Management of TR in Patients Undergoing Mitral Interventions

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Clinical Case

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- A 77 year old male was referred for decompensated CHF, refractory ascites and anasarca.
- Past medical history was significant for partial gastrectomy, prostate cancer, hypertension, chronic atrial fibrillation, and CABG (10 yrs ago).
- Echo demonstrated preserved left ventricular systolic function and moderate-severe dilatation of the right ventricle with severe TR .

Baseline TTE

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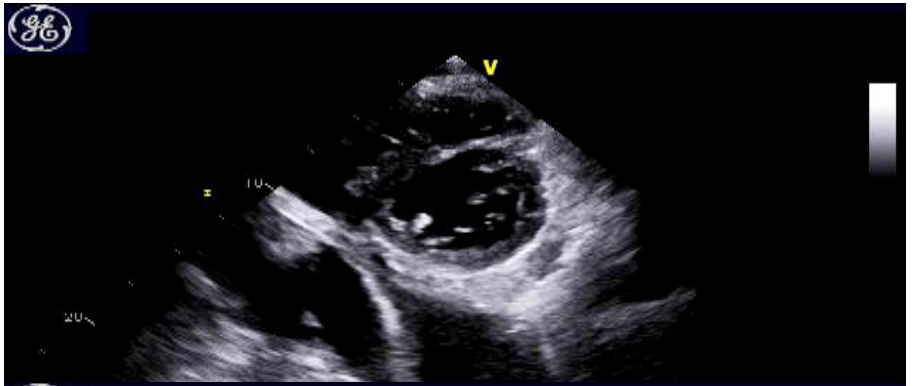
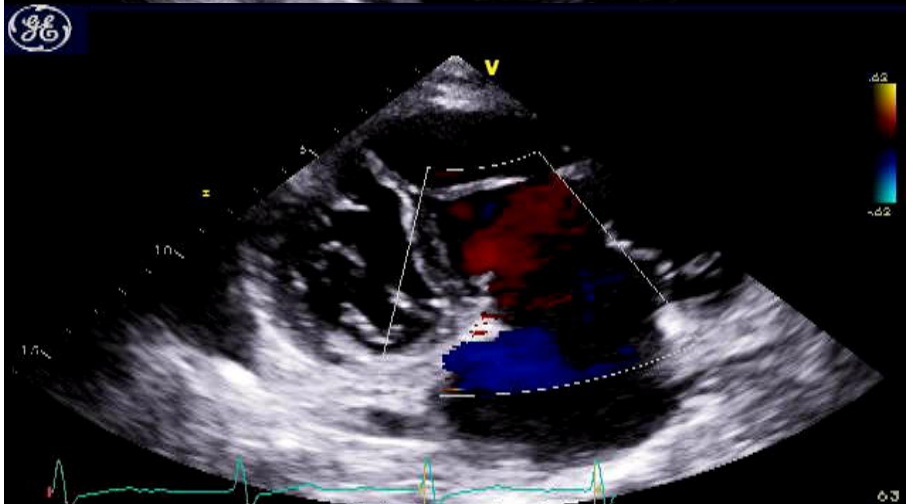
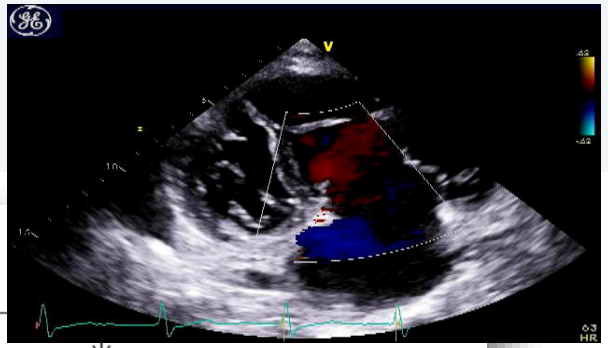
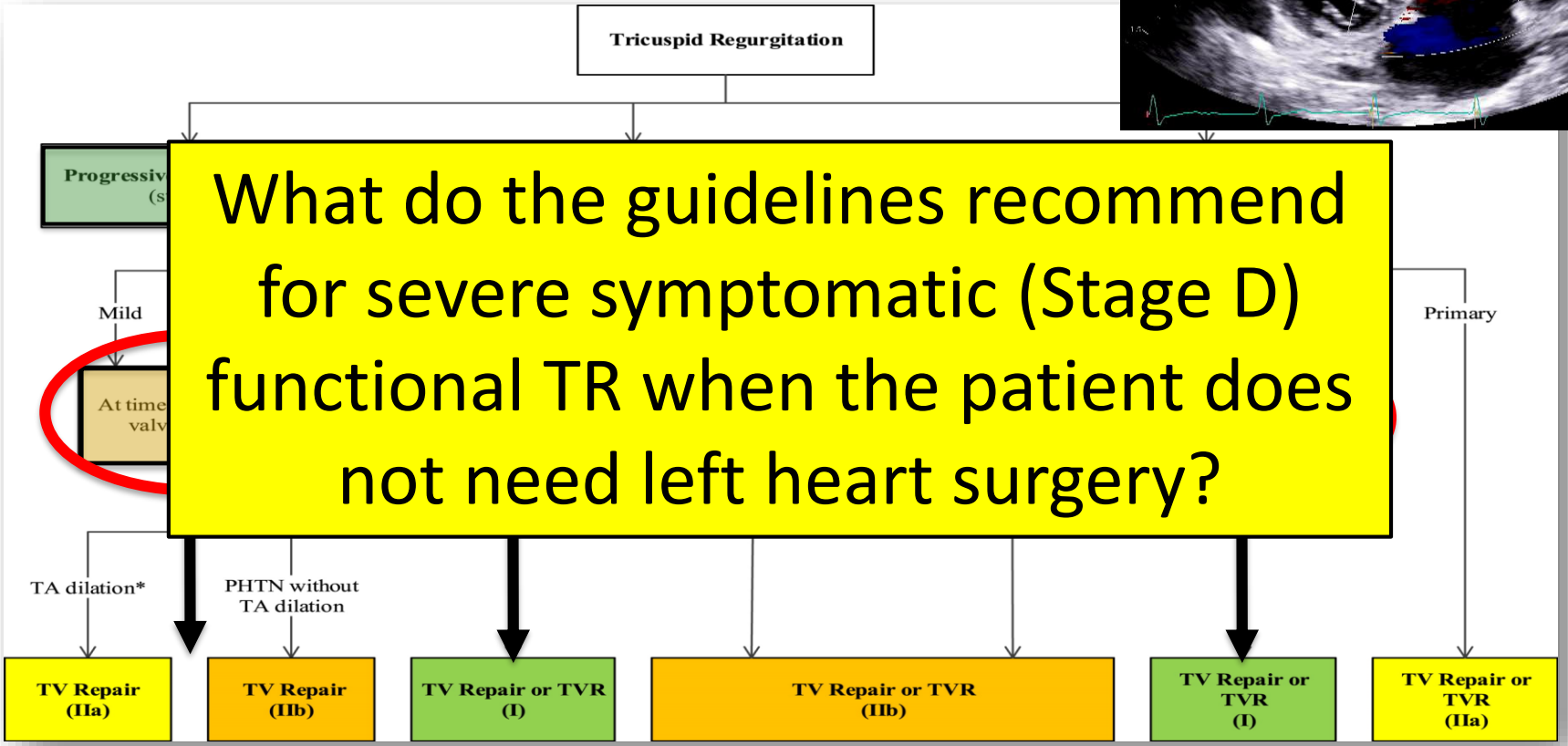




2014 AHA/ACC Guideline for the Management of TR





What do the guidelines recommend for severe symptomatic (Stage D) functional TR when the patient does not need left heart surgery?

Nishimura et al. J Am Coll Cardiol. 2014;63(22)

The Tricuspid Valve

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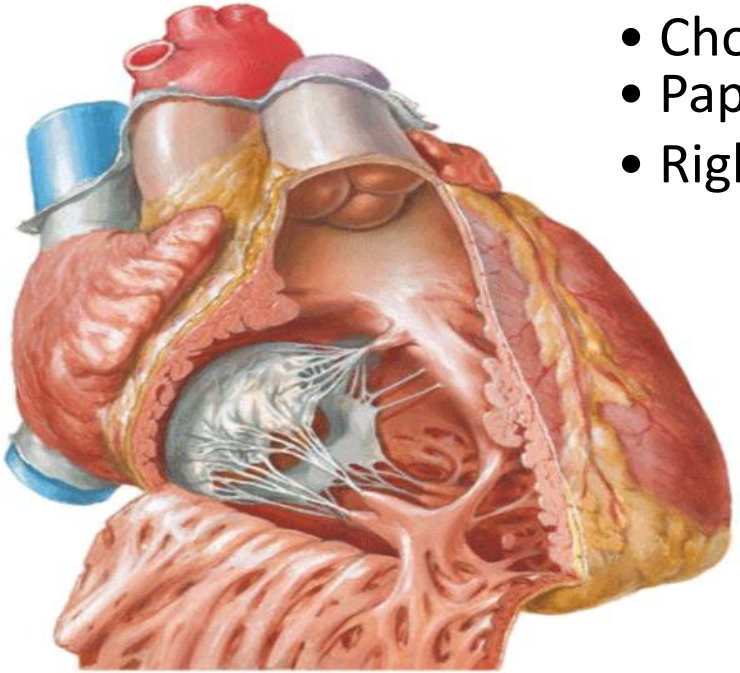
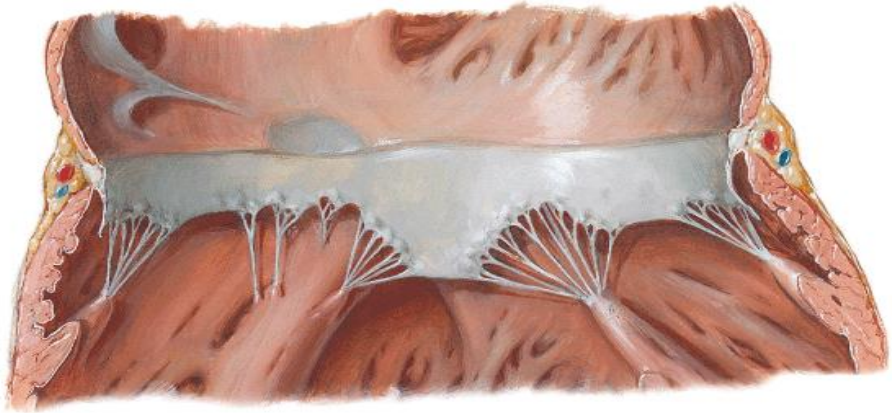
F. Netter M.D. ©IGN

Opened Right Ventricle
Anterior View



- Leaflets
- Annulus
- Chordae
- Papillary muscles
- Right Ventricle

Tricuspid (Right Atrioventricular) Valve



Etiology – Primary TR

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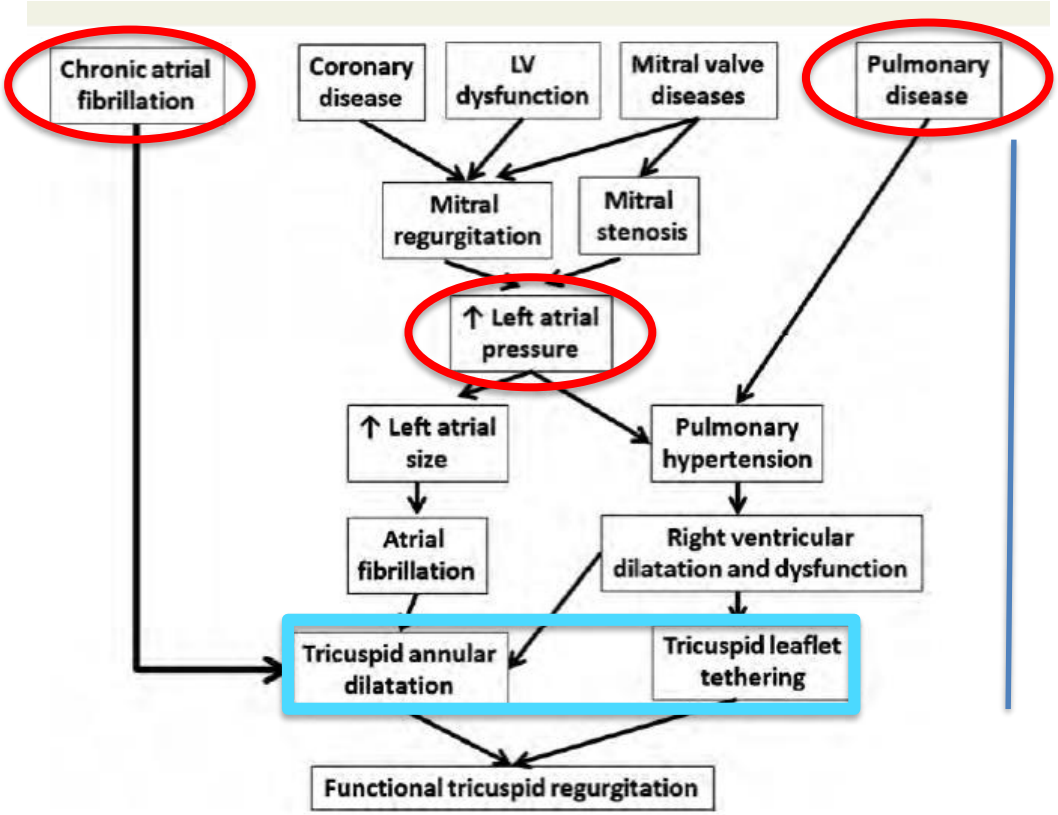
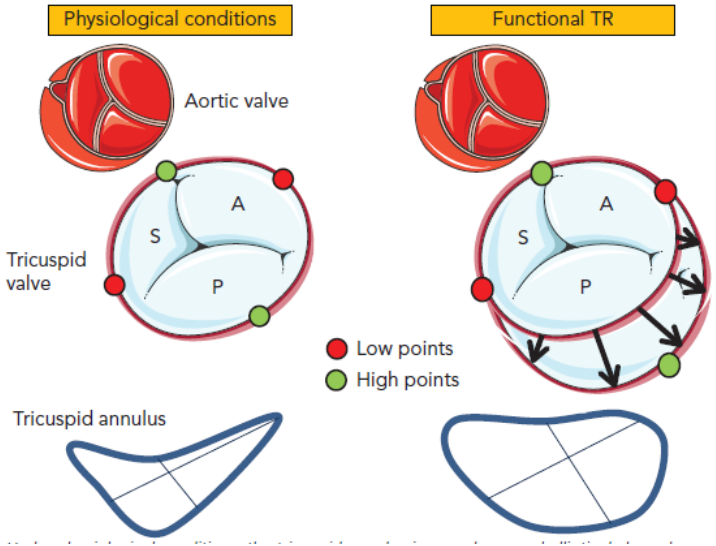
- Myxomatous degeneration
- Valve injury from PM or ICD lead
- Recurrent Endomyocardial biopsies (Transplant patients)
- Endocarditis
- Congenital – Ebstein's Anomaly
- Rheumatic Disease
- Carcinoid Heart Disease

Functional TR



Badano LP et al. Euro Heart J. 2013



Besler et al. Interventional Cardiology Review 2018;13(1):8–13.

Tricuspid Valve Revealed

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2D echo

- 3 leaflets cannot be visualized simultaneously
- Variable as to which leaflets are visualized in a given view
- Significant annular dilatation:
  - End-diastolic diameter >40 mm or >21 mm/ m^2 (4 Chamber TTE)

Evaluating TR

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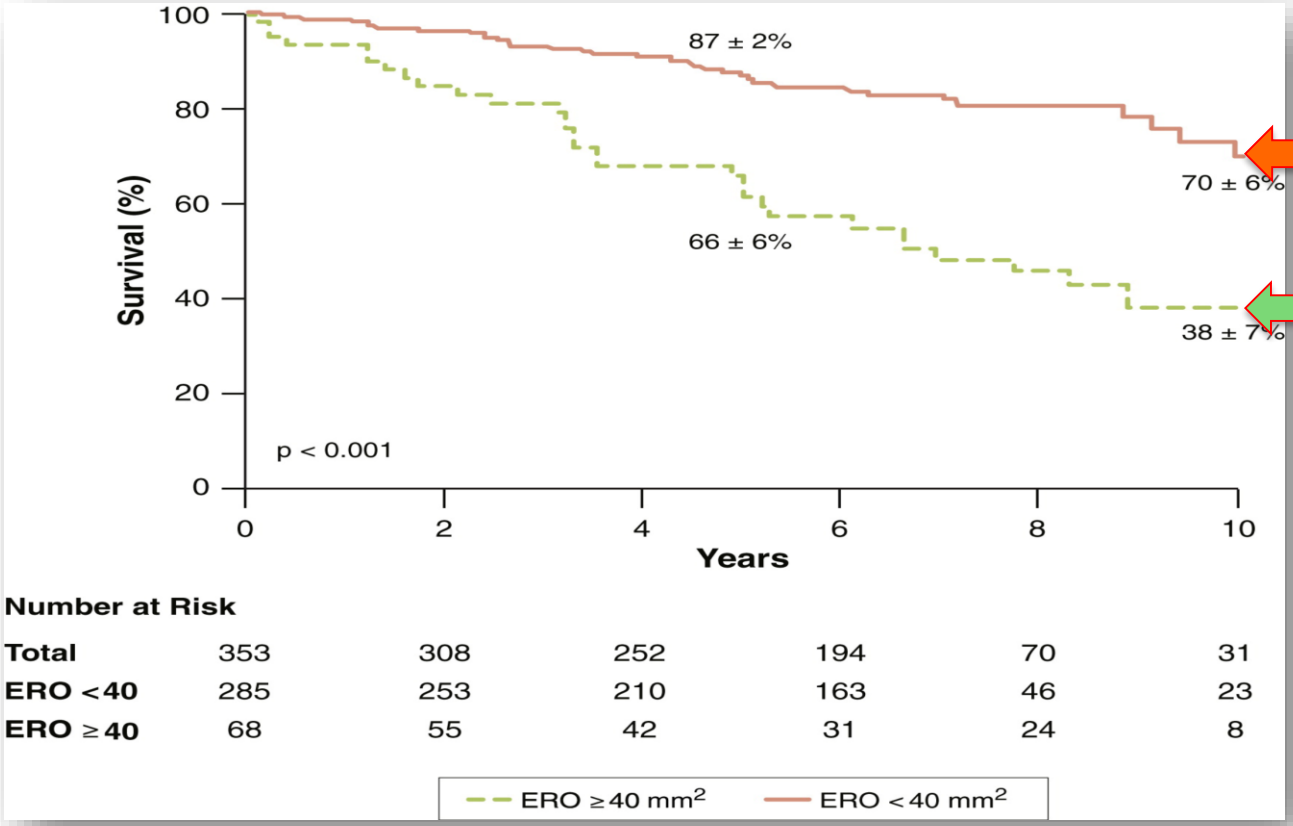
A tough assignment

- Imaging the RV is tough
- Imaging the TV is also tough
- Identifying TV leaflets is tougher
- Quantification of TR severity is difficult but…

Clinical Outcome of Isolated TR

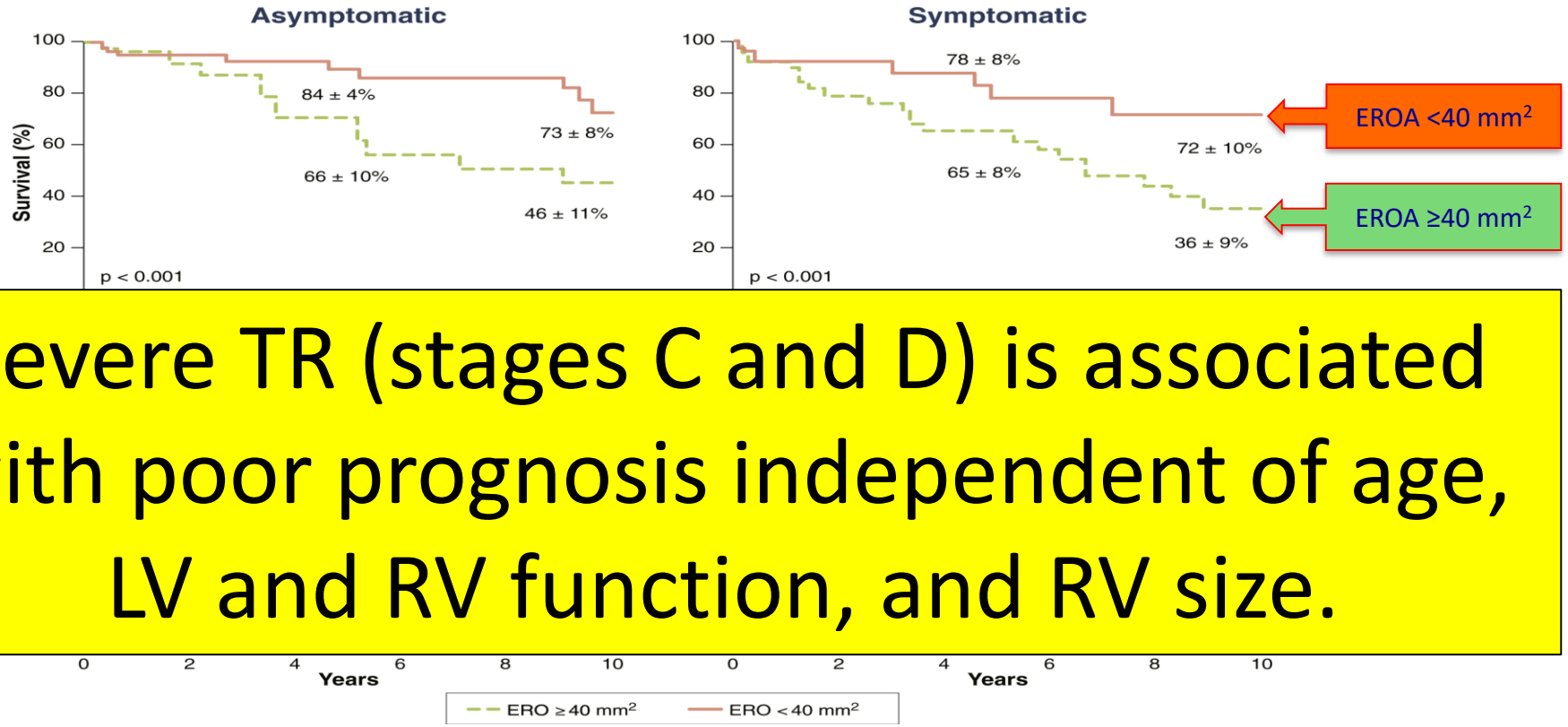


EROA < 40 mm²

EROA ≥40 mm²

J Am Coll Cardiol Img. 2014;7(12):1185-1194

Clinical Outcome of Isolated TR



Severe TR (stages C and D) is associated with poor prognosis independent of age, LV and RV function, and RV size.

J Am Coll Cardiol Img. 2014;7(12):1185-1194. doi:10.1016/j.jcmg.2014.07.018

Recommendations for Noninvasive Evaluation of Native Valvular Regurgitation

A Report from the American Society of Echocardiography Developed in Collaboration with the Society for Cardiovascular Magnetic Resonance

William A. Zoghbi, MD, FASE (Chair), David Adams, RCS, RDCS, FASE, Robert O. Bonow, MD, Maurice Enriquez-Sarano, MD, Elyse Foster, MD, FASE, Paul A. Grayburn, MD, FASE, Rebecca T. Hahn, MD, FASE, Yuchi Han, MD, MMSc,* Judy Hung, MD, FASE, Roberto M. Lang, MD, FASE, Stephen H. Little, MD, FASE, Dipan J. Shah, MD, MMSc,* Stanton Shernan, MD, FASE, Paaladinesh Thavendiranathan, MD, MSc, FASE,* James D. Thomas, MD, FASE, and Neil J. Weissman, MD, FASE, *Houston and Dallas, Texas; Durham, North Carolina; Chicago, Illinois; Rochester, Minnesota; San Francisco, California; New York, New York; Philadelphia, Pennsylvania; Boston, Massachusetts; Toronto, Ontario, Canada; and Washington, DC*

Zoghbi et al. JASE 2017

Qualitative TR Estimate

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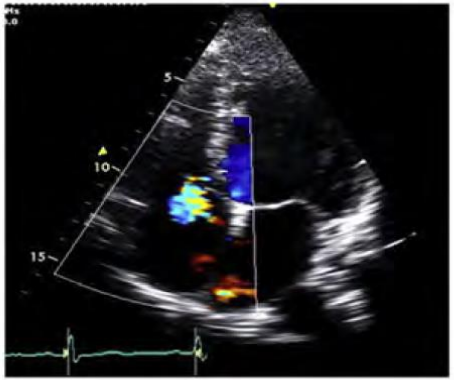
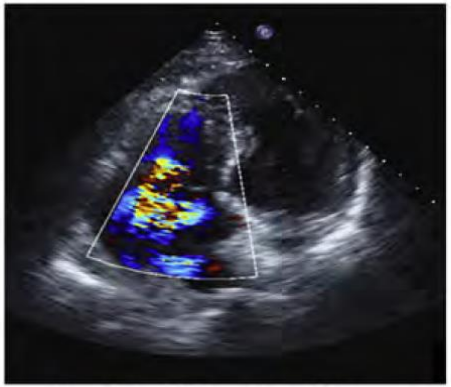
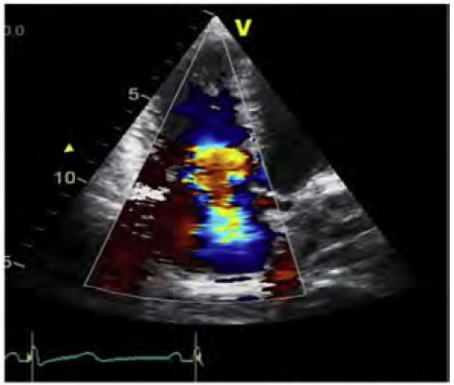
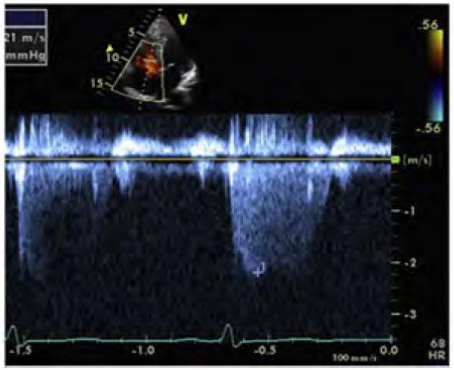
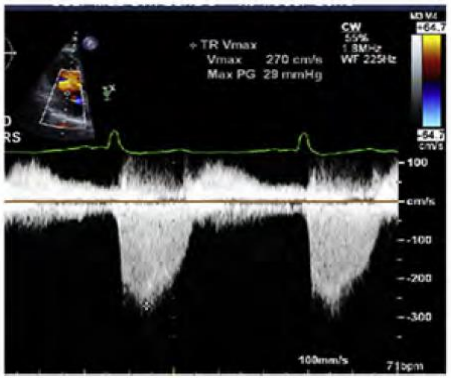
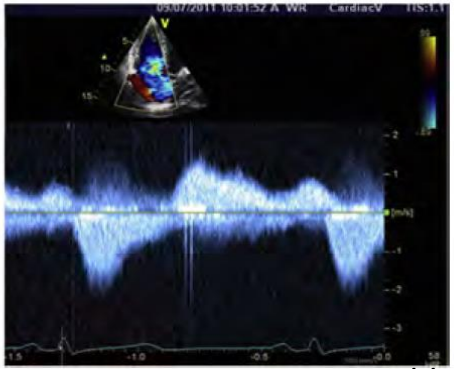
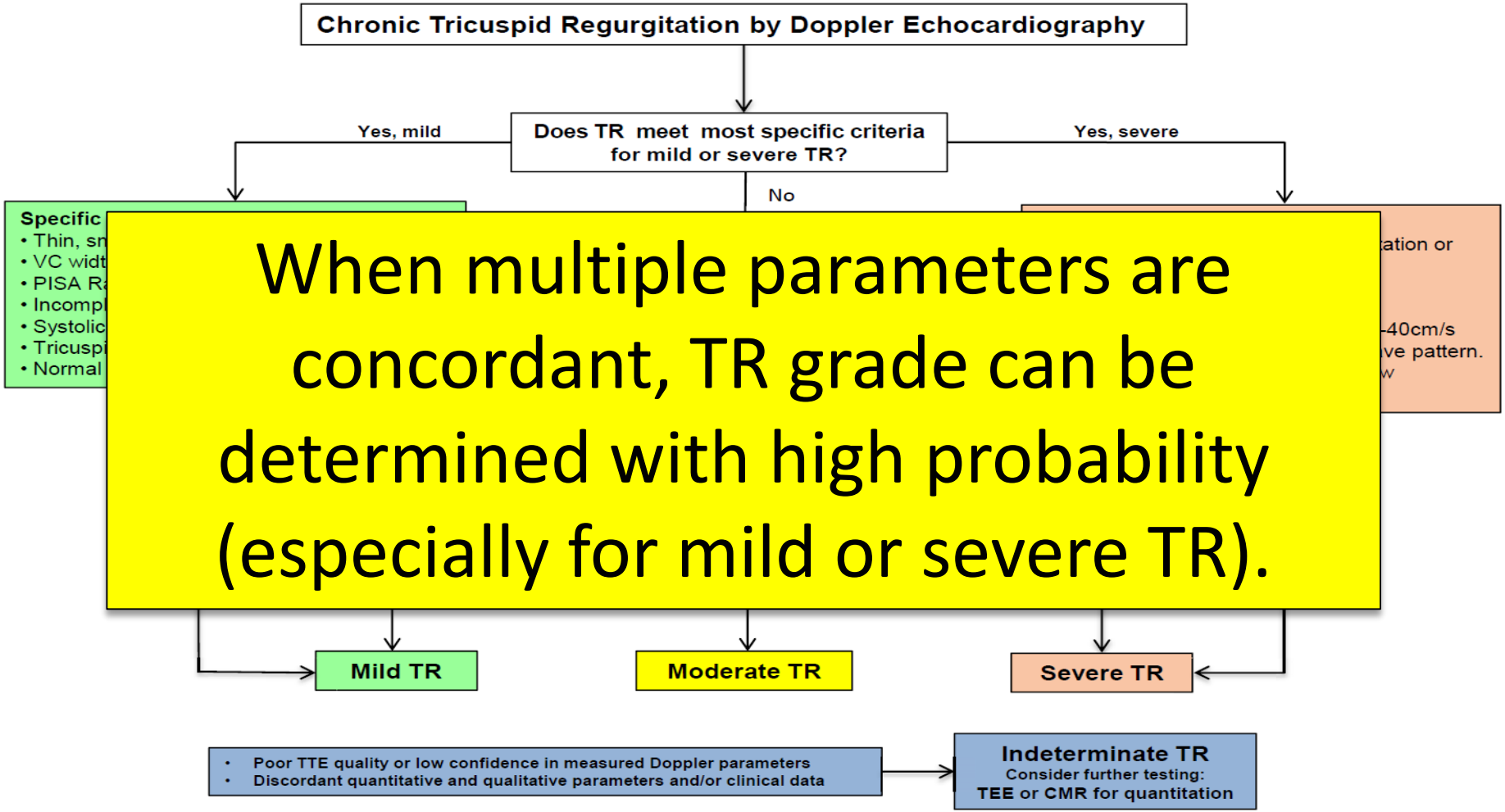
Mild TR	Severe Eccentric TR	Severe Central TR
		
		

Zoghbi et al. JASE 2017



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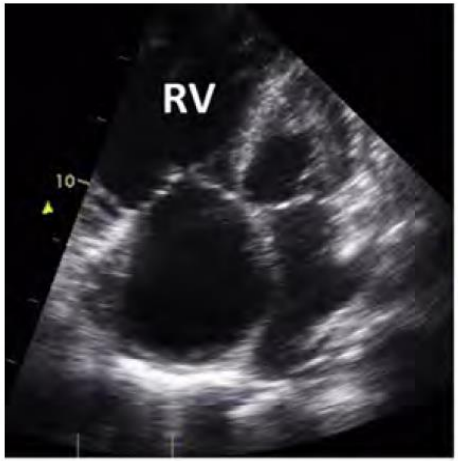
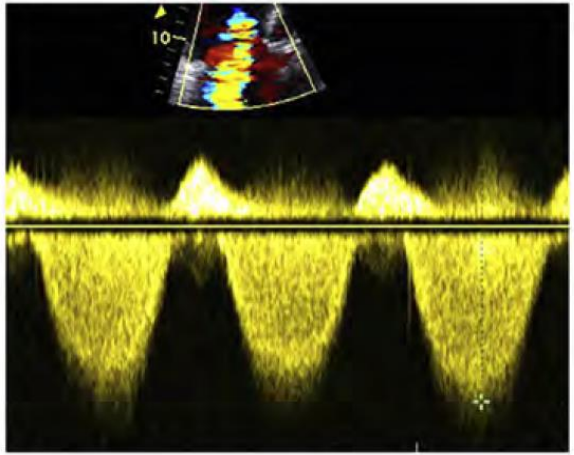
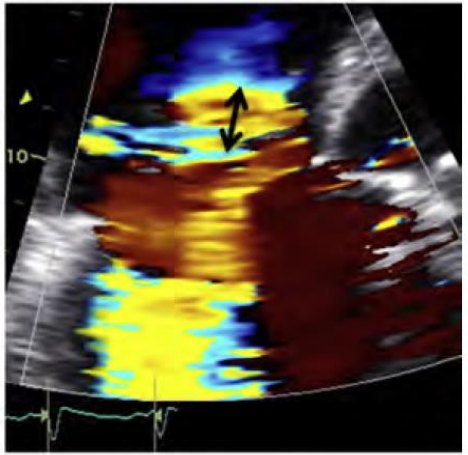
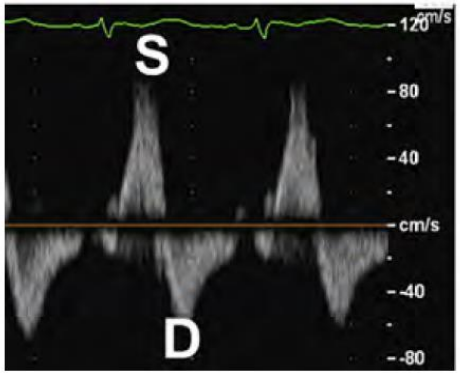
Quantitative TR Measures









TR Peak Velocity = 386 cm/s
VTI of jet= 109 cm

Alias Velocity = 32 cm/s
Radius = 0.9 cm

EROA = $6.28 * 0.9^2 * 32 / 386 = 0.4\ cm^2$
RVol = 0.4 * 109 = 44 mL

Zoghbi et al. JASE 2017

3D TEE of Tricuspid Valve

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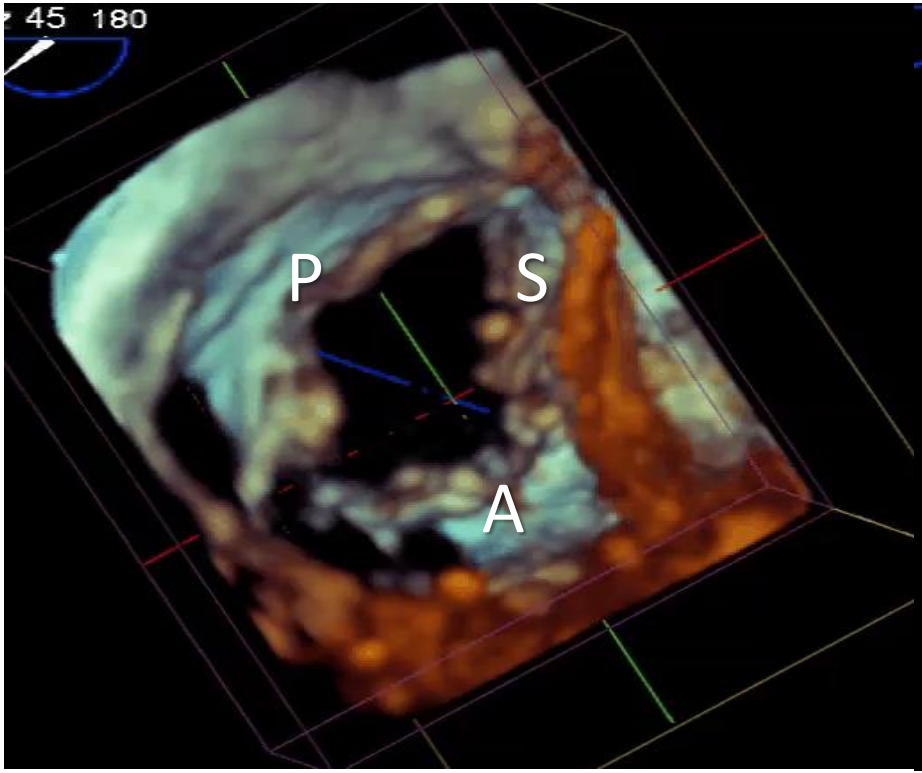
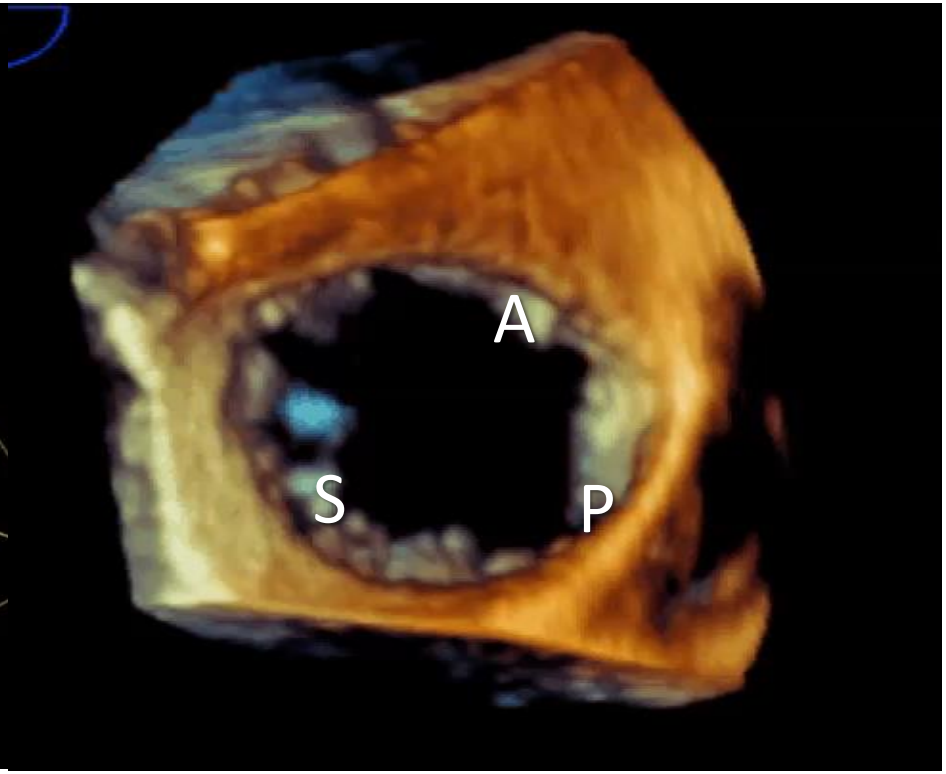


RV view



RA view

Severe Secondary TR

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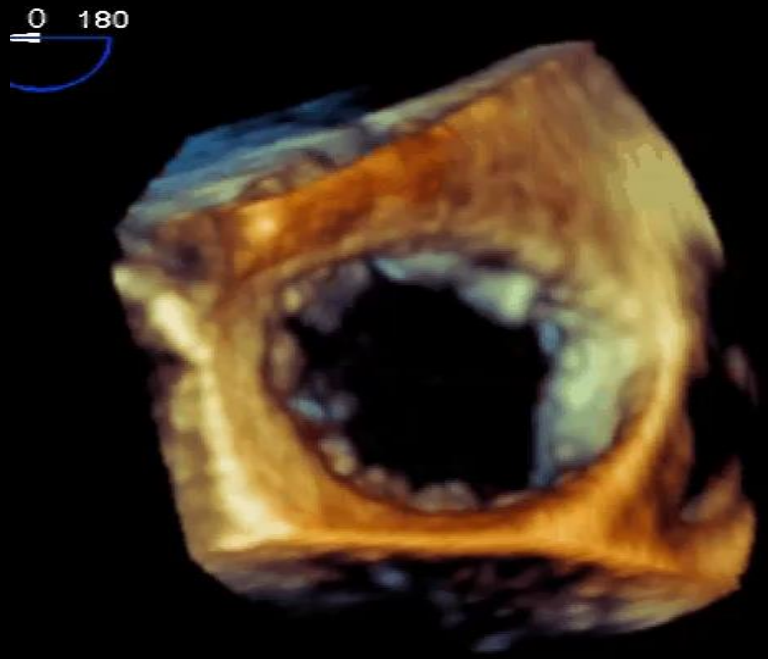

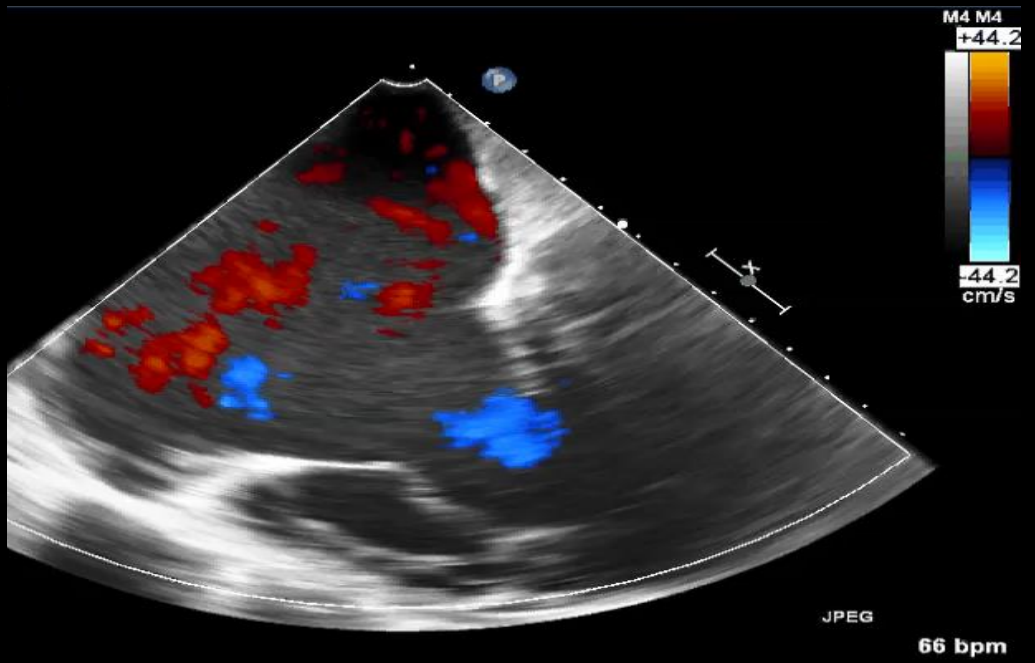

Tricuspid annular dilation & RV dilation

TR: The New Frontier

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Novel Interventions

Emerging Percutaneous Therapies for TR

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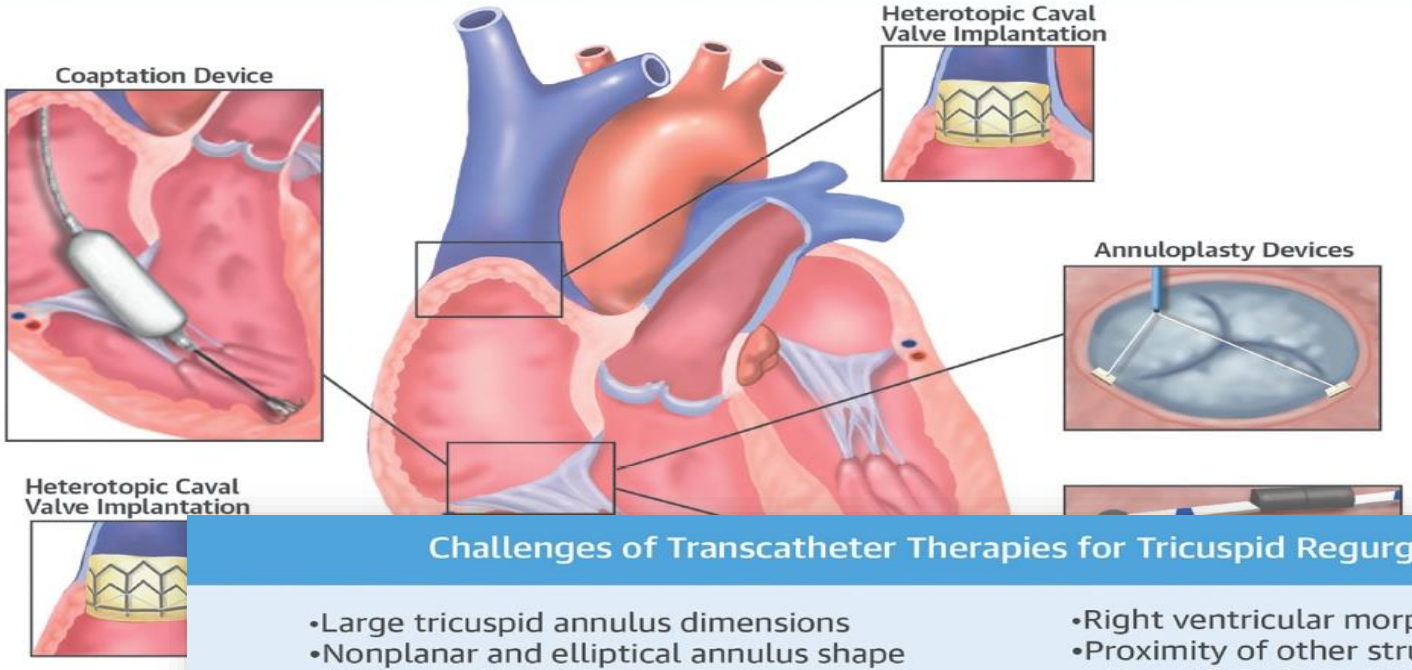
Transcatheter Therapies for Tricuspid Regurgitation



Challenges of Transcatheter Therapies for Tricuspid Regurgitation

- Large tricuspid annulus dimensions
- Nonplanar and elliptical annulus shape
- Absence of calcium
- Right ventricular morphology
- Proximity of other structures (coronary sinus, AV node and HIs bundle, vena cava, right coronary artery)

Rodés-Cabau, J. et al. J Am Coll Cardiol. 2016;67(15):1829–45.

TR repair with Trialign

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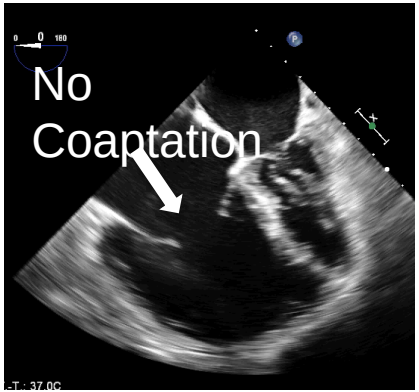
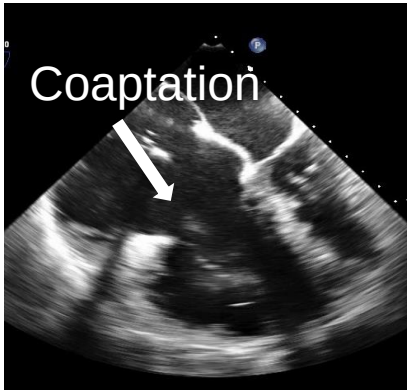
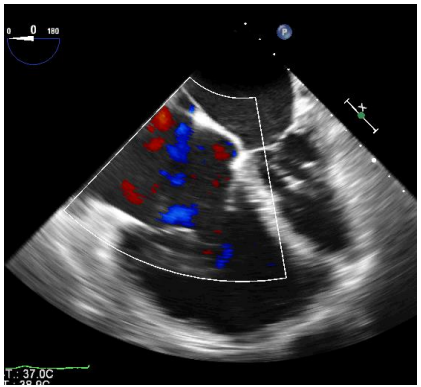
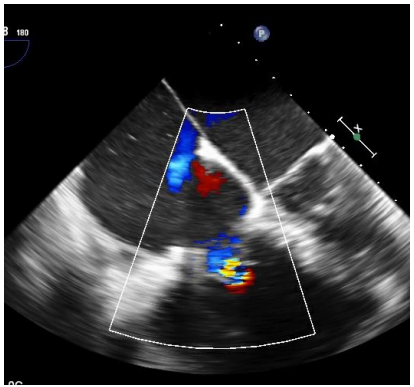
Baseline

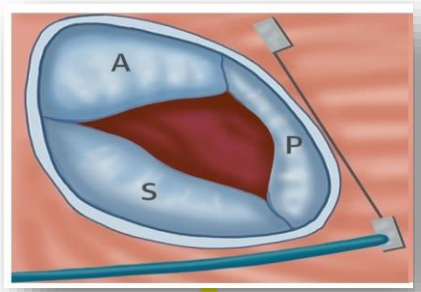
Post

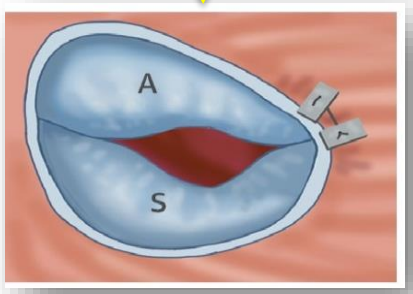






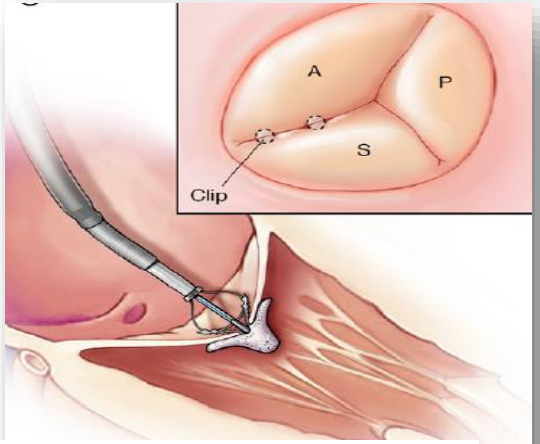






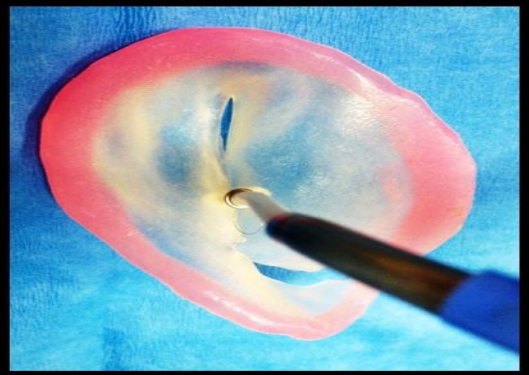
Repair options:

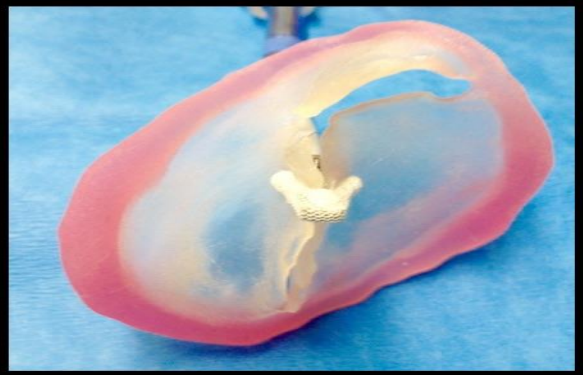
- A catheter based intervention was considered based high risk for surgery
- Can a MitraClip dev
  high risk surgical pa



Fender; Nishimura. Heart 2017

3D printed, patient-specific, tricuspid valve based on 3D TEE data





Implantation of MitraClip in systolic TV model

3D TEE guided procedure

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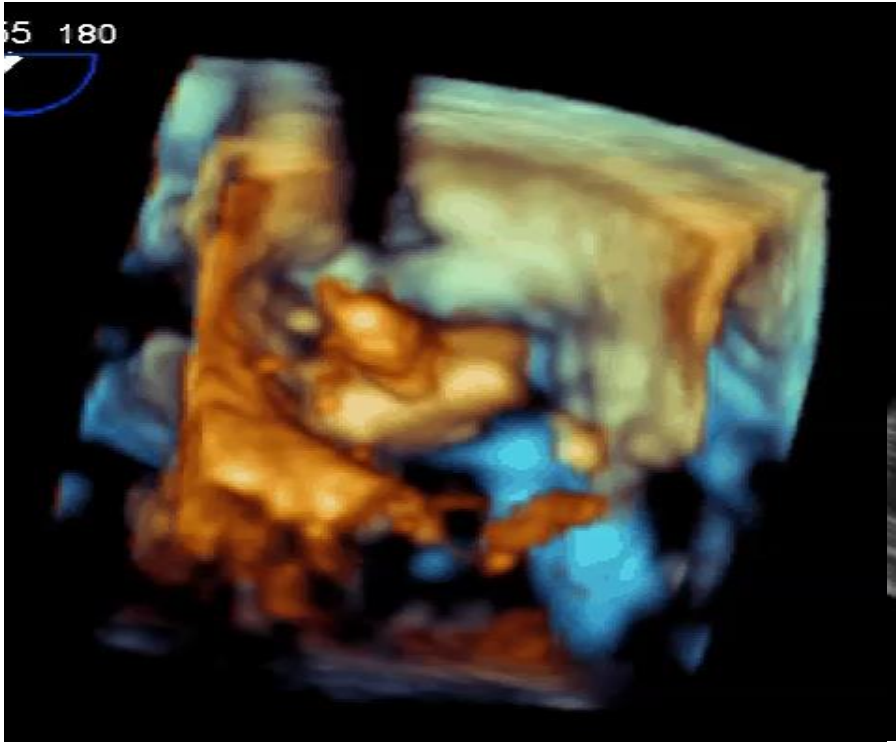

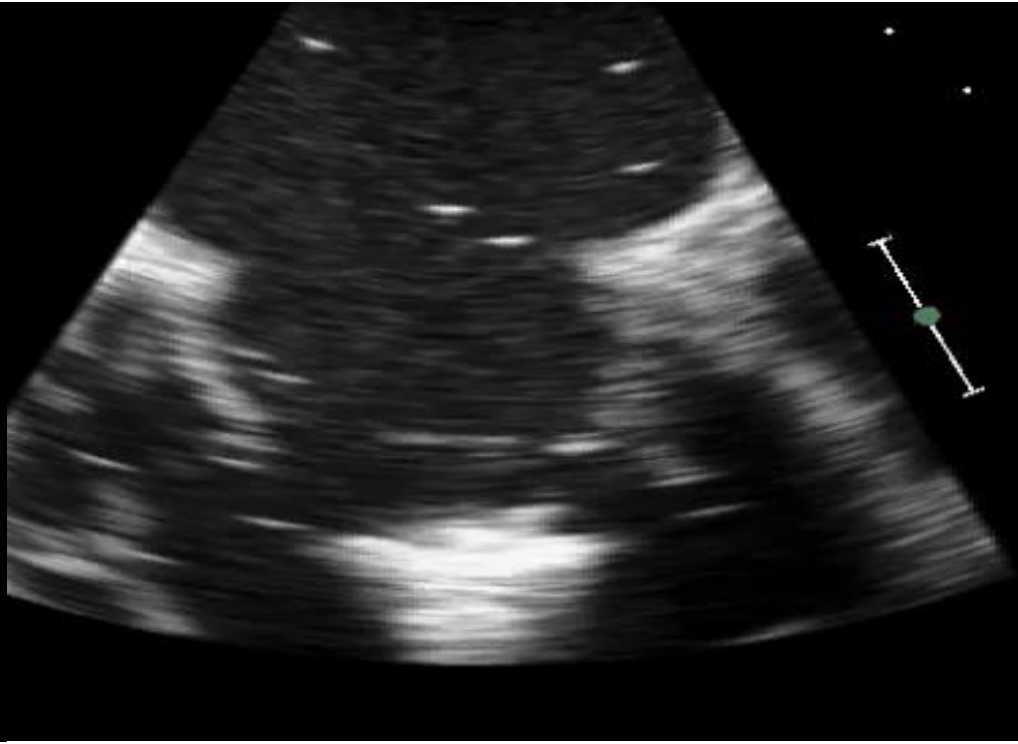

3D for orientation

2D for leaflet capture

3D TEE guided procedure

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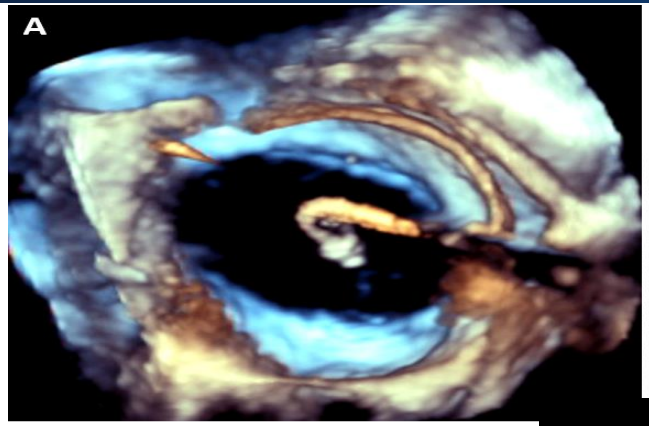

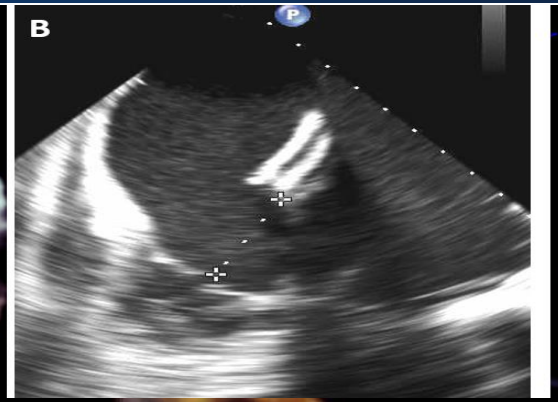

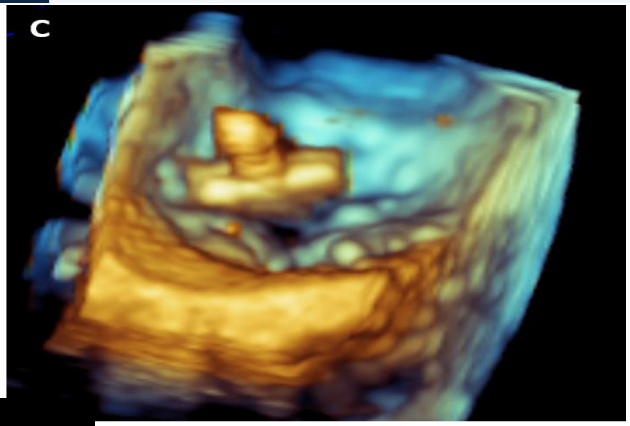

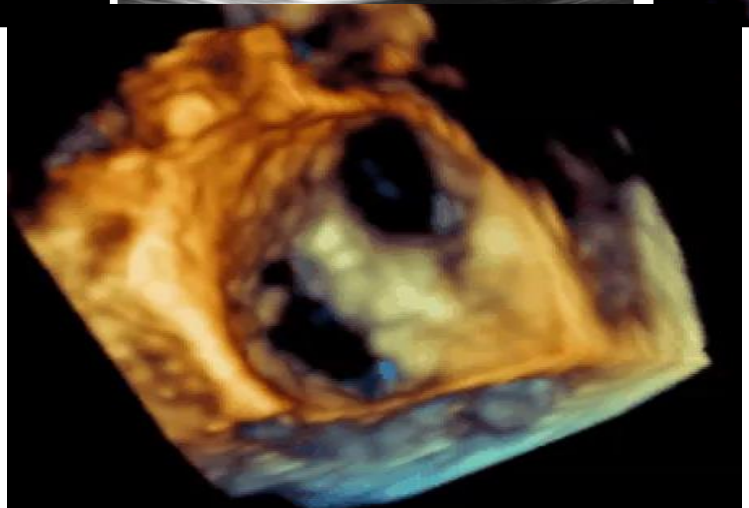

A short 3 hrs later…

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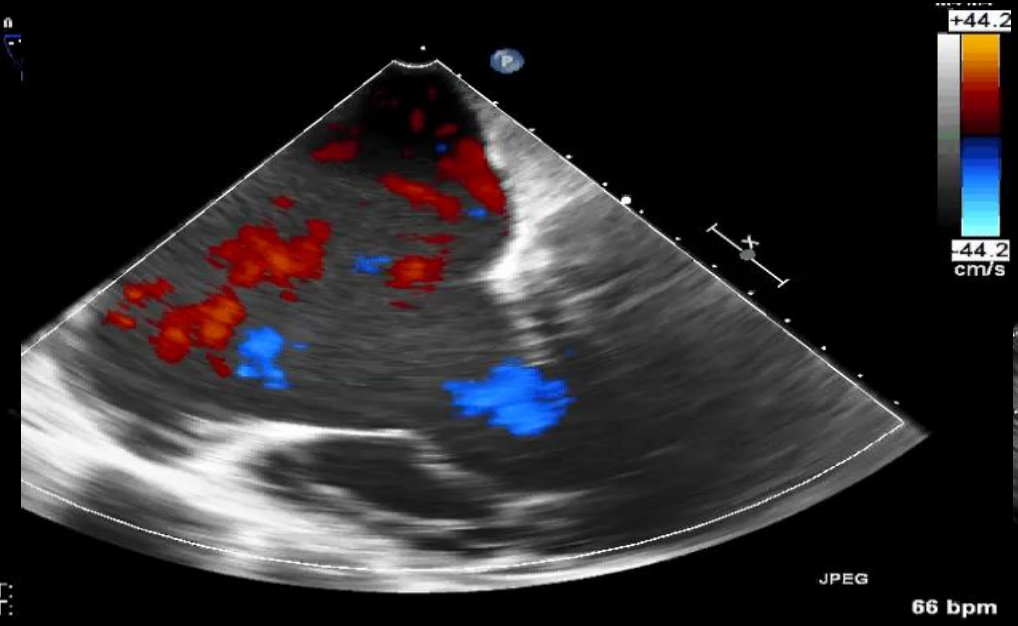

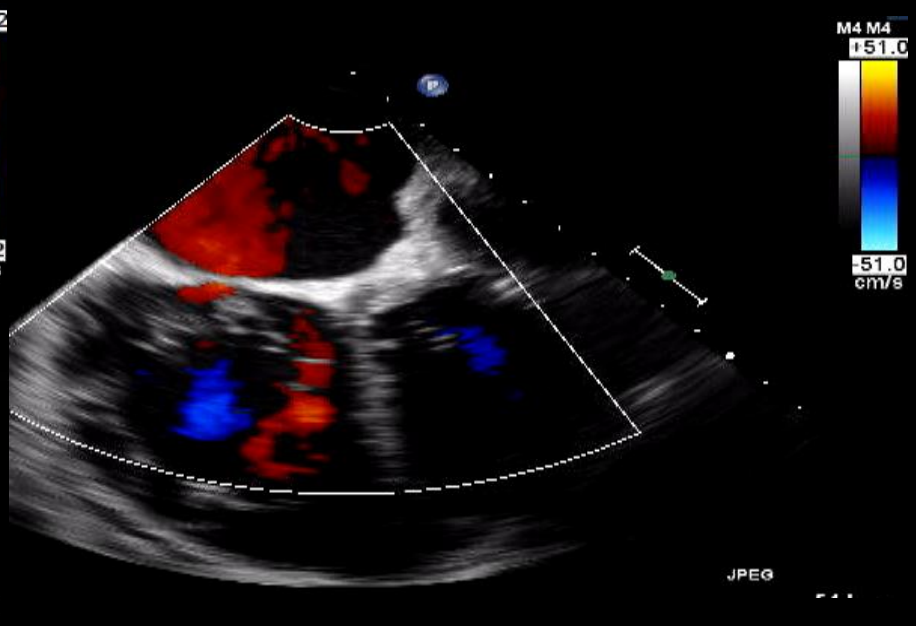

TR has improved
…significantly?

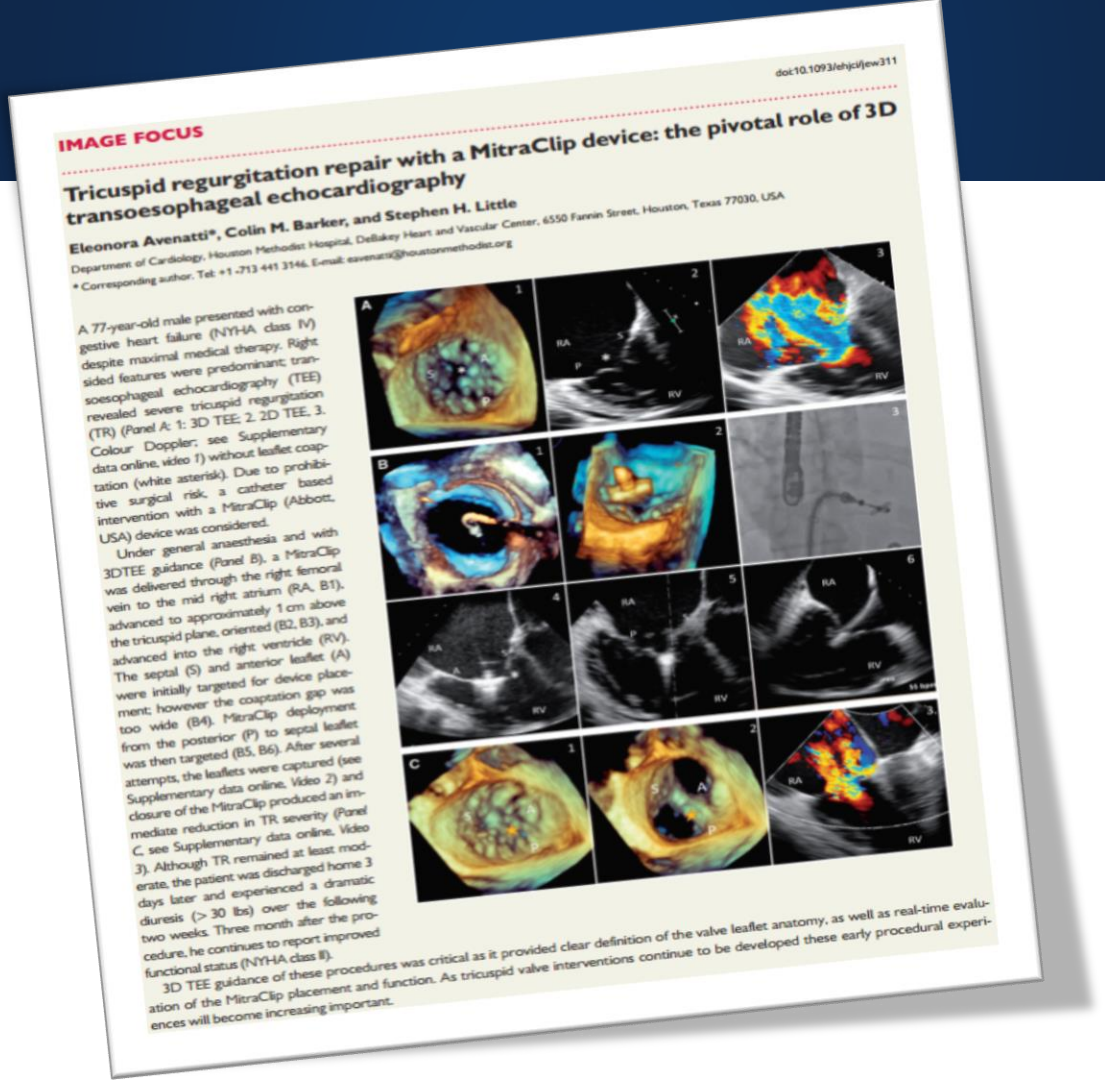

IMAGE FOCUS

doi:10.1093/ehjci/jew311

Tricuspid regurgitation repair with a MitraClip device: the pivotal role of 3D transoesophageal echocardiography

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A 77-year-old male presented with congestive heart failure (NYHA class IV) despite maximal medical therapy. Right sided features were predominant; transoesophageal echocardiography (TEE) revealed severe tricuspid regurgitation (TR) (*Panel A*: 1: 3D TEE; 2. 2D TEE, 3. Colour Doppler; see Supplementary data online, video *1*) without leaflet coaptation (white asterisk). Due to prohibitive surgical risk, a catheter based intervention with a MitraClip (Abbott, USA) device was considered.

Under general anaesthesia and with 3DTEE guidance (*Panel B*), a MitraClip was delivered through the right femoral vein to the mid right atrium (RA, B1), advanced to approximately 1 cm above the tricuspid plane, oriented (B2, B3), and advanced into the right ventricle (RV). The septal (S) and anterior leaflet (A) were initially targeted for device placement; however the coaptation gap was too wide (B4). MitraClip deployment from the posterior (P) to septal leaflet was then targeted (B5, B6). After several attempts, the leaflets were captured (see Supplementary data online, *Video 2*) and closure of the MitraClip produced an immediate reduction in TR severity (*Panel C*, see Supplementary data online, *Video 3*). Although TR remained at least moderate, the patient was discharged home 3 days later and experienced a dramatic diuresis (> 30 lbs) over the following two weeks. Three month after the procedure, he continues to report improved functional status (NYHA class II).

3D TEE guidance of these procedures was critical as it provided clear definition of the valve leaflet anatomy, as well as real-time evaluation of the MitraClip placement and function. As tricuspid valve interventions continue to be developed these early procedural experiences will become increasing important.

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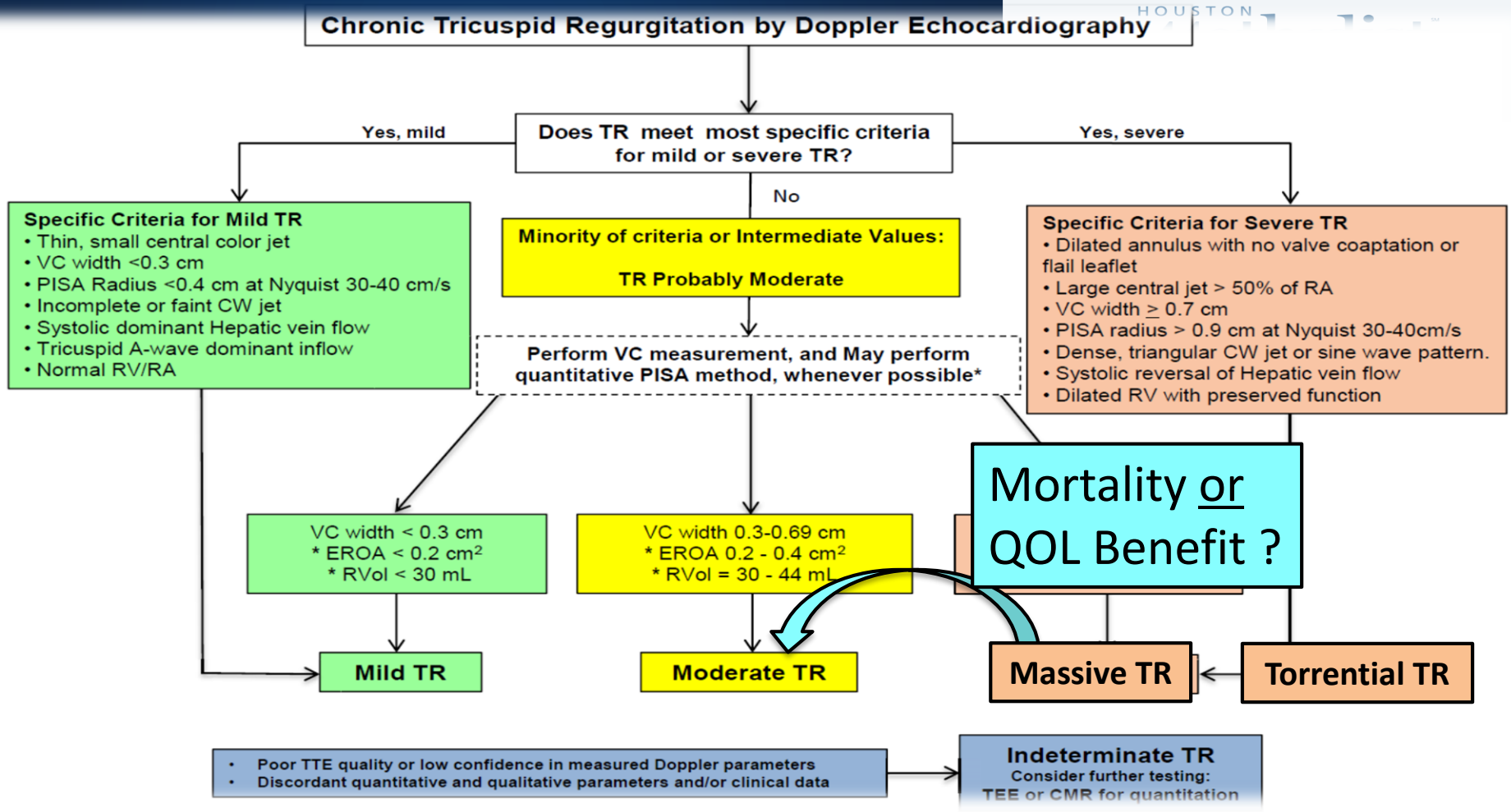
MitraClip repair of TR:

- Long procedure
- At least moderate residual TR
- But…a very impressive clinical response with a rapid diuresis of > 30 lbs

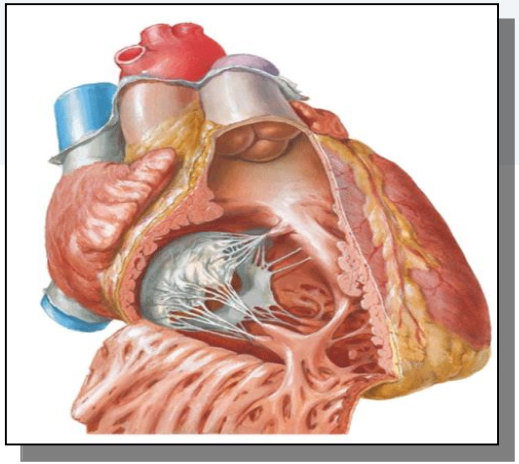
E. Avenatti, C. Barker, S. Little. European Heart Journal. 2017



Zoghbi et al. JASE 2017

Summary

Functional TR Guidelines



- Consider the RV and TV anatomy
- Distinguish 1° from 2° TR
- Establish TR severity (Quantify if needed)
- Severe TR is associated with poor prognosis
- Consider functional TR repair at the time of Left heart surgery
- Catheter-repair may change this approach (TBD)

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