What is the Optimal Clinical Approach to Tricuspid Regurgitation

Yan Topilsky

Rationale for “Clinical approach”

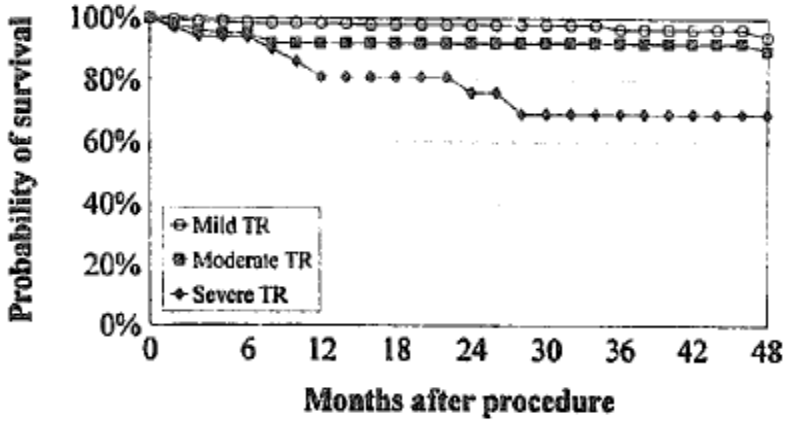
- **Natural history of disease under conservative treatment**
- **Outcome with present invasive treatment (surgery)**
- **Therapeutic benefit**
- **Therapeutic risk**

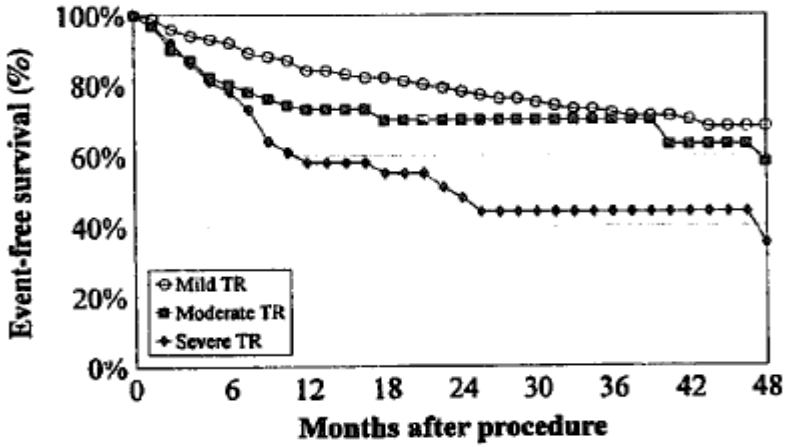
Significant Tricuspid Regurgitation Is a Marker for Adverse Outcome in Patients Undergoing Percutaneous Balloon Mitral Valvuloplasty

ALEX SAGIE, MD, EHUD SCHWAMMENTHAL, MD, JOHN B. NEWELL, BS, LARI HARRELL, BS, TALBOT B. JOZIATIS, BT, RDCS, ARTHUR E. WEYMAN, MD, FACC, ROBERT A. LEVINE, MD, FACC, IGOR F. PALACIOS, MD, FACC

Boston, Massachusetts

JACC Vol. 24, No. 3
September 1994:696–702





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Vol. 43, No. 3, 2004
ISSN 0735-1097/04/$30.00
doi:10.1016/j.jacc.2003.09.036

Impact of Tricuspid Regurgitation on Long-Term Survival

Jayant Nath, MD,* Elyse Foster, MD, FACC,† Paul A. Heidenreich, MD*
Palo Alto and San Francisco, California

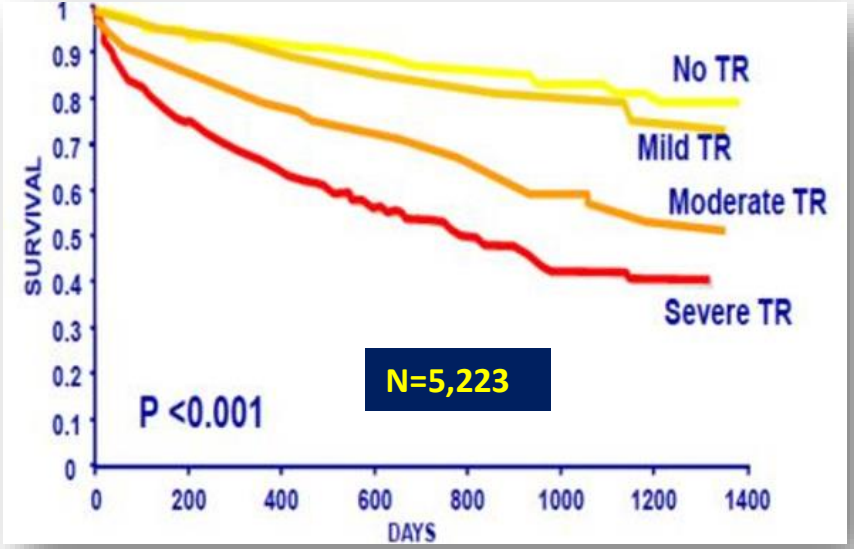


Table 1. Clinical and Echocardiographic Features of Patients With Tricuspid Regurgitation

	No TR (n = 600)	Mild TR (n = 3,804)	Moderate TR (n = 620)	Severe TR (n = 199)	p Value
Age (yrs)	62.2 ± 12.8	66.0 ± 12.6	71.9 ± 11.7	71.9 ± 12.4	< 0.0001
LVEF (%)	57.3 ± 9.1	55.4 ± 11.6	47.1 ± 15.6	40.4 ± 17.2	< 0.0001
RV dilation	8%	11%	35%	66%	< 0.0001
RV dysfunction	3%	8%	30%	61%	< 0.0001
Dilated IVC	6%	11%	44%	76%	< 0.0001

Data are presented as the mean value ± SD or percentage of patients.
IVC = inferior vena cava; LVEF = left ventricular ejection fraction; RV = right ventricular; TR = tricuspid regurgitation.

One year mortality with severe TR was ≈35%

Nath J. et al JACC 2004

Criticism on Outcome of TR Nath Paper

- Etiologies of TR were not recorded
- Only hospitalized patients
- Systemic and cardiac co-morbidities were not documented
- TR was not quantified
- Outdated heart failure therapy

- *Thus, TR may be just a surrogate of mortality*

Burden of Tricuspid Regurgitation in Patients Diagnosed in the Community Setting

JACC: CARDIOVASCULAR IMAGING

Yan Topilsky, MD,[a] Simon Maltais, MD,[b] Jose Medina Inojosa, MD,[c] Didem Oguz, MD,[c] Hector Michelena, MD,[c] Joseph Maalouf, MD,[c] Douglas W. Mahoney, MSc,[d] Maurice Enriquez-Sarano, MD[c]

FIGURE 1 Patient Selection Process

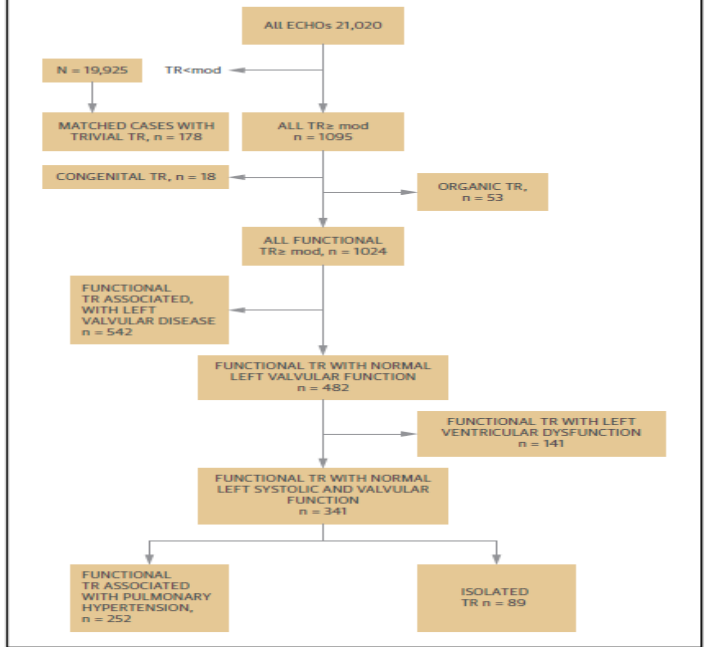
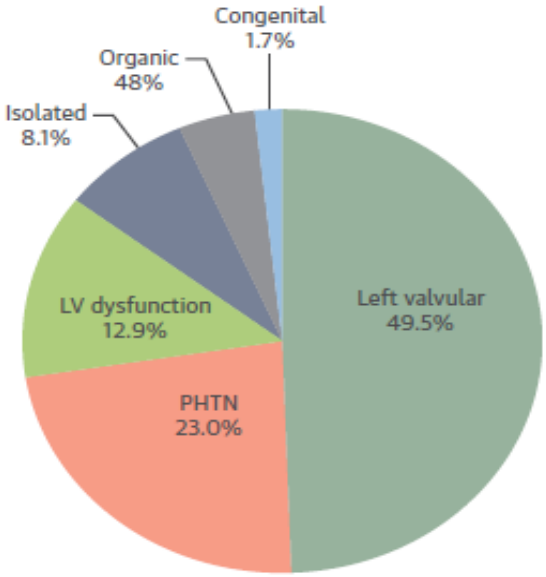


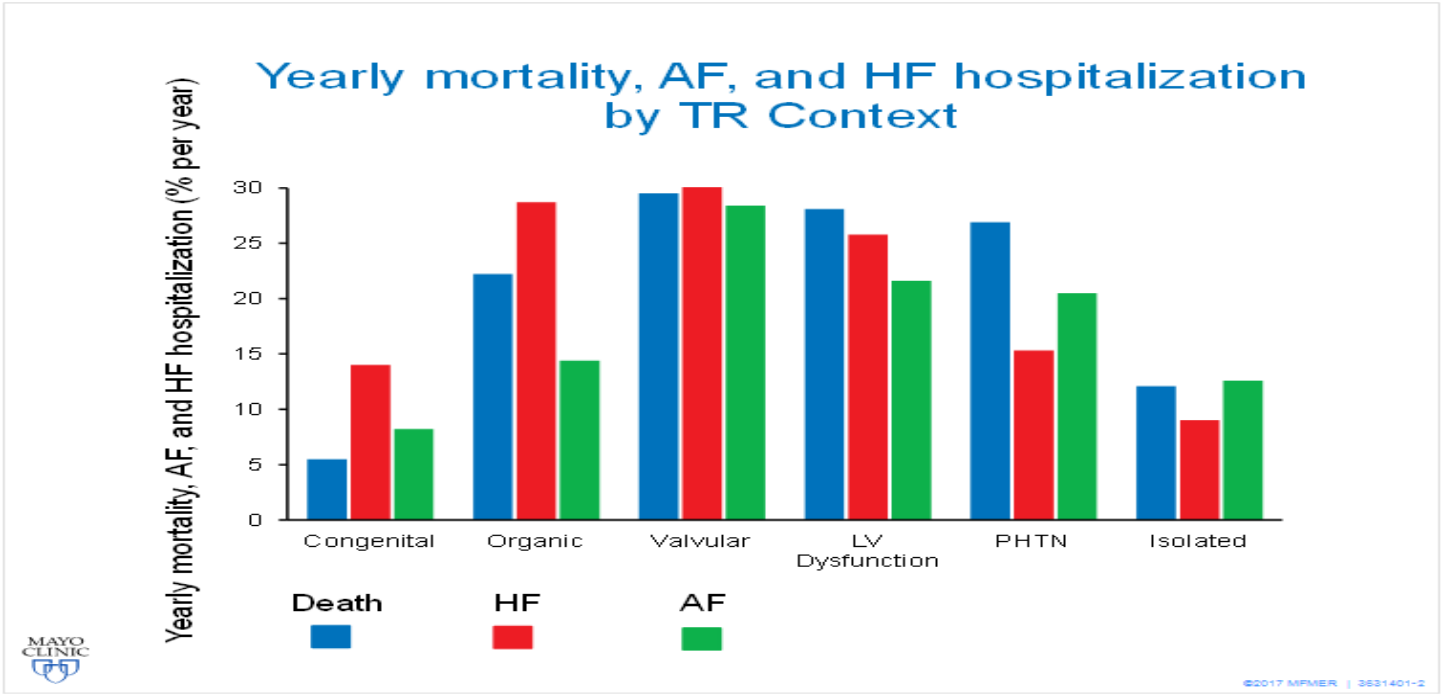
FIGURE 3 Distribution Patterns of TR in the Community



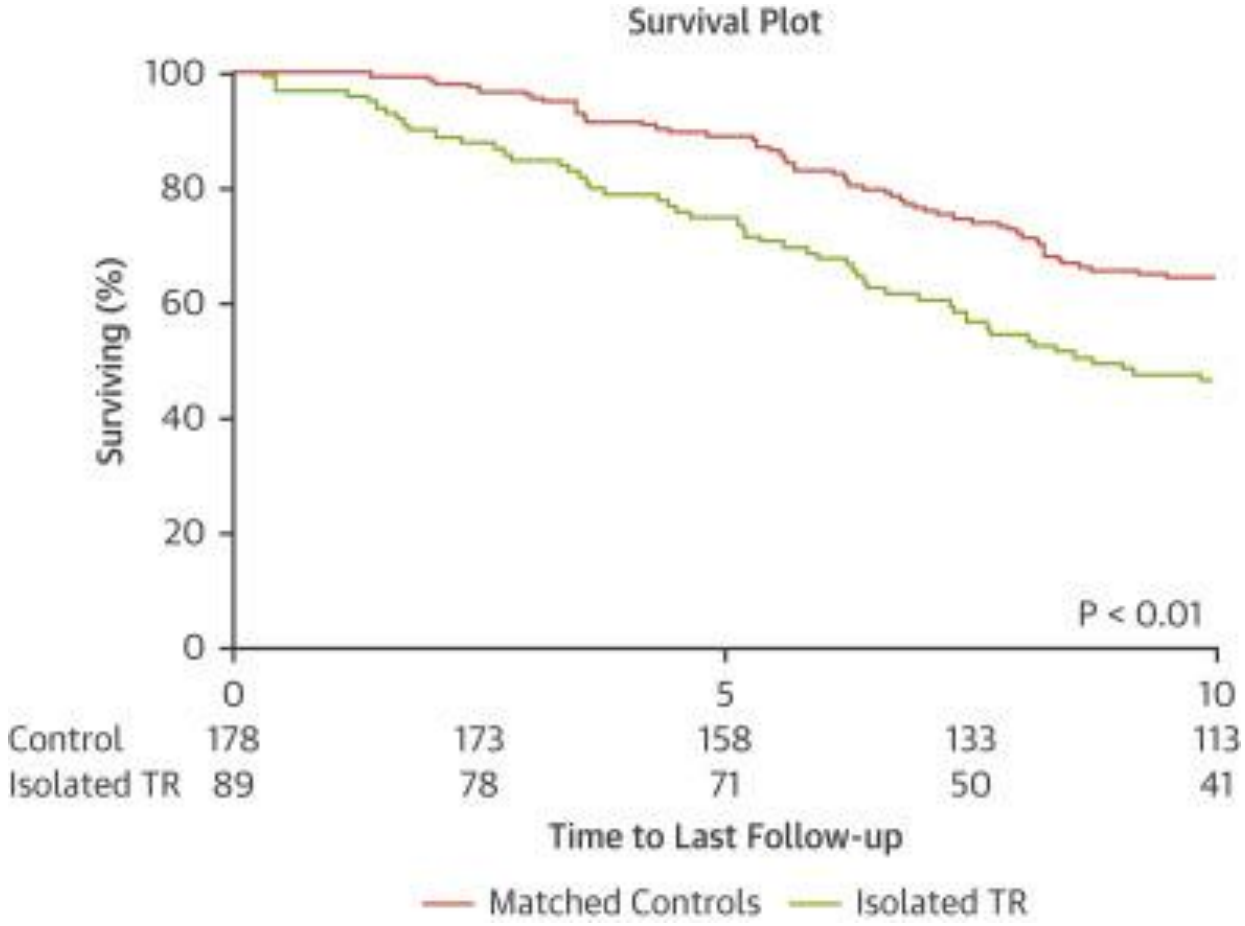
Burden of Tricuspid Regurgitation in Patients Diagnosed in the Community Setting

JACC: CARDIOVASCULAR IMAGING

Yan Topilsky, MD,[a] Simon Maltais, MD,[b] Jose Medina Inojosa, MD,[c] Didem Oguz, MD,[c] Hector Michelena, MD,[c] Joseph Maalouf, MD,[c] Douglas W. Mahoney, MSc,[d] Maurice Enriquez-Sarano, MD[c]



TR and Left Heart Disease


Survival Plot
100
80
60
40
20
0
Surviving (%)
P < 0.01
0
5
10
Control 178 173 158 133 113
Isolated TR 89 78 71 50 41
Time to Last Follow-up
Matched Controls
Isolated TR

JACC: CARDIOVASCULAR IMAGING
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http://dx.doi.org/10.1016/j.jcmg.2014.07.018

Clinical Outcome of Isolated Tricuspid Regurgitation

Yan Topilsky, MD,* Vuyisile T. Nkomo, MD,† Ori Vatury, MD,† Hector I. Michelena, MD,† Thierry Letoumeau, MD,† Rakesh M. Suri, MD, DPhil,‡ Sorin Pislaru, MD,† Soon Park, MD,‡ Douglas W. Mahoney, MSc,§ Simon Biner, MD,* Maurice Enriquez-Sarano, MD†

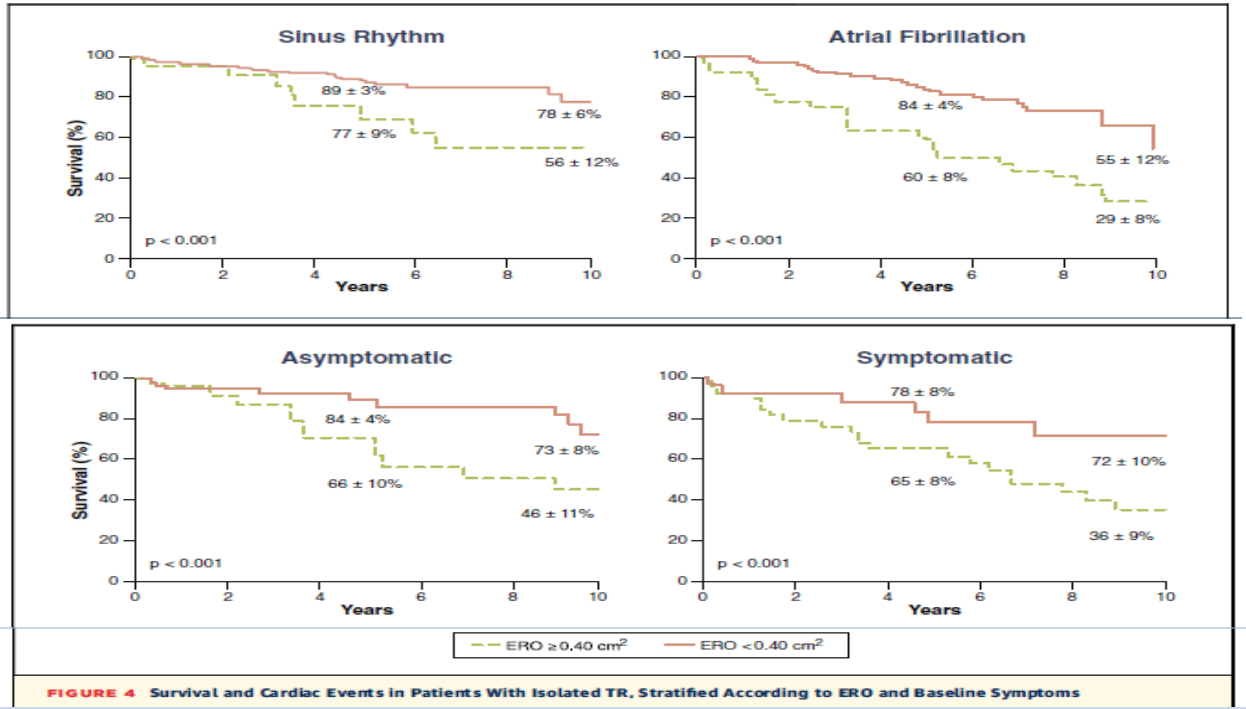


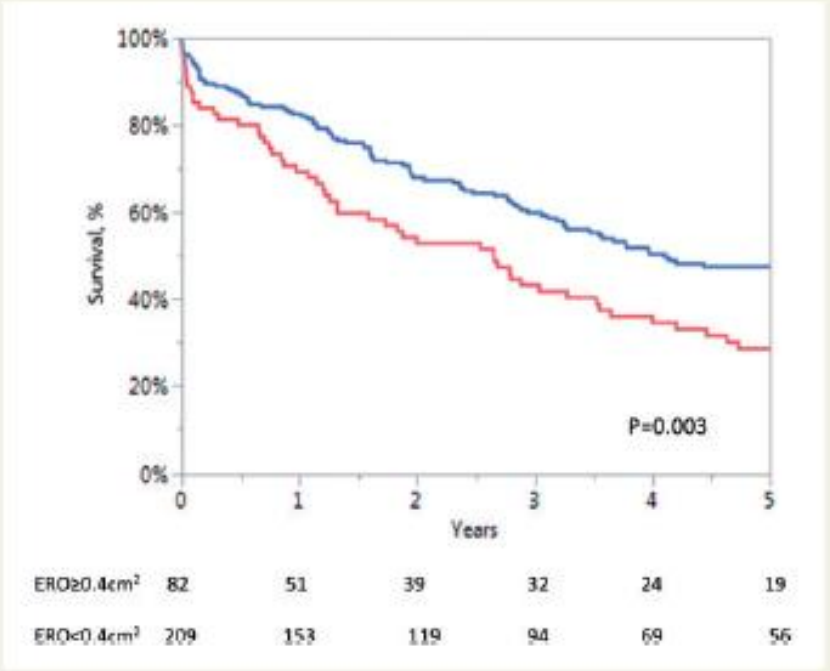
FIGURE 4 Survival and Cardiac Events in Patients With Isolated TR, Stratified According to ERO and Baseline Symptoms

Topilsky; JACC imaging, 2014

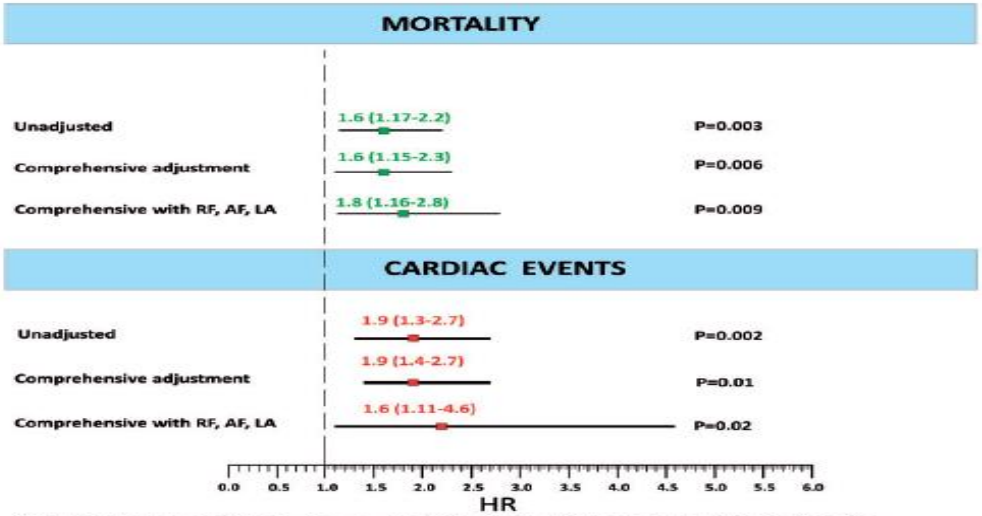
ESC European Society of Cardiology
European Heart Journal (2018) 0, 1–9
doi:10.1093/eurheartj/ehy434

Clinical presentation and outcome of tricuspid regurgitation in patients with systolic dysfunction

Yan Topilsky[1], Jose Medina Inojosa[2], Giovanni Benfari[2], Ori Vaturi[2], Simon Maltais[2], Hector Michelena[2], Sunil Mankad[2], and Maurice Enriquez-Sarano[2]*



Impact of severe regurgitation (effective-regurgitant-orifice ≥ 0.4 cm2), compared to lesser degree of TR, on mortality and cardiovascular events risk after the diagnosis of tricuspid regurgitation in patients with systolic dysfunction.



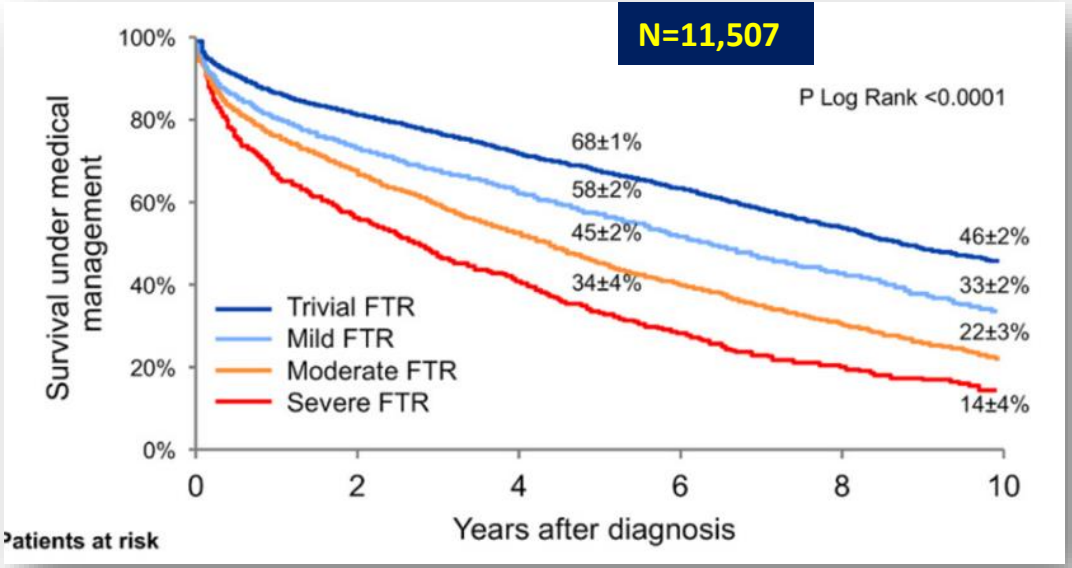
* Adjustment was for age, sex, co-morbidity index, left ventricular ejection fraction, right ventricular dysfunction ≥ moderate and right ventricular systolic pressure.

** Adjustment was for age, sex, co-morbidity index, left ventricular ejection fraction, right ventricular dysfunction ≥ moderate, renal failure(RF), atrial fibrillation(AF), LA size and right ventricular systolic pressure.

ORIGINAL RESEARCH ARTICLE

Excess Mortality Associated With Functional Tricuspid Regurgitation Complicating Heart Failure With Reduced Ejection Fraction

Giovanni Benfari, MD
Clemence Antoine, MD
Wayne L. Miller, MD, PhD
Prabin Thapa, BS
Yan Topilsky, MD
Andrea Rossi, MD
Hector I. Michelena, MD
Sorin Pislaru, MD
Maurice Enriquez-Sarano, MD



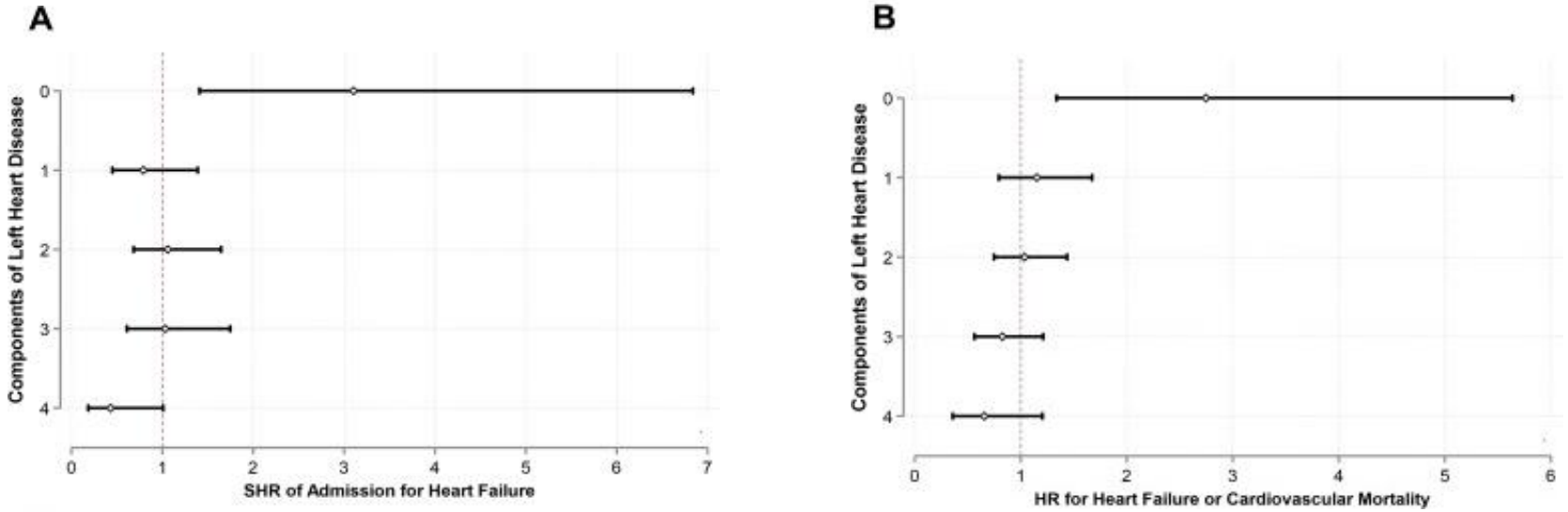
Benfari; Circulation 2019

Lack of Increased Cardiovascular Risk due to Functional Tricuspid Regurgitation in Patients with Left-Sided Heart Disease

Journal of the American Society of Echocardiography, 2019-12-01, Volume 32, Issue 12, Pages 1538-1546.

Mutlak, Khoury, Lessick, Kehat, Agmon, Aronson

Left heart disease components include reduced LVEF, LA enlargement ≥ moderate, aortic or mitral valve disease (regurgitation or stenosis ≥ moderate), and PASP ≥ 50 mm Hg



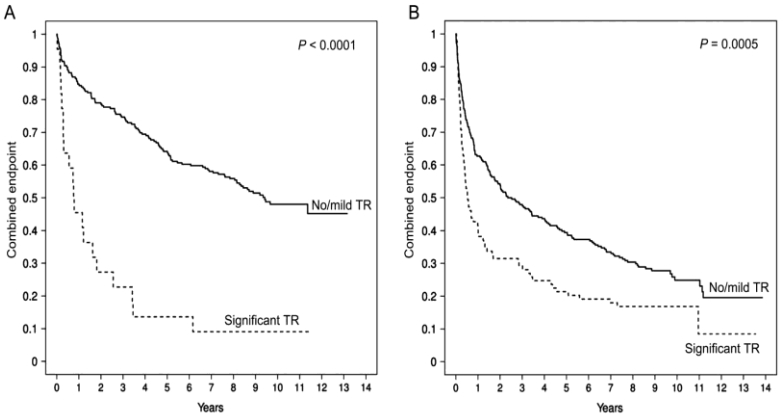
European Heart Journal (2013) 34, 844–852
doi:10.1093/eurheartj/ehs465

CLINICAL RESEARCH
Heart failure/cardiomyopathy

Impact of tricuspid regurgitation on survival in patients with chronic heart failure: unexpected findings of a long-term observational study

Stephanie Neuhold[1,2], Martin Huelsmann[1]*, Elisabeth Pernicka[3], Alexandra Graf[3], Diana Bonderman[1], Christopher Adlbrecht[1], Thomas Binder[1], Gerald Maurer[1], Richard Pacher[1], and Julia Mascherbauer[1]

By multivariable analysis TR was related to outcome only in patients with mild/moderately impaired LV systolic function (EF≥35%), and/or mild elevation in NT-BNP (≤2367pg/mL) but had no impact in patients with severely impaired LV function or severe elevation in NT-BNP.



Multivariable analysis:
TR significantly related to outcome with EF≥35%
(HR: 1.36, *P* = 0.01)

But not in patients with EF<35%
(HR: 0.876, *P* = 0.14)

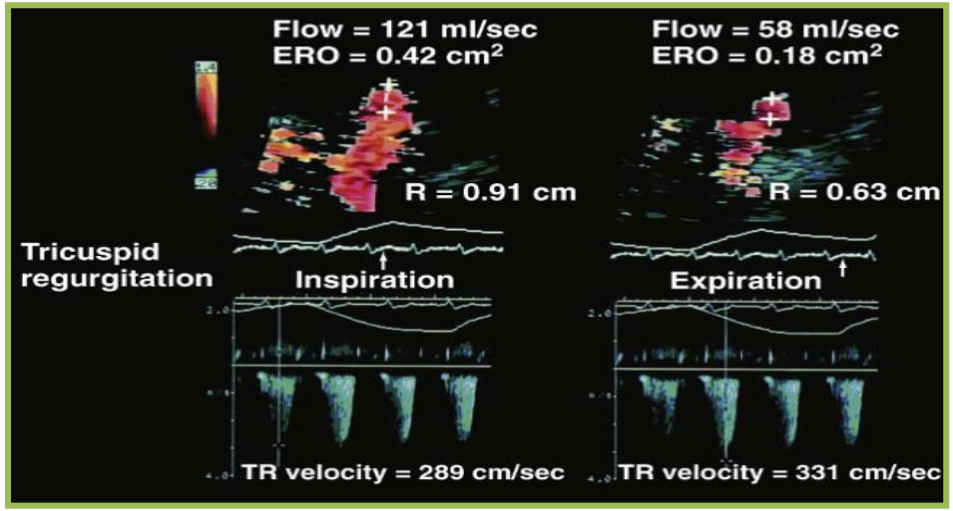
Outcome of TR with contemporary heart failure therapy (Diuretics)

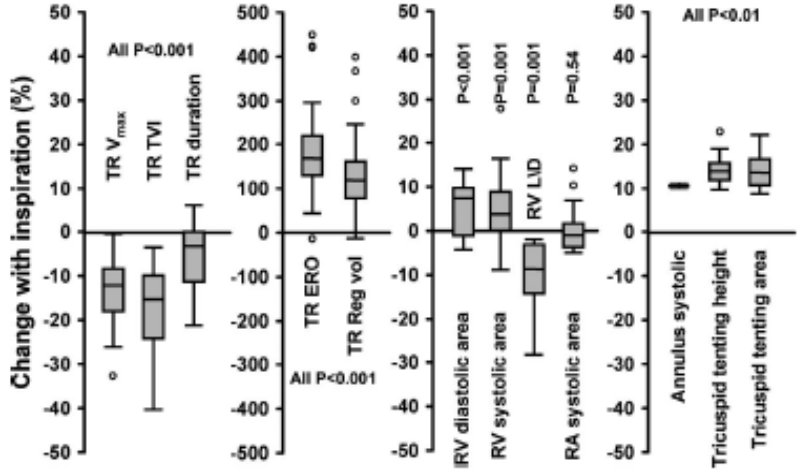
Pathophysiology of Tricuspid Regurgitation

Quantitative Doppler Echocardiographic Assessment of Respiratory Dependence

Yan Topilsky, MD; Christophe Tribouilloy, MD; Hector I. Michelena, MD; Sorin Pislaru, MD; Douglas W. Mahoney, MS; Maurice Enriquez-Sarano, MD

Circulation. 2010;122:1505-1513



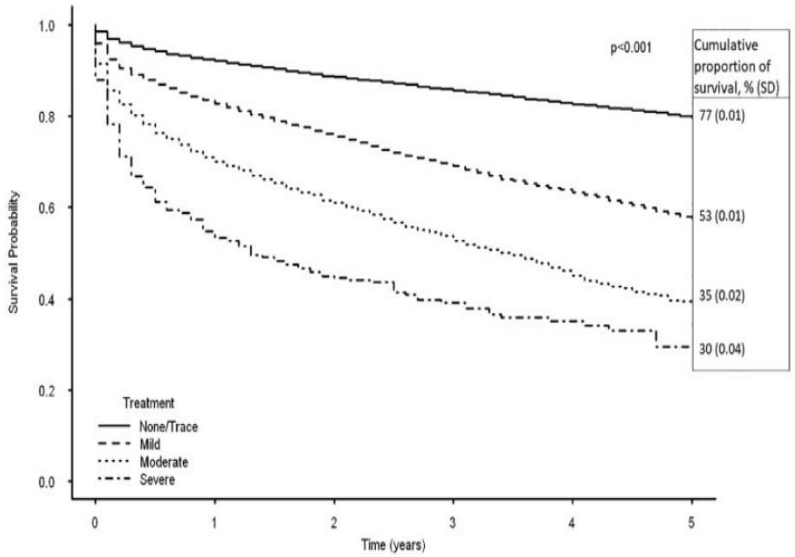


TR is extremely load dependent

Tricuspid regurgitation and long-term clinical outcomes

Ehud Chorin[1†], Zach Rozenbaum[1†], Yan Topilsky[1], Maayan Konigstein[1], Tomer Ziv-Baran[2], Eyal Richert[1], Gad Keren[1], and Shmuel Banai[1*]

N=33,305



tcomes of sample of hospitalized patients according to TR grade compared to none/minimal adjusted for TAPSE

Outcomes	TR	%	Crude HR (95% CI)	*P*-value	Adj HR[a] (95% CI) *n* = 5237	*P*-value
1-year mortality	None/trace	12.4	1		1	
	Mild	20.1	1.7 (1.58–1.84)	<0.001	1.02 (0.85–1.23)	0.823
	Moderate	33.7	3.13 (2.87–3.42)	<0.001	1.22 (0.97–1.54)	0.086
	Severe	51.6	5.44 (4.5–6.58)	<0.001	1.89 (1.29–2.79)	0.001
Overall mortality	None/trace	23.3	1		1	
	Mild	38.7	1.82 (1.72–1.93)	<0.001	1 (0.87–1.15)	0.985
	Moderate	53.1	3.03 (2.83–3.25)	<0.001	1.07 (0.89–1.29)	0.447
	Severe	66.4	4.58 (3.89–5.41)	<0.001	1.41 (1.01–1.98)	0.046
Heart failure re-admission	None/trace	2.9	1	1	1	
	Mild	6.5	2.29 (1.98–2.65)	<0.001	1.48 (1.03–2.12)	0.034
	Moderate	10.6	3.94 (3.33–4.65)	<0.001	1.65 (1.08–2.52)	0.021
	Severe	20.2	7.93 (5.82–10.82)	<0.001	3.52 (1.92–6.47)	<0.001
30-day mortality	None/trace	3.7	1		1	
	Mild	7.0	1.98 (1.73–2.28)	<0.001	1.53 (1.04–2.24)	0.032
	Moderate	13.9	4.23 (3.63–4.93)	<0.001	2.61 (1.68–4.05)	<0.001
	Severe	18.8	6.08 (4.29–8.61)	<0.001	3.96 (1.94–8.07)	<0.001

[a]Age, gender, echocardiographic parameters (diastolic dysfunction, left atrium volume index, E/e, stroke volume, systolic pulmonary artery pressure, ejection fraction, aortic insufficiency, aortic stenosis, mitral stenosis, mitral regurgitation, TAPSE), and comorbidities (lung disease, ischaemic heart disease, pacemaker/implantable cardiac defibrillator, atrial fibrillation/flutter, diabetes mellitus, obesity, hypertension, hyperlipidaemia, renal dysfunction, deep vein thrombosis/pulmonary embolism, malignancy, cerebrovascular accident/transient ischaemic attack).

TR ≥ Moderate is associated with poor survival, regardless of age, echo parameters and comorbidities

Chorin; EHJ CVI 2020

Outcome with contemporary conservative treatment

- Natural history of disease is very bad
- Contemporary conservative treatment is useless
- In isolated TR the adverse hemodynamic effect of TR dominates the clinical outcome
- Added adverse effect of TR in severe LV dysfunction is still controversial

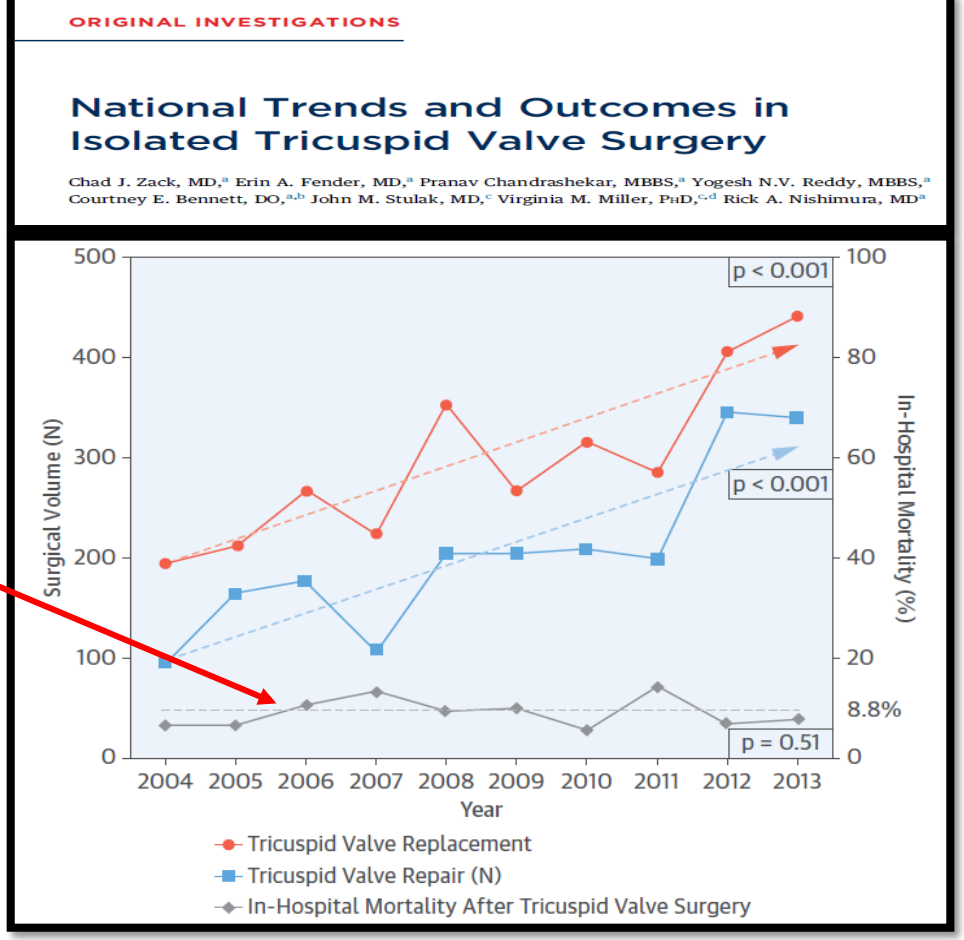
Outcome with present invasive treatment (surgery)

Isolated Tricuspid Surgery

The database represents ≈25% of hospital admissions in the USA (approximately 1000 hospitals)

- **Only ≈3000/year Isolated TV surgeries in the US**
- **≈ 5% of patients with severe TR undergo surgery**

In-hospital mortality for isolated TV surgery was 8.8% and did not change



Zack; JACC 2017

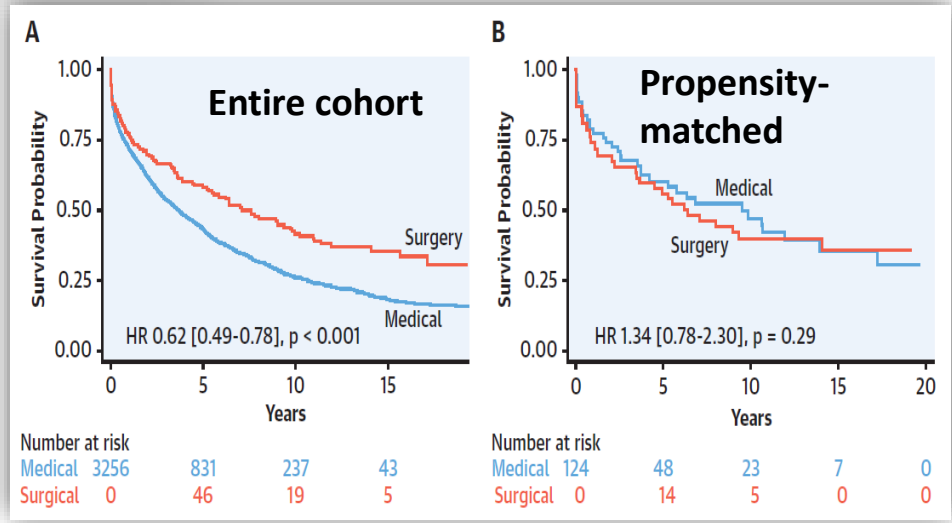
ORIGINAL INVESTIGATIONS

Surgery Does Not Improve Survival in Patients With Isolated Severe Tricuspid Regurgitation

Andrea L. Axtell, MD, MPH,[a,b] Vijeta Bhambhani, MS, MPH,[c] Philicia Moonsamy, MD,[a,d] Emma W. Healy, BS,[c] Michael H. Picard, MD,[c] Thoralf M. Sundt III, MD,[a] Jason H. Wasfy, MD, MPHIL[c]

- 3,276 patients with severe TR
  - 171 (5%) had isolated TV surgery (84% repair)
- **No difference in long-term survival between surgery and medical therapy**
  - No difference between TV repair and replacement

Surgical mortality was adversely affected by delaying operative intervention to when right ventricular failure or end-organ damage develop



Axtell ; JACC, August 2019

ESC European Society of Cardiology
European Heart Journal (2022) 43, 654–662
https://doi.org/10.1093/eurheartj/ehab679

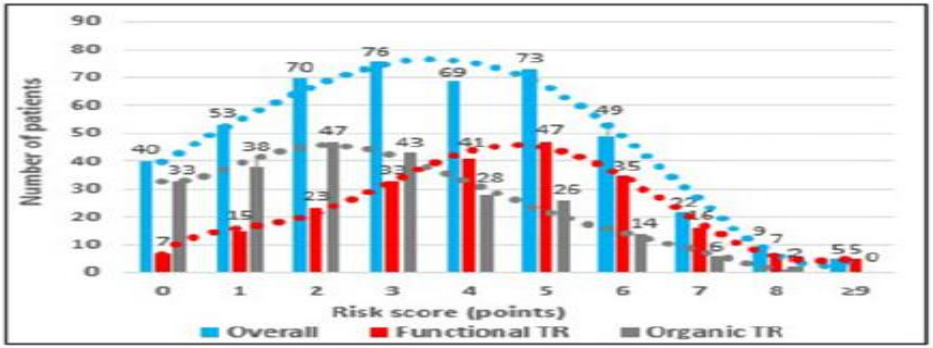
TRI-SCORE: a new risk score for in-hospital mortality prediction after isolated tricuspid valve surgery

Julien Dreyfus [1,*,†], Etienne Audureau[2,3,†], Yohann Bohbot[4,5],

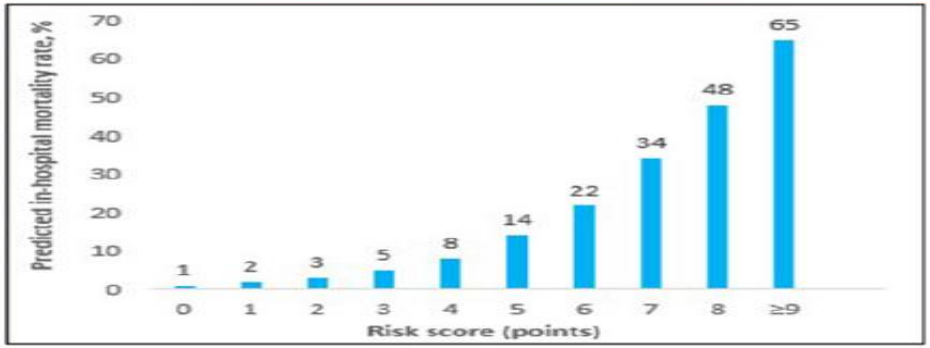
Risk factors and scoring system for in-hospital mortality after isolated tricuspid valve surgery

Risk factors (final model from multivariate analysis)	Scoring
Age ≥ 70 years	1
NYHA functional class III-IV	1
Right-sided heart failure signs	2
Daily dose of furosemide ≥ 125mg	2
Glomerular filtration rate < 30 ml/min	2
Elevated total bilirubin	2
Left ventricular ejection fraction < 60%	1
Moderate/severe right ventricular dysfunction	1
Total	12

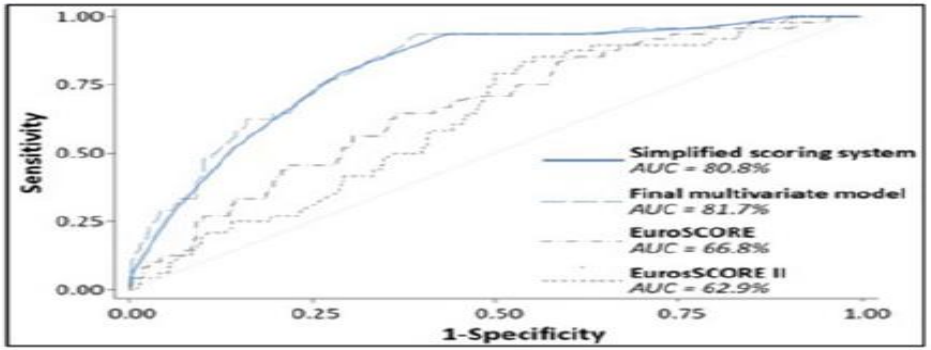
Number of patients presenting with each score value and trends



Predicted in-hospital mortality rate according to the final risk score model



Receiver operating characteristic curves

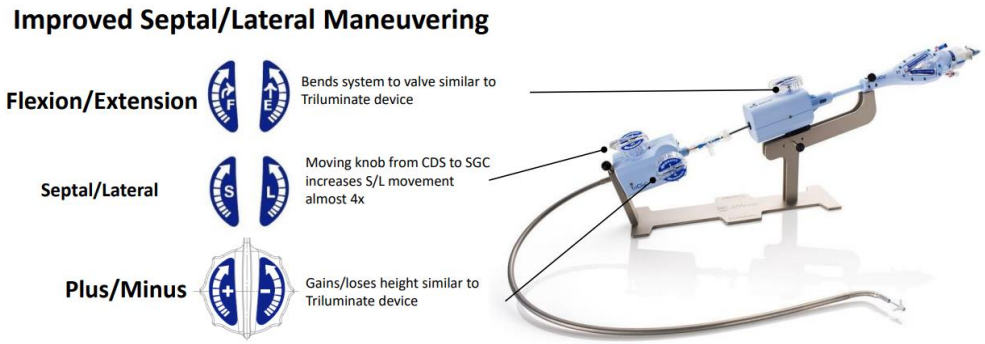


Therapeutic benefit of new devices

Tricuspid edge-to-edge repair

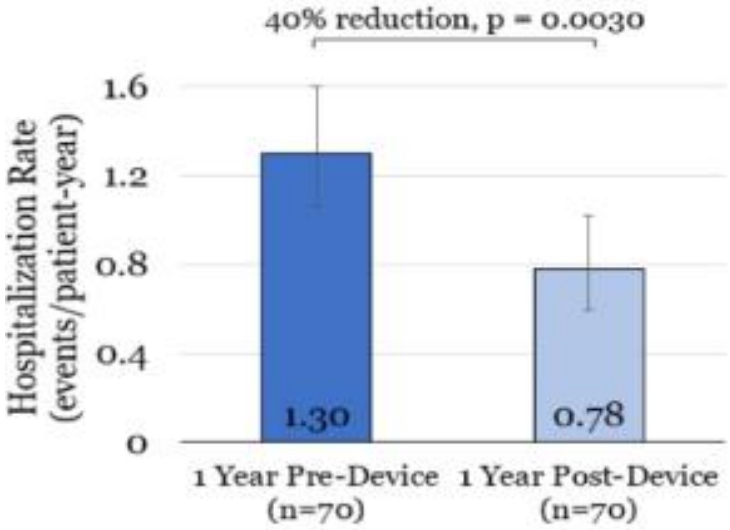
TriClip

- Modified MitraClip dedicated for tricuspid repair.
- Based on the 3rd generation MitraClip (NT/XT)
- CE Mark (2019)

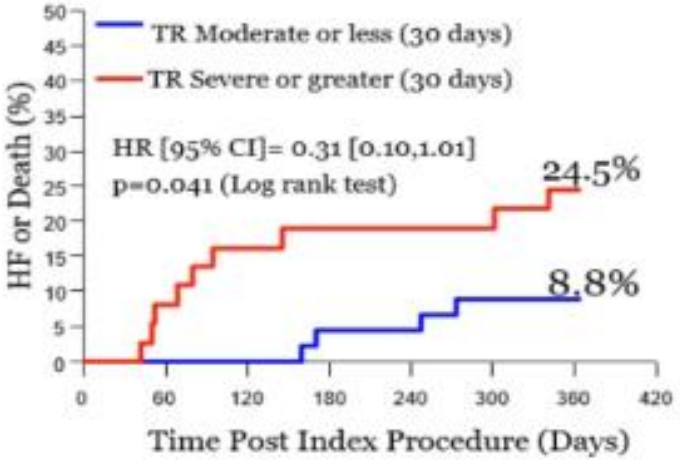


TRILUMINATE Study – 1 year results

Reduced Hospitalization Rate

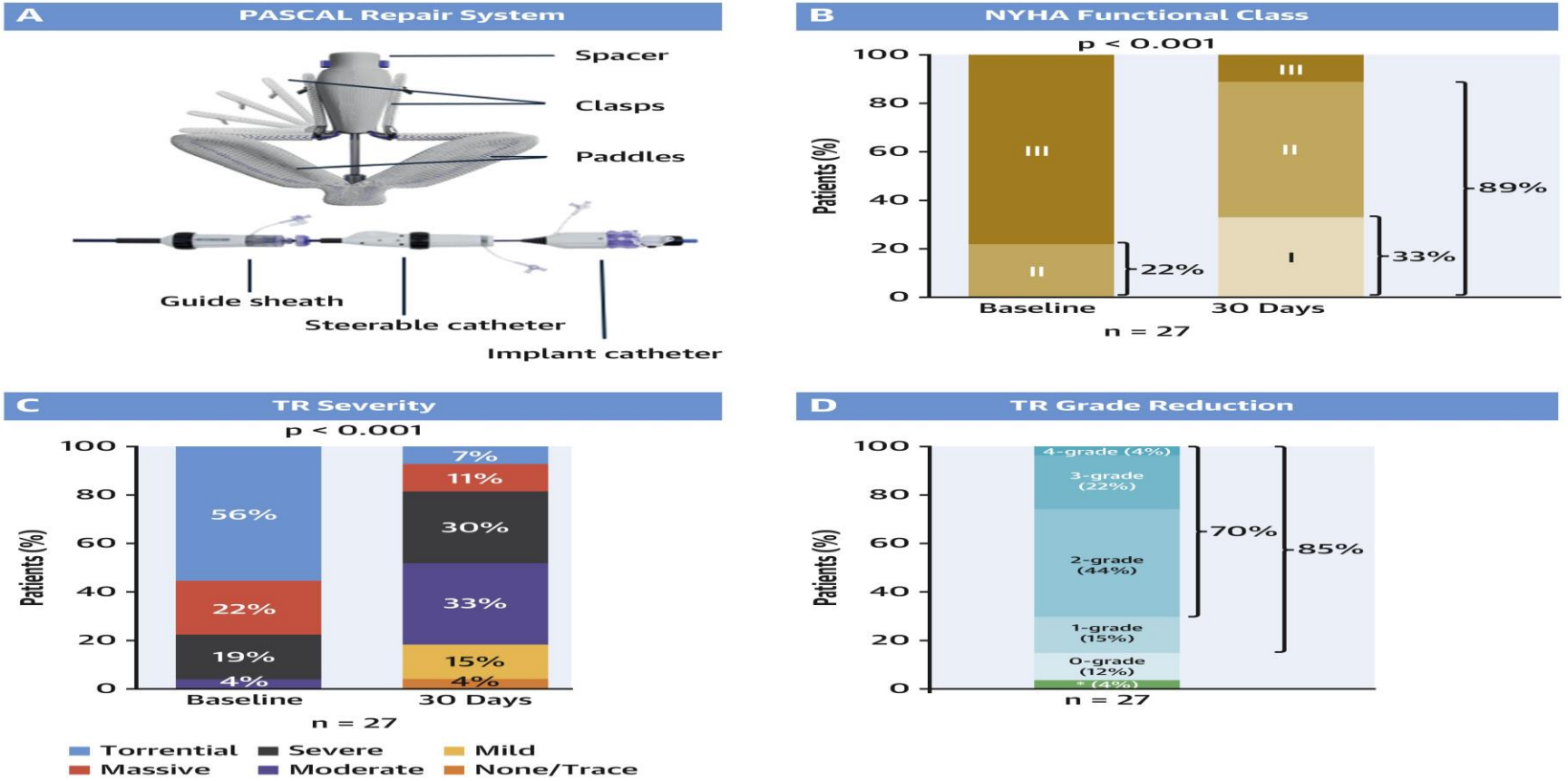


Procedural Success Predictive of Mortality and Heart Failure Hospitalizations at 1Y



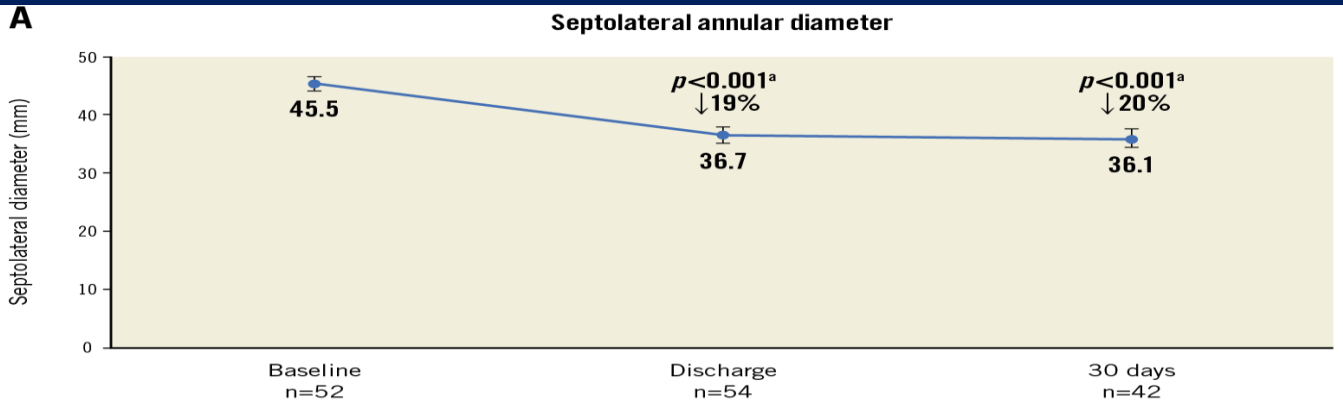
CLASP TR (PASCAL) Study

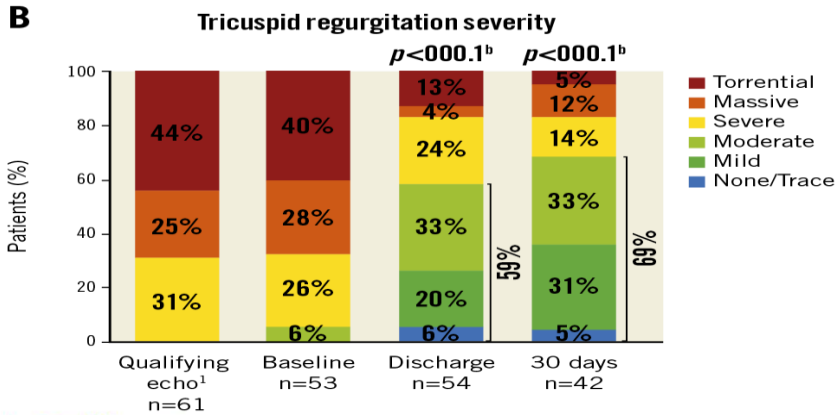
CENTRAL ILLUSTRATION: The PASCAL Transcatheter Valve Repair System

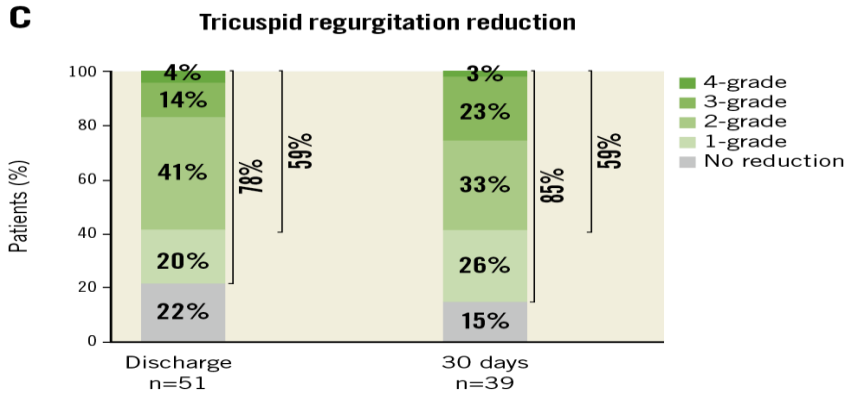


Kodali, S. et al. J Am Coll Cardiol. 2021;77(4):345–56.

TRI-Band Study – 30 day results



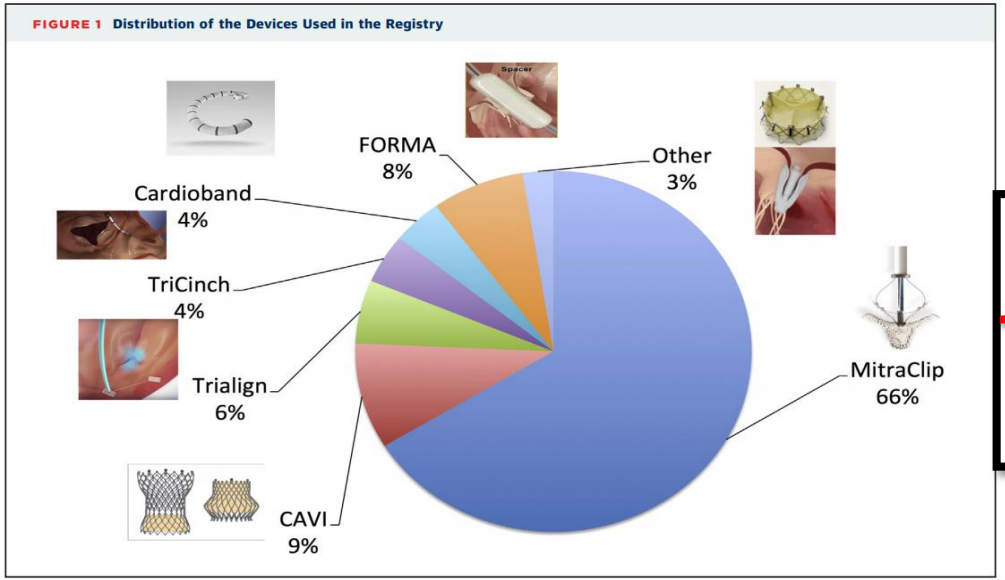




Mixture of Devices in Tricuspid Valve

TriValve Registry

- 21 Heart Centers in Europe and N. America
- Trans-catheter tricuspid valve repair with various techniques



1-Year Outcomes After Edge-to-Edge Valve Repair for Symptomatic Tricuspid Regurgitation

Results From the TriValve Registry

Taramasso; JACC CV interventions, 2019

Mehr; JACC CV interventions, 2019

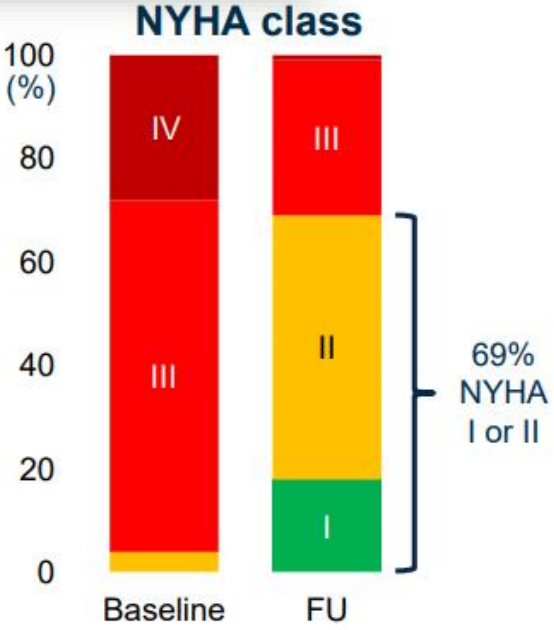
Mixture of Devices in Tricuspid Valve

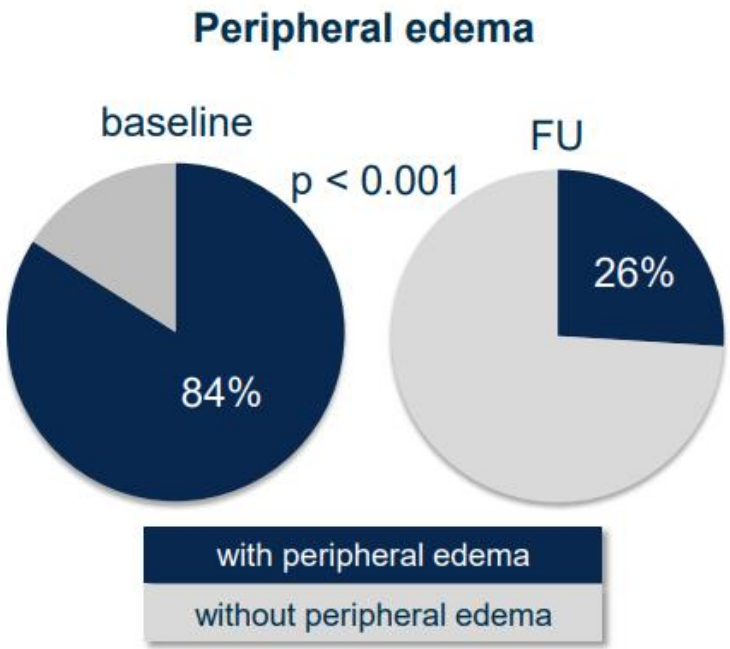
1-Year Outcomes After
Edge-to-Edge Valve Repair for
Symptomatic Tricuspid Regurgitation

Results From the TriValve Registry

TriValve Registry

Clinical Improvement





Heart Failure & World Congress on Acute Heart Failure 2022

Mehr; JACC CV interv. 2019

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Transcatheter Versus Medical Treatment of Patients With Symptomatic Severe Tricuspid Regurgitation

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Transcatheter Versus Medical Treatment of Patients With Symptomatic Severe Tricuspid Regurgitation

Cohort- 472 patients from the tri-Valve registry

Controls- 1179 patients from severe TR registries of patients treated conservatively (Mayo, Leiden)

Propensity matching (1:1; distance ±0.2 SD) found 268 matched pairs (age, EuroSCORE II, SPAP)

Cox hazard adjustment for sex, NYHA, RV dysfunction, AF, MR, Pacemaker

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Taramasso; JACC, 2019

TABLE 2 Cox Proportional Hazard Models Testing the Effect of TTVI in the Propensity-Matched Cohort

Model for Control Group	HR for Death or Heart Failure Hosp. (Primary Endpoint)	p Value	HR for Mortality (Secondary Endpoint)	p Value
Unadjusted	0.60 (0.46-0.79)	0.003	0.56 (0.39-0.79)	0.001
Adjusted for sex and NYHA functional class	0.46 (0.31-0.68)	0.0001	0.49 (0.31-0.79)	0.003
Adjusted for sex and NYHA functional class, atrial fibrillation, and RV dysfunction	0.39 (0.26-0.59)	<0.0001	0.41 (0.26-0.67)	0.0004

Therapeutic risk

TRILUMINATE Study – 1 year results

Low Occurrence of Major Adverse Events

Event	(n)*
Major Adverse Event (MAE) through 1 Year	6
Cardiovascular Mortality	4
Myocardial Infarction	1
Stroke	1
New Onset Renal Failure	1
Non-elective CV surgery, TVRS Device-related AE	0

[1] Subjects were reported drop in hemoglobin of 3-5 g/Dl (BARC Type 3a)
[2] Subjects TR severity and clinical symptoms did not worsen, as compared to baseline. No additional intervention was needed.

*n=total number of subjects

Minimal Safety Concerns

Event	(n)*
Other Clinical Safety Endpoints	
All-cause Mortality	6
Major Bleeding[1]	10
Pulmonary Thromboembolism	0
New Onset Liver Failure	0
New Onset Atrial Fibrillation	1
Single Leaflet Device Attachement[2]	5
Embolization	0
Tricuspid Valve Mean Gradient ≥ 5mmHg	4

PCR on-line; June 2020

TRI-Band Study – 30 day results

Table 4. CEC adjudicated safety events at 30 days.

Major adverse events	N=61 n (%)
Cardiovascular mortality	0
Myocardial infarction	1 (1.6)
Stroke	0
Pericardial effusion requiring intervention	1 (1.6)
Coronary artery injury requiring intervention	4 (6.6)
Arrhythmia and conduction disorders requiring permanent pacing	1 (1.6)
New need for renal replacement therapy	2 (3.3)
Severe bleeding*	7 (11.5)
Non-elective tricuspid valve reinterventions	0
Major access-site and vascular complications	4 (6.6)
Major cardiac structural complications	0
Composite MAE rate	12 (19.7)
Other events	
All-cause mortality	1 (1.6)¶

* Severe bleeding is major, extensive, life-threatening or fatal bleeding, as defined by MVARC. ¶ Due to procedure-related renal failure. CEC: clinical events committee; MAE: major adverse event

Mixture of devices in the Tricuspid Position

1-Year Outcomes After
Edge-to-Edge Valve Repair for
Symptomatic Tricuspid Regurgitation

Results From the TriValve Registry

TriValve Registry

In-Hospital Events	249 patients
Mortality	7 (2.8%)
Blood transfusion / severe bleeding	15 (6.0%)
Infection	12 (4.8%)
Acute kidney injury	9 (3.6%)
Stroke	2 (0.8%)
Conversion to surgery	1 (0.4%)

Mehr; JACC interventions, 2019

What is the right time for intervention

- The individual immediate risk
- The therapeutic benefit
- The risk of procedure

A validated score to predict one-year and long-term mortality in patients with significant tricuspid regurgitation

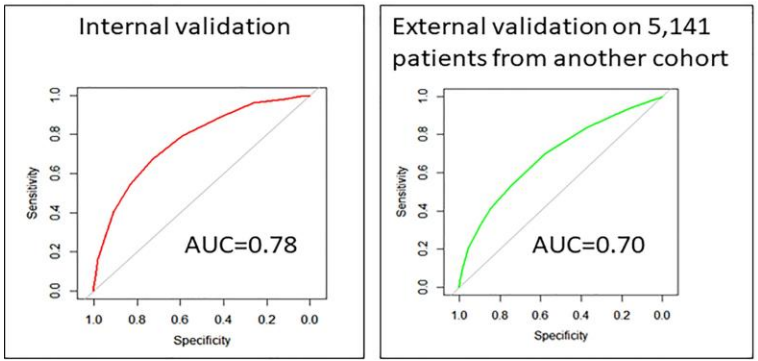
Aims: Predicting mortality in patient with significant TR

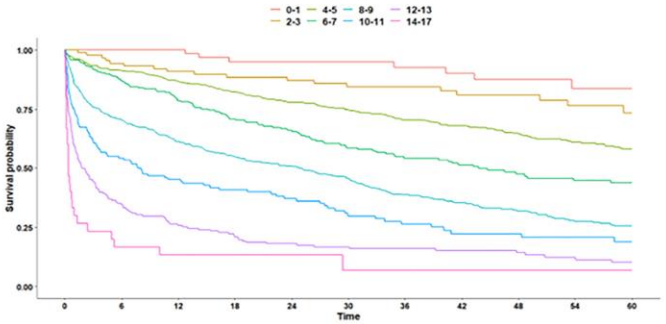
Methods:

1,701 Consecutive patients with significant TR with clinical, laboratory and echocardiographic parameters

0-17 Score predicting 1- year survival

Results:





Five-year mortality by score

Conclusions:

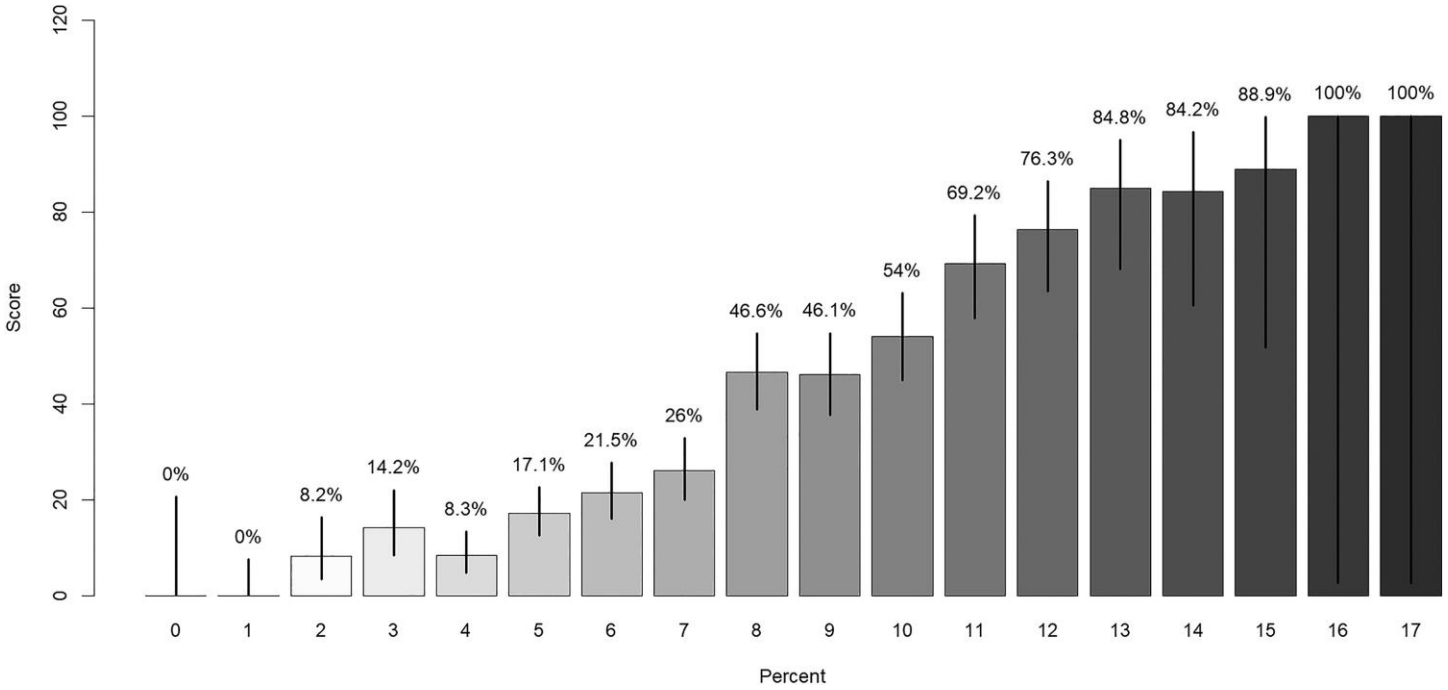
A relatively simple 17-point score can predict 1-year and long-term mortality in patients with TR. The score has shown high external validity and is robust to other cardiac pathologies and comorbidities.

European Heart Journal Open, Volume 2, Issue 6, November 2022

Ichilov and Tel Ha-shomer

Points	Parameter
1+	Age ≥ 65 and <80 years
2+	Age ≥ 80 and <85 years
3+	Age ≥ 85 years
1+	BMI ≤ 25
2+	Diagnosis of liver disease
2+	Diagnosis of chronic lung disease
1+	eGFR ≤ 50 and >30 mL/h/1.73m^2
3+	eGFR ≤ 30 and >20 mL/h/1.73m^2
5+	eGFR ≤ 20 mL/h/1.73m^2
1+	Minimal Hgb ≤ 12.5 g/dL
2+	Minimal Hgb ≤ 8 g/dL
1+	LVEF ≤ 30%
1+	RAP >5 and ≤ 15 mmHg
2+	RAP >15 mmHg
1+	Left-ventricular SVI ≤ 30
1+	LVEDD ≤ 45
1+	Echocardiographic signs of RV dysfunction

A validated score to predict one-year and long-term mortality in patients with significant tricuspid regurgitation



Mixture of Devices in Tricuspid Valve

1-Year Outcomes After Edge-to-Edge Valve Repair for Symptomatic Tricuspid Regurgitation

Results From the TriValve Registry

TriValve Registry

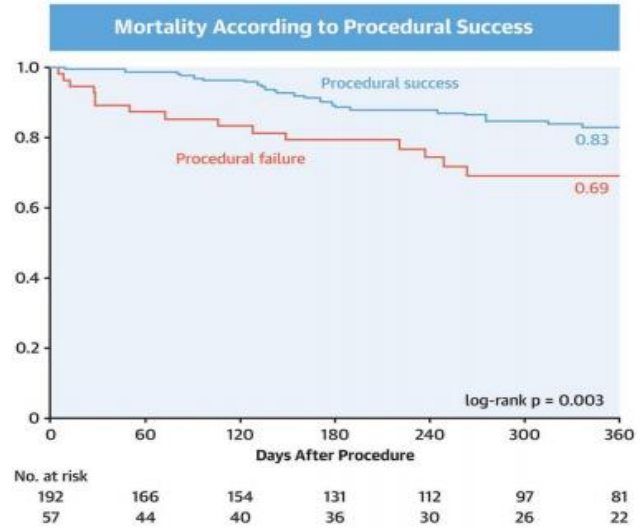
1-year mortality: 20.3%

Combined mortality or HF hospitalization: 35%

Predictors of Mortality:

- Procedural Failure- massive/torrential TR
- Absence of sinus rhythm
- Renal failure (GFR)

CENTRAL ILLUSTRATION: Kaplan-Meier Estimates of 1-Year Mortality According to Procedural Failure After Edge-to-Edge Tricuspid Valve Repair



Mehr, M. et al. J Am Coll Cardiol Intv. 2019;12(15):1451-61.

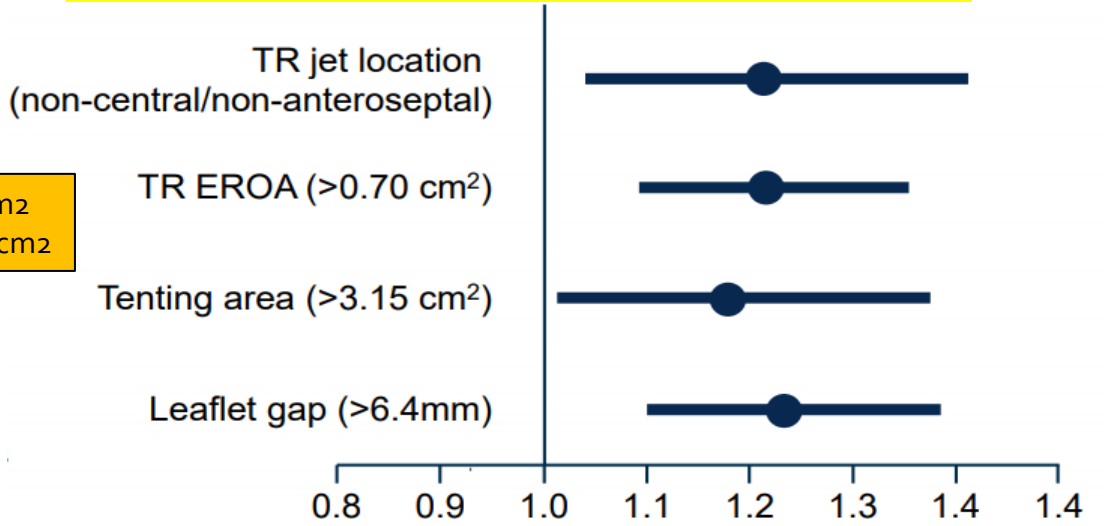
Mehr; JACC interventions, 2019

MitraClip in Tricuspid Valve

1-Year Outcomes After
Edge-to-Edge Valve Repair for
Symptomatic Tricuspid Regurgitation
Results From the TriValve Registry

TriValve Registry

Independent Predictors for Procedural Failure



Massive TR: EROA ≥ 0.6 cm2
Torrential TR: EROA ≥ 0.8 cm2

Mehr; JACC interventions, 2019

Philipp Lurz, Mathias Orban, Christian Besler, Daniel Braun, Florian Schlotter, Thilo Noack, Steffen Desch, Nicole Karam, Karl-Patrik Kresoja, Christian Hagl, Michael Borger, Michael Nabauer, Steffen Massberg, Holger Thiele, Jörg Hausleiter, Karl-Philipp Rommel

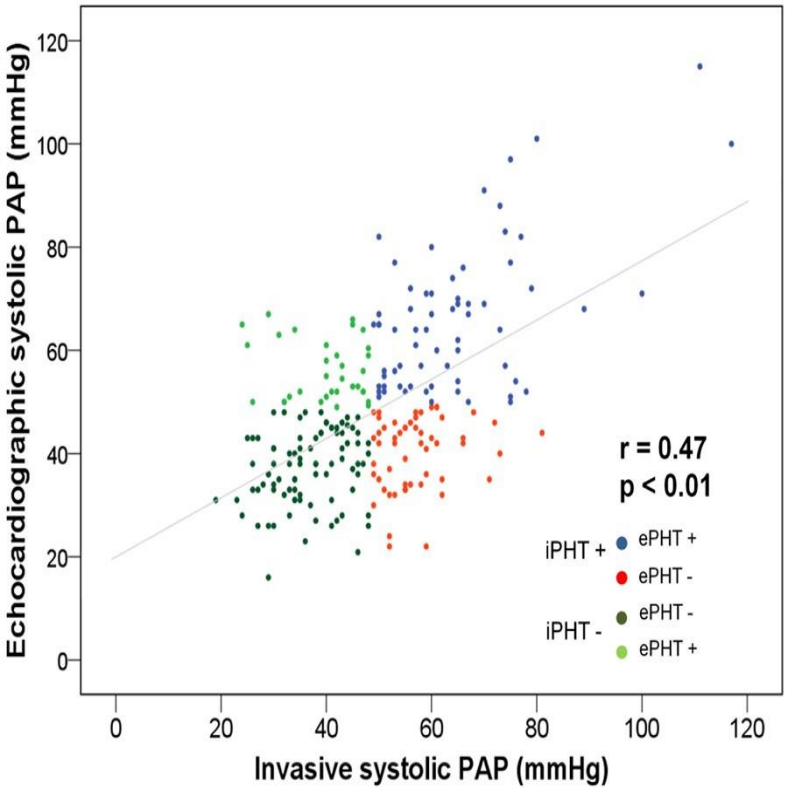
Clinical characteristics, diagnosis, and risk stratification of pulmonary hypertension in severe tricuspid regurgitation and implications for trans-catheter tricuspid valve repair

PCR london valves

2022

Heart Failure & World Congress on Acute Heart Failure 2022

Eur Heart J. 2020 Aug 1:41 (29): 2785-2795



Moderate correlation between invasive and echo PAPs (r = 0.47).

Sensitivity for echocardiography to detect iPHT+ (>50mmHg) only 55%

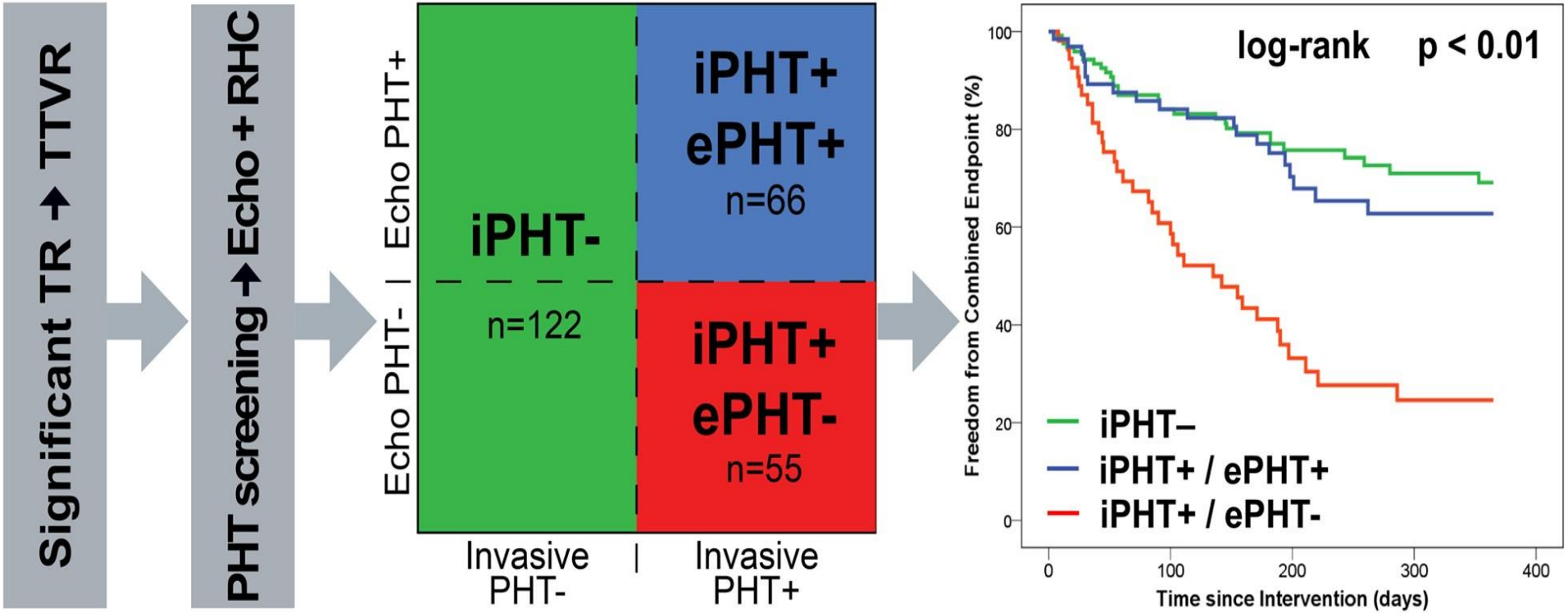
Poor correlation between invasive and echo RAPs (r = 0.28)

Invasive RAP showed higher absolute values compared with echo

Poor correlation for echo and invasive PVR (r = 0.40)

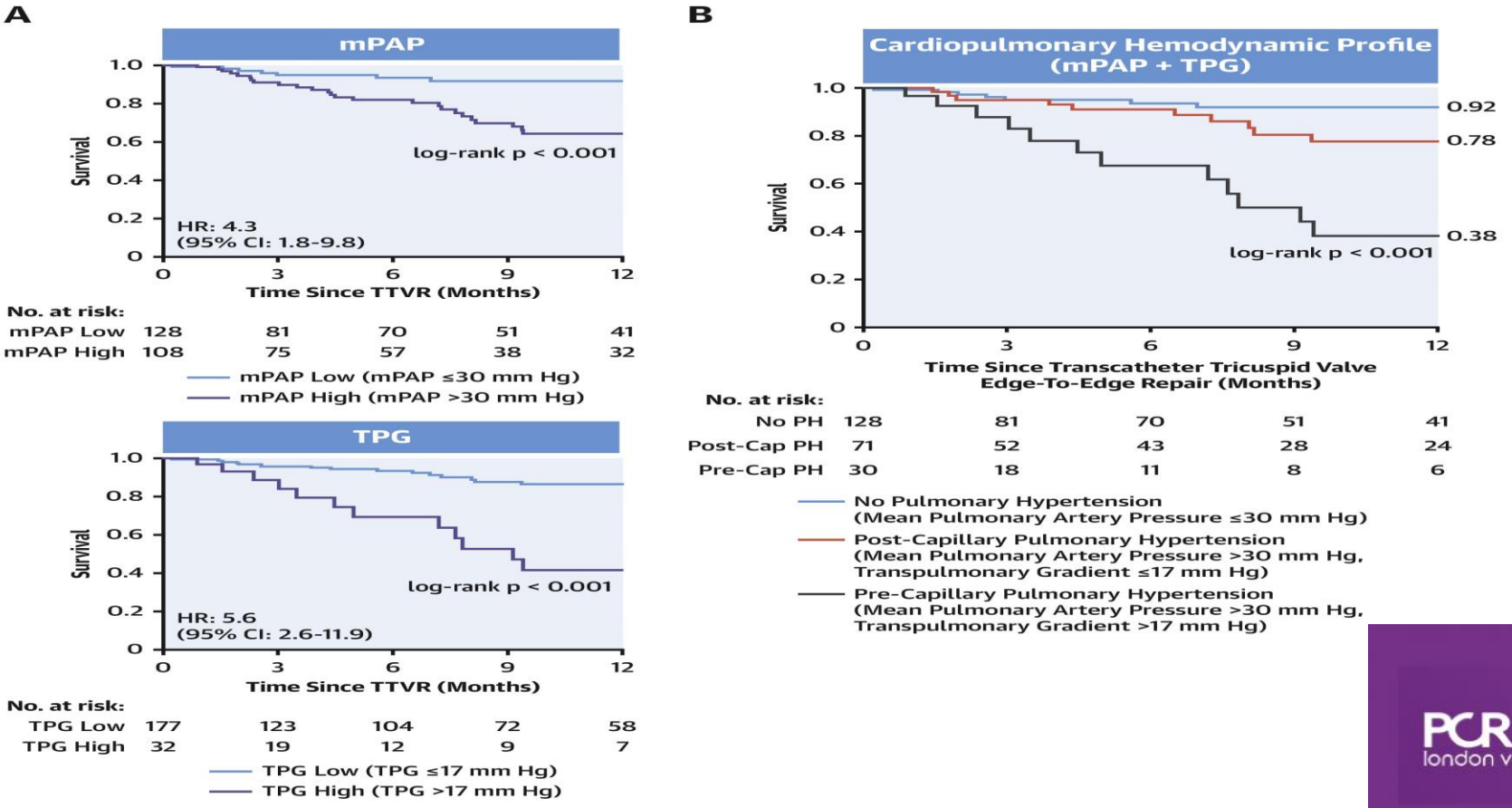
PCR london valves

2022



Patients with discrepant iPHT and ePHT had:
Highest iRAP (20±7)
Lower 6 minute walk distance (175±93 meters)
Largest ERO (0.60±0.2 cm^2)

CENTRAL ILLUSTRATION: Assessment of the Cardiopulmonary Hemodynamic Profile Predicts Survival After Transcatheter Tricuspid Valve Edge-to-Edge Repair



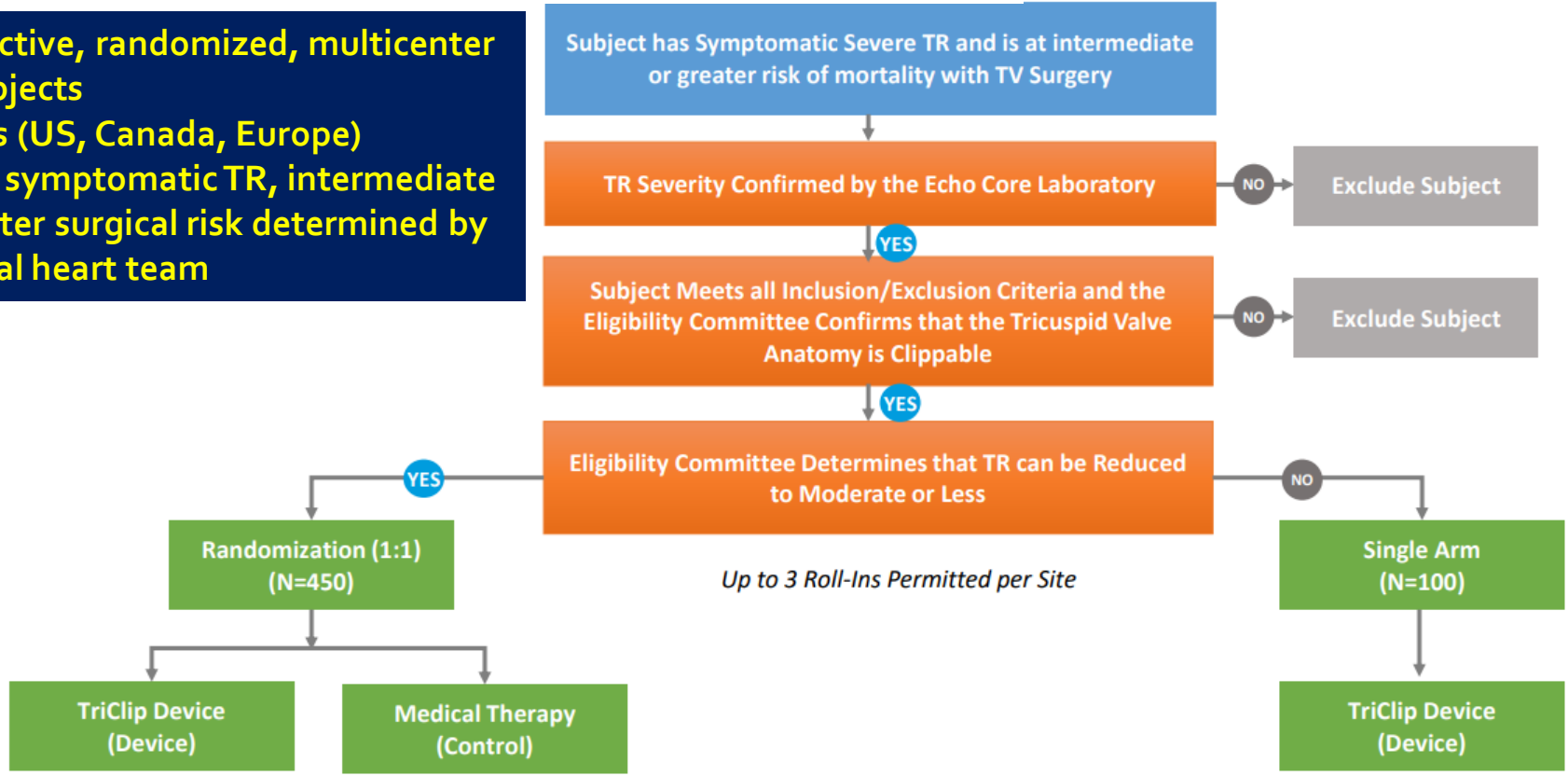
Stocker, T.J. et al. J Am Coll Cardiol Intv. 2021;14(1):29–38.

PCR london valves

2022

TRILUMINATE
PIVOTAL TRIAL

- Prospective, randomized, multicenter
- 700 subjects
- 80 sites (US, Canada, Europe)
- Severe symptomatic TR, intermediate or greater surgical risk determined by the local heart team



האם צריך לחכות למחקר רנדומלי כפול סמיות?

התיאור הראשון של תמותה מוגברת מהיצרות אאורטלית קשה בטיפול שמרני בשנת 1968 (מאמר בראונוולד)

הניתוחים הראשונים להיצרות אאורטלית קשה בוצעו עוד לפני כן

המחקר הרנדומלי כפול הסמיות הראשון "בעולם ההצרות האאורטלית" ב2010 (מחקרי הפרטנר)

בין הניתוח הראשון ועד למחקר הפרטנר בוצעו כ 20000 ניתוחי החלפת מסתם אאורטלי בשנה רק בארצות הברית והצילו חיים של עשרות אלפי חולים

In summary

CONSERVATIVE

- Isolated TR adversely effects prognosis
- Added adverse effect of TR in severe LVD is controversial
- Medical therapy is practically worthless

INVASIVE

- Isolated surgery mortality (≈10%)
- Surgical mortality ranges 1-65%

- Trans-catheter treatment is safe
- It improves symptoms
- Mortality post Trans-catheter treatment is increased:

Pre-capillary pulmonary hypertension

False negative echo PHT diagnosis

Torrential TR

But not in post-capillary PH