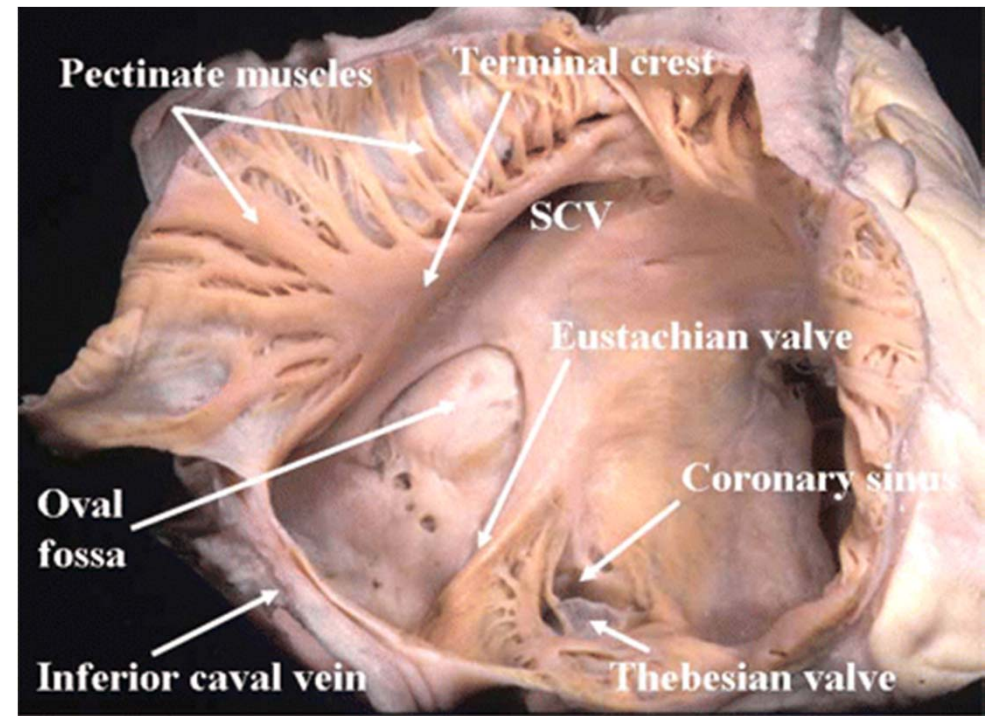
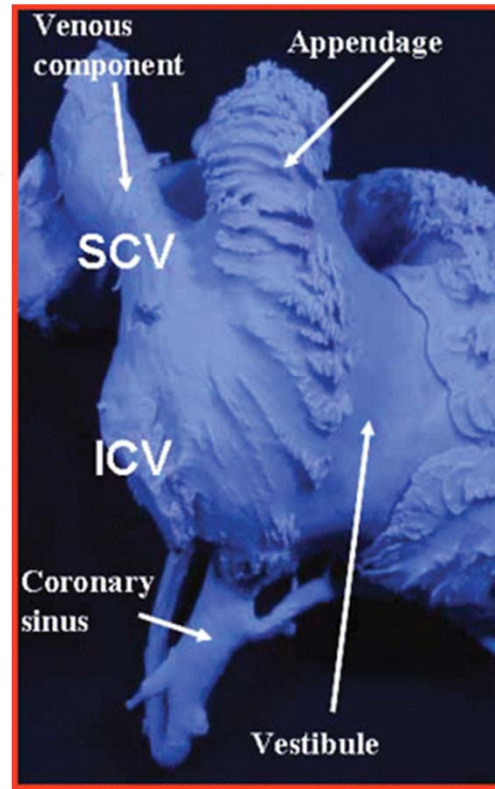


Comprehensive Assessment of Right Atrial & Caval Function

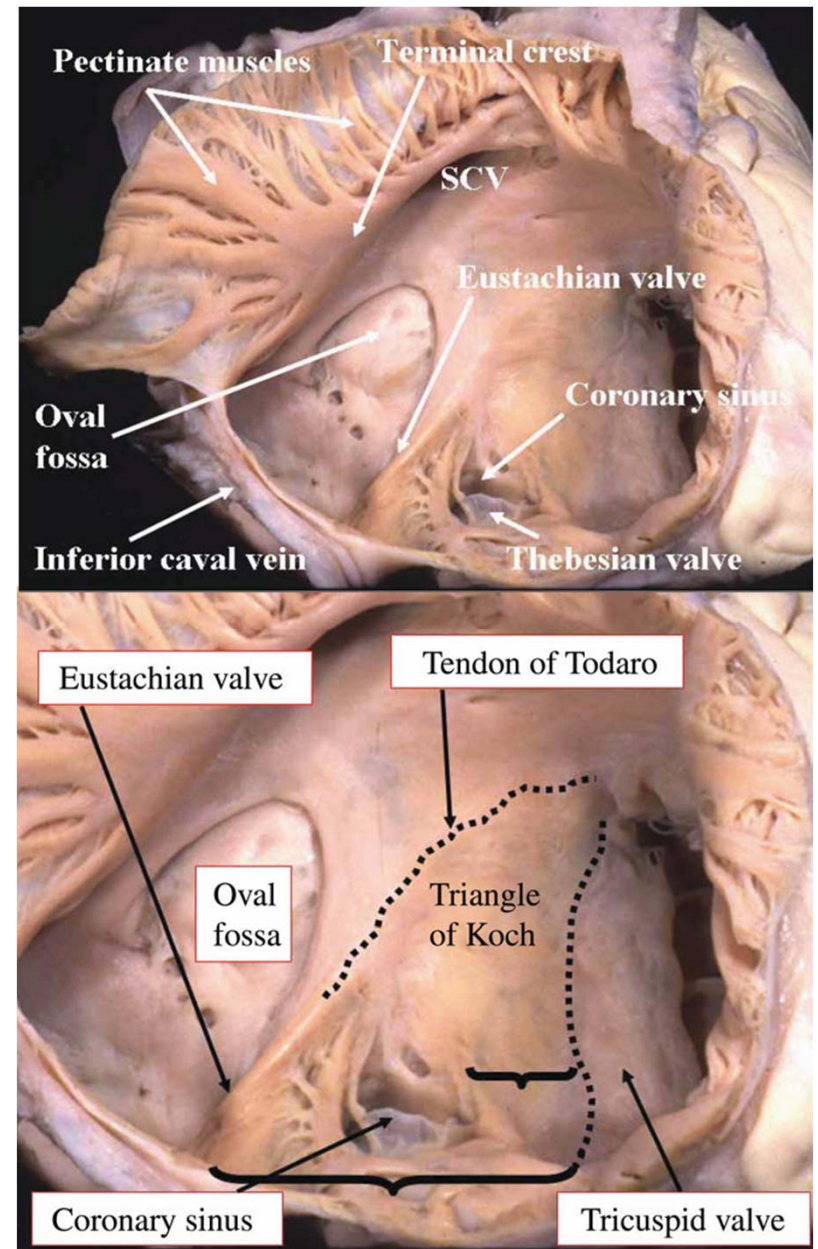
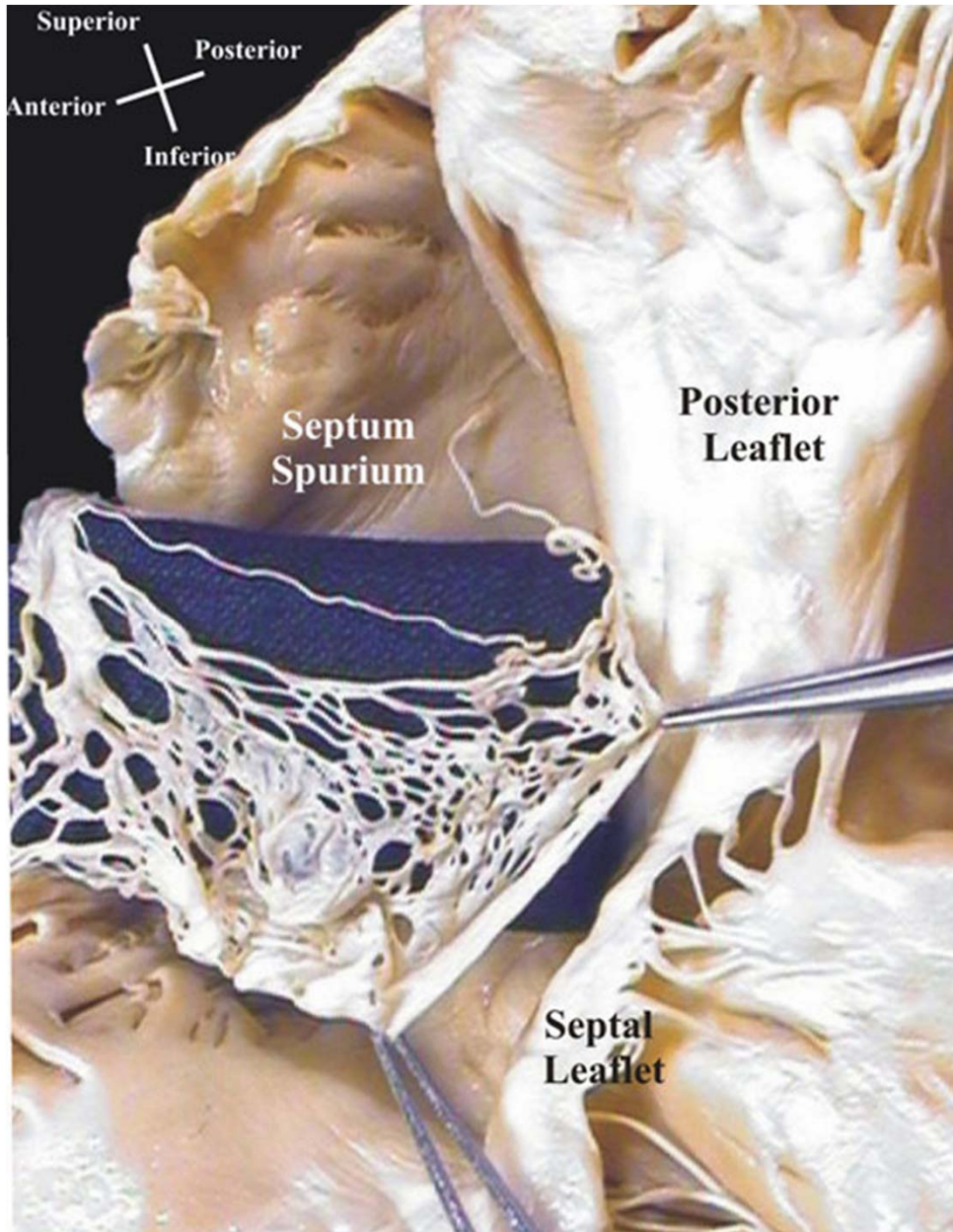
Hyungseop Kim. MD., PhD.

Division of Cardiology, Department of Internal Medicine
Keimyung University Dongsan Medical Center, Daegu, Korea

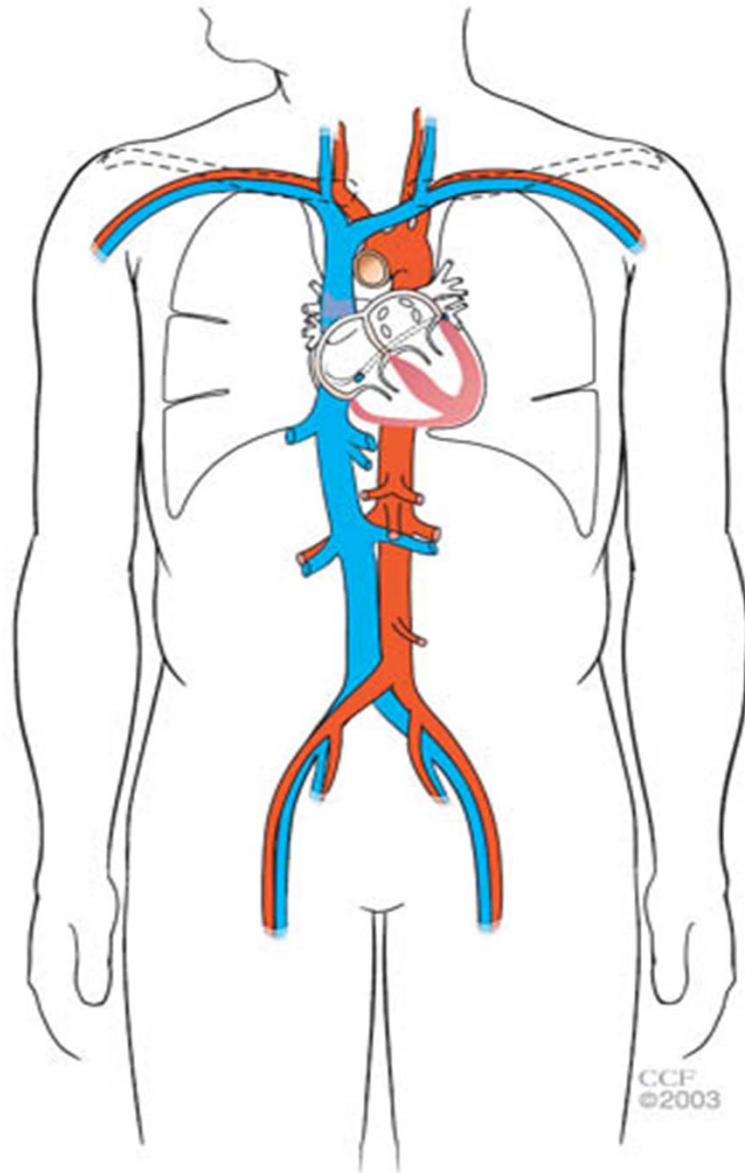
Anatomy of Right Heart



E-Valve & Chiari's Network in RA



Right atrium



Right Atrium

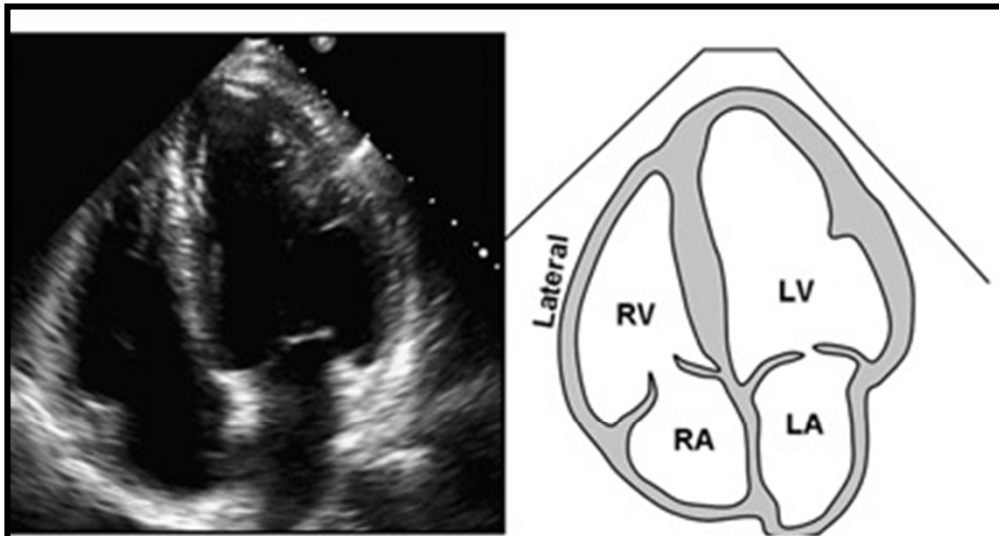
Assists in filling the RV by

- 1) acting as a reservoir for systemic venous return when the TV is closed.
- 2) acting as a passive conduit in early diastole when the TV is open
- 3) acting as an active conduit in late diastole during atrial contraction.

Unfortunately, to date,

only a few studies have focused on the role of the RA in disease states.

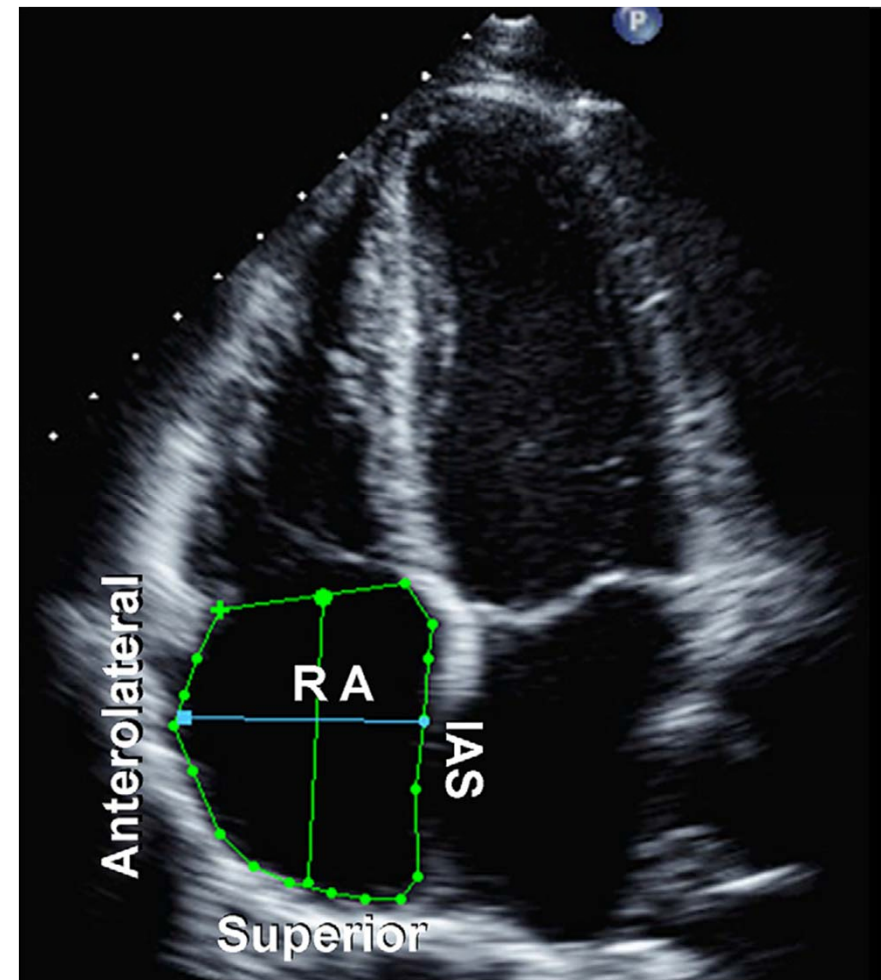
Reference Limits of RA



Apical 4-chamber

- Useful view for demonstrating RV/RA size, shape and function.
- Used to measure RV maximal long-axis distance, minor distances at base and mid-level, RV area and RV fractional area change. RA major and minor axis dimensions, RA area and volume are commonly measured here.
- RV inflow, TR jet by Doppler, tricuspid annulus excursion by M-mode and RV strain by tissue Doppler are also commonly assessed in this view.
- TR jet parameters can be measured in this view provided the TR jet is parallel to the U/S beam.

Variable	Normal range
RA major dimension	≤ 5.3 cm
RA minor dimension	≤ 4.4 cm
RA end-systolic area	≤ 18 cm ²



RA Area

Evaluation of Right Atrial Size in Patients with Atrial Arrhythmias: Comparison of 2D versus Real Time 3D Echocardiography

Hajo Müller, M.D., Haran Burri, M.D., and René Lerch, M.D.

Division of Cardiology, University Hospitals of Geneva, Switzerland

- 1) RA dilation was documented in atrial arrhythmias by 2D and 3D-Echo
- 2) Apical 4C planimetry area is a simple alternative methods
- 3) 2D-derived RA volume by single plane are-length method was not better correlated with 3DE volume.

RA Area

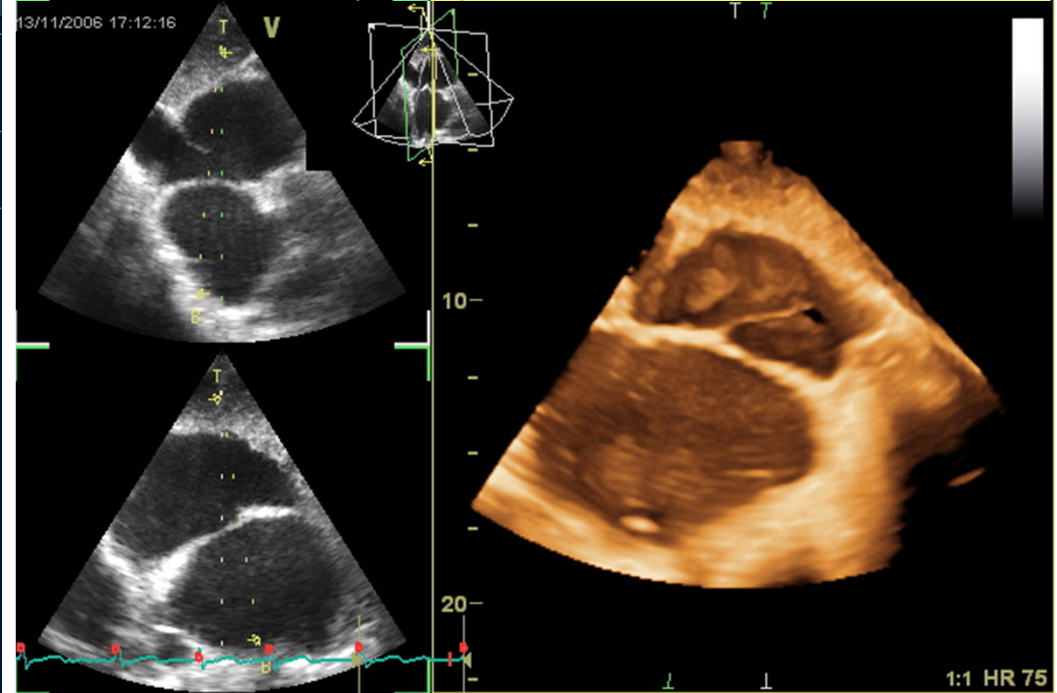
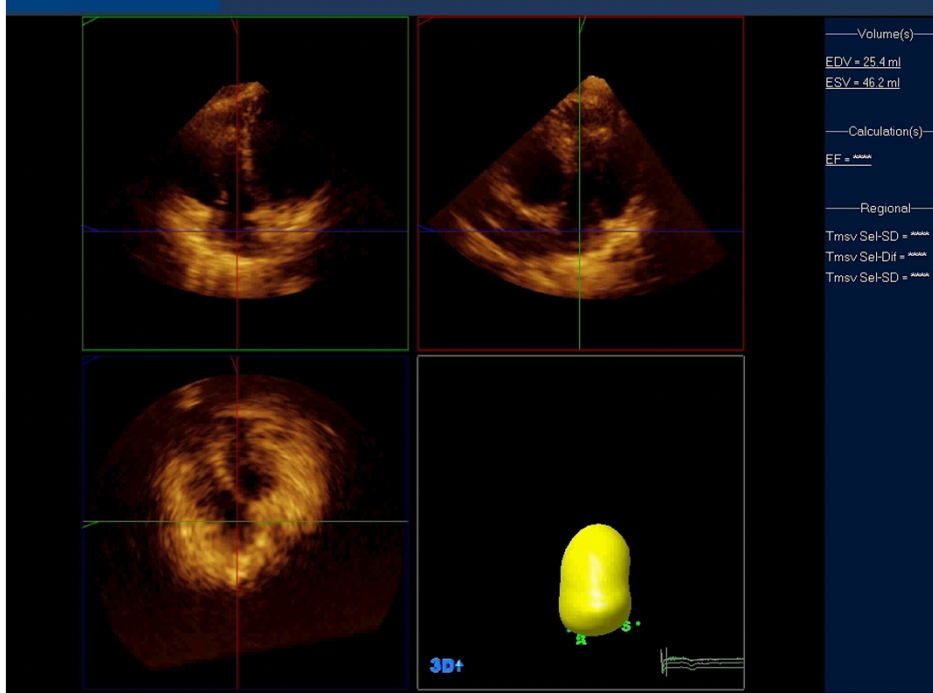
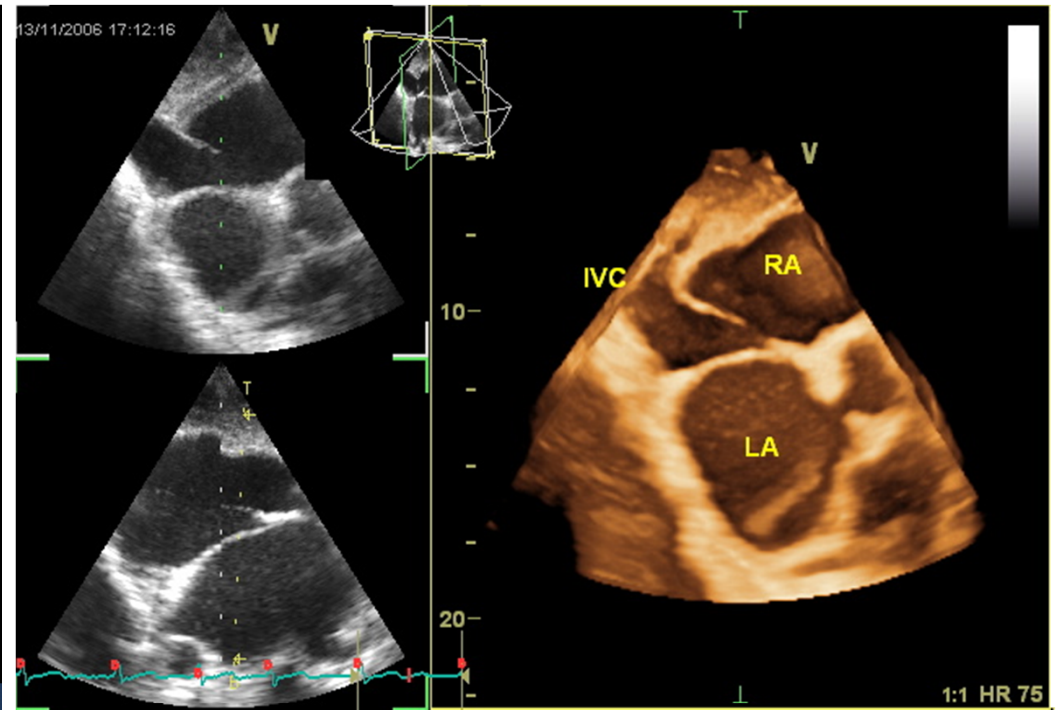
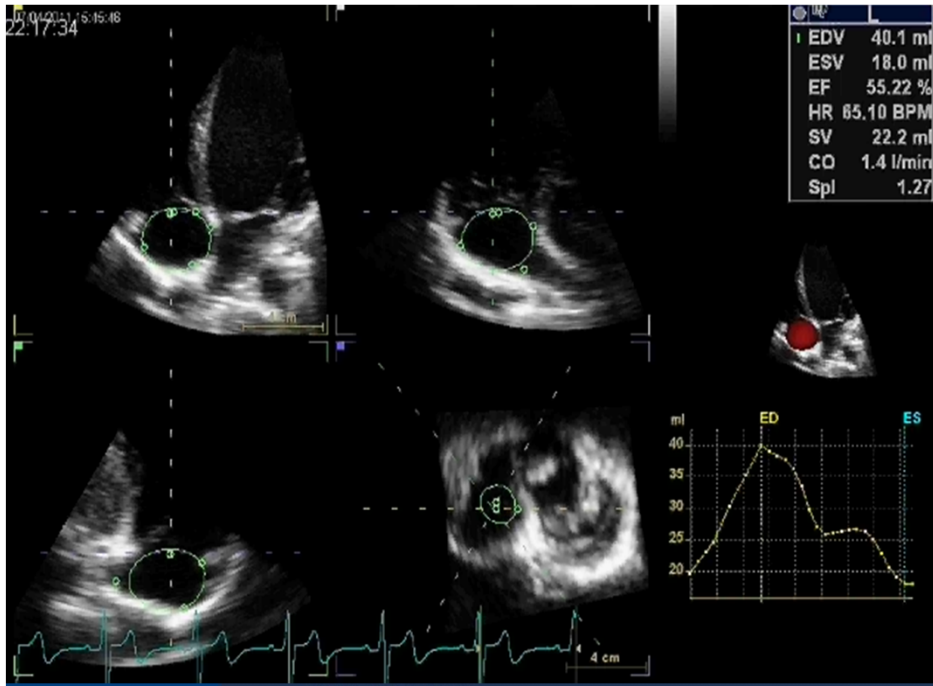
Biatrial anatomical reverse remodelling after radiofrequency catheter ablation for atrial fibrillation: evidence from real-time three-dimensional echocardiography

Hajo Müller, Stephane Noble, Pierre-Frédéric Keller, Philippe Sigaud, Pascale Gentil, René Lerch, Dipen Shah, and Haran Burri*

Cardiology Service, University Hospital of Geneva, 24, rue Micheli-du-Crest, 1211 Geneva, Switzerland

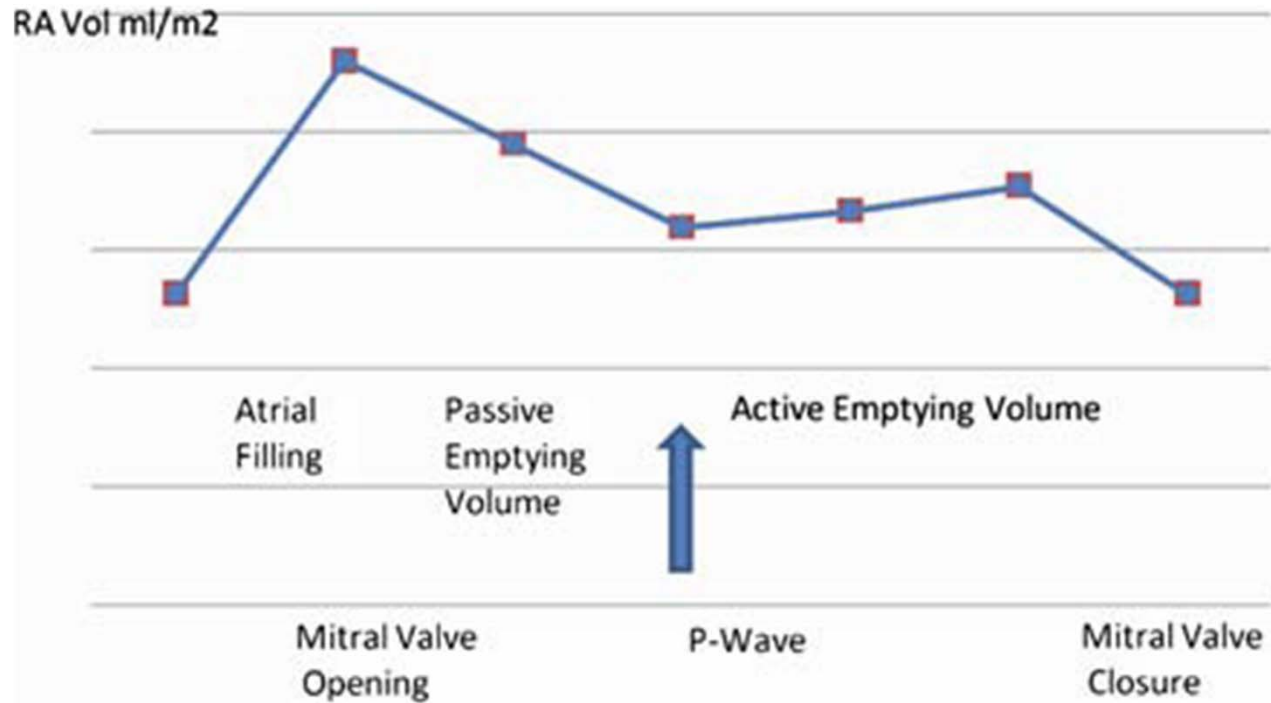
- 1) Biatrial anatomical reverse remodeling after RACA for AF was demonstrated in 3D-Echo.
- 2) A reduction in the atrial volume occurred despite recurrence of AF.

Right Atrium



RA Volume Cycles

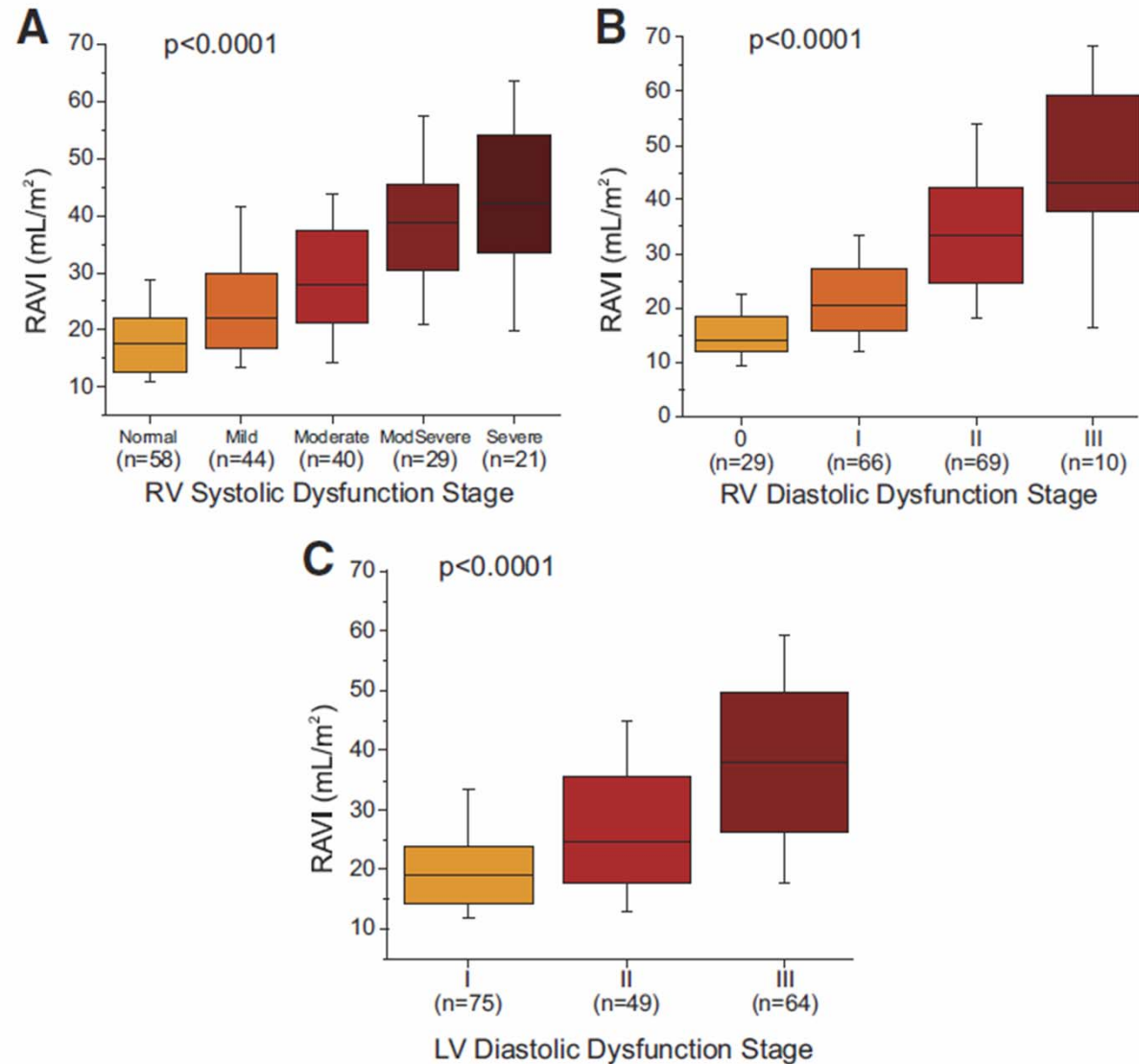
RA volume change over time



- Aging and PAH are associated with
 - A decrease in passive RA emptying
 - An increase in RA active emptying

RA Volume & Prognosis

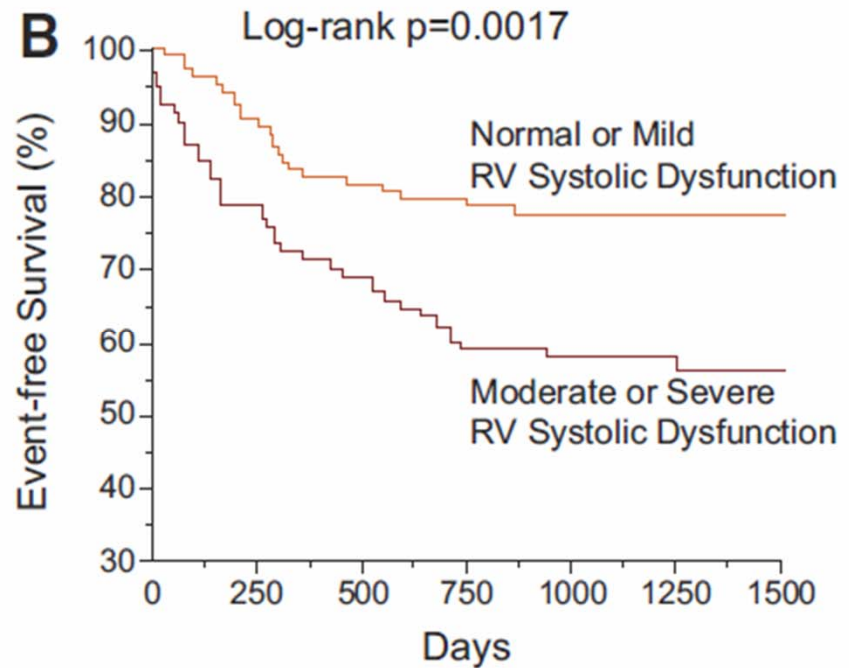
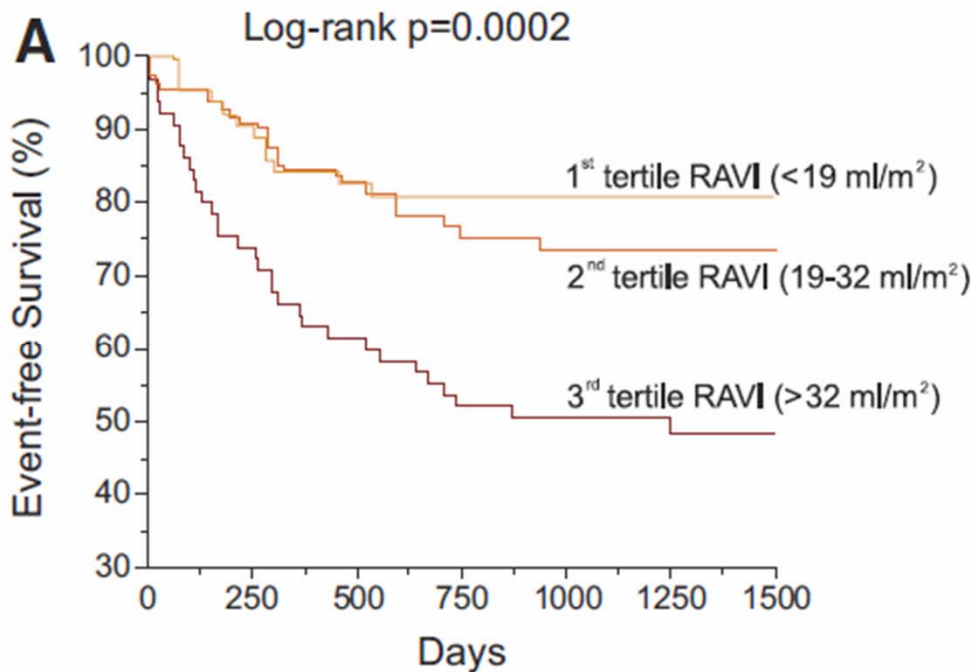
RA volume index in chronic systolic HF and prognosis



RAVI According to Severity of RV and LV Dysfunction

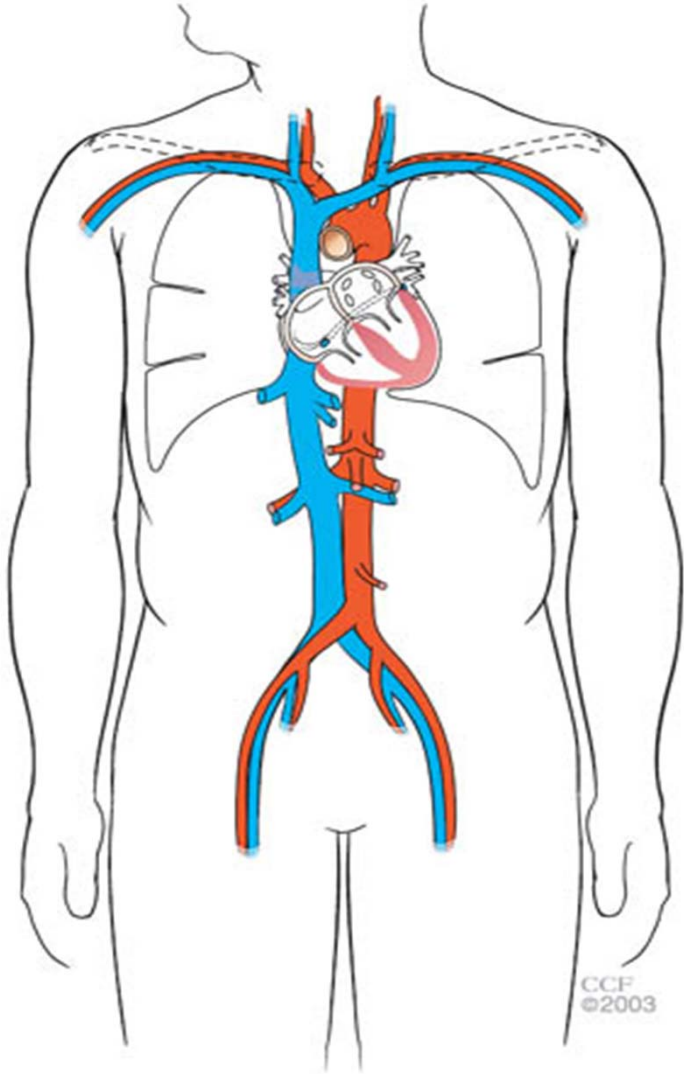
RA Volume & Prognosis

RA volume index in chronic systolic HF and prognosis

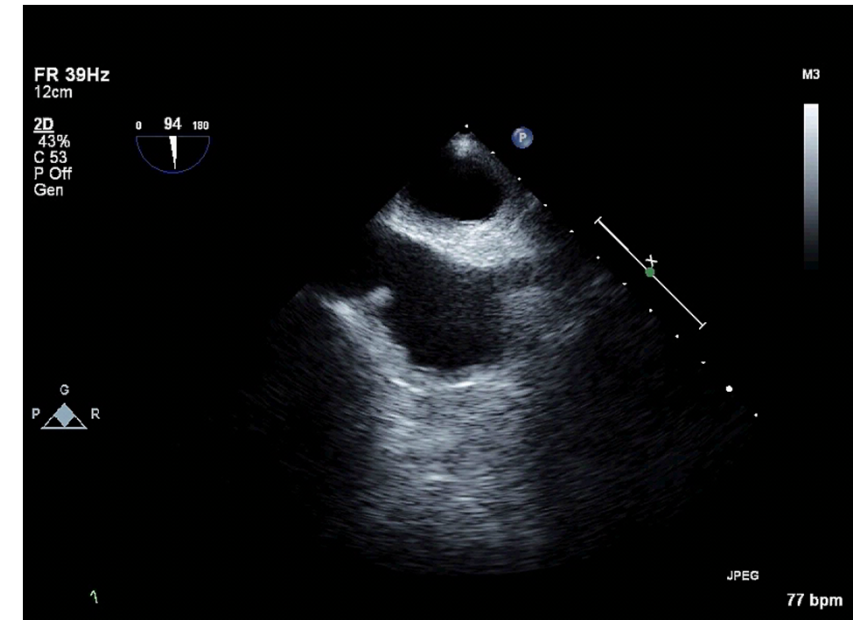
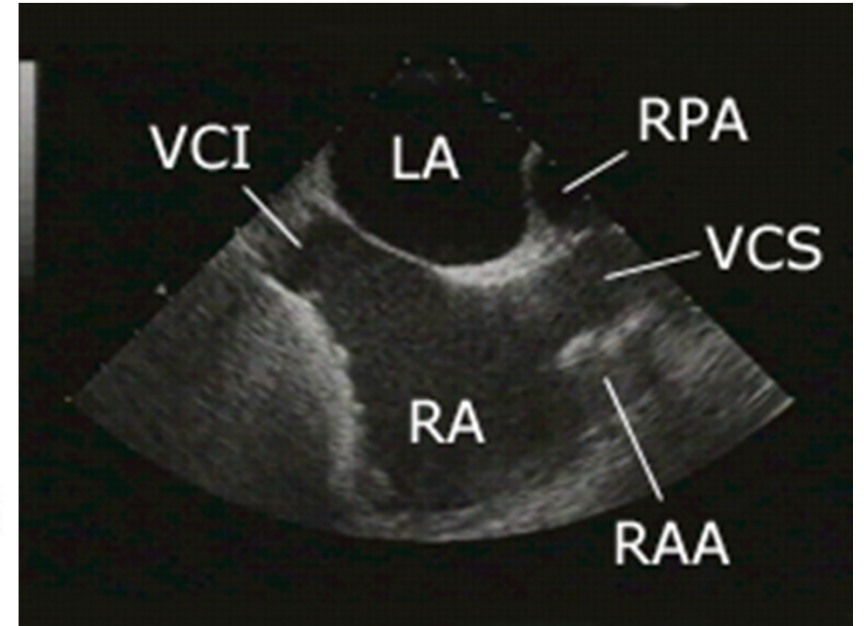
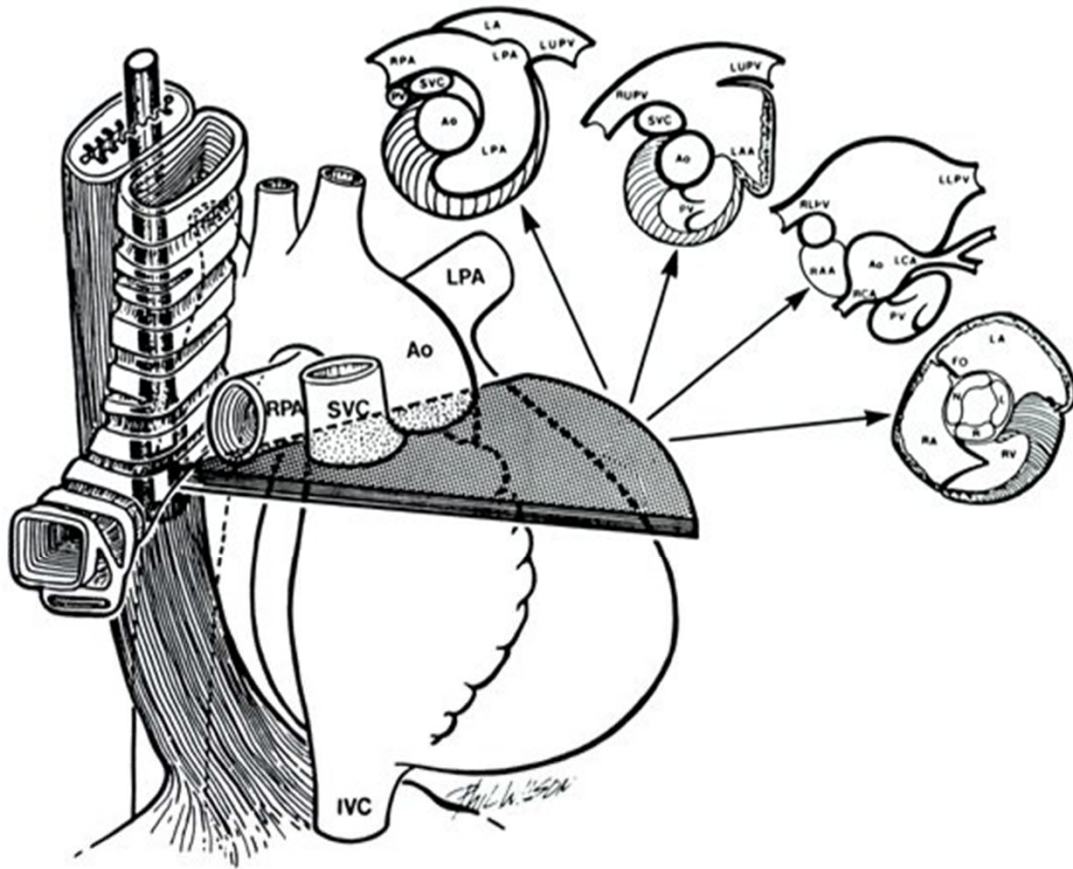


Kaplan-Meier Survival Analysis Across Severity of RAVI and RV Systolic Dysfunction

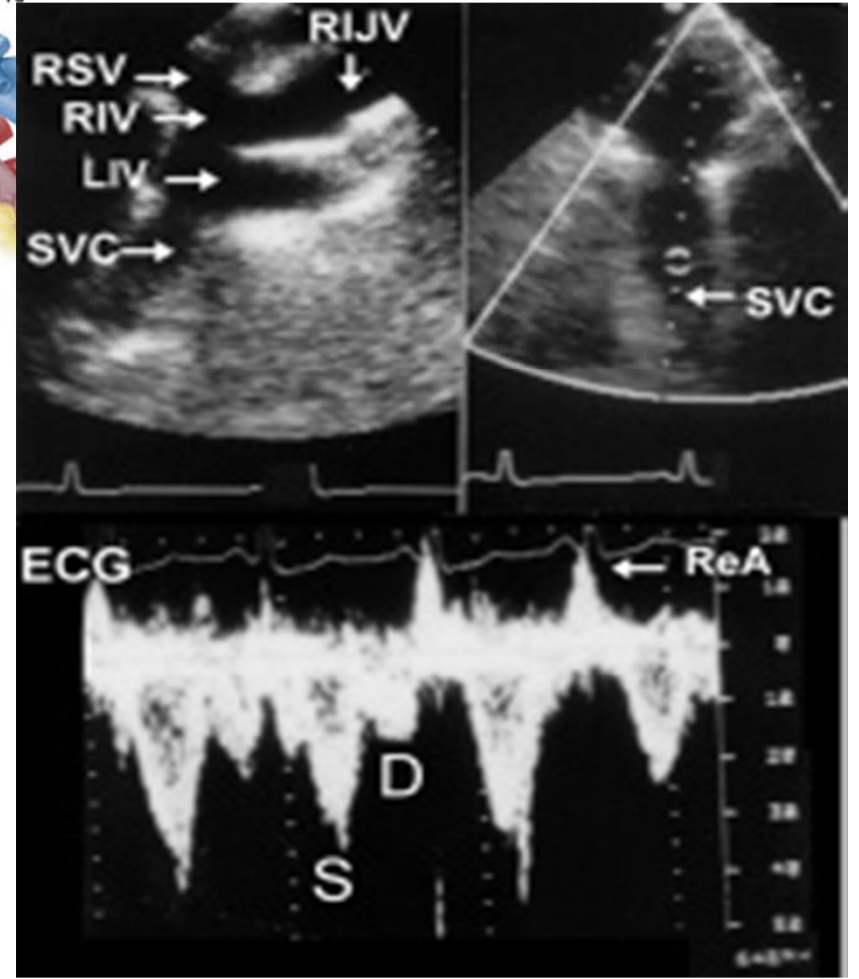
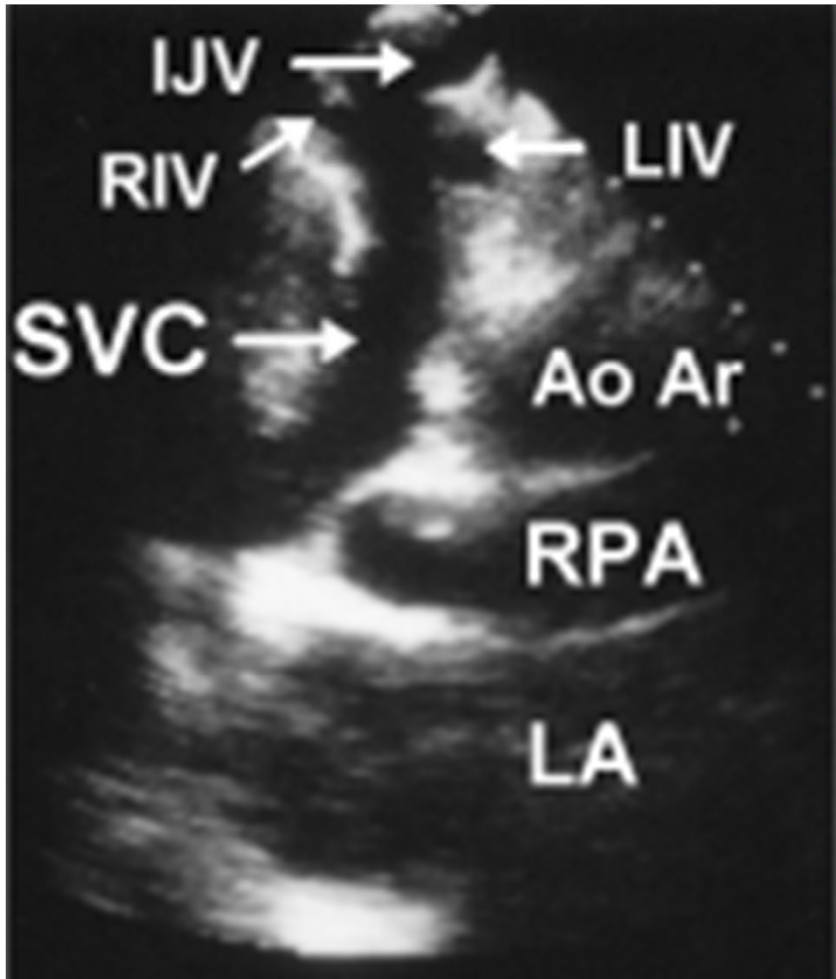
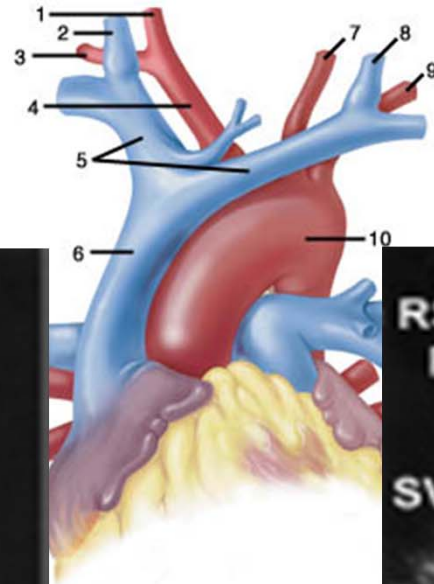
Superior Vena Cava



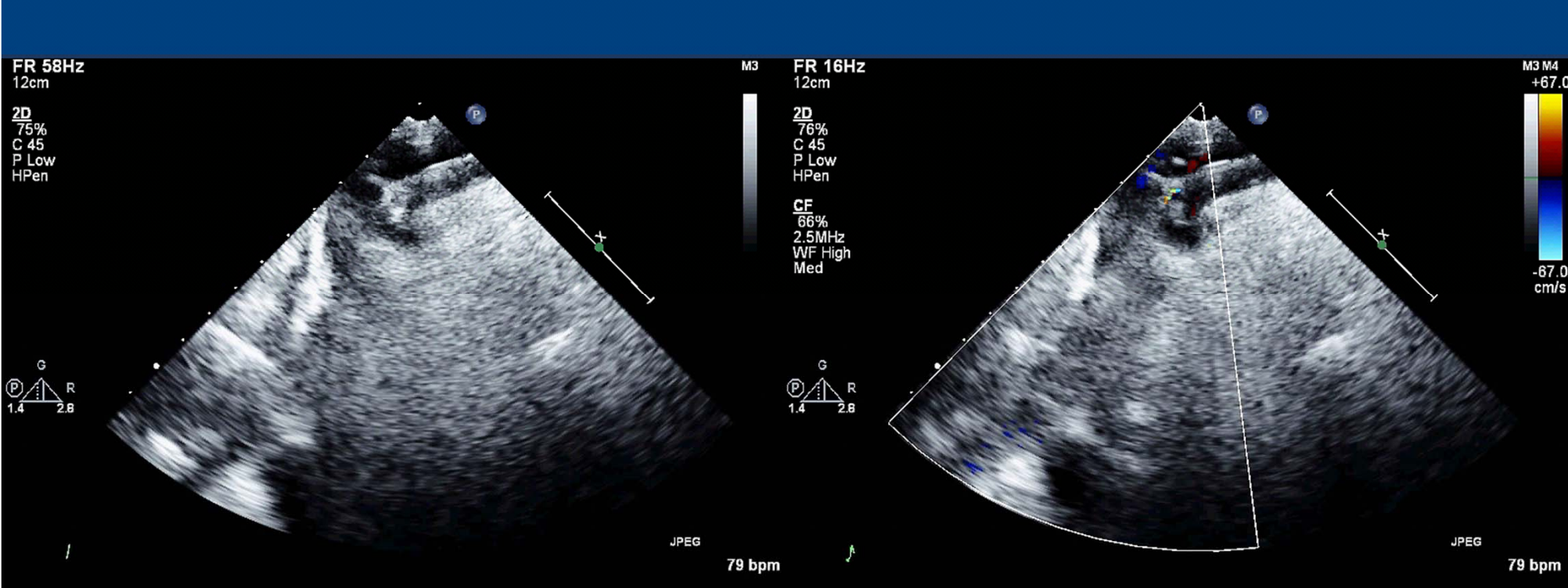
SVC & IVC



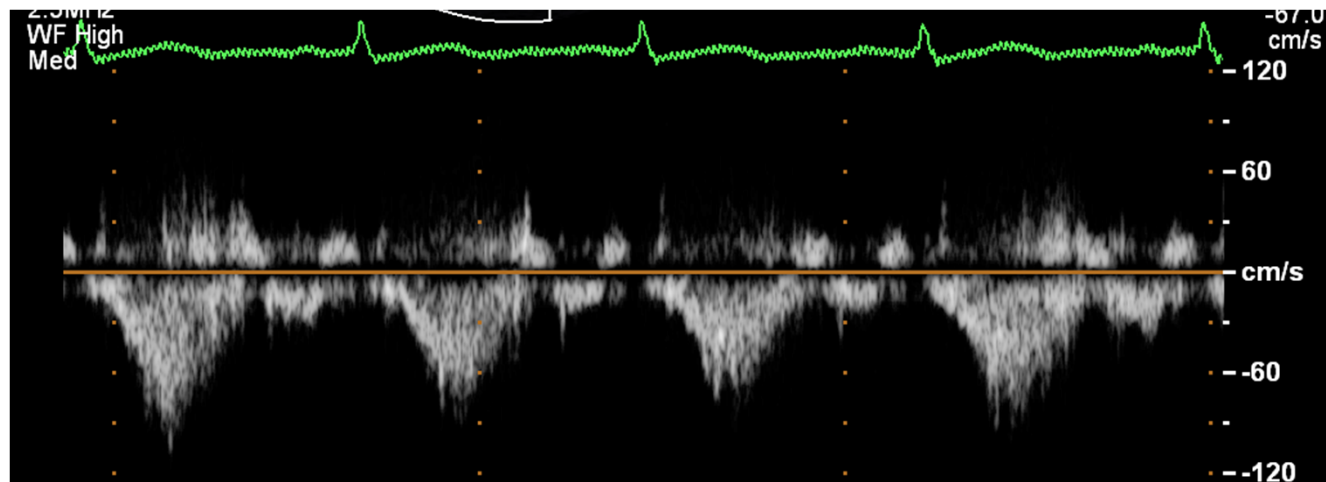
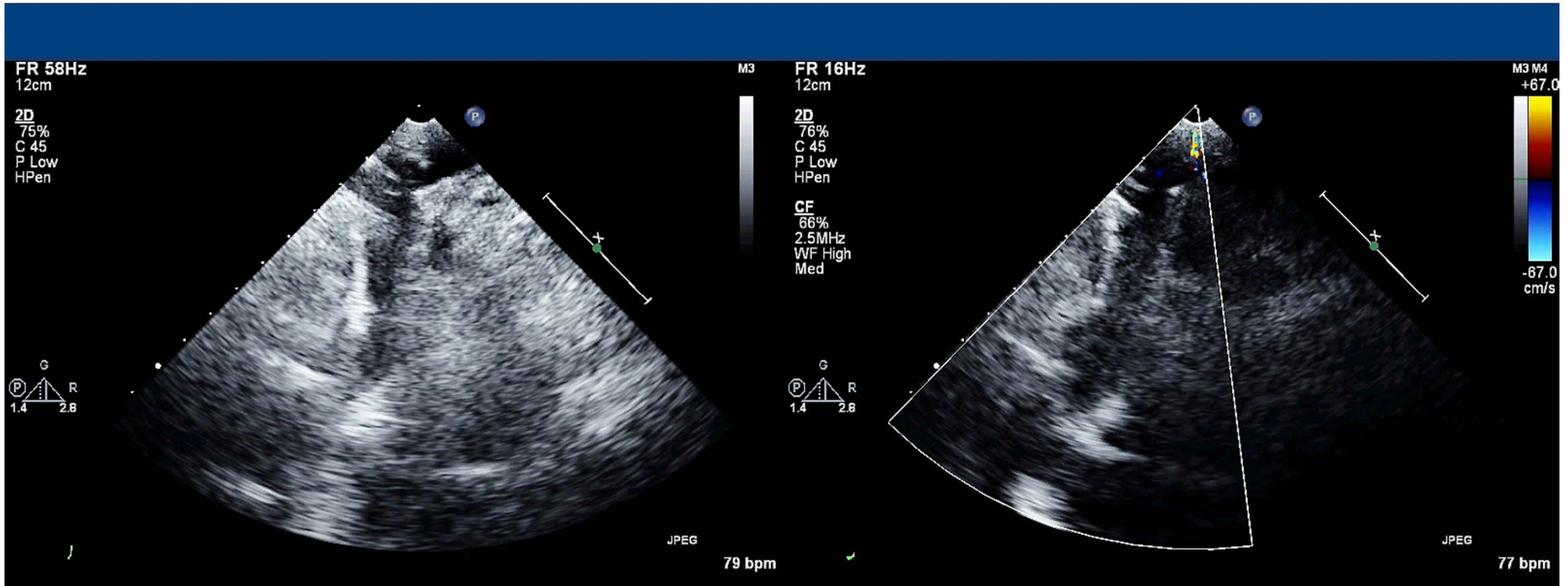
Superior Vena Cava



Superior Vena Cava

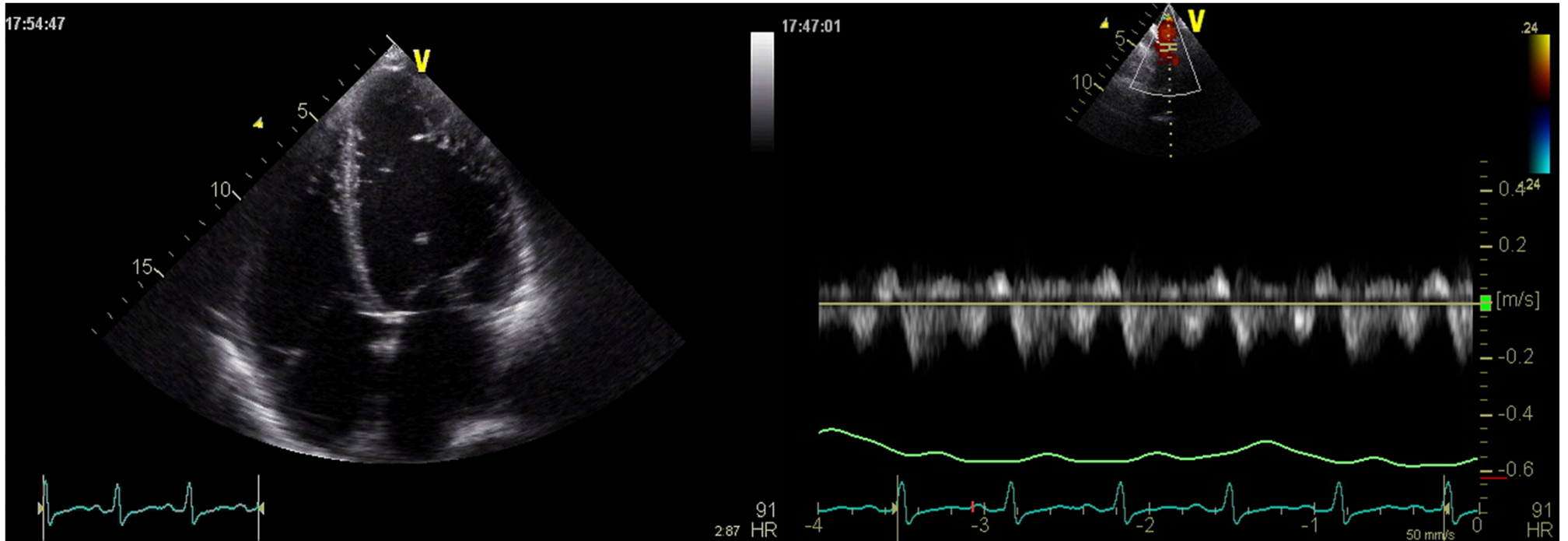


Superior Vena Cava



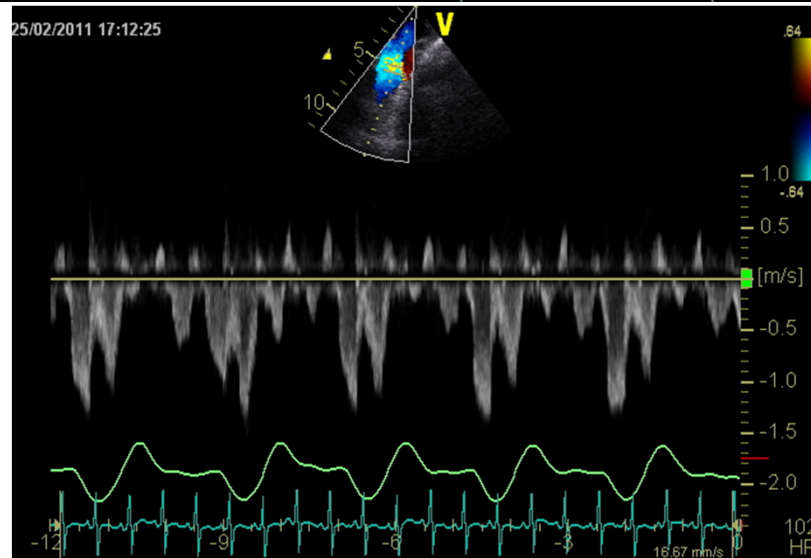
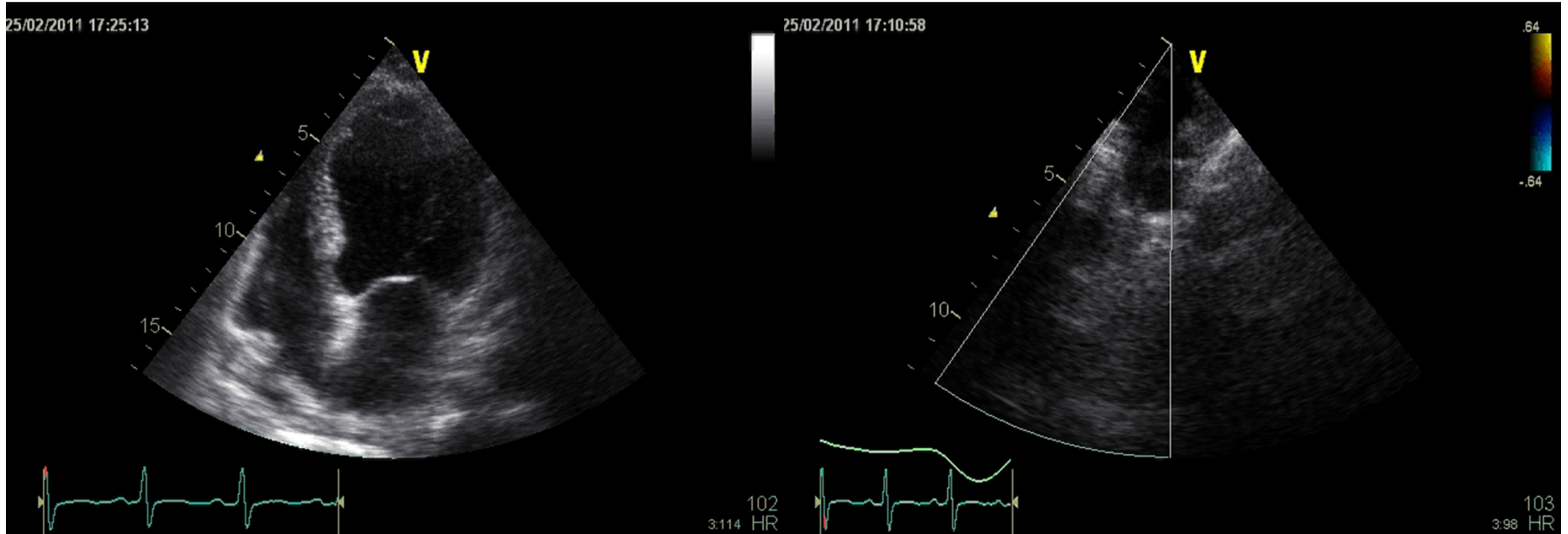
Superior Vena Cava

Severe LV dysfunction I

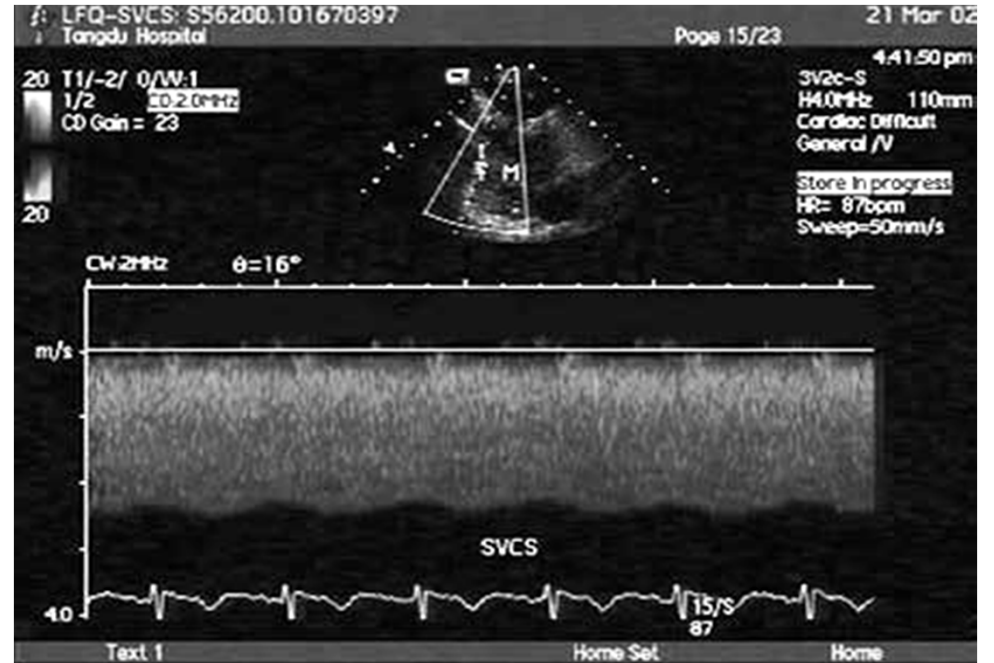
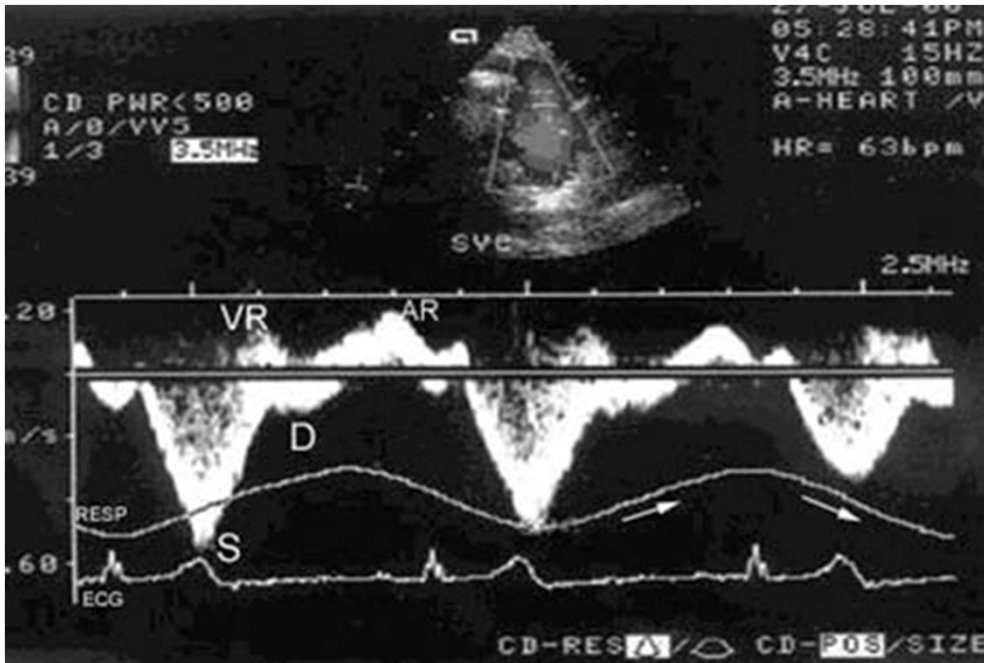


Superior Vena Cava

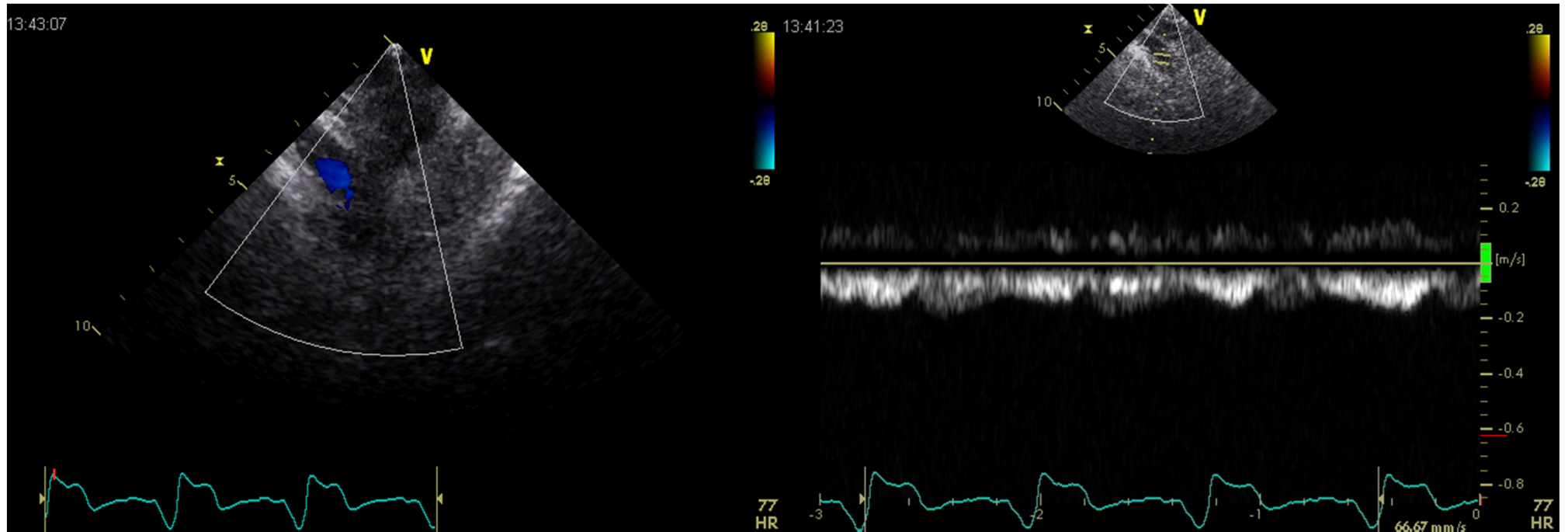
Severe LV dysfunction II



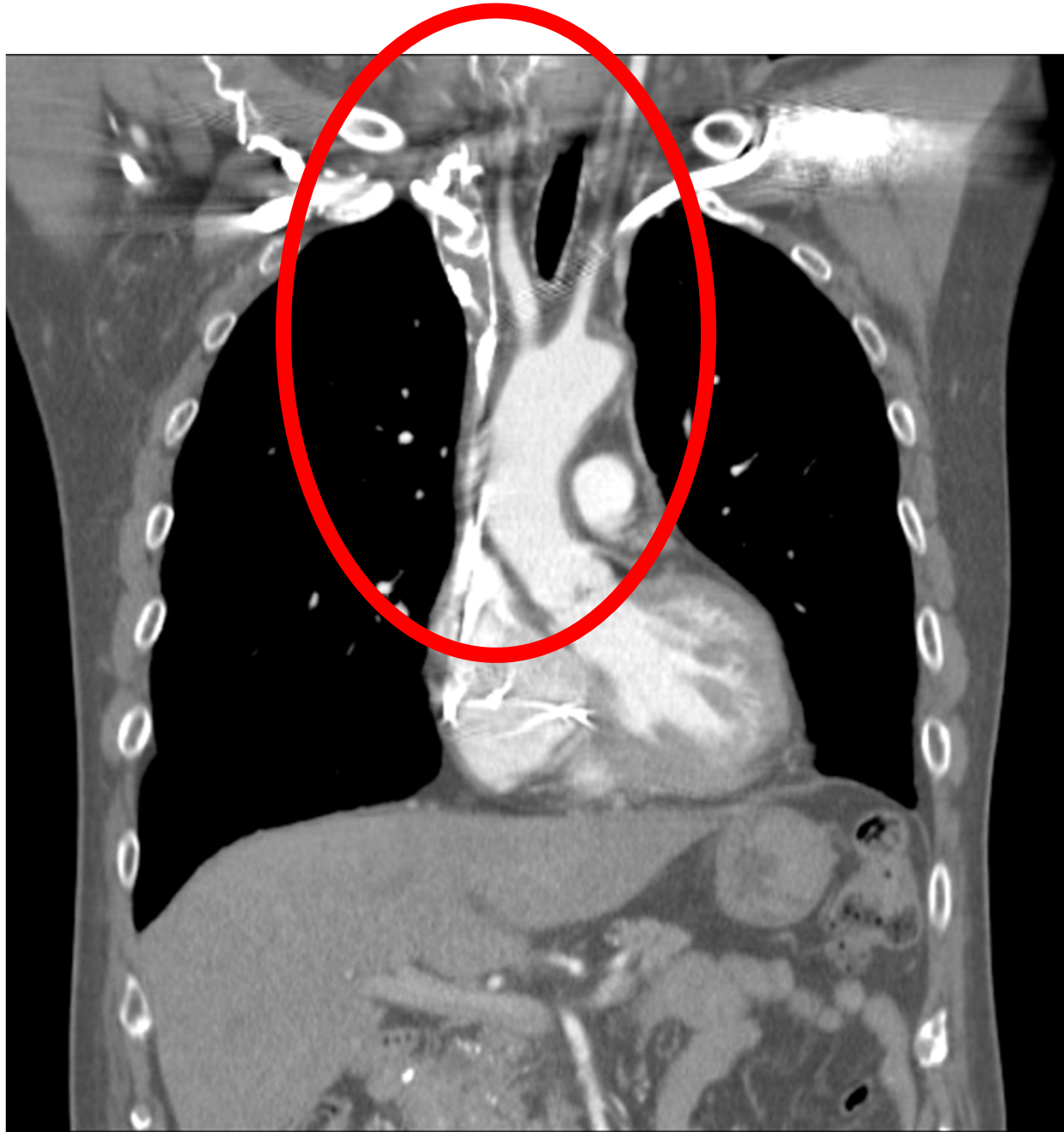
SVC Syndrome



SVC Syndrome

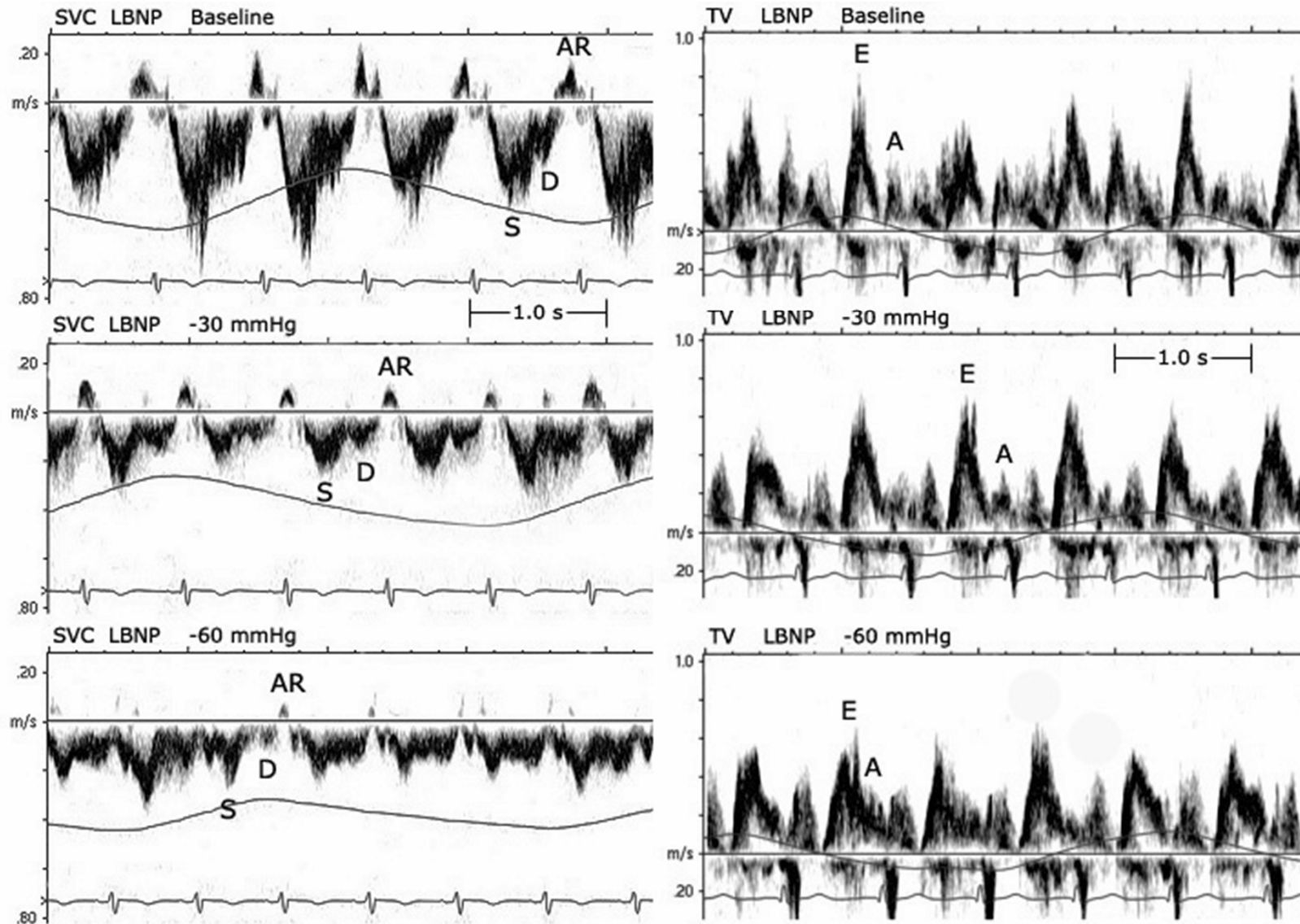


SVC Syndrome

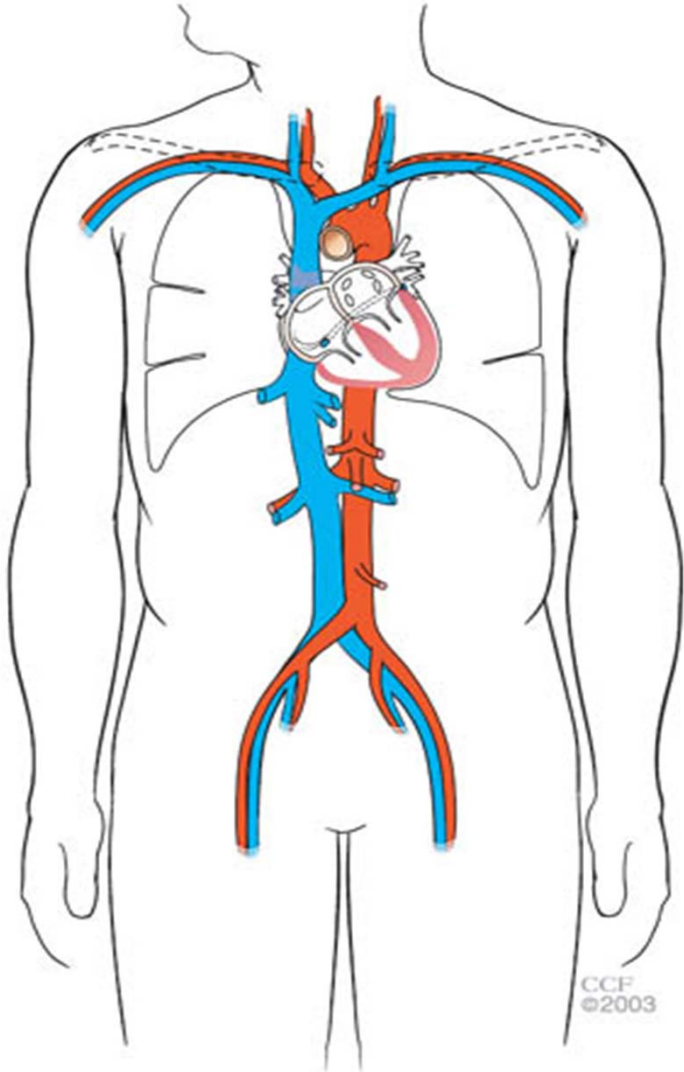


Comparison of tricuspid inflow and superior vena caval Doppler velocities in acute simulated hypovolemia: new non-invasive indices for evaluating right ventricular preload

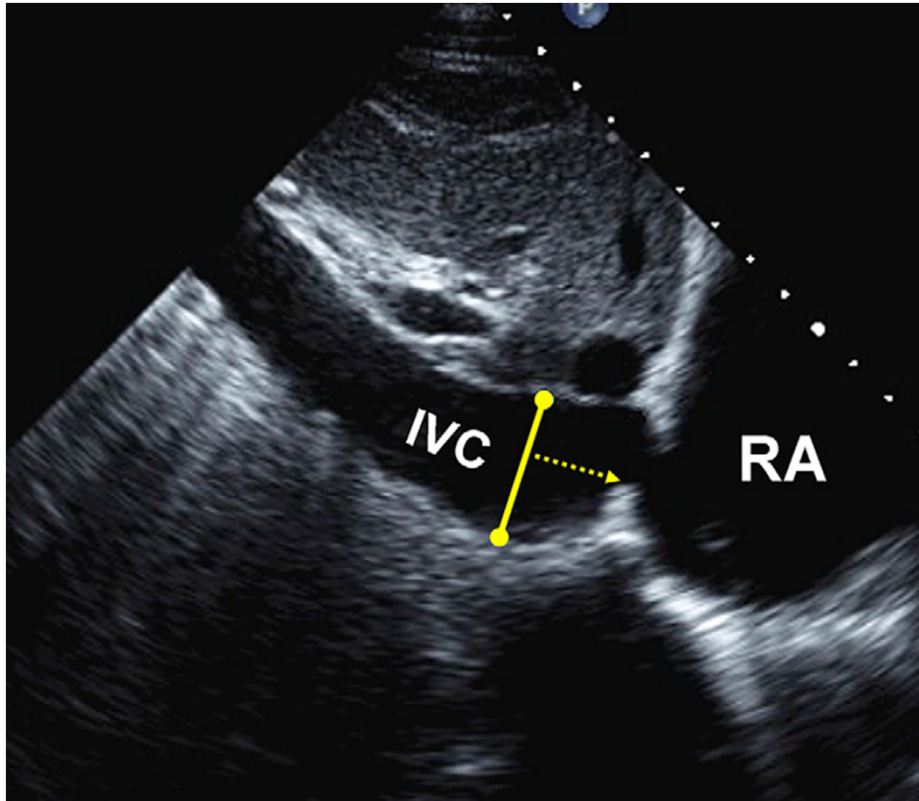
Jie Liu, Tie-Sheng Cao*, Li-Jun Yuan, Yun-You Duan and Yi-Lin Yang



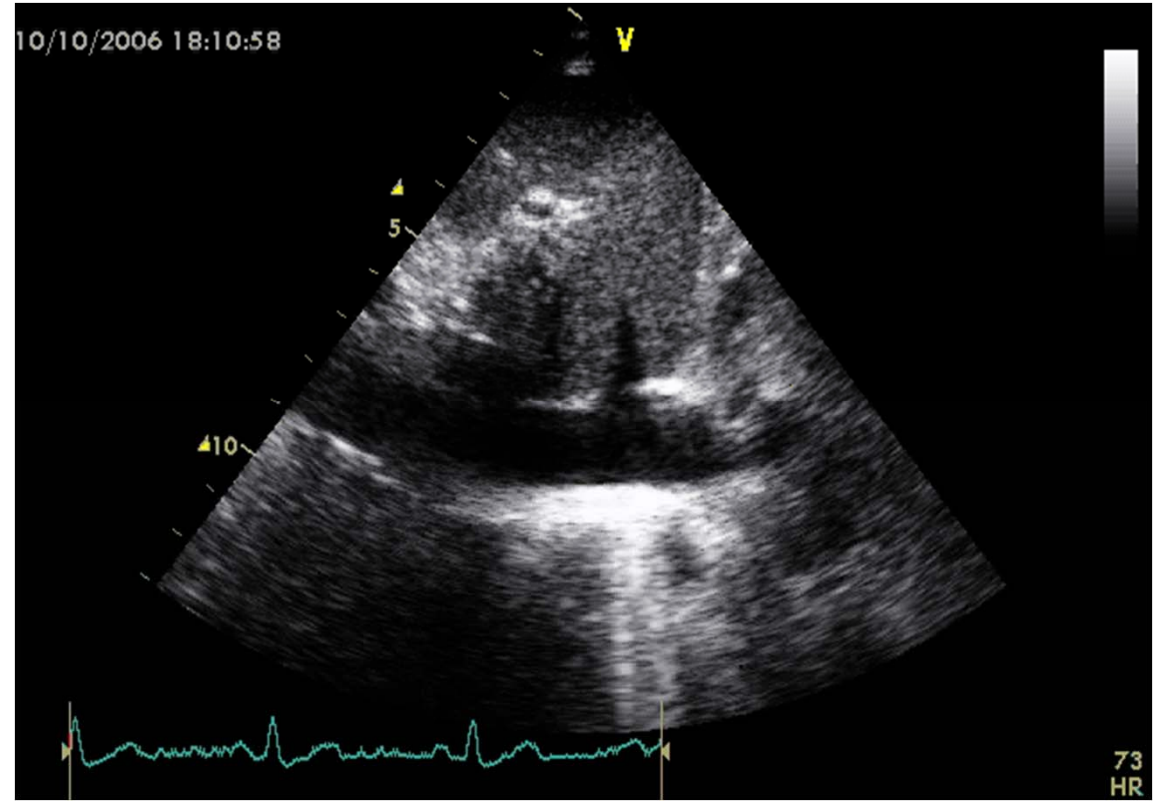
Inferior Vena Cava



IVC Measurement



From 0.3 to 0.5 proximal to the ostium of RA



Brief Sniff

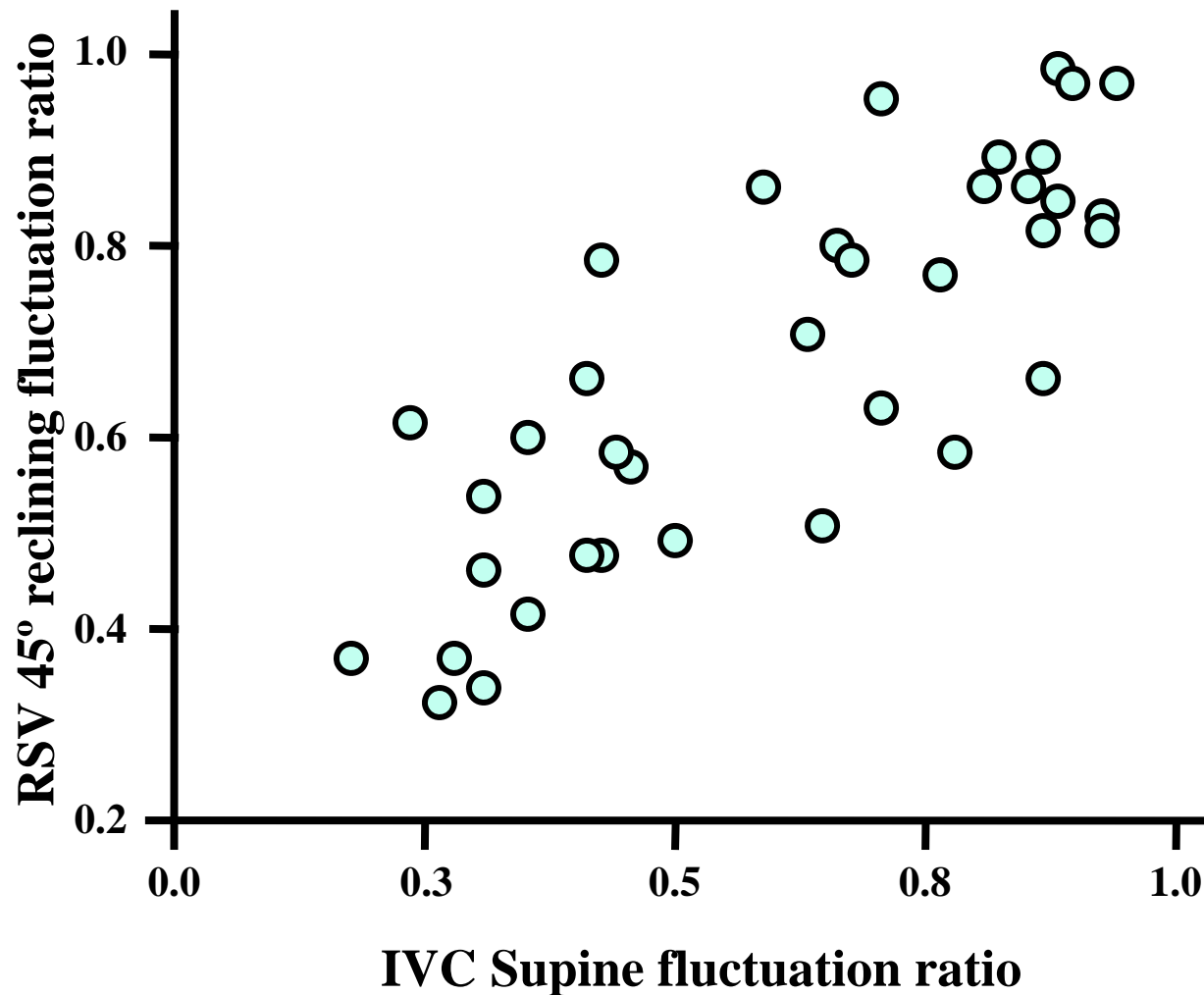
Estimation of RA Pressure

Estimation of RA pressure on the basis of IVC diameter and collapse

Variable	Normal (0~5mmHg)	Intermediate (5~10mmHg)	High (15mmHg)	
IVC diameter	≤ 2.1 cm	≤ 2.1 cm	> 2.1 cm	> 2.1 cm
Collapse with sniff	$> 50\%$	$< 50\%$	$> 50\%$	$< 50\%$
Secondary indices of elevated RA pressure				<ul style="list-style-type: none">• Restrictive filling• Tricuspid E/E' > 6• Diastolic flow predominance in hepatic veins (systolic filling fraction $< 55\%$)

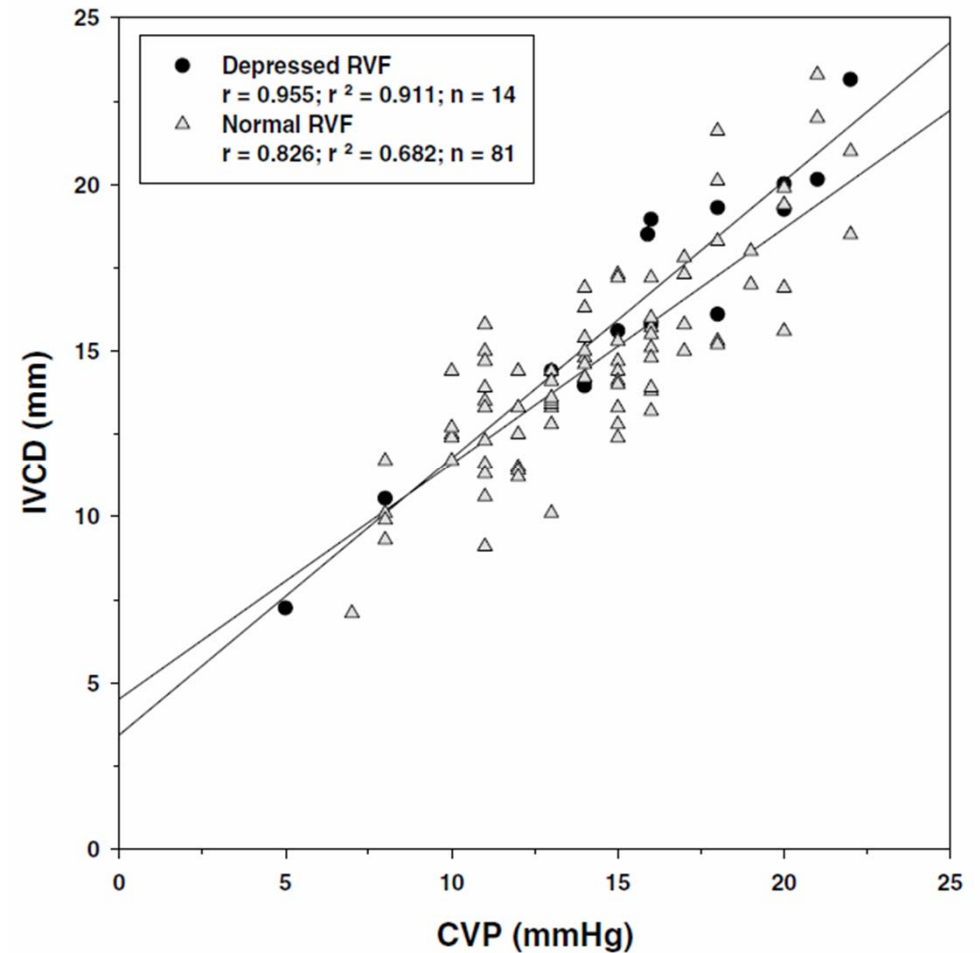
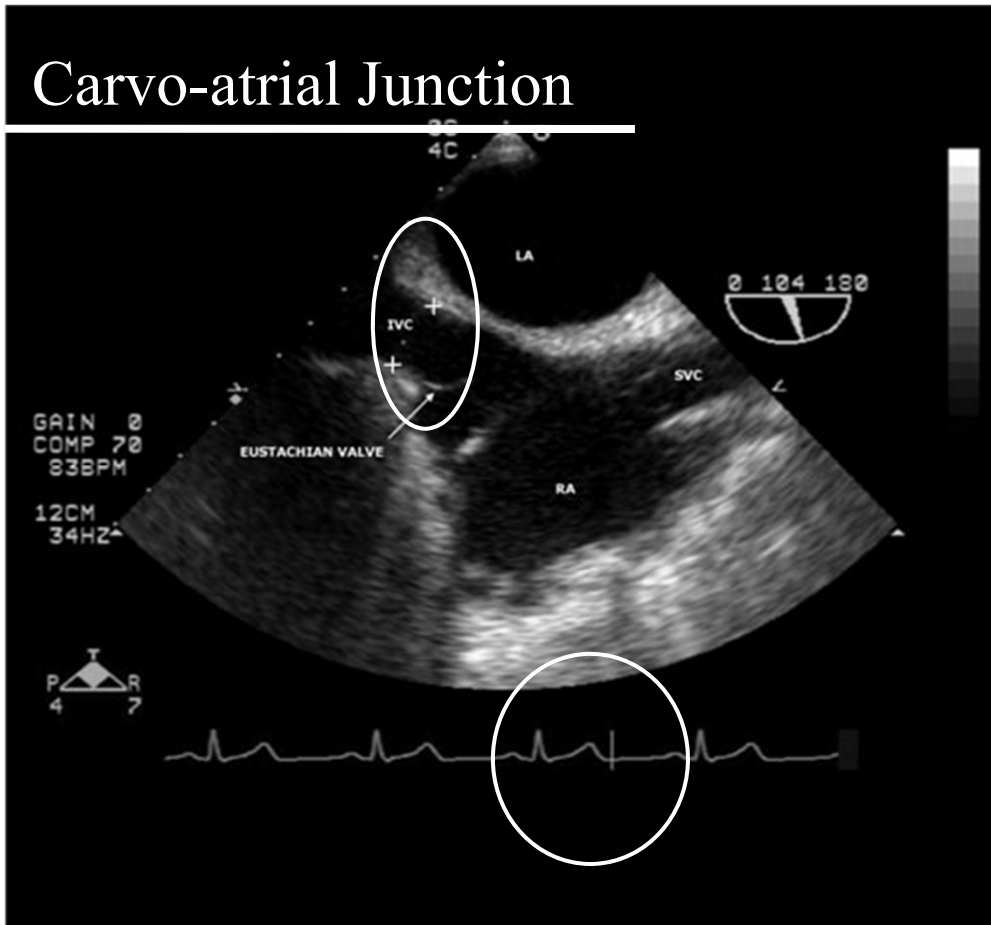
Hemodynamic Indicator

IVC caliber, correlated well with Rt. subclavian vein caliber as an echocardiographic indicator of systemic congestion



Hemodynamic Indicator

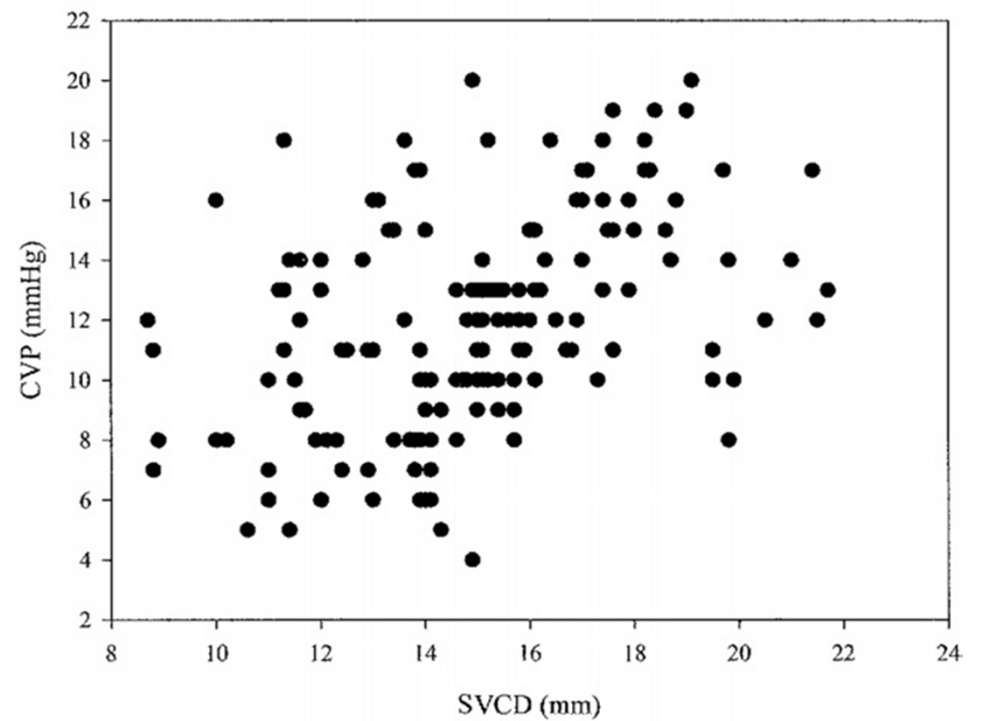
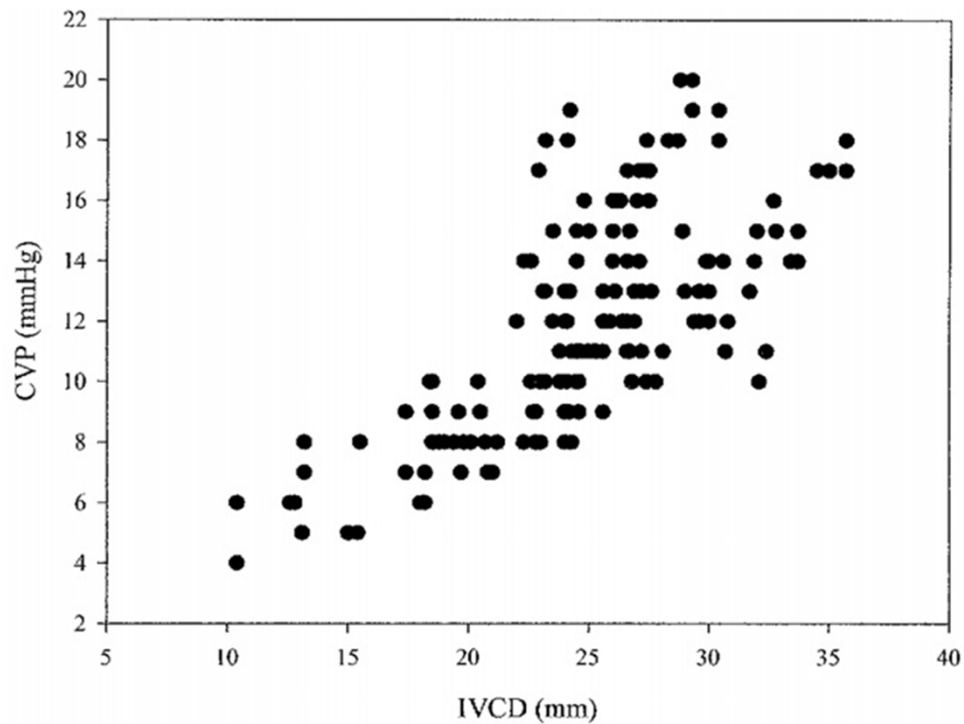
IVC diameter with TEE



Correlation of IVC diameter and mean CVP

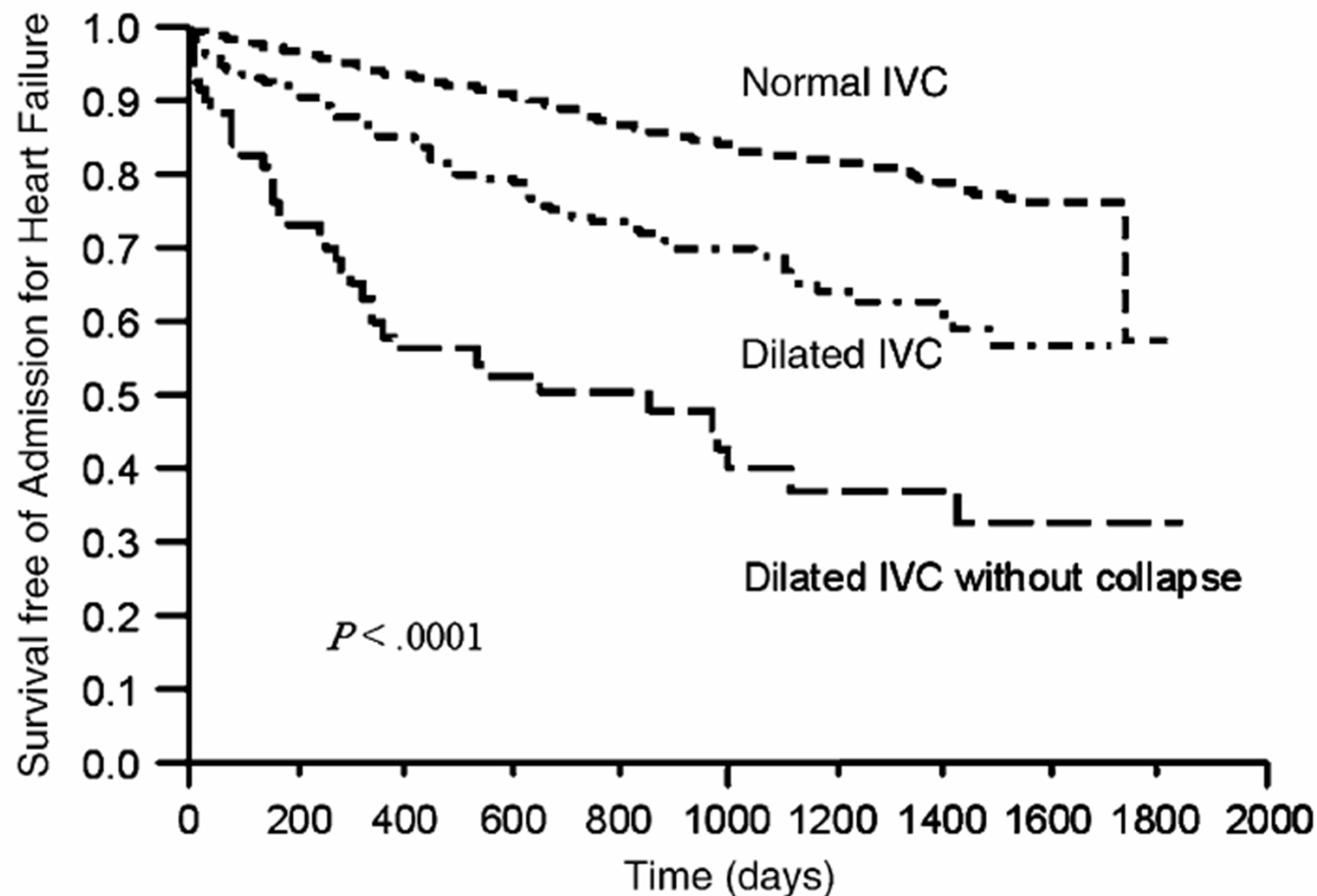
Hemodynamic Indicator

IVC diameter & CVP correlation during cardiac surgery or mechanical ventilator application



Prognostic Indicator

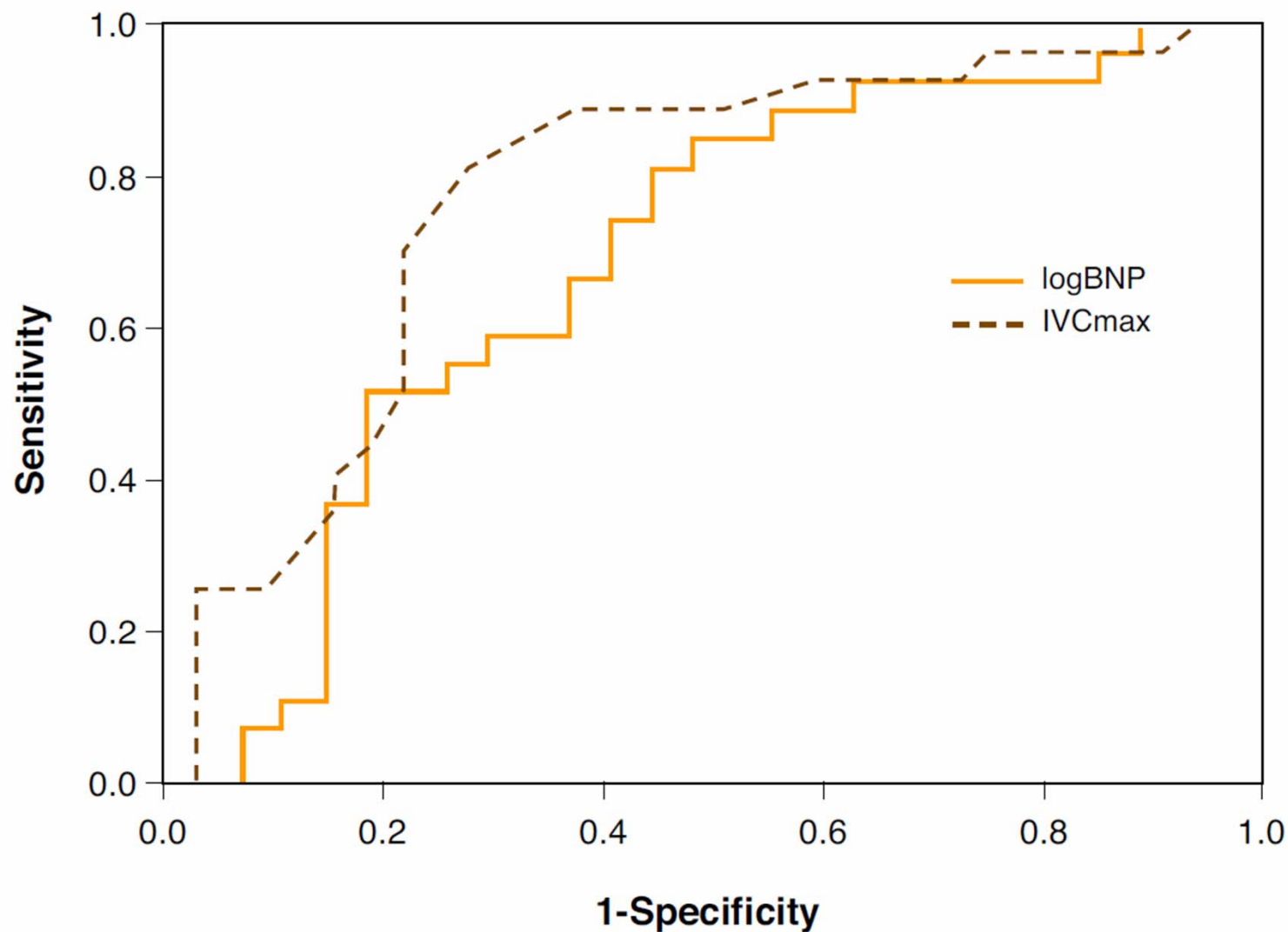
IVC diameter & CVP correlation during cardiac surgery



- Survival free from HF hospitalization is delayed for patients with different IVC morphology.
- Event-free survival is greatest for those with a normal IVC.

Prognostic Indicator

Assessment of IVC and NT-ProBNP for Predicting Readmission After Hospitalization for ADHF



Take Home Message

1) Imaging of the IVC should be part of the routine 2DE examination.

2) Doppler recordings of SVC flow are useful in certain situations;

For example, LV dysfunction , or Preload evaluation

3) RA is not merely reservoirs or conduits.

Considering RA function,

RA area or 3D-volume may be reasonable evaluation tools

If these three structures would be evaluated more adequately

Proper treatment can be initiated more accurately.

The effects of treatment on the right sided heart can be evaluated.

Comprehensive Assessment of Right Atrial & Caval Function

Thank you
for your attention !

Hyungseop Kim. MD., PhD.

Division of Cardiology, Department of Internal Medicine
Keimyung University Dongsan Medical Center, Daegu, Korea