

Choosing Right Patient for Transcatheter Tricuspid Valve Intervention

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Disclosure Statement of Financial Interest

Within the past 12 months, I or my spouse/partner have had a financial interest, arrangement or affiliation with the organization(s) listed below.

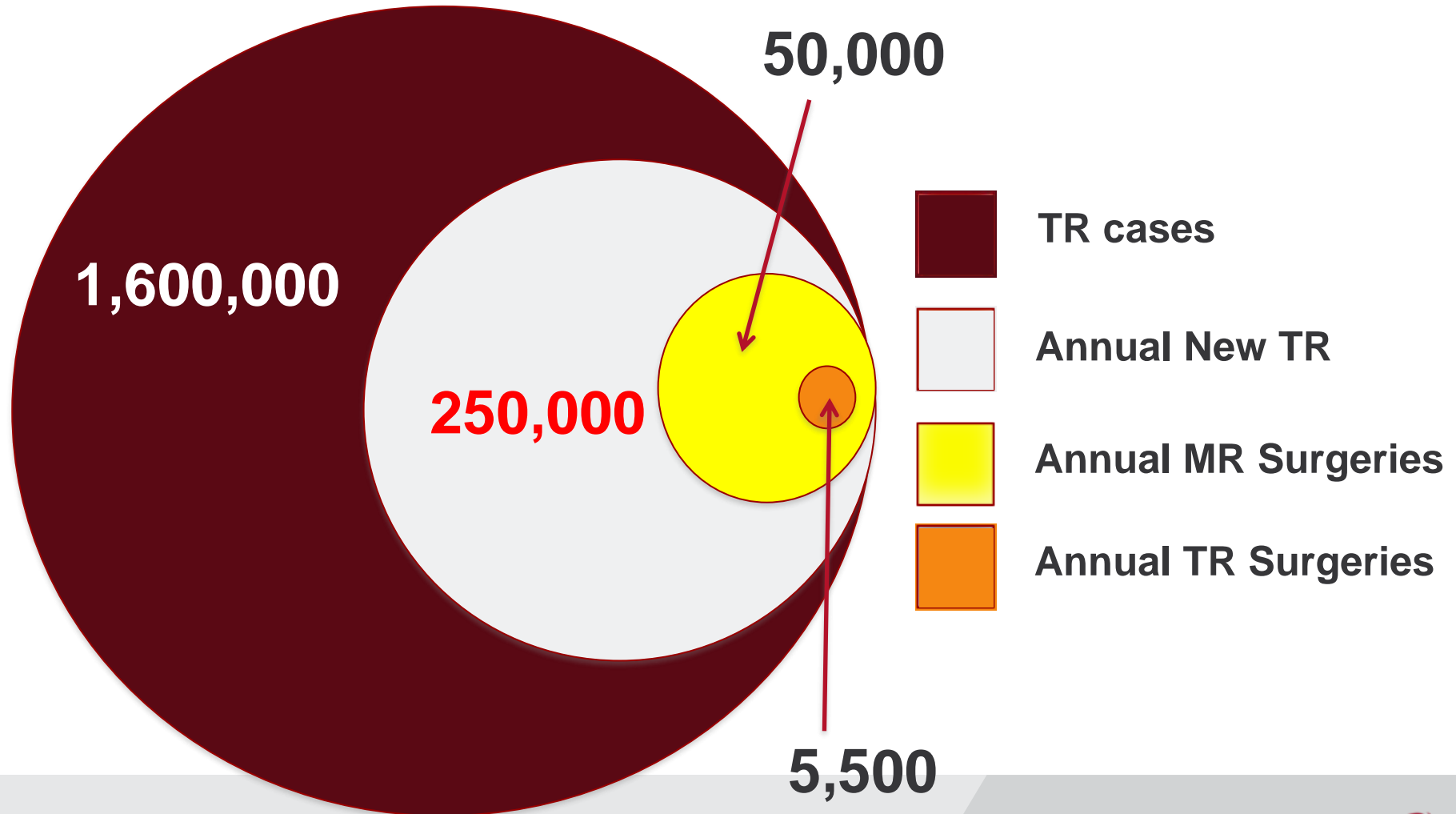
Financial Relationship

- Consulting Activities

Company

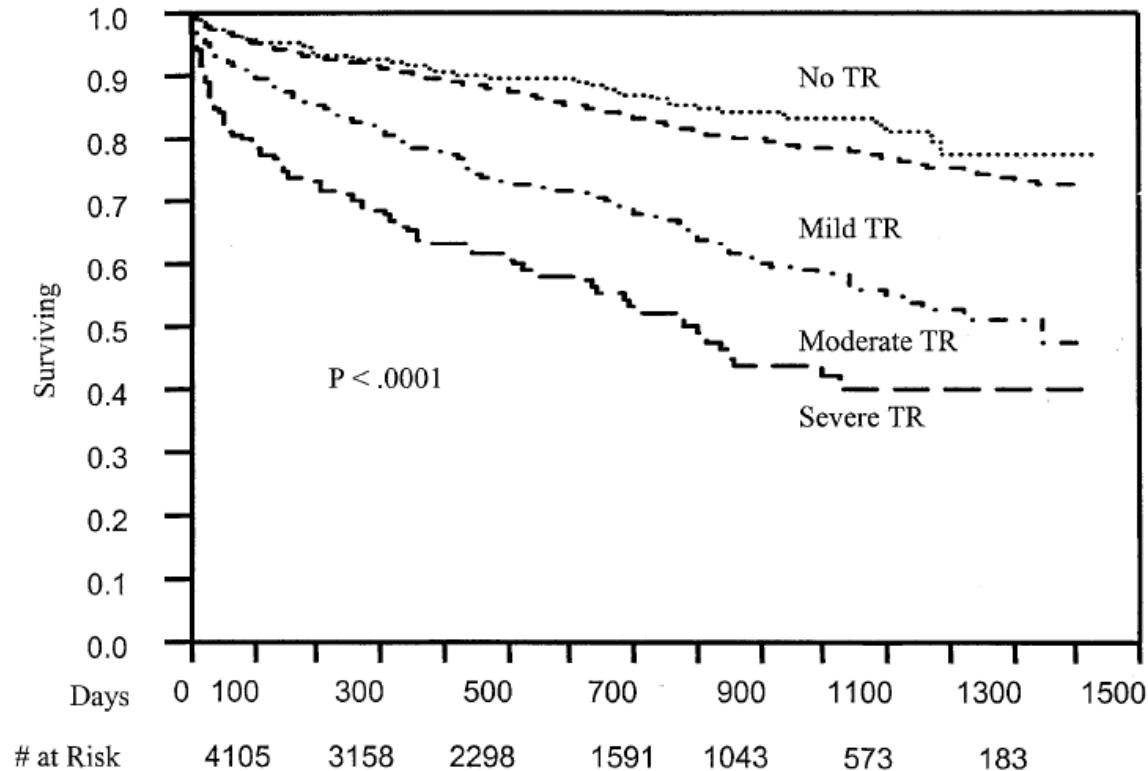
Abbott, Boston Scientific, Edwards Lifesciences, Medtronic, 4C, Anteris

TR is currently undertreated



Untreated Tricuspid Regurgitation

- 40% Mortality Rate for Severe TR

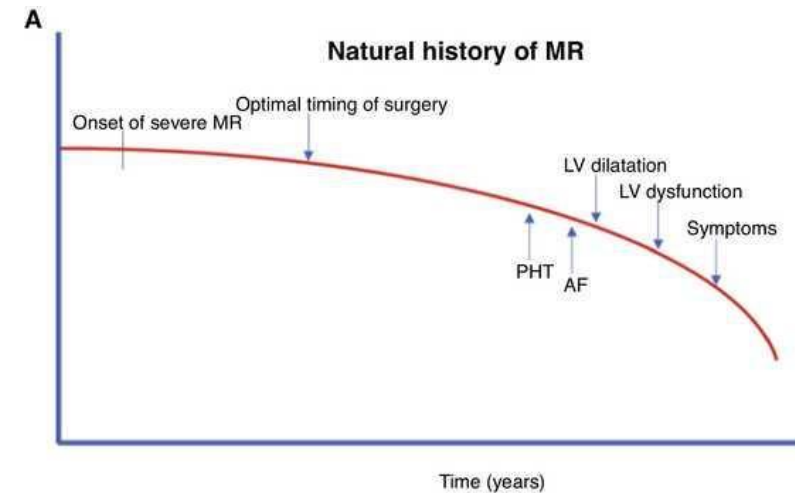
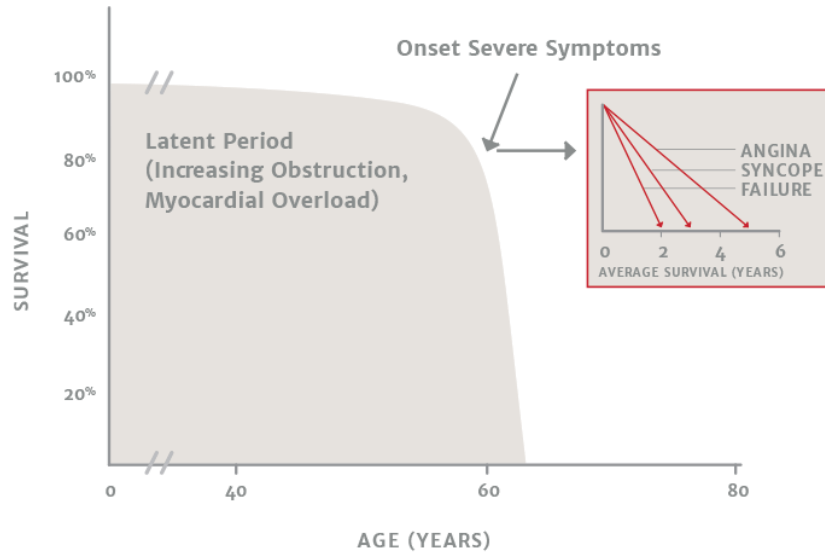


Prevalence: 2.4 million

10,000 TR surgeries/year

Increasing severity: higher excess-mortality

Natural history of TR is not well documented



In TR the symptoms do not guide us in timing an early intervention

Challenges with Tricuspid Regurgitation

- Symptoms
 1. Decreased CO – fatigue, decreased exercise tolerance

Considered too early for intervention

2. Right Heart Failure – Ascites, LE edema

May be too late for intervention

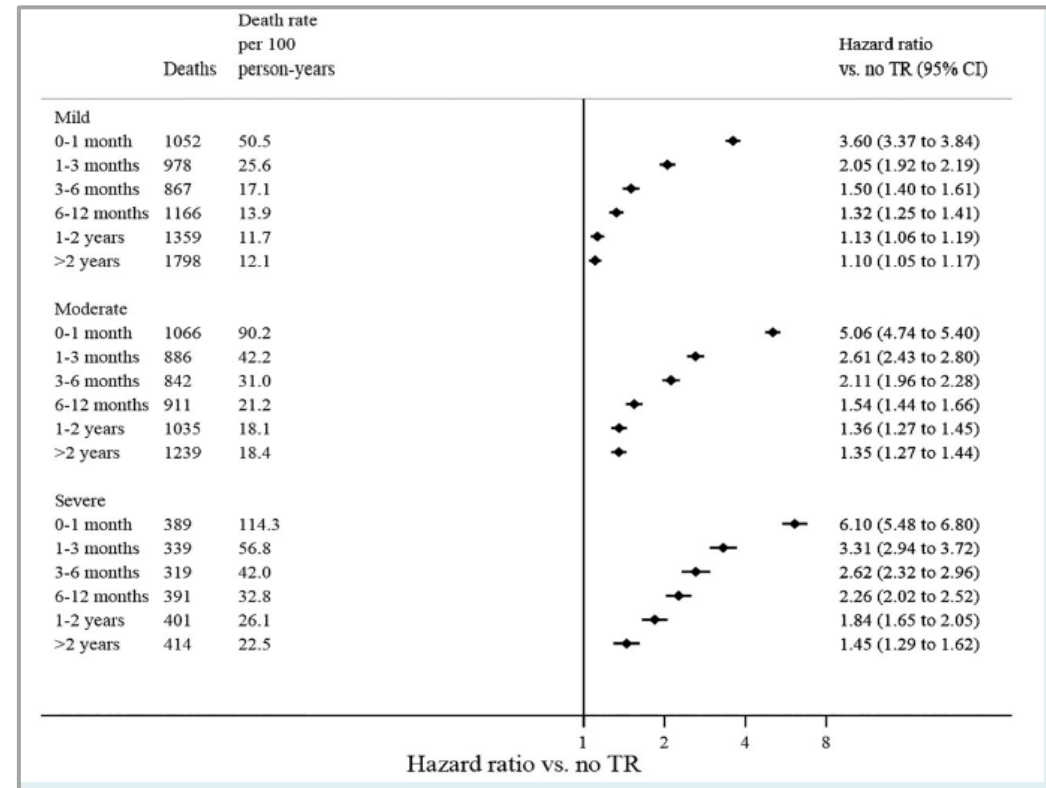
Diagnostic Challenges with TR

- Regurgitation can be dynamic and very volume dependent
- Volume overload is well-tolerated for years
- Poor understanding about grading the severity of TR on Echo
 - Is Mild, moderate and severe a good grading?

Early Diagnosis and Follow Up are Critical to Reduce Mortality

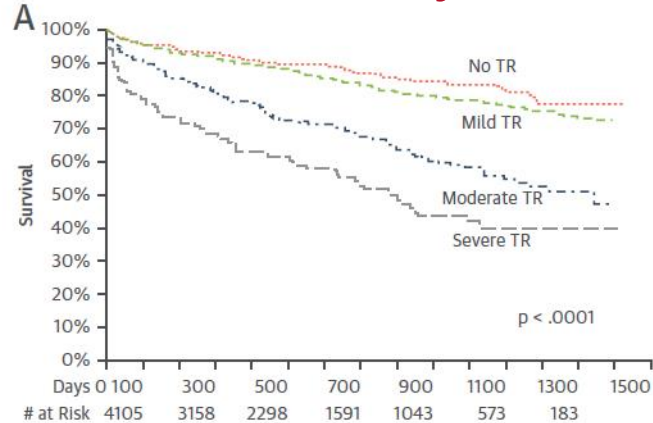
- TR can progress:
 - From trivial/mild to moderate/severe: 5.3 ± 2.9 yrs.
 - Follow up is critical

- Risk of death is higher with TR severity as well as in the early period after TR diagnosis

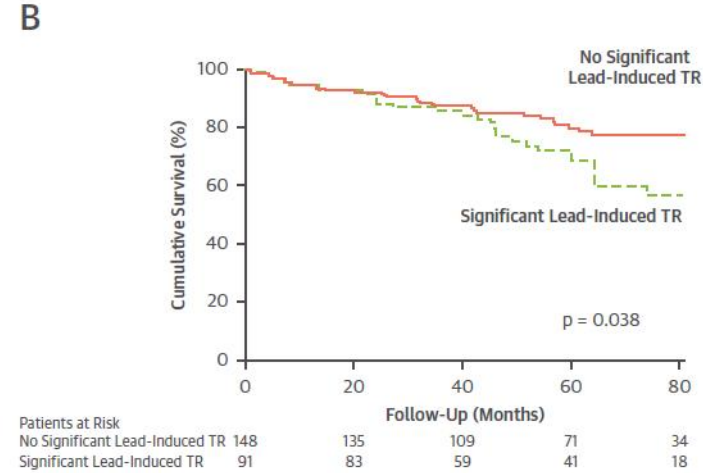


TR – Morphologic Types vary but prognosis does not

Secondary TR

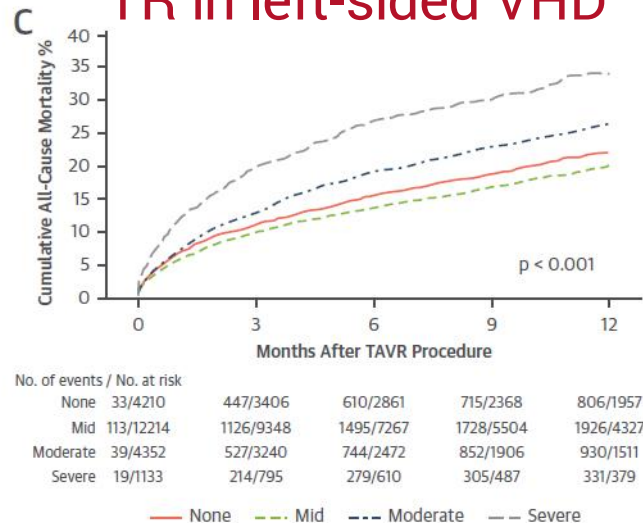


Lead-induced TR

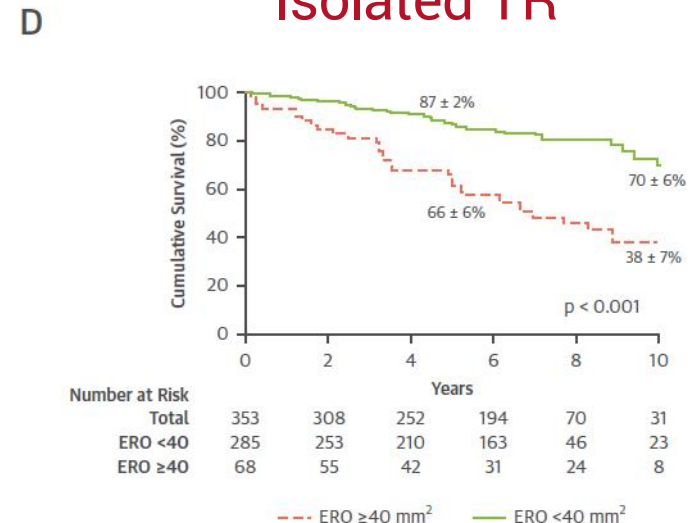


As TR progresses, survival is significantly worse with 5-year survival of 50%

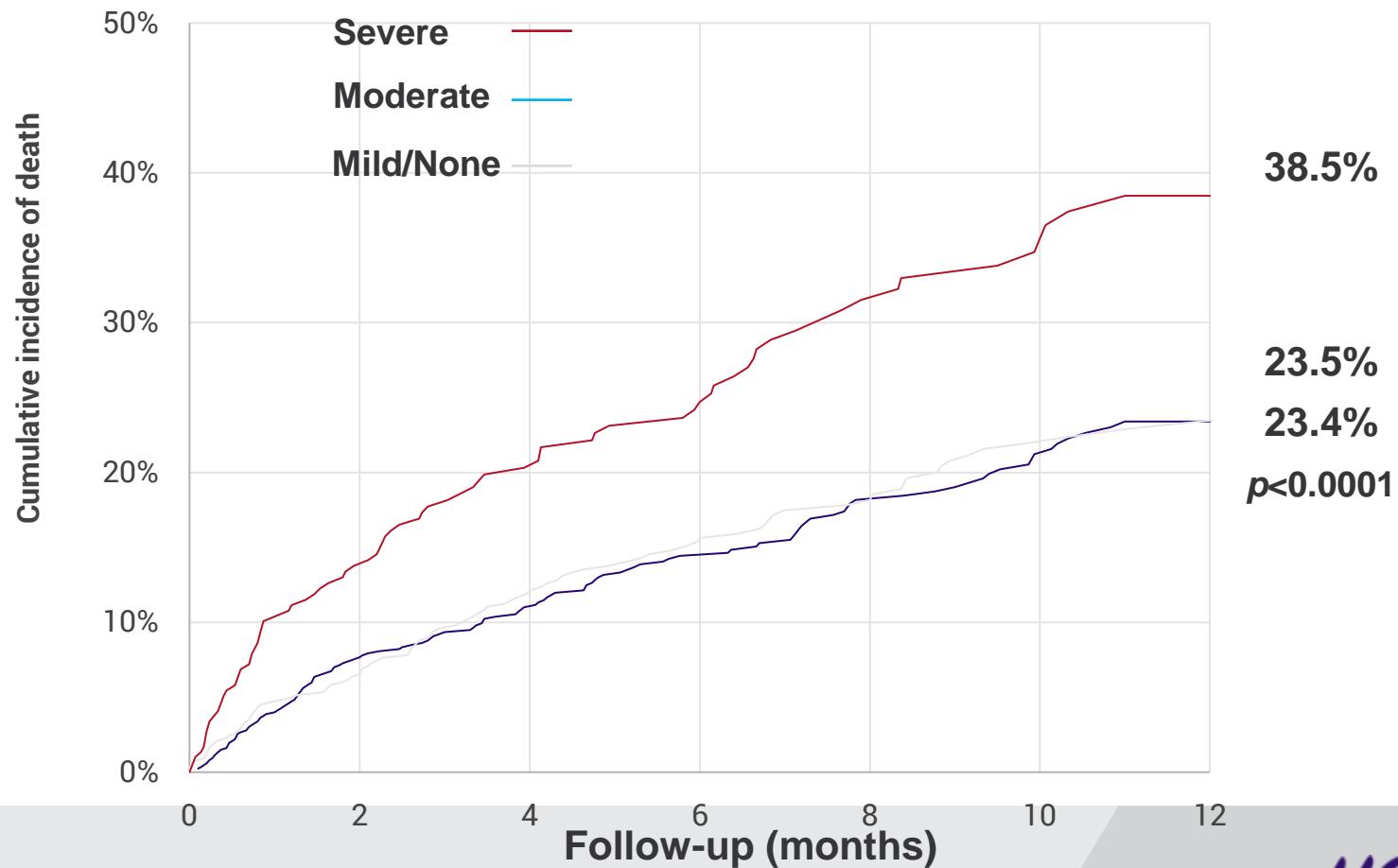
TR in left-sided VHD



Isolated TR

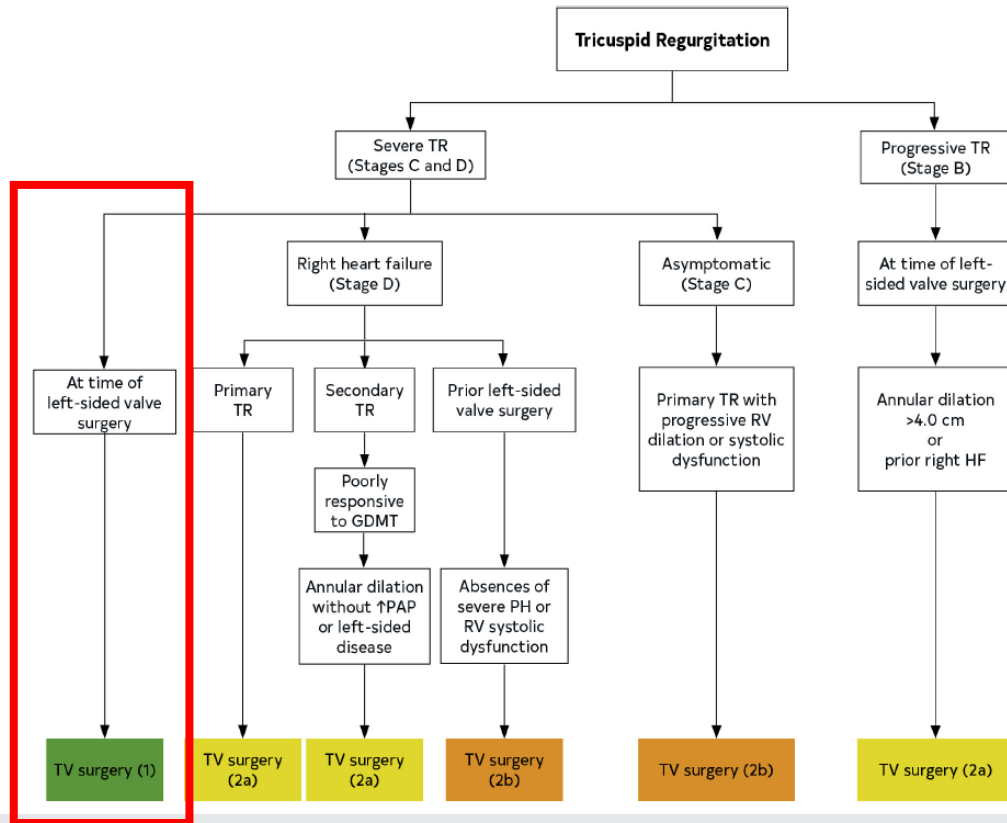


US TVT Registry: Impact of TR on MitraClip Death



Guidelines Indicate TR Surgery for Selected Patients with Isolated TR and Left-Sided Valve Lesions

- Recommendations for Intervention



- Recommendations for Medical Therapy

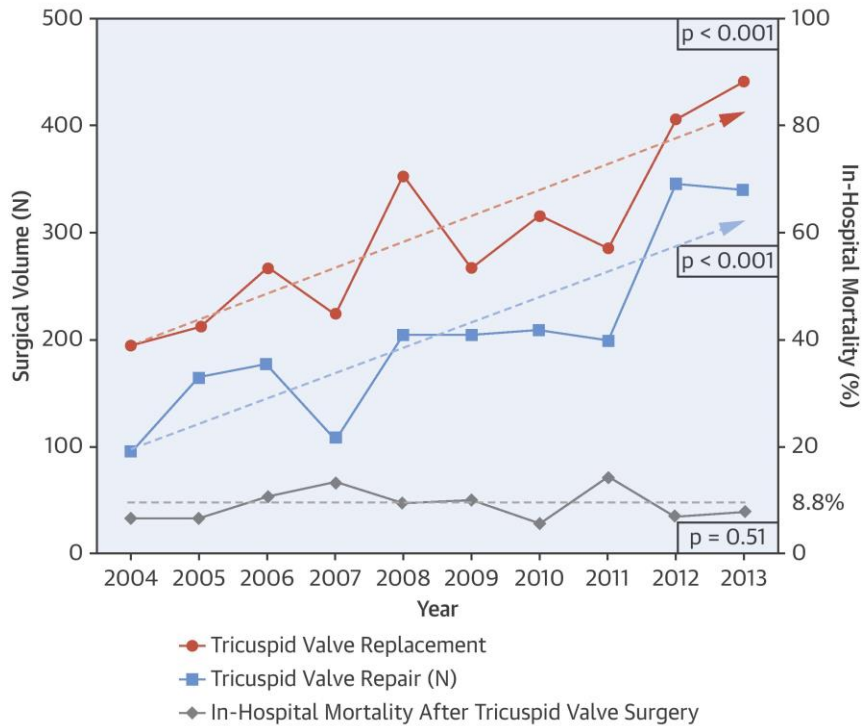
COR	LOE	RECOMMENDATIONS
2a	C-E0	1. In patients with signs and symptoms of right-sided HF attributable to severe TR (Stages C and D), diuretics can be useful.
2a	C-E0	2. In patients with signs and symptoms of right-sided HF attributable to severe secondary TR (Stages C and D), therapies to treat the primary cause of HF (eg, pulmonary vasodilators to reduce elevated pulmonary artery pressures, GDMT for HF with reduced LVEF, or rhythm control of AF) can be useful (1,2)

Surgery is indicated for patients with severe TR, but many have significant RV failure

Should we consider earlier treatment?

Isolated TV surgery

CENTRAL ILLUSTRATION: Temporal Trends in Surgical Volume and Mortality for Isolated Tricuspid Valve Surgery



Zack, C.J. et al. J Am Coll Cardiol. 2017;70(24):2953-60.

2004-2013 National Trend
 5005 surgeries
 Steady increase in number
 2004: 290
 2013: 780
 In hospital mortality : 8.8%










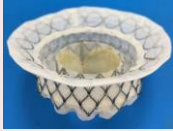
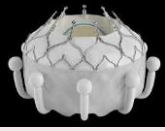

Repair: 40.8%
 Replacement: 59.2%

Mortality: Repair: 5.9%
 Replacement (M): 13.6%
 Replacement (T): 9.1%

Hence



New tricuspid therapies

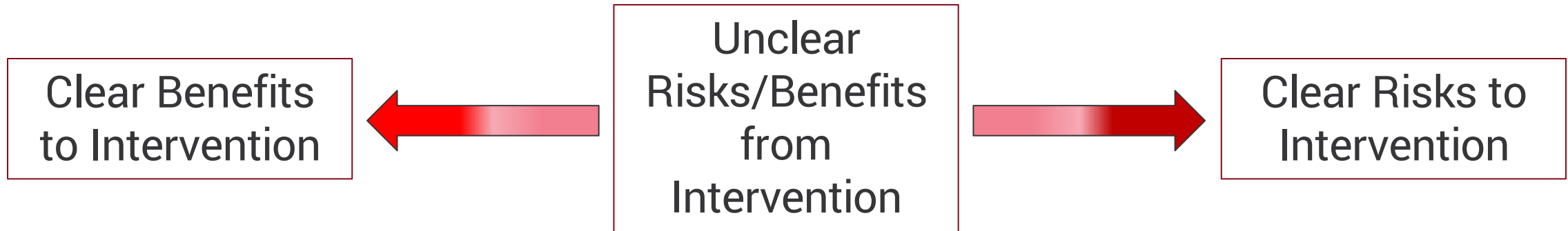
Mechanism	New Technologies
Annuloplasty (Direct and Indirect)	    <p>TriAlign Millepede</p> <p>CardioBand</p> <p>4 i ech</p>
Leaflet Devices	   <p>Forma</p> <p>MitraClip</p> <p>PASCAL</p>
Stented Valves in IVC/SVC	   <p>Trinity /Sapien</p> <p>NVT</p>
Valve Replacement	    

Results can be Near Perfect

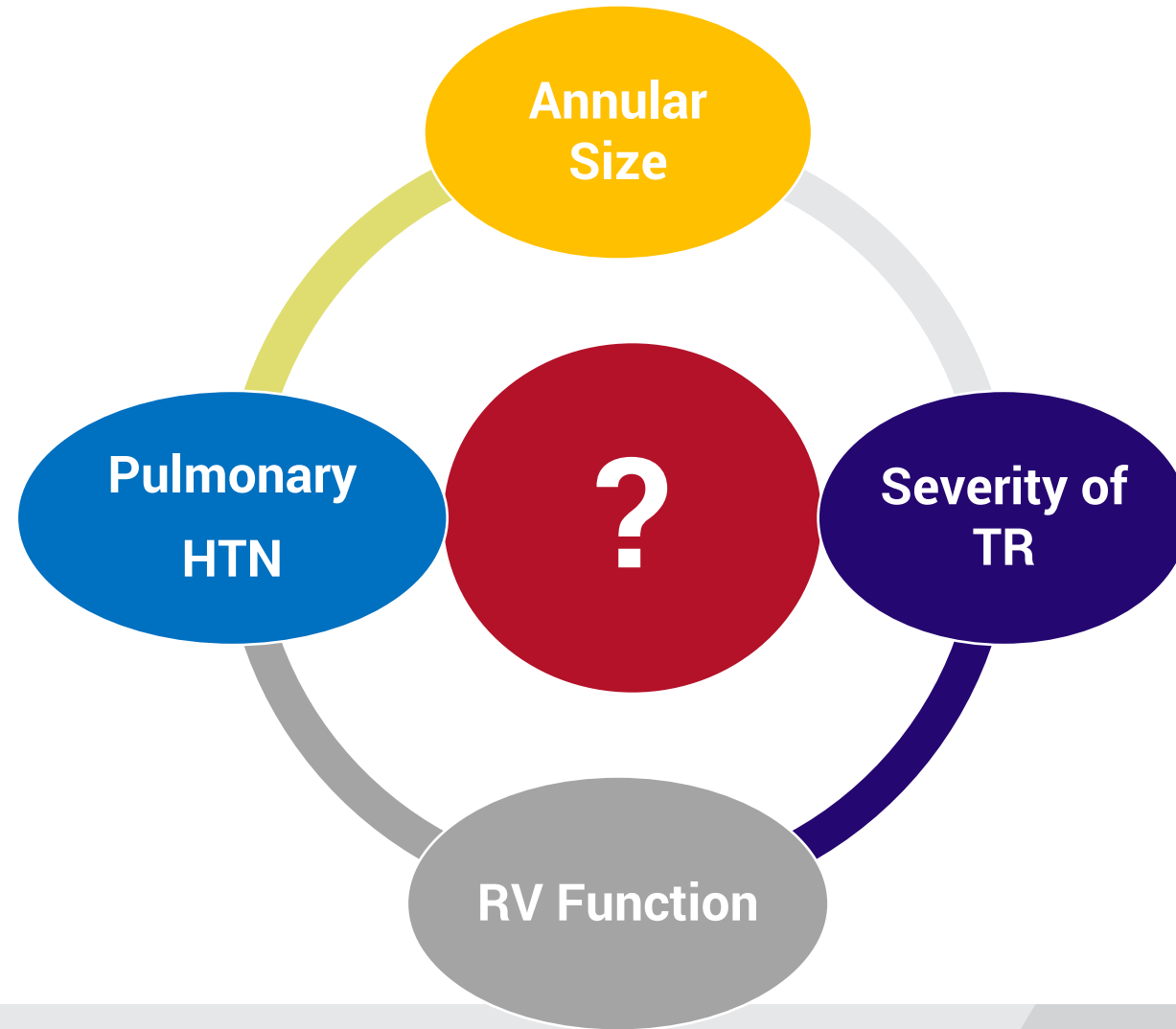


But can they predict recovery and Survival benefit?

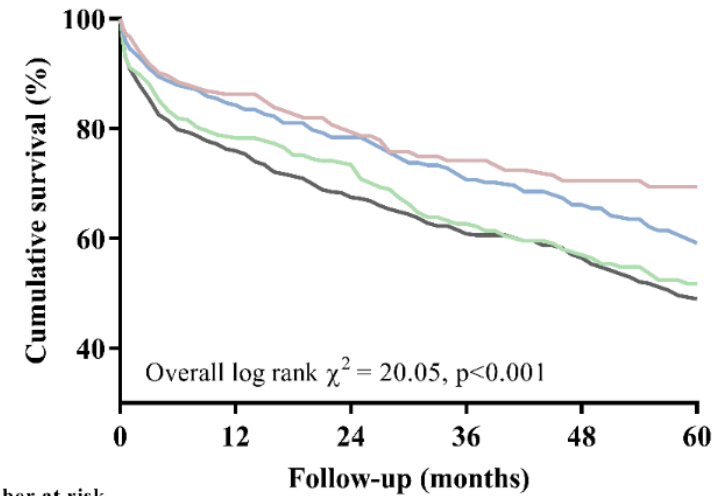
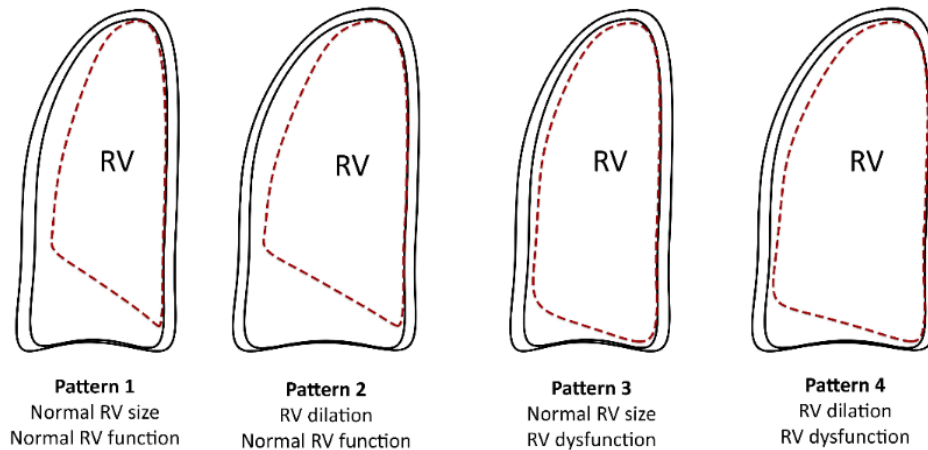
But we still need to Understand



When to Intervene is bit unclear

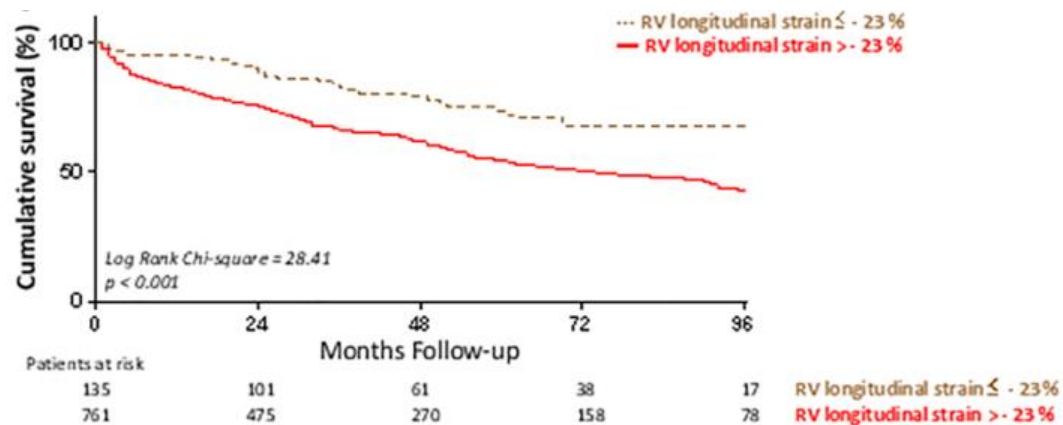
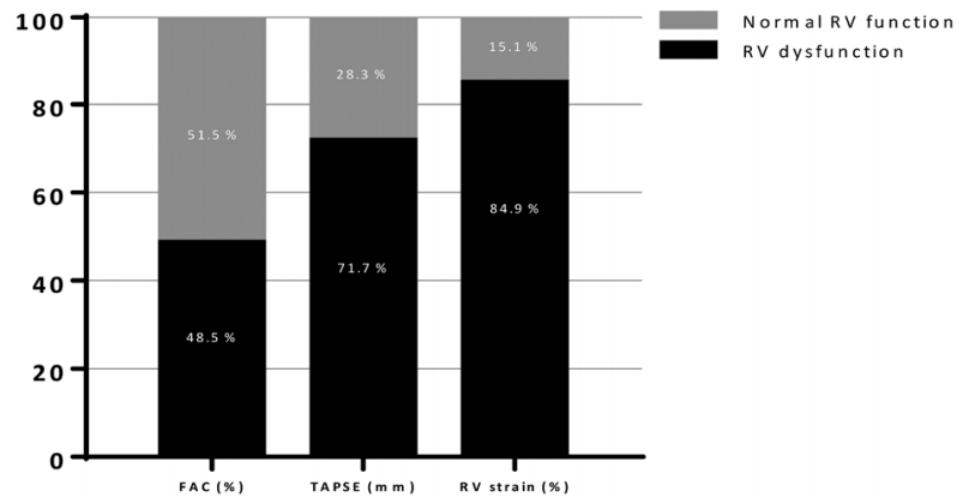
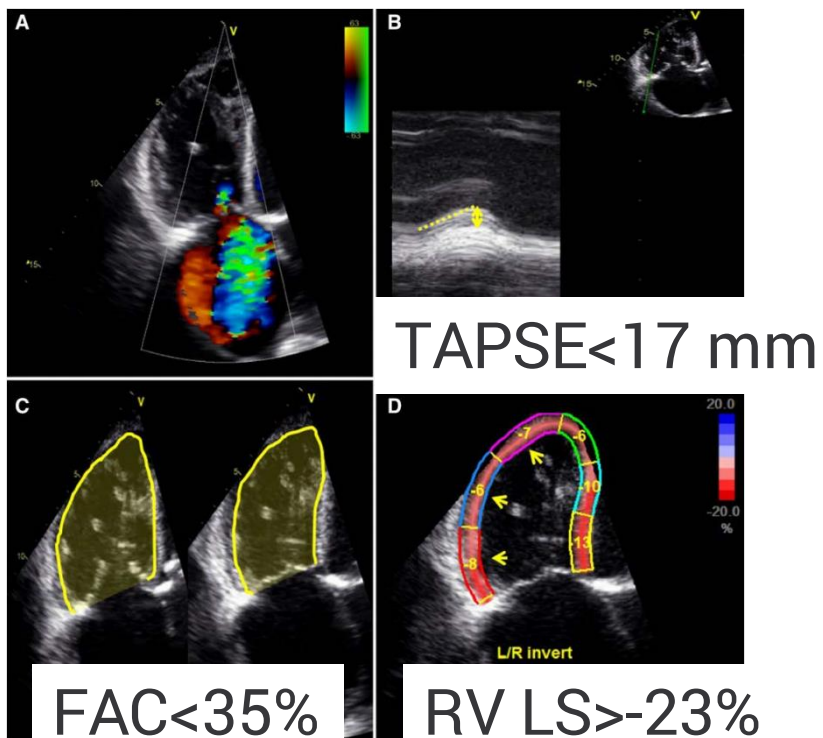


Understanding : RV Systolic Function

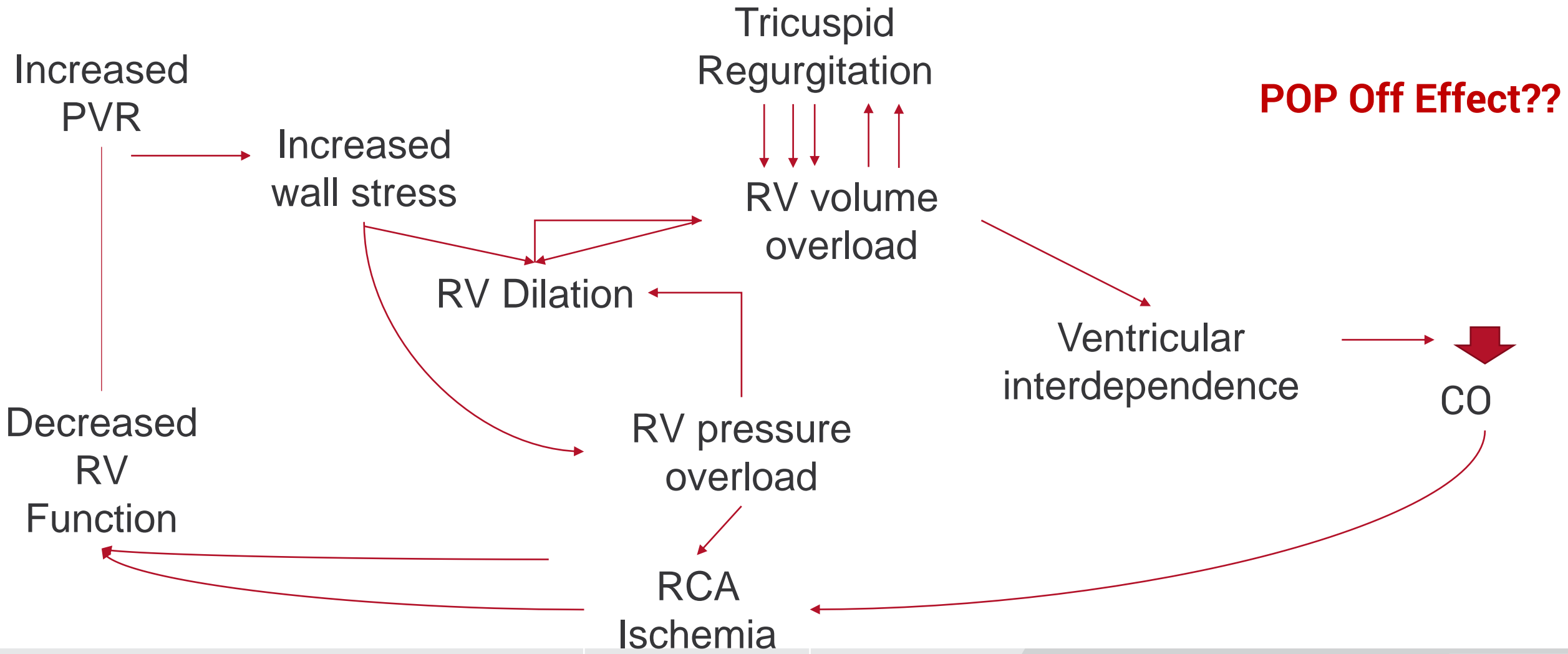


	Number at risk					
	0	12	24	36	48	60
— Pattern 1	183	154	119	91	71	59
— Pattern 2	256	211	179	137	107	78
— Pattern 3	304	239	203	153	109	77
— Pattern 4	549	415	329	253	200	156

RV Systolic Function



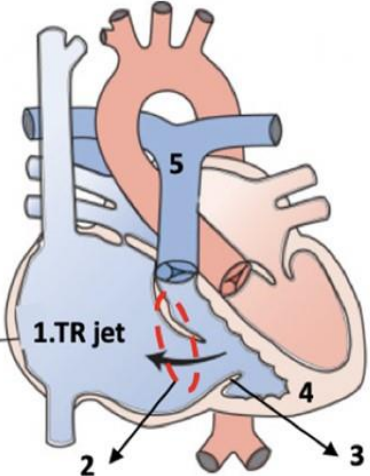
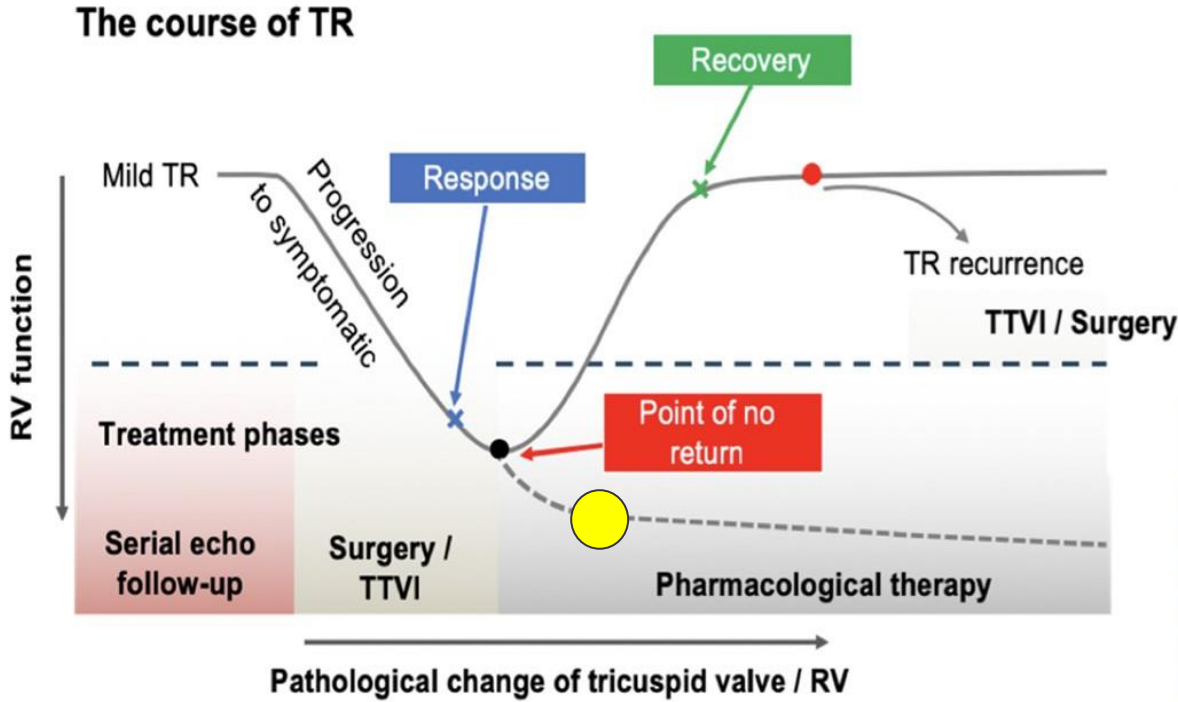
Pathophysiology of RV Failure



Adapted from Green et al. *Curr Heart Fail Rep* 2012;9:228-235.

Heart Team Approach to Determine Best Timing for Treatment

- 1. Demographic**
e.g. age, Sex
- 2. Clinical symptoms**
e.g. NYHA functional class
- 3. Comorbidities**
e.g. stroke, COPD, renal, liver failure
- 4. Cardiac disease**
e.g. combined left-sided disease
- 5. Surgical characteristics**
e.g. isolated, combined



- 1. TR severity**
- 2. Annulus size**
- 3. Tricuspid valve morphology**
- 4. RV remodelling**
- 5. Pulmonary vascular resistance**

Patient risk stratification

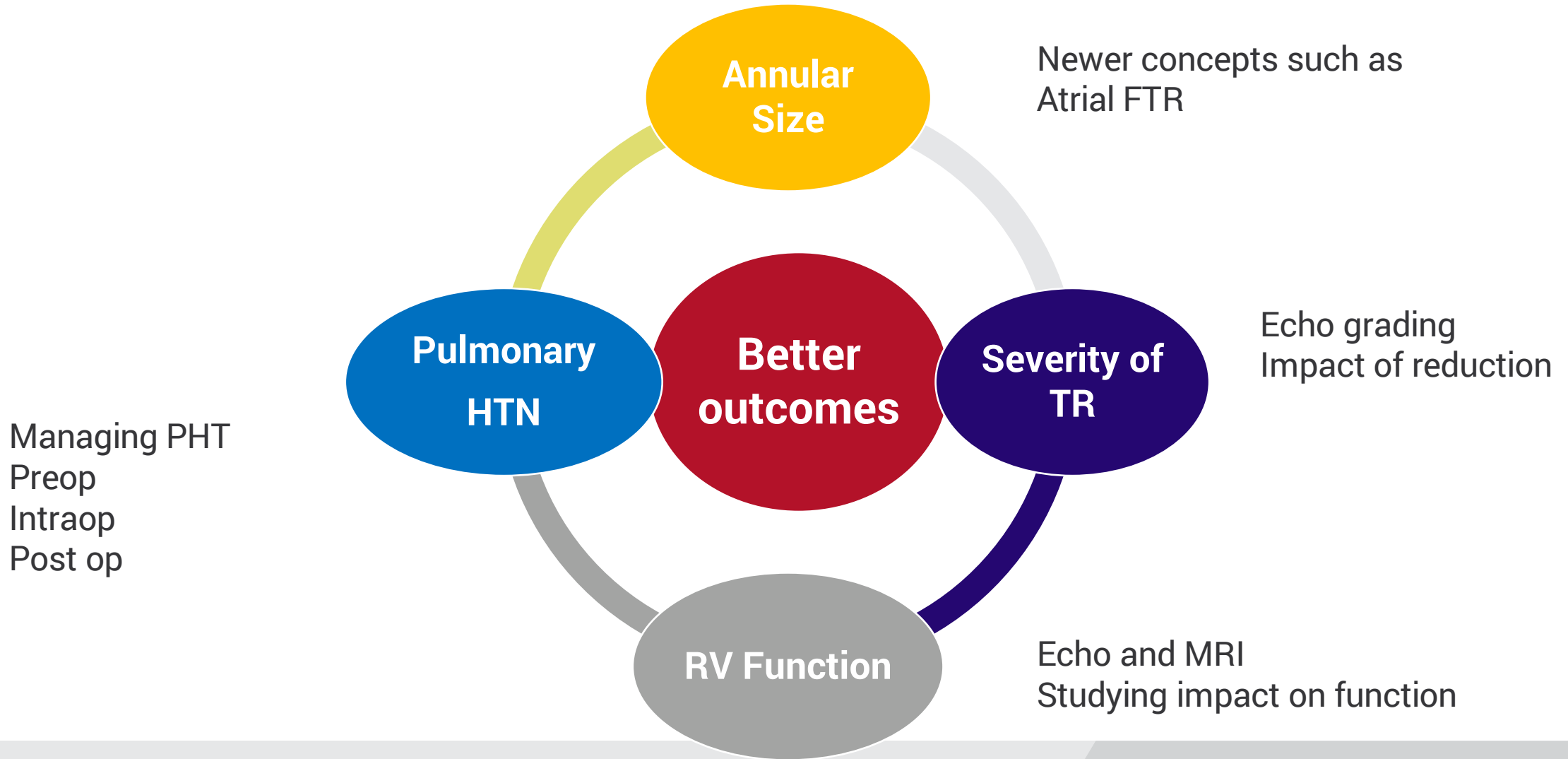
Heart team decision-making

Cardiac pathological remodelling

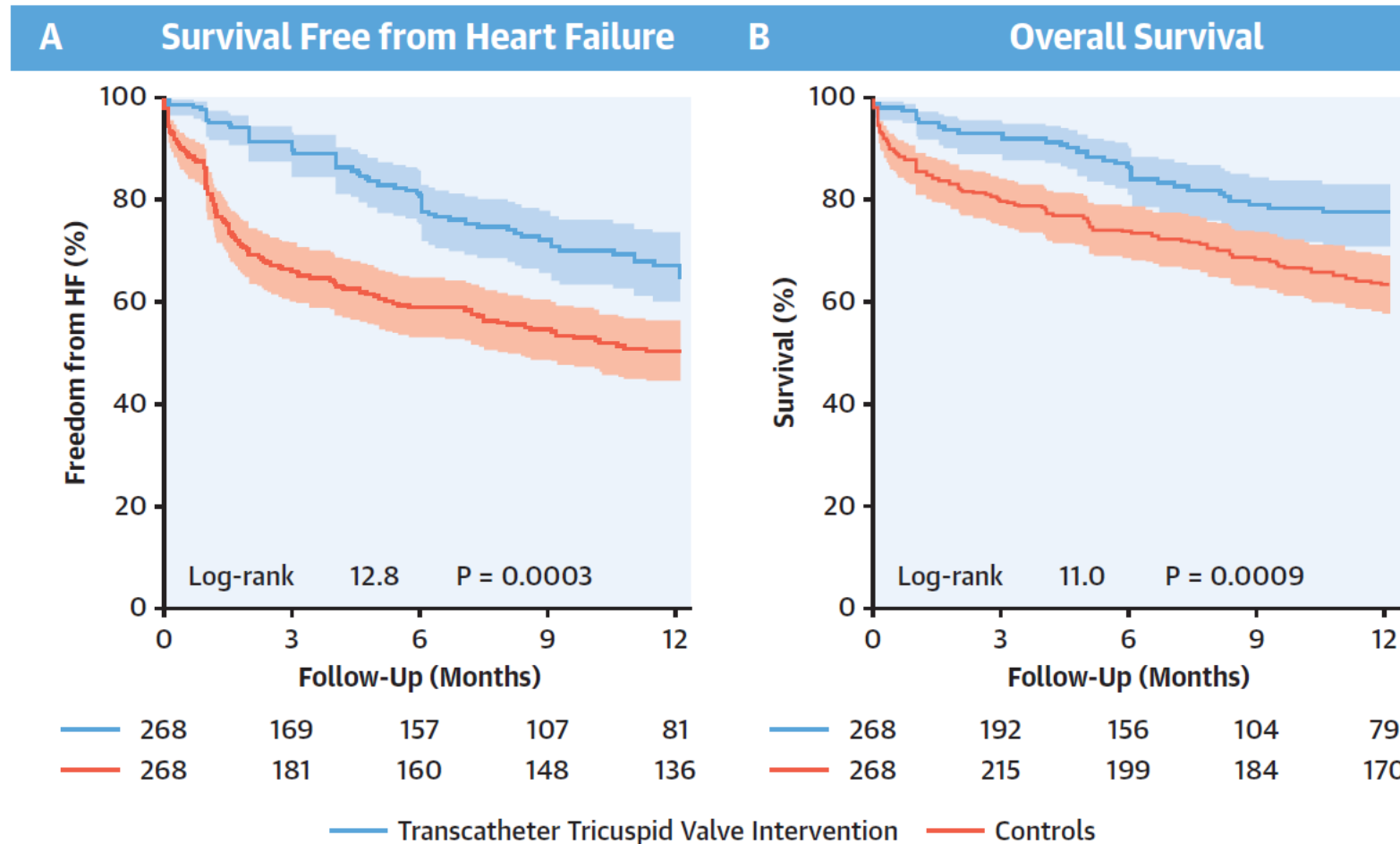
Chang CC, Veen KM, Hahn RT, et al. Uncertainties and challenges in surgical and transcatheter tricuspid valve therapy: a state-of-the-art expert review. *EUROPEAN HEART JOURNAL*. 2020;41(20):1932



Heart Team 3.0



Significantly Improved Clinical Outcomes with Transcatheter TV Therapy versus Medical Therapy



Tamasso M. et al., 2019 Transcatheter Versus Medical Treatment of Patients With Symptomatic Severe Tricuspid Regurgitation

HOPE
DISCOVERED HERE™

Minneapolis Heart Institute Foundation
Creating a world without heart and vascular disease

Improvements and Impact

- Critical piece
 - Early diagnosis and monitoring progression
 - Trigger for intervention
 - Procedure planning
 - Quantifying improvements

Extended Grading Scheme

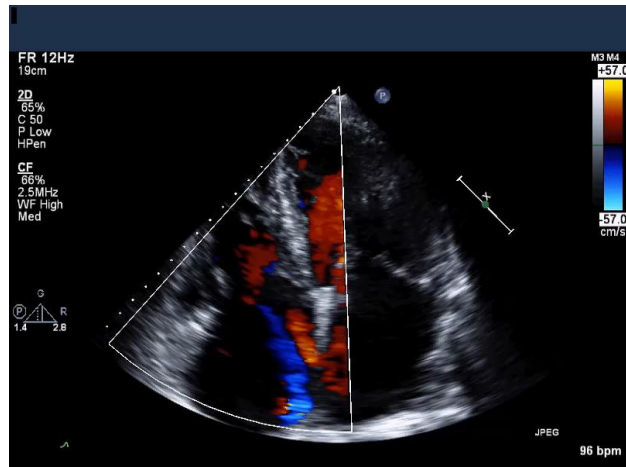
Table I Proposed expansion of the 'Severe' grade

Variable	Mild	Moderate	Severe	Massive	Torrential
VC (biplane)	<3 mm	3-6.9 mm	7-13 mm	14-20 mm	≥21 mm
EROA (PISA)	<20 mm ²	20-39 mm ²	40-59 mm ²	60-79 mm ²	≥80 mm ²
3D VCA or quantitative EROA ^a			75-94 mm ²	95-114 mm ²	≥115 mm ²

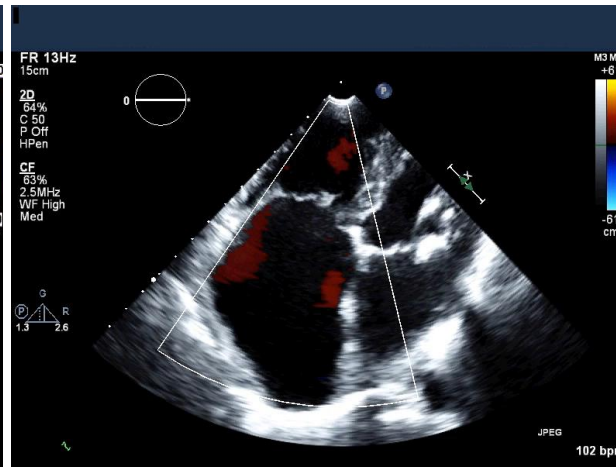
VC, vena contracta; EROA, effective regurgitant orifice area; 3D VCA, three-dimensional vena contracta area.

^a3D VCA and quantitative Doppler EROA cut-offs may be larger than PISA EROA.

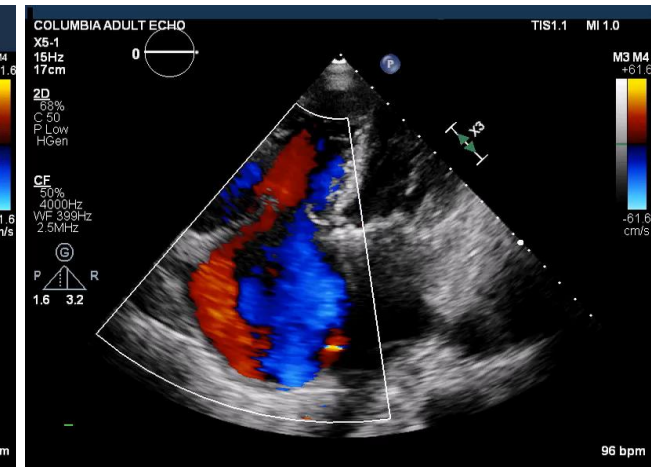
Rebecca T. Hahn, and Jose L. Zamorano. "The Need for a New Tricuspid Regurgitation Grading Scheme." *European Heart Journal - Cardiovascular Imaging*, 2017



Severe

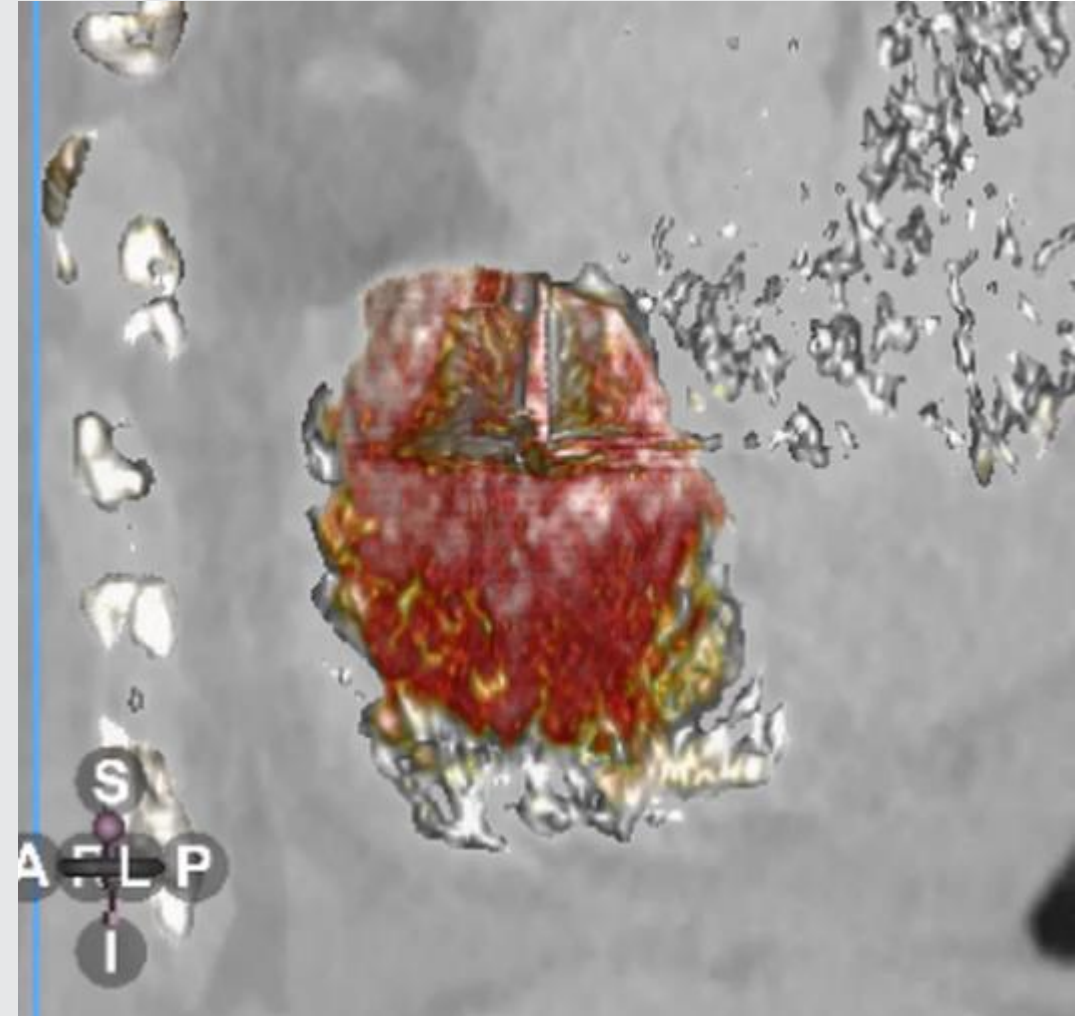


Massive

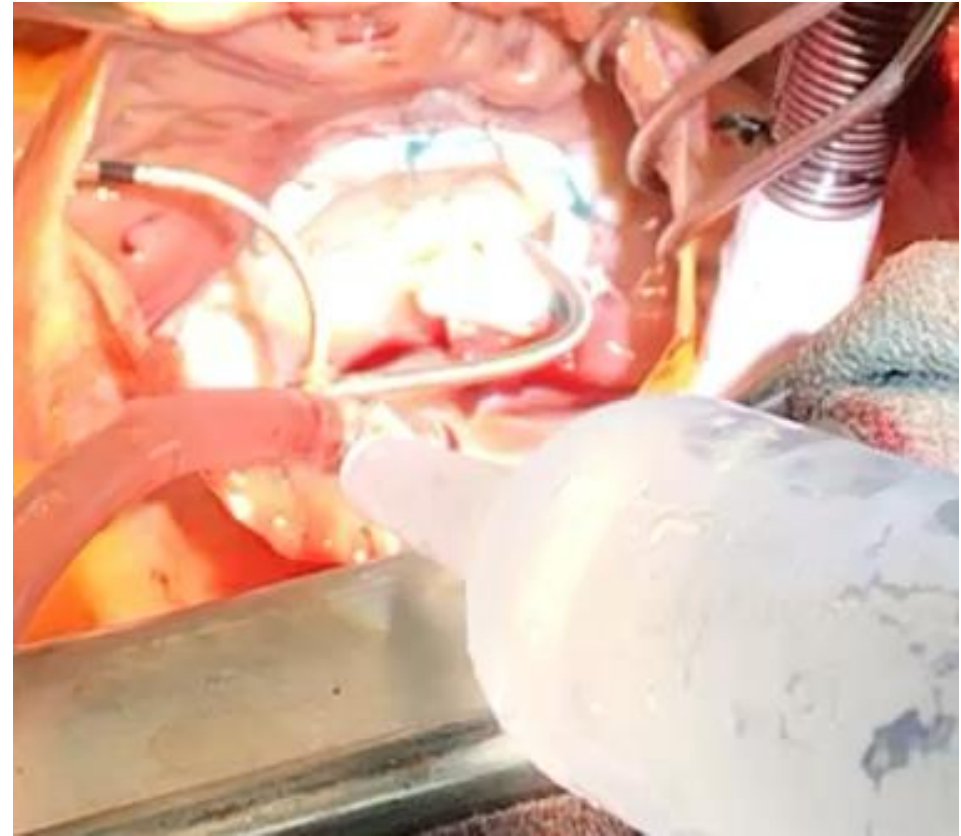


Torrential

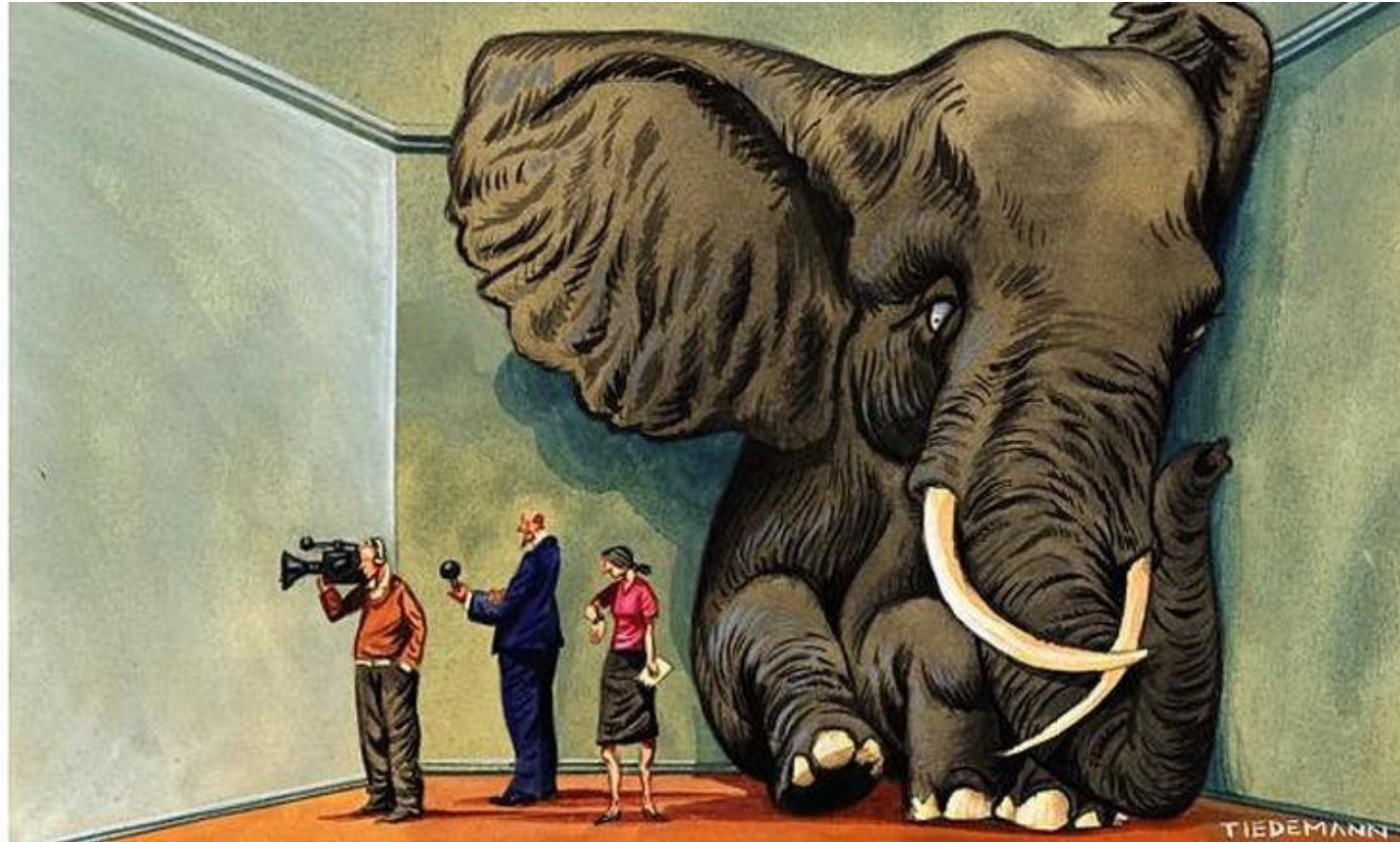
Procedure planning: Case example



Examples



Should we intervene earlier?



Elephant in the room

Triluminate Trial Results

6. TRILUMINATE Pivotal: TEER With the TriClip Benefits Patients With Severe TR

The trial establishes that TEER for tricuspid regurgitation is safe and effective, but to the surprise of some observers, quality-of-life improvements were what drove the primary endpoint, rather than the “harder” gains seen in the mitral space.

Only Conclusion : We need better Devices and Earlier Interventions?

“Prophylactic” Tricuspid Repair for Functional Tricuspid Regurgitation

Nicholas R. Teman, MD, Lynn C. Huffman, MD, Marguerite Krajacic, RN, Francis D. Pagani, MD, PhD, Jonathan W. Haft, MD, and Steven F. Bolling, MD

Department of Cardiac Surgery, University of Michigan Health System, Ann Arbor, Michigan

- Moderate TR repaired at time of L-sided valve surgery vs. late FTR patients requiring reoperative TR
- 66 pts, propensity matched

Table 2. Actuarial Survival After Tricuspid Valve Repair

Mortality	Prophylactic TVr (n = 42) No. (%)	Redo TVr (n = 21) No. (%)	p Value
30-day	0 (0)	3 (14.3)	0.033
1-year	3 (7.1)	4 (19.0)	
2-year	5 (11.9)	5 (23.8)	
Overall	6 (14.3)	6 (28.6)	

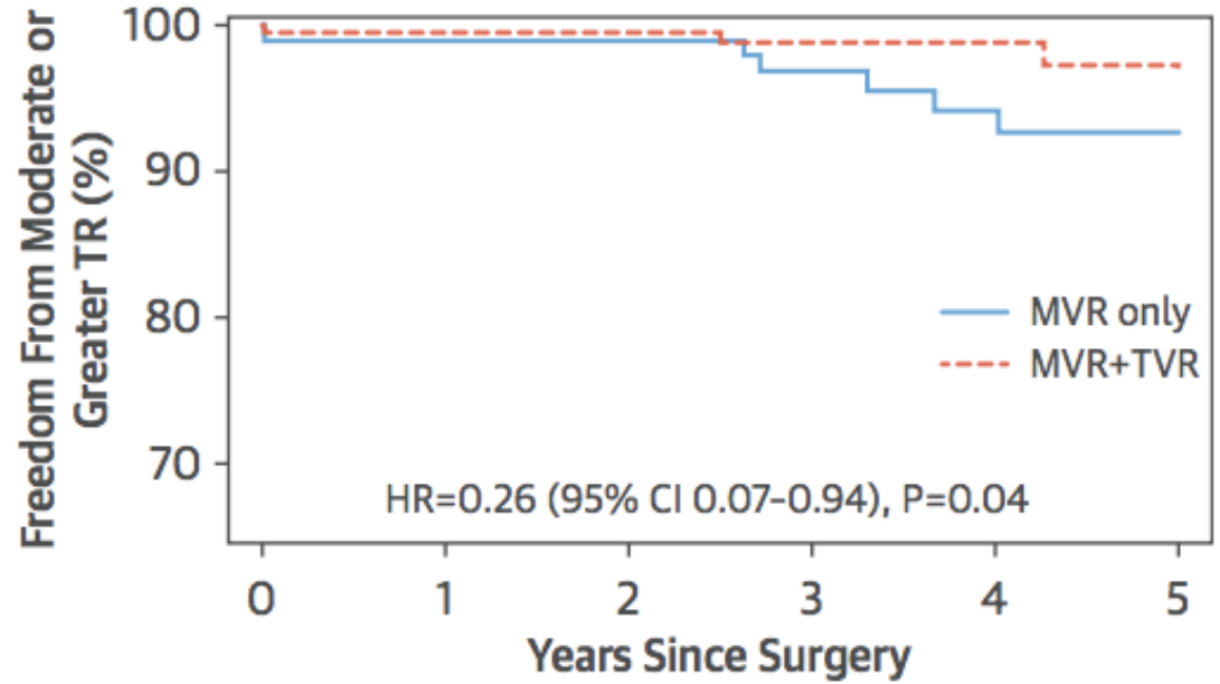
TVr = tricuspid valve repair.

(Ann Thorac Surg 2014;97:1520–5)



Impact of Concomitant Tricuspid Annuloplasty on Tricuspid Regurgitation, Right Ventricular Function, and Pulmonary Artery Hypertension After Repair of Mitral Valve Prolapse

Joanna Chikwe, MD, Shinobu Itagaki, MD, Anelechi Anyanwu, MD, David H. Adams, MD



	0	1	2	3	4	5
MVR only	226	147	108	80	66	54
MVR+TVR	419	280	179	113	79	35

Future Outlook

As therapy and understanding of the disease process and its impact grows

Better Long term outcomes

Early Intervention

Safer Intervention