

AZIENDA OSPEDALIERO-UNIVERSITARIA "S. MARIA DELLA MISERICORDIA"
DI RILIEVO NAZIONALE E DI ALTA SPECIALIZZAZIONE
UDINE



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DIPARTIMENTO DI SCIENZE CARDIOPOLMONARI
S.O.C. Cardiologia – *Direttore: Paolo M. Fioretti*

HOW TO EVALUATE AND TREAT TRICUSPID REGURGITATION IN THE YEAR 2009?

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*Dr. Badano received honoraries and research grants from GE Healthcare, Sorin Cardio S.p.A,
Edwards Life Sciences, Actelion

*No off-label uses of devices or equipment

TRICUSPID REGURGITATION

Etiology

“Organic” due to primary valve disease (25%)

- Rheumatic
- Myxomatous
- Ebstein anomaly
- Endomyocardial fibrosis
- Endocarditis
- Carcinoid disease
- Traumatic (blunt chest injury, laceration)
- Iatrogenic (pacemaker/defibrillator lead, RV biopsy)

“Functional” due to annular dilatation (75%)

- Left heart disease (LV dysfunction or valve disease) resulting in pulmonary hypertension;
- Pulmonary hypertension (COPD, pulmonary thromboembolism, left-to-right shunt;
- RV dysfunction (myocardial disease, RV ischemia/infarction).



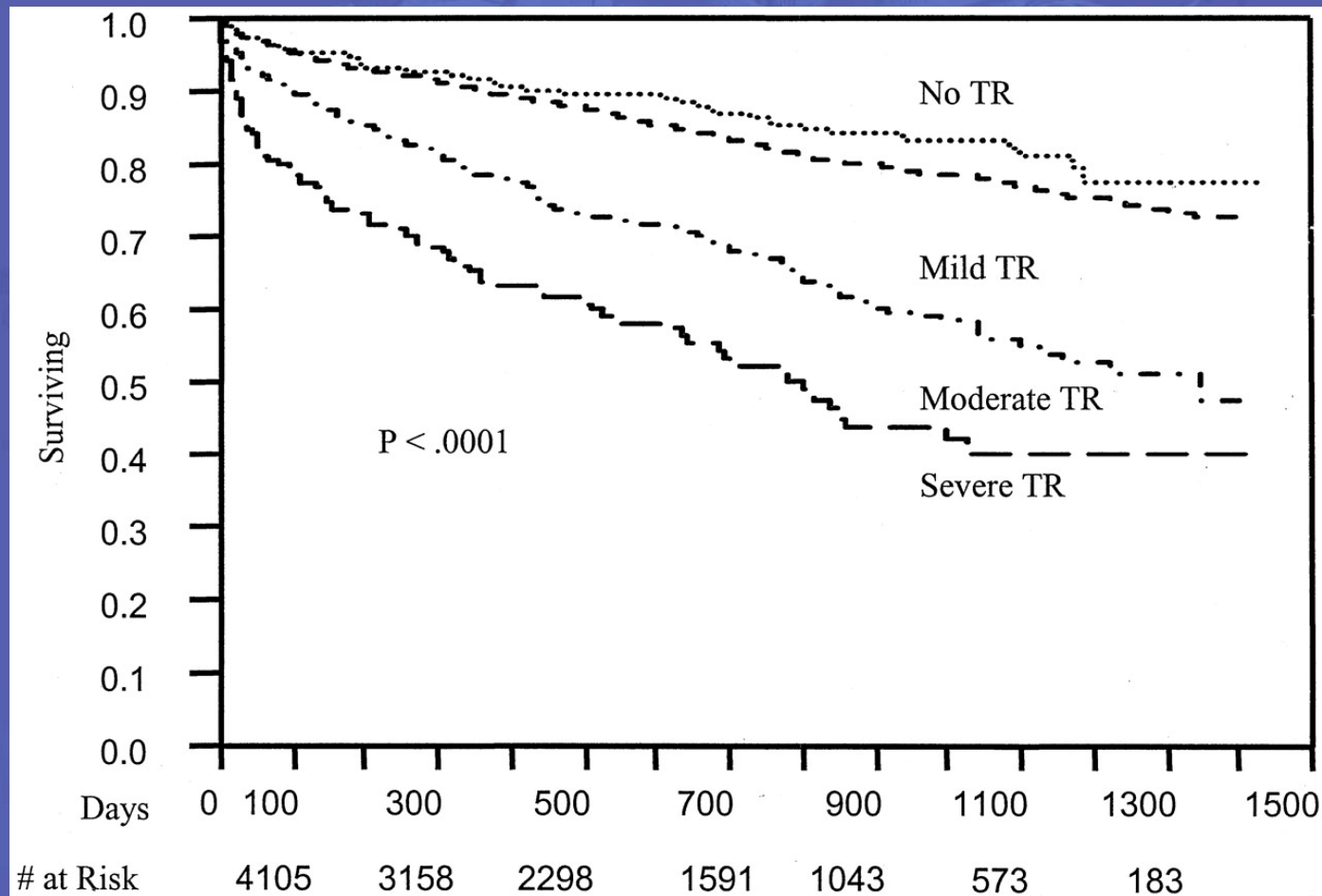
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WHY CARING ABOUT TRICUSPID REGURGITATION?

Tricuspid Regurgitation and Prognosis



Nath, J. et al. J Am Coll Cardiol 2004



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TRICUSPID REGURGITATION

Incidence

70% of normal subjects show trivial tricuspid regurgitation;

90% of cardiac patients have tricuspid regurgitation

ESTIMATED STRUCTURAL VALVULAR DISEASE IN US		
Moderate to severe & severe valve lesions	Population	Currently treated
Mitral regurgitation	2,520,000	48,000 (2%)
Aortic stenosis	749,000	79,000 (10%)
Tricuspid regurgitation	1,600,000	<8,000 (0.5%)

THE FORGOTTEN VALVE

Stuge O. et al. JCTS 2006



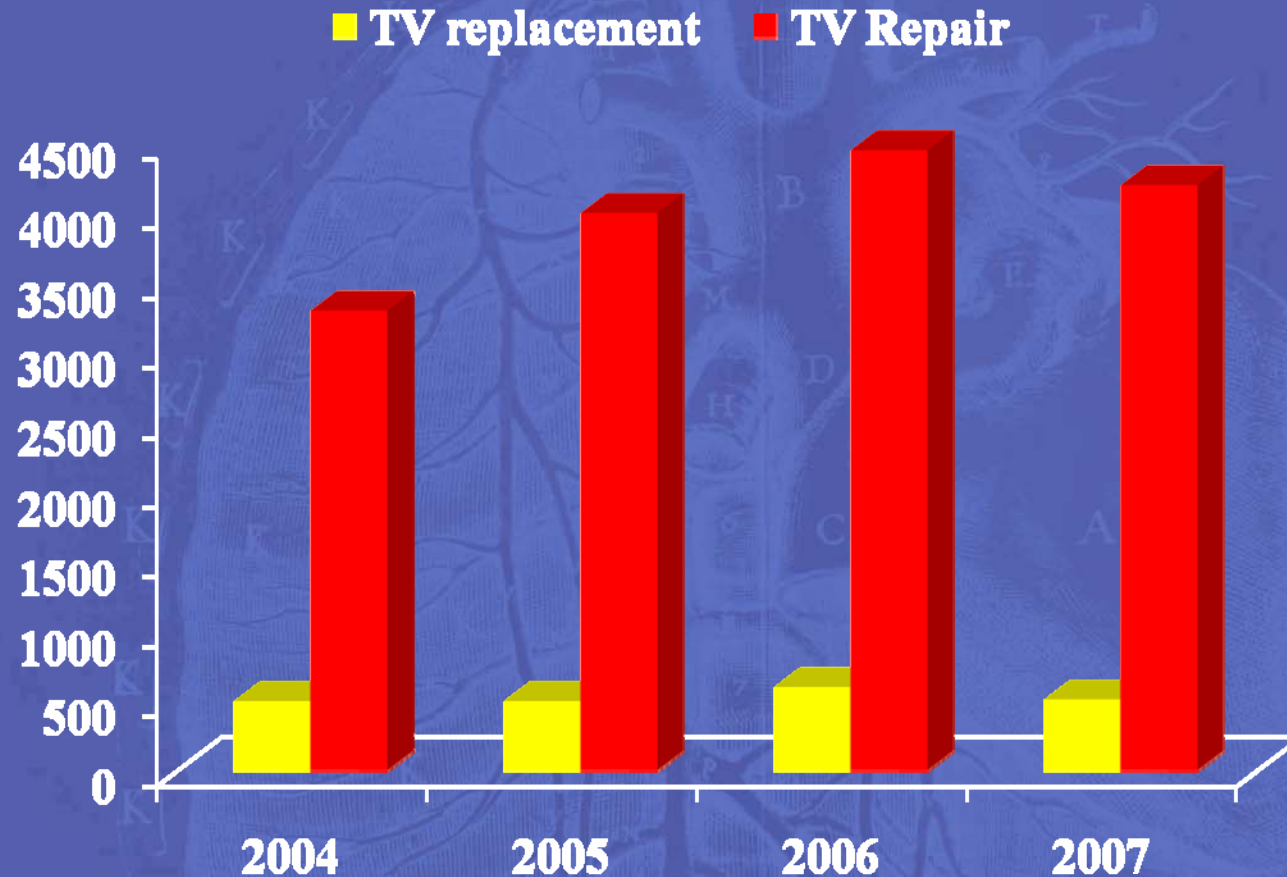
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TRICUSPID REGURGITATION

Society of Thoracic Surgeons Database



Mitral valve operations ~40,000/yr

Rogers JH. et al. Circulation 2009



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TRICUSPID REGURGITATION

European Guidelines for Management

Table 14 (modified). Indications for intervention in tricuspid regurgitation (TR)

	Class
Severe TR in pts undergoing left-sided valve surgery	IC
Severe primary TR and symptoms despite medical therapy without severe RV dysfunction	IC
Moderate organic TR in a patient undergoing left-sided valve surgery	IaC
Moderate functional TR with dilated annulus (> 40 mm) in a patient undergoing left sided valve surgery	IaC
Severe TR and symptoms, after left-sided valve surgery, in the absence of left-sided myocardial , valve or RV dysfunction and without severe pulmonary hypertension (i.e. Systolic PAP> 60 mm Hg	IaC
Severe isolated TR with mild or no symptoms and progressive dilation or deterioration of RV function	IbC

TRICUSPID REGURGITATION

When should we operate?

The timing of surgical intervention and the appropriate technique **remain controversial** mostly due to the **limited data available** and their heterogeneous nature (ESC Guidelines Valvular Heart Disease, 2007)

- No consensus to guide decision making
- Limited echo data about TV anatomy and regurgitation mechanism
- TV repair often dictated by team or surgeon predisposition
- Lack of clear guideline on TV repair indications

- Organic severe TR should always be treated;
- Severe functional TR should always be repaired;
- The question is how to manage Pts. with mild/moderate TR at initial surgery



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HOW TO ASSESS THE TV PRIOR TO LEFT HEART SURGERY

A Step-by-step approach

- Evaluation of TV structure, severity of regurgitation/stenosis and etiology;
- Assessment of TV annulus, RV size and function and pulmonay pressures (TV annulus diameter > 3.5 cm indication to TV annuloplasty?);
- Address transvenous pace maker related significant TV regurgitation;
- Communicate TV and right heart findings to the surgeon and surgical team

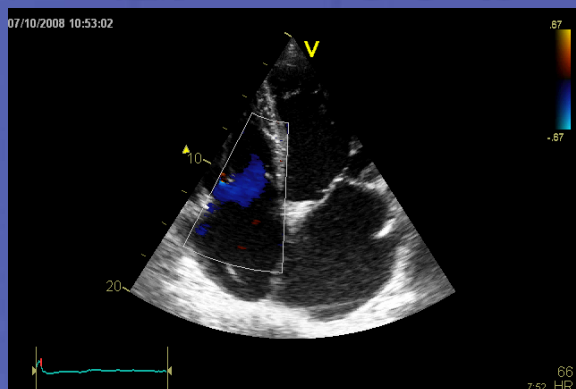


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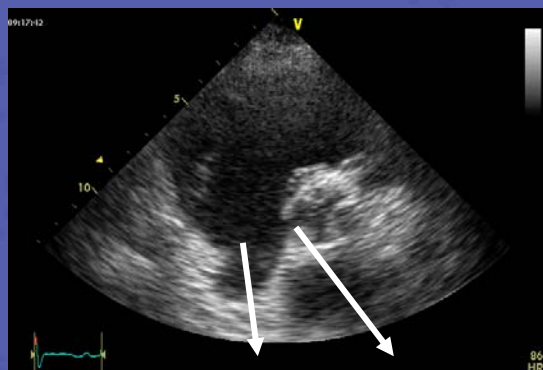
ASSESSMENT OF TRICUSPID REGURGITATION SEVERITY



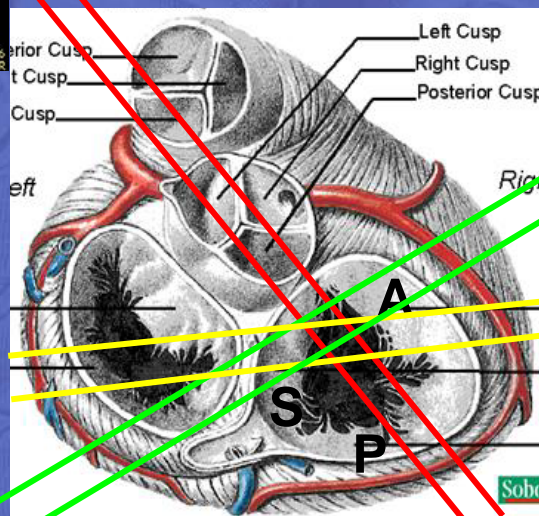
Parameter	Mild	Moderate	Severe
Tricuspid valve	Usually normal	Normal or abnormal	Abnormal/Flail leaflet/ Poor coaptation
RV/RA/IVC size	Normal ¹	Normal or dilated	Usually dilated ²
Jet area- central jets (cm ²) ³	< 5	5-10	>10
VC width (cm)	Not defined	Not defined, but <0.7	>0.7
PISA radius (cm) ⁴	<0.5	0.6 – 0.9	>0.9
Jet density and contour –CW	Soft and parabolic	Dense, variable contour	Dense, triangular with early peaking
Hepatic vein flow ⁵	Systolic dominance	Systolic blunting	Systolic reversal

TRICUSPID VALVE ANATOMY

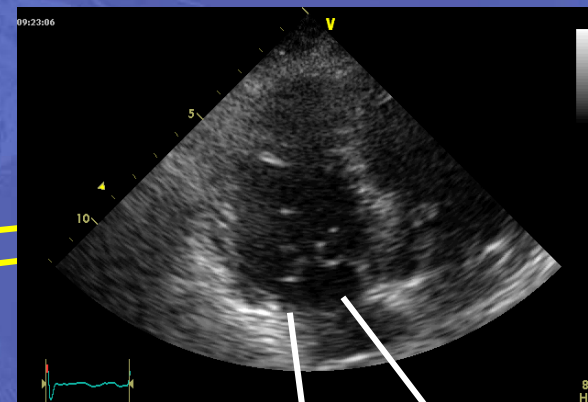
Limits of 2D mental reconstruction



Septal	0%	48%
Anterior	0%	52%
Posterior	92%	0%

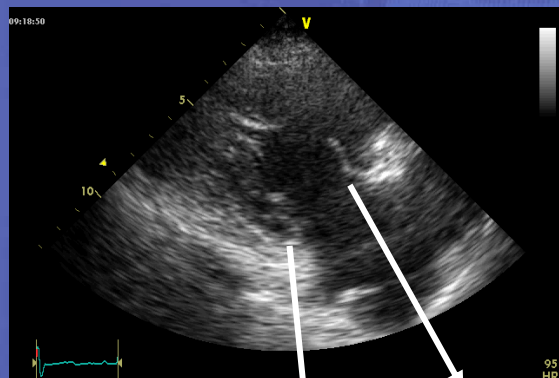


APICAL 4CH VIEW



Septal	0%	100%
Anterior	100%	0%
Posterior	0%	0%

PARASTERNAL RV-Inflow

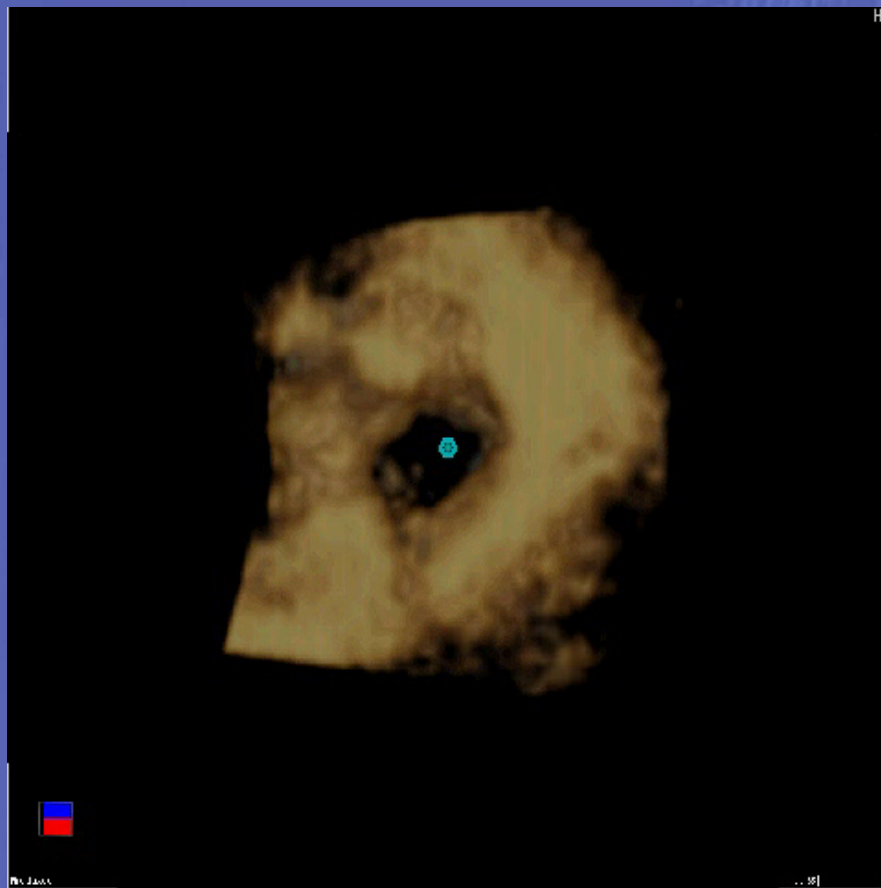


Septal	100%	0%
Anterior	0%	100%
Posterior	0%	0%

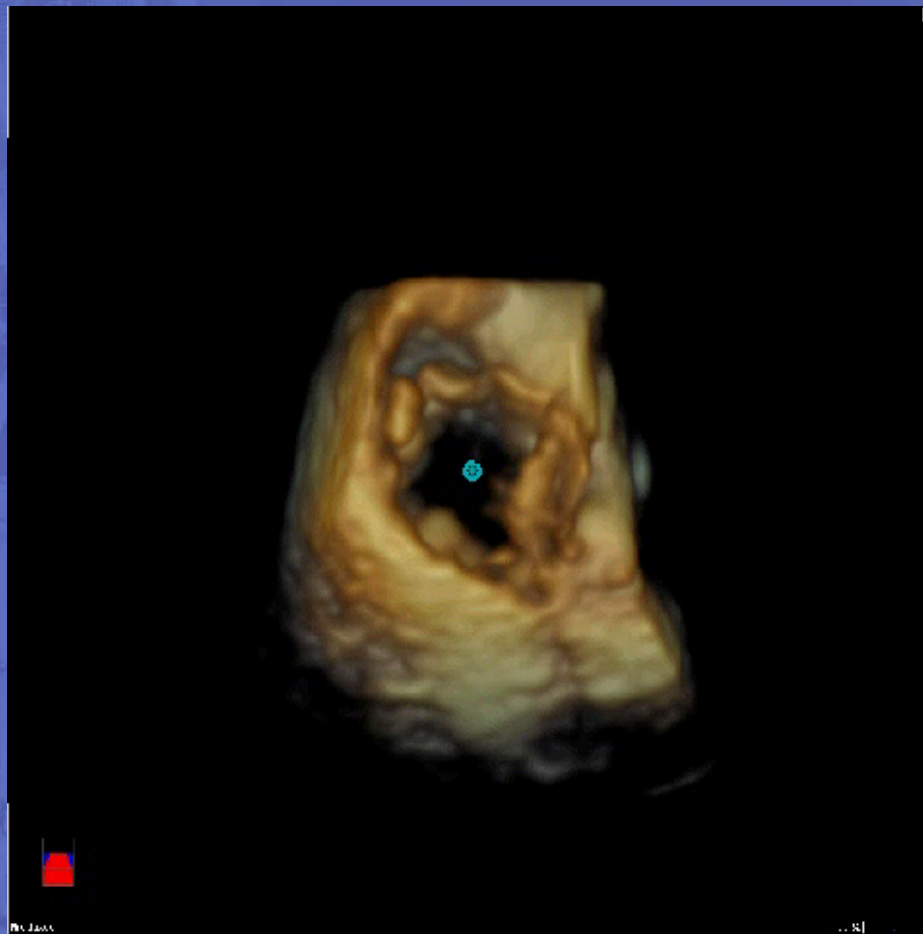
Anwar et al. J Cardiovasc Imaging 2007

TRICUSPID VALVE ANATOMY

Incremental Value of 3D Echo



Atrial View



Ventricular View

Badano LP, et al. Eur J Echocardiogr 2009

TRICUSPID REGURGITATION

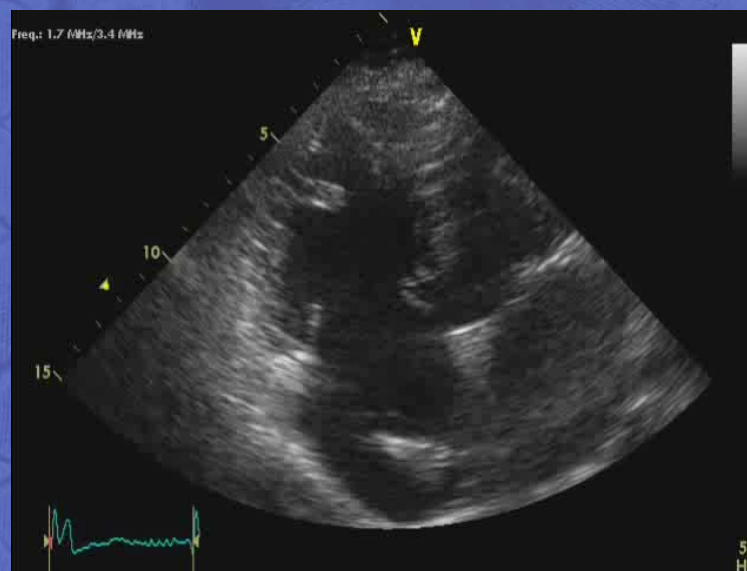
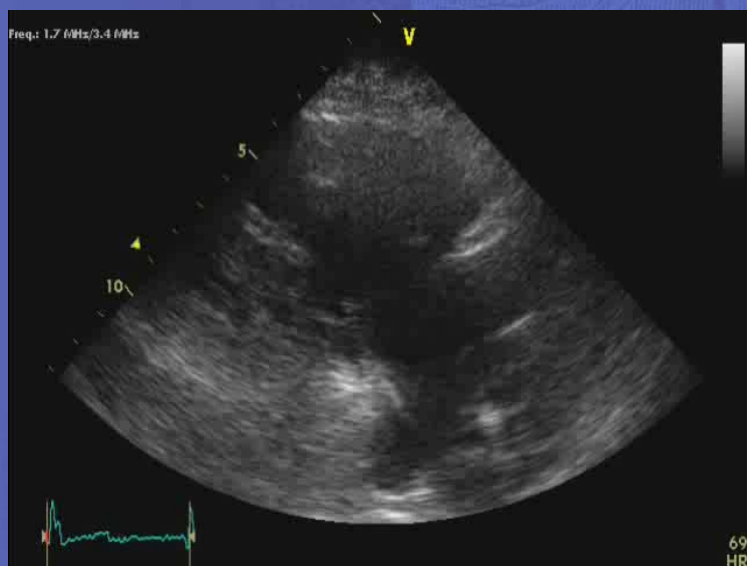
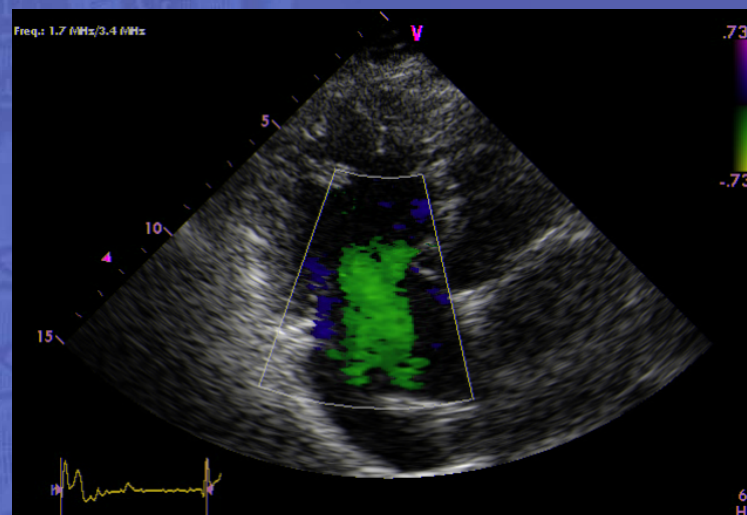
Clinical Case #1

74-yr-old woman

Congestive HF

Previous DDD-R P.M implant

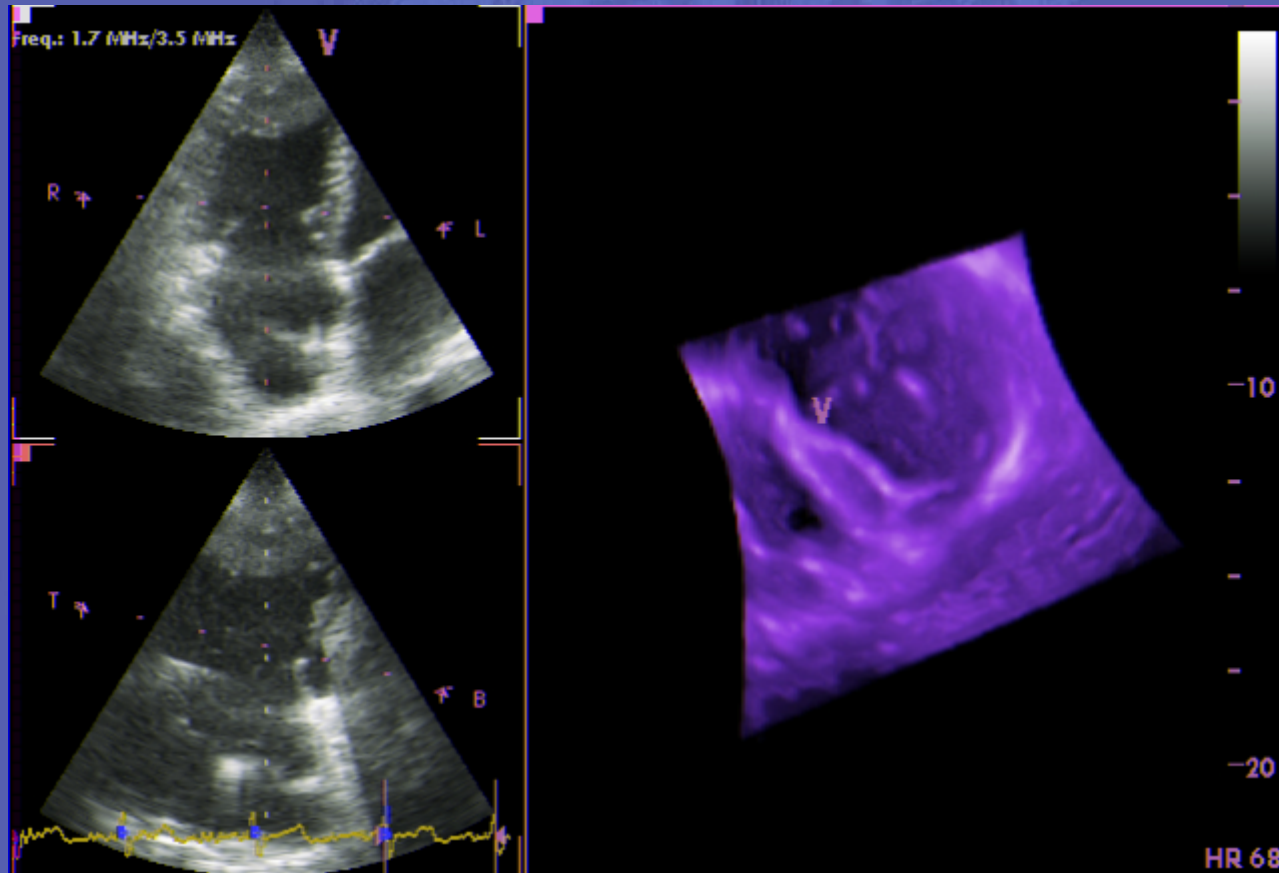
Symptomatic Sick Sinus
Syndrome



Nucifora G, Badano LP, et al. Echocardiography 2007

HOW TO ASSESS TRICUSPID REGURGITATION?

Clinical Case #1



Nucifora G, Badano LP, et al. Echocardiography 2007



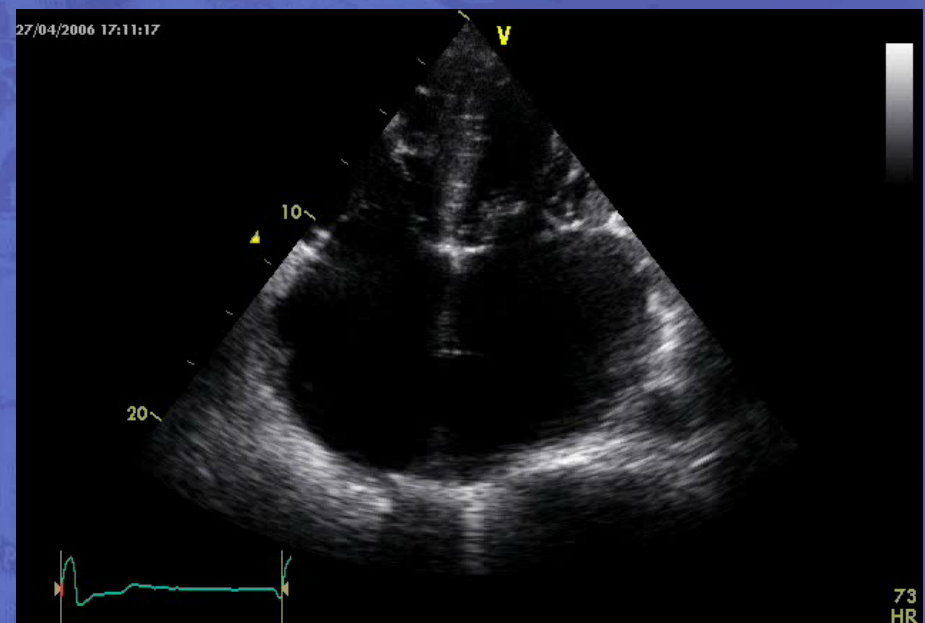
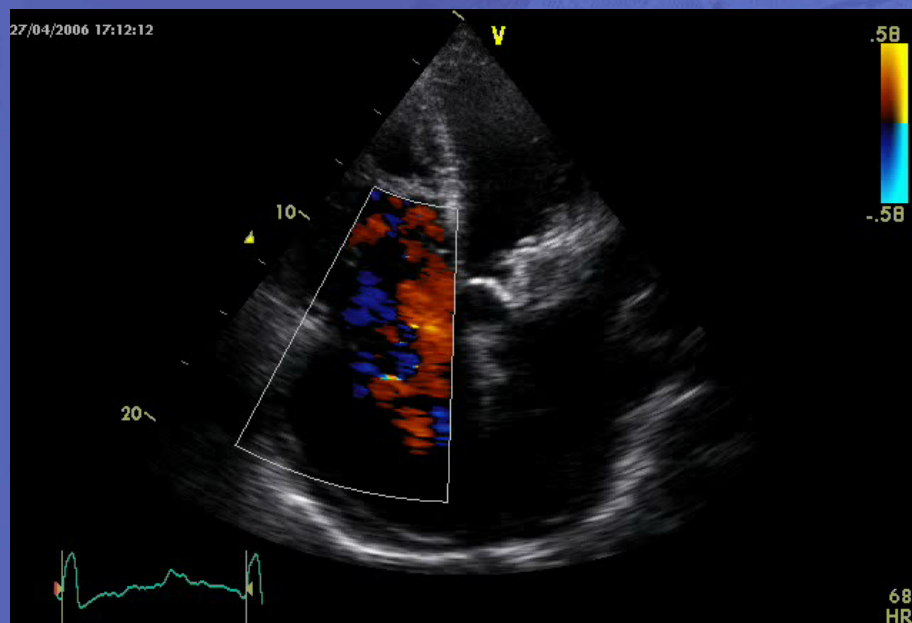
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HOW TO ASSESS TRICUSPID REGURGITATION?

Functional Tricuspid Regurgitation



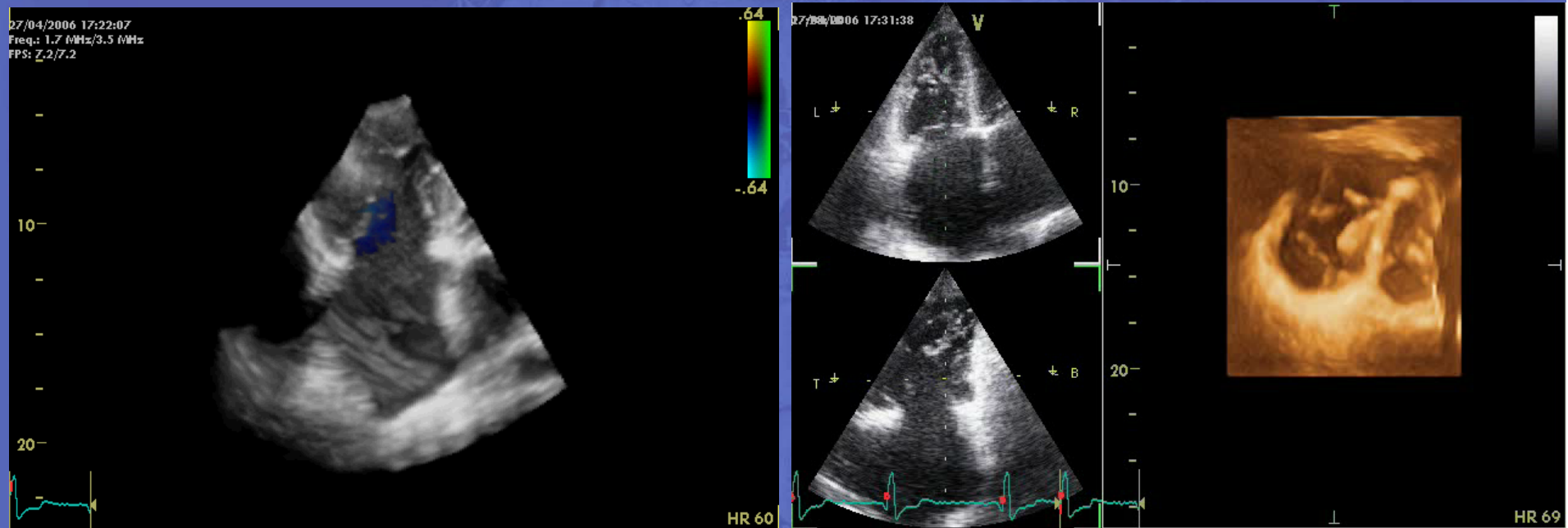
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HOW TO ASSESS TRICUSPID REGURGITATION?

Valve Morphology and Function



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HOW TO ASSESS TRICUSPID REGURGITATION?

Assessment is difficult → Difficult decide when to repair

The degree of regurgitation depends on:

- Tricuspid annulus diameter
- Preload: blood volume
- RV function
- Afterload (the only factor corrected by left-side surgery): PVR

Tricuspid annulus diameter: it can be measured (4CH view) and has been proposed to be more reliable as a guide to decision making

HOW TO ASSESS TRICUSPID REGURGITATION?

Severity of Regurgitation or Annulus Dilation

Group 1 (163 pts, 52.4%) Mitral valve repair only

Group 2 (148 pts, 47.6%) MVR + Tricuspid annuloplasty if
TAD > 2 x Normal (i.e. 70 mm) regardless the grade of TR

TR increased > 2 grades:

- 48% in Group 1
- 2% in Group 2 (p<0.001)

NYHA Class at follow-up:

- 1.6 in Group 1
- 1.1 in Group 2 (p=0.01)

Dreyfus G et al. Ann Thorac Surg 2005



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HOW TO ASSESS TRICUSPID REGURGITATION?

Severity of Regurgitation or Annulus Dilation



70 mm at surgical inspection =
40 mm at Echo

- Considerable tricuspid annulus dilatation can be present even in the absence of significant TR;
- Tricuspid annulus dilatation is an ongoing disease process that will, with time, lead to severe TR.

Dreyfus G et al. Ann Thorac Surg 2005



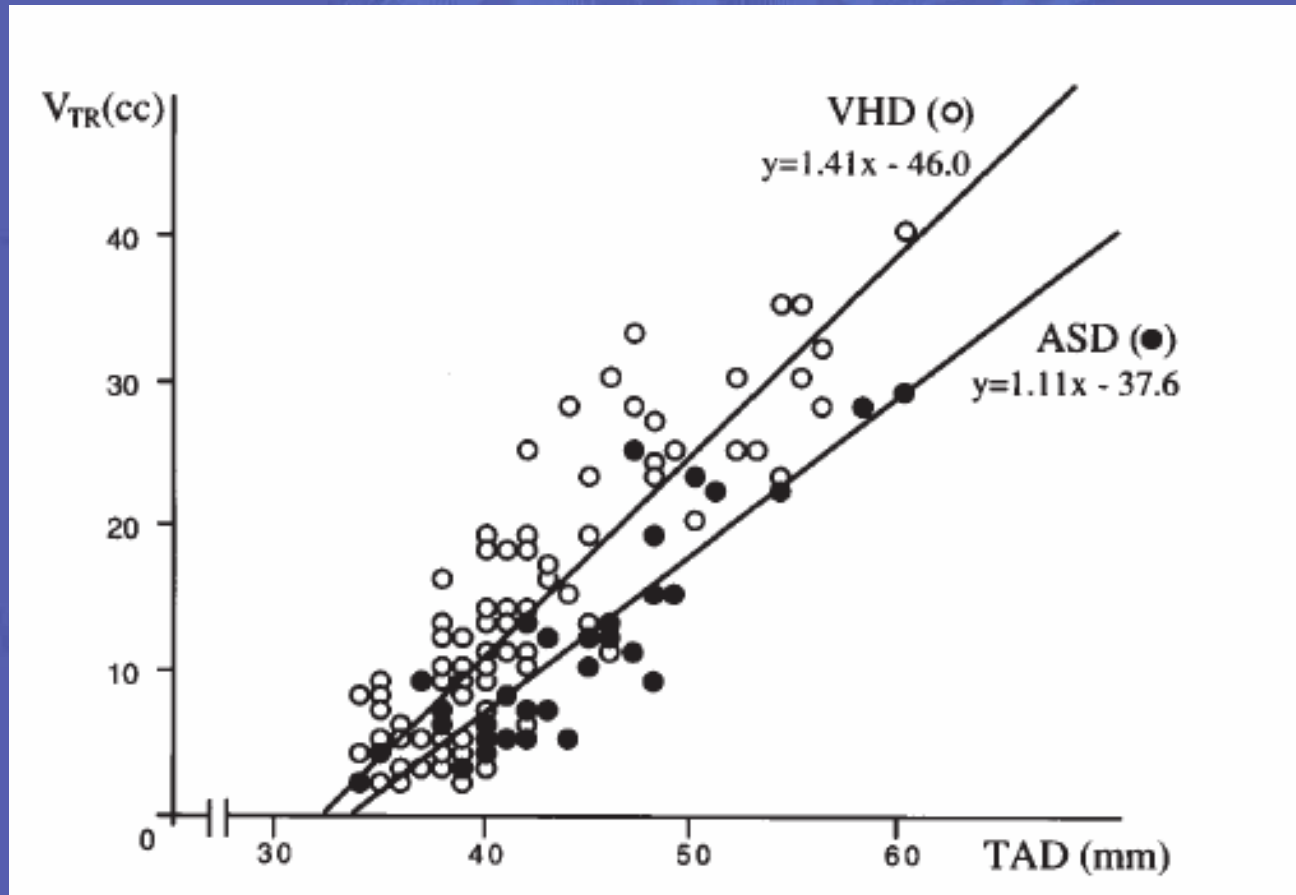
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HOW TO ASSESS TRICUSPID REGURGITATION?

Annulus diameters



Sugimoto T et al. J Thorac Cardiovasc Surg 1999



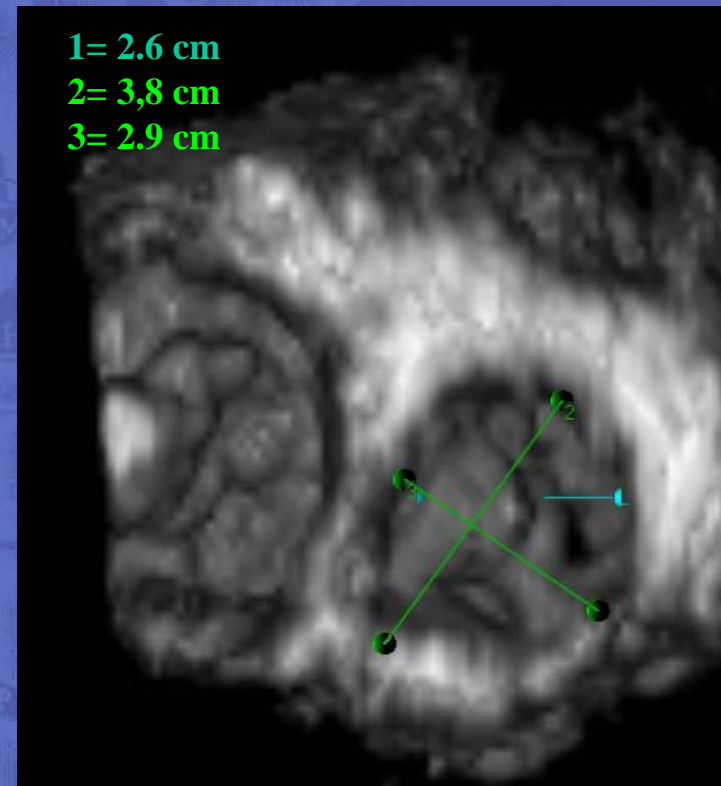
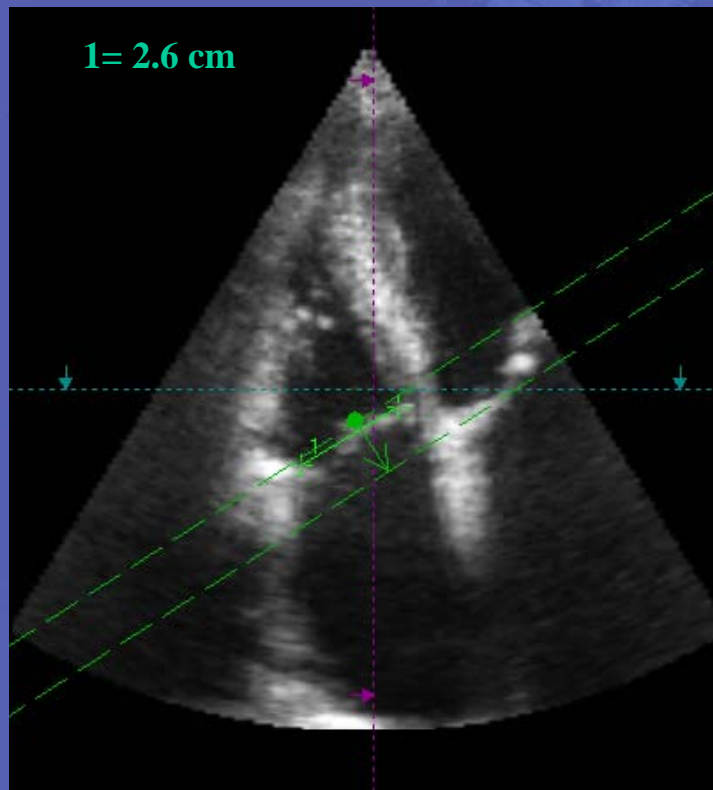
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HOW TO ASSESS TRICUSPID REGURGITATION?

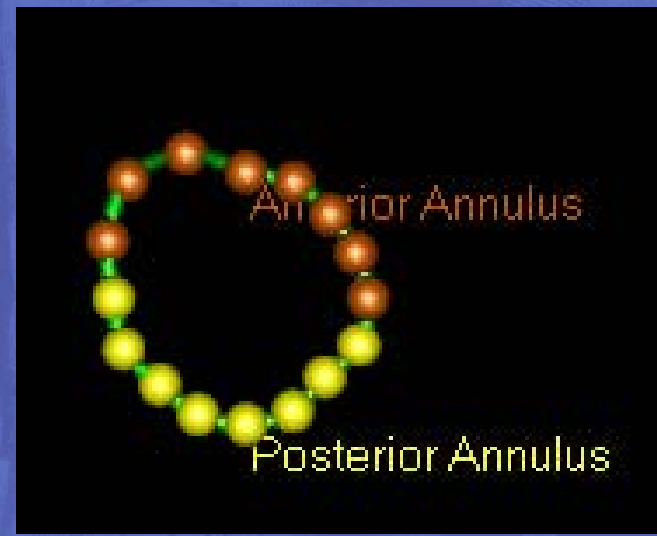
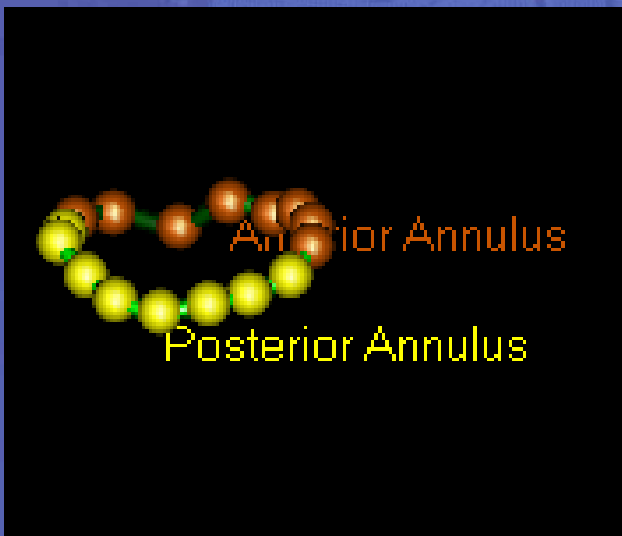
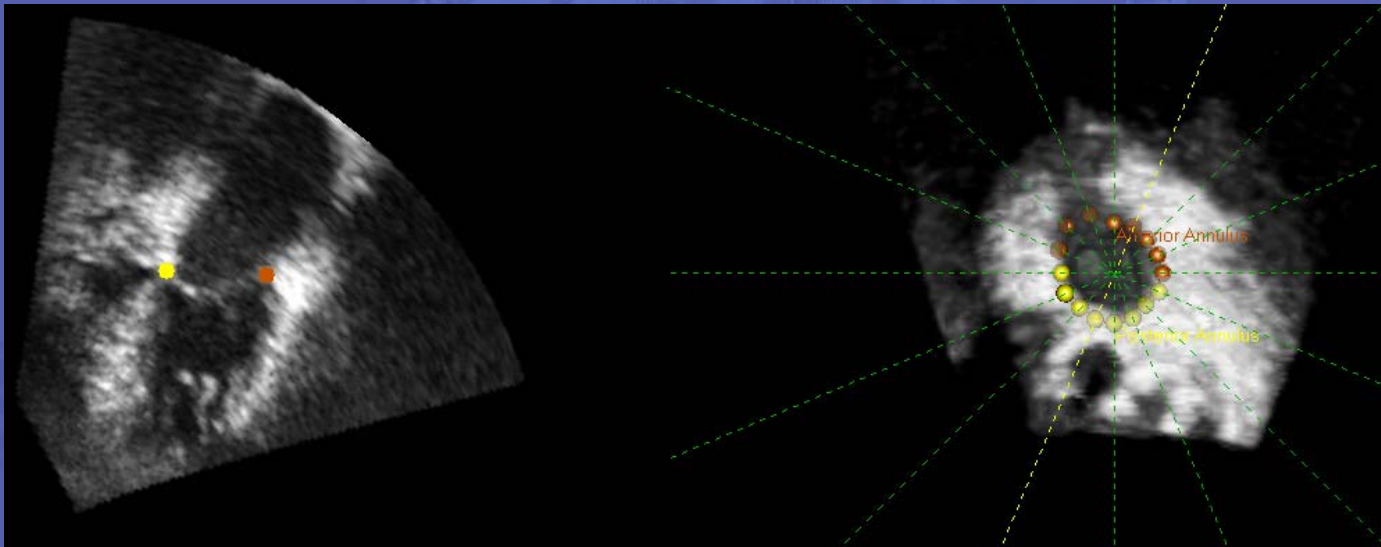
Annulus diameters



Badano LP, et al. Eur J Echocardiogr 2009

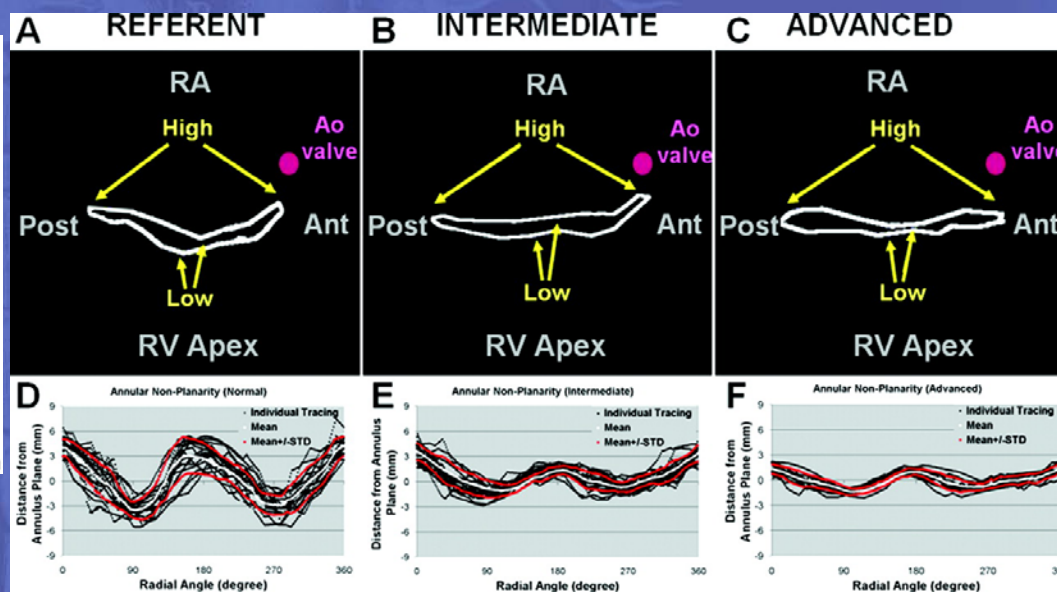
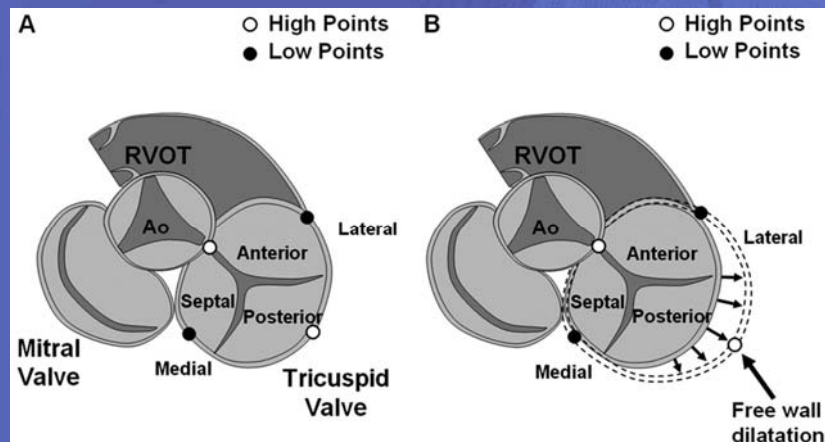
HOW TO ASSESS TRICUSPID REGURGITATION?

Annulus Area and Shape



HOW TO ASSESS TRICUSPID REGURGITATION?

Annulus Morphology Assessment

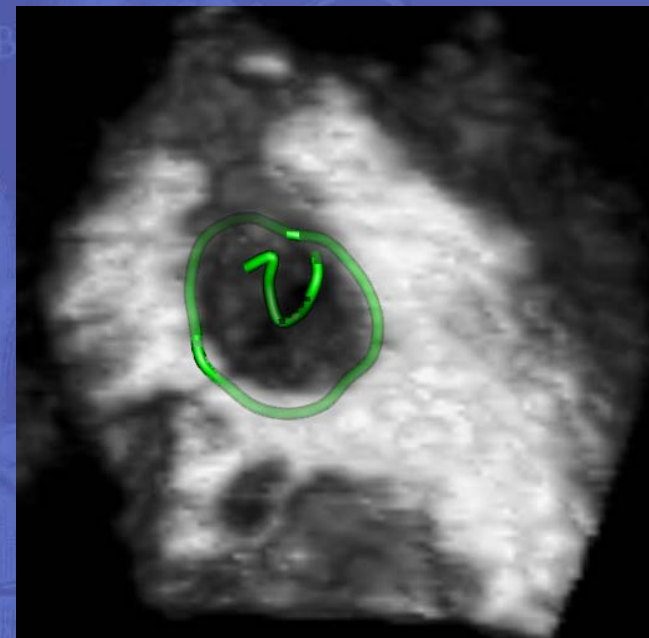


Ton-Nu T et al. Circulation 2006

HOW TO ASSESS TRICUSPID REGURGITATION?

Annulus Area

Automatic Measurements	
AP Diameter:	3.1 cm
AL-PM Diameter:	3.1 cm
Sphericity Index:	1.0
Non-planar Angle:	173.7°
Annulus Circumference:	10.7 cm
Annulus Area (2D) :	8.3 cm ²



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HOW TO ASSESS TRICUSPID REGURGITATION?

Clinical Case #2

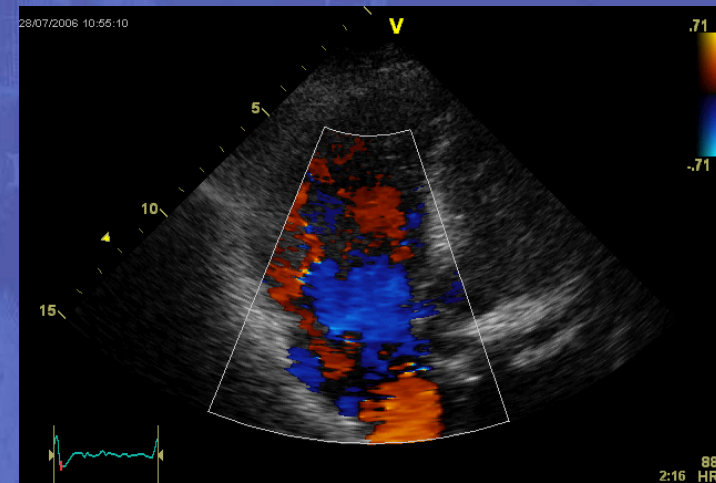
66-yr-old man

Previous Heart Transplant

CHF

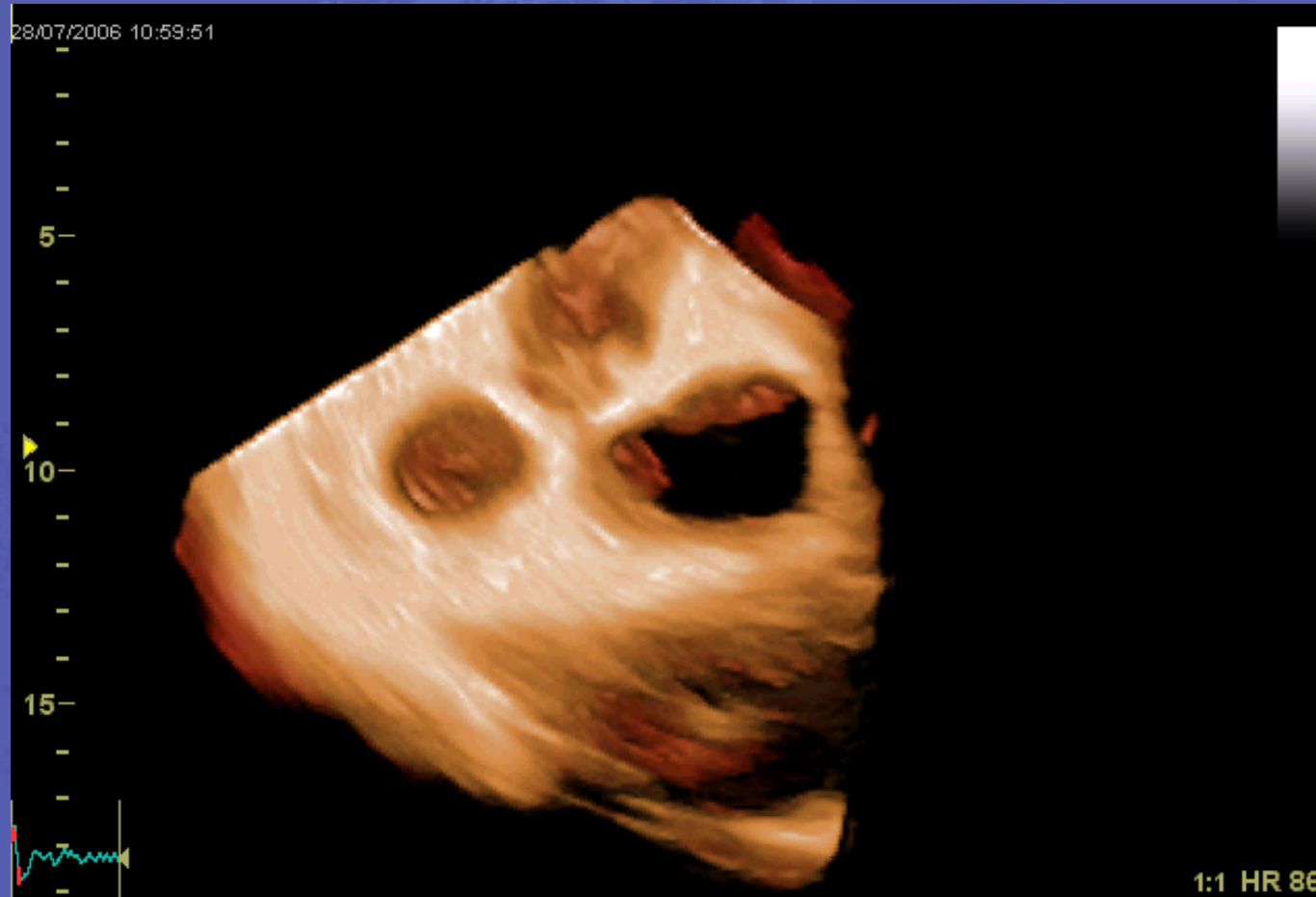
Moderately enlarged RV

TAPSE= 1.1 cm



HOW TO ASSESS TRICUSPID REGURGITATION?

Clinical Case #2



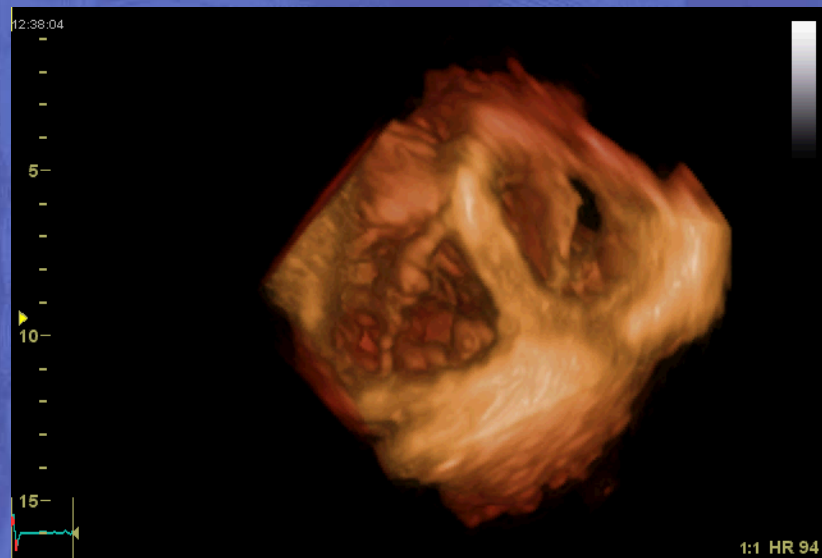
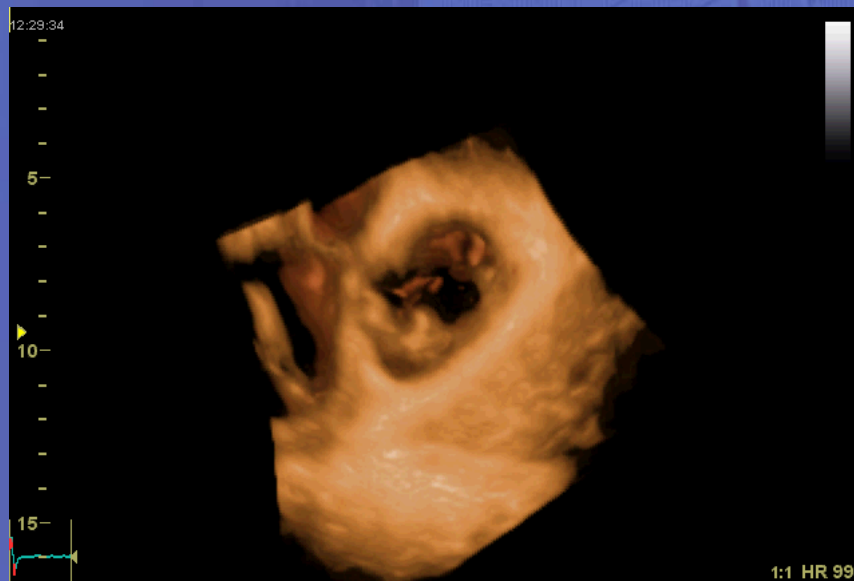
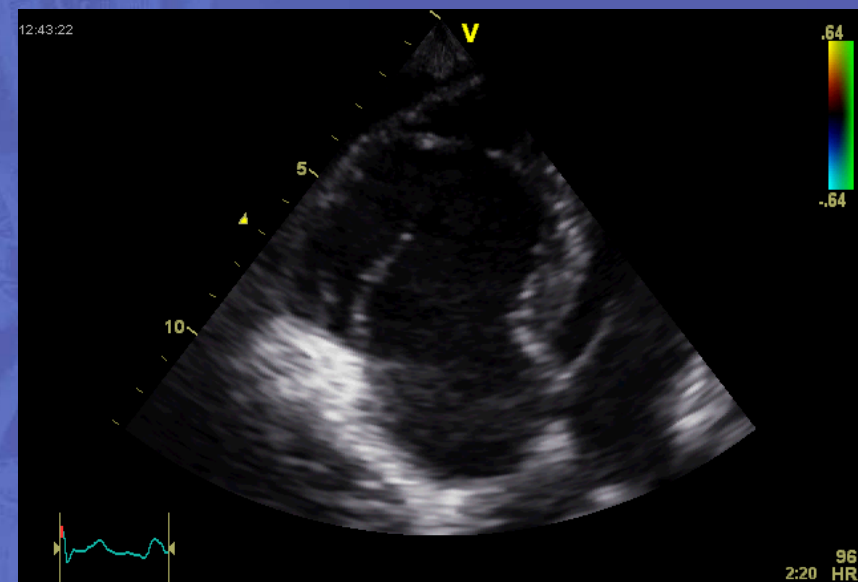
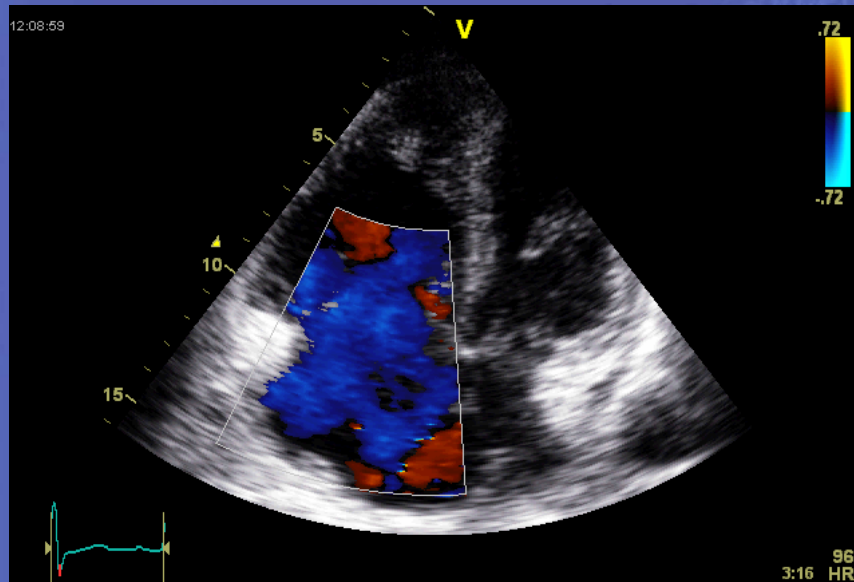
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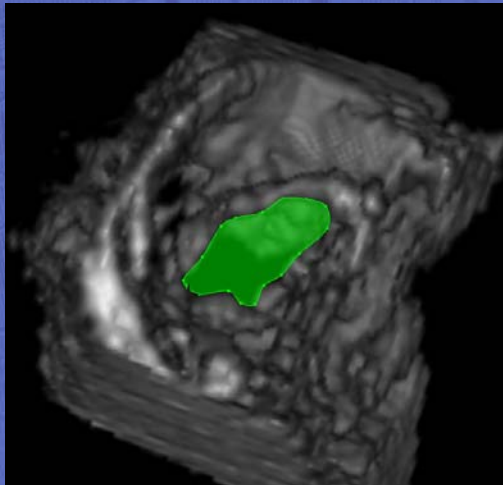
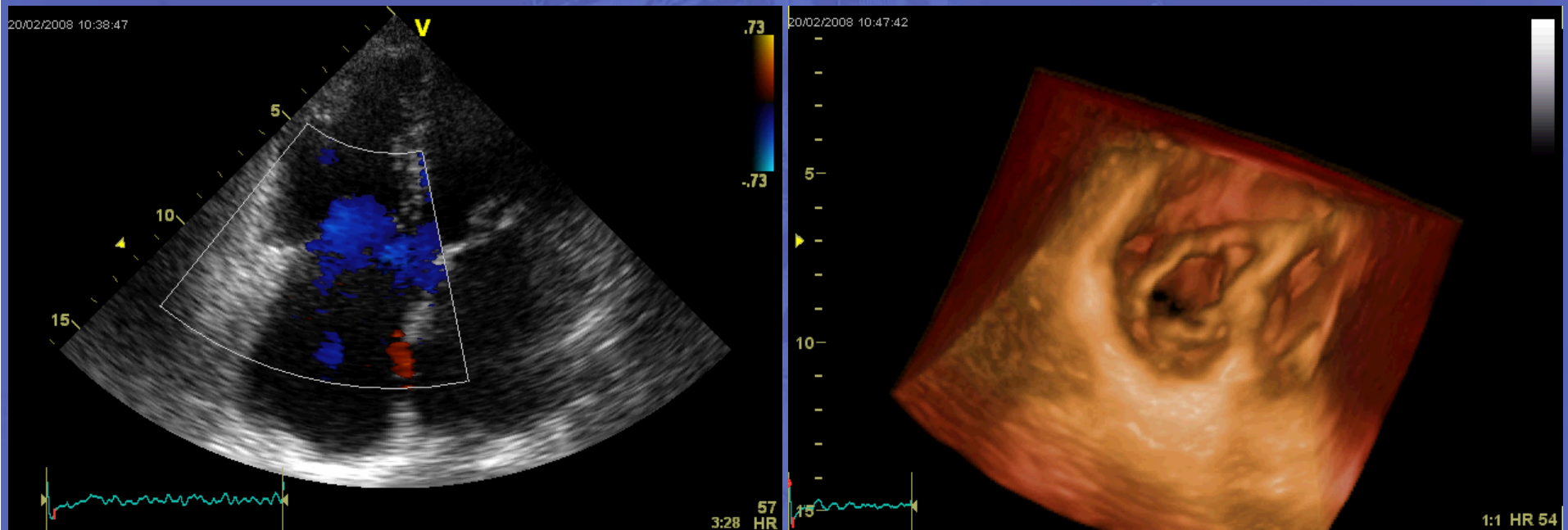
HOW TO ASSESS TRICUSPID REGURGITATION?

Tricuspid Valve Prolapse



HOW TO ASSESS TRICUSPID REGURGITATION?

Not just fancy images! Tricuspid valve assessment



Tricuspid Valve Area= 3.6 cm²



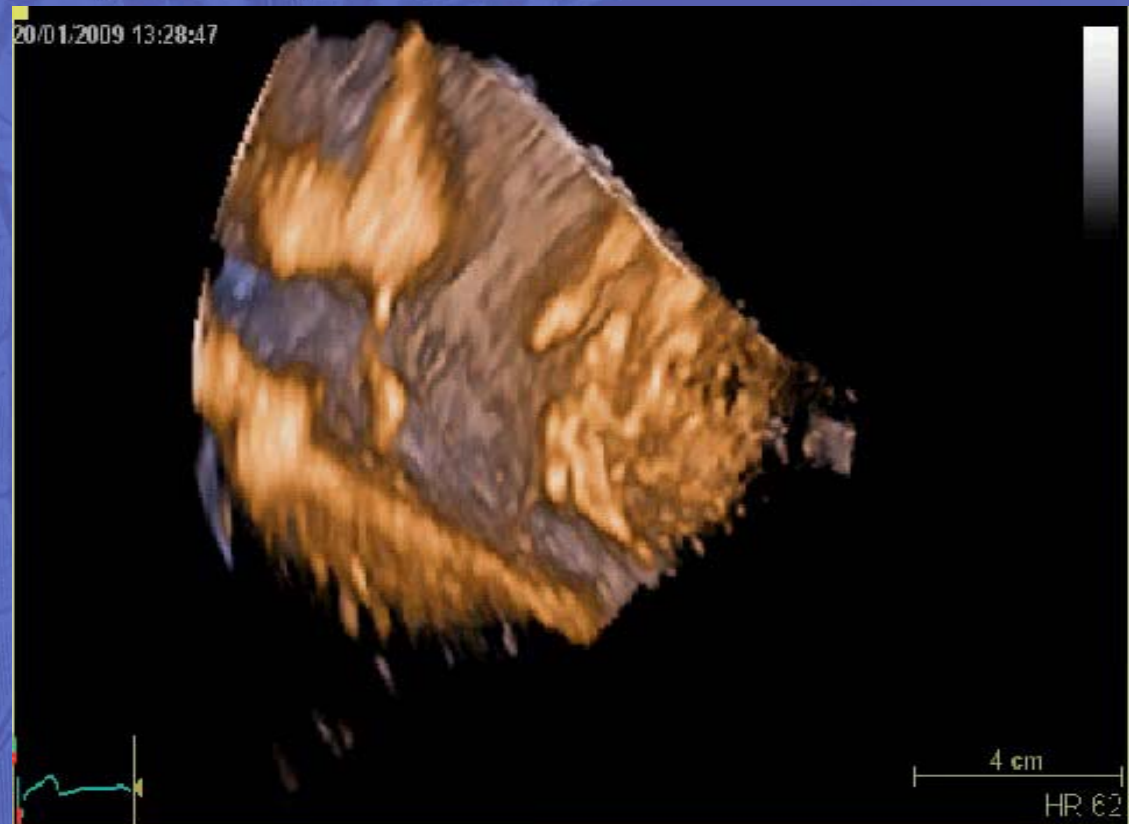
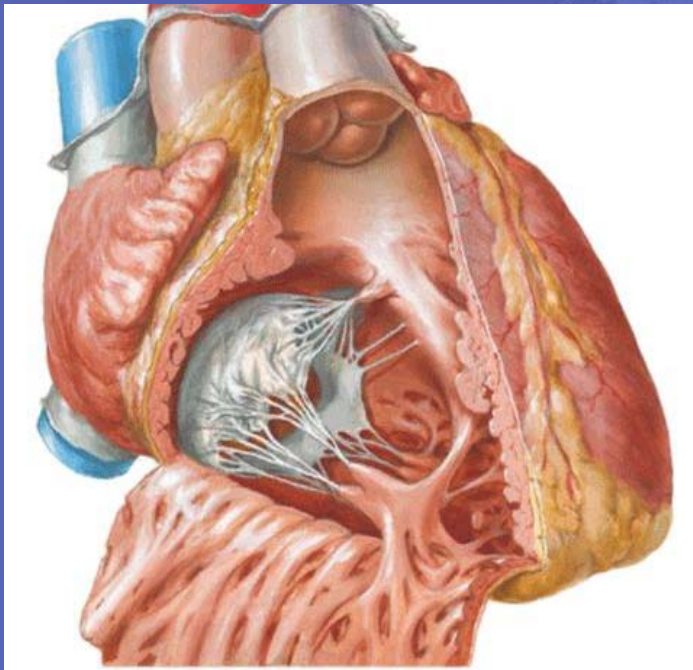
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HOW TO ASSESS TRICUSPID REGURGITATION?

Right Ventricular Size and Function



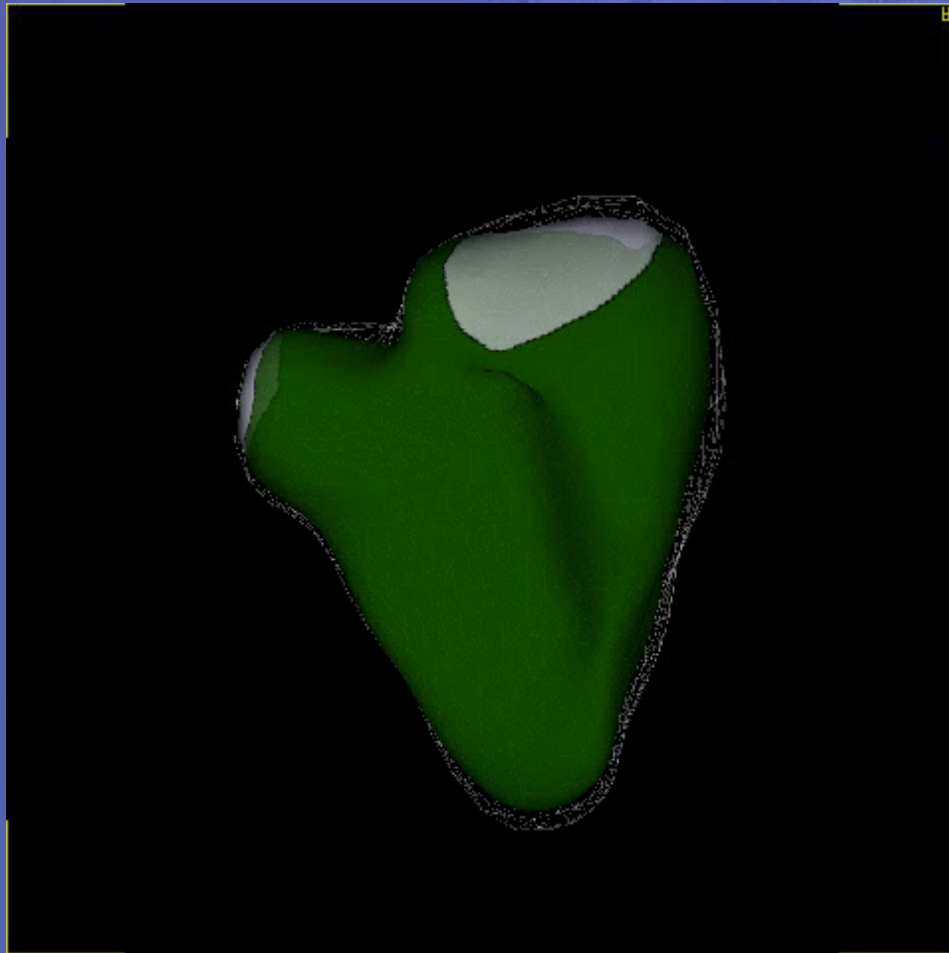
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HOW TO ASSESS TRICUSPID REGURGITATION?

Right Ventricular Size and Function



RV EDV = 77 ml

RV ESV = 28 ml

RV EF = 64%



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HOW TO ASSESS TRICUSPID REGURGITATION?

Conclusions

- TR in patients with MV disease is associated with poor outcome (reduced survival, heart failure and reduced functional capacity);
- Functional TR is common in left-sided heart diseases;
- Functional TR might progress after correction of left sided valve disease, if left untreated, even if mild before left sided surgery BUT robust data are lacking;
- Outcome of isolated TV surgery is generally poor because of RV dysfunction
- Detailed TV assessment, including RV function and annulus diameter is mandatory in all patients with MV disease.



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EUROECHO 2009



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in cooperation with the Working Group on Echocardiography of the Spanish Society of Cardiology.

9-12 DECEMBER 2009
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