVENTI
CHIRURGICI A CUORE APERTO DELLA
MAYO CLINIC di ROCHESTER-MINNESOTA
FECE DEL SUO LAVORO UNA
MISSIONE DI UMANITÀ
E LEGÒ IL SUO NOME AD
UN'INTESSIGNANE CONQUISTE DELLA
CHIRURGIA CARDIOVASCOLARE

VITA MUTATA
NON TOLLIT



Mayo Clinic Drawings

Rastelli A



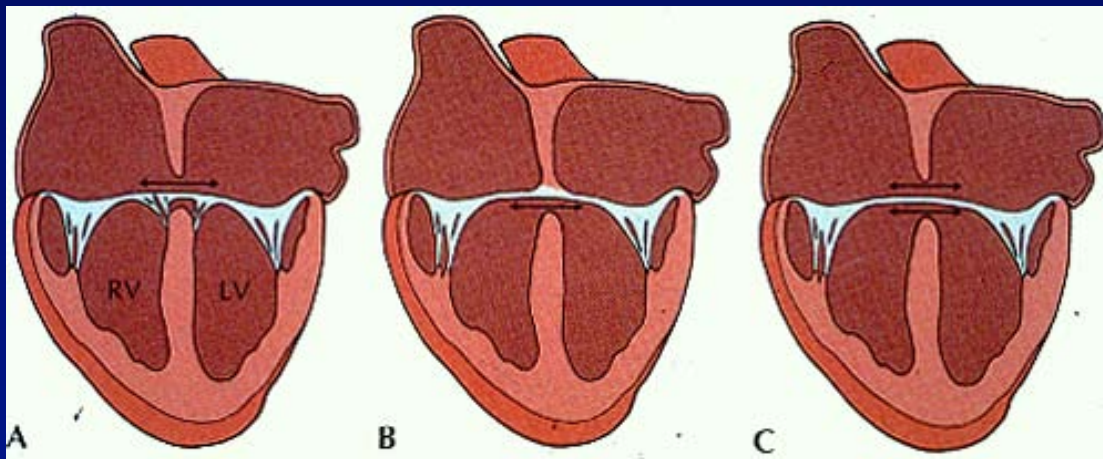
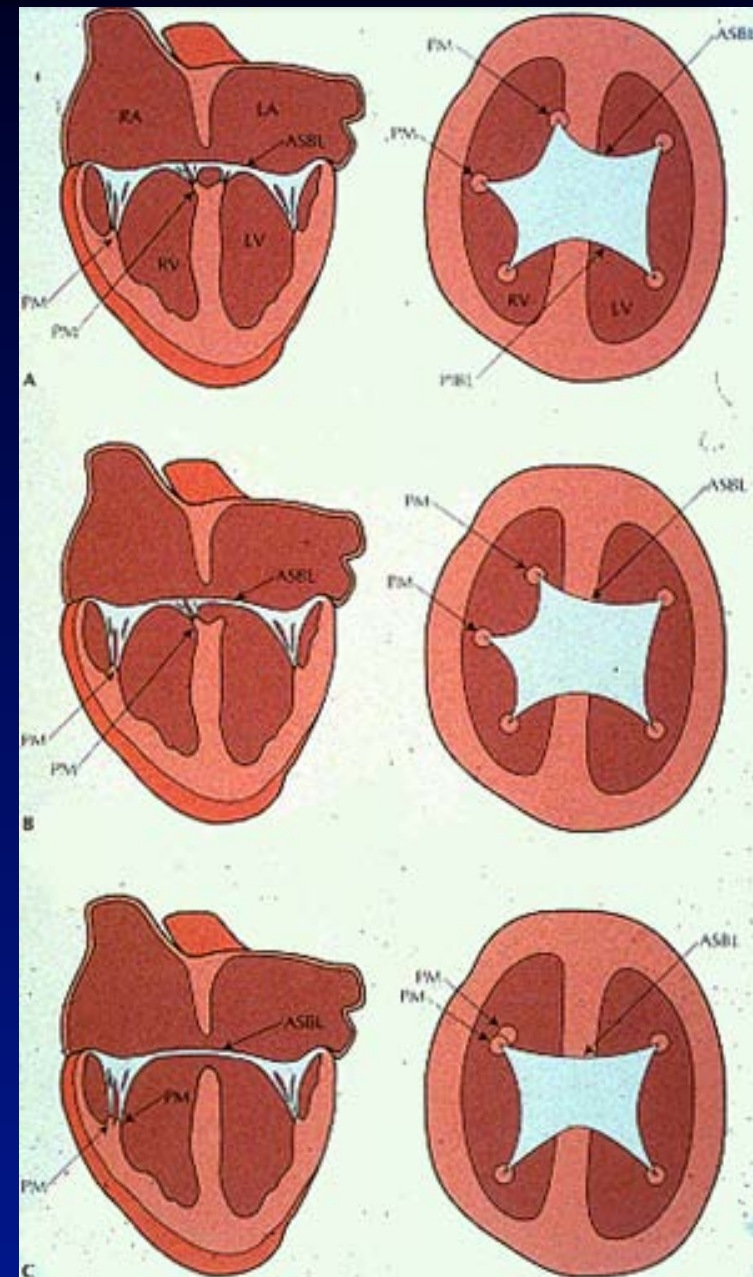
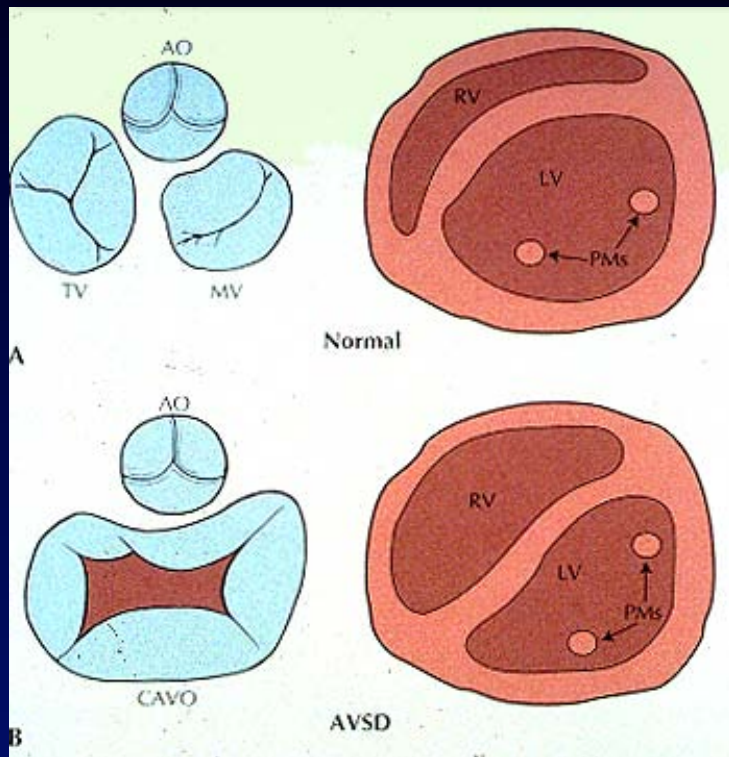
Rastelli B



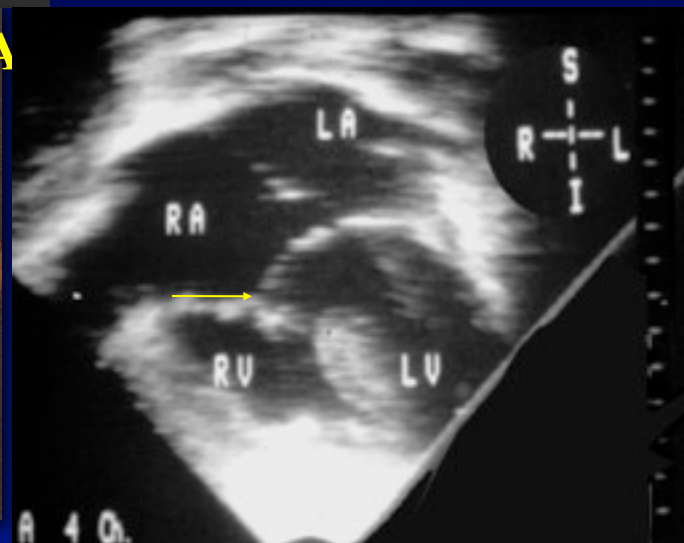
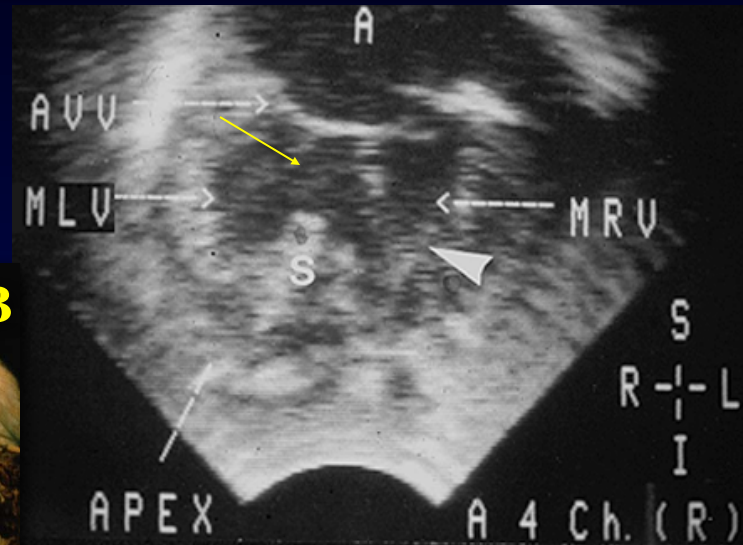
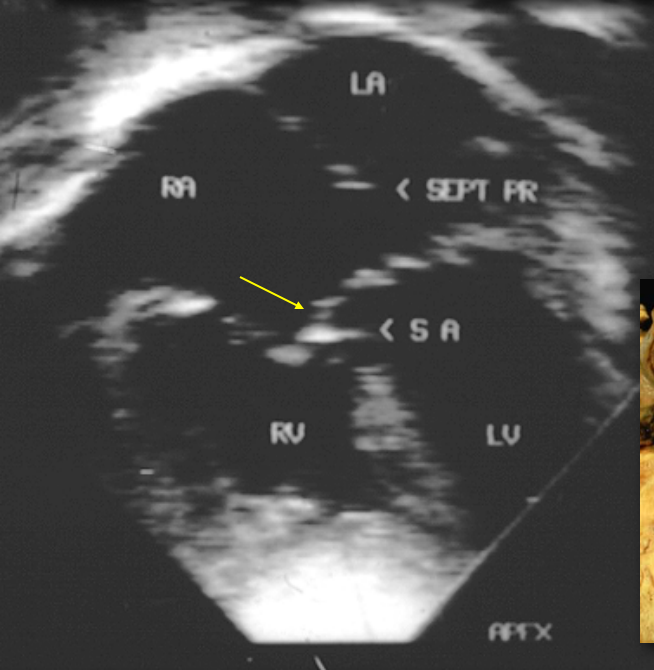
Rastelli C



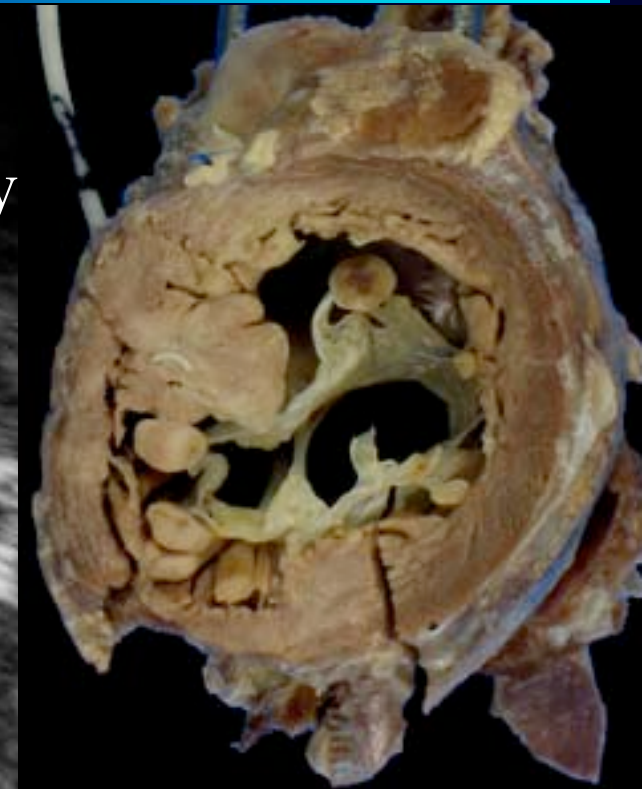
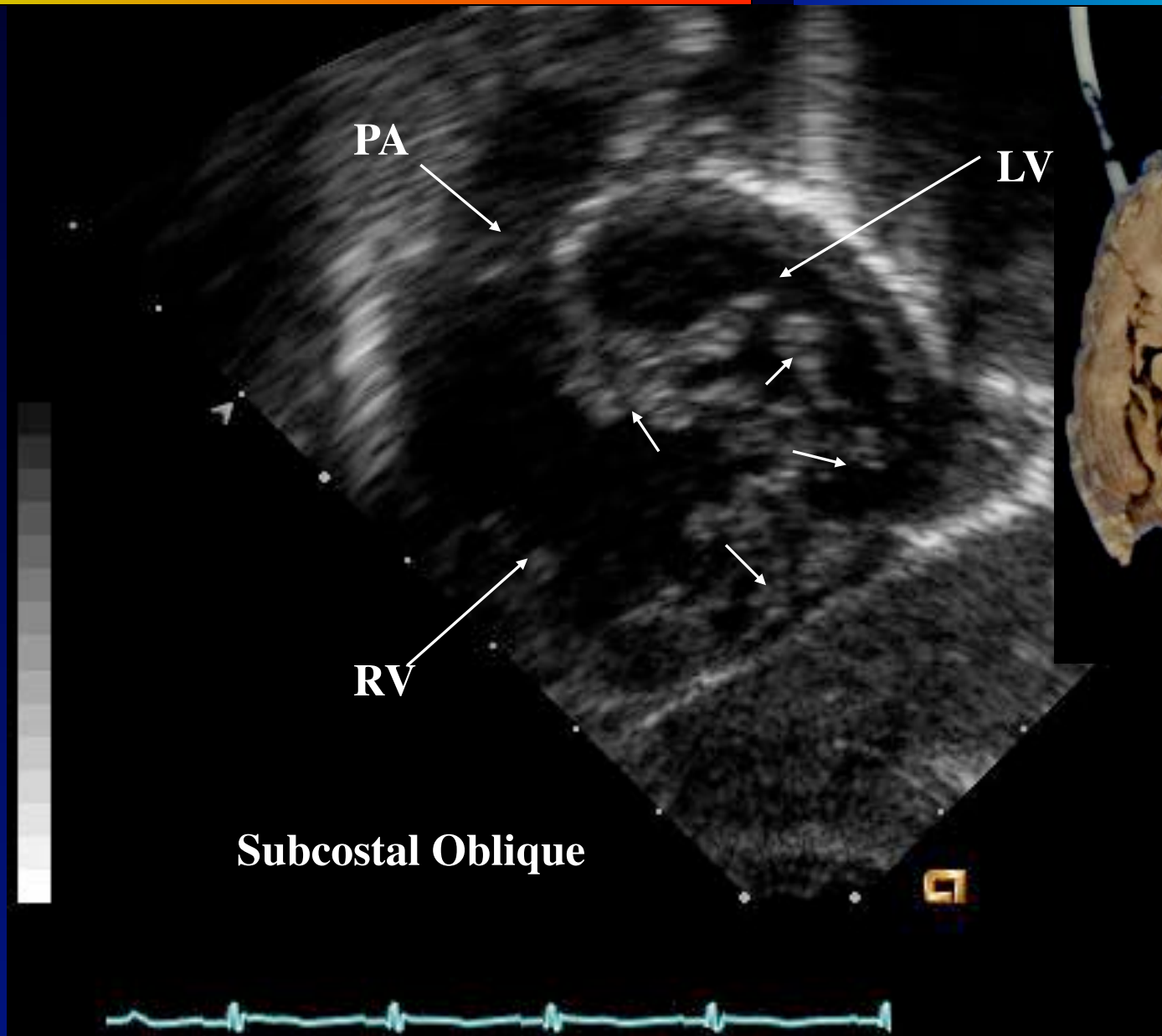
AVSD Concept by Echo



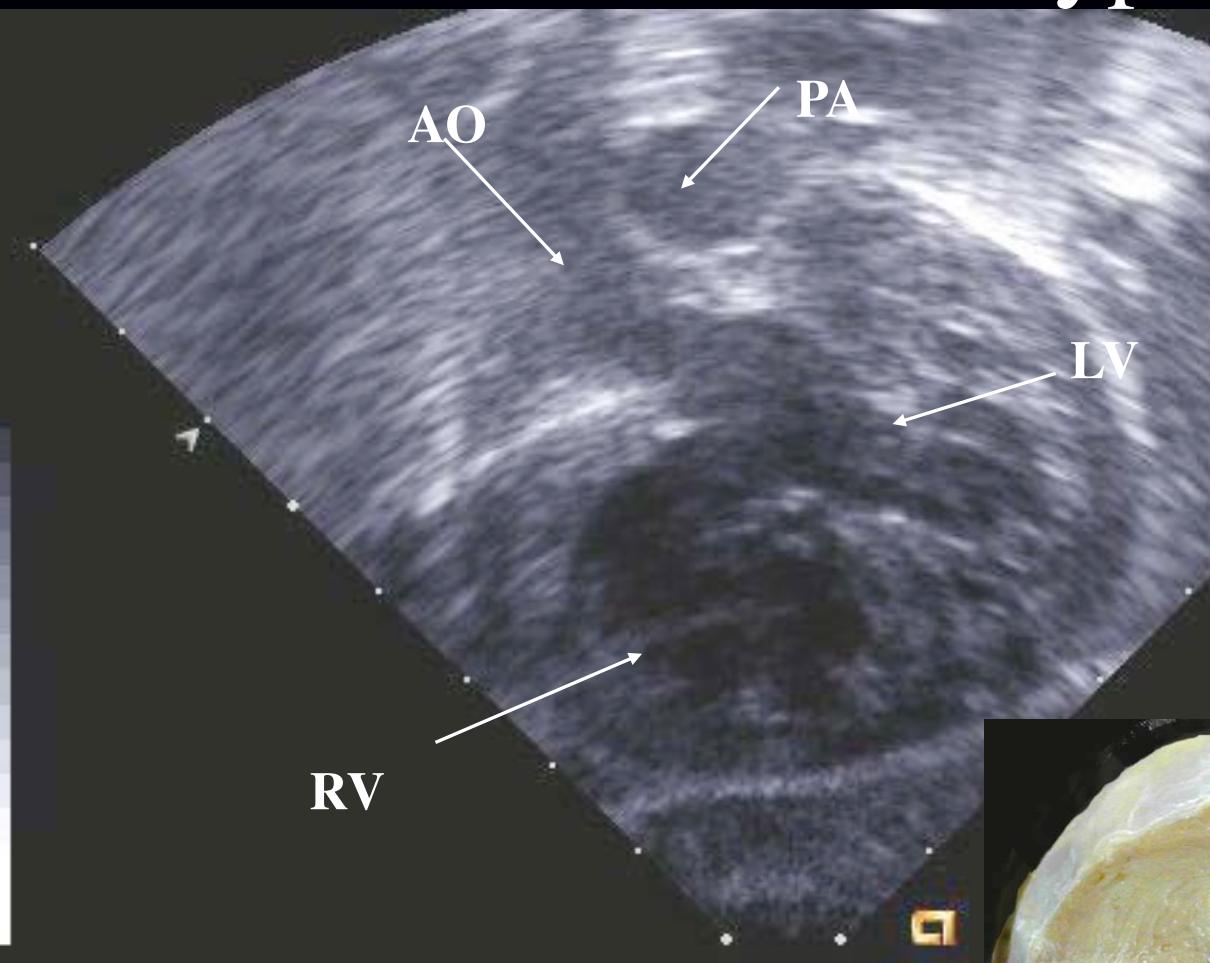
Rastelli Classification- AVSD



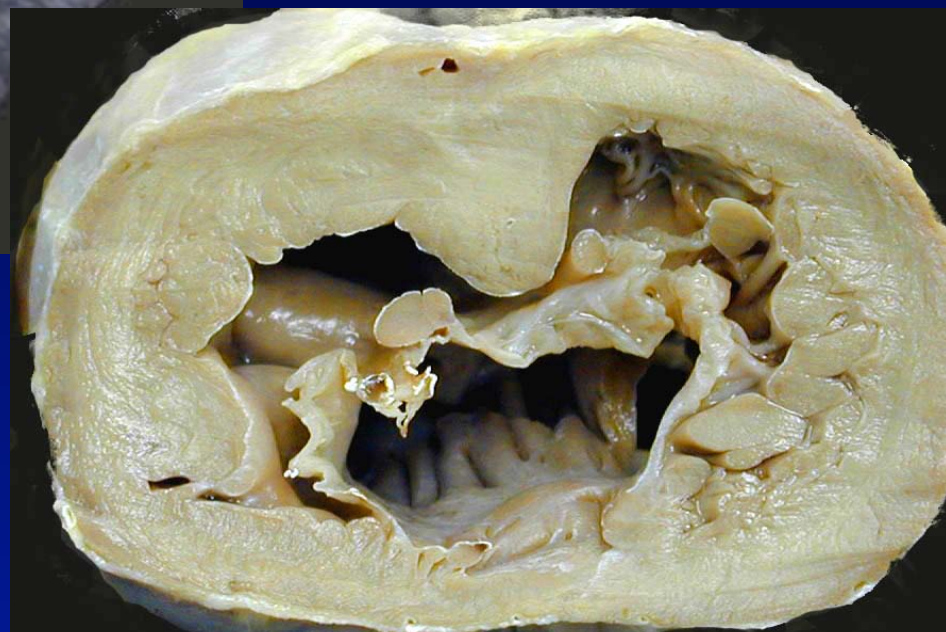
Rastelli Type A



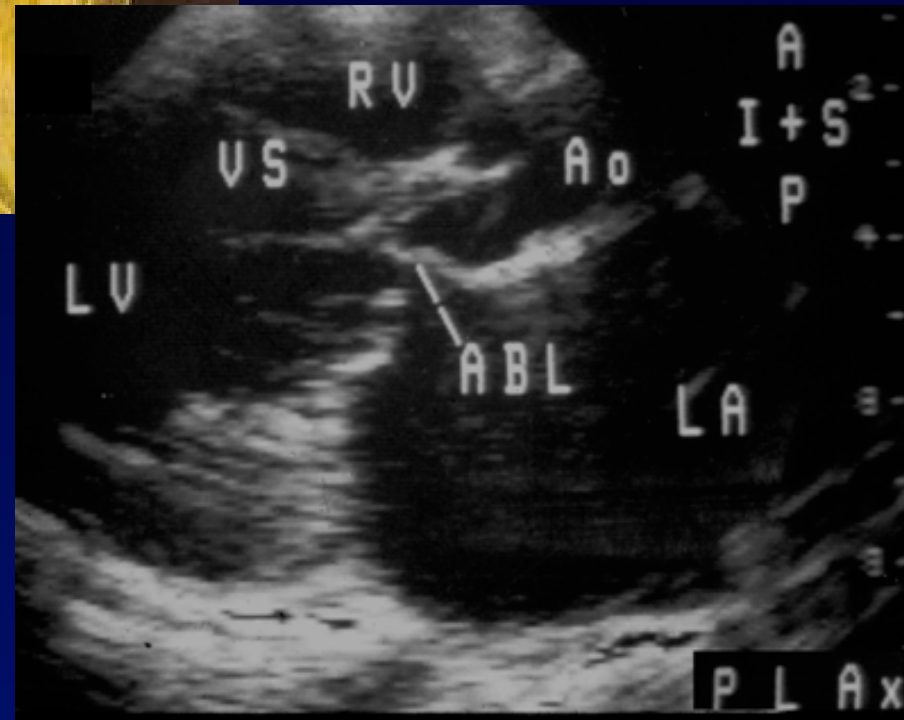
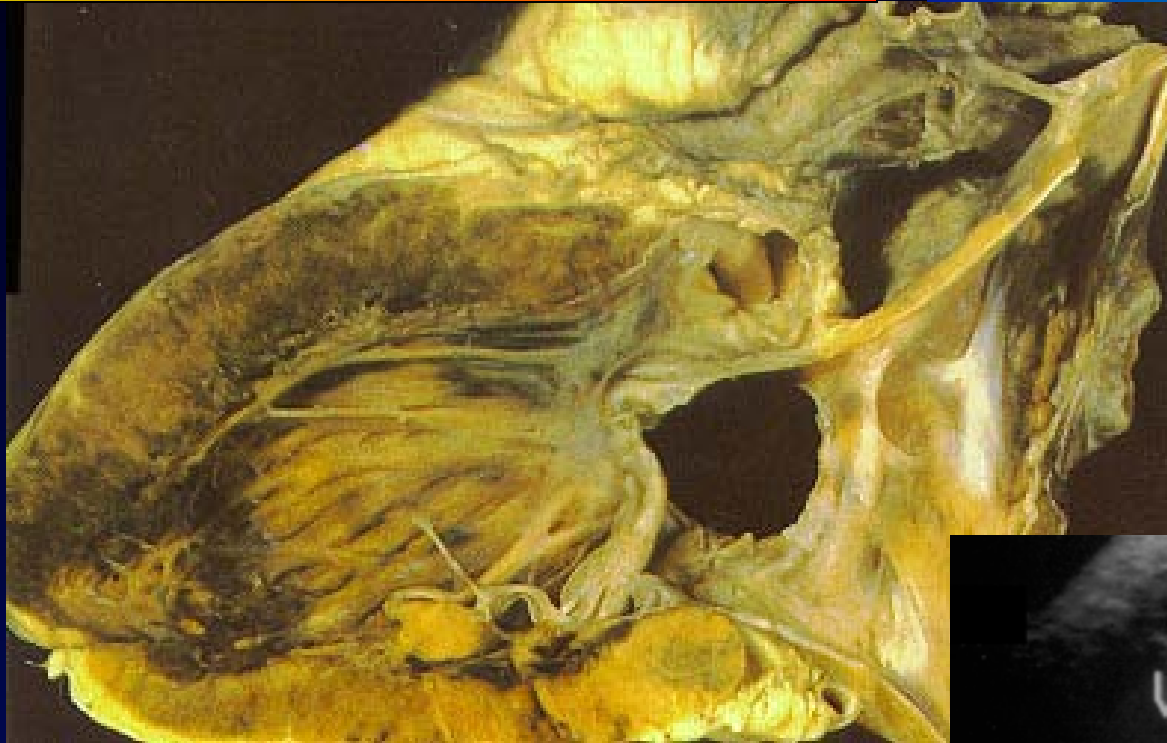
Rastelli Type C



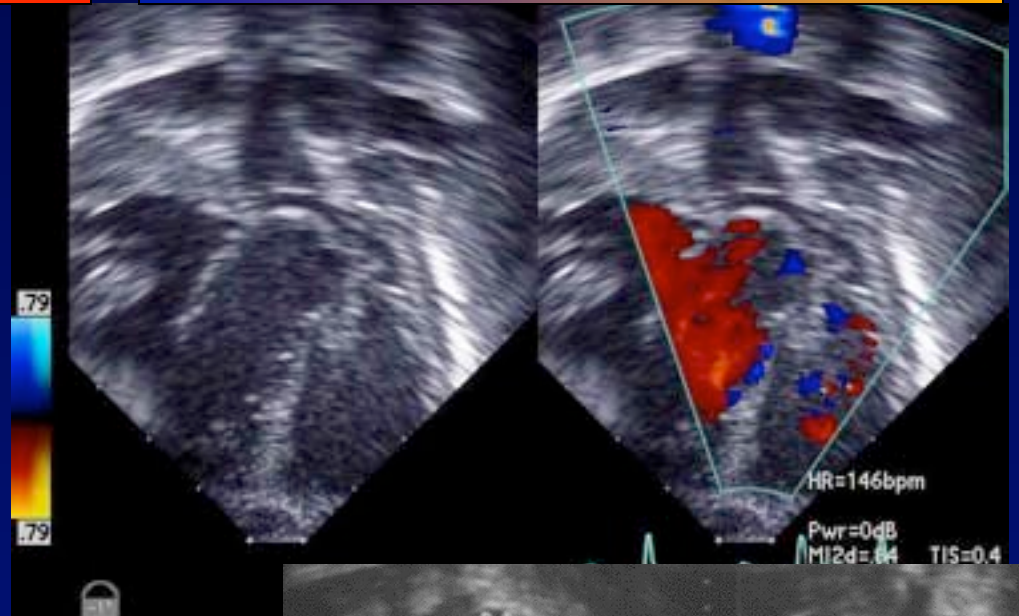
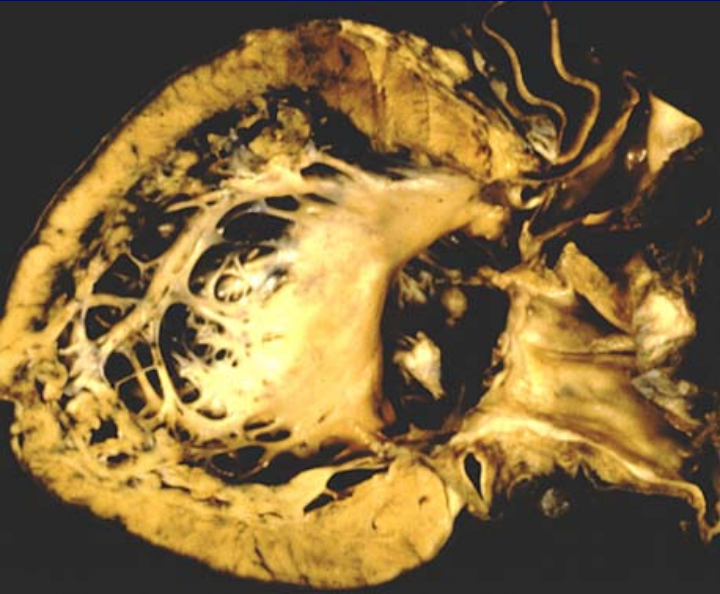
Subcostal Oblique



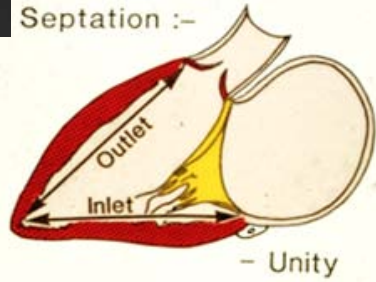
LV Outflow Obstruction



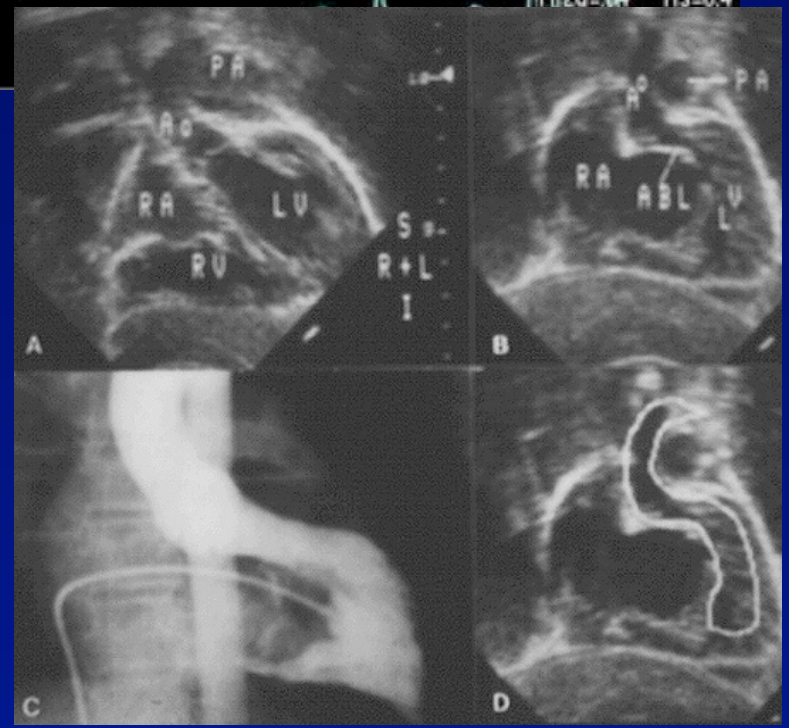
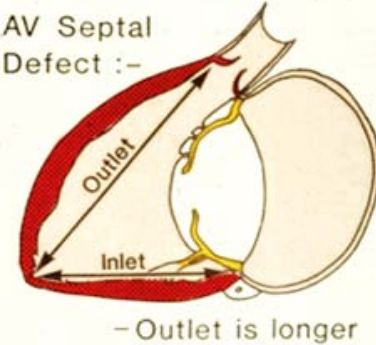
The Gooseneck Deformity



Normal AV Septation :-



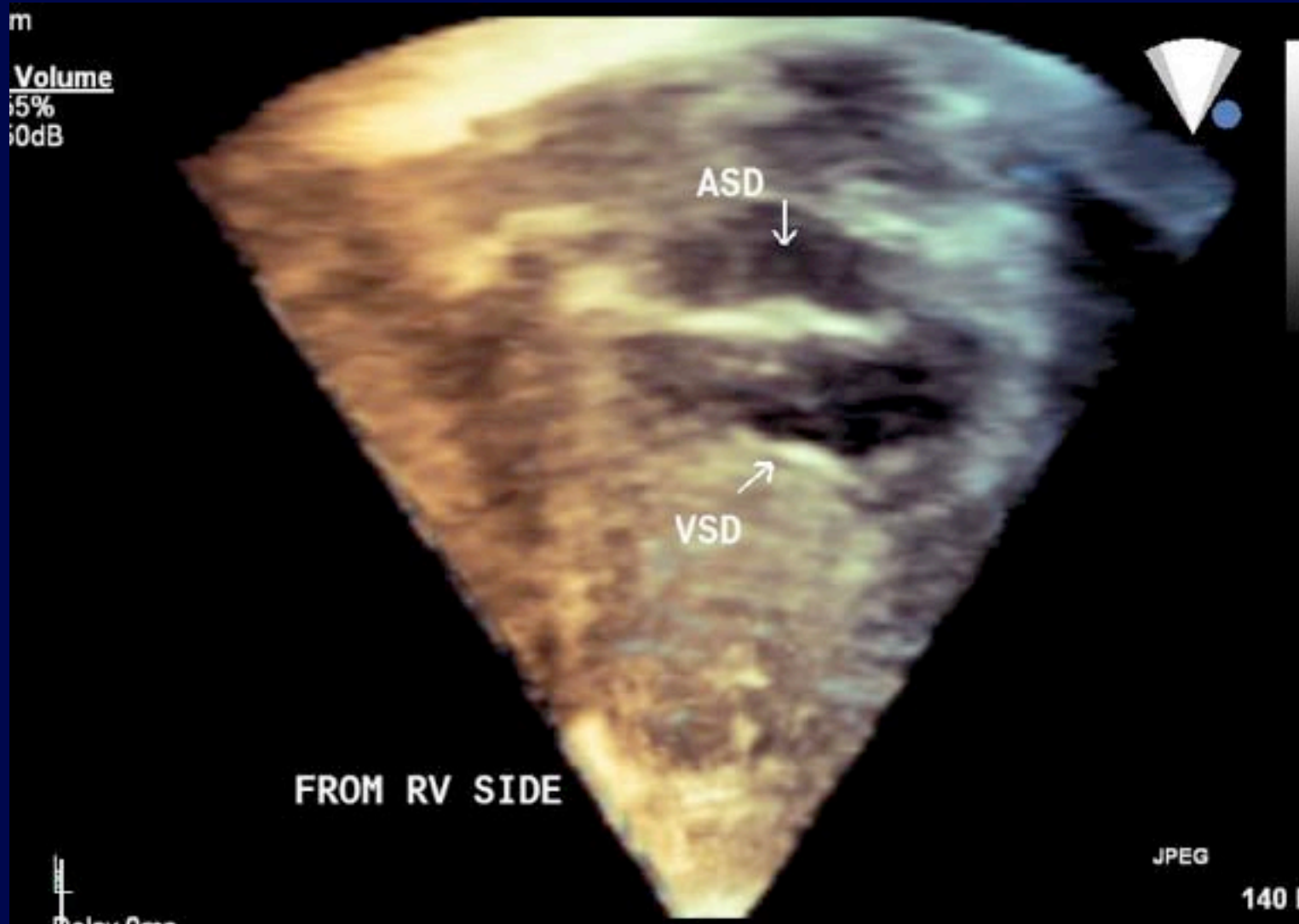
AV Septal Defect :-



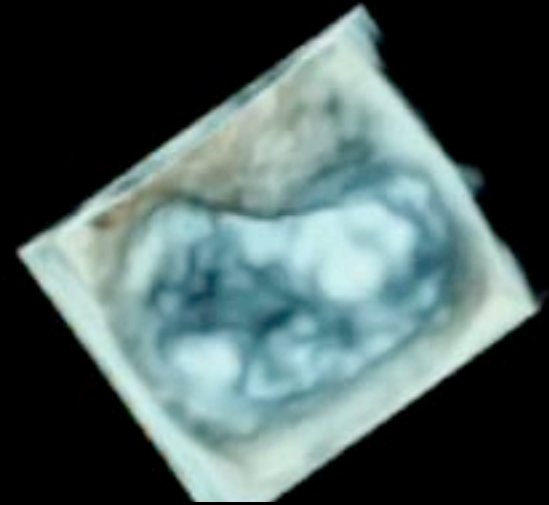
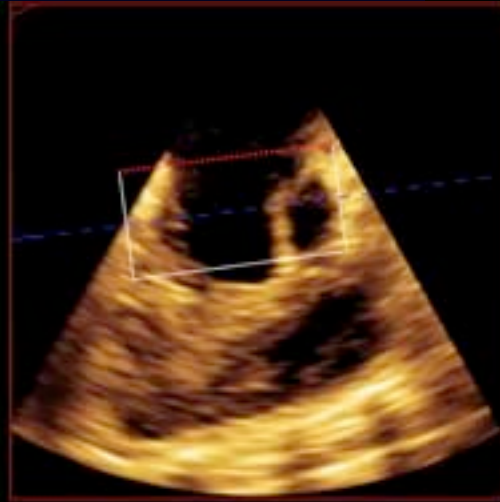
AV Septal Defect 3-D Left Side



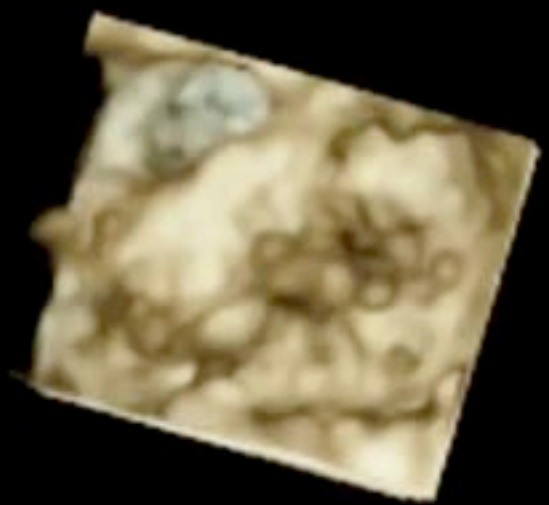
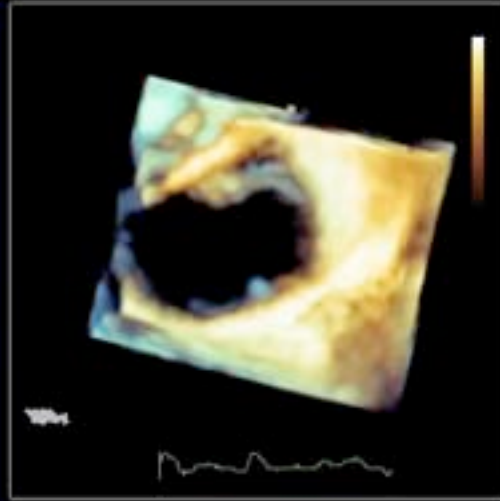
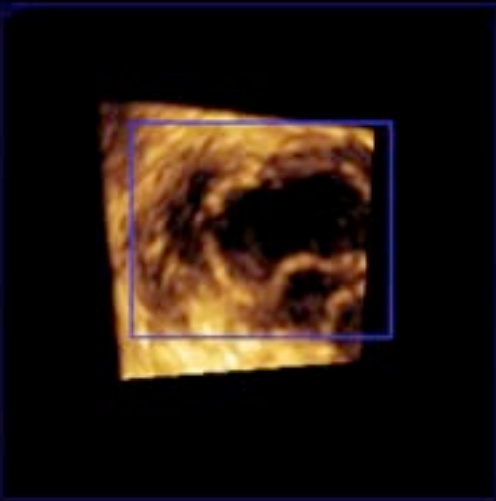
AV Septal Defect 3-D Right Side



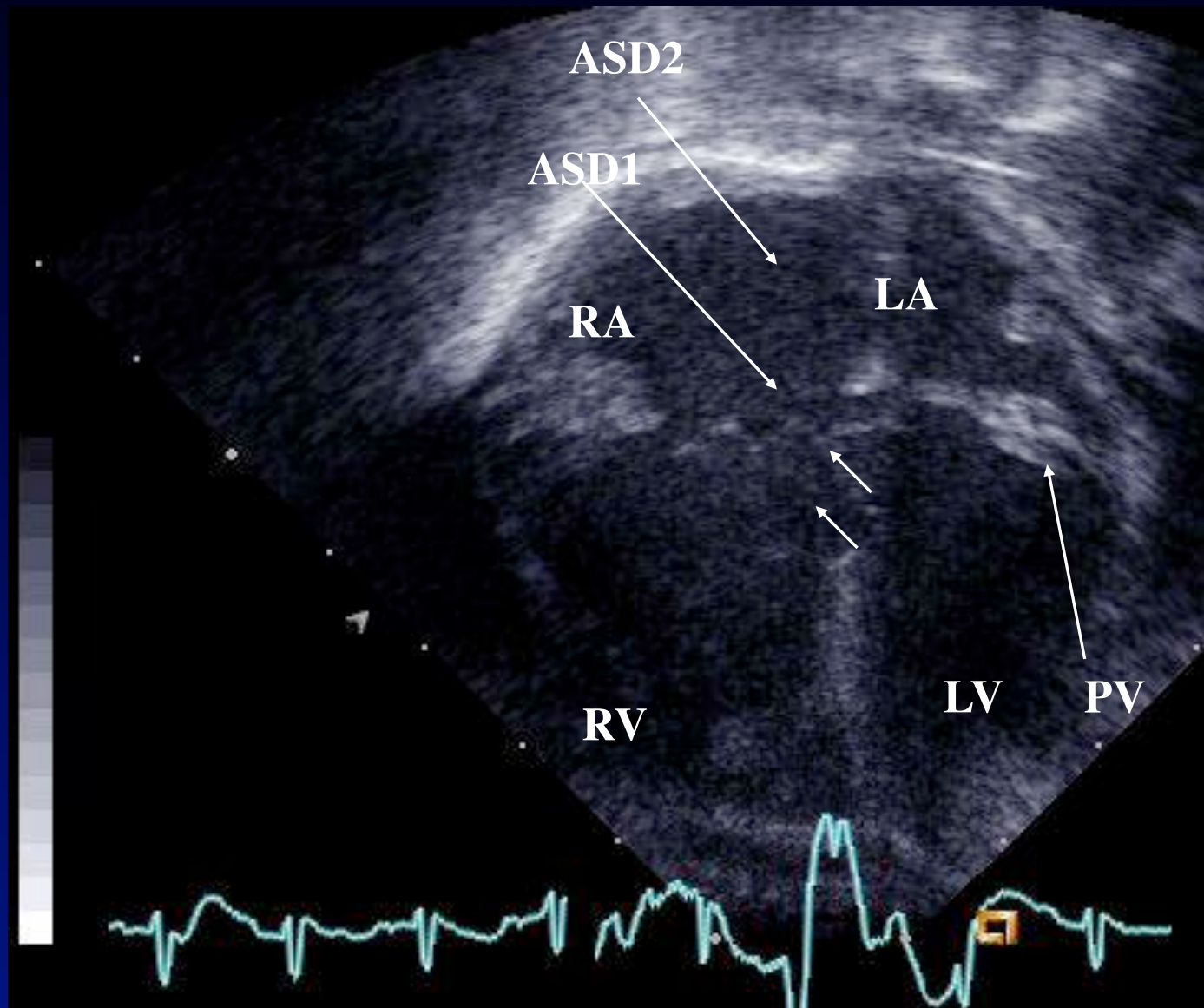
3 D Zoom Technique



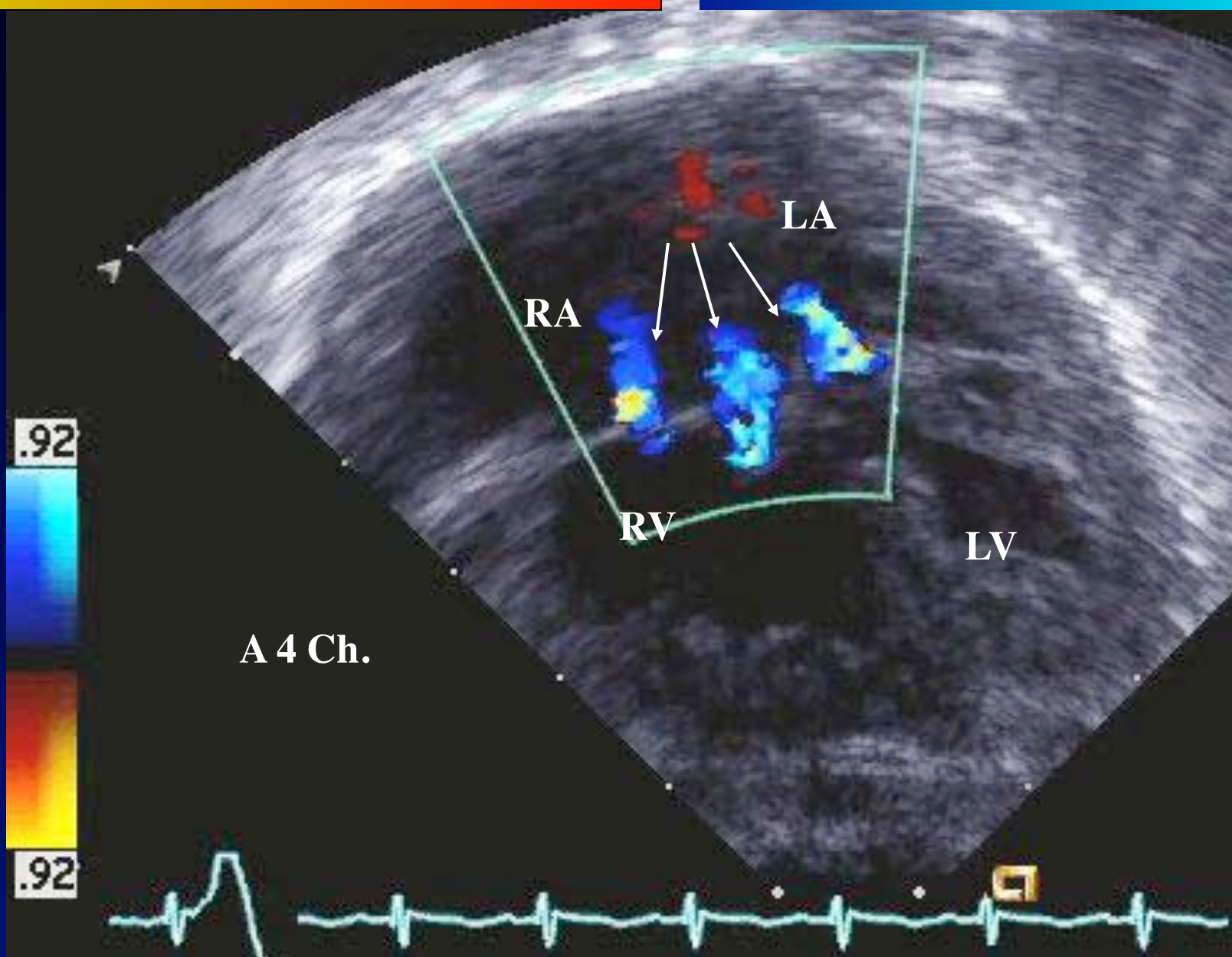
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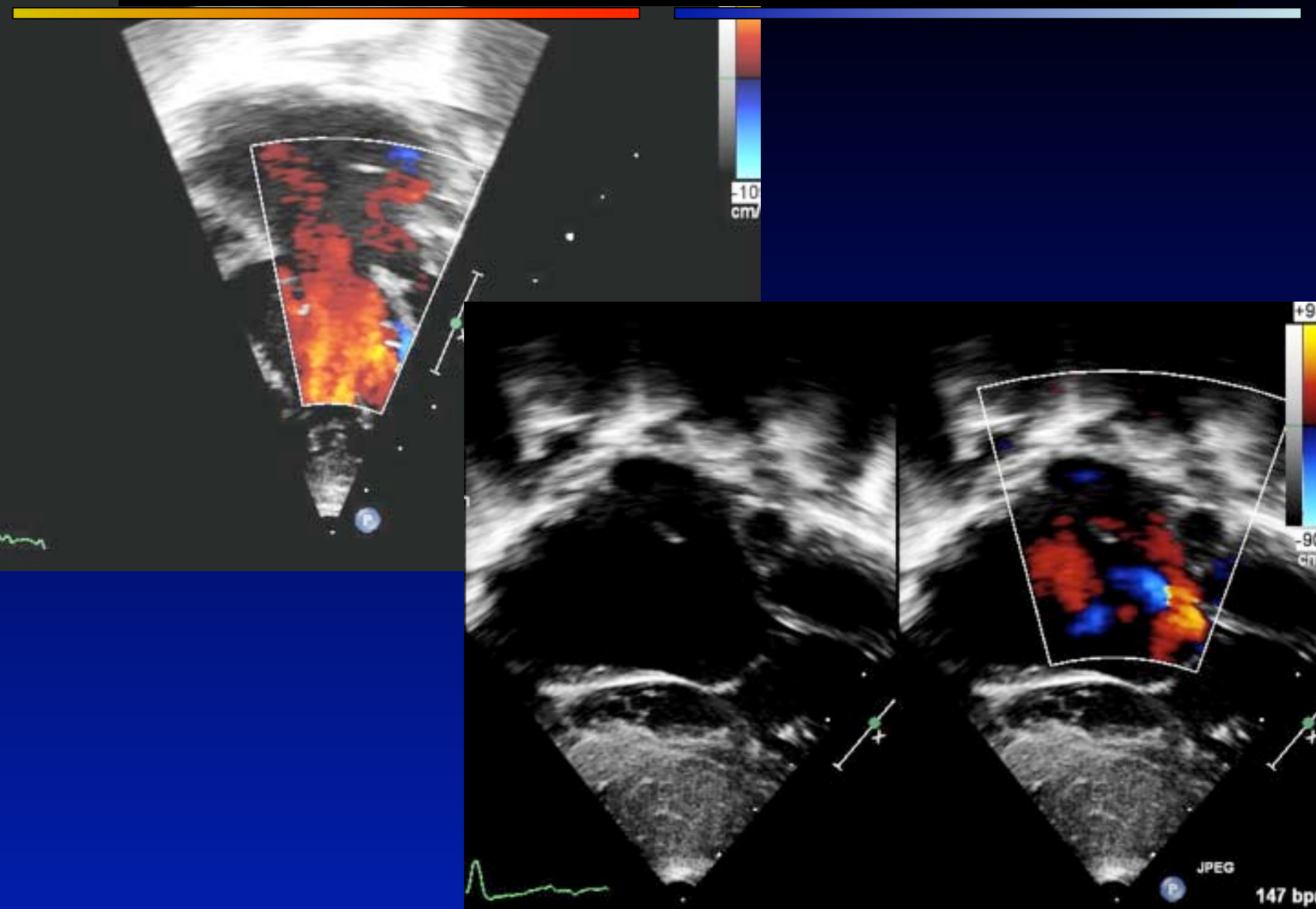
TYPE A, AVSD: A V Valvar Regurgitation



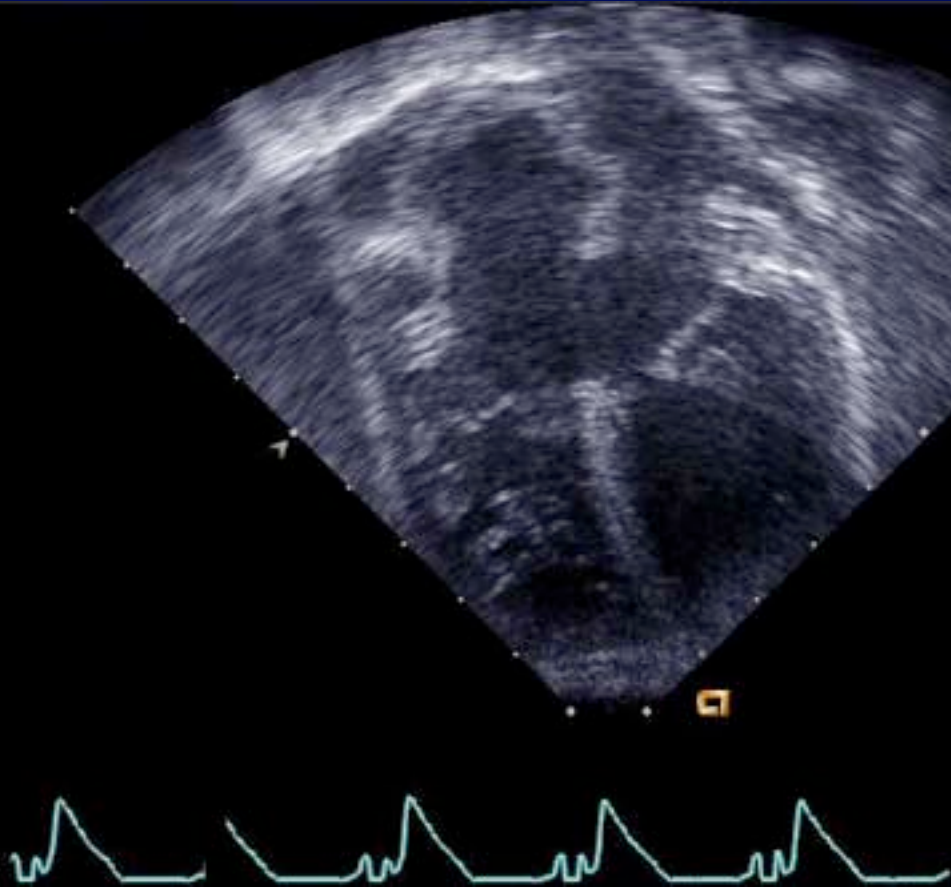
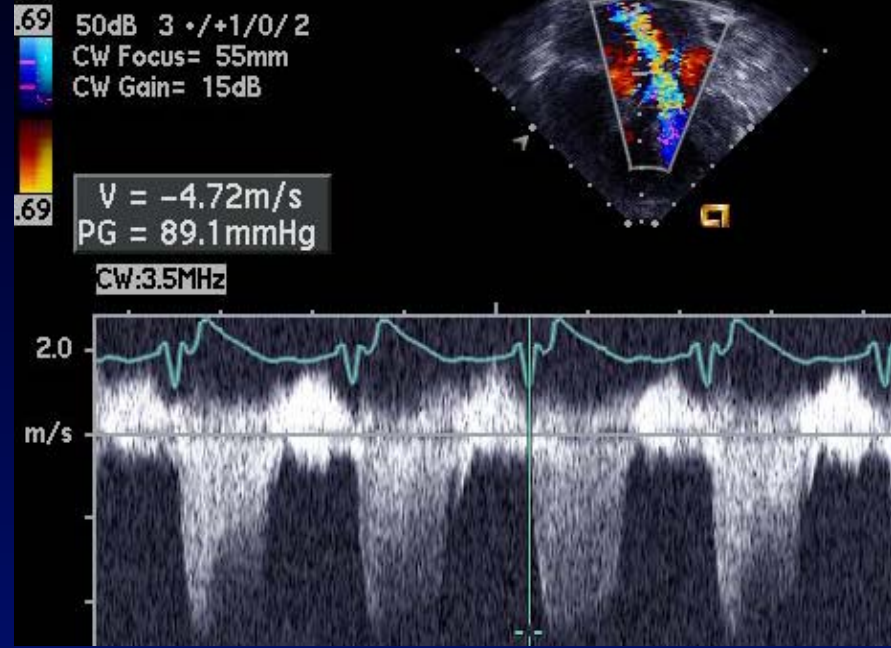
AVSD Type C : AV valve regurgitation



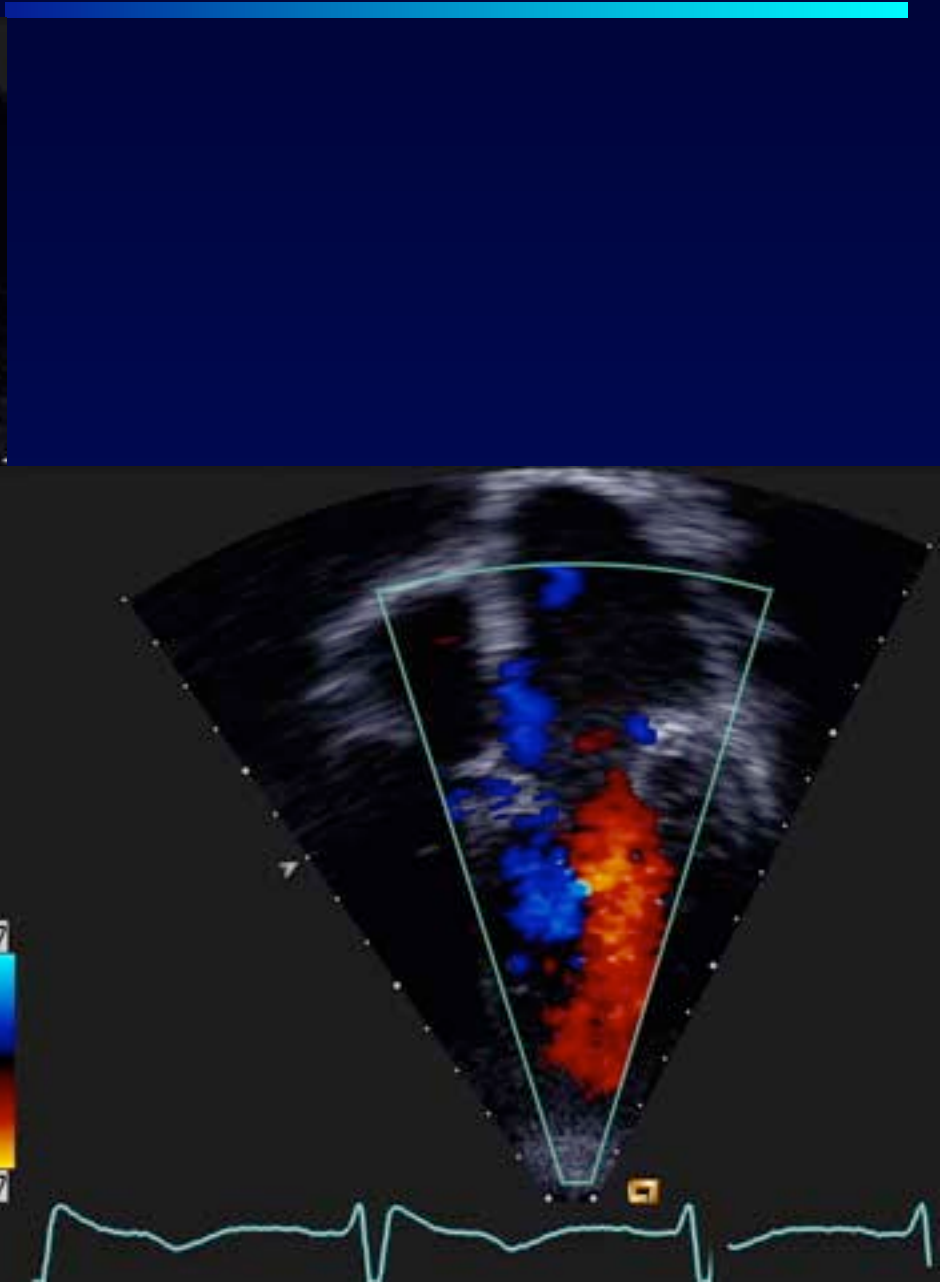
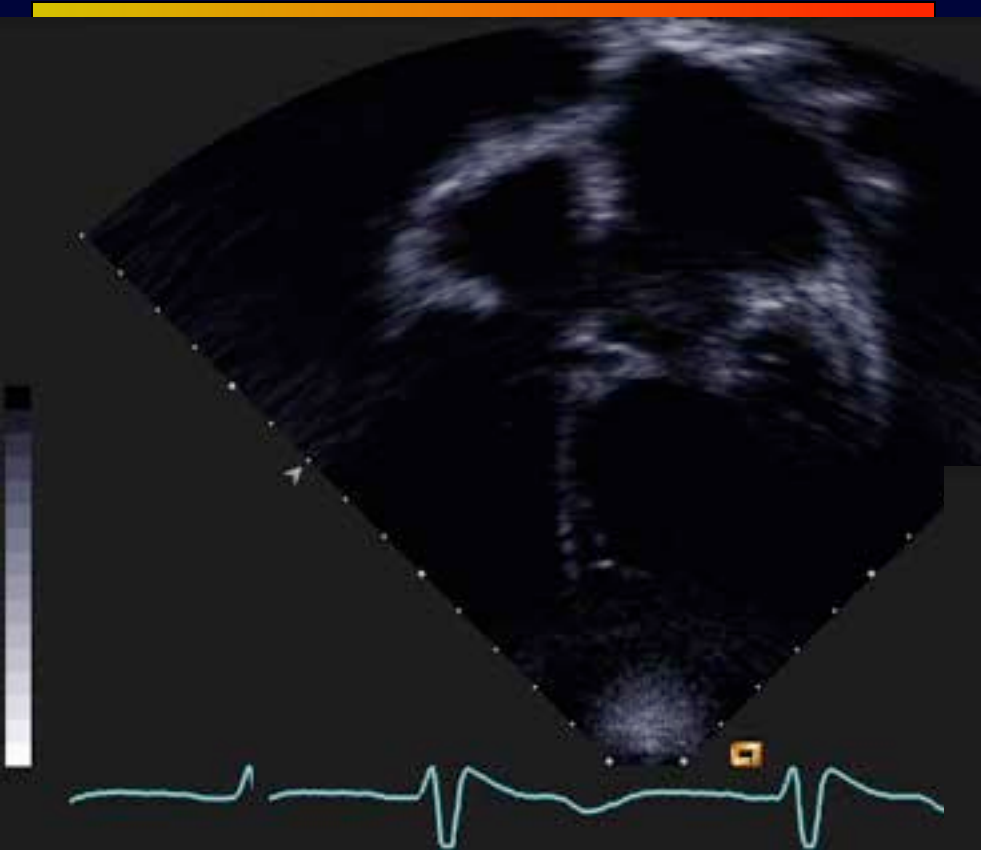
Entrainment



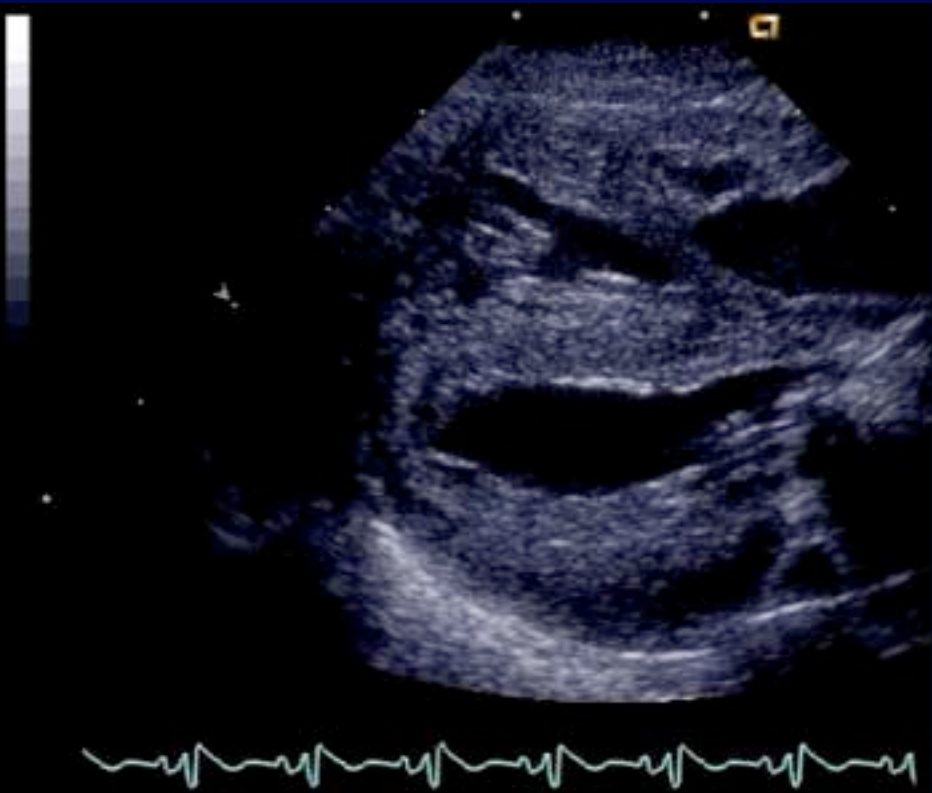
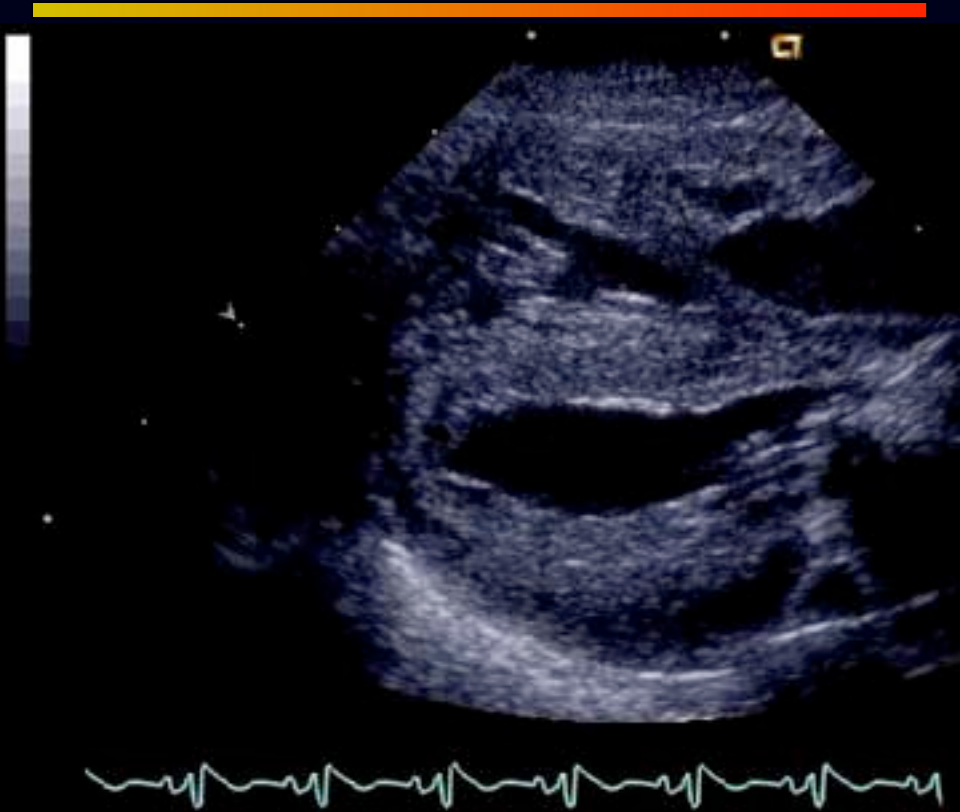
Left Ventricular -Right Atrial Shunt



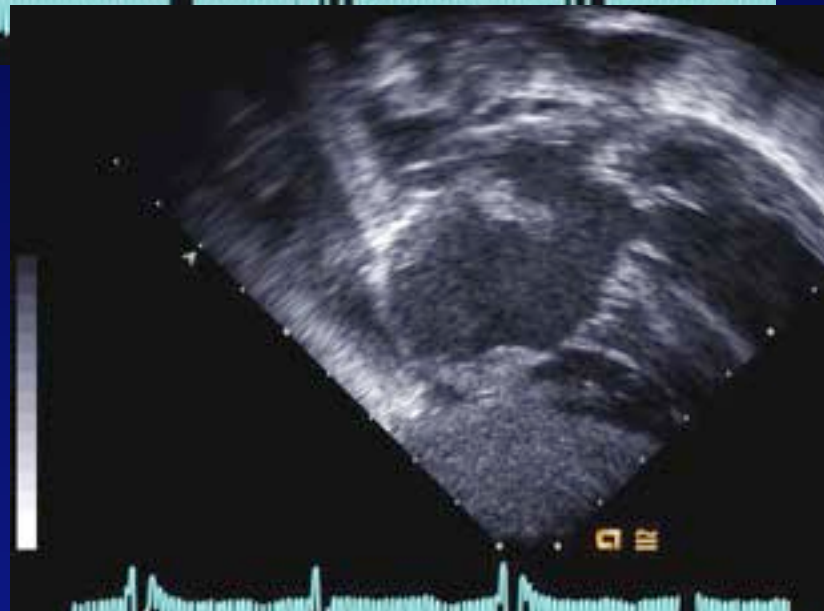
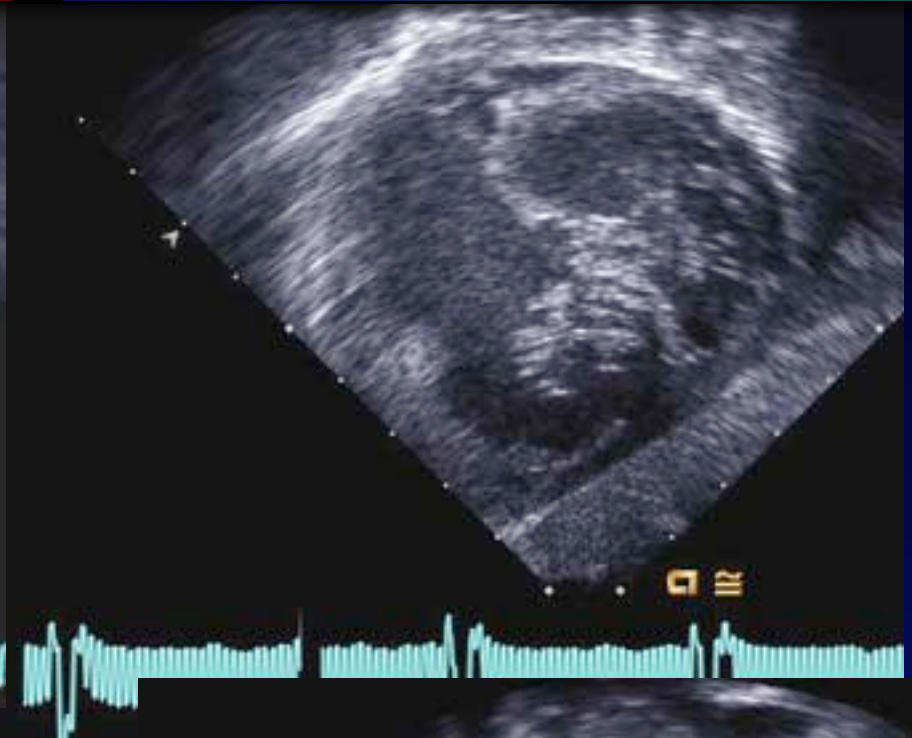
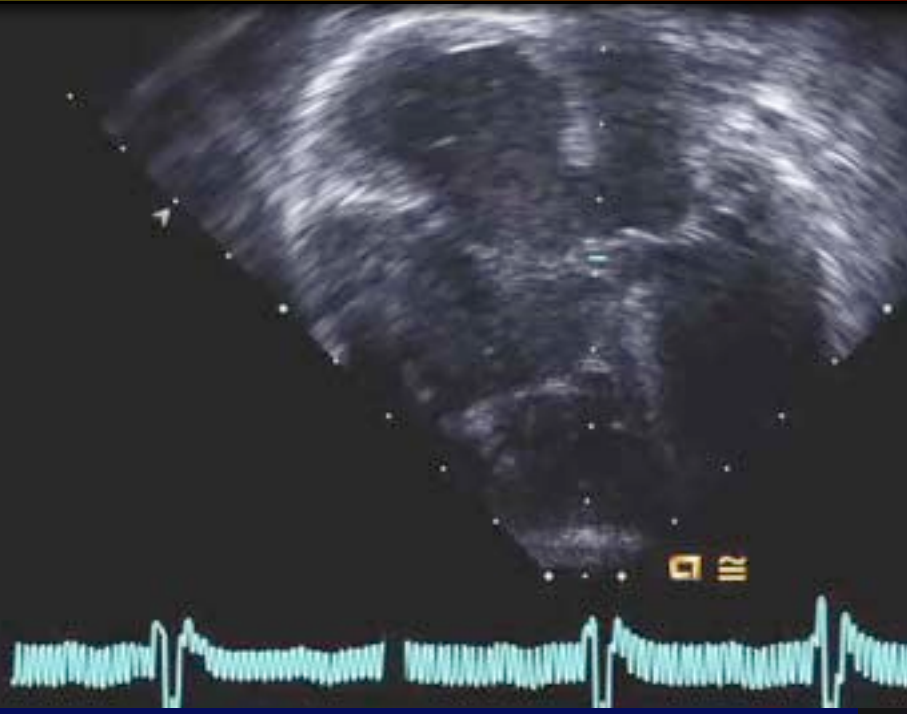
Atrioventricular Septal Defects: Left AV Valvar Leakage



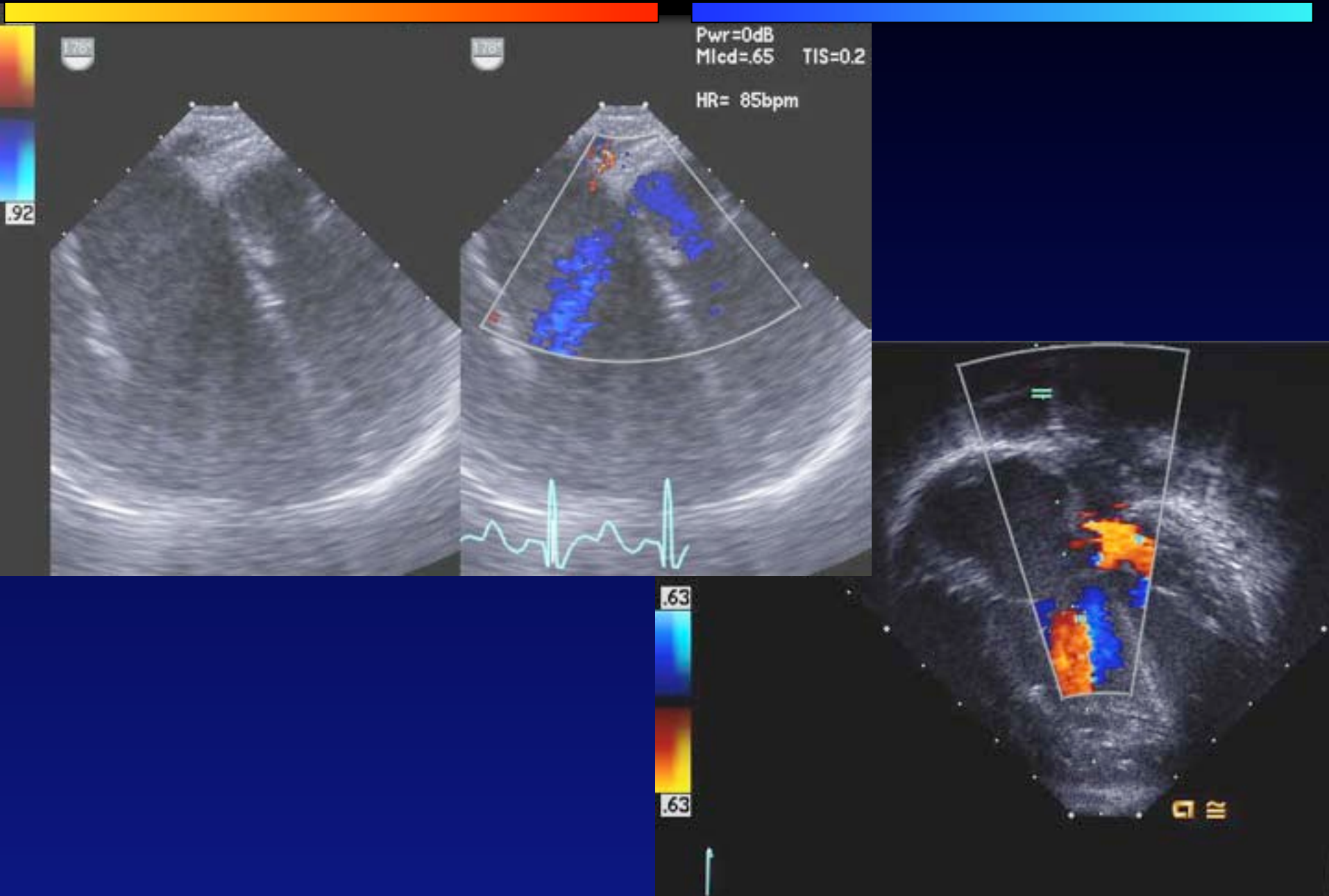
Atrioventricular Septal Defects: Associations- Sub AS



Ostium Primum ASD. (Same Patient)



Ostium Primum ASD.

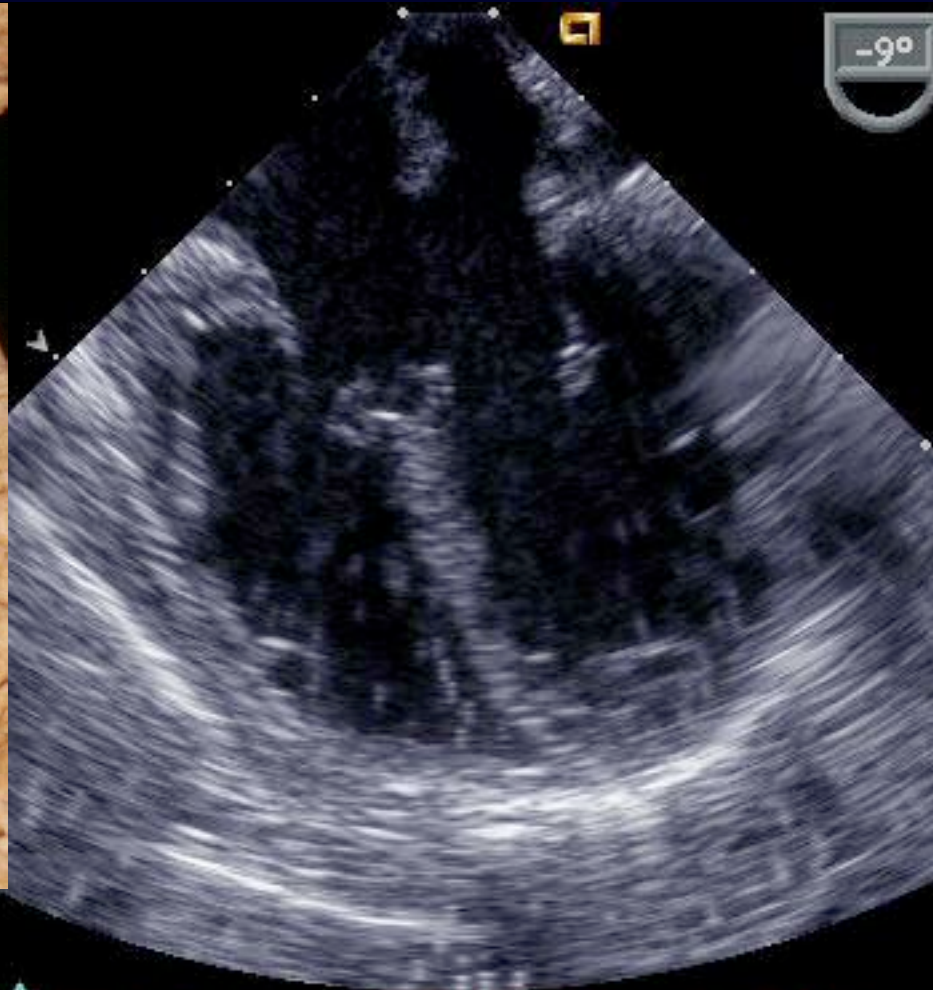


The connecting tongue and the “Partial Canal”



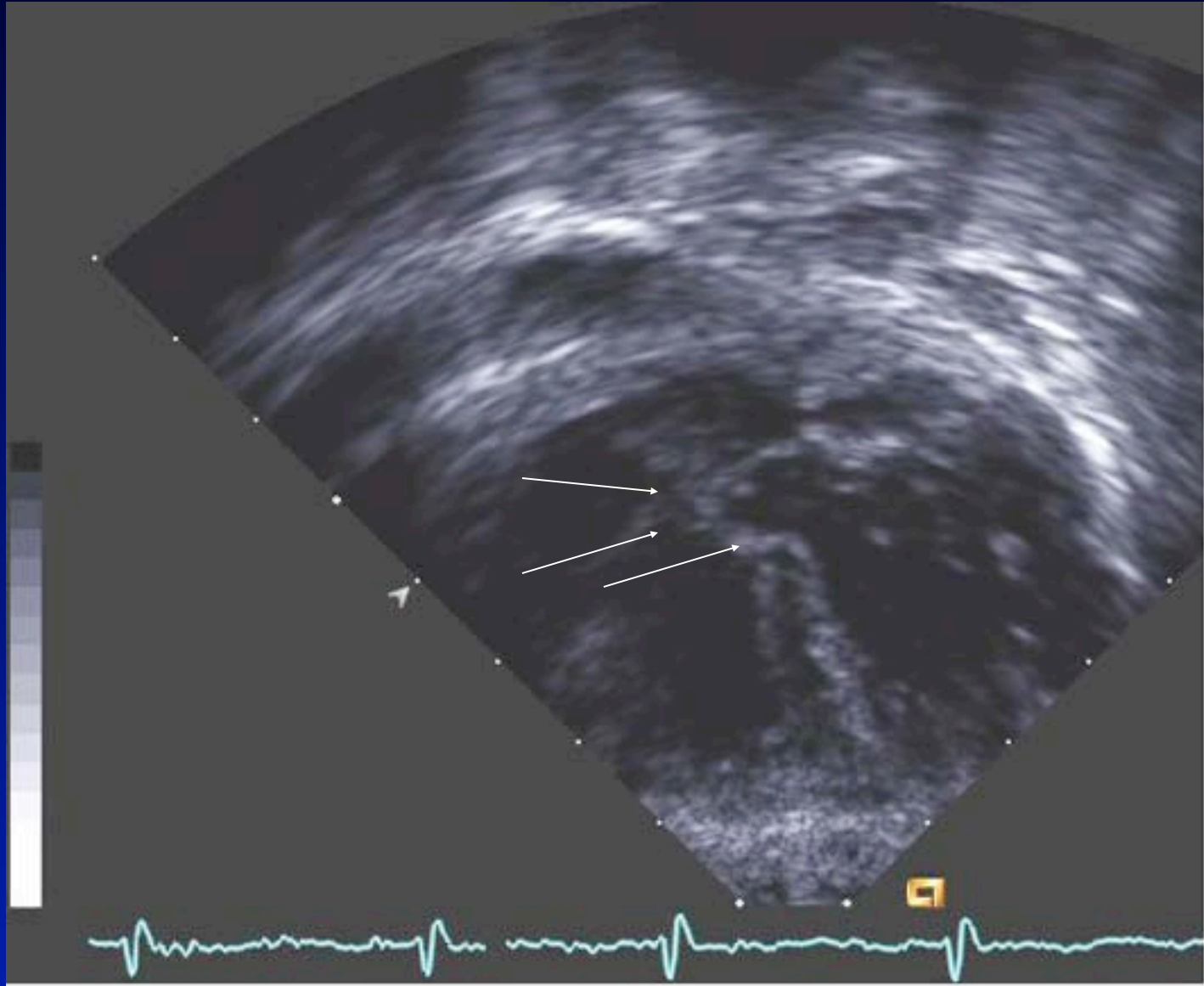
Partial Atrioventricular Septal Defects: Associations

- The Tricuspid Pouch Lesion

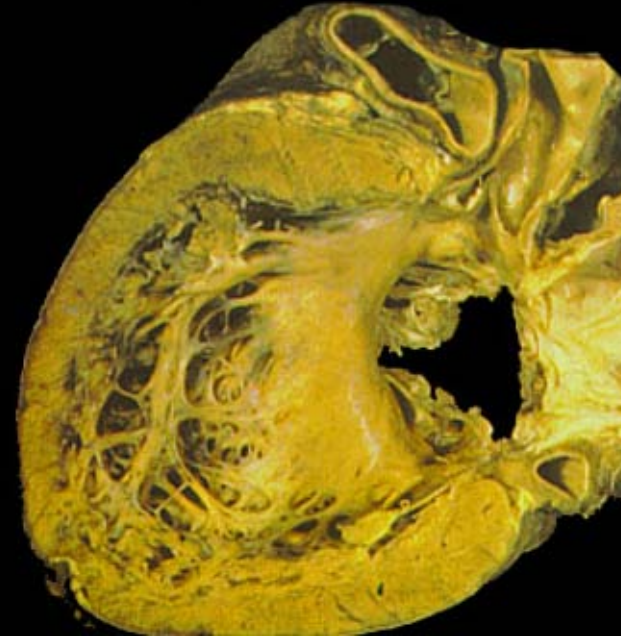
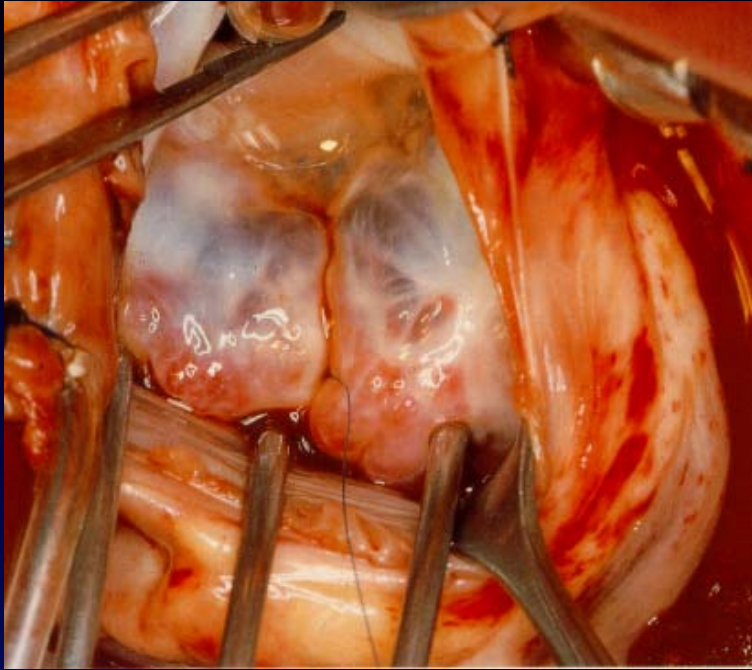


Atrioventricular Septal Defects: Associations

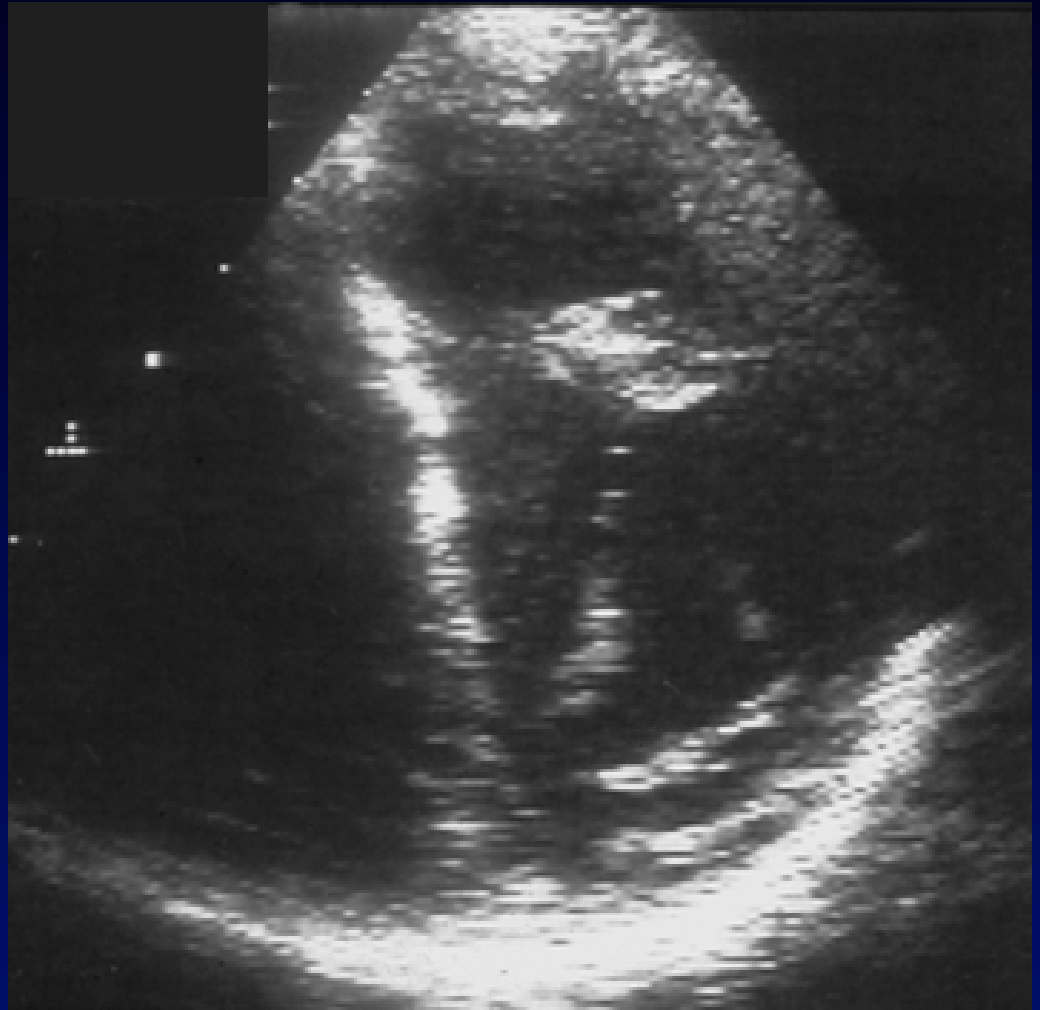
- The Tricuspid Pouch Lesion



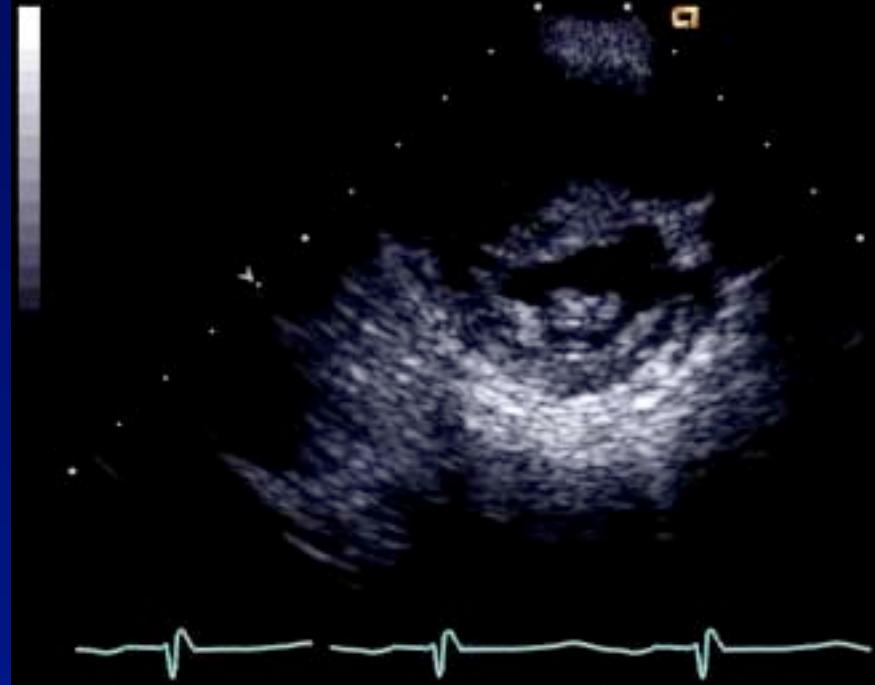
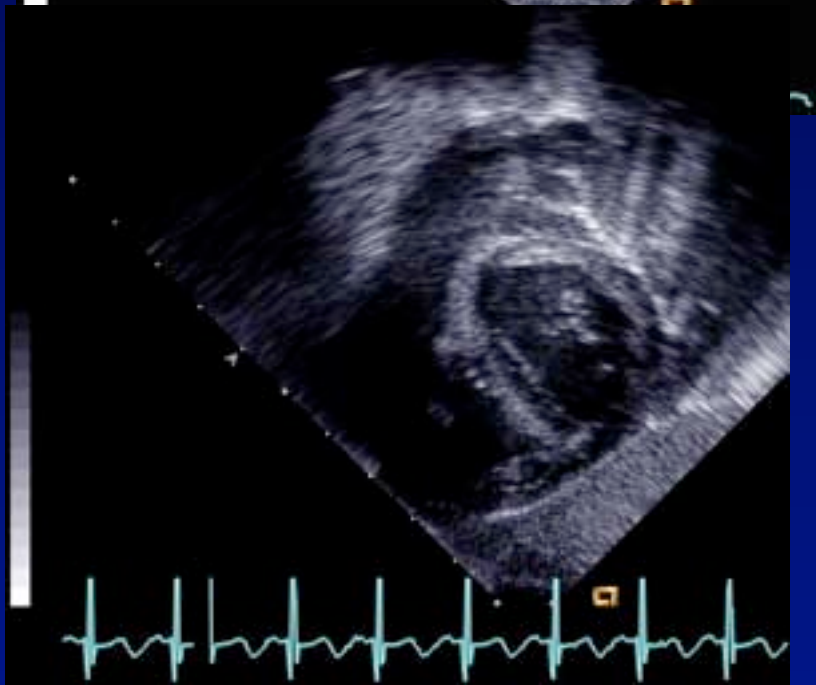
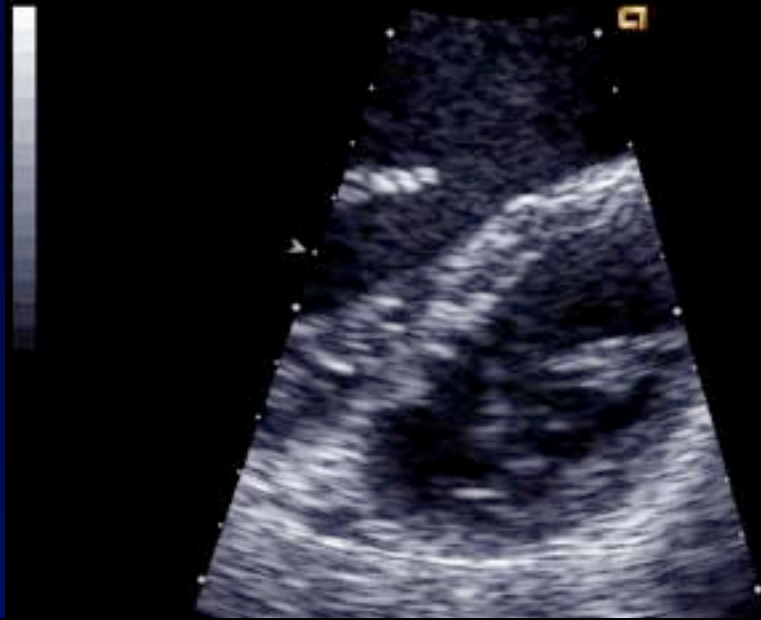
Cleft in the Left Atrioventricular Valve



The So-Called “Cleft Mitral Valve”

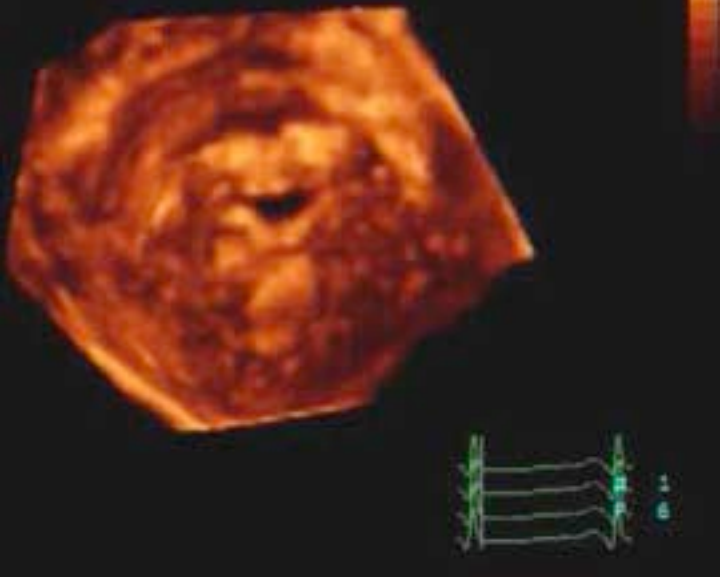


The so-called “Cleft Mitral Valve”



Left Atrioventricular Valve & Regurgitation

3D Normal Mitral Valve



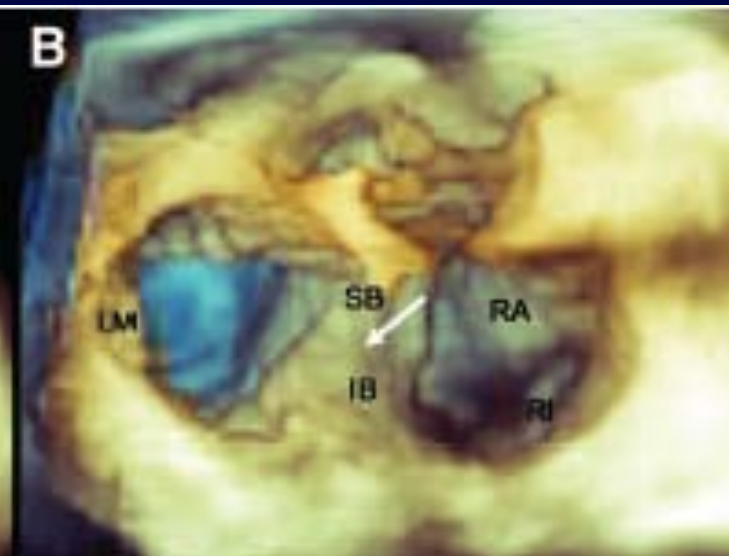
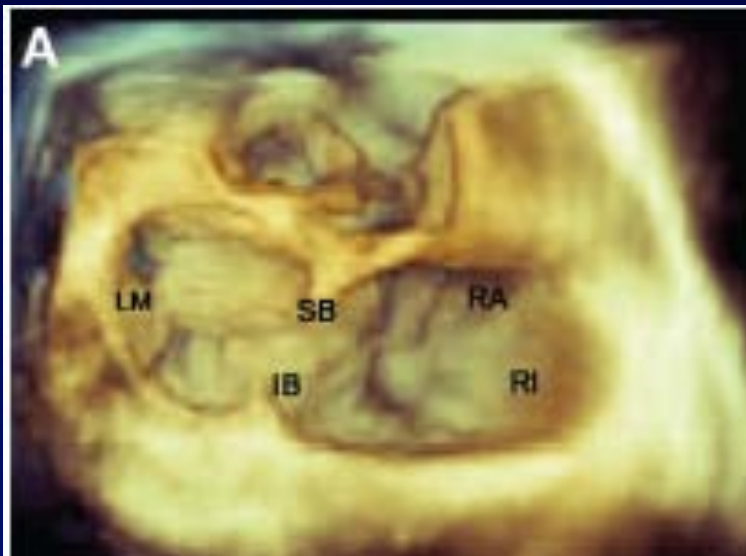
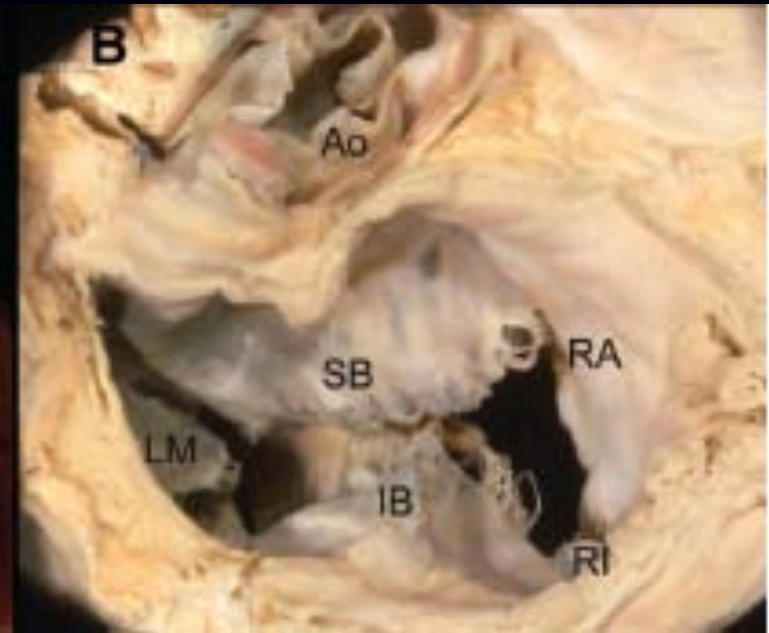
3D Cleft Left Atrioventricular Valve



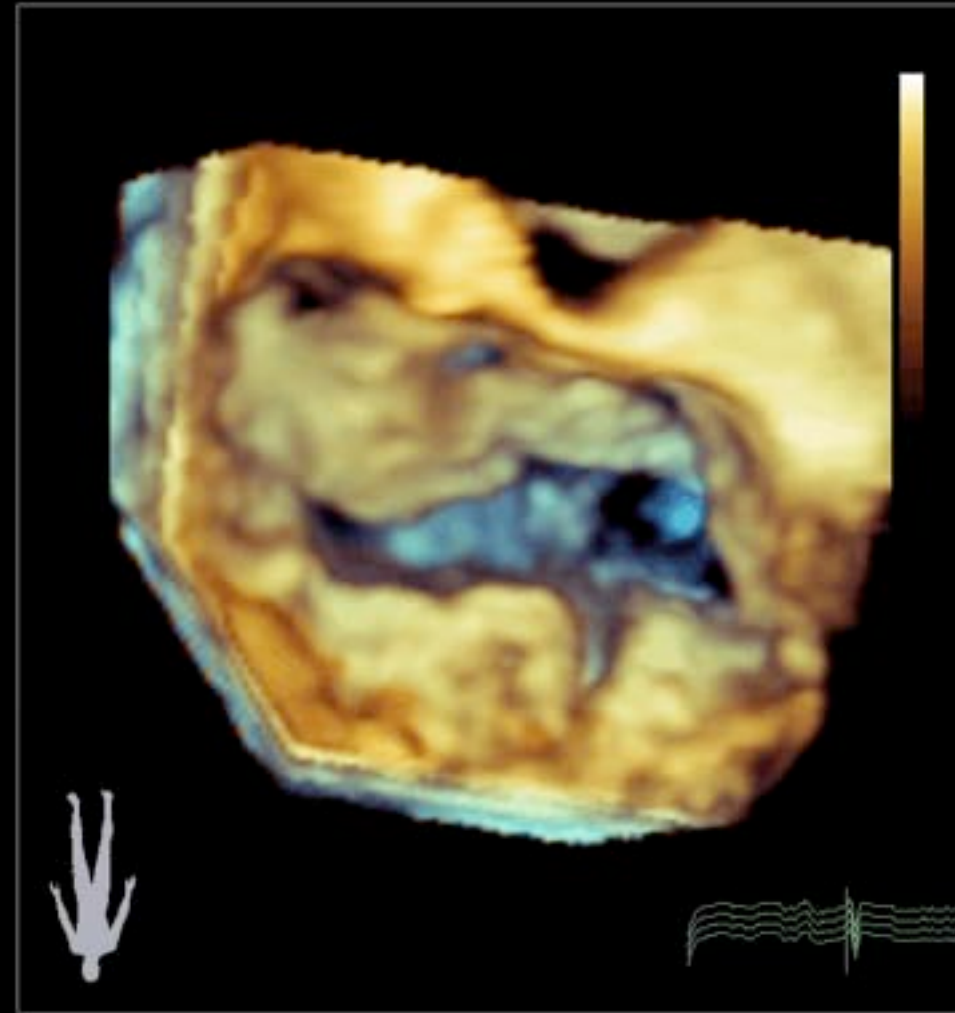
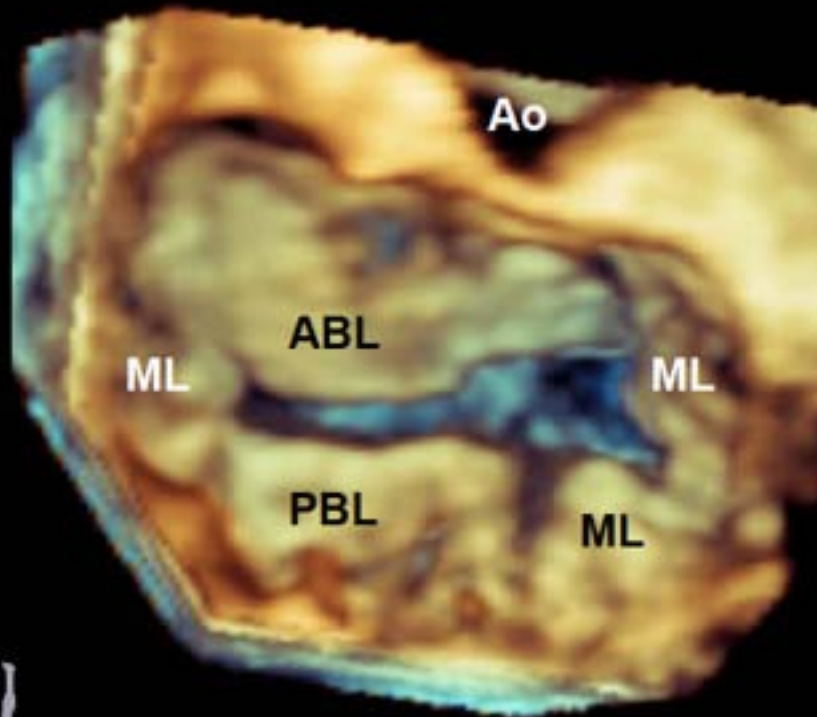
Surgical View of Cleft

Courtesy of Jeff. Smallhorn

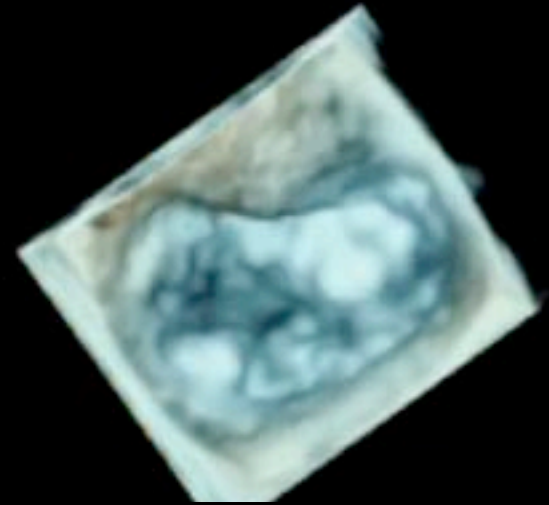
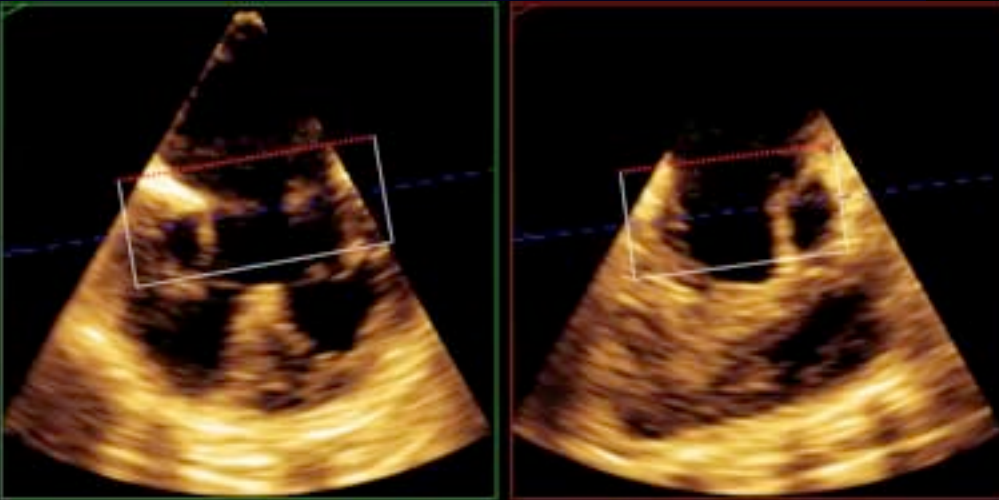
New Contributions of 3 D Echocardiography.



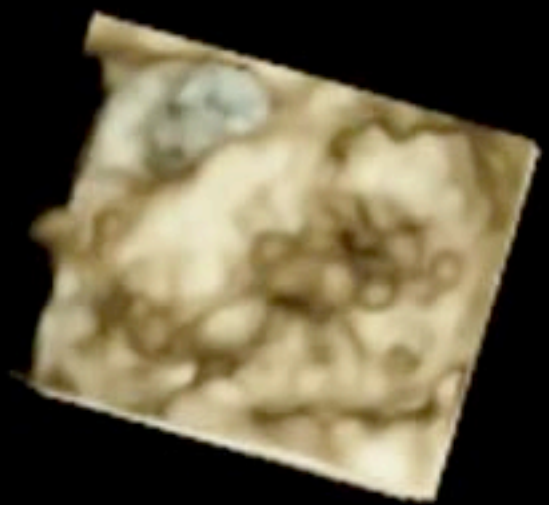
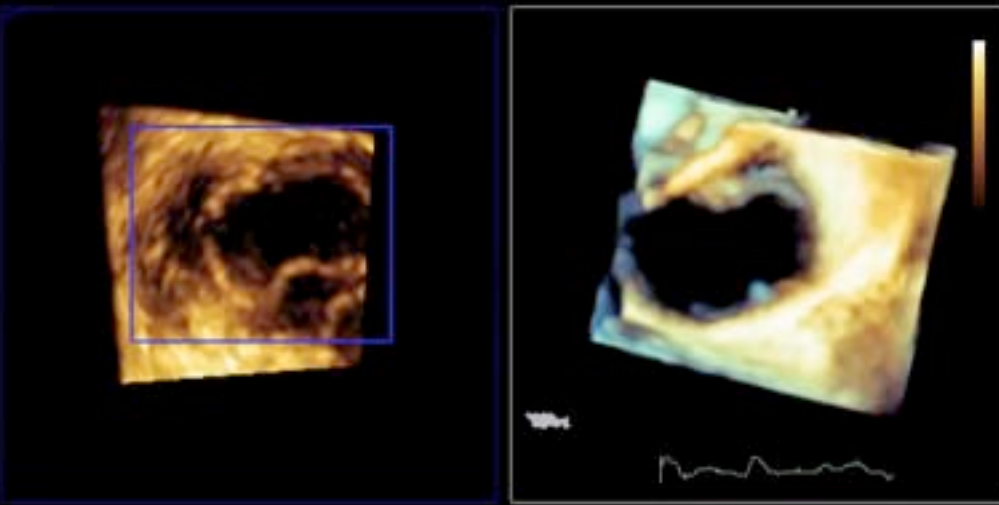
The So-called “Cleft Mitral Valve”



3 D Zoom Technique



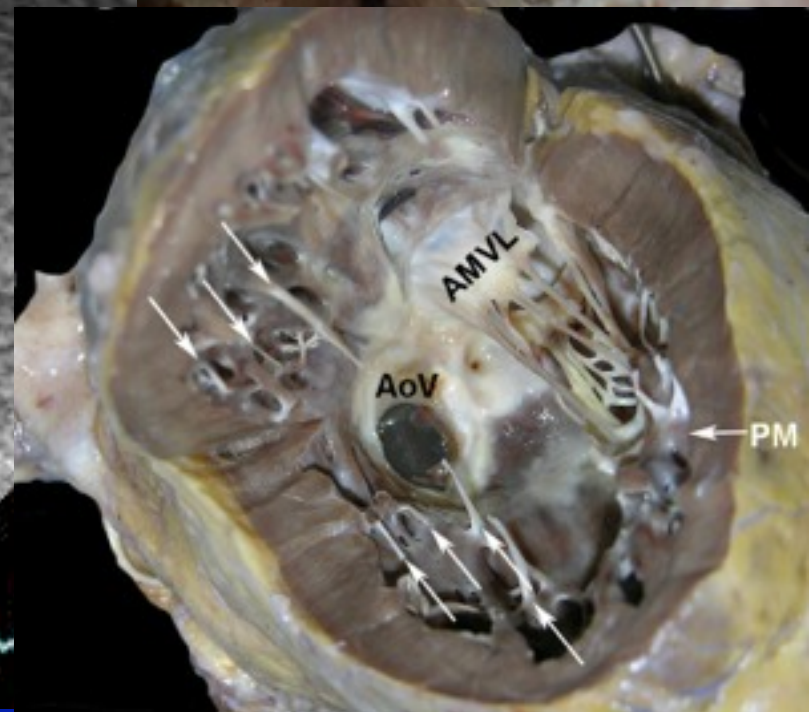
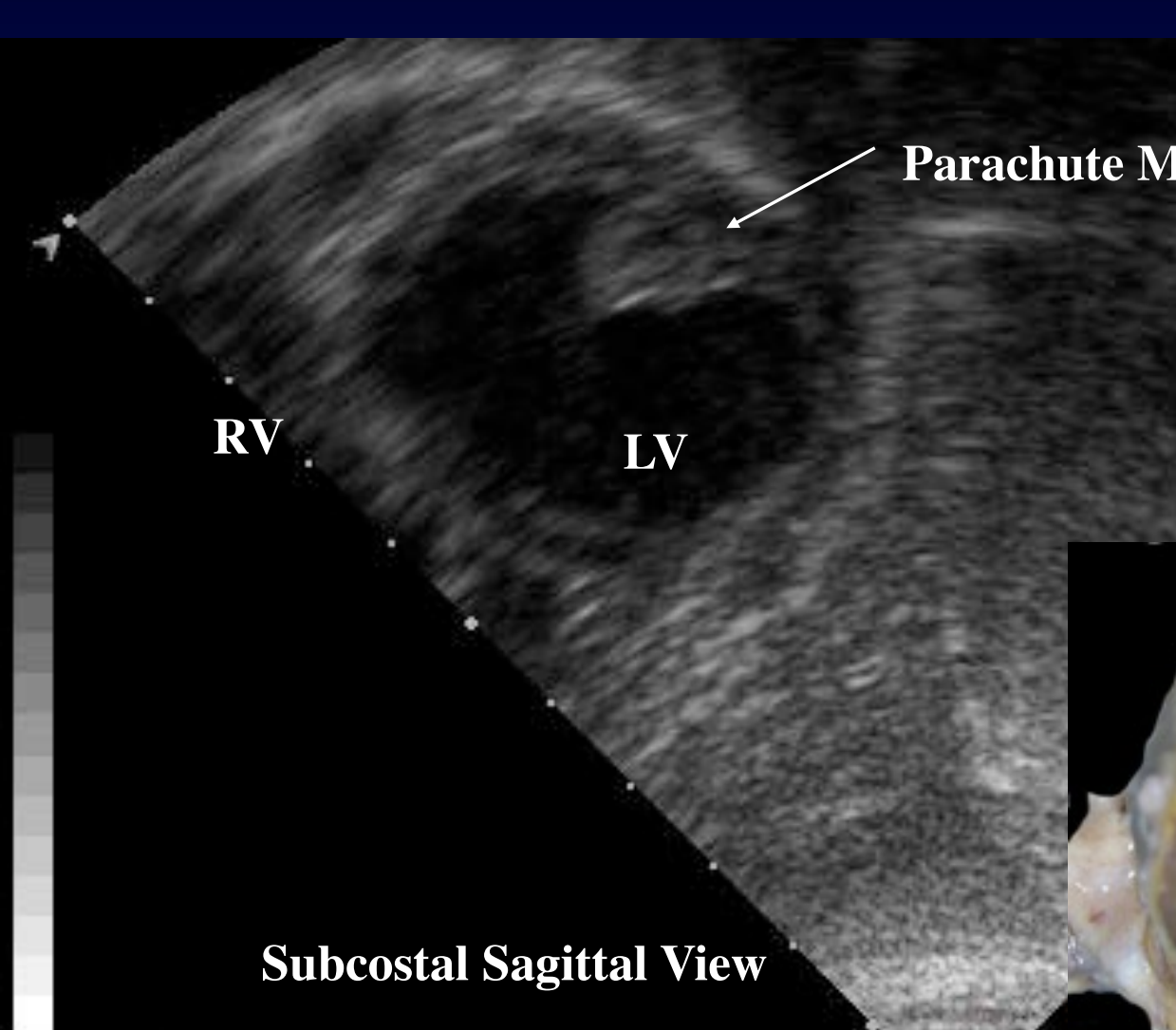
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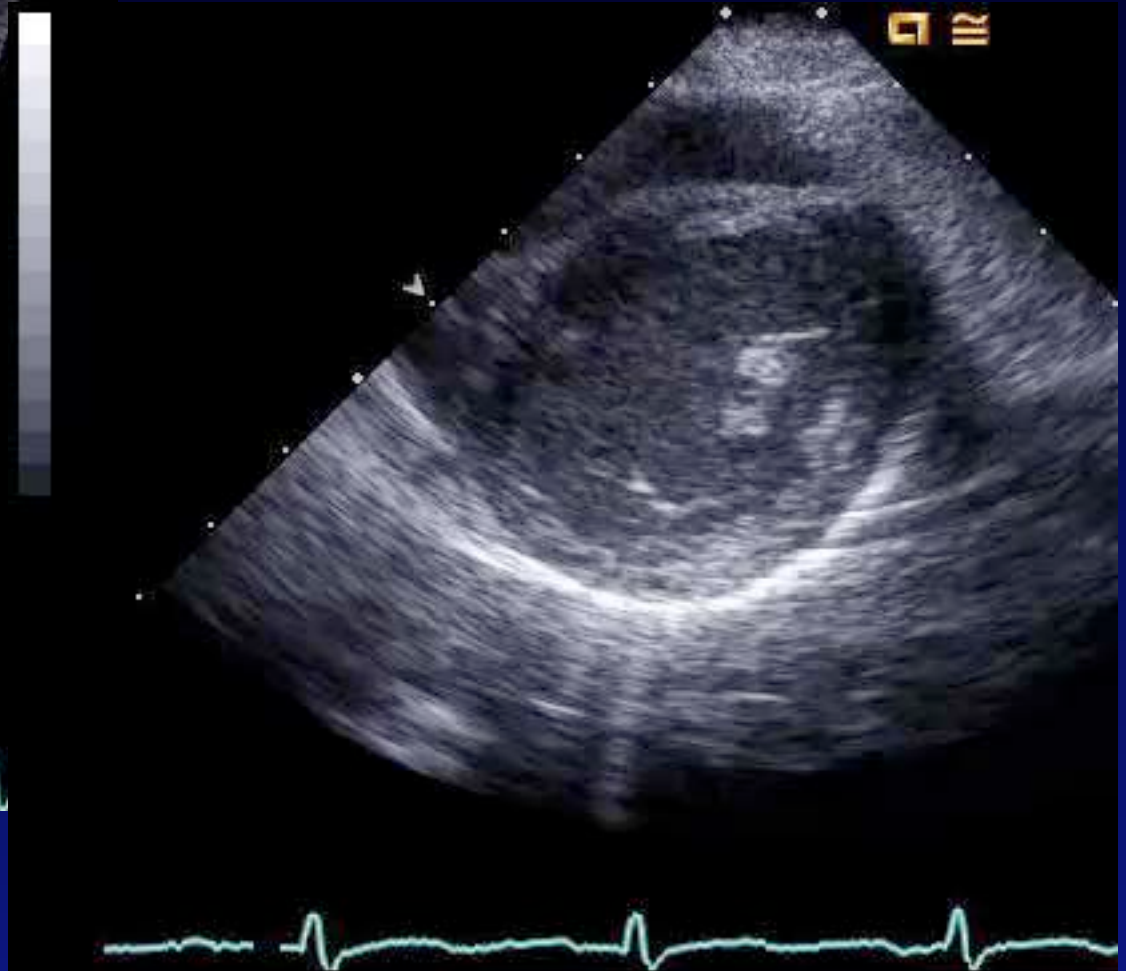
Single papillary muscle as a risk factor



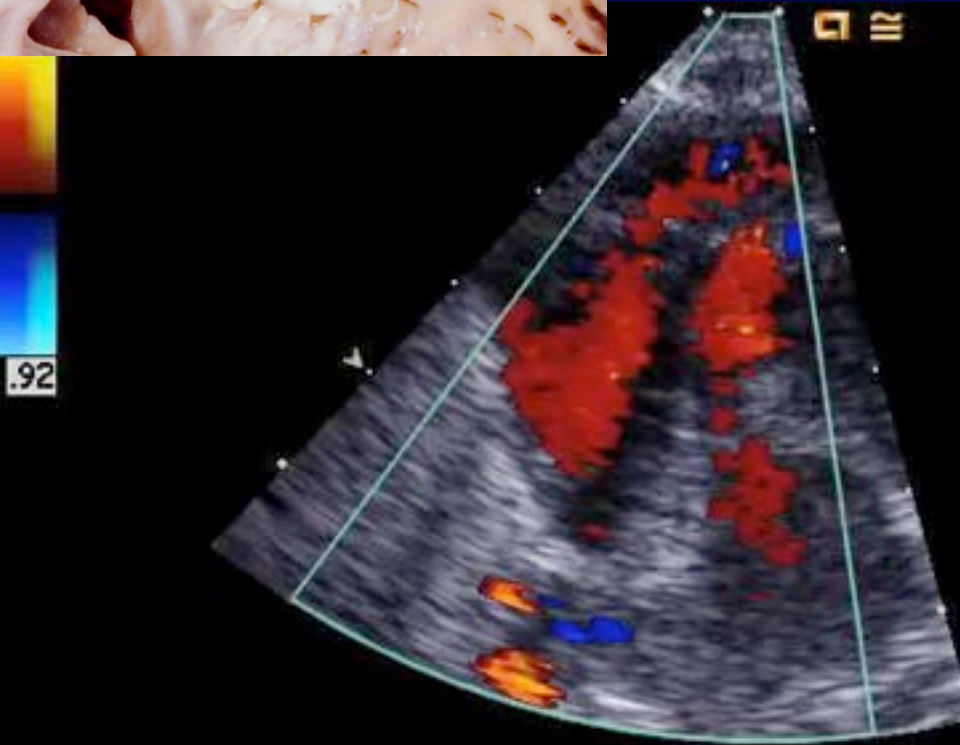
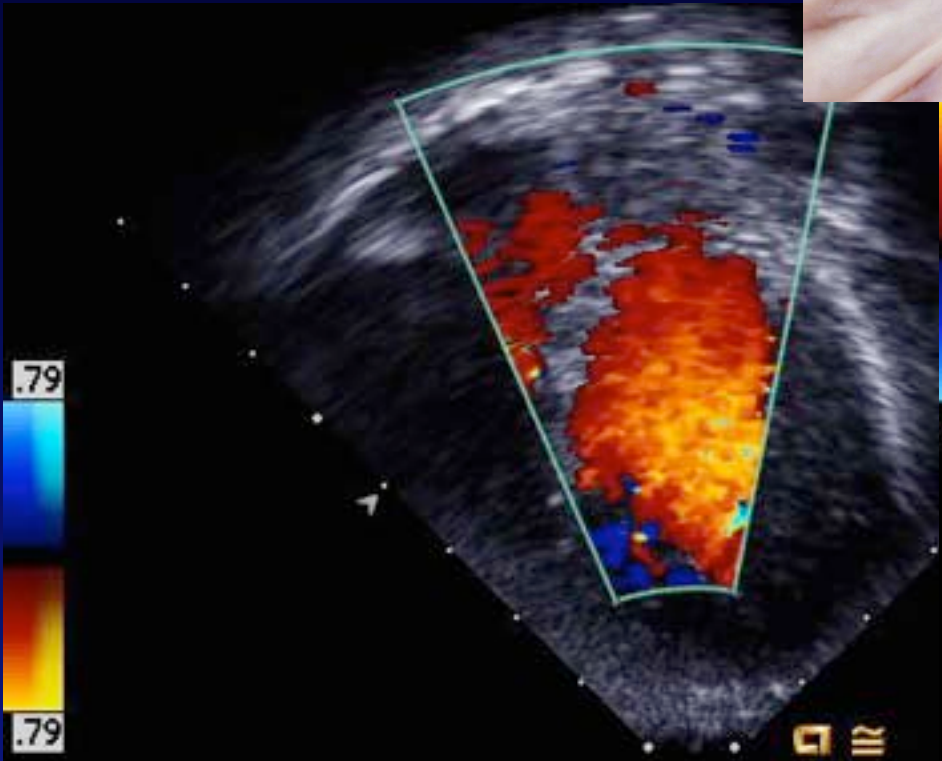
Single left ventricular papillary muscle



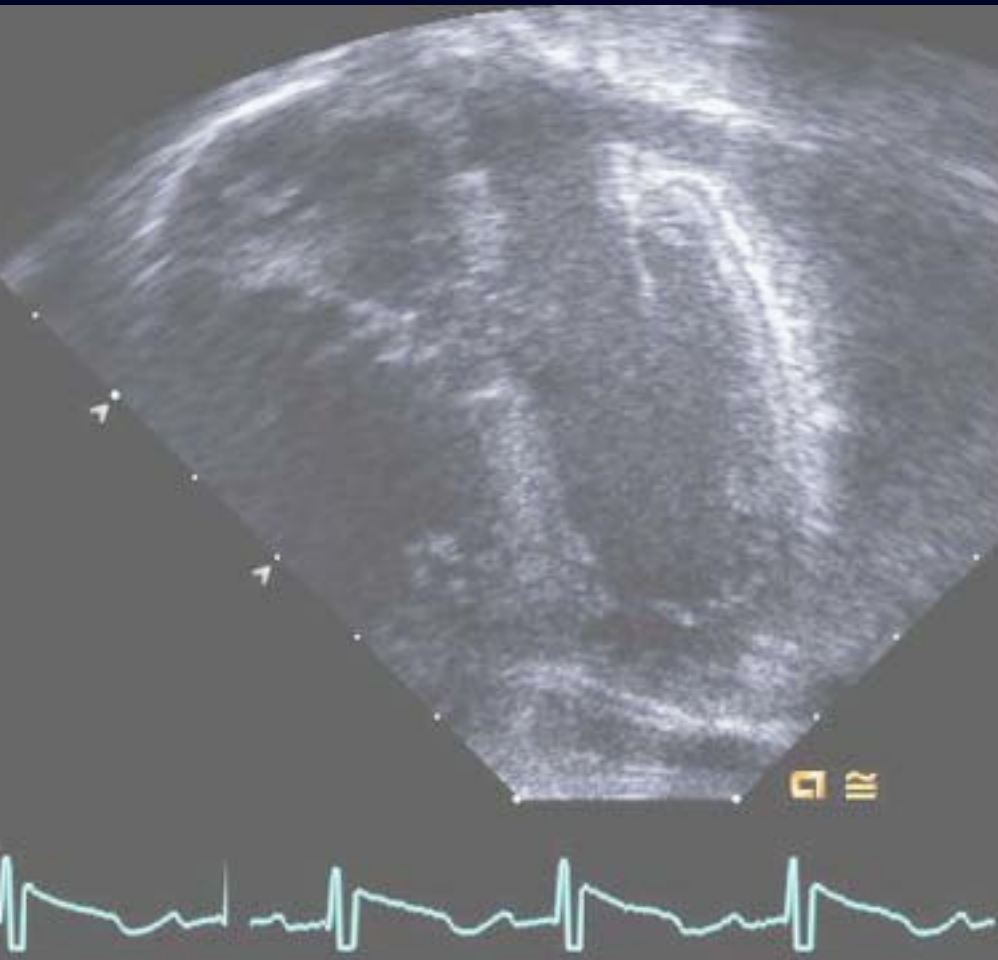
Isolated ventricular component of an AVSD



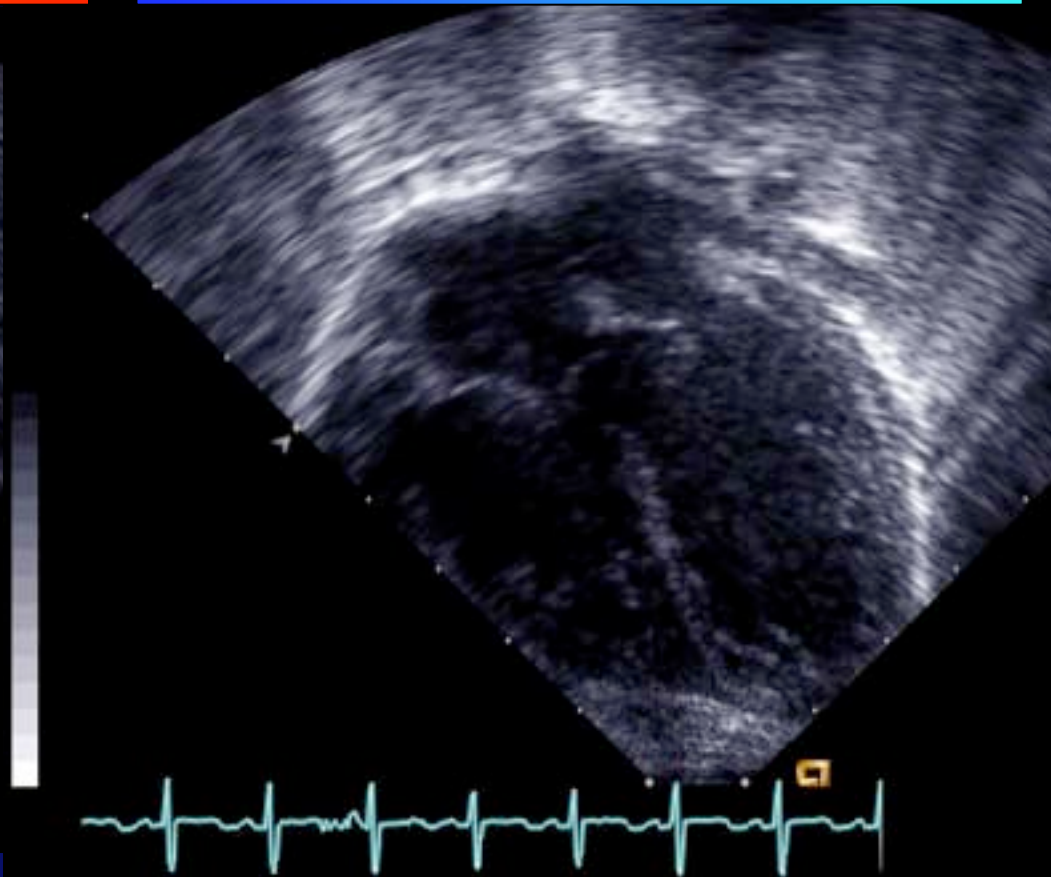
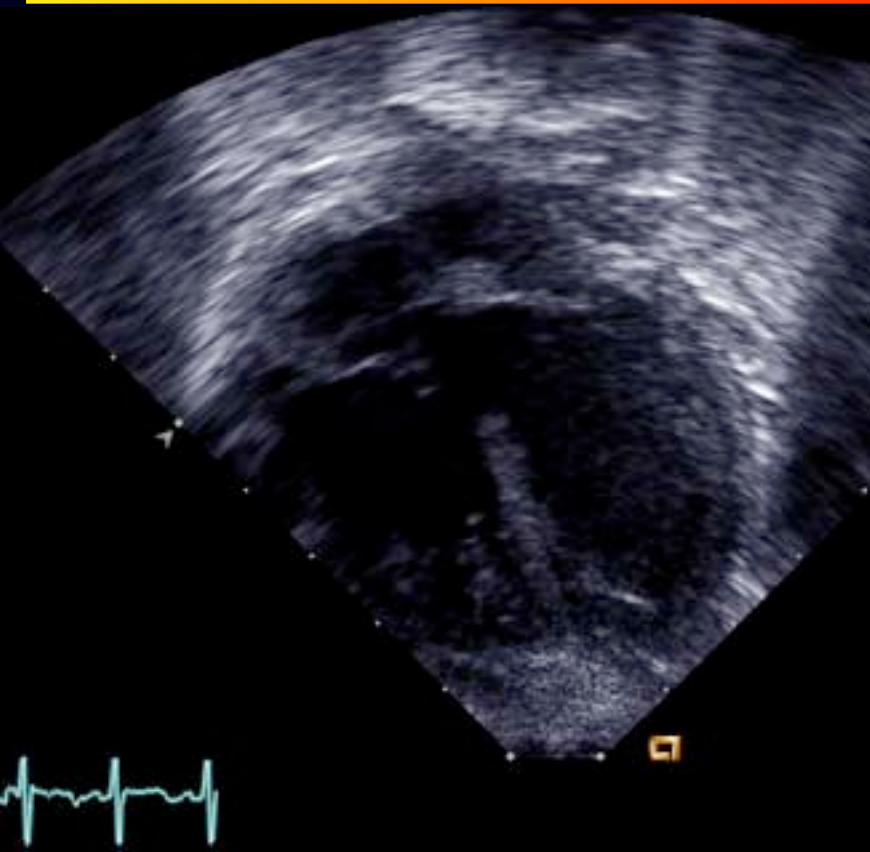
Isolated ventricular component of an AVSD



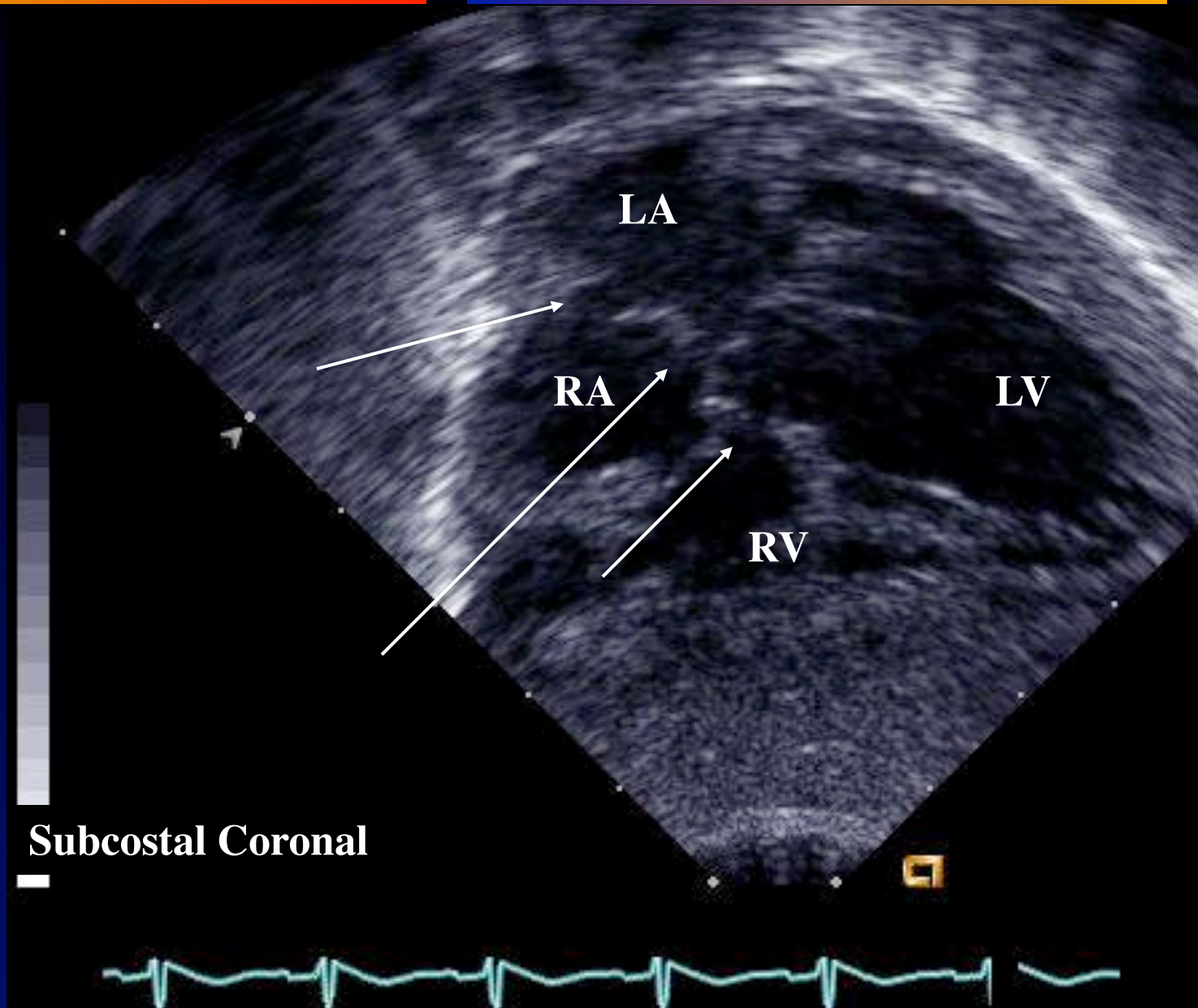
Isolated ventricular component of an AVSD



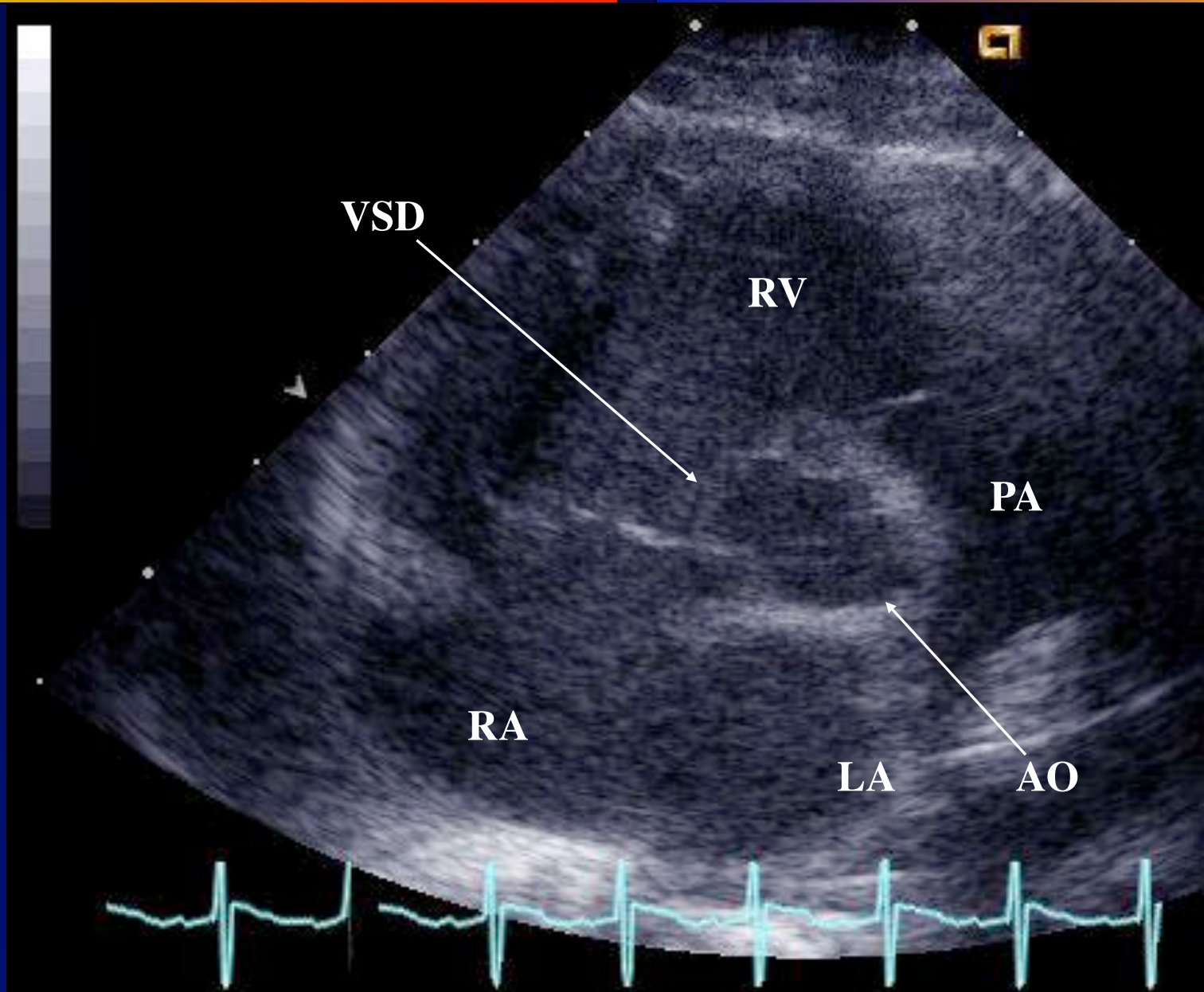
Isolated ventricular component of an AVSD



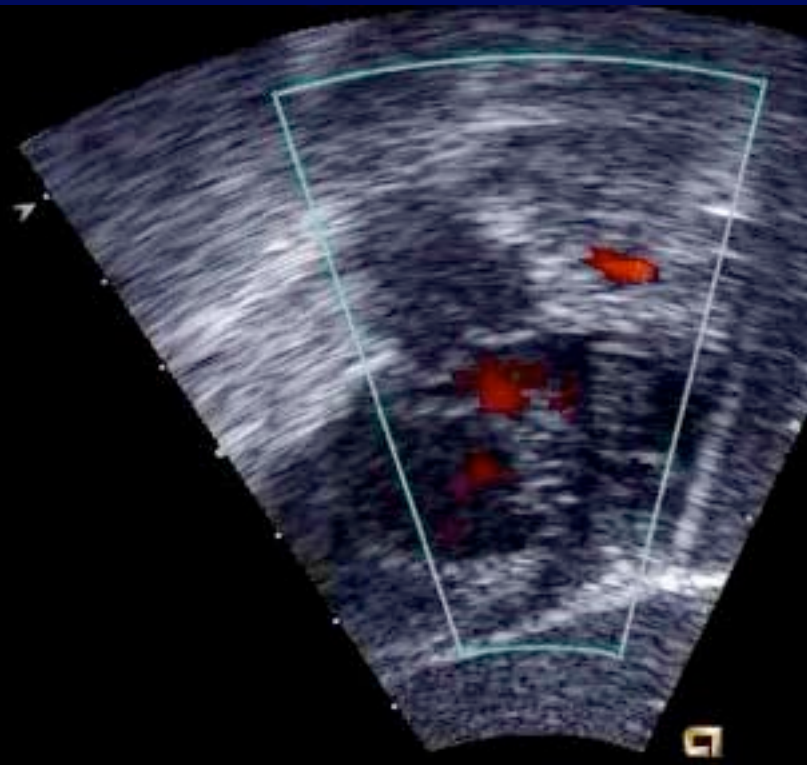
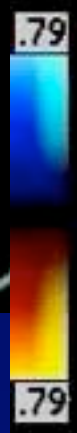
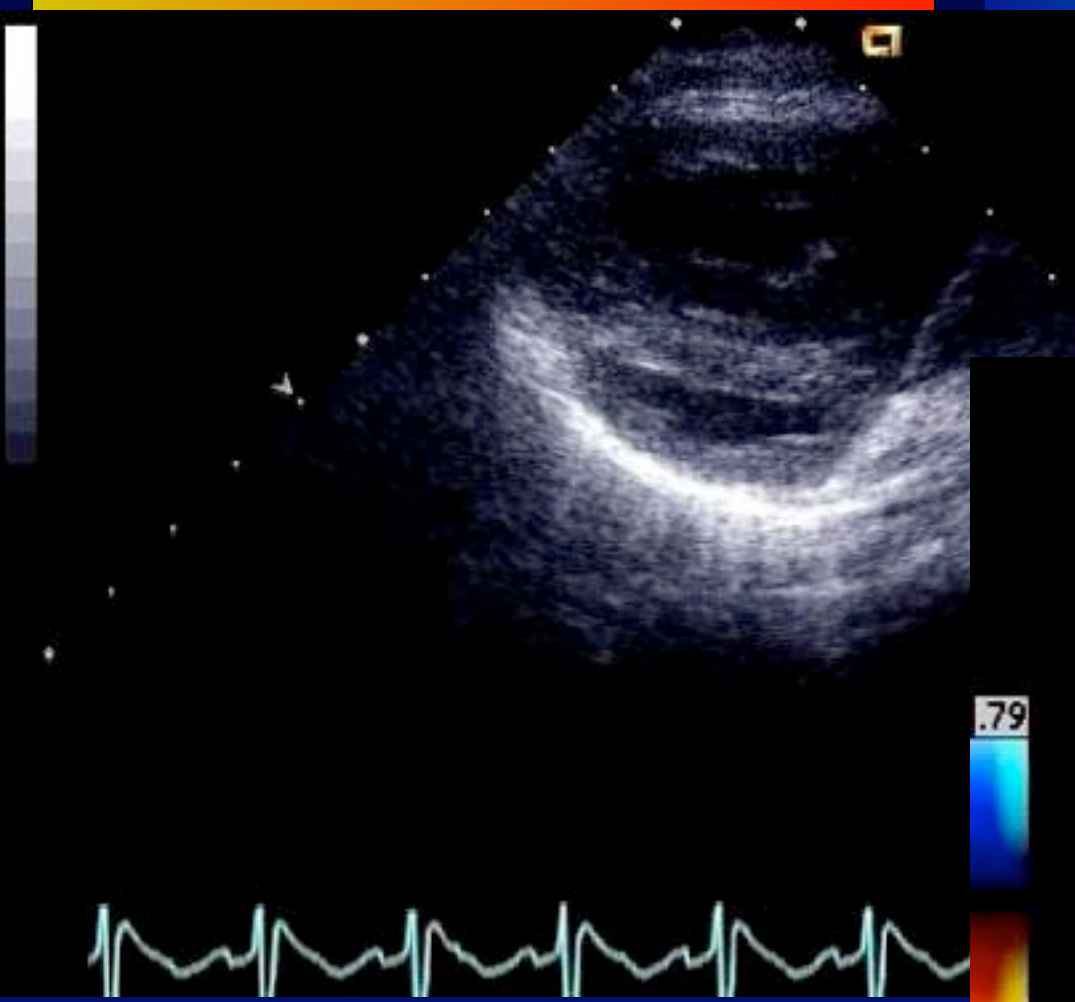
AVSD :Secundum ASD Type A. AVSD



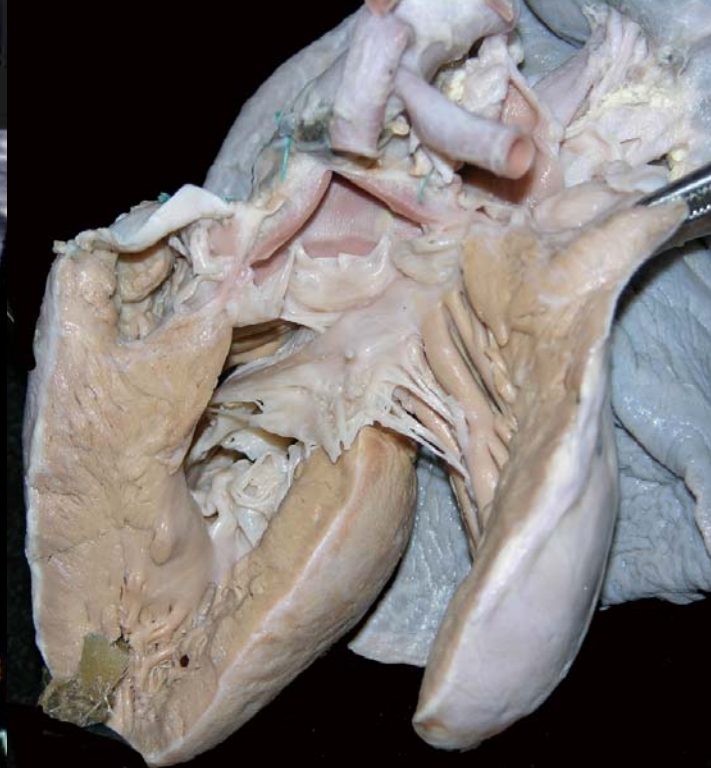
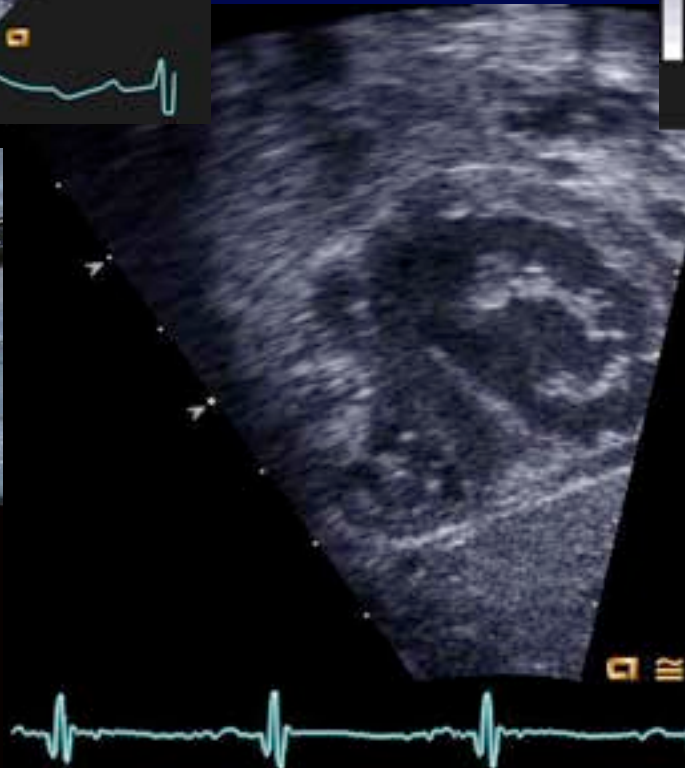
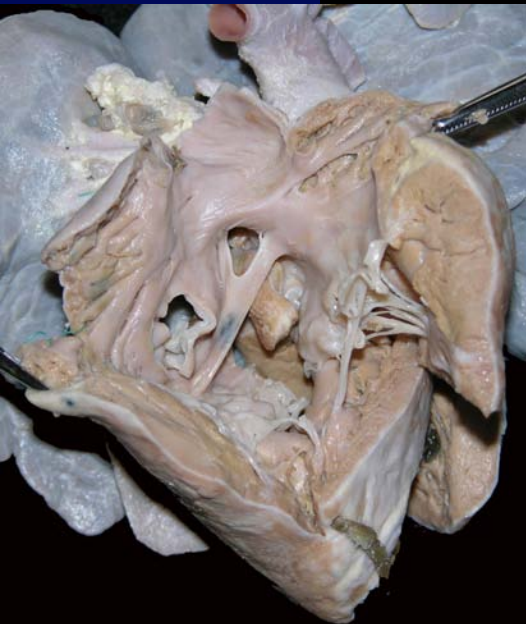
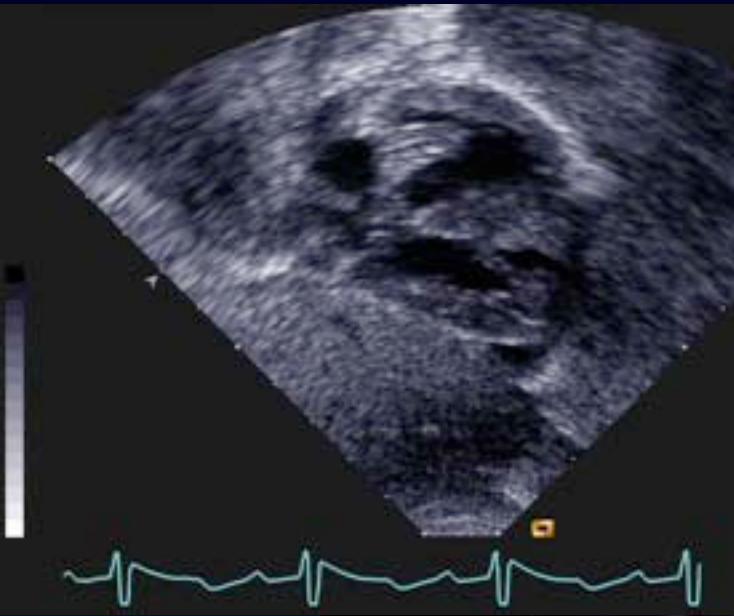
AVSD: Parasternal Short Axis of VSD



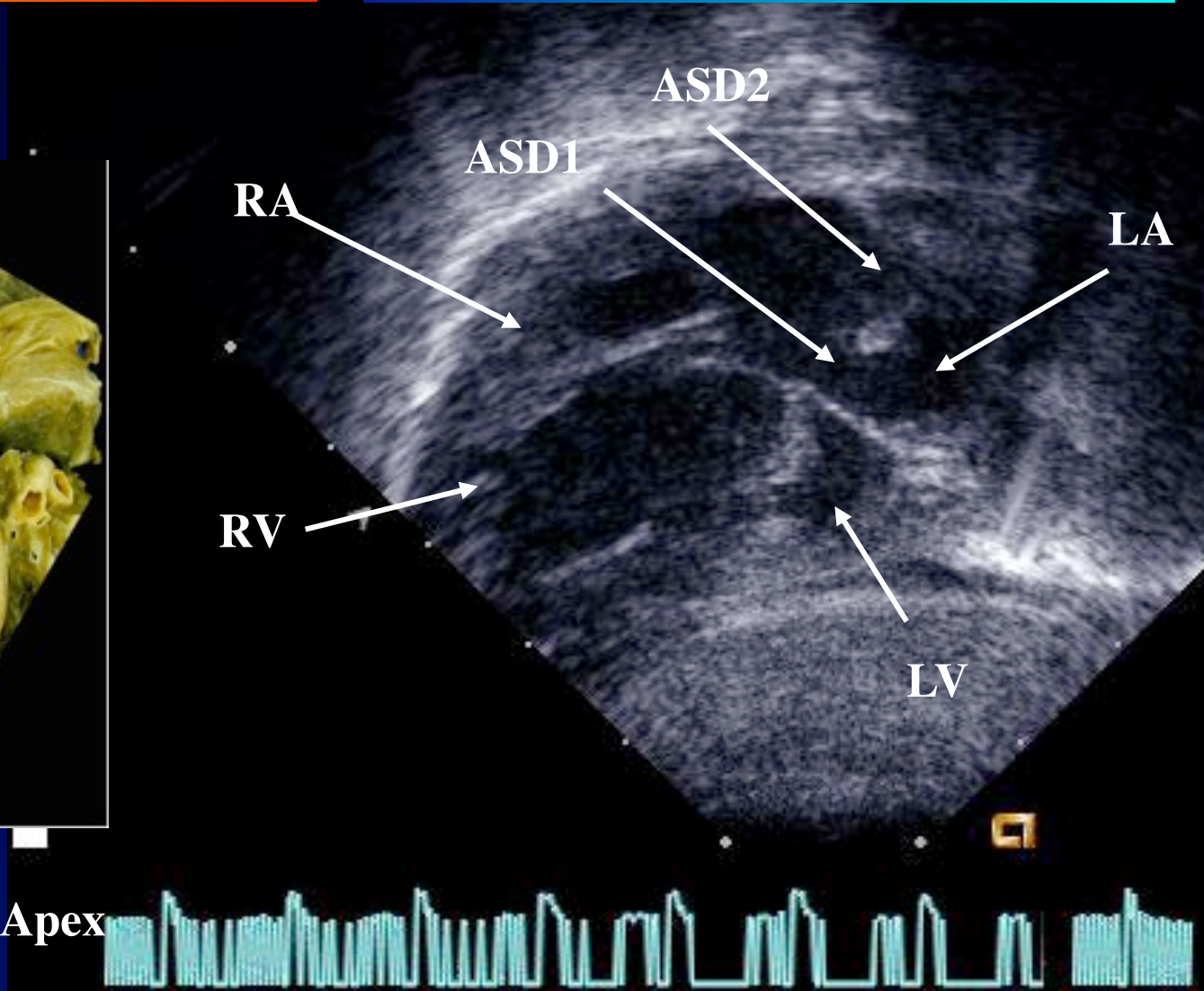
Atrioventricular Septal Defects: Associations- DORV



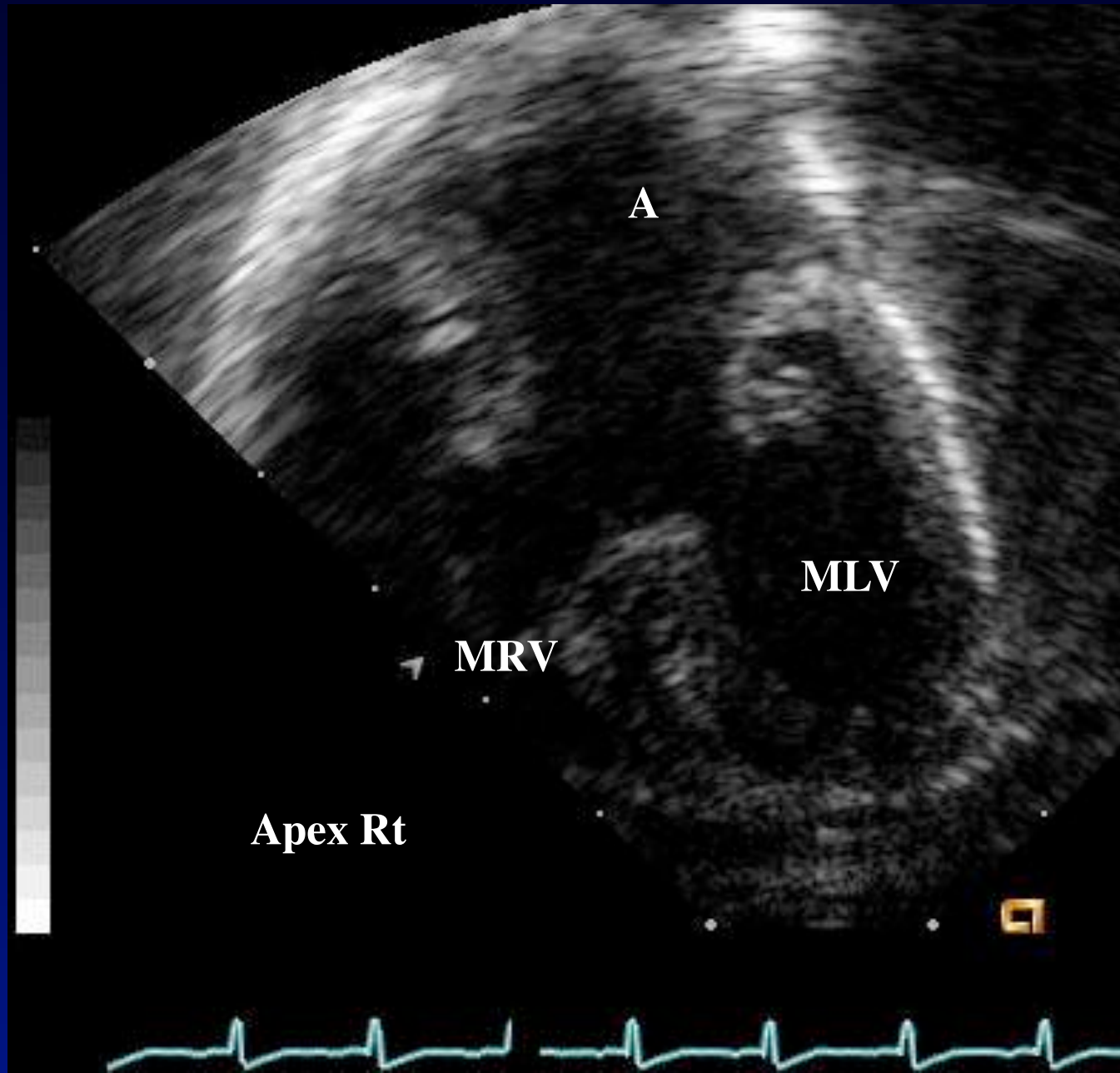
Atrioventricular Septal Defects: Associations- Tetralogy of Fallot



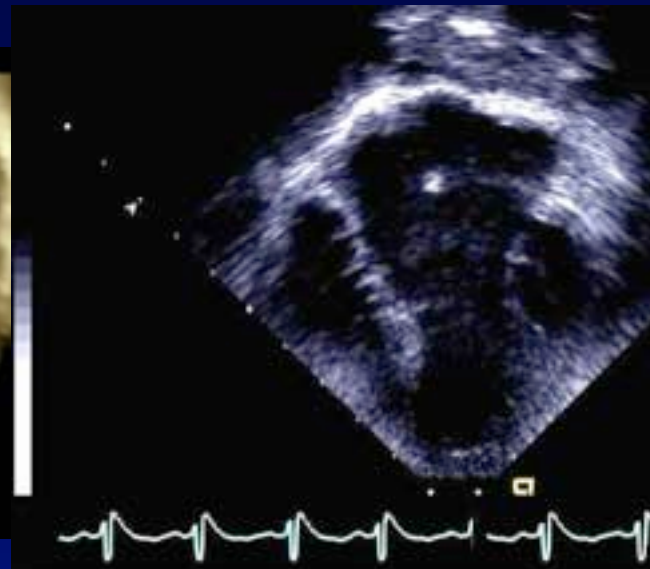
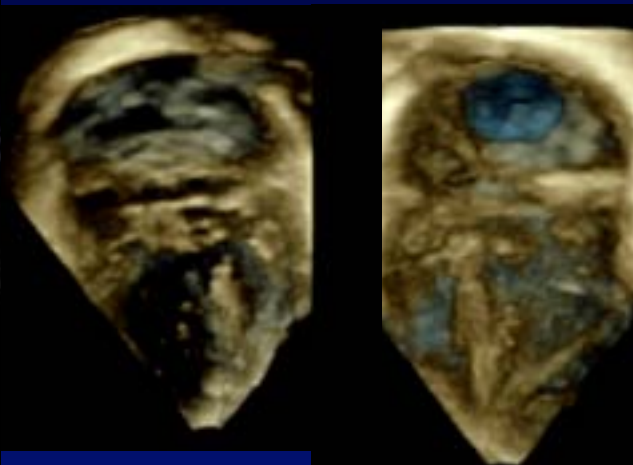
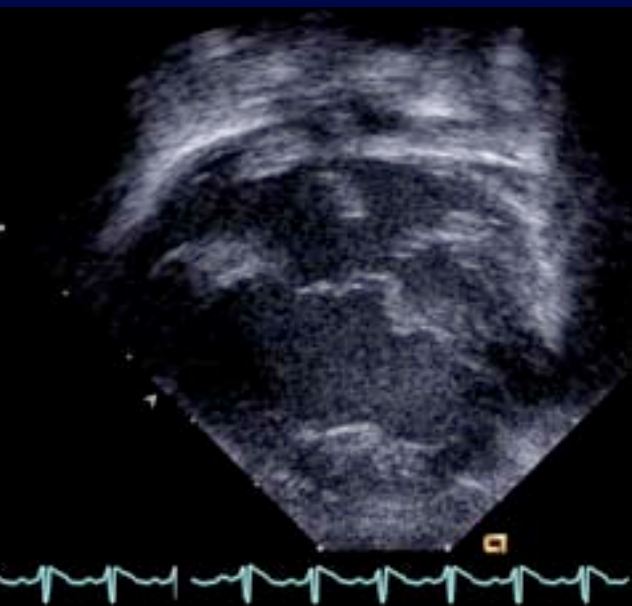
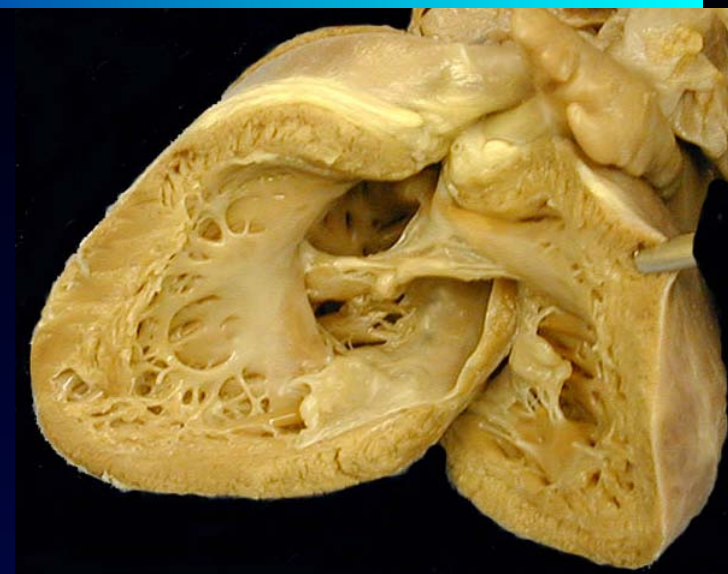
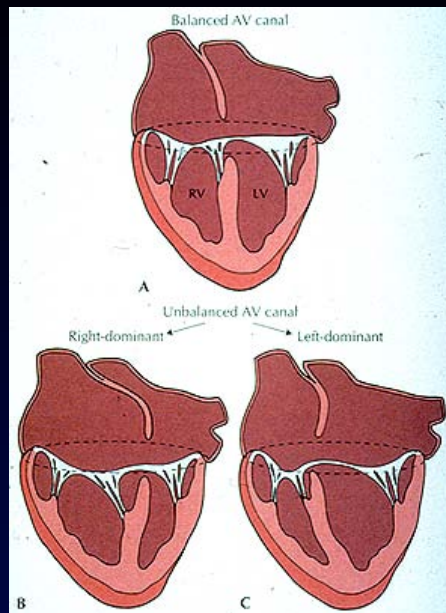
Dextrocardia, Right Isomerism and R Dom. AVSD



Type A AVSD. Left Isomerism



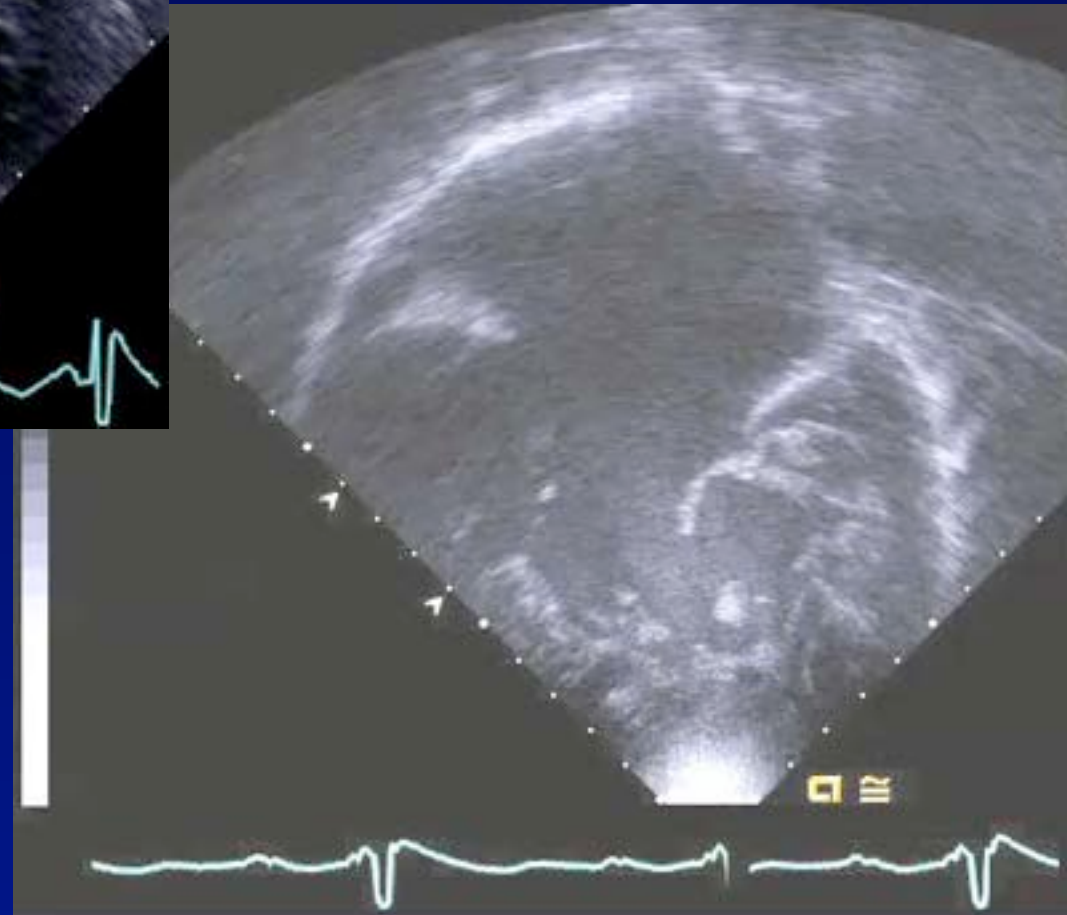
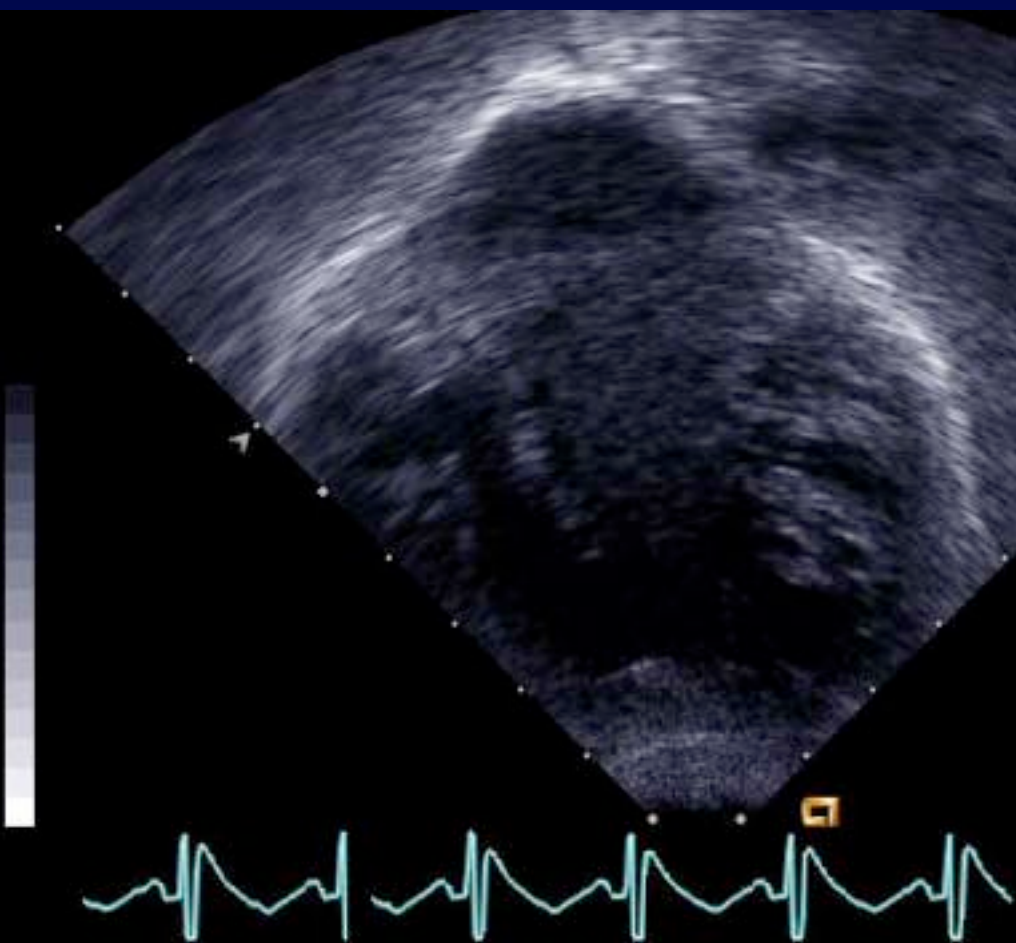
Unbalanced Atrioventricular Septal Defects



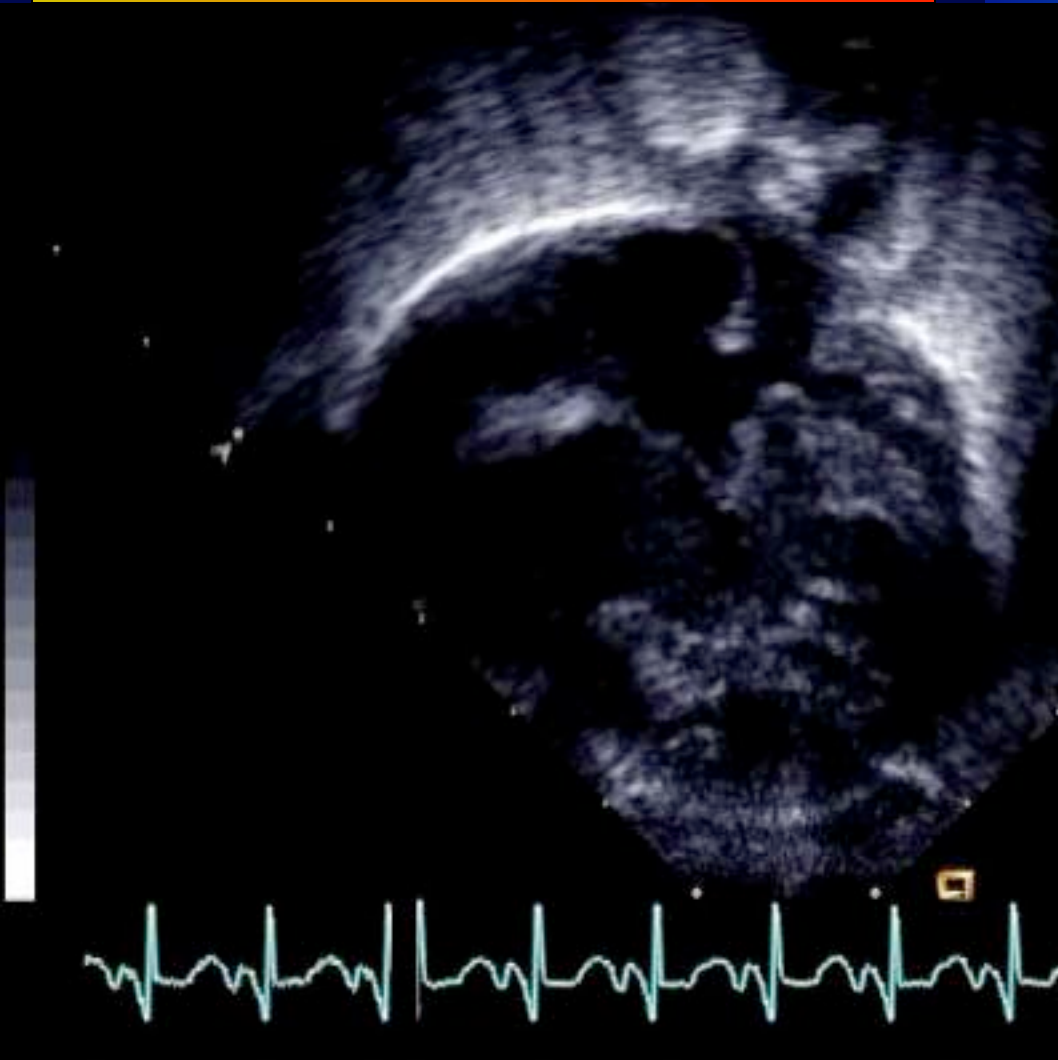
Left Dominant AVSD

- When is the right ventricle too small?
 - This is less clear than for right ventricular dominance.
- Options include:
 - “cheating” on the patch
 - a one and a half ventricle repair
 - single ventricle repair

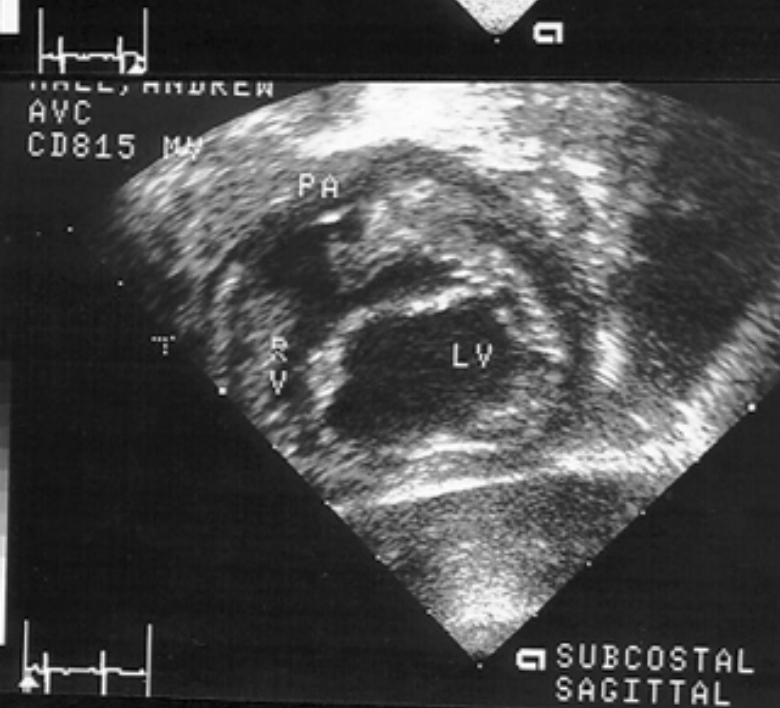
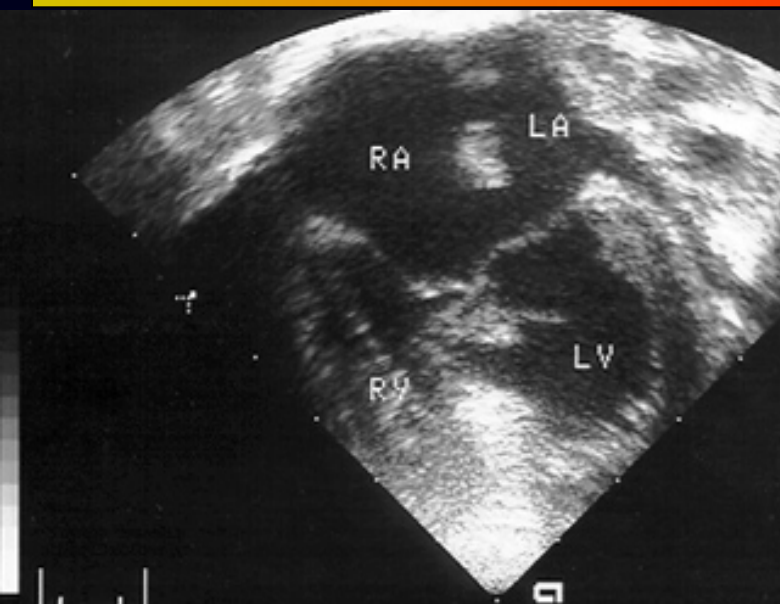
Atrioventricular Septal Defects: Right Dominant Associations



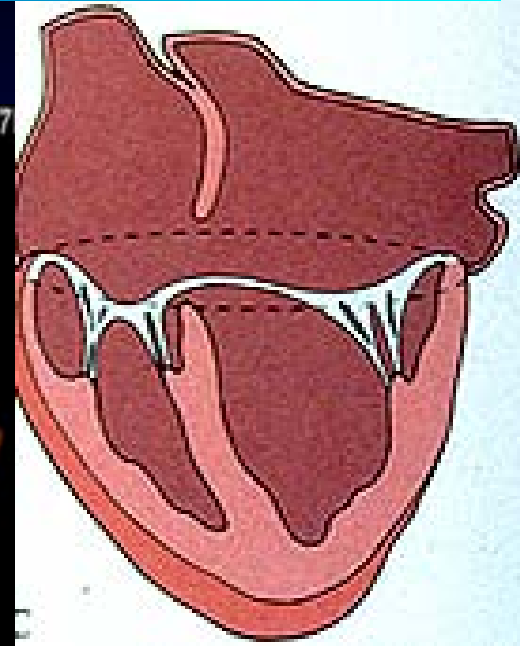
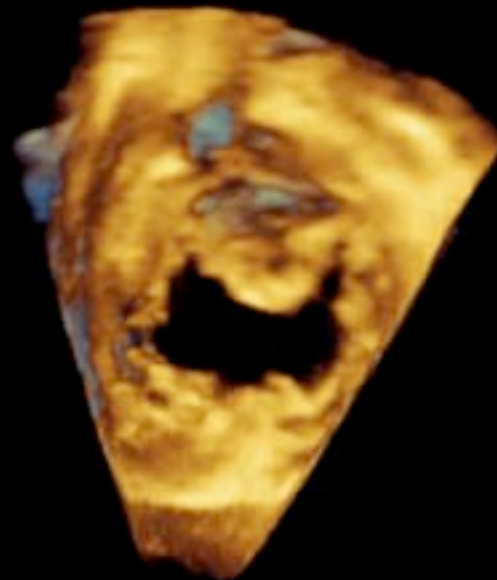
Atrioventricular Septal Defects: Right Dominant Associations



Left Dominant AVSD

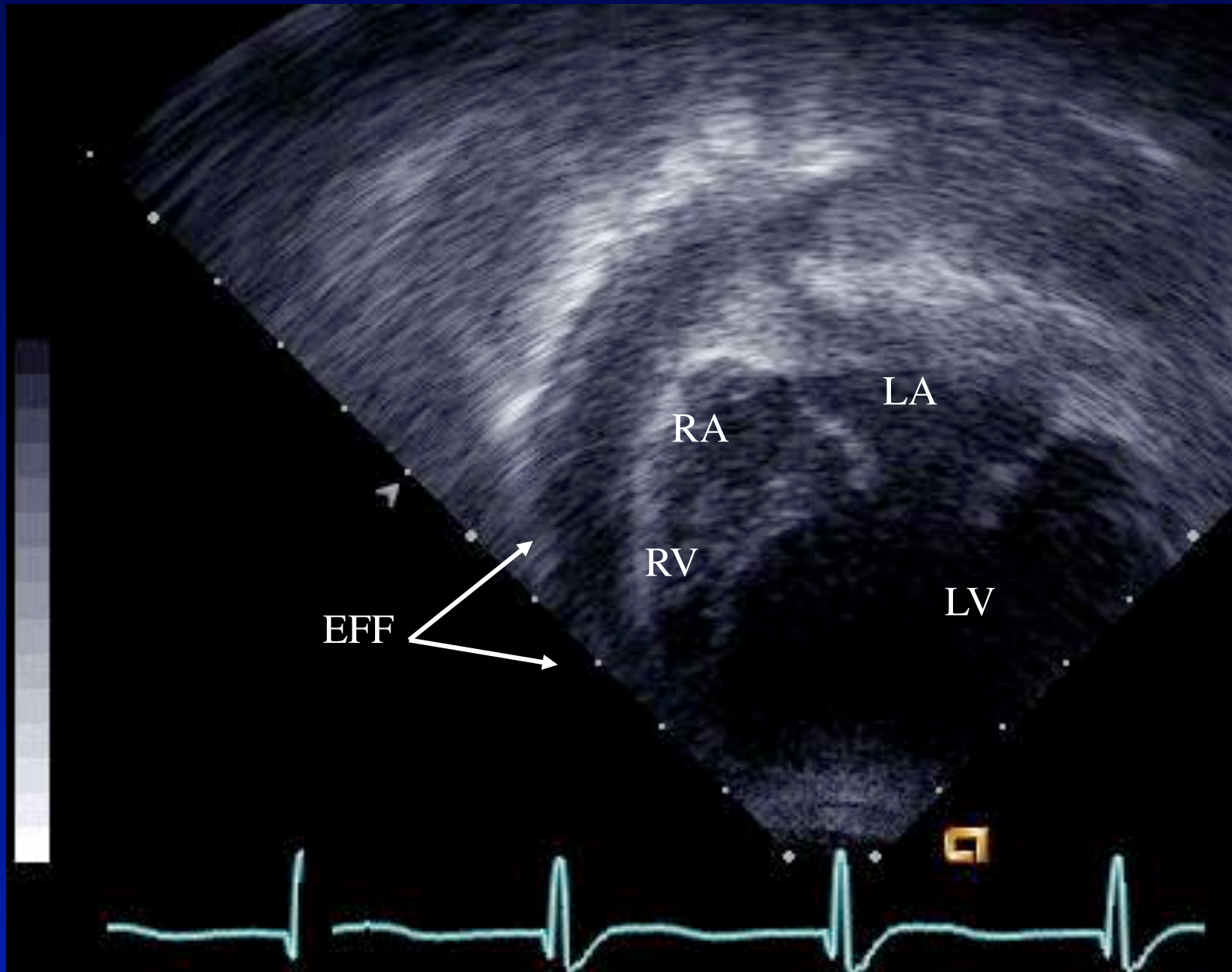


2009/09/21 03:43:57
Hope Childrens Hospital



0 bpm

L Dominant AVSD



Unbalanced Atrioventricular Canal Defects

- Repair related to:-
 - Size of the ventricle
 - Volume
 - Length
 - Size of the amount of tissue over the valve
 - Area
 - Quality of the valvar tissue
 - The presence of associated defects
 - Outflow tract
 - Vascular abnormalities

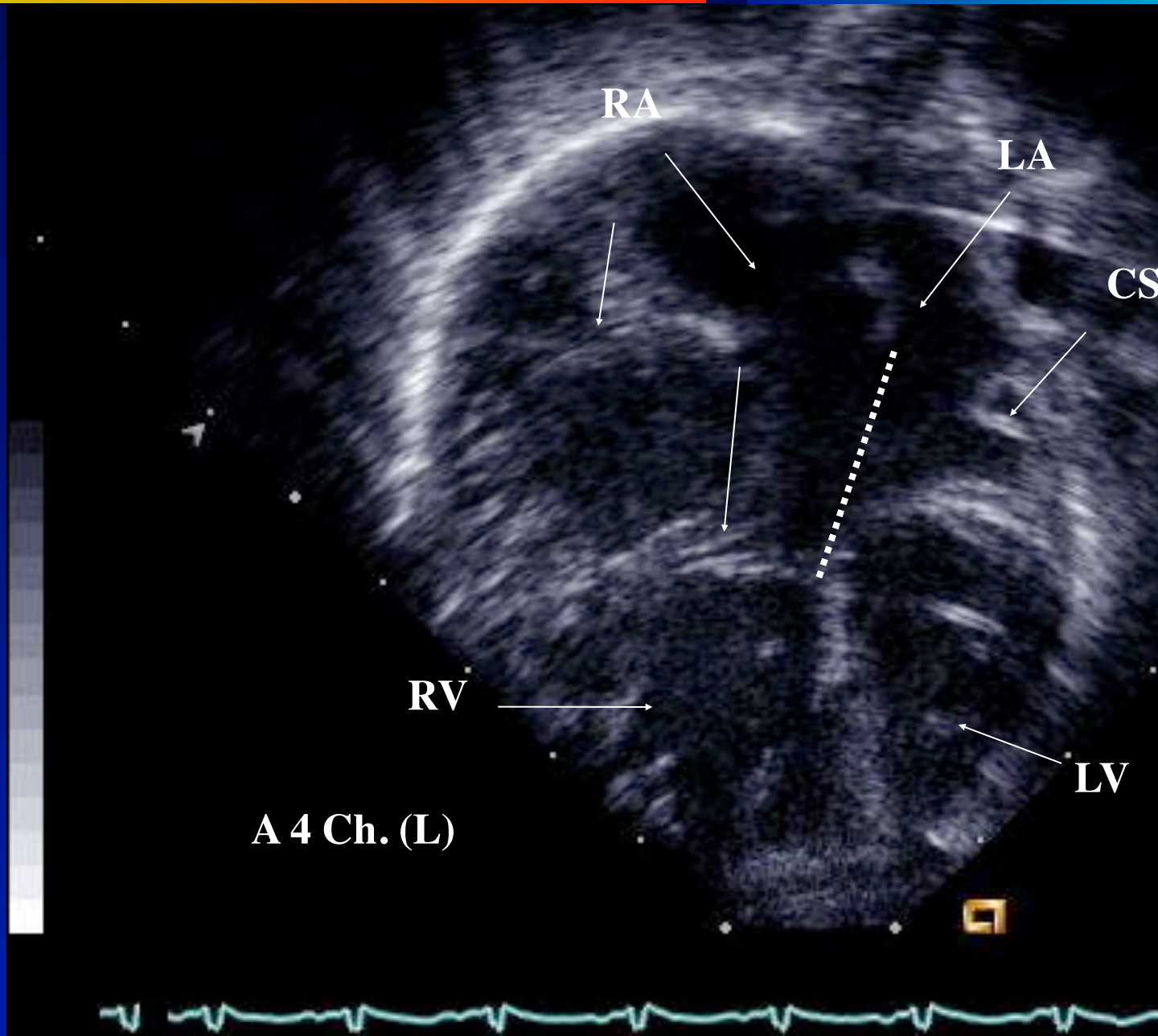
Philosophy for Repair of Unbalanced AVSD's

- Relative advantages of a one vs. a two ventricle repair.
- Is a prosthetic valve worse or better than a one ventricle repair.
- Are there extraneous factors which would prevent a two ventricle repair.

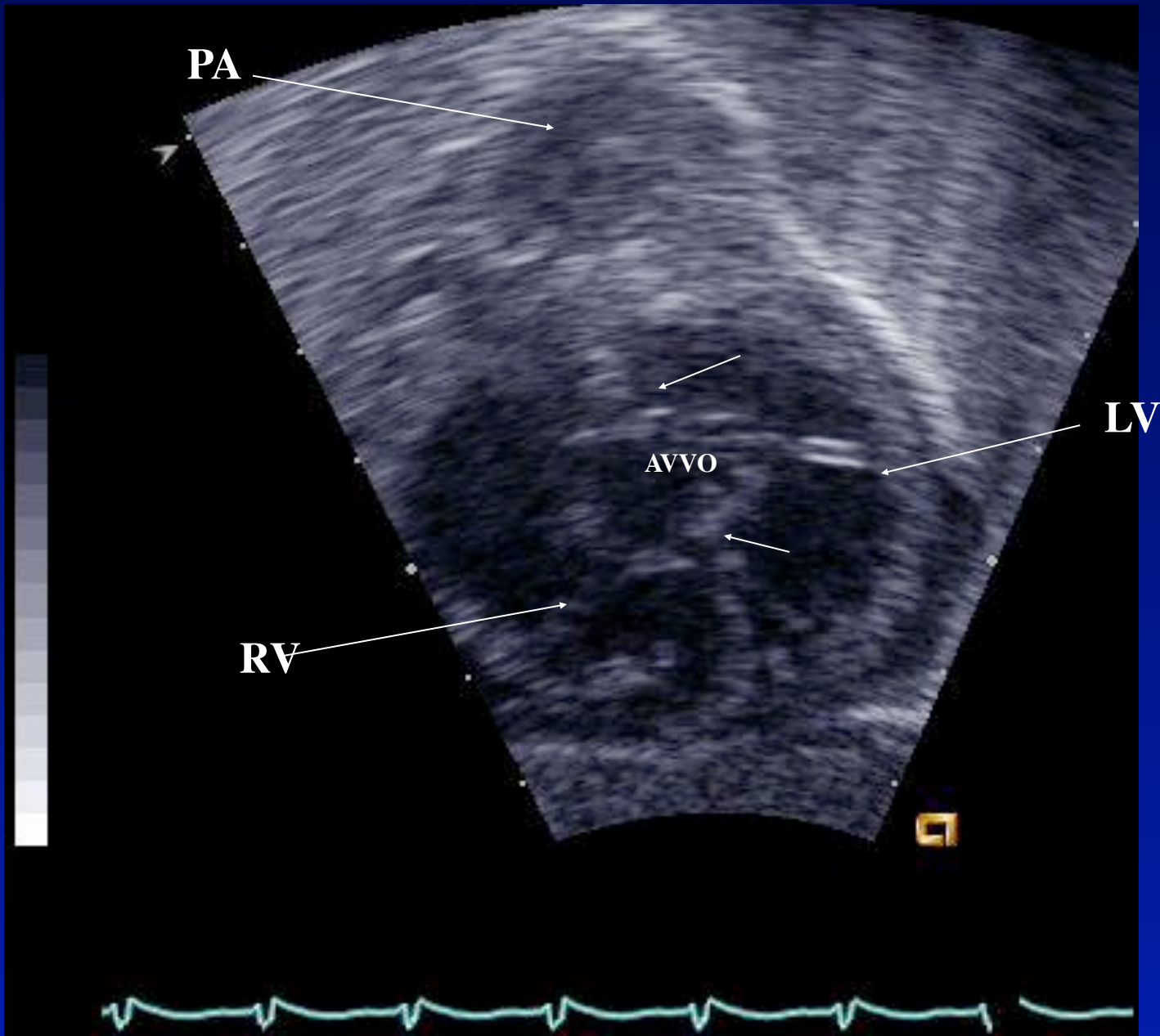
Left Dominant AVSD

- When is the right ventricle too small?
 - This is less clear than for right ventricular dominance.
- Options include:
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 - a one and a half ventricle repair
 - single ventricle repair

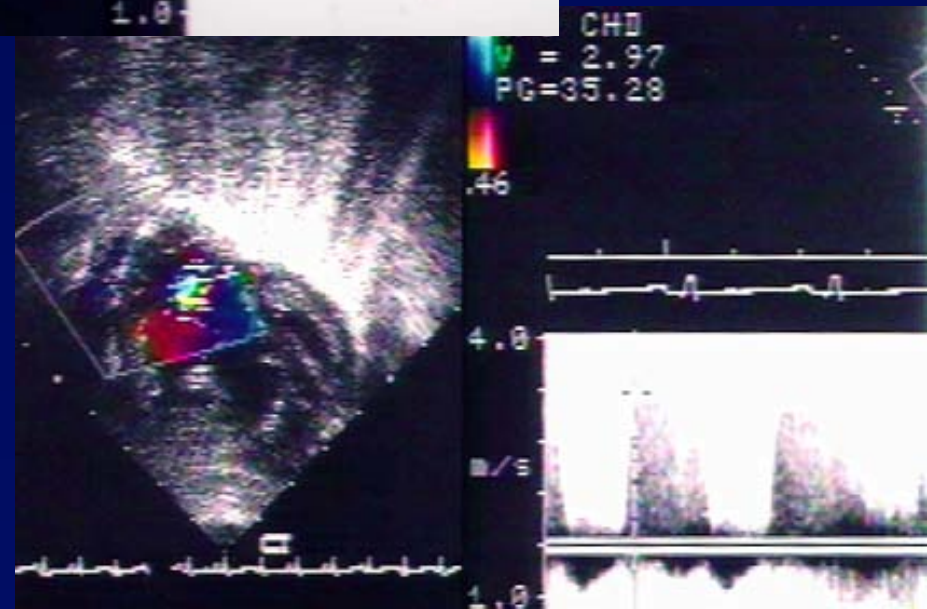
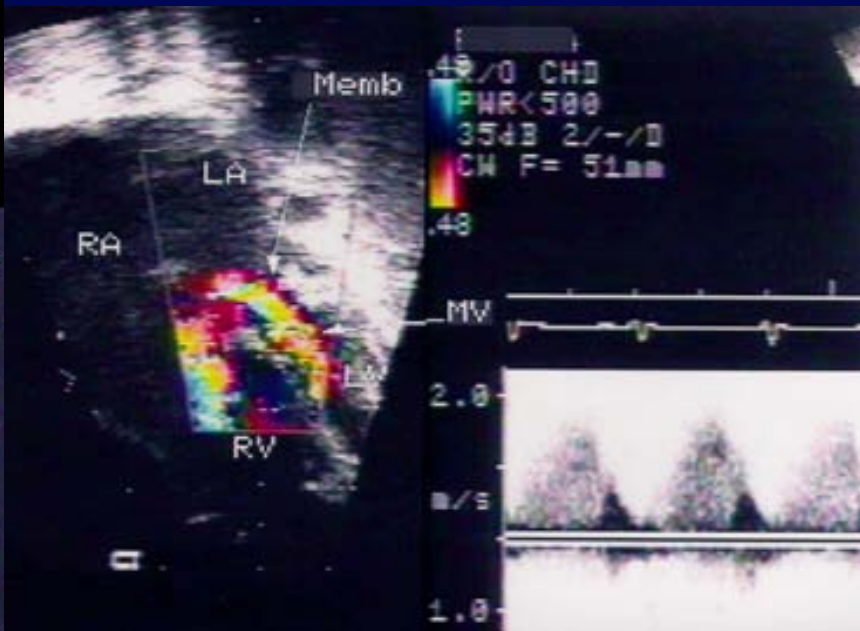
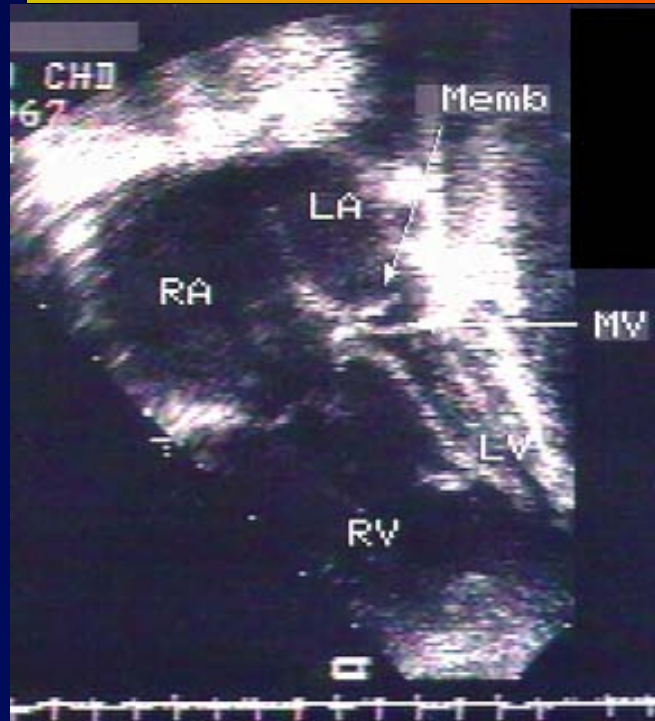
R. DOM. AVSD (L. ISOMERISM)



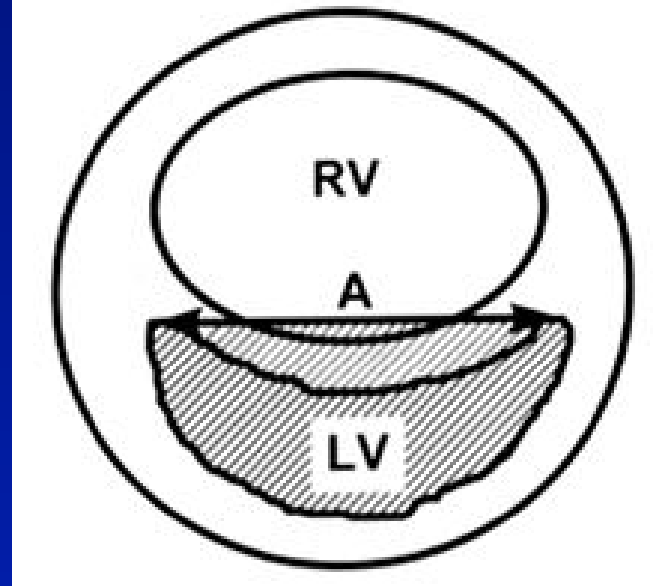
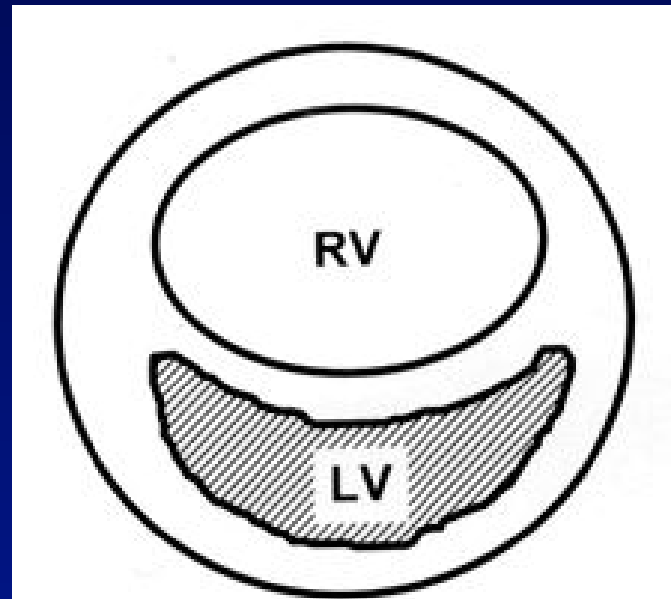
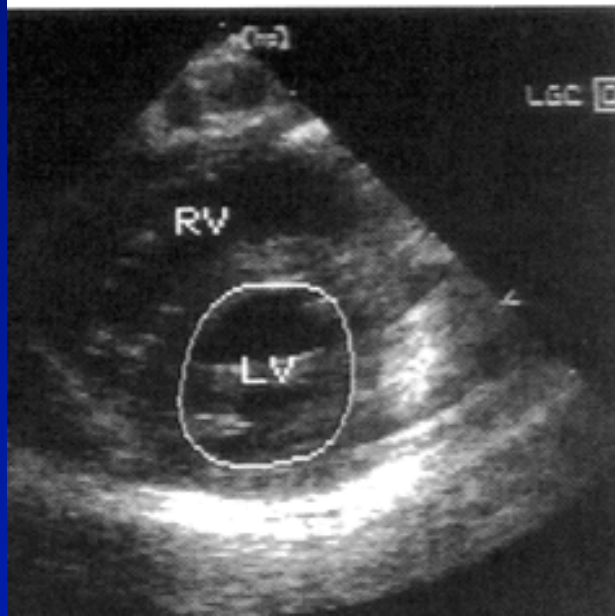
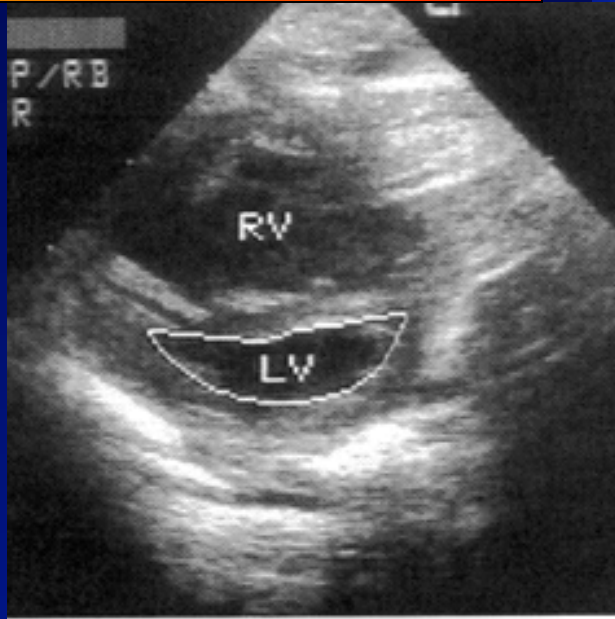
Left Isomerism, AVSD , (Rt. Dom.)



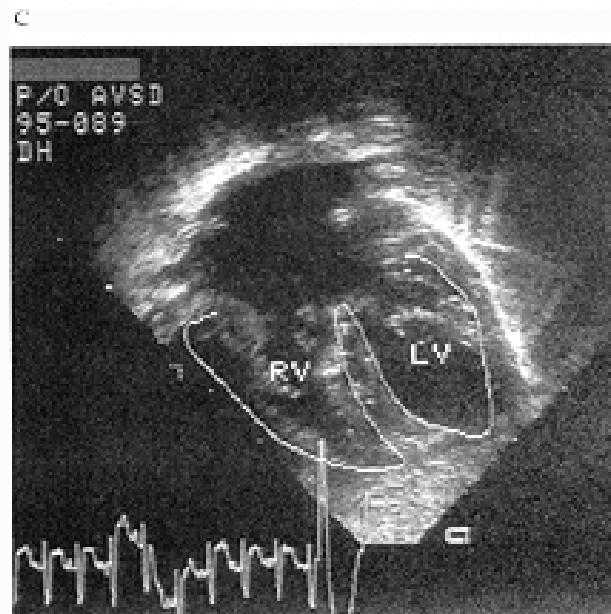
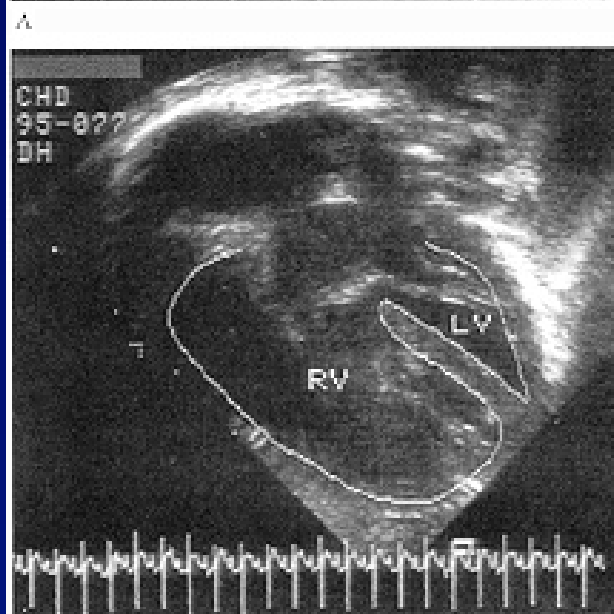
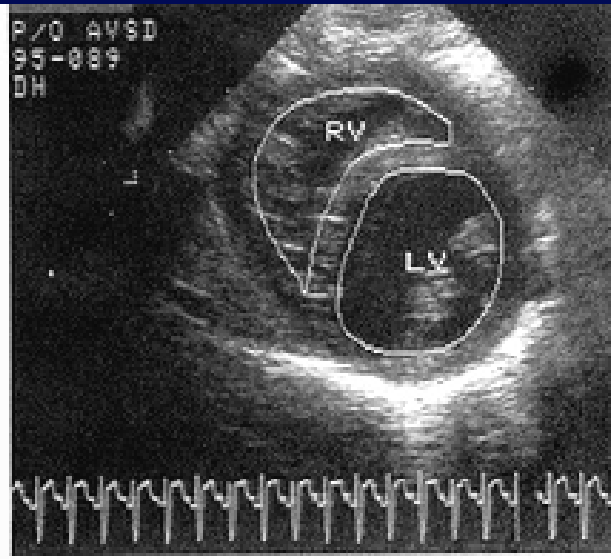
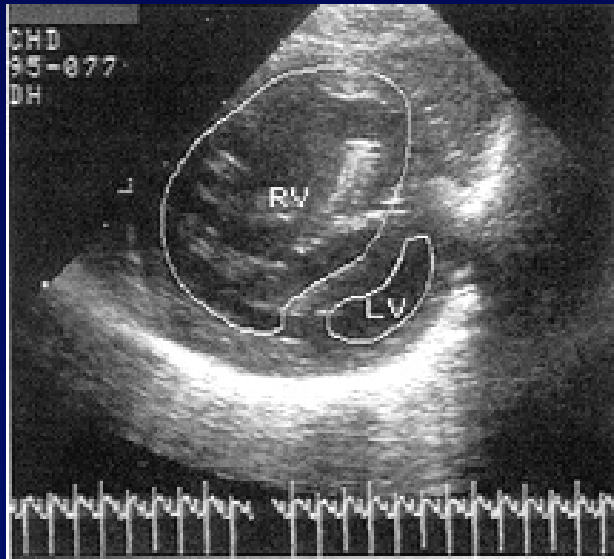
Questionable LV Size? Cor Triatriatum



Short axis change pre- and postop. TAPVR

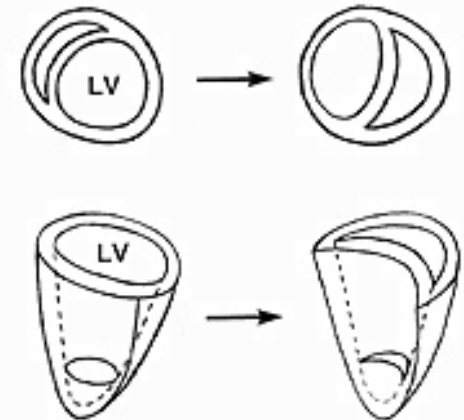


Preoperative/postoperative echo in unbalanced



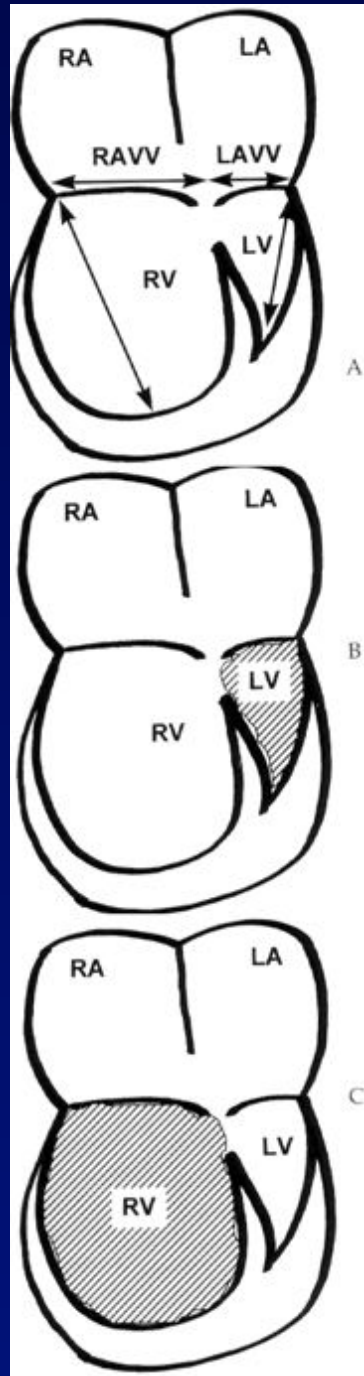
Van Son &
Phoon

JACC Vol. 30, No. 6
November 15, 1997:1547-53



Dimension Measurements

Van Son & Phoon



Indexed LVEDV= 14.8 ± 9.1 ml /m²

Potential Indexed LV EDV= 32.2 ± 18.8

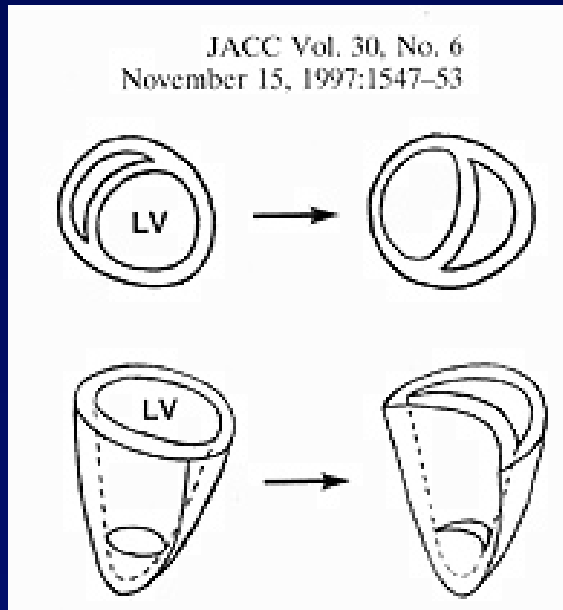
Indexed LV long axis dimension
= 8.9 ± 1.4 cm/m²

RV/LV Long axis ratio= 0.65 ± 0.1

L AV Valve/Total Valve Ratio = 0.30 ± 0.06

LV/RV Area Ratio= 0.27 ± 0.01

Postoperative echocardiographic dimensions



Postoperative dimensions

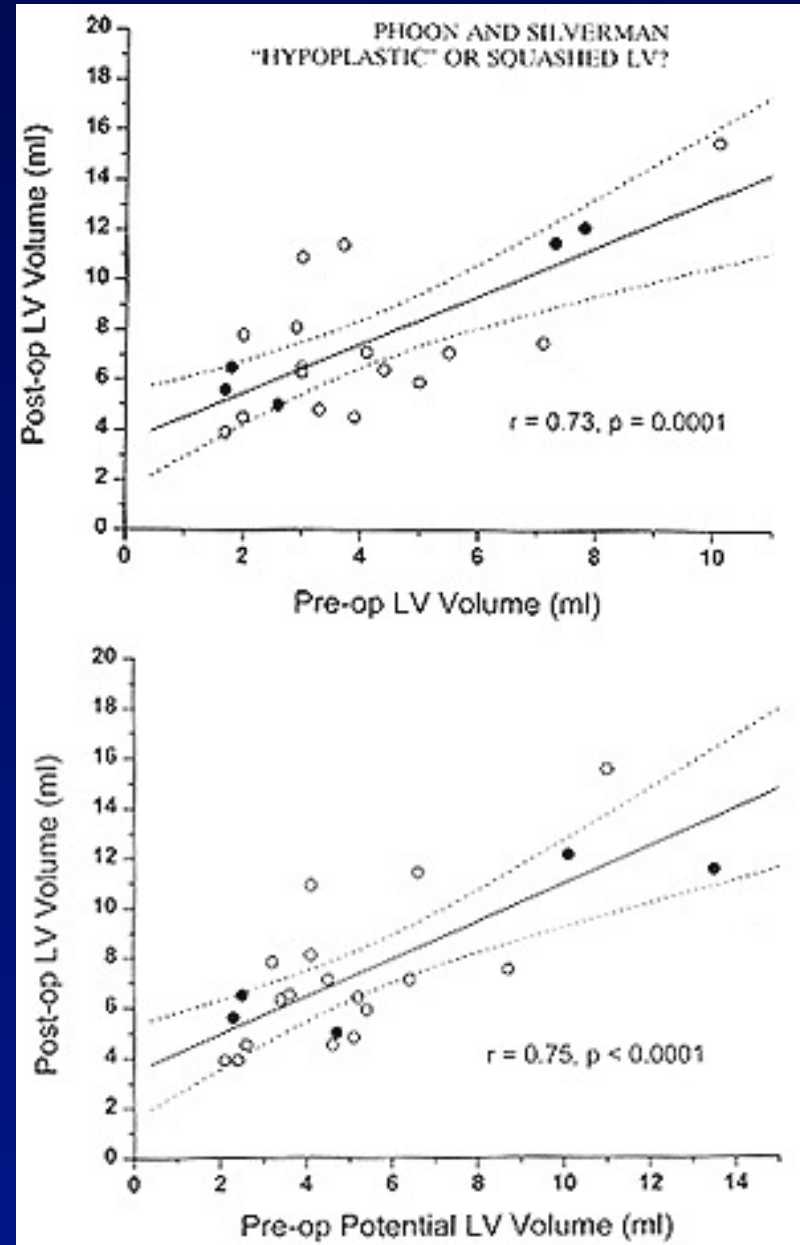
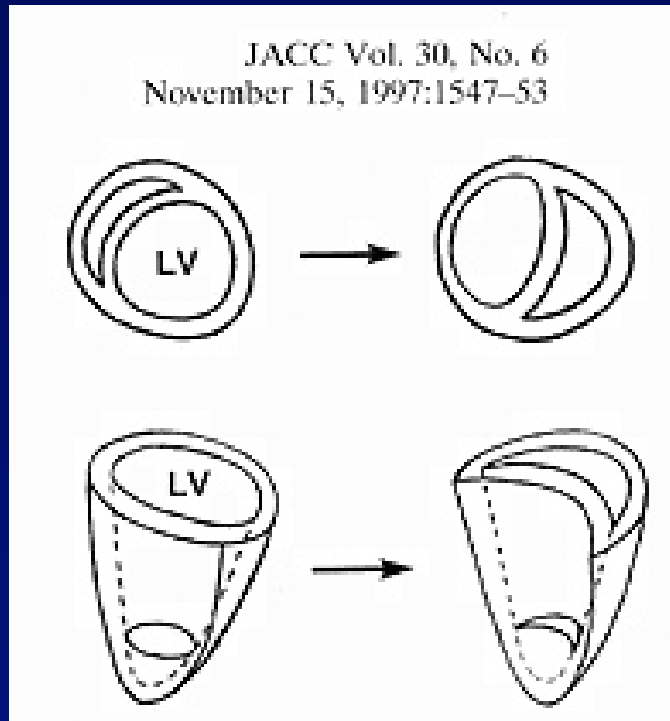
LV EDV Index 35.6 ± 3.9 ml./m²

LV/RV long ratio 0.88 ± 0.11

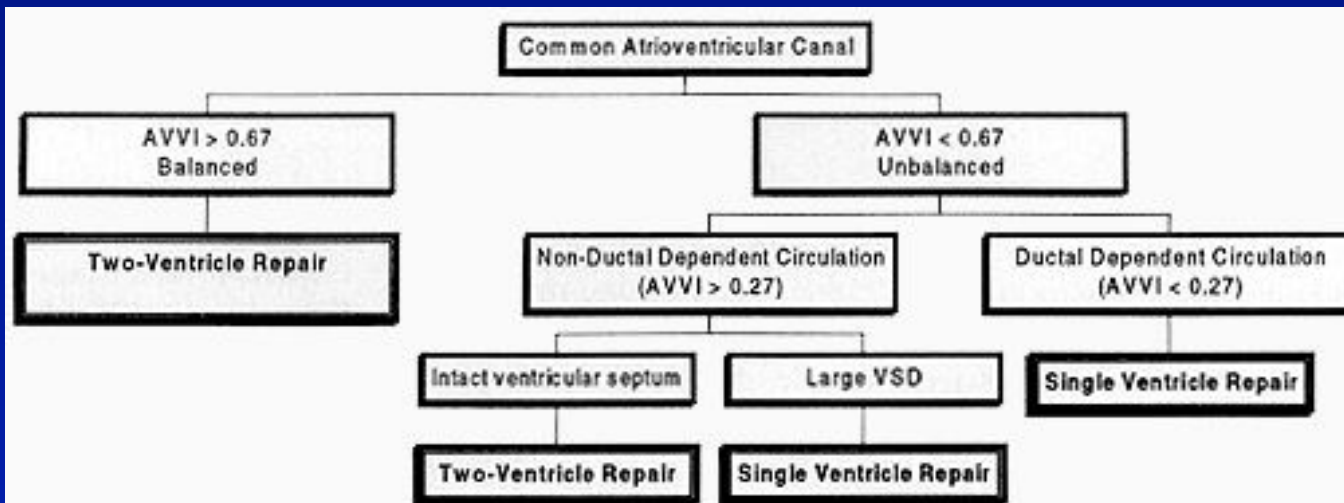
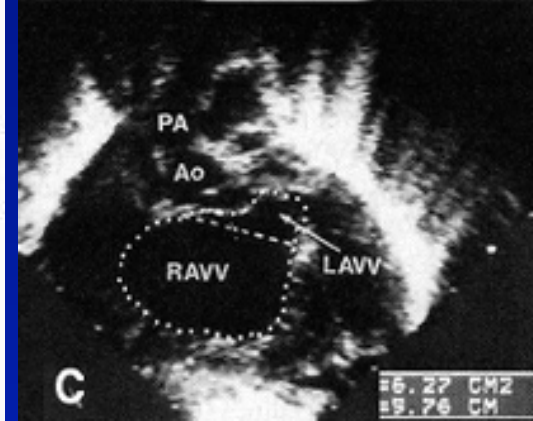
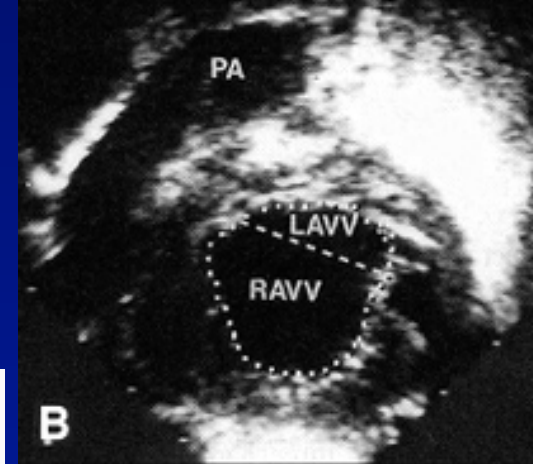
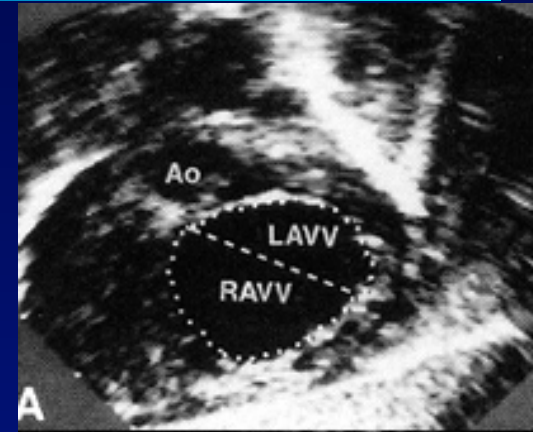
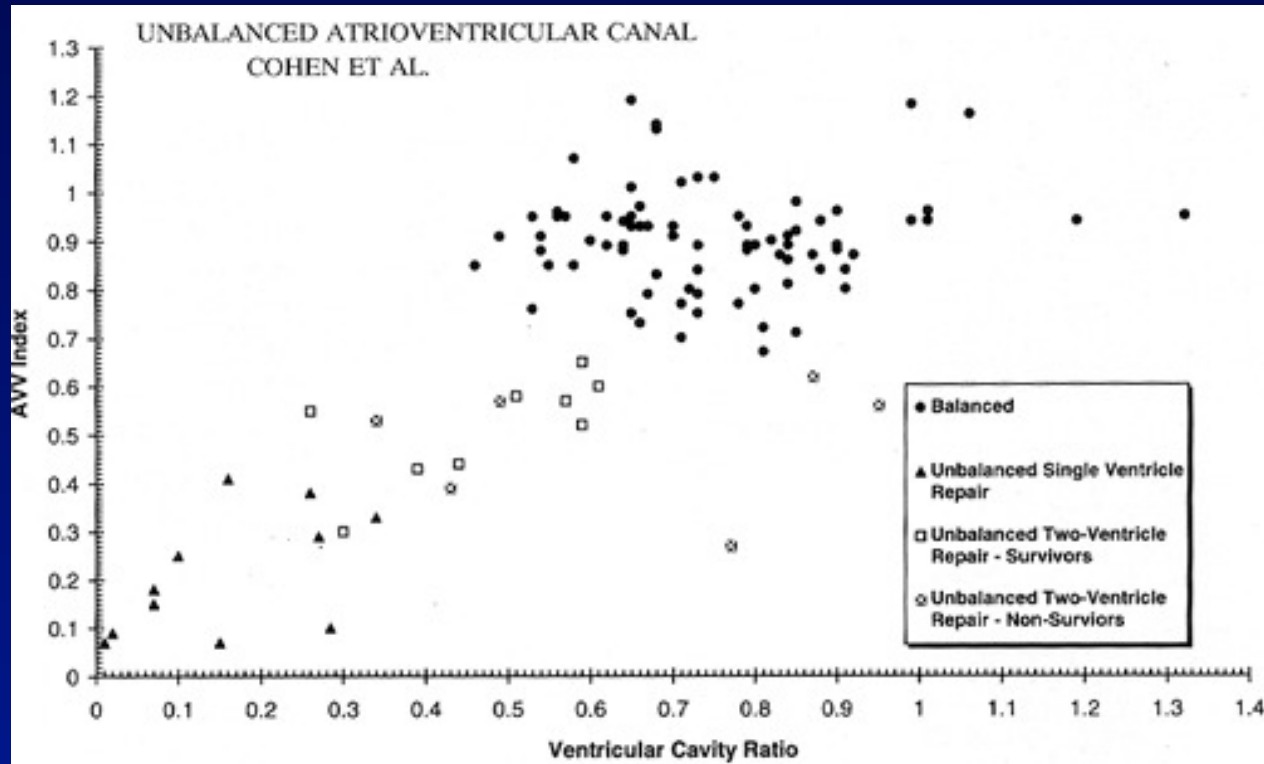
L AV Valve / total Valve ratio = 0.42 ± 0.03

LV/RV area ratio = 0.88 ± 0.18 /m²

LV Volume change real and calculated



Unbalanced AVSD. Cohen et al.



Balance :Summary

- Balance is a complex issue
- Treatment is based on several factors:
 - morphological factors
 - direct vs. indirect
 - surgical preference
 - philosophical factors
- Echocardiography provides one of many determinants
- Inspection of the morphology at surgery is the final point of arbitration.

Conclusion

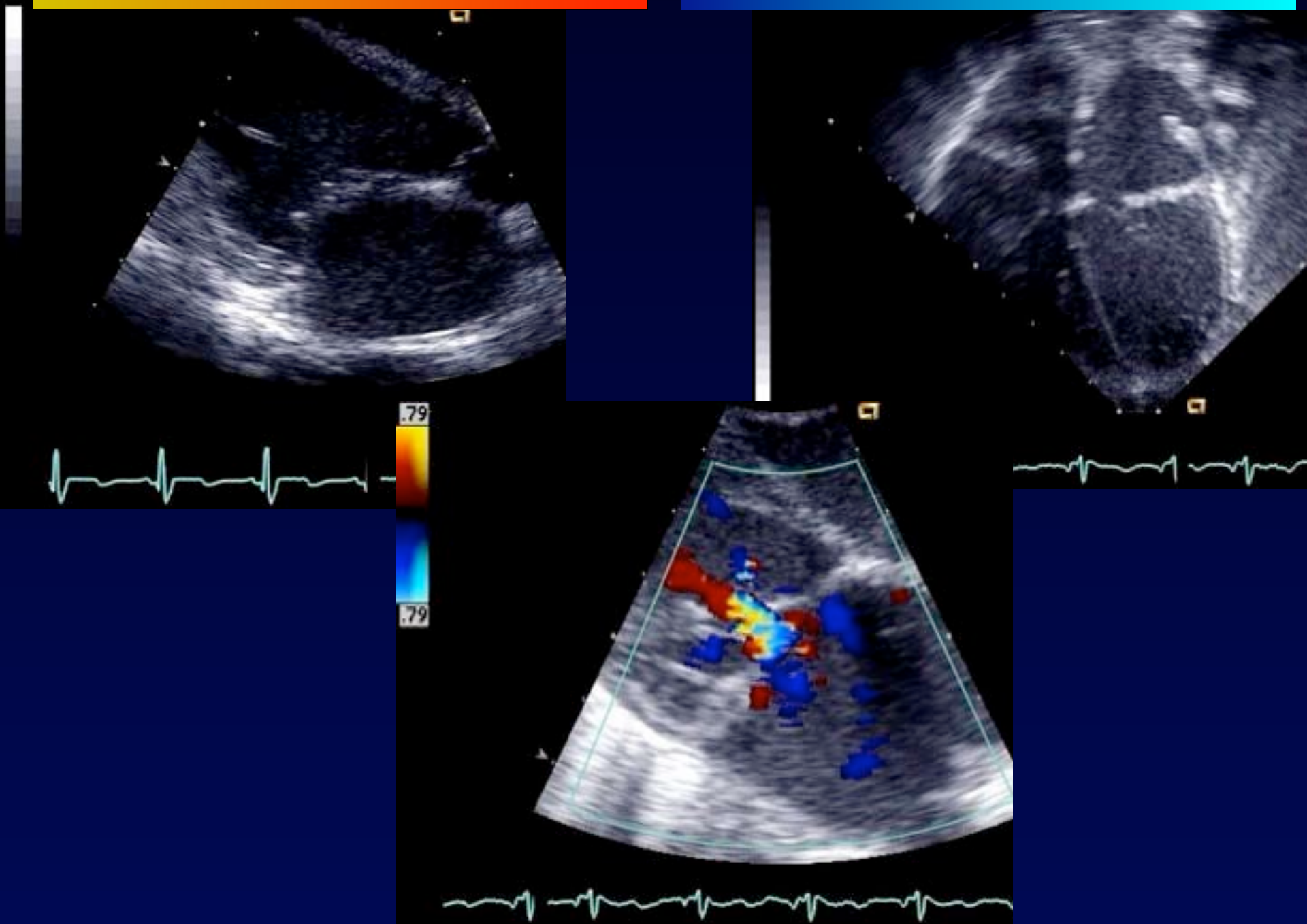
- Balance is a complex issue
- Treatment is based on several factors:
 - morphological factors
 - direct vs. indirect
 - surgical preference
 - philosophical factors
- Echocardiography provides one of many determinants
- Inspection of the morphology at surgery is the final point of arbitration.



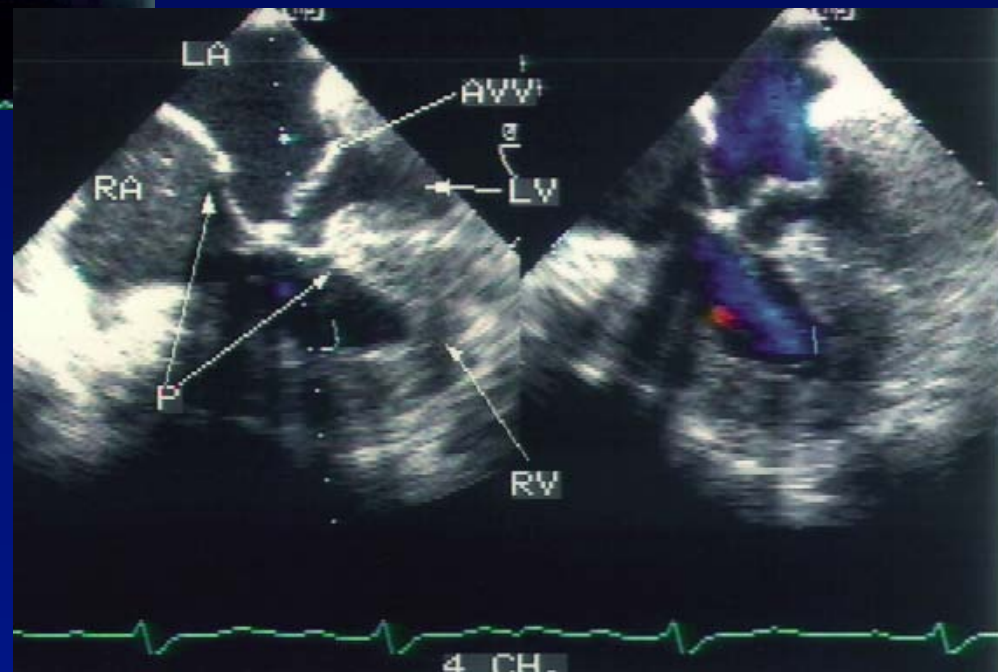
Postoperative Findings



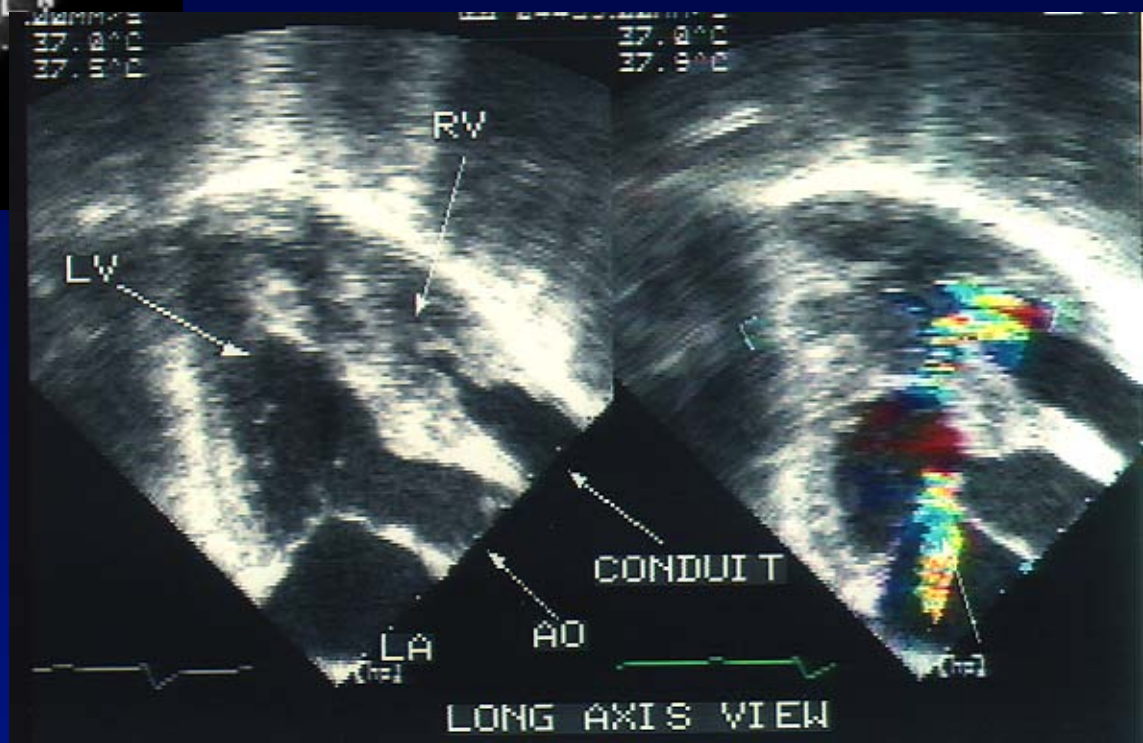
Atrioventricular Septal Defects: Postop. L AV Valve



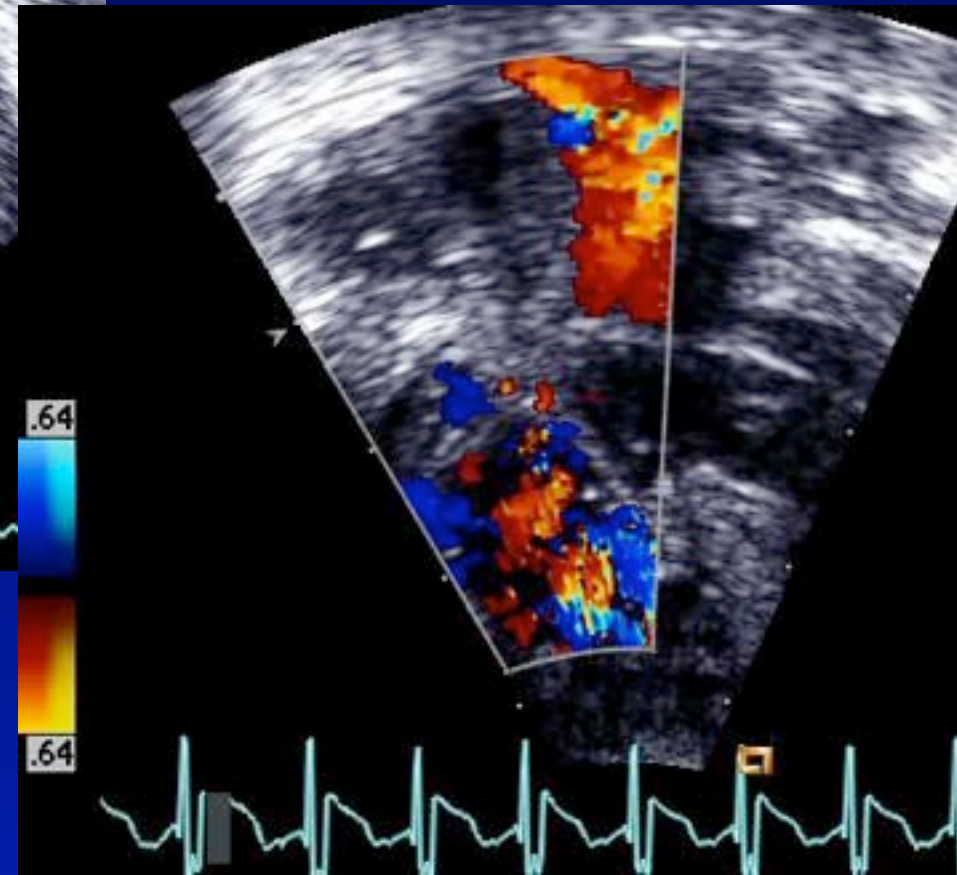
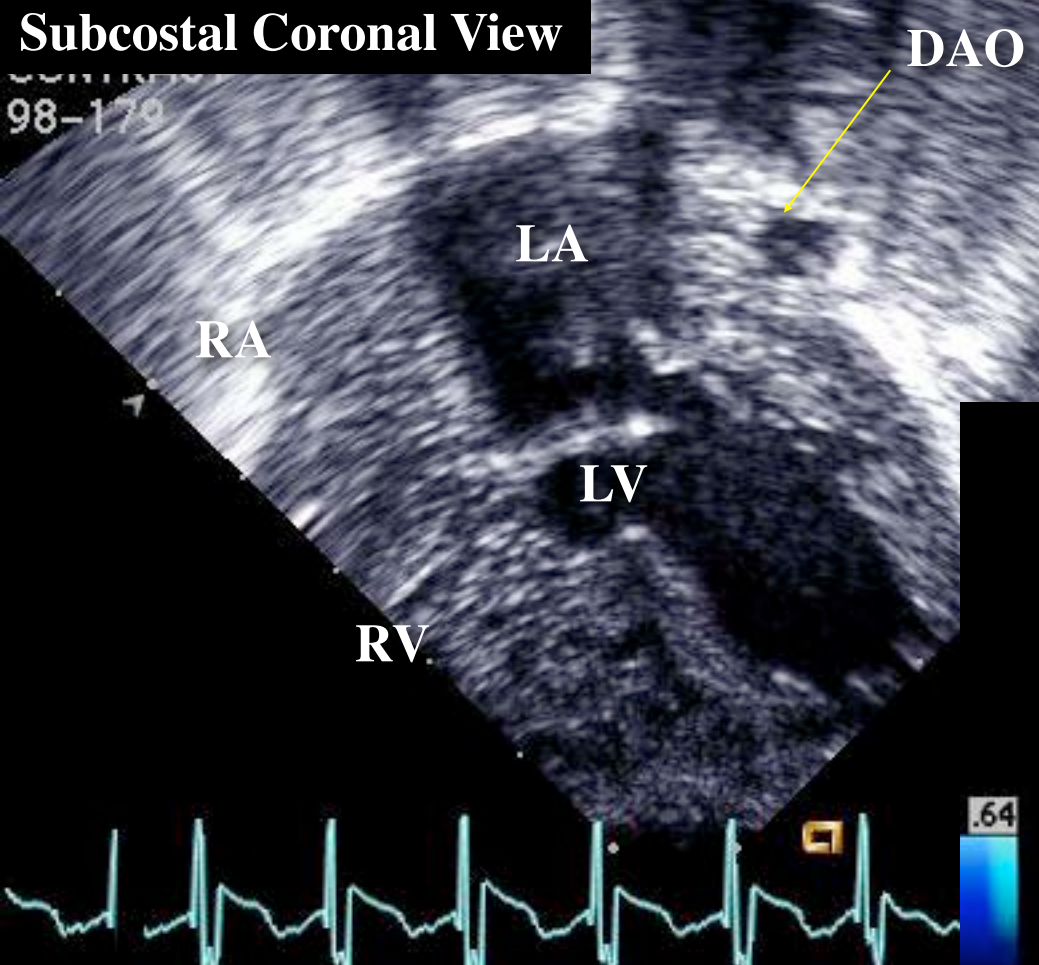
AV Valve Regurgitation- Pre- and Post Op



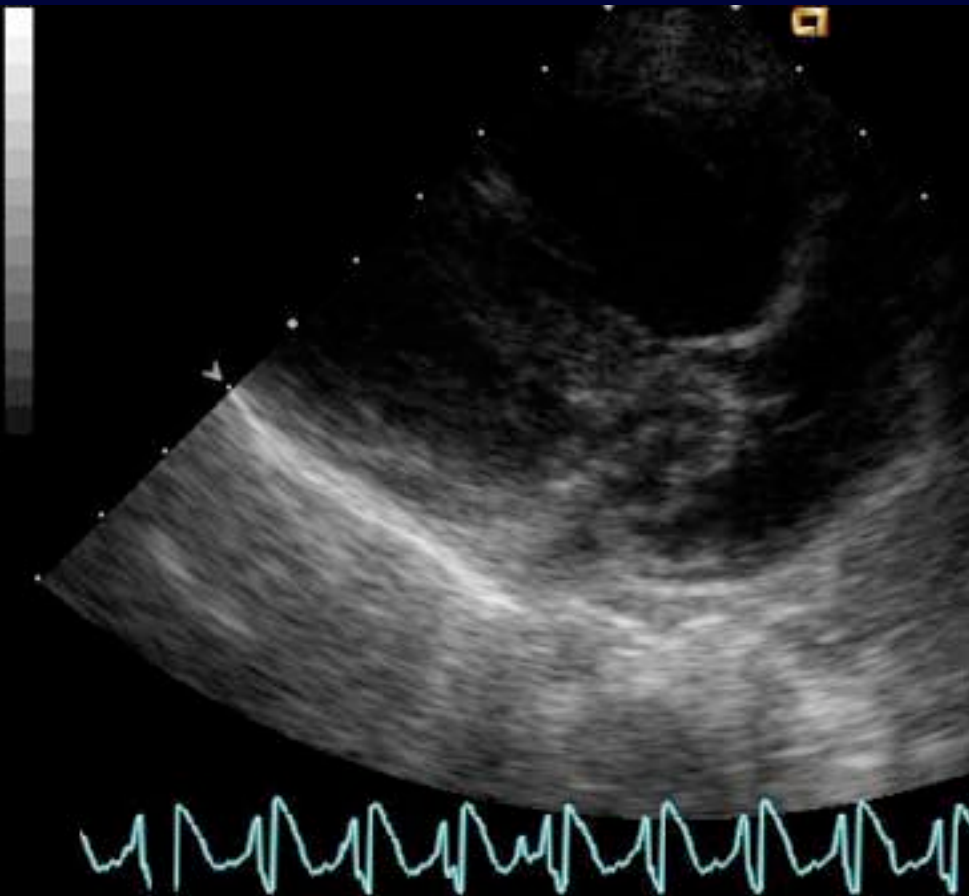
Tetralogy and AVSD (Type C): Pre & Post Repair



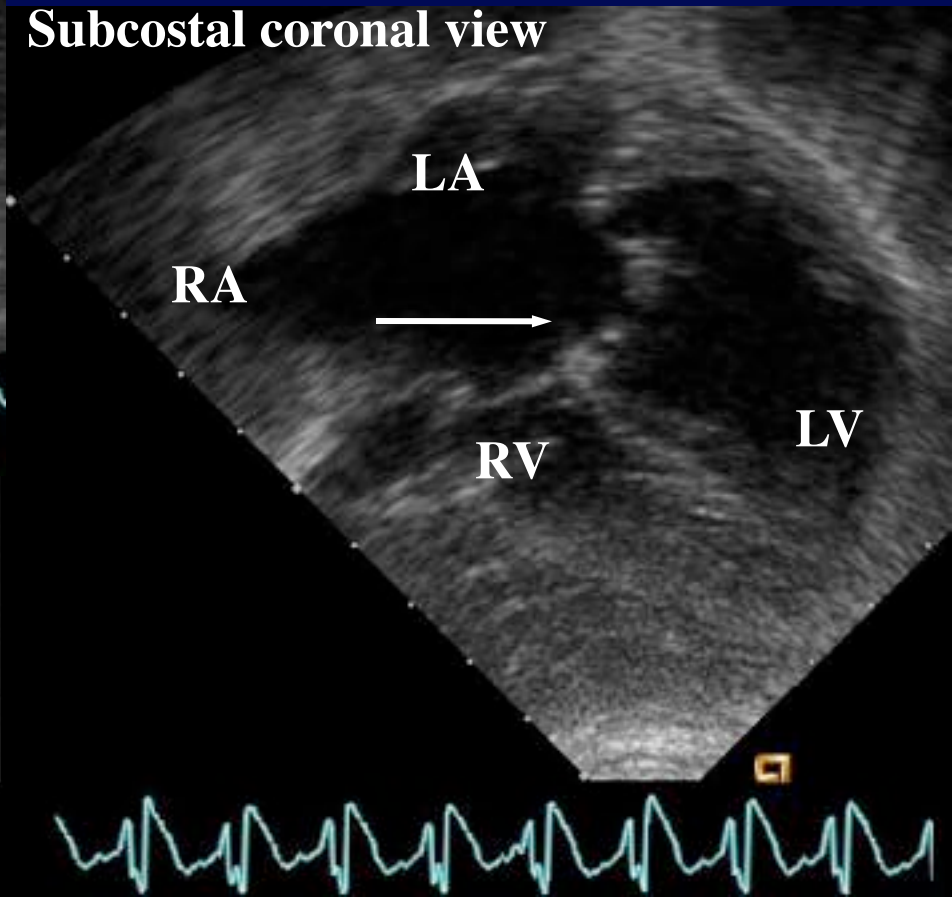
AVSD Postop. Contrast & Color Doppler Studies



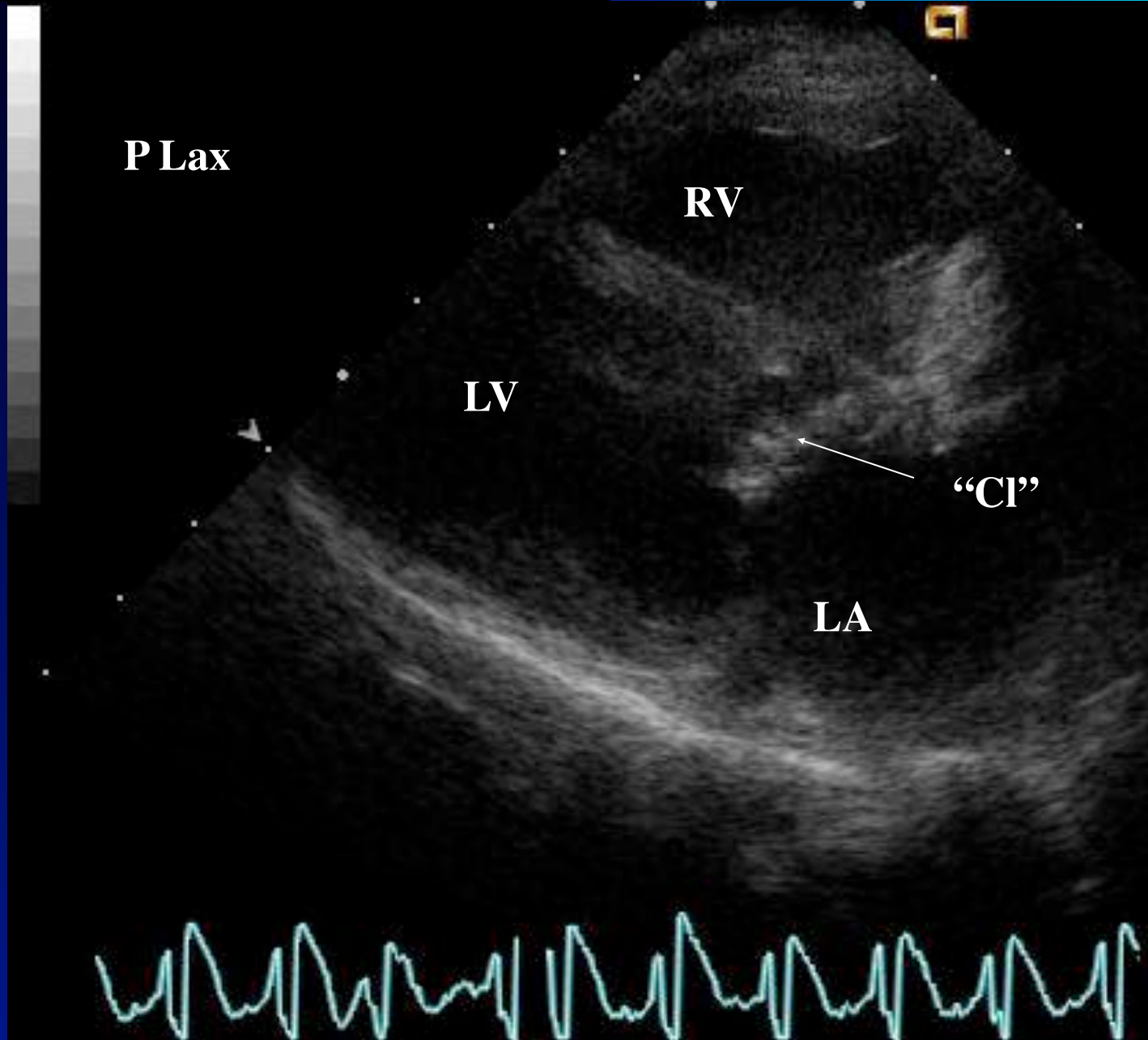
Postoperative breakdown of left AV valve repair



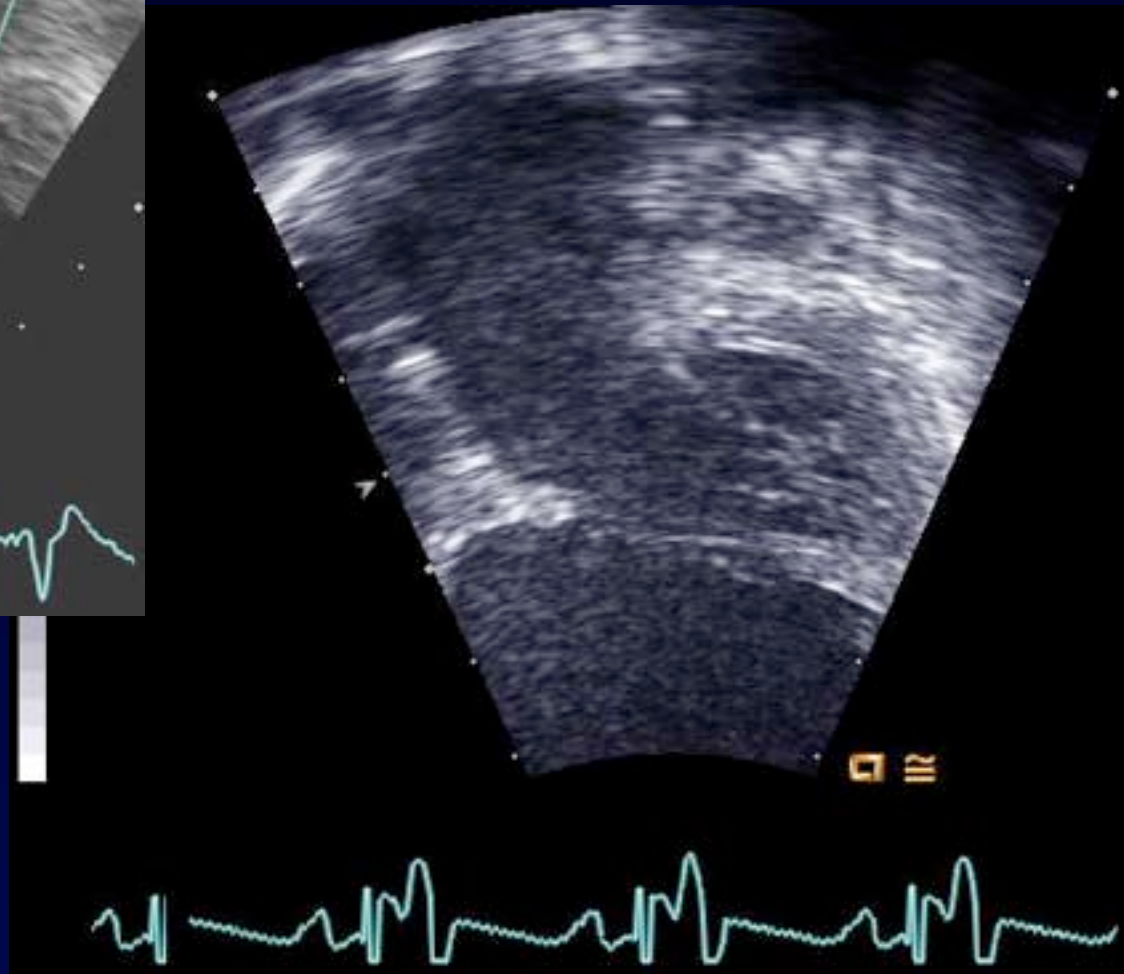
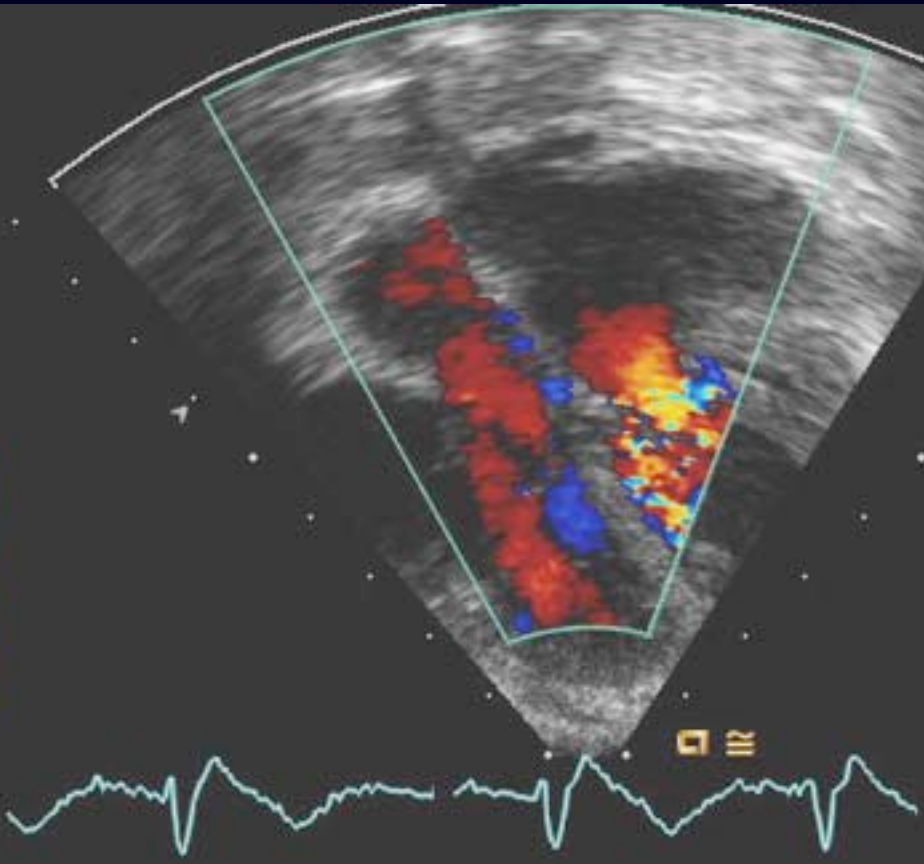
Subcostal coronal view



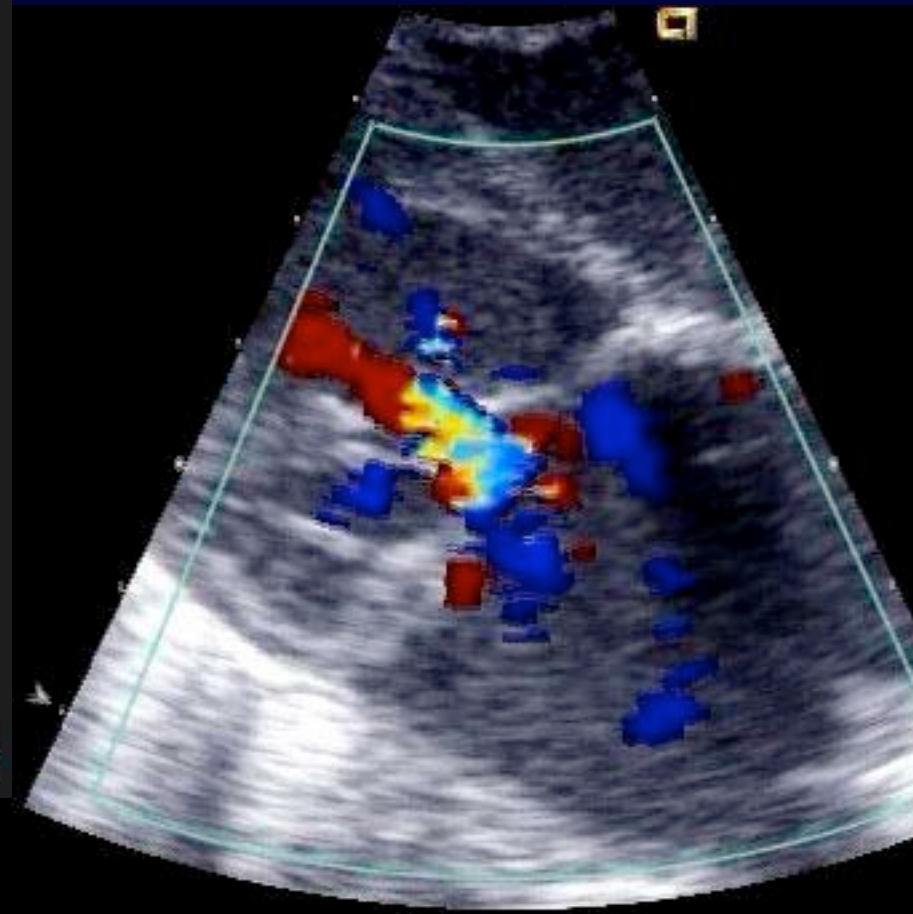
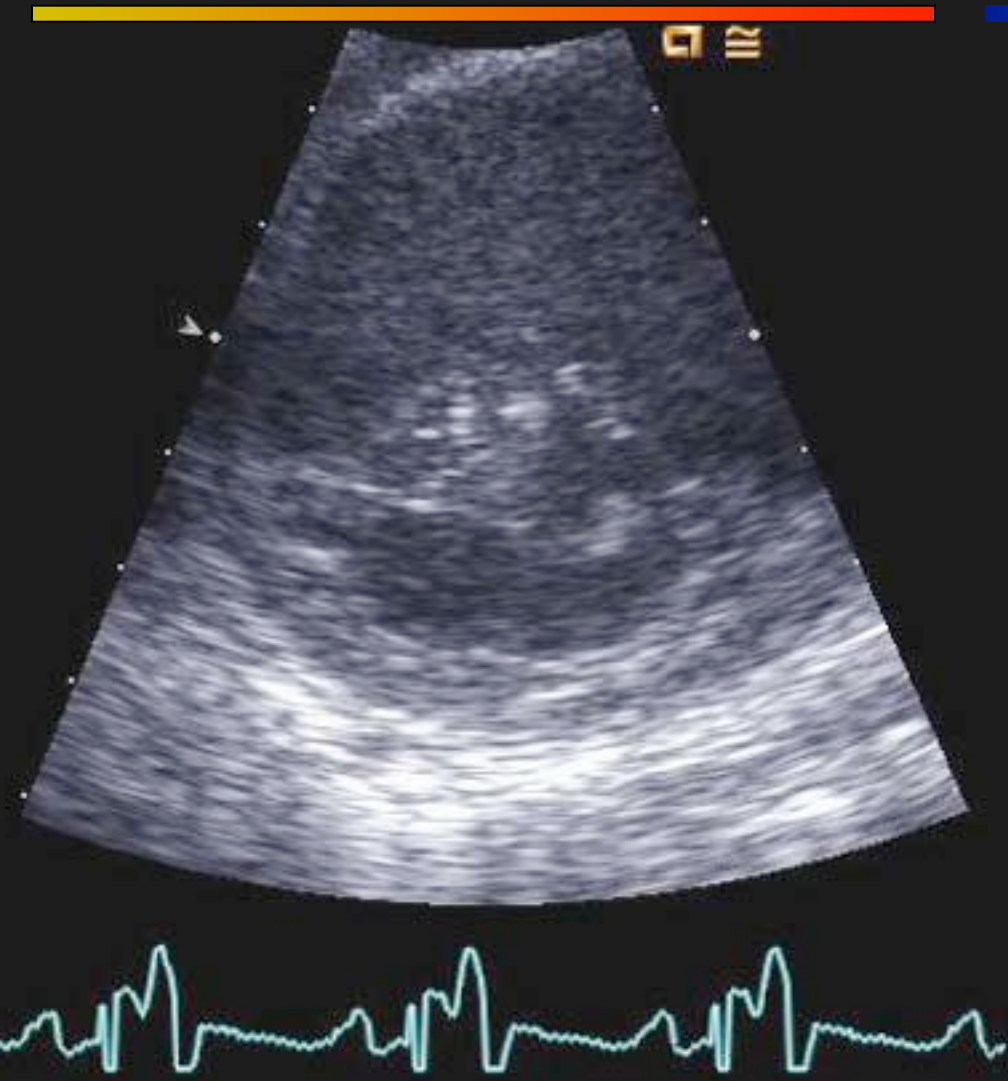
Dehisced Sutured Commissure (“Cleft”)



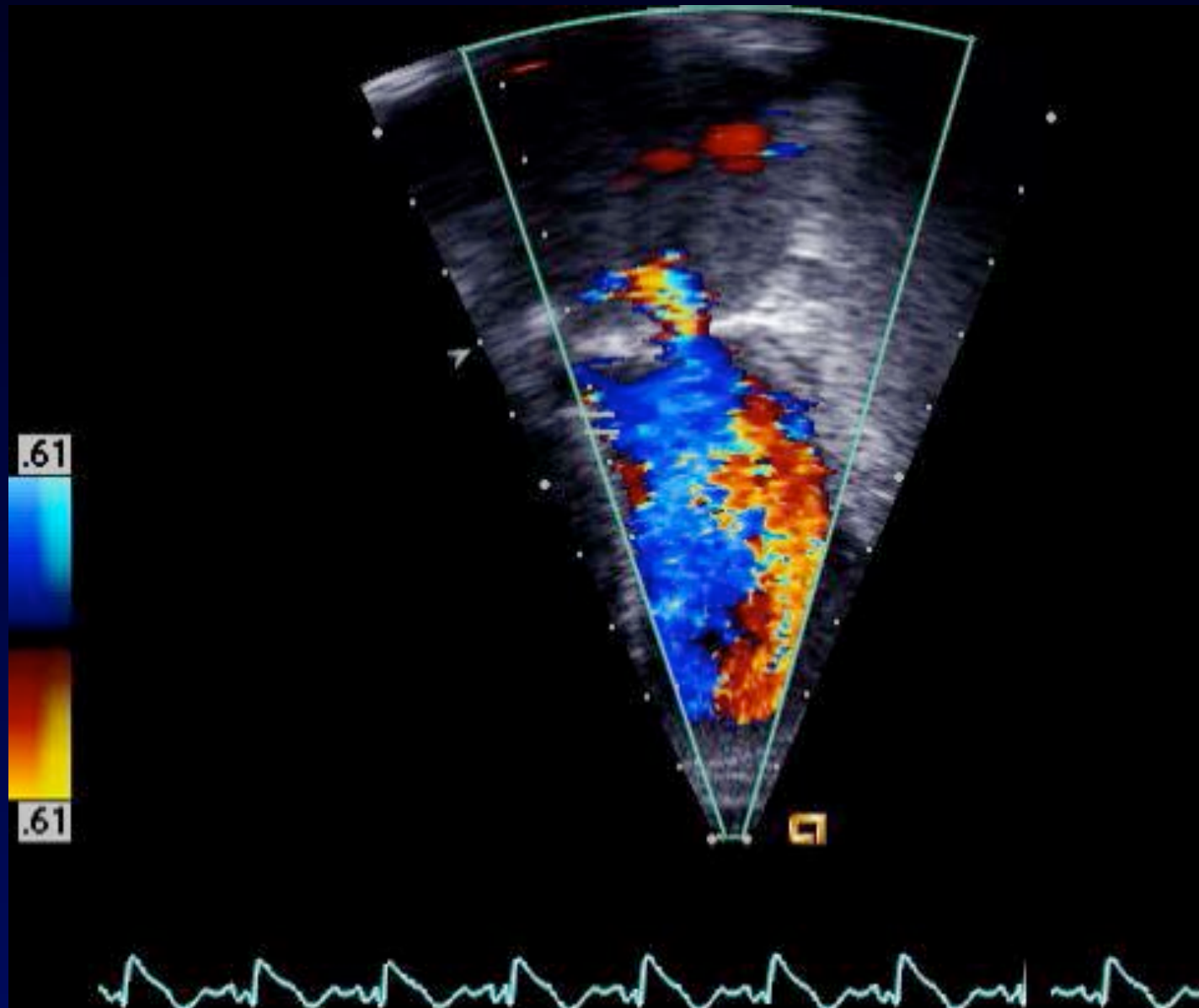
Postop AVVR



Postop AVVR



AV Regurgitation & Stenosis



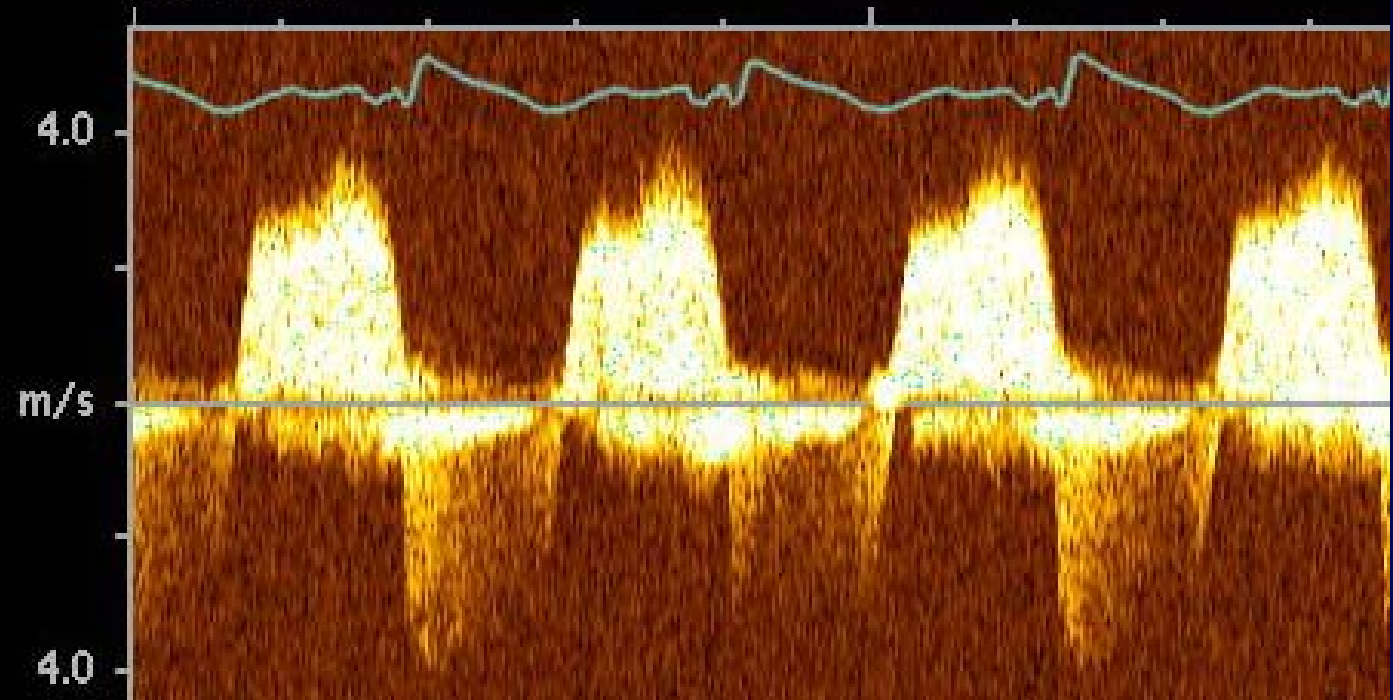
Postoperative Pearls- The AV Septal Defect

.61 55dB 3 +/-1/0/2
CW Focus= 65mm
CW Gain= 17dB

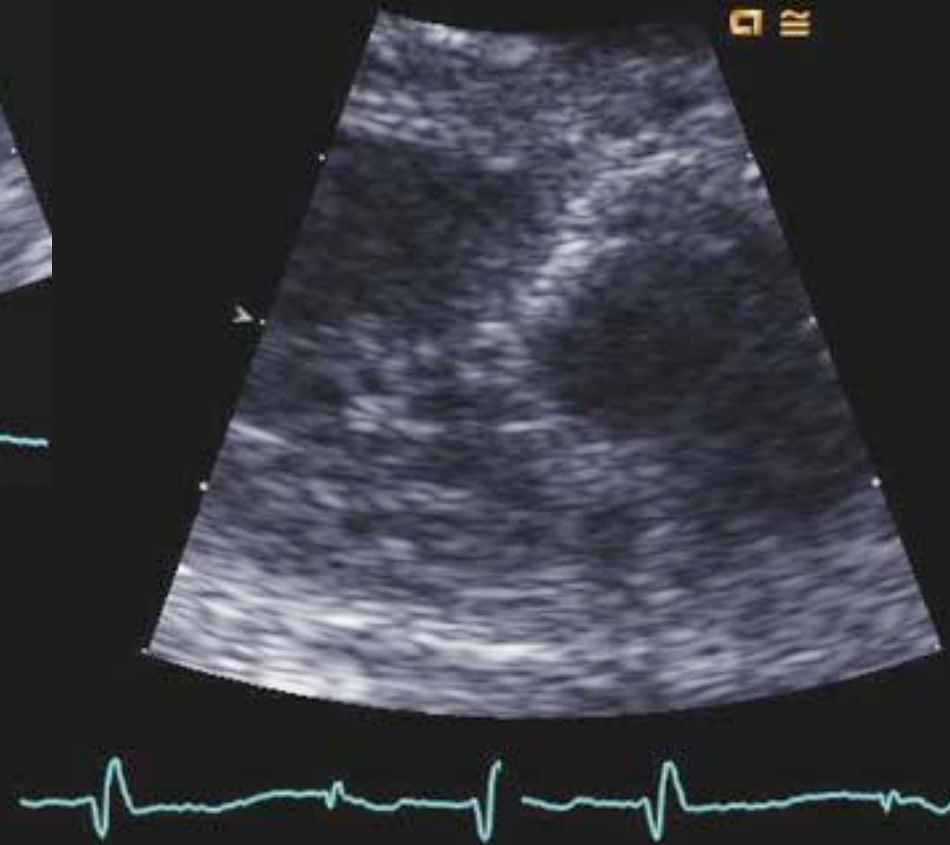
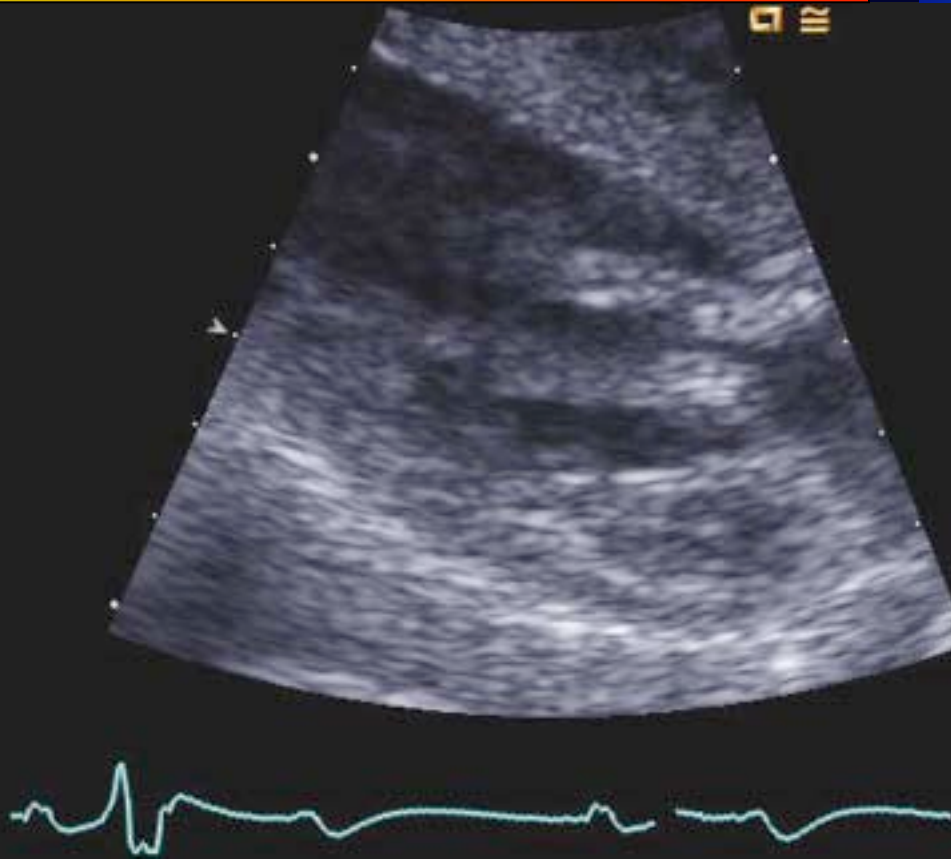


.61

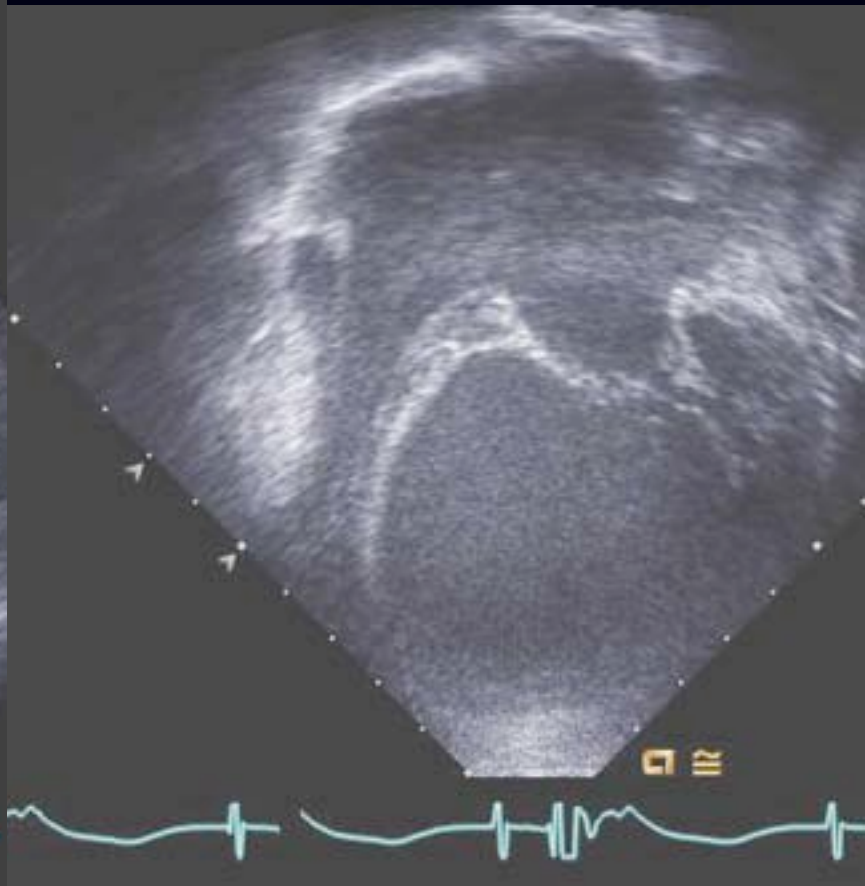
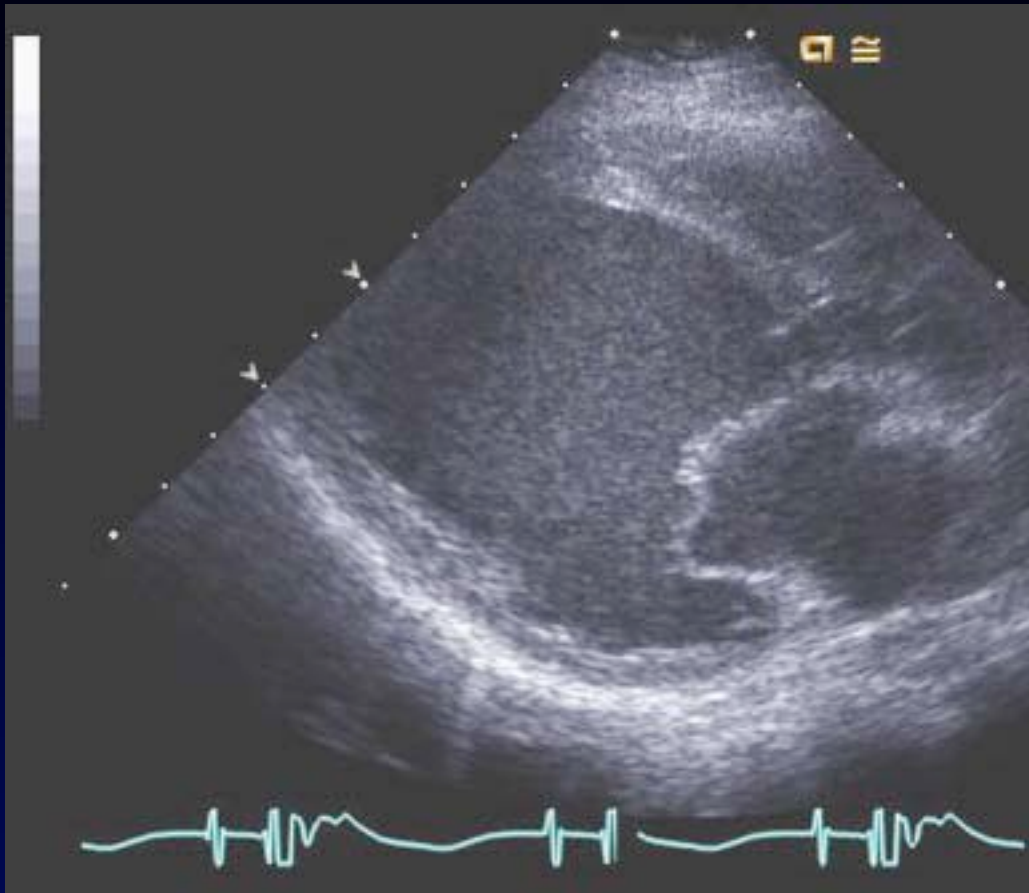
CW:3.5MHz



Annuloplasty

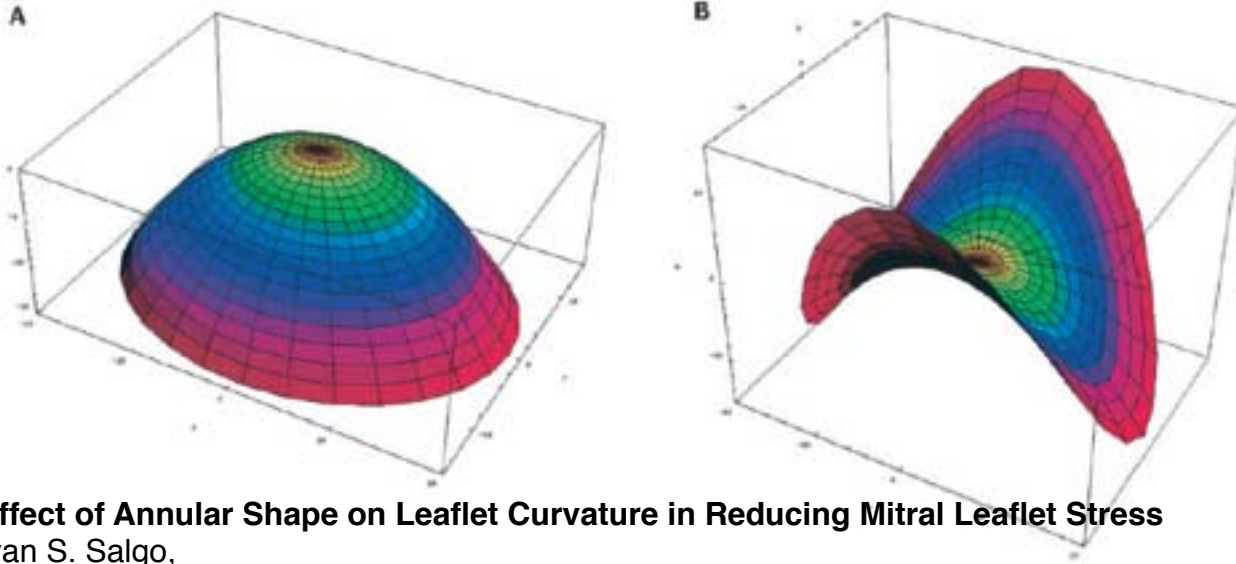


Postop AVVR



The Normal and Abnormal (Mitral) Annulus

712 *Circulation* August 6, 2002



Effect of Annular Shape on Leaflet Curvature in Reducing Mitral Leaflet Stress

Ivan S. Salgo,

Changes in Areal Strain in 3 Shape Variations.

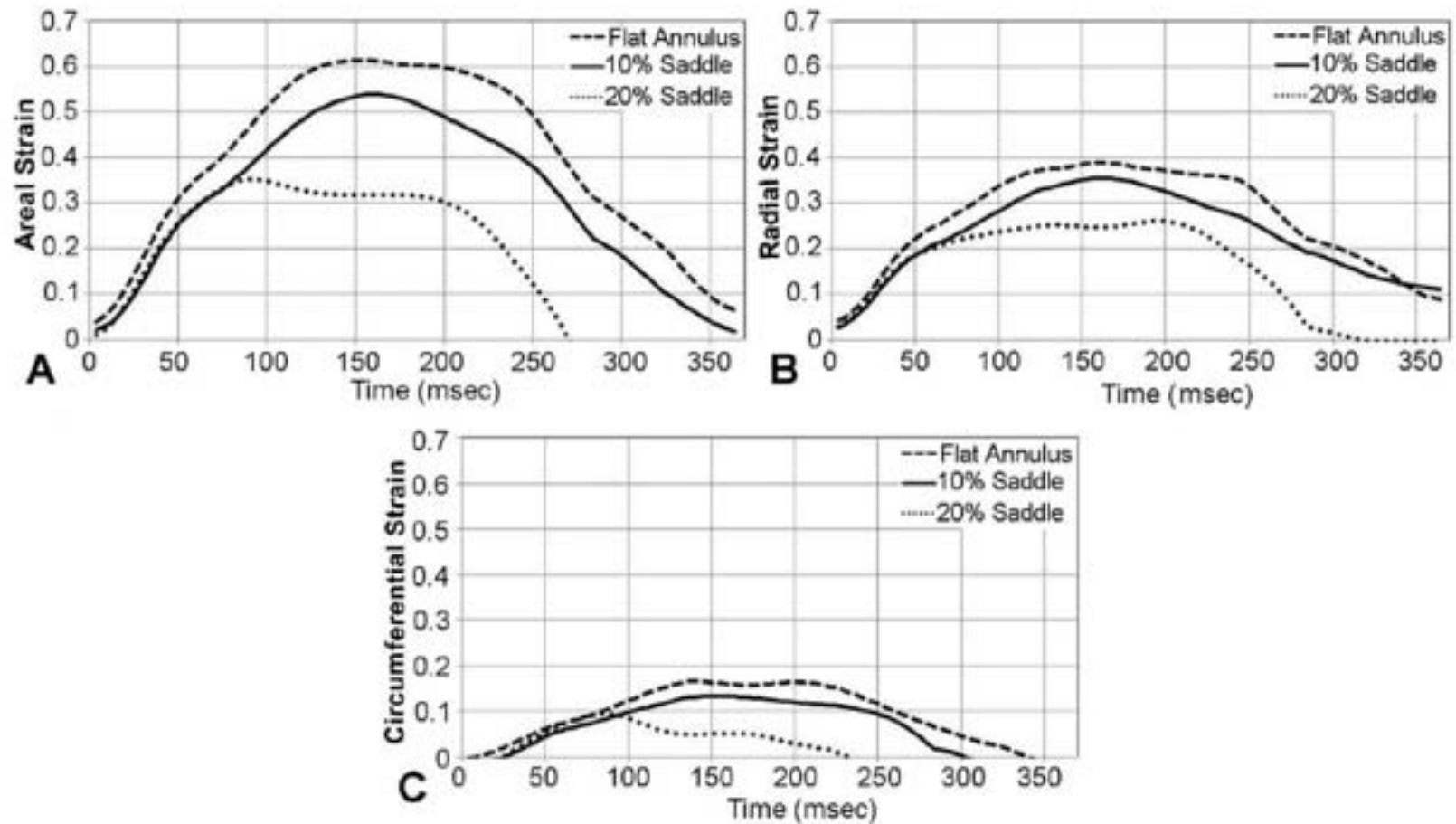
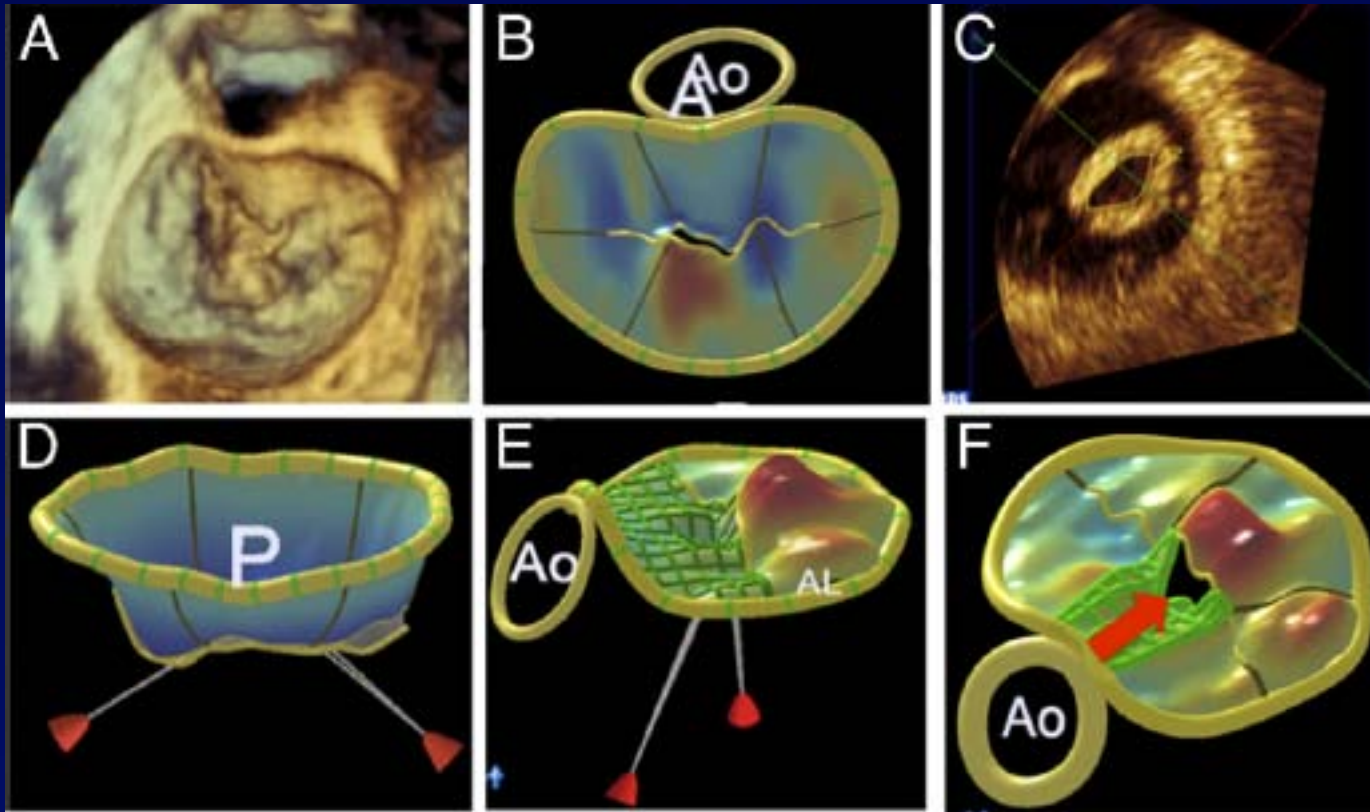
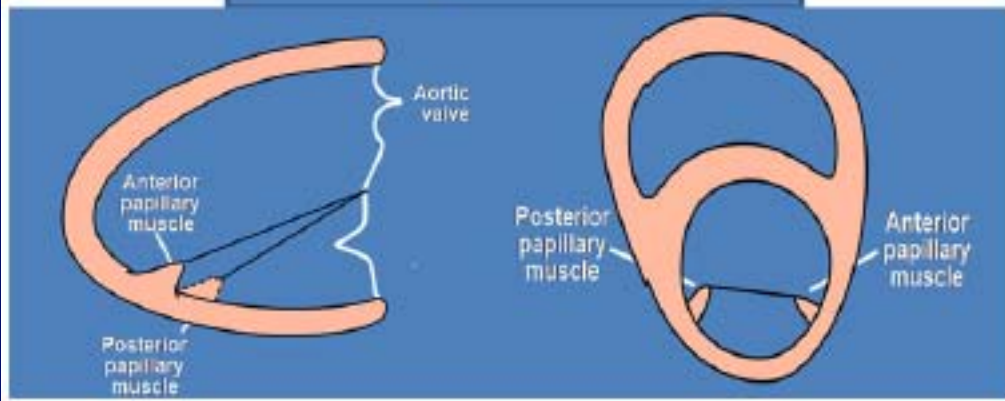
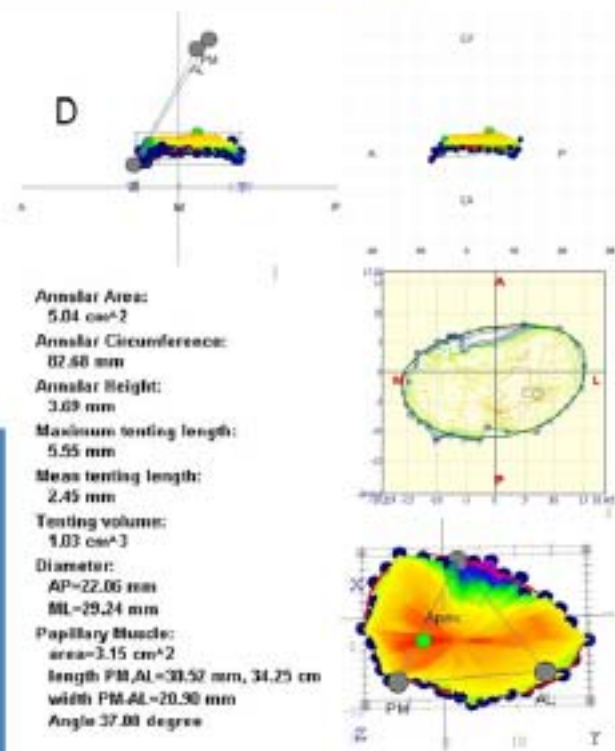
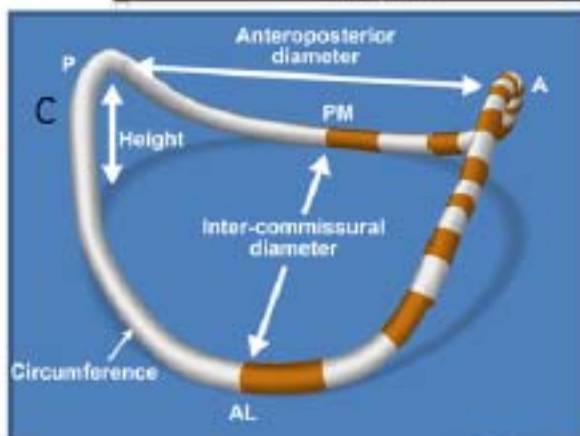
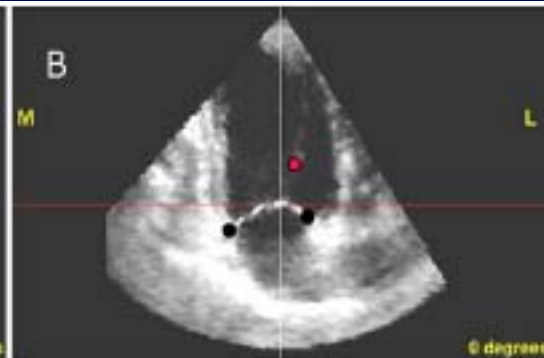
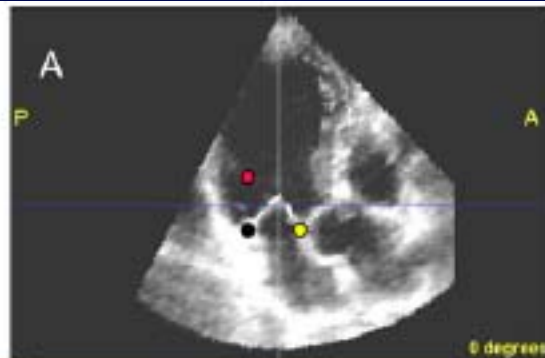


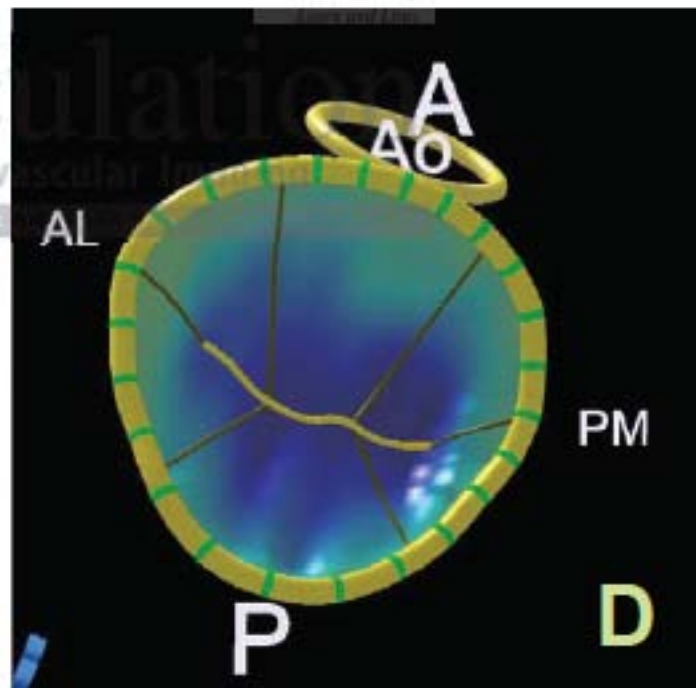
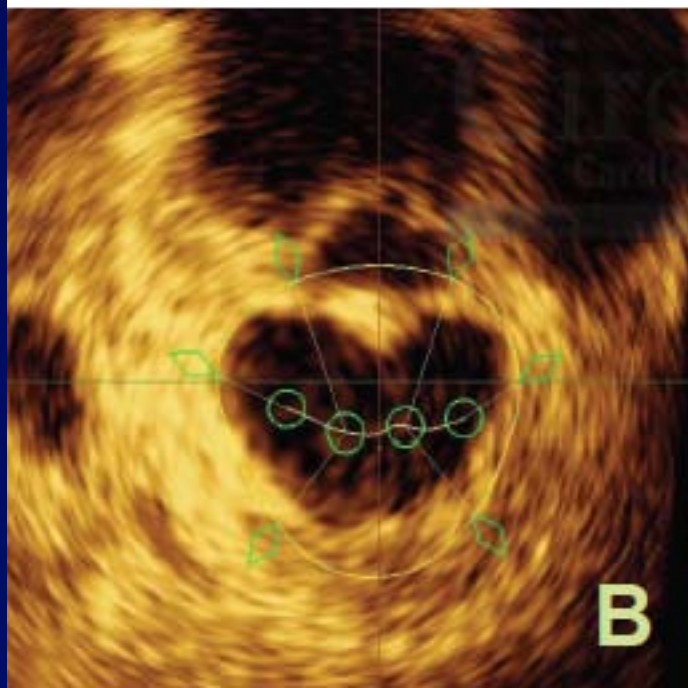
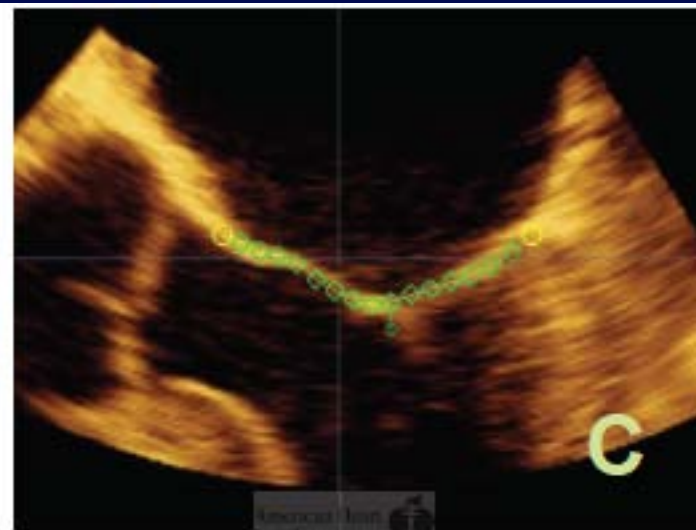
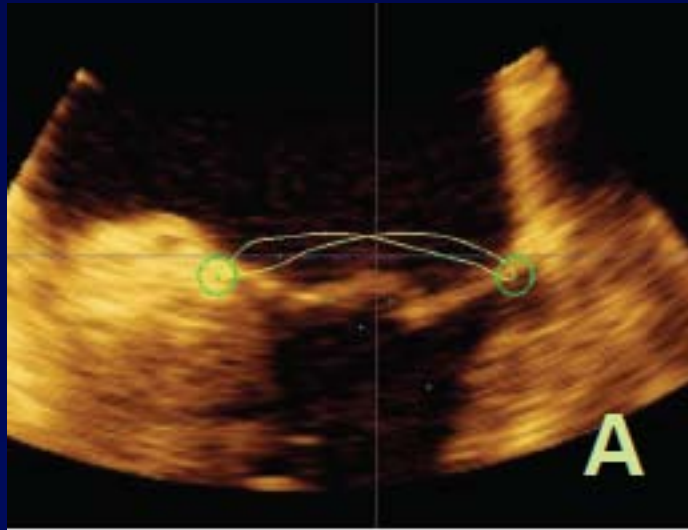
Fig 3. (A) Temporal changes in the areal strain for the three annular shapes. (B) Variations in the circumferential strain. (C) Variations in the radial strain.

The End





The End



Goals of Ultrasound

- 1. Define the extent of the atrial communication.
- 2. Define the type and extent of the ventricular communications.
- 3. Demonstrate the valve morphology attachments and function.
- 4. Display the shunting patterns, the magnitude of the shunt.
- 5. Type of atrioventricular valve regurgitation, magnitude position and direction.
- 6. Assess the commitment of the atrioventricular junction to the underlying ventricular mass and the size of the underlying ventricle (balance).
- 7. Recognize associated anomalies.

Thank You!