

Chronic Tricuspid Regurgitation

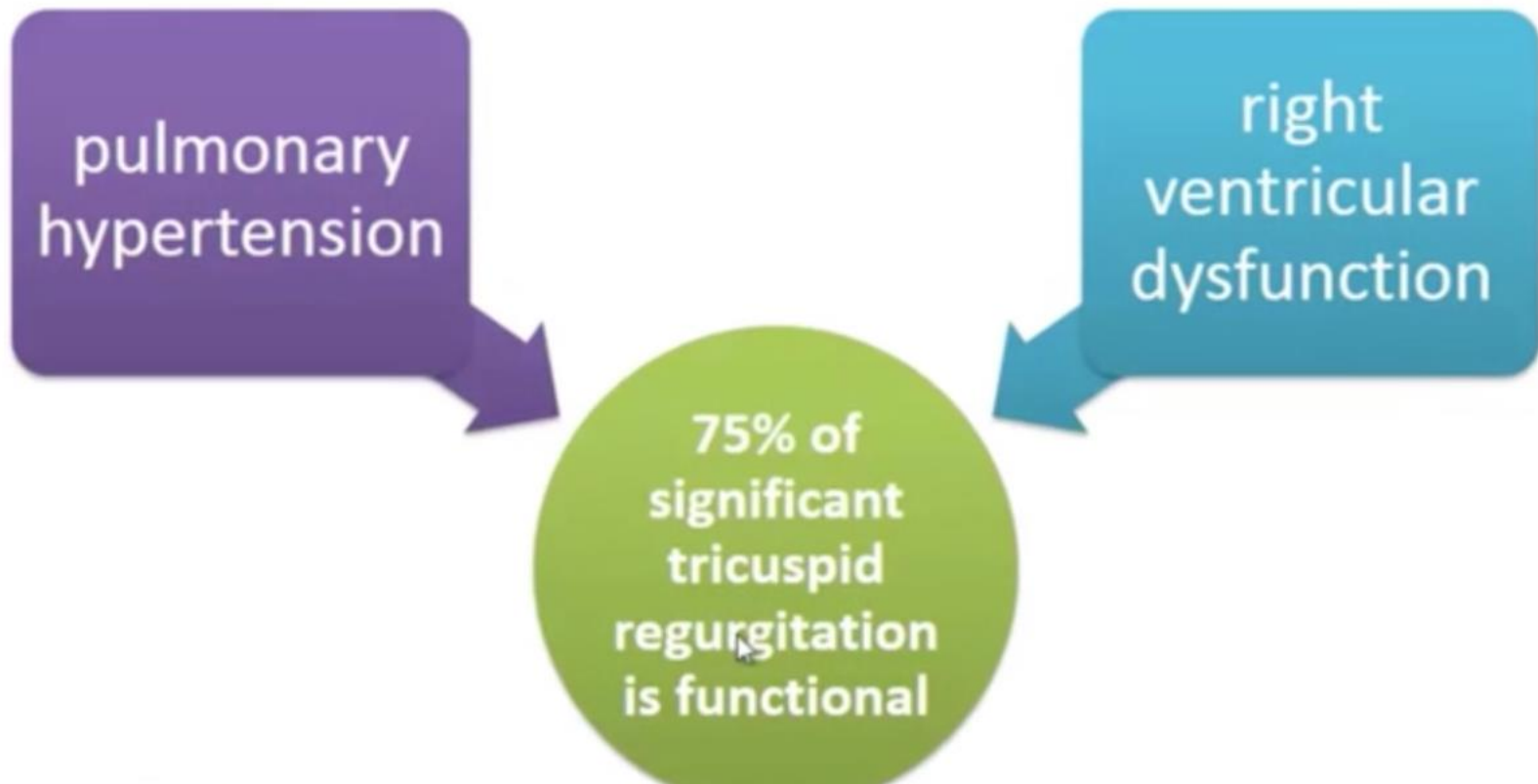
Horses and Zebras (and Zorses)

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Conflict of Interest:
Siemens- Research Support

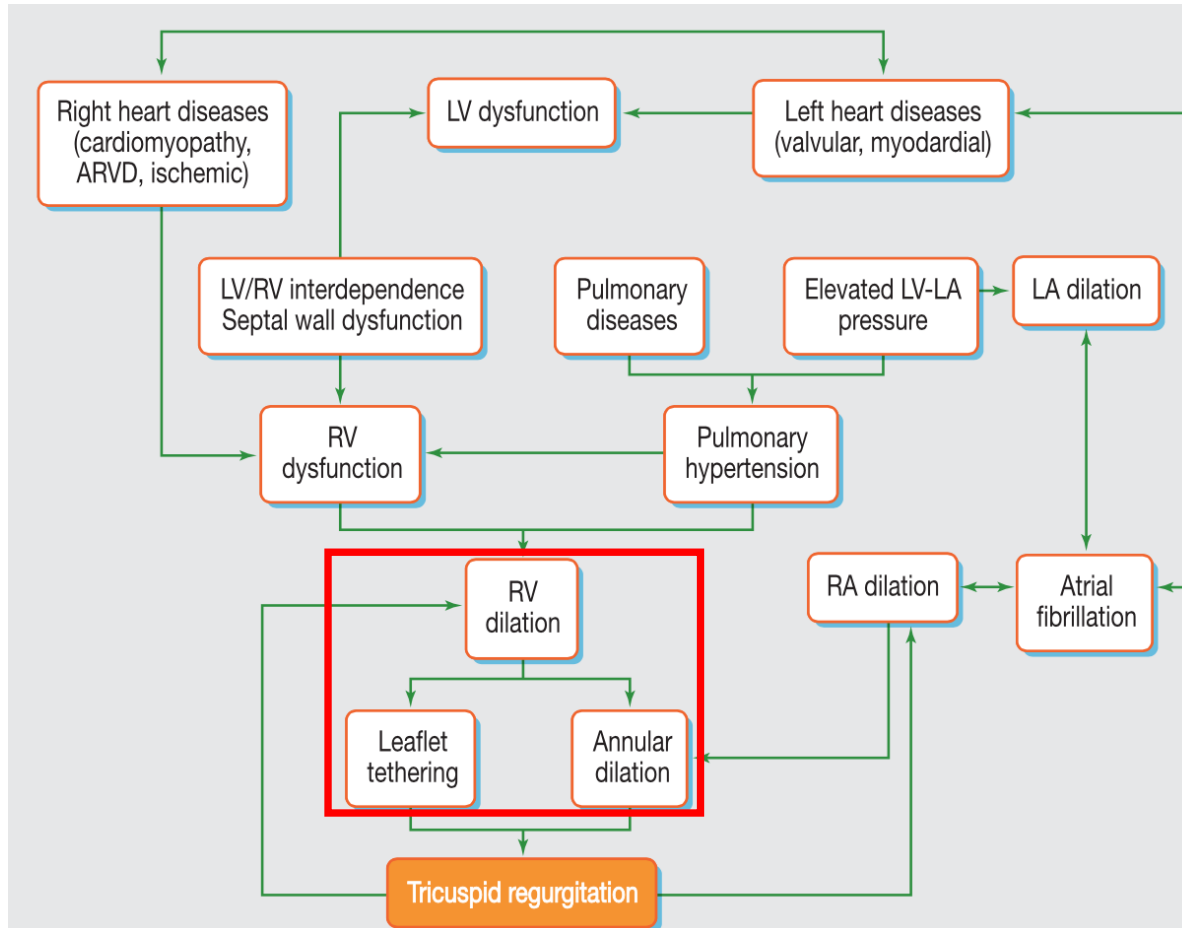
Functional TR

Incidence



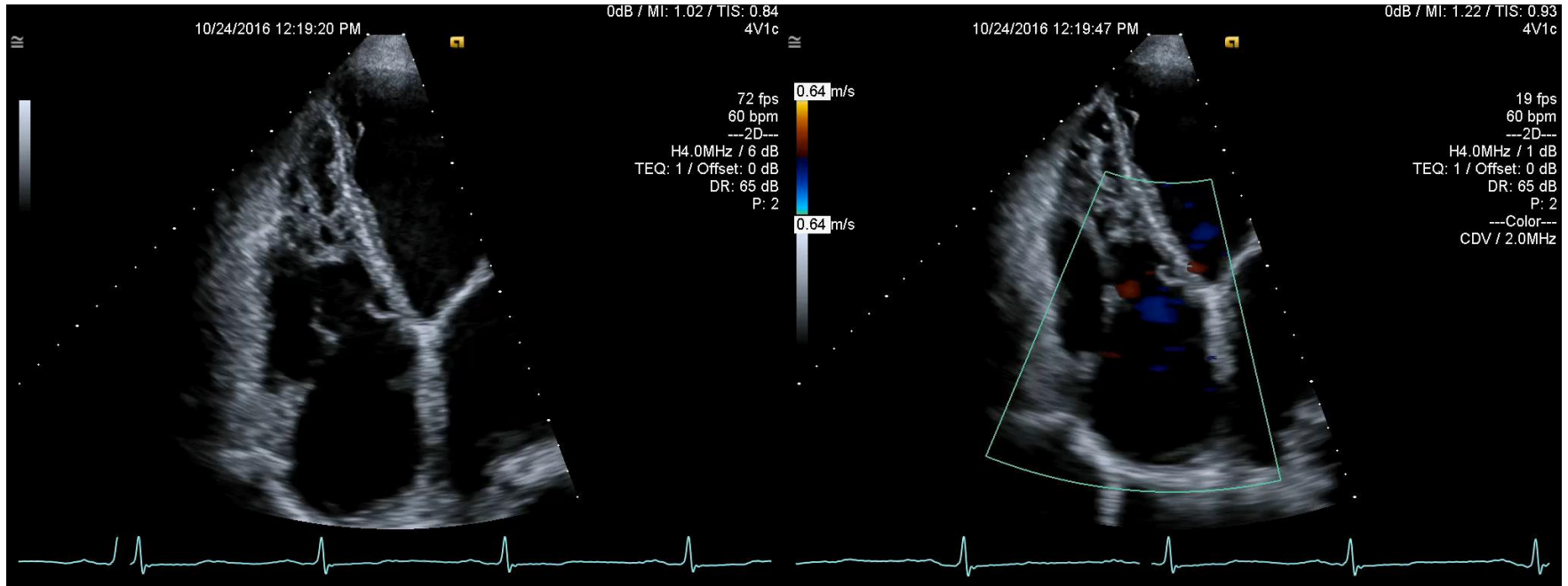
Functional TR

Patho-physiology and Anatomical Substrate



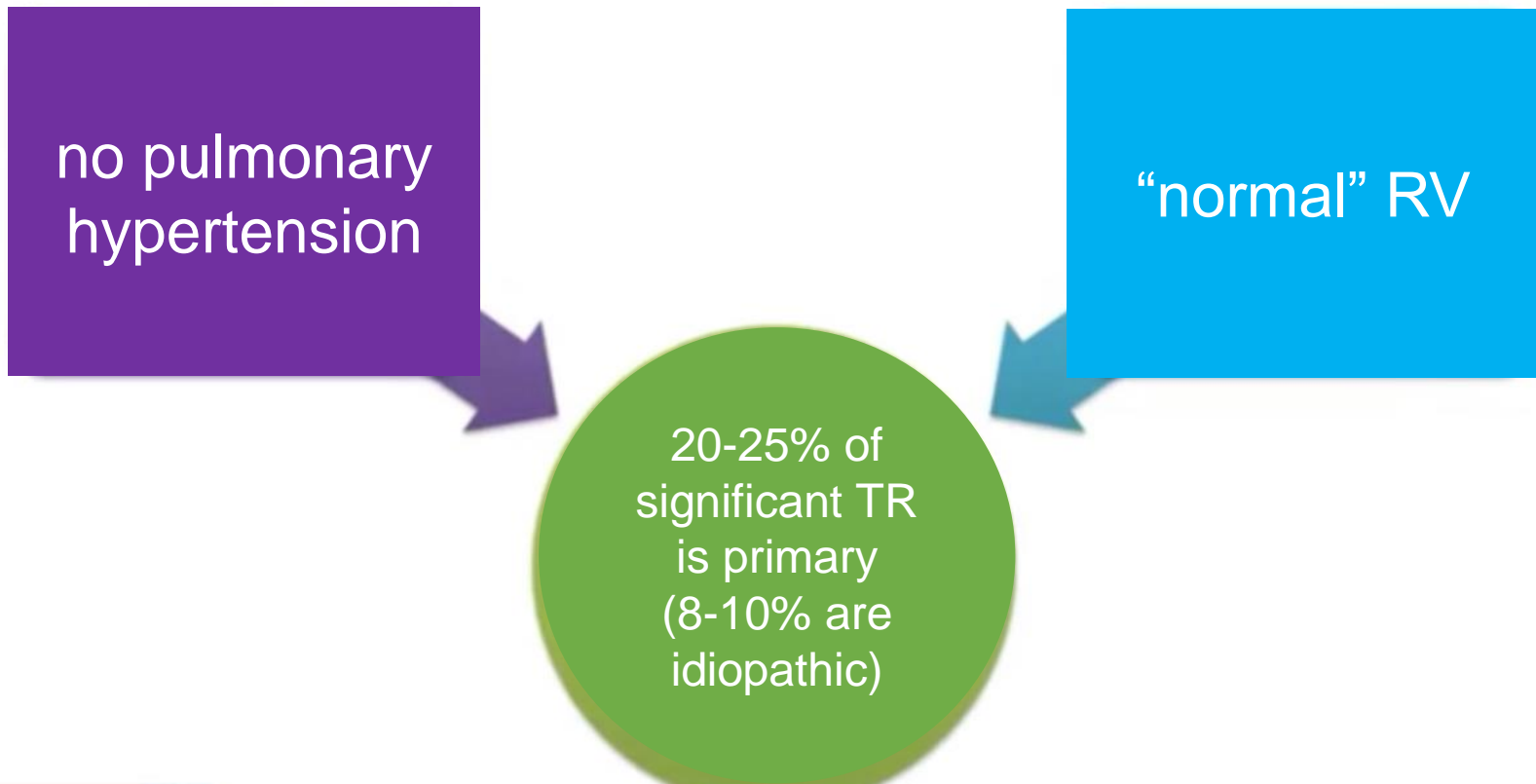
Secondary TR

Leaflet Abnormality



Primary TR

Incidence



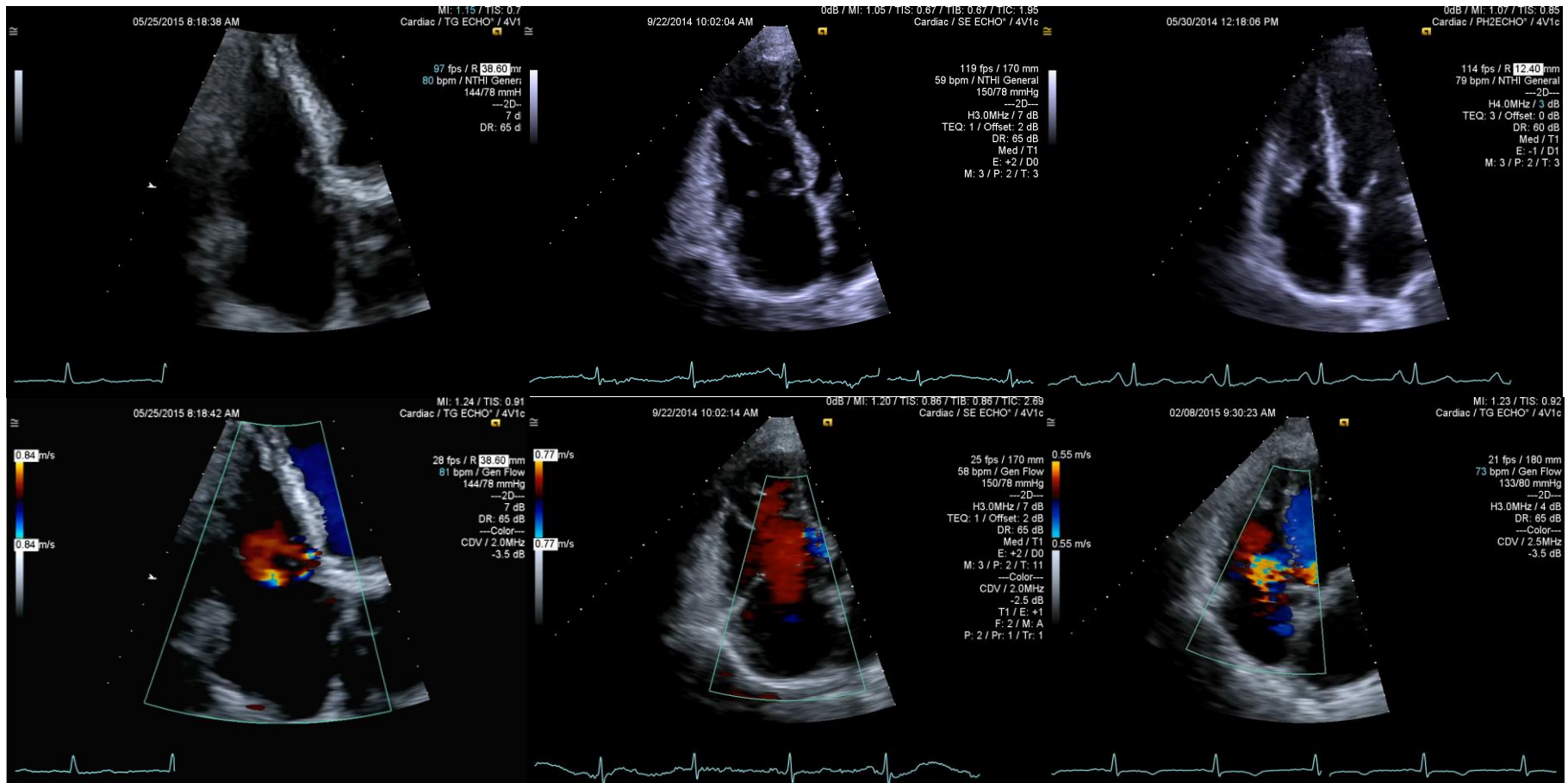
Primary TR

Leaflet Abnormality

Prolapse: Septal leaflet

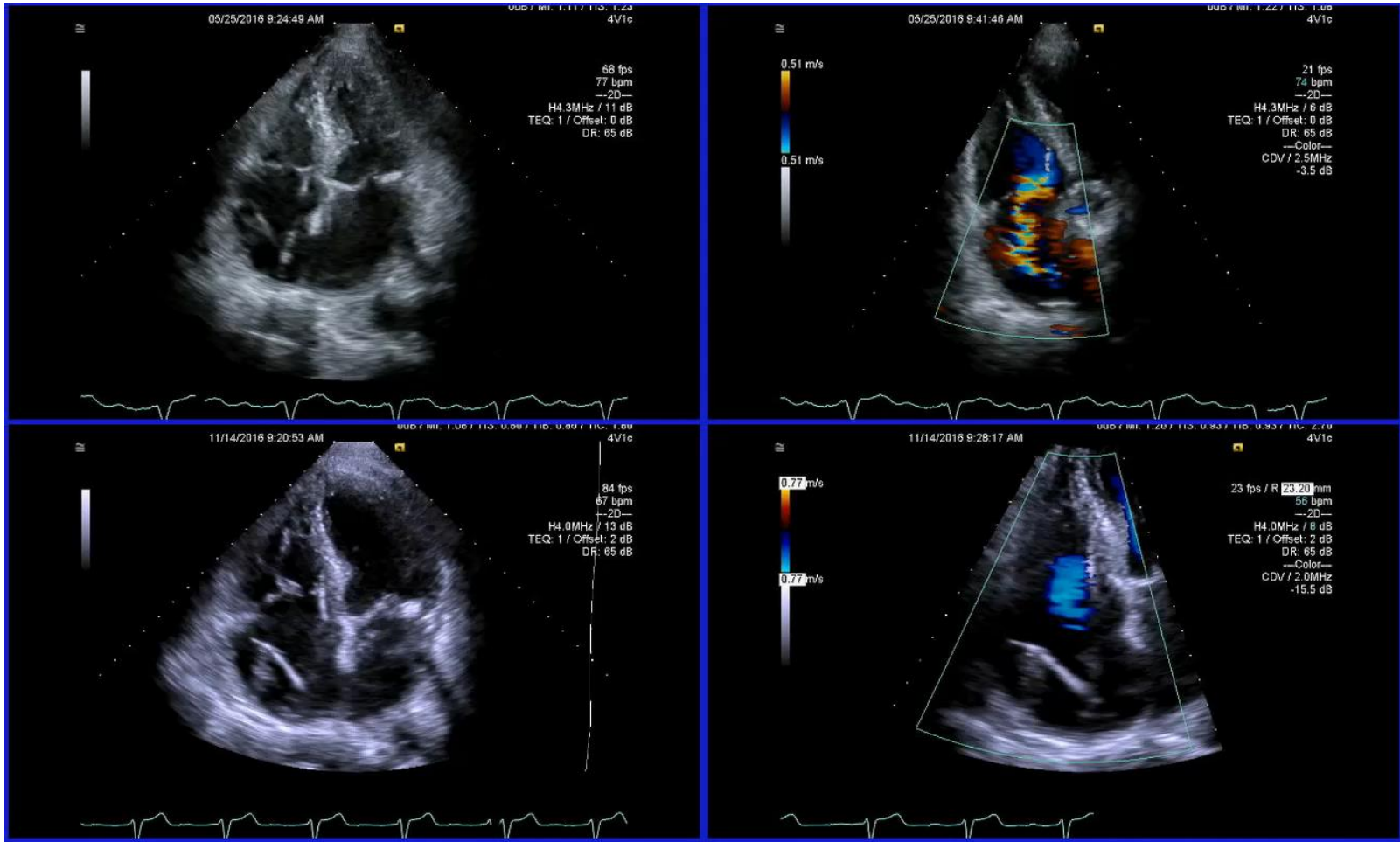
Carcinoid Heart Disease

Endocarditis



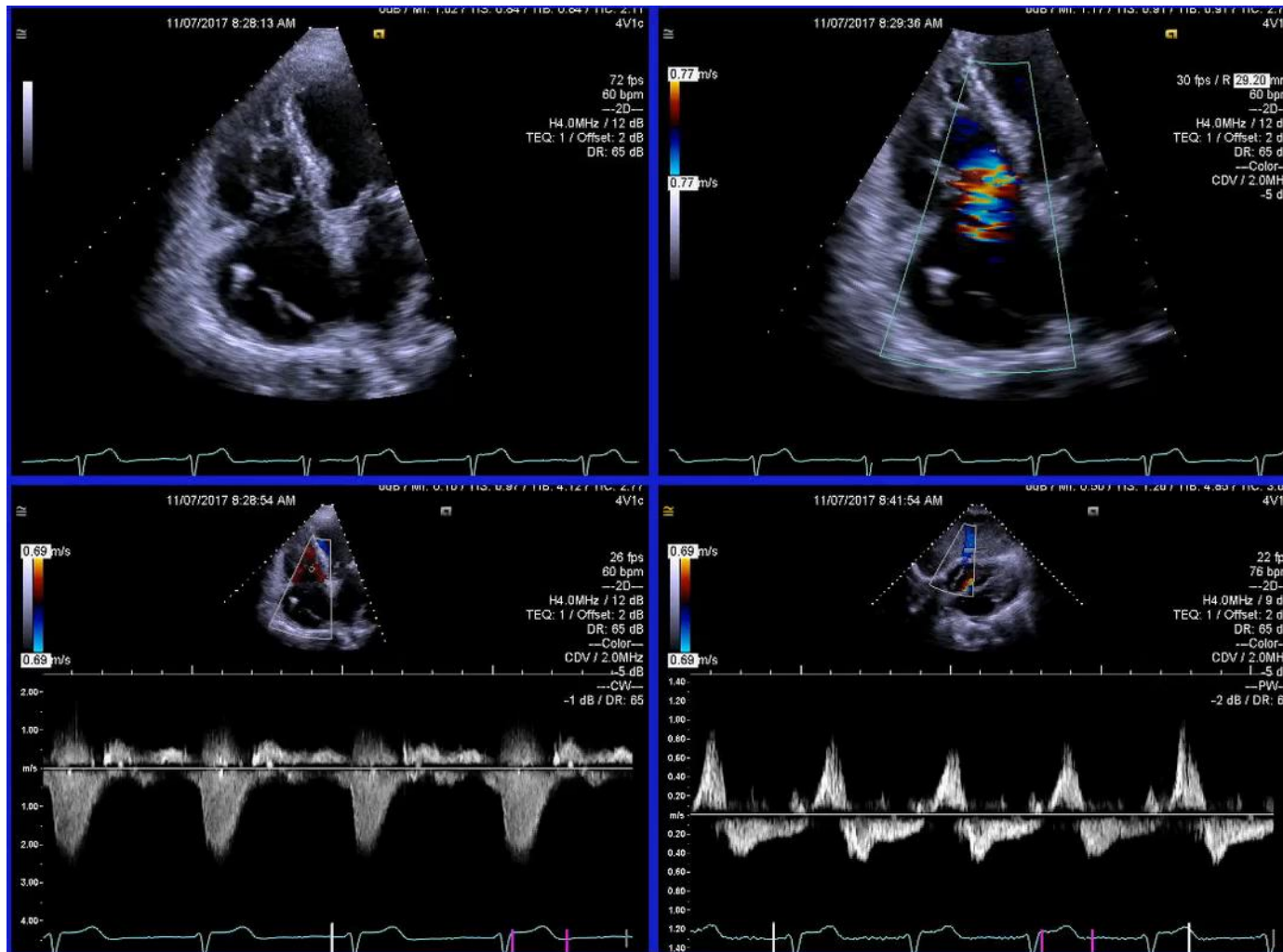
Primary TR

Pacemaker Lead Induced



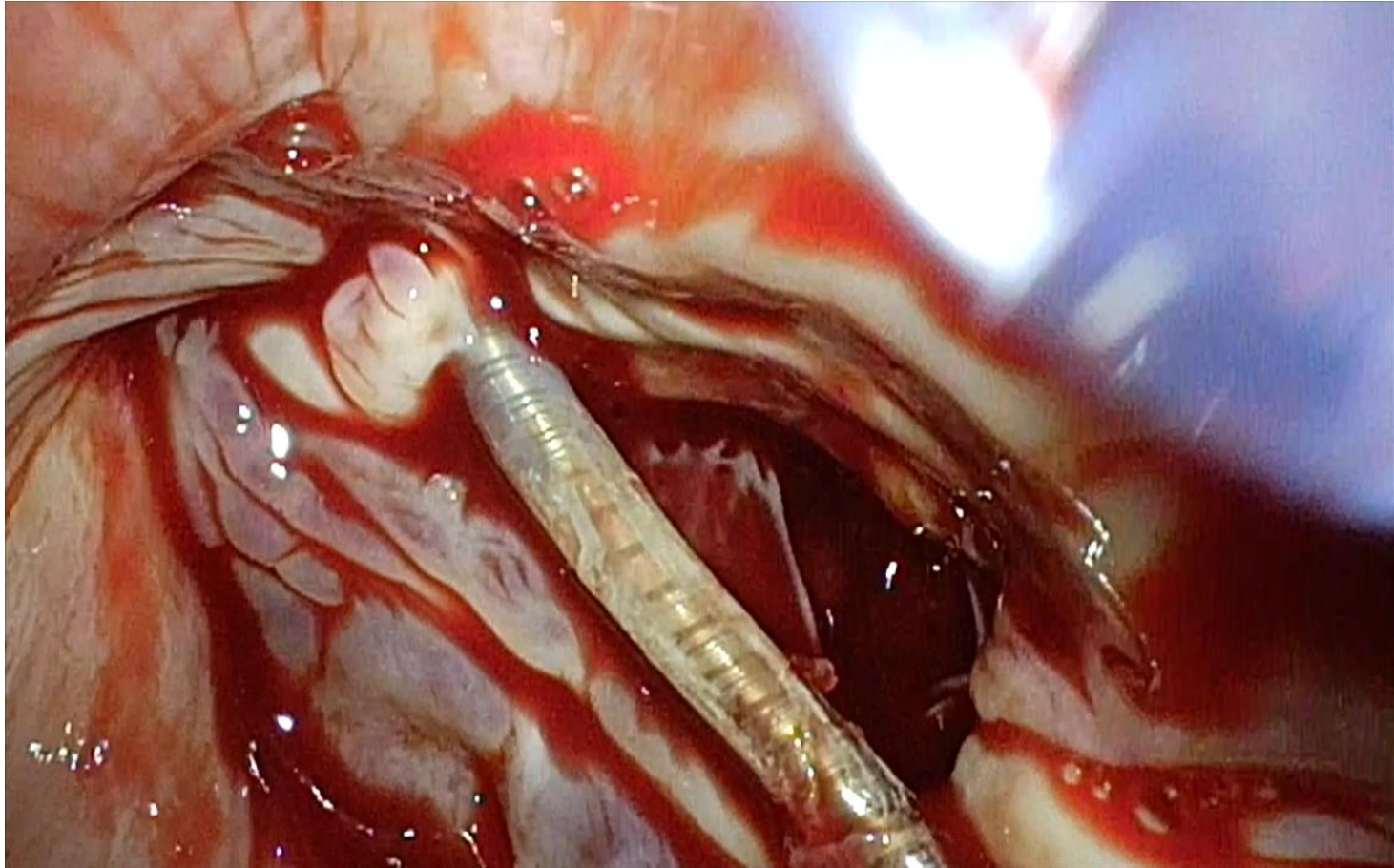
Primary TR

Pacemaker Lead Induced – Post Lead Extraction



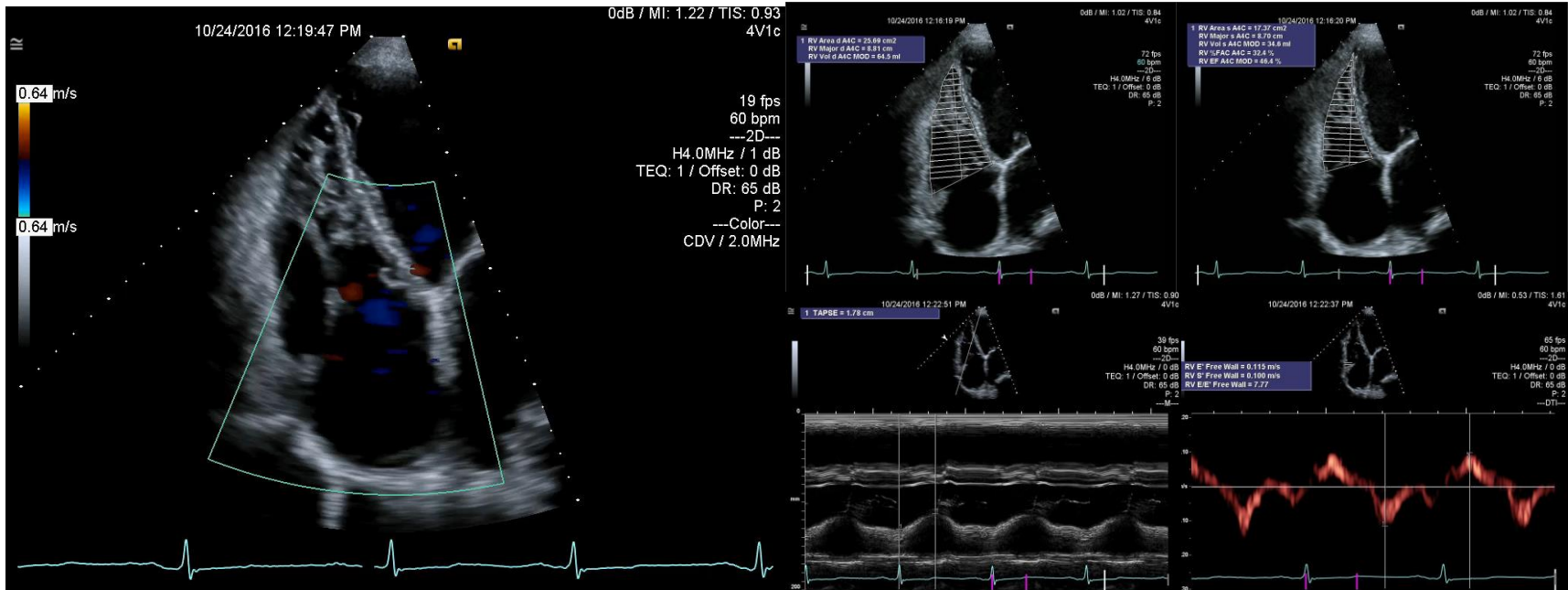
Primary TR

Pacemaker Lead Induced - Surgery



Chronic TR

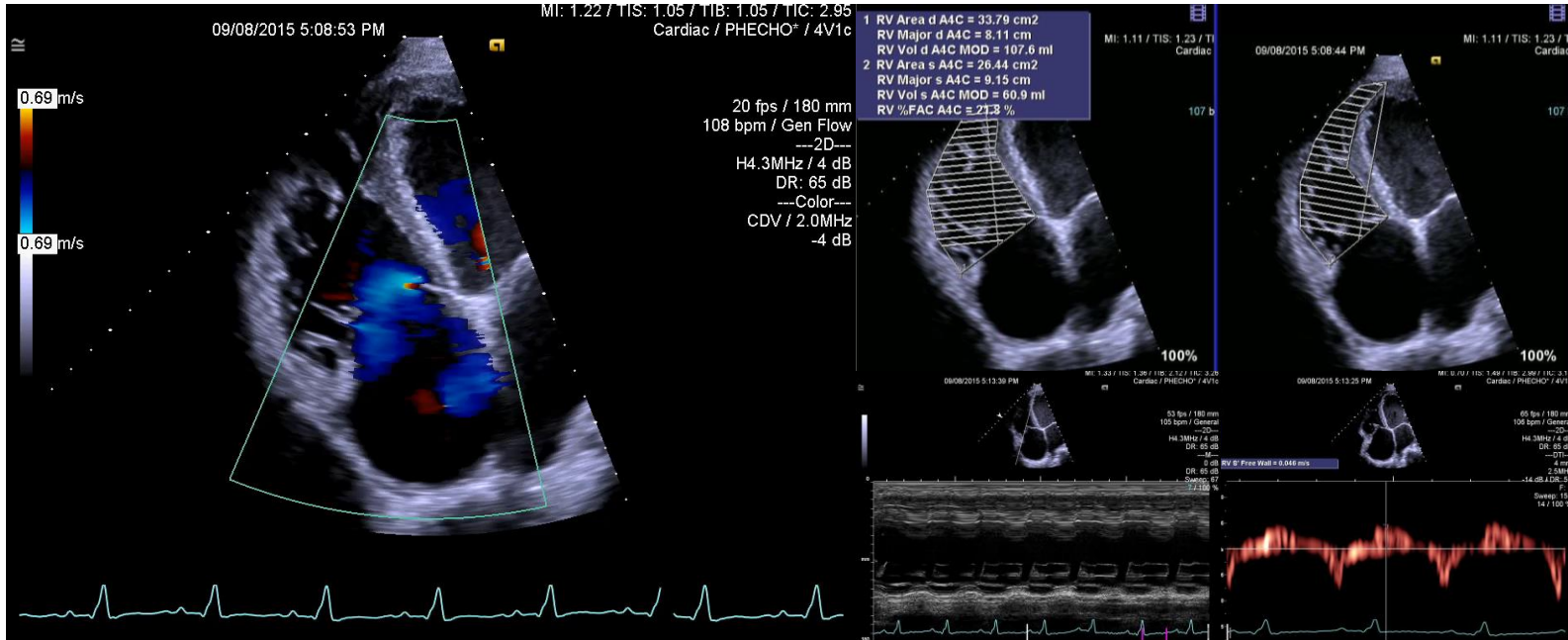
Timing of Intervention – RV Function



	<i>Normal value</i>	<i>Actual Values</i>
FAC	≥ 35 %	33 %
TAPSE	> 16 mm	18 mm
S' Wave	≥ 10 cm/s	10 cm/s

Chronic TR

Timing of Intervention – RV Function



	Normal value	Actual Values
FAC	≥ 35 %	22 %
TAPSE	> 16 mm	9 mm
TDI S' Wave	≥ 10 cm/s	5 cm/s

Chronic TR

Timing of Intervention

Degree of tricuspid regurgitation	Mild	Moderate	Severe	Late sequelae severe
Symptoms	None	None	Fatigue, dyspnea, satiety, atrial arrhythmia	Worsened fatigue, dyspnea, satiety, abdominal distention from ascites; upper GI bleeding from esophageal varices; atrial arrhythmias
JVP	<7 cmH ₂ O	<7 cmH ₂ O	“cV” wave apparent above clavicle	Elevated, at mandible with “cV” wave
Right ventricle	No lift, PMI not displaced	No lift, PMI not displaced	Lift	Lift and PMI displaced
Murmurs/Gallops				
Rest (sensitivity)	None	LLSB (20%)	LLSB (68%)	LLSB (68%)
Frequency of Increase with Inspiration	None	15%	15%; RVS ₃	15%; RVS ₃
Second heart sound	Normal	Normal	Normal or RBBB and widely split	Normal and RBBB widely split
Abdominal	Normal	Normal	Pulsatile liver	Pulsatile and distended liver, ascites
Lower extremities	Normal	Normal	Pedal edema	anasarca
Hemoglobin	Normal	Normal	Mild anemia, secondary hypersplenism	Hgb <11 g/dL
Creatinine	Normal	Normal	Drop in GFR due to perfusion	Fall in GFR

Chronic TR

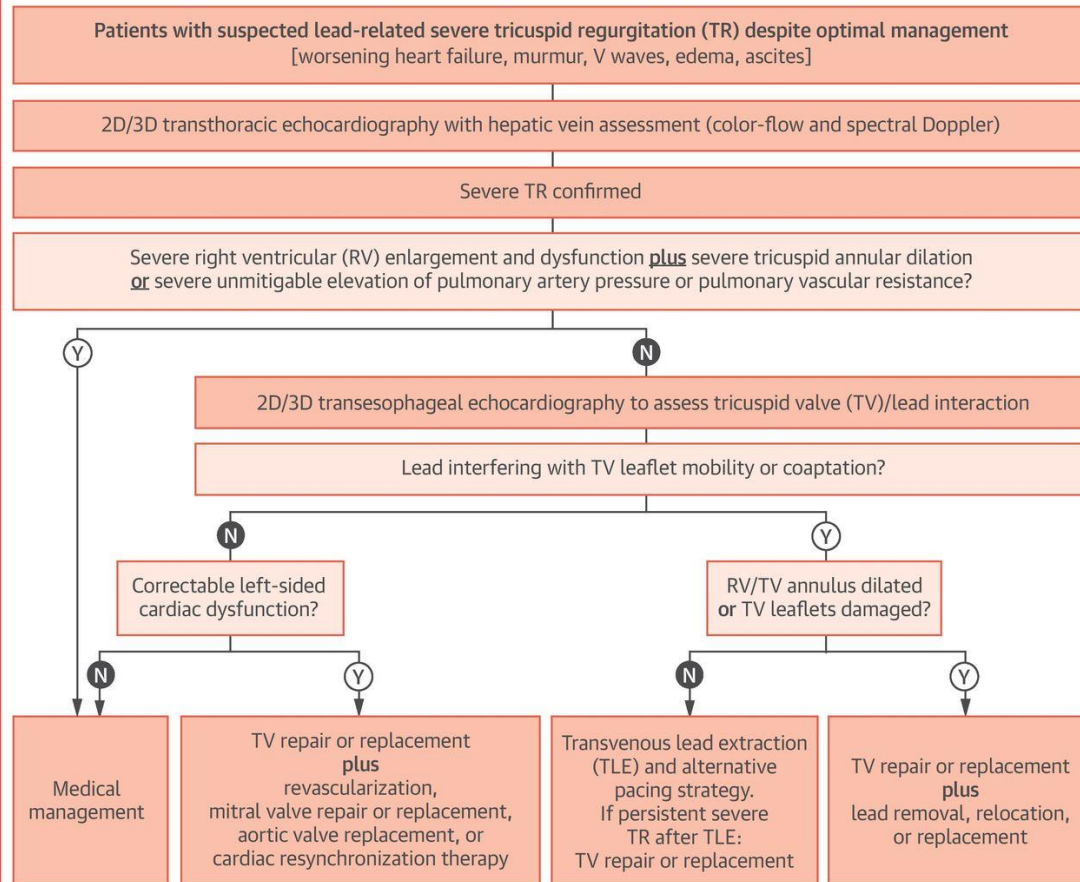
Timing of Intervention

Tricuspid valve components	Mild	Moderate	Severe	Late sequelae severe
Leaflet	Mild prolapse or mal-coaptation	Prolapse, restriction	Flail, perforation, retraction	Can have tethering
Annulus	Normal <4 cm (21 mm ²)	Normal <4 cm	Normal <4 cm	May dilate
R.V. echo parameters				
ED area	Normal	Normal	Increased	Increased
ES area	Normal, <20 cm ²	Normal, <20 cm ²	Increased, >20 cm ²	>>20 cm ²
% area change	>40	>40	>35	<35
Septum	Normal	Normal	Normal to bulging left	Bulging left
TAPSE*	>16 mm	>16 mm	>16 mm	<16 mm
S' (cm/s)**	>10 cm/sec	>10 cm/sec	~10 cm/sec	<10 cm/sec
IVC	Normal	Normal, mild dilation	± dilated	Dilated (>2.1 cm) and ↓ respirophasic
R→L shunting	-	-	-	Possible
Catheterization lab				
RA pressure	Normal 3–9 mmHg	Normal 3–9 mmHg	>9 mmHg	>>9 mmHg
cV Wave	None	Late, small	Earlier, large	Early, large, ventricularized
RVEDP	<10 mmHg	<10 mmHg	~10–14 mmHg	>14 mmHg
Tricuspid stenosis structural				
Leaflets				
Annulus	Not large, <40 mm			
Tapse	Reduced			
IVC	Dilated			
RA	Size increased			

Chronic TR

Timing of Intervention

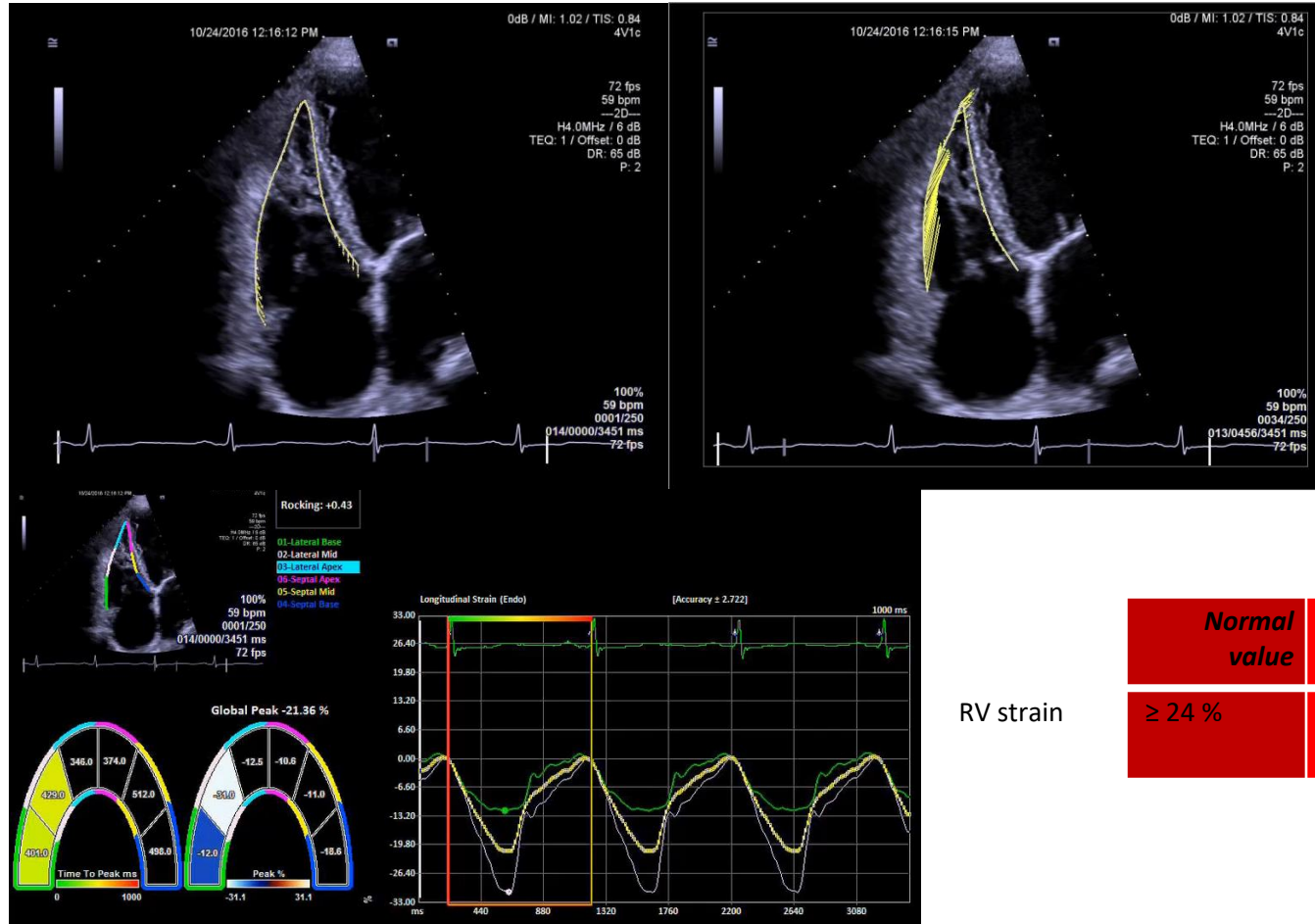
CENTRAL ILLUSTRATION: Decision Tree for Cardiac Implantable Electronic Device Lead Removal for the Indication of Tricuspid Regurgitation in the Absence of Device or Endovascular Infection



Chang, J.D. et al. J Am Coll Cardiol. 2017;69(18):2331-41.

Chronic Secondary TR

RV Strain

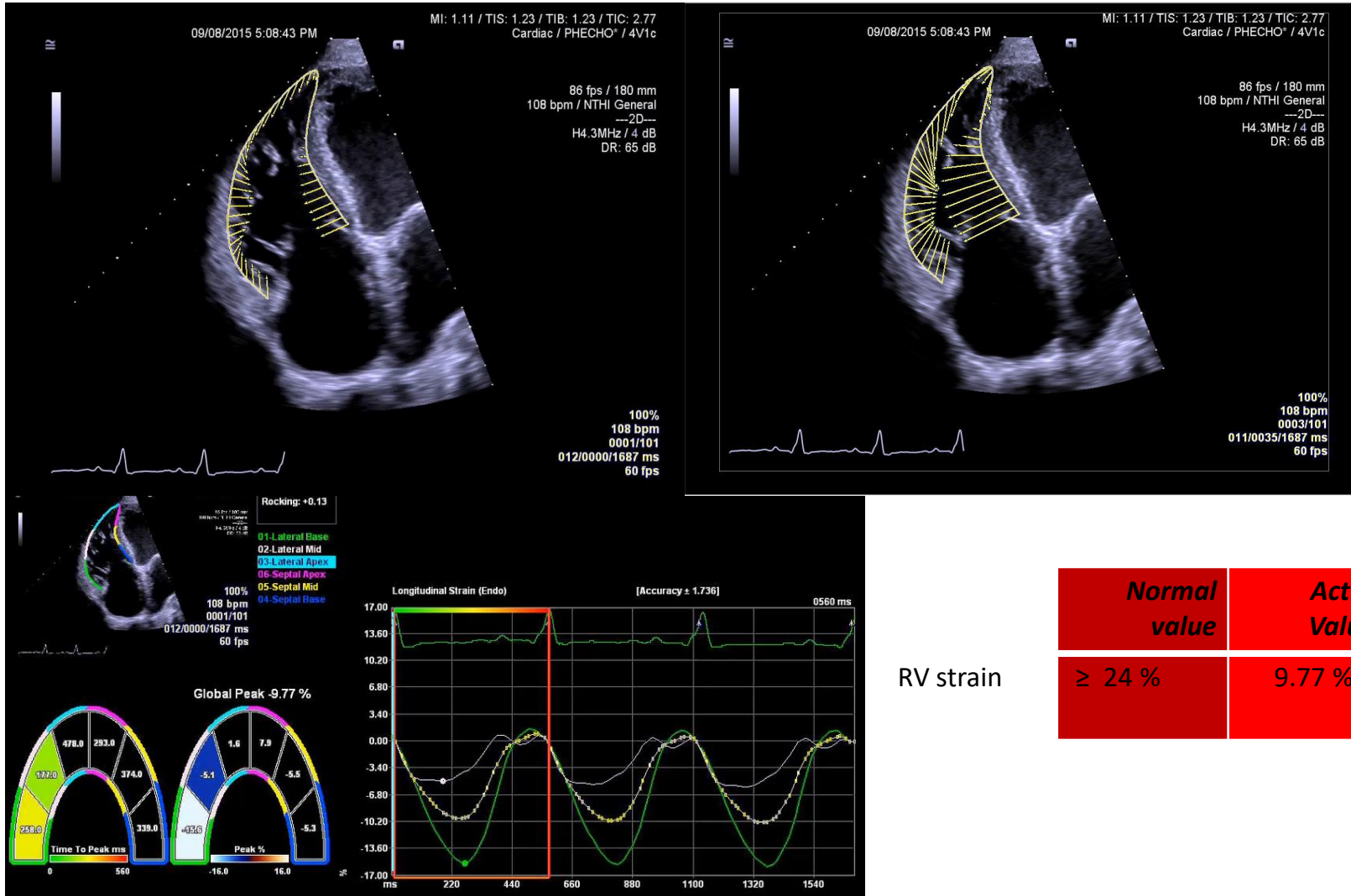


RV strain

Normal value	Actual Values
≥ 24 %	21.36 %

Chronic Secondary TR

RV Strain

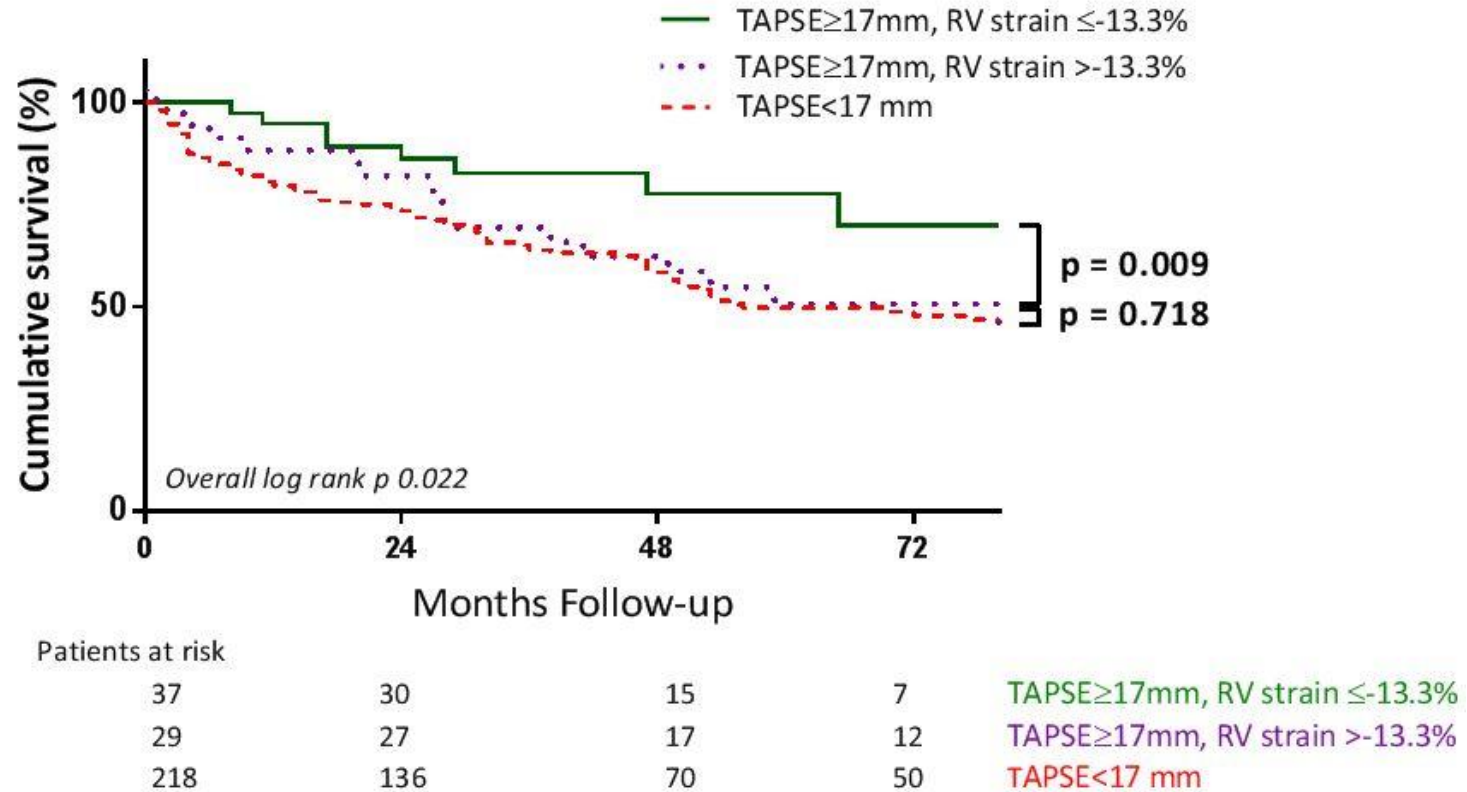


RV strain

Normal value	Actual Values
≥ 24 %	9.77 %

Why Measure RV Strain?

GLS in Functional TR



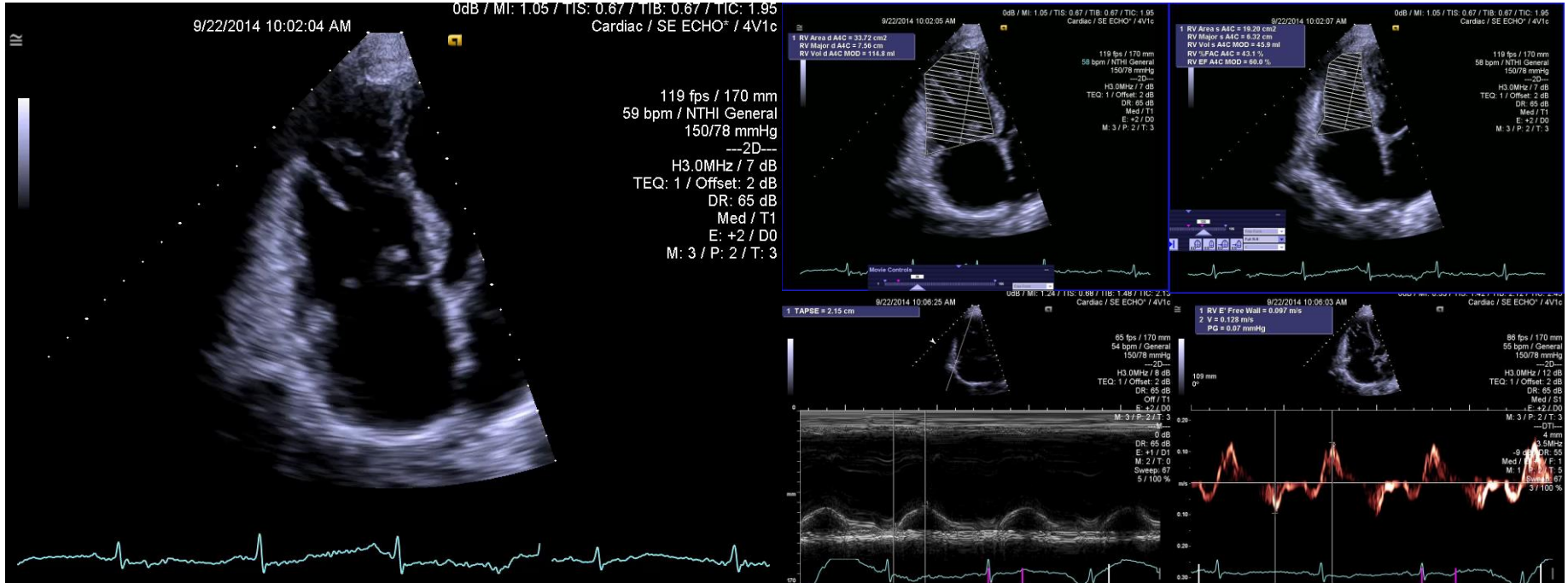
Chronic TR

Timing of Intervention

Items	Indications	Caution
1.	Severe, symptomatic tricuspid regurgitation	Already present signs of right ventricular late sequelae, right ventricular end systolic area >20 cm ² , or area change <35%, hypersplenism, co-morbidities, → increased operative mortality, may limit survival to less than few years
2.	Severe, asymptomatic tricuspid regurgitation with early signs of right ventricular impairment; right ventricular end diastolic area increased; right ventricular end systolic area increasing; reduced exercise capacity with transient lack of right ventricular end systolic area improvement	–
3.	With spontaneous bacterial endocarditis involving tricuspid valve. Vegetation on tricuspid valve >20 mm with severe tricuspid regurgitation; right heart failure with severe tricuspid regurgitation; recurrent emboli; intractable fever despite antibiotics	–

Chronic TR

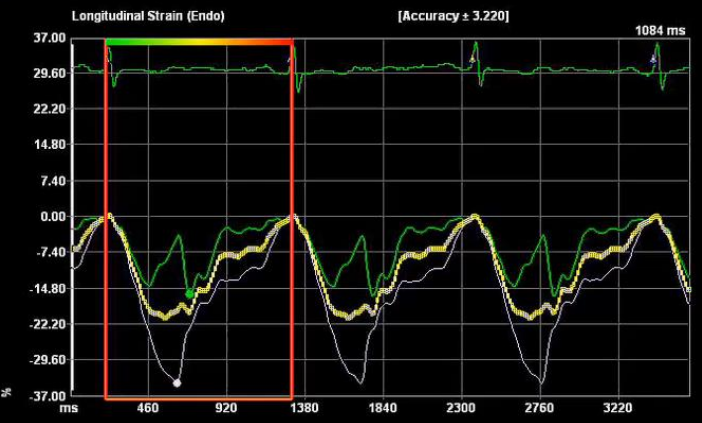
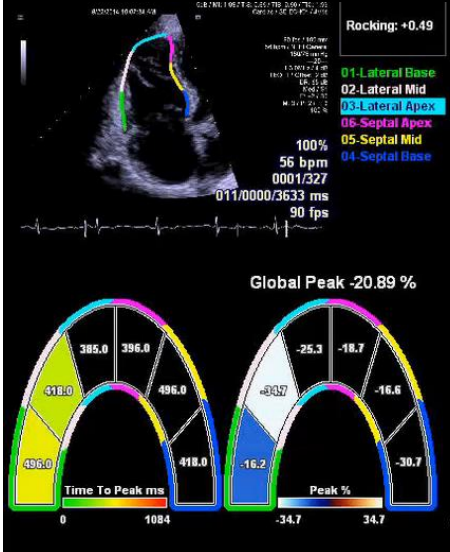
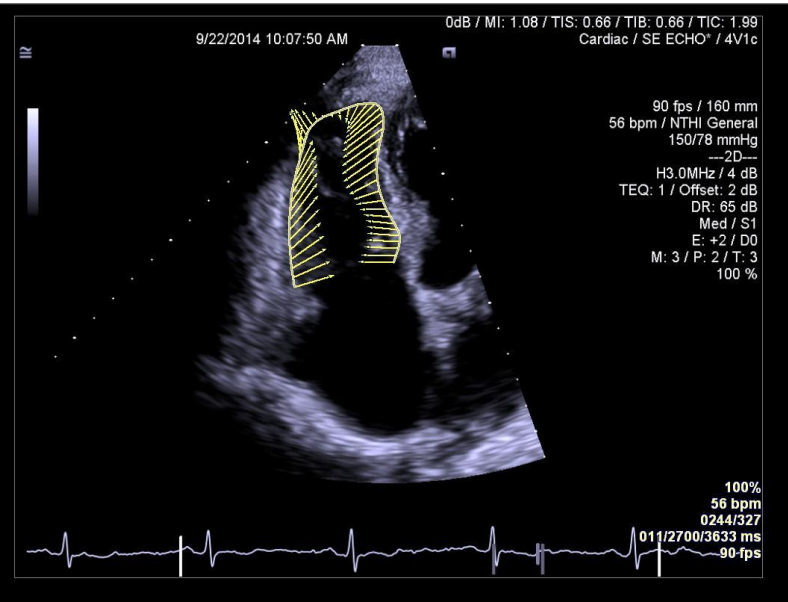
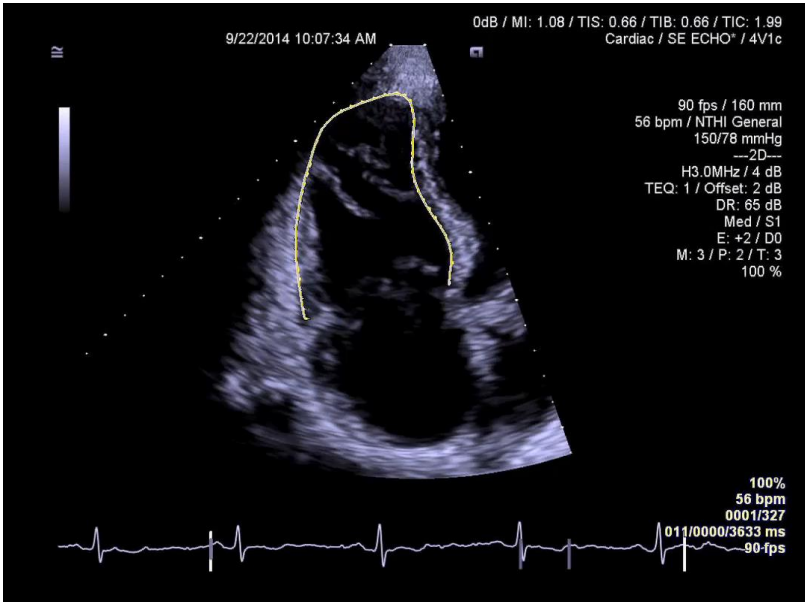
Timing of Intervention – RV Function



	<i>Normal value</i>	<i>Actual Values</i>
FAC	≥ 35 %	43 %
TAPSE	≥ 16 mm	22 mm
S' Wave	≥ 10 cm/s	13 cm/s

Chronic TR

RV Strain



RV strain

Normal value	Actual Values
≥ 24 %	20.89 %

Chronic Significant TR

Horses, Zebras, Zorses



Functional (Secondary) TR



Mixed Pathophysiology
RV Function



Primary TR