

Tricúspide: Forgotten valve?

Cangas del Narcea, 28 de mayo de 2022

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*La muerte no llega con la vejez,
sino con el olvido*

Gabriel García Márquez

1

**La válvula
olvidada**

Supuesta benignidad

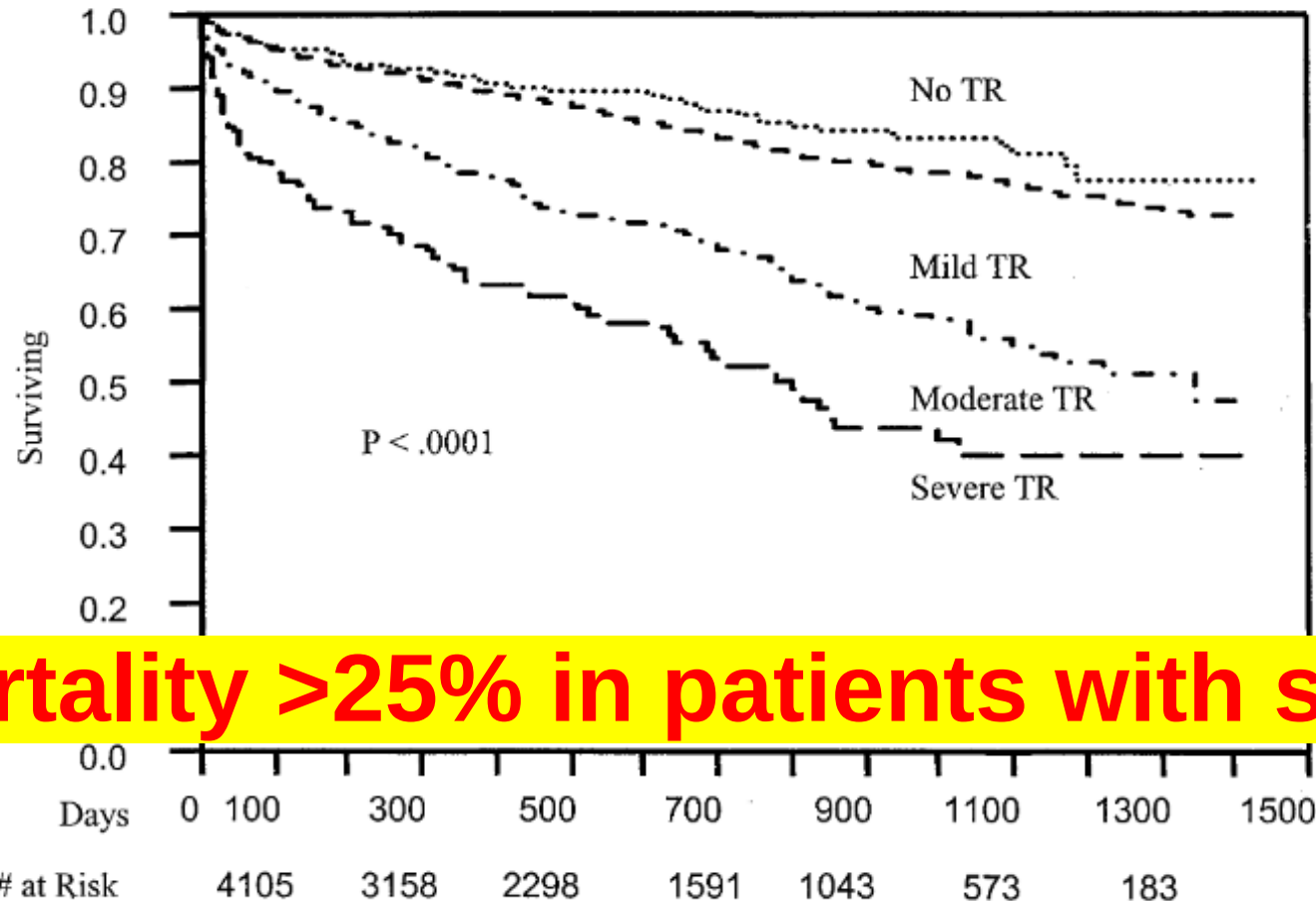
**Dificultad técnica en
cuantificación...**

**Alta morbimortalidad
quirúrgica SIN beneficio
pronóstico demostrado**

2

**La válvula
olvidada?**

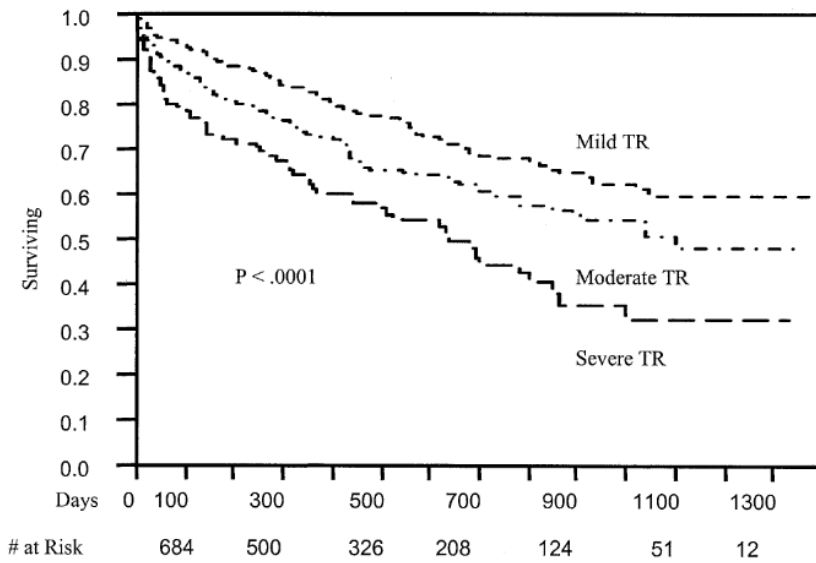
Bad prognosis of TR



1-year mortality >25% in patients with severe TR.

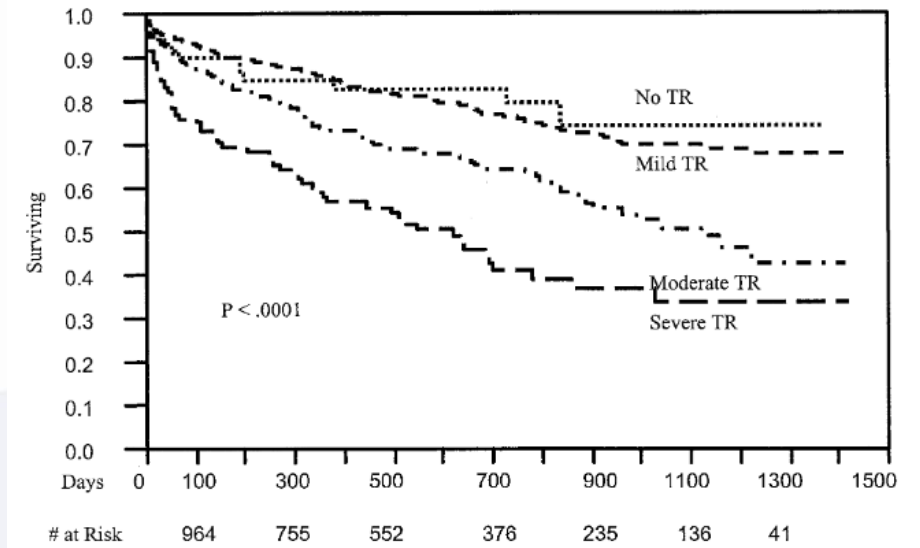
Figure 1. Kaplan-Meier survival curves for all patients with tricuspid regurgitation (TR). Survival is significantly worse in patients with moderate and severe TR.

PAH



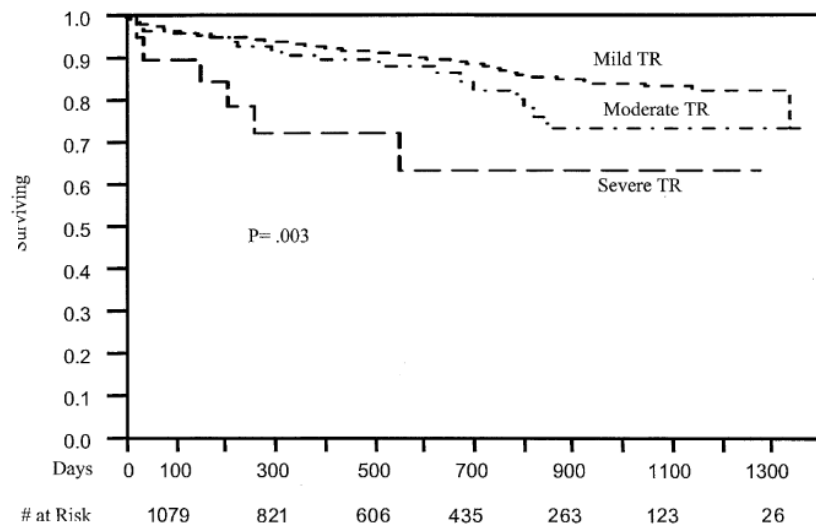
A

LVEF < 50%



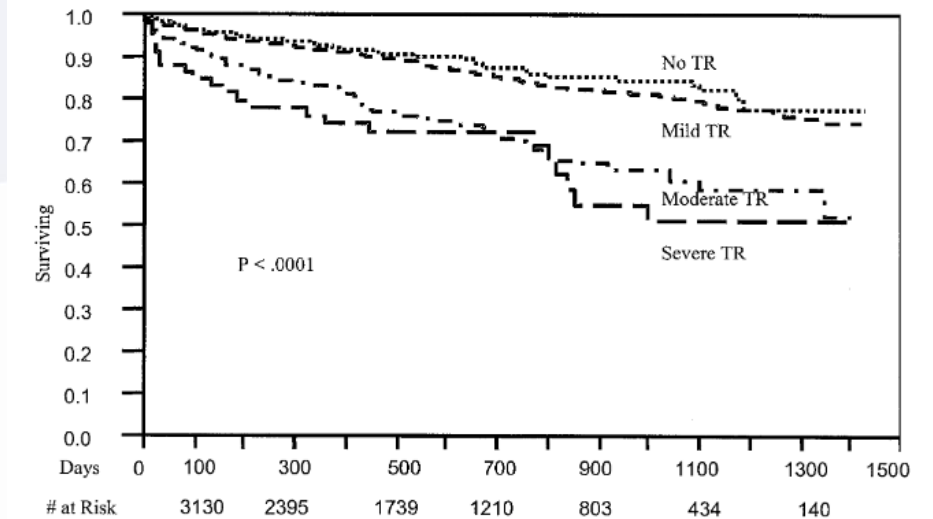
A

No PAH



B

LVEF $\geq$ 50%



B

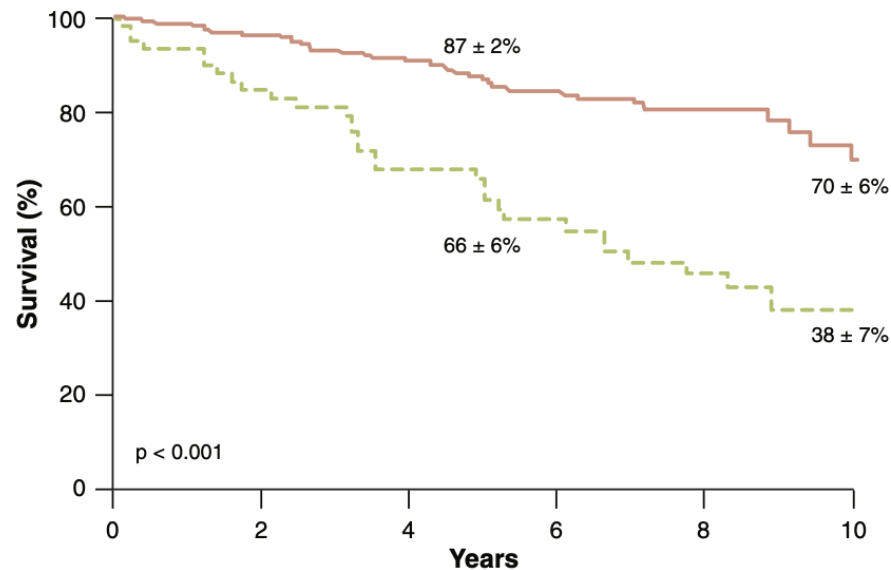
Figure 2. Kaplan-Meier survival curves for (A) patients with tricuspid regurgitation (TR) and high pulmonary artery systolic pressure (≥ 40 mm Hg) and (B) patients with TR and normal pulmonary artery systolic pressure (< 40 mm Hg).

Figure 3. Kaplan-Meier survival curve for (A) patients with tricuspid regurgitation (TR) and a low left ventricular ejection fraction ($< 50\%$) and (B) patients with TR and a normal left ventricular ejection fraction ($\geq 50\%$).

Clinical Outcome of Isolated Tricuspid Regurgitation



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

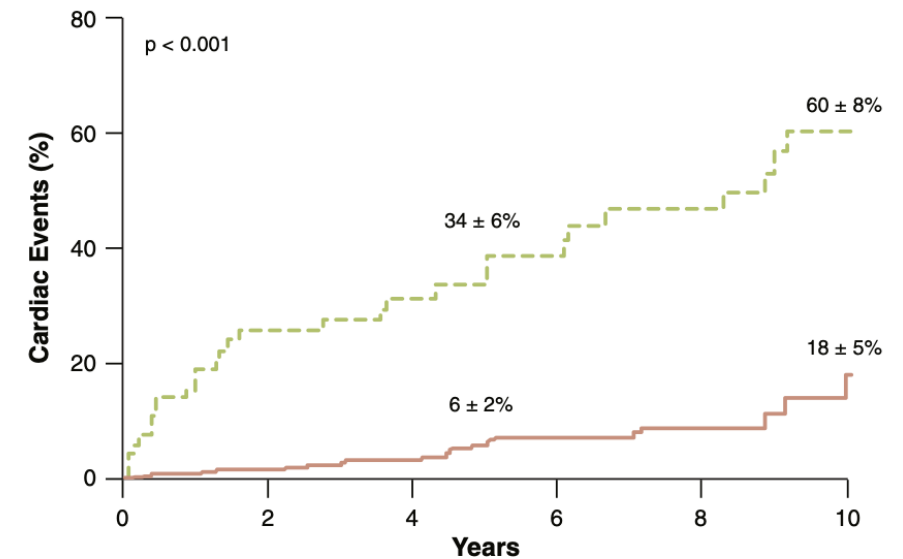


Number at Risk

Total	353	308	252	194	70	31
ERO <40	285	253	210	163	46	23
ERO ≥40	68	55	42	31	24	8

— ERO ≥40 mm² — ERO <40 mm²

FIGURE 1 Survival in Patients With Isolated TR, Stratified According to ERO



Number at Risk

Total	353	294	242	183	65	29
ERO <40	285	252	209	160	46	23
ERO ≥40	68	42	33	23	19	6

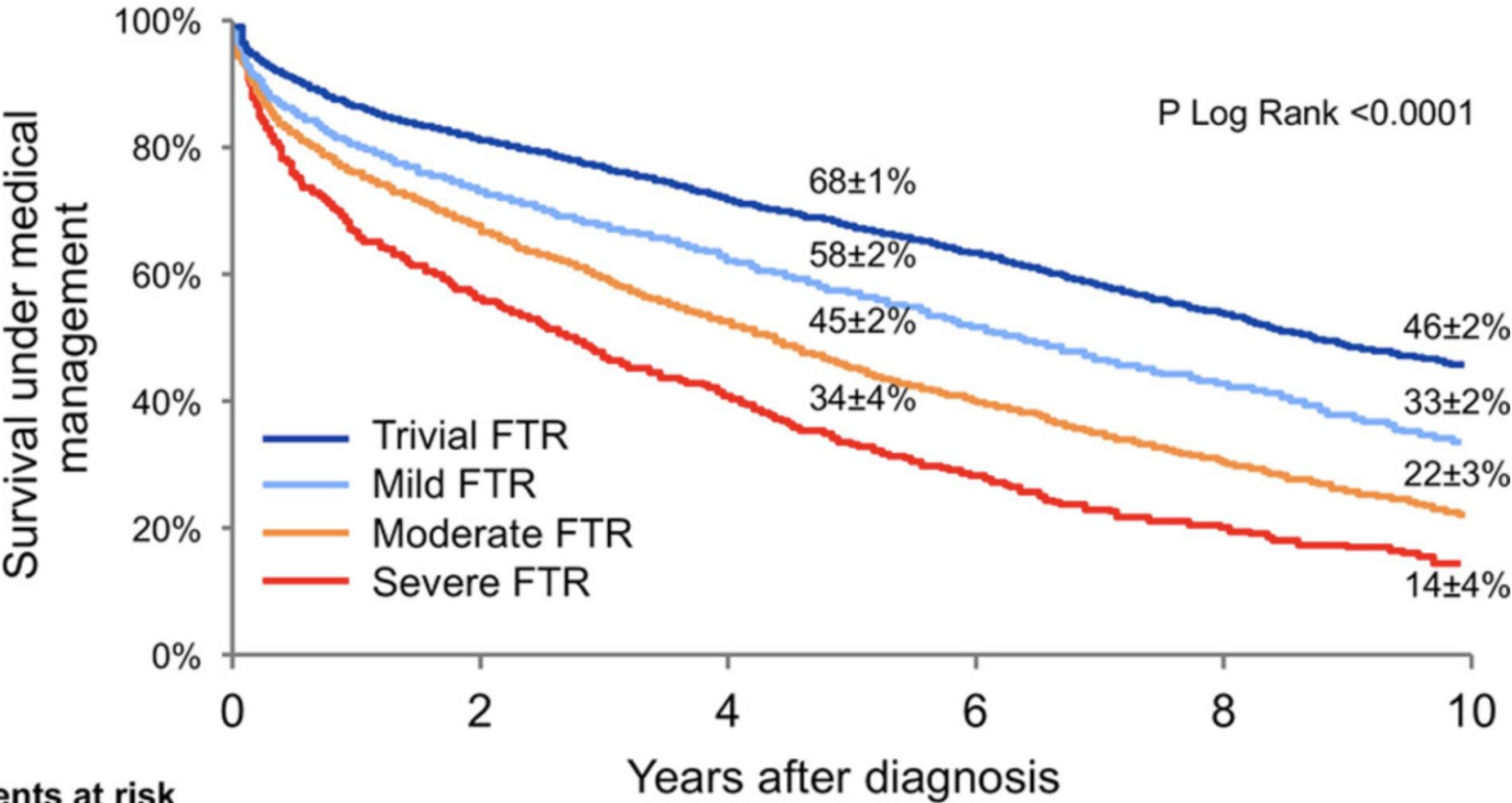
— ERO ≥40 mm² — ERO <40 mm²

FIGURE 2 Cardiac Events (Cardiac Death or Congestive Heart Failure) in Patients With Isolated TR, Stratified According to the ERO



ORIGINAL RESEARCH ARTICLE

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



Patients at risk

Trivial FTR	4329	3218	3069	2384	1640	762
Mild FTR	4178	2789	2119	1384	809	359
Moderate FTR	2255	1336	935	555	307	119
Severe FTR	745	352	230	135	65	23

3

Riesgo
quirúrgico



Procedure Type

Isolated CAB

Isolated AVR

Isolated MVR

AVR + CAB

MVR + CAB

MV Repair

MV Repair + CAB

STS Adult Cardiac Surgery Database Version 4.20

RISK SCORES

No procedure selected

CALCULATE

Risk of Mortality: NA

Renal Failure: NA

Permanent Stroke: NA

Prolonged Ventilation: NA

DSW Infection: NA

Reoperation: NA

Morbidity or Mortality: NA

Short Length of Stay: NA

Long Length of Stay: NA

PRINT

CLEAR

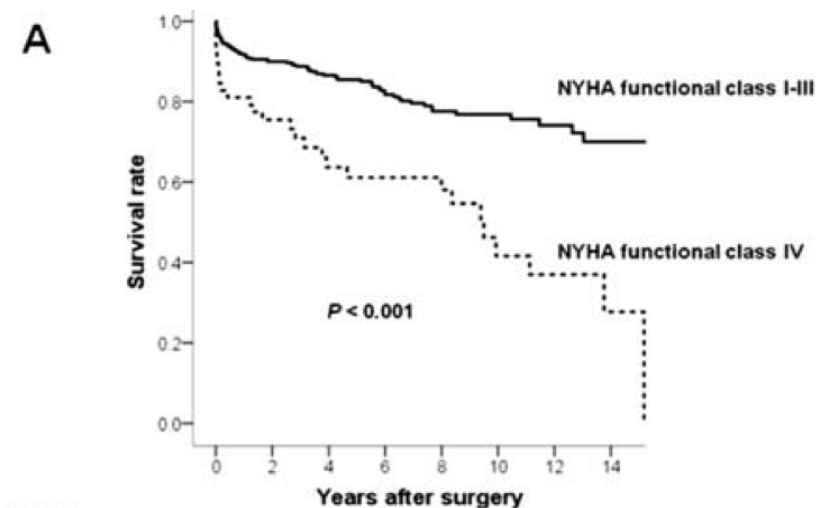
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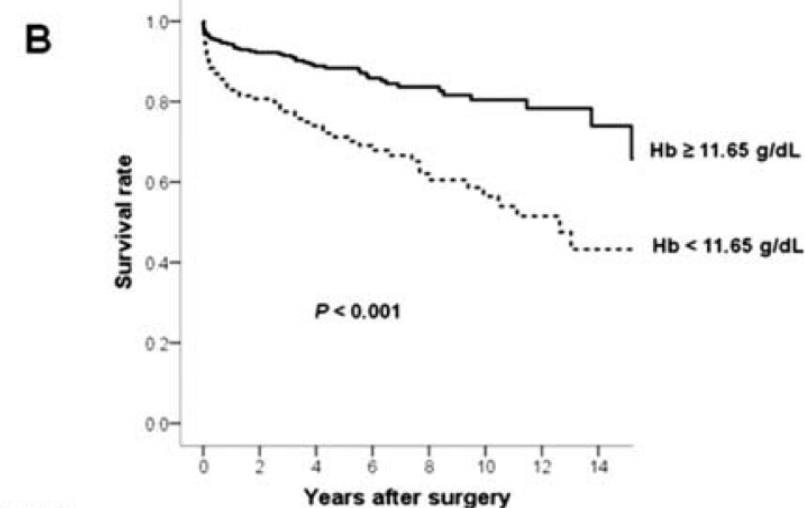
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Surgical outcomes of severe tricuspid regurgitation: predictors of adverse clinical outcomes

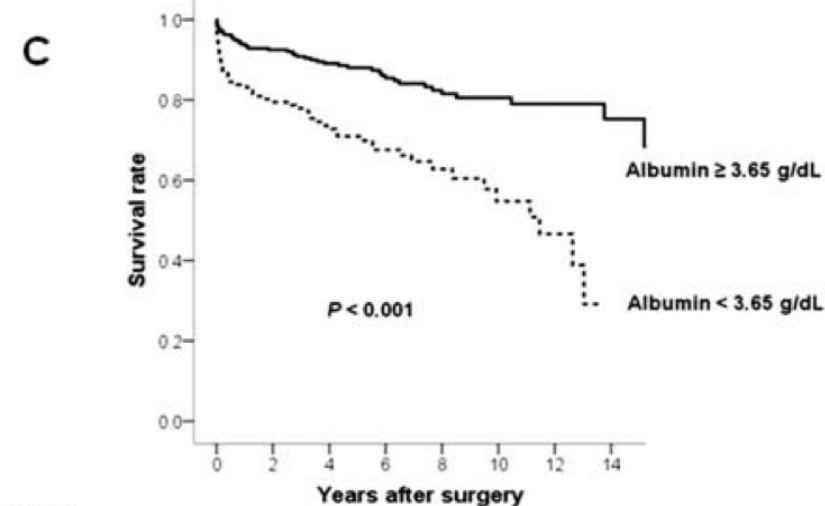
Joon Bum Kim, Sung-Ho Jung, Suk Jung Choo, Cheol Hyun Chung, Jae Won Lee



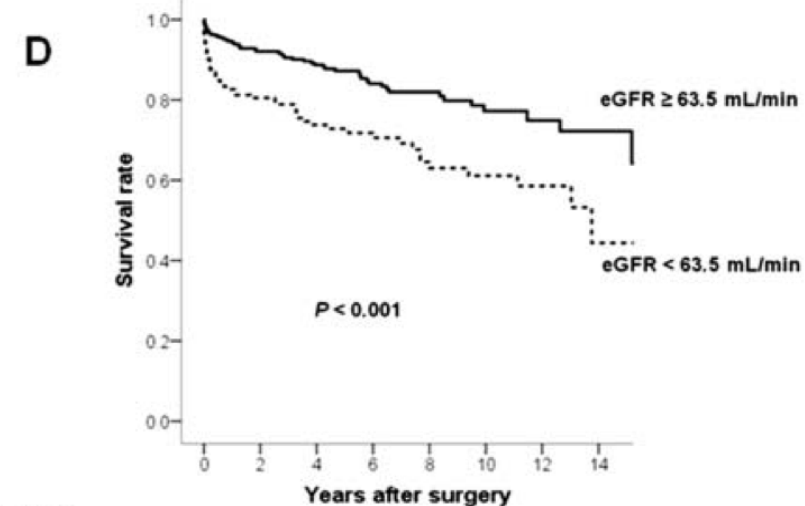
N. at risk								
NYHA class I-III	391	323	250	168	112	75	47	16
NYHA class IV	58	38	26	24	19	9	6	2



N. at risk								
Hb ≥ 11.65 g/dL	273	229	174	120	83	52	31	12
Hb < 11.65 g/dL	171	129	100	70	46	32	19	4



N. at risk								
Albumin ≥ 3.65 g/dL	350	294	223	156	106	64	43	14
Albumin < 3.65 g/dL	86	58	44	28	18	14	6	0



N. at risk								
eGFR ≥ 63.5 mL/min	267	220	164	108	71	47	27	10
eGFR < 63.5 mL/min	173	135	106	79	56	33	22	5

Surgical outcomes of severe tricuspid regurgitation: predictors of adverse clinical outcomes

Joon Bum Kim, Sung-Ho Jung, Suk Jung Choo, Cheol Hyun Chung, Jae Won Lee

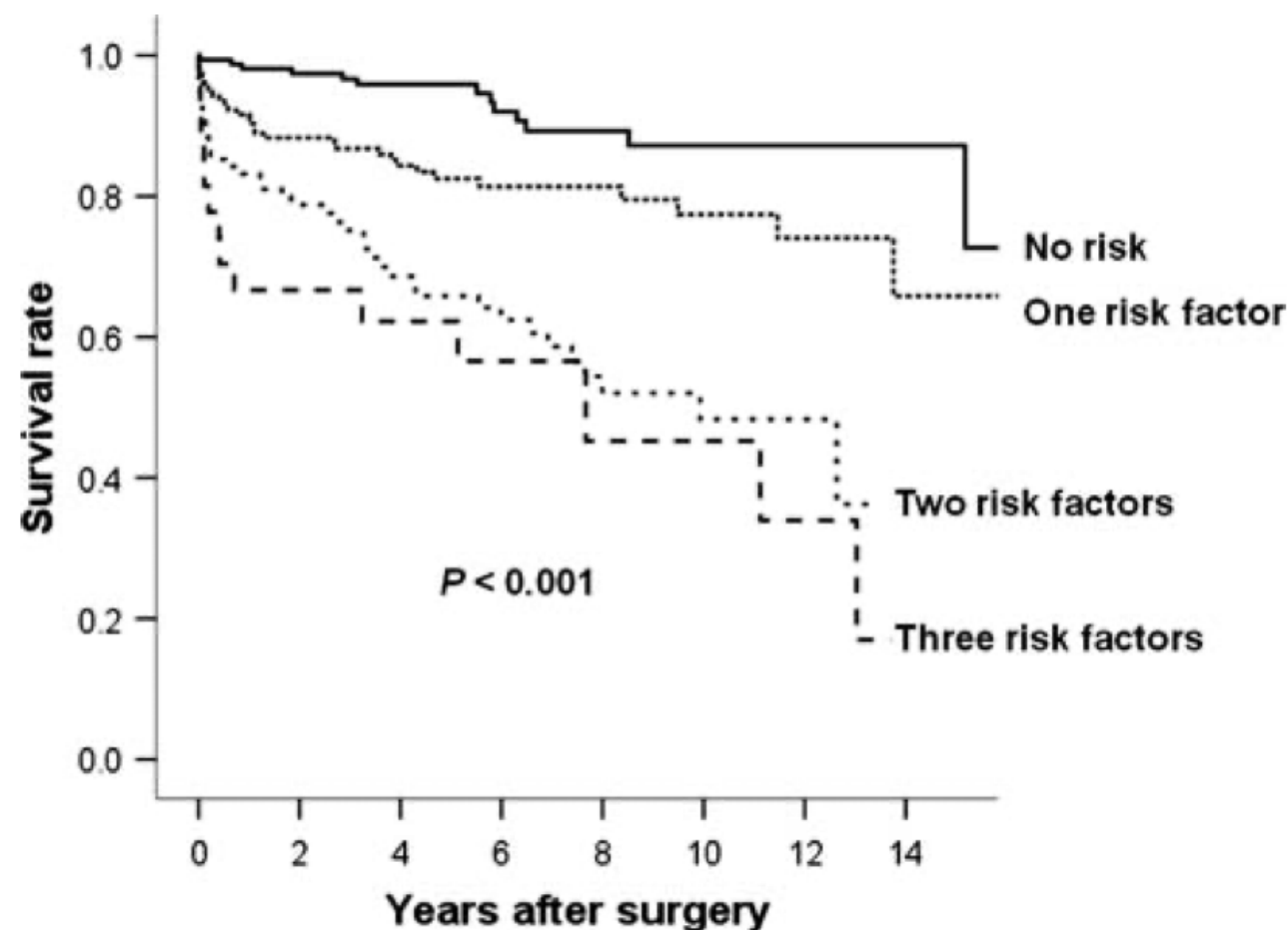
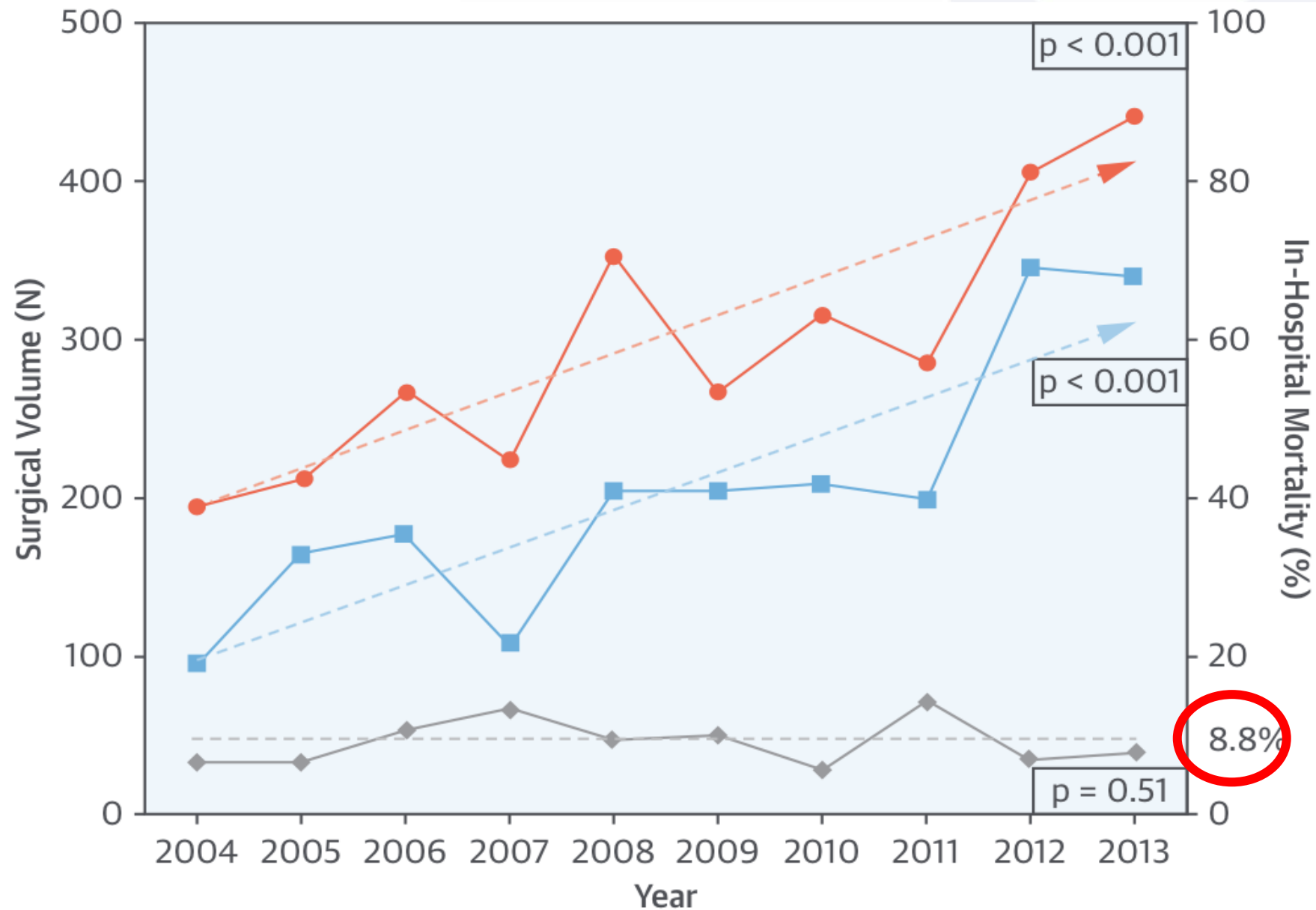


Figure 3 Survival curves according to the number of laboratory risk factors. Laboratory risk factors are as follow: (1) haemoglobin <11.65 g/dl, (2) serum albumin <3.65 g/dl and (3) estimated glomerular filtration rate <63.5 ml/min/1.73 m².

National Trends and Outcomes in Isolated Tricuspid Valve Surgery

Chad J. Zack, MD,^a Erin A. Fender, MD,^a Pranav Chandrashekar, MBBS,^a Yogesh N.V. Reddy, MBBS,^a
Courtney E. Bennett, DO,^{a,b} John M. Stulak, MD,^c Virginia M. Miller, PhD,^{c,d} Rick A. Nishimura, MD^a

- Tricuspid Valve Replacement
- Tricuspid Valve Repair (N)
- In-Hospital Mortality After Tricuspid Valve Surgery

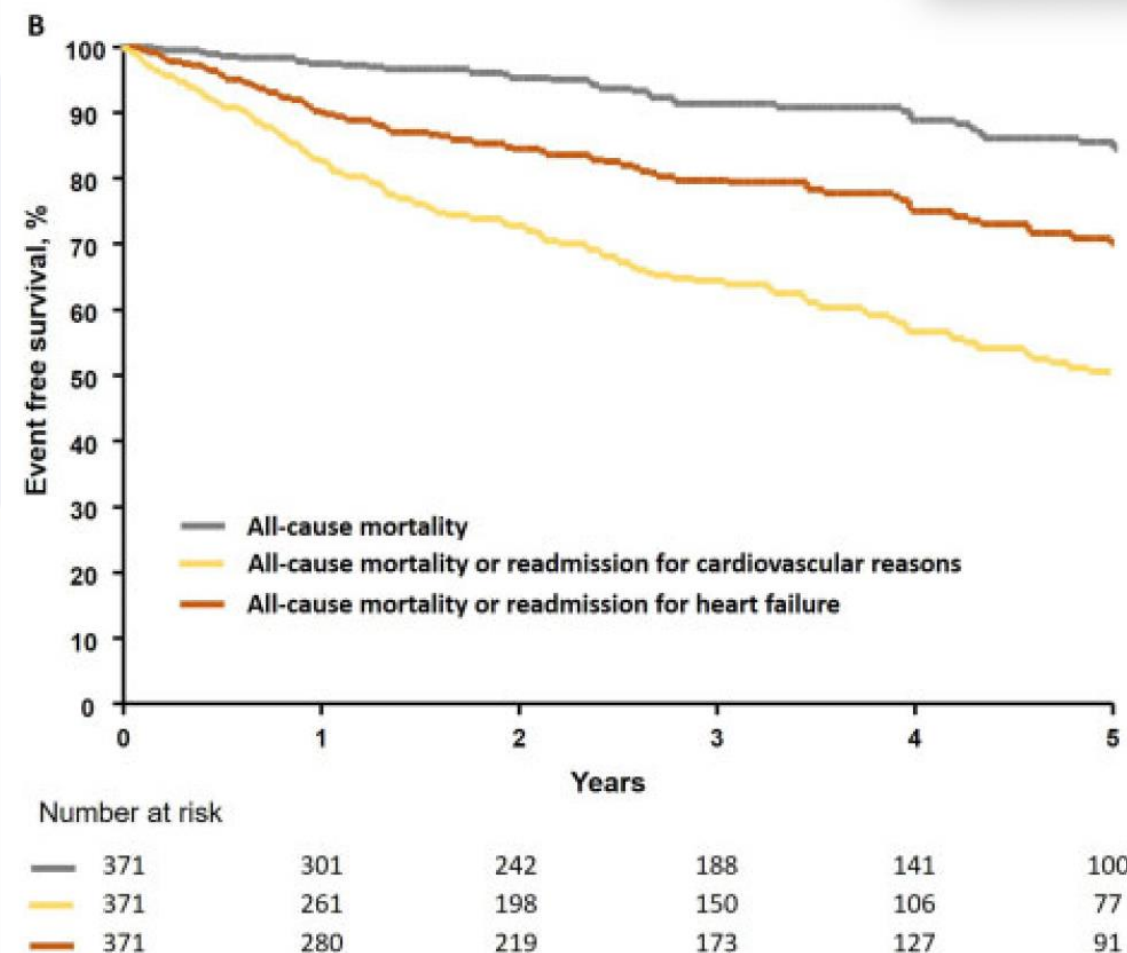
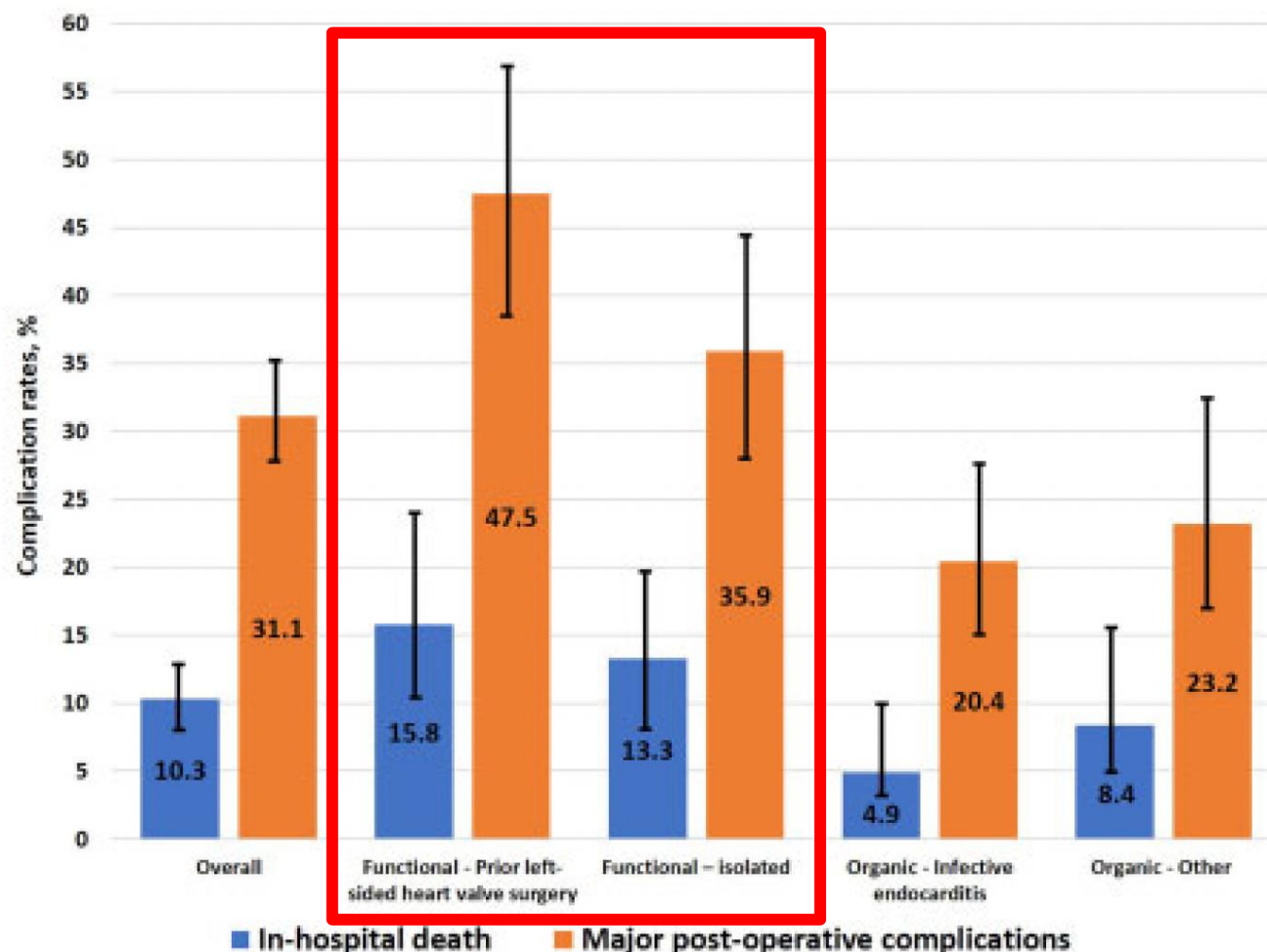


4

Cirugía de la IT aislada

Isolated tricuspid valve surgery: impact of aetiology and clinical presentation on outcomes

Julien Dreyfus ^{1*}, Michele Flagiello², Baptiste Bazire ³, Florian Eggenspieler⁴,



Evolution of tricuspid regurgitation after mitral valve repair for functional mitral regurgitation in dilated cardiomyopathy[☆]

Michele De Bonis^{*}, Elisabetta Lapenna, Flavia Sorrentino, Giovanni La Canna, Antonio Grimaldi, Francesco Maisano, Lucia Torracca, Ottavio Alfieri

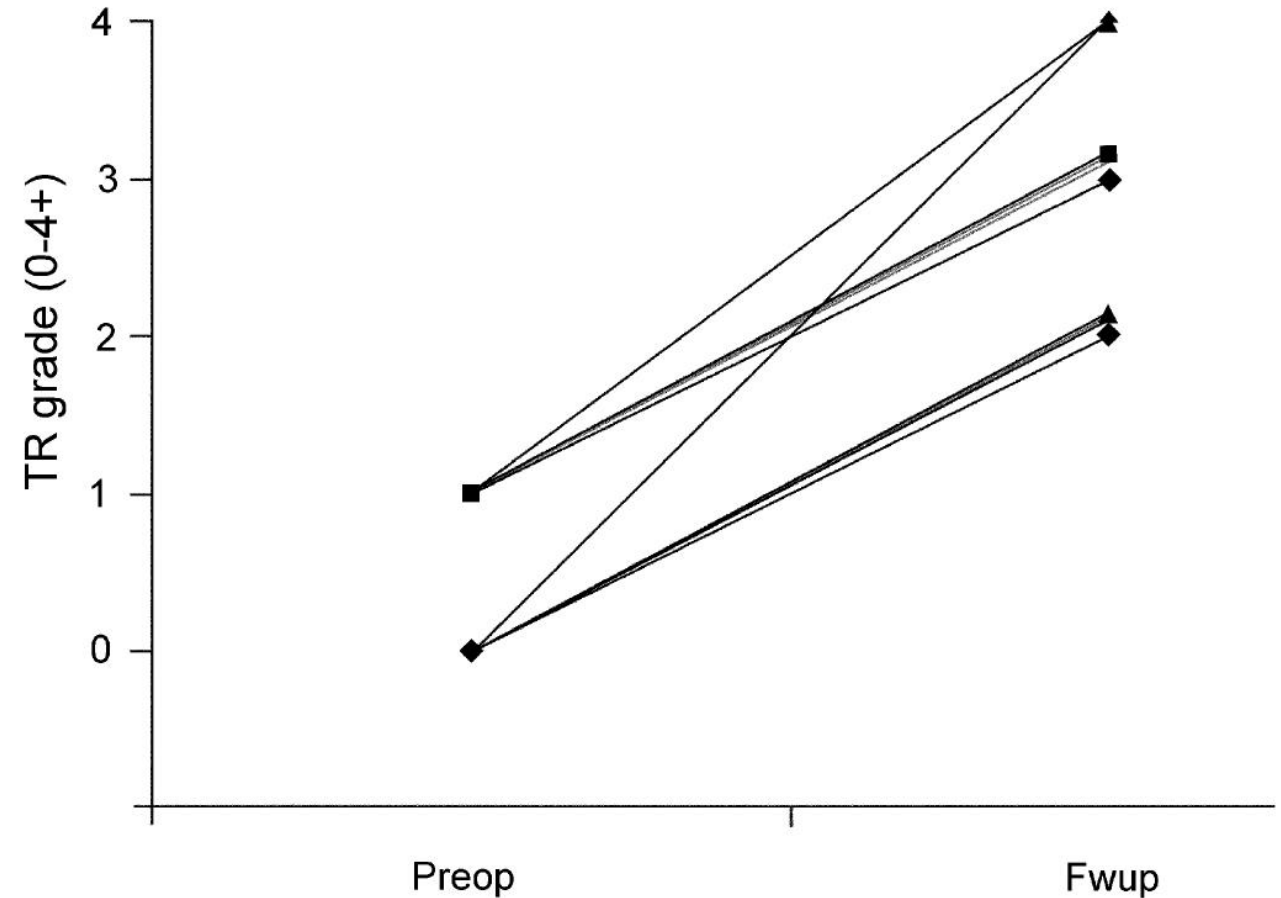
Department of Cardiac Surgery, San Raffaele University Hospital, Via Olgettina 60, 20132 Milan, Italy

Received 3 September 2007; received in revised form 3 January 2008; accepted 8 January 2008; Available online 12 February 2008

Table 4
Predictors of tricuspid regurgitation $\geq 3+$

	Univariate		Multivariate	
	Odds ratio	p value	Odds ratio	p value
Preoperative variables				
LVEF	1	0.6		
LVEDVI	1	0.4		
LVESVI	1	0.6		
SPAP >40 mmHg	2.8	0.2		
RV dilatation	8.3	0.009	1.7	0.6
RV dysfunction	13.7	0.0001	19.6	0.02
Tricuspid repair	0.5	0.6		
TR at discharge	3	0.01	5.4	0.01

LVEF: left ventricular ejection fraction; LVEDVI: left ventricular end-diastolic volume index; LVESVI: left ventricular end-systolic volume index; SPAP: systolic pulmonary artery pressure; RV: right ventricle; TR: tricuspid regurgitation.



Clinical and Echocardiographic Impact of Functional Tricuspid Regurgitation Repair at the Time of Mitral Valve Replacement

Vincent Chan, MD, Ian G. Burwash, MD, B-Khanh Lam, MD, MPH, Titus Auyeung, BS, Anthony Tran, BS, Thierry G. Mesana, MD, PhD, and Marc Ruel, MD, MPH

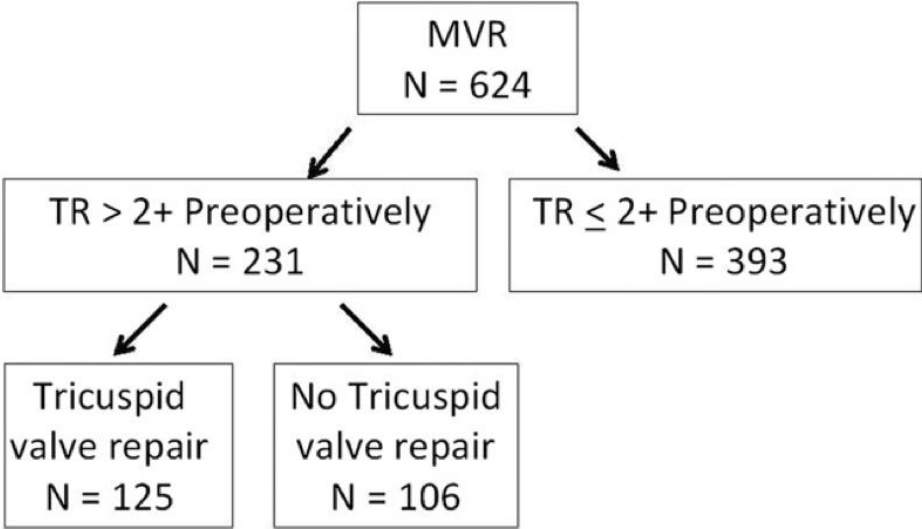
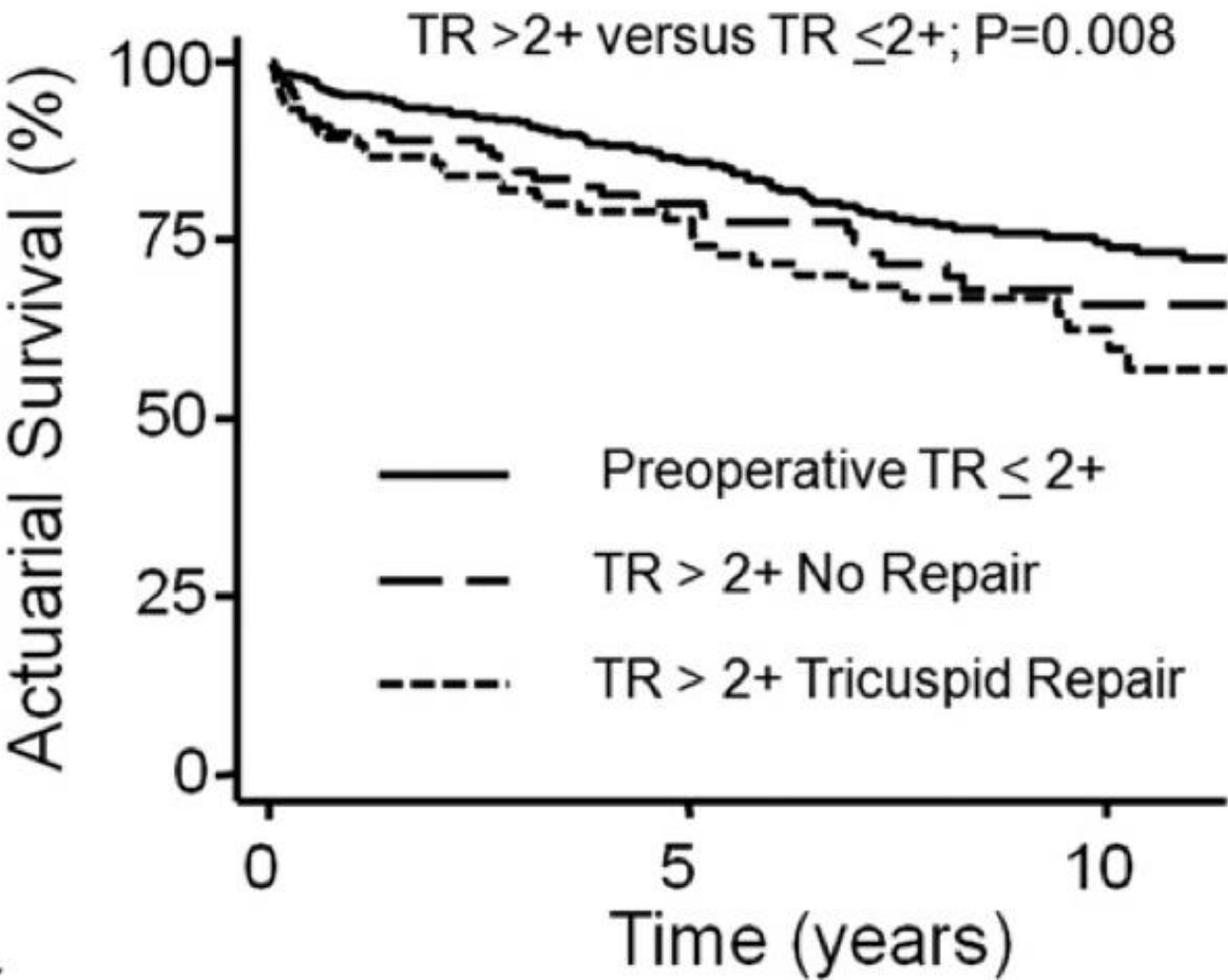


Fig 1. Study algorithm. (MVR = mitral valve replacement; TR = tricuspid regurgitation.)



Numbers at risk

TR > 2+ Tricuspid Repair	125	66	25
TR > 2+ No Tricuspid Repair	106	64	32
TR ≤ 2 No Tricuspid Repair	393	242	109

Concomitant Tricuspid Repair in Patients with Degenerative Mitral Regurgitation

Table 2. Primary E

Composite End Po

Imputed calculati

Observed calculat

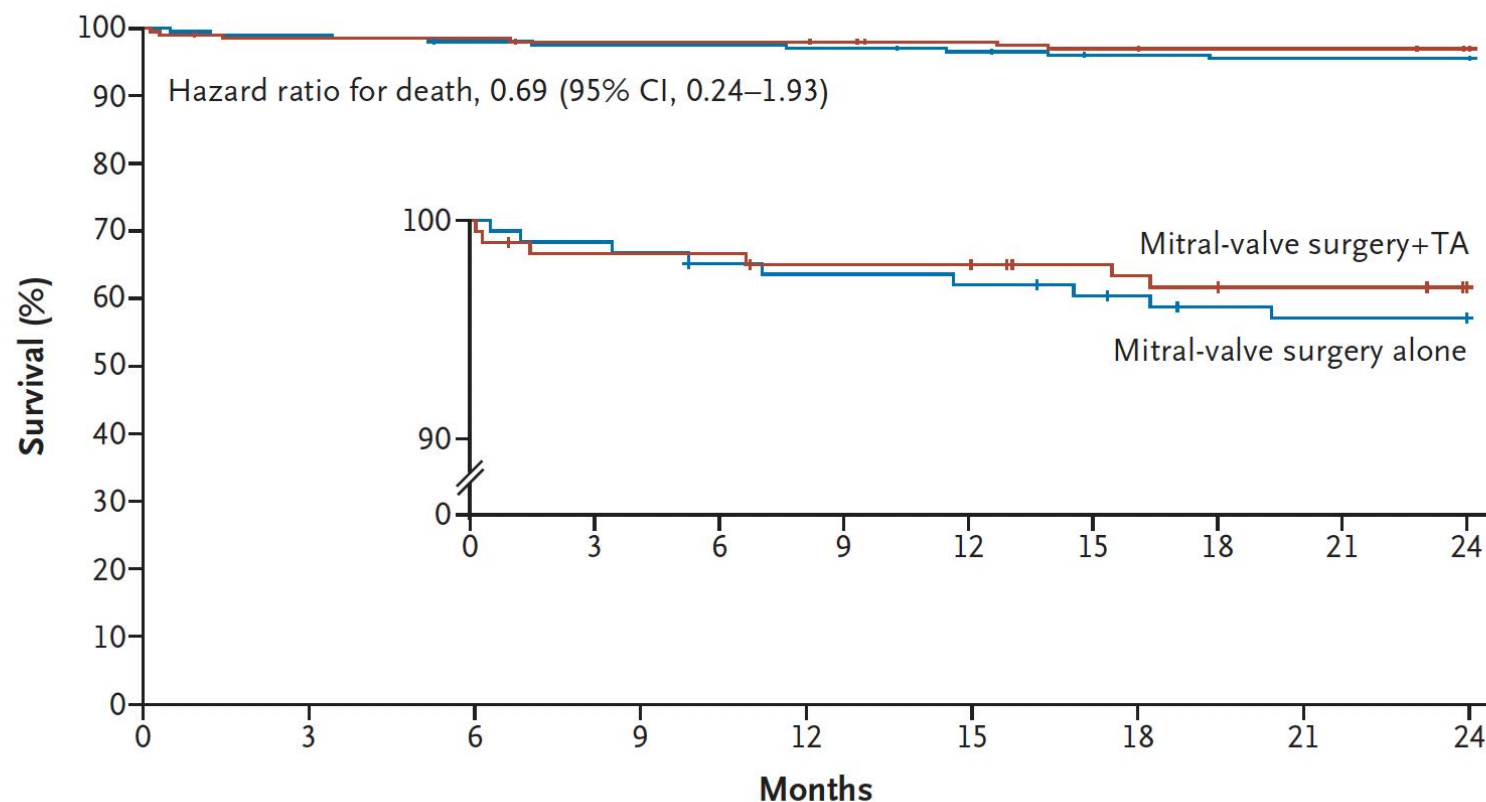
Reoperation fo

Progression of

Death

P Value

0.02



No. at Risk

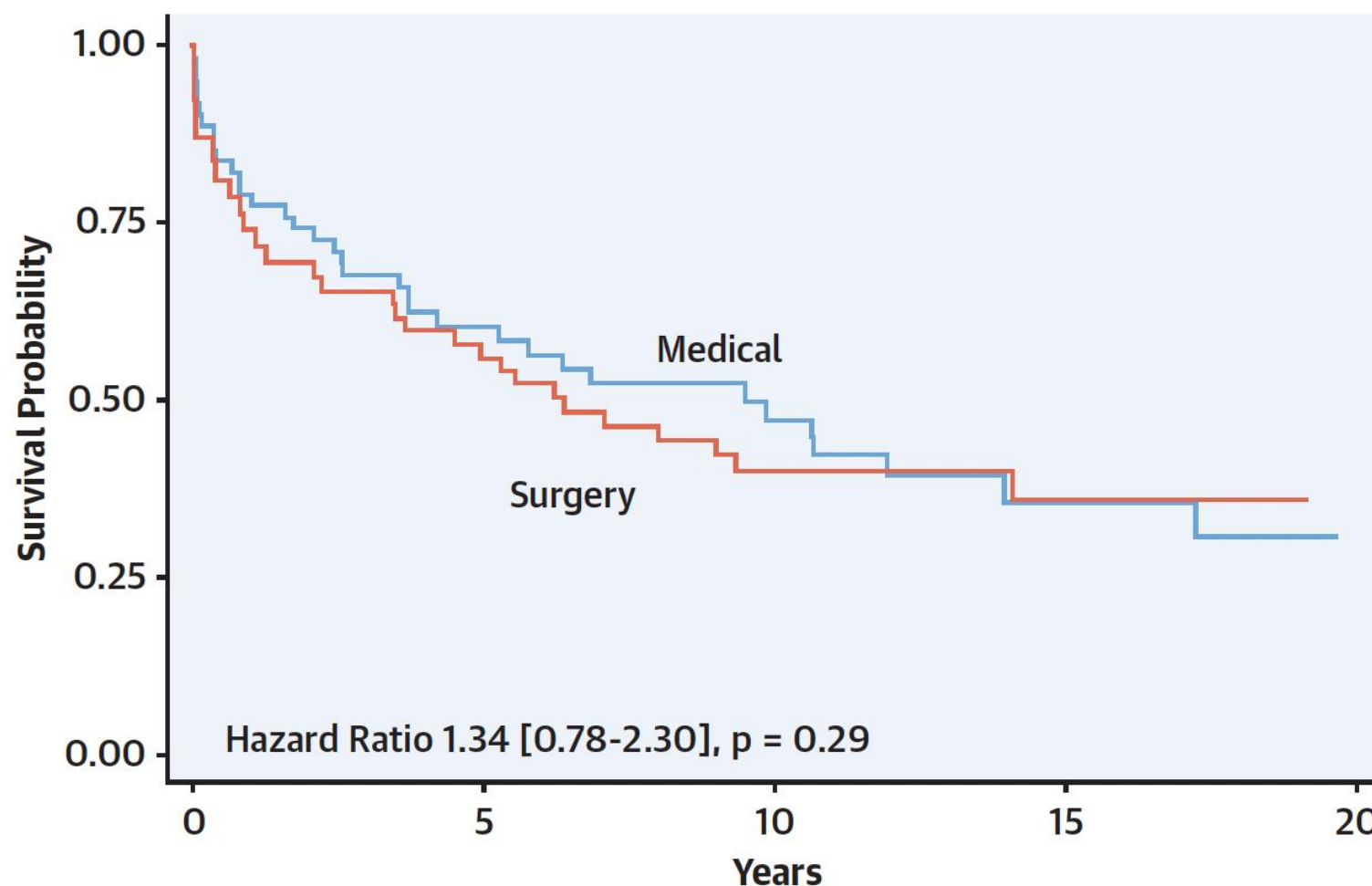
Mitral-valve surgery+TA	198	194	194	192	192	189	187	186	184
Mitral-valve surgery alone	203	201	198	197	196	194	191	190	190

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, MPH^{HL}^c

CENTRAL ILLUSTRATION Surgery Versus Medical Therapy for Severe Tricuspid Regurgitation



5

**Soluciones
transcatéter**

Outcomes After Current Transcatheter Tricuspid Valve Intervention

Mid-Term Results From the International TriValve Registry

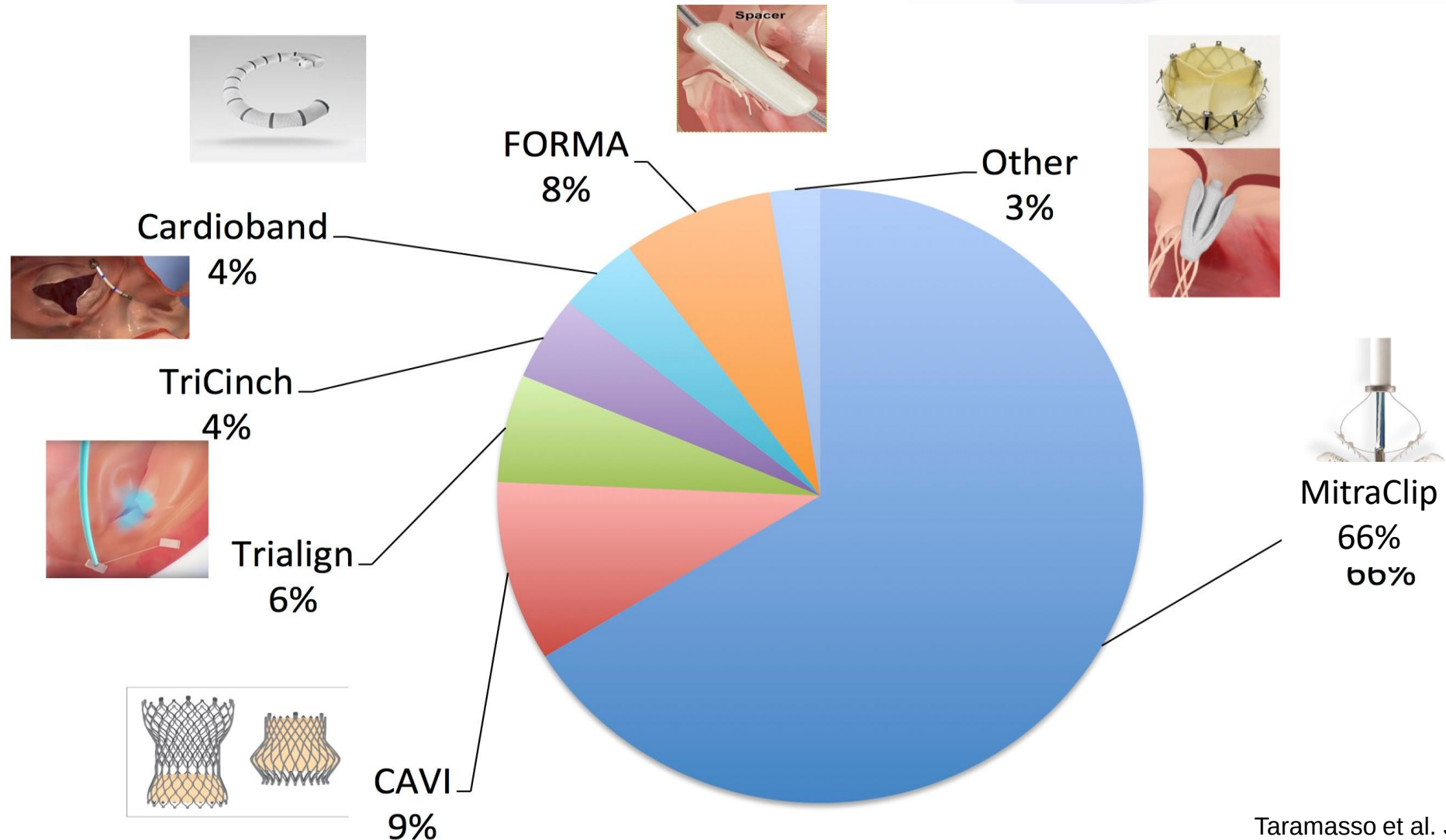
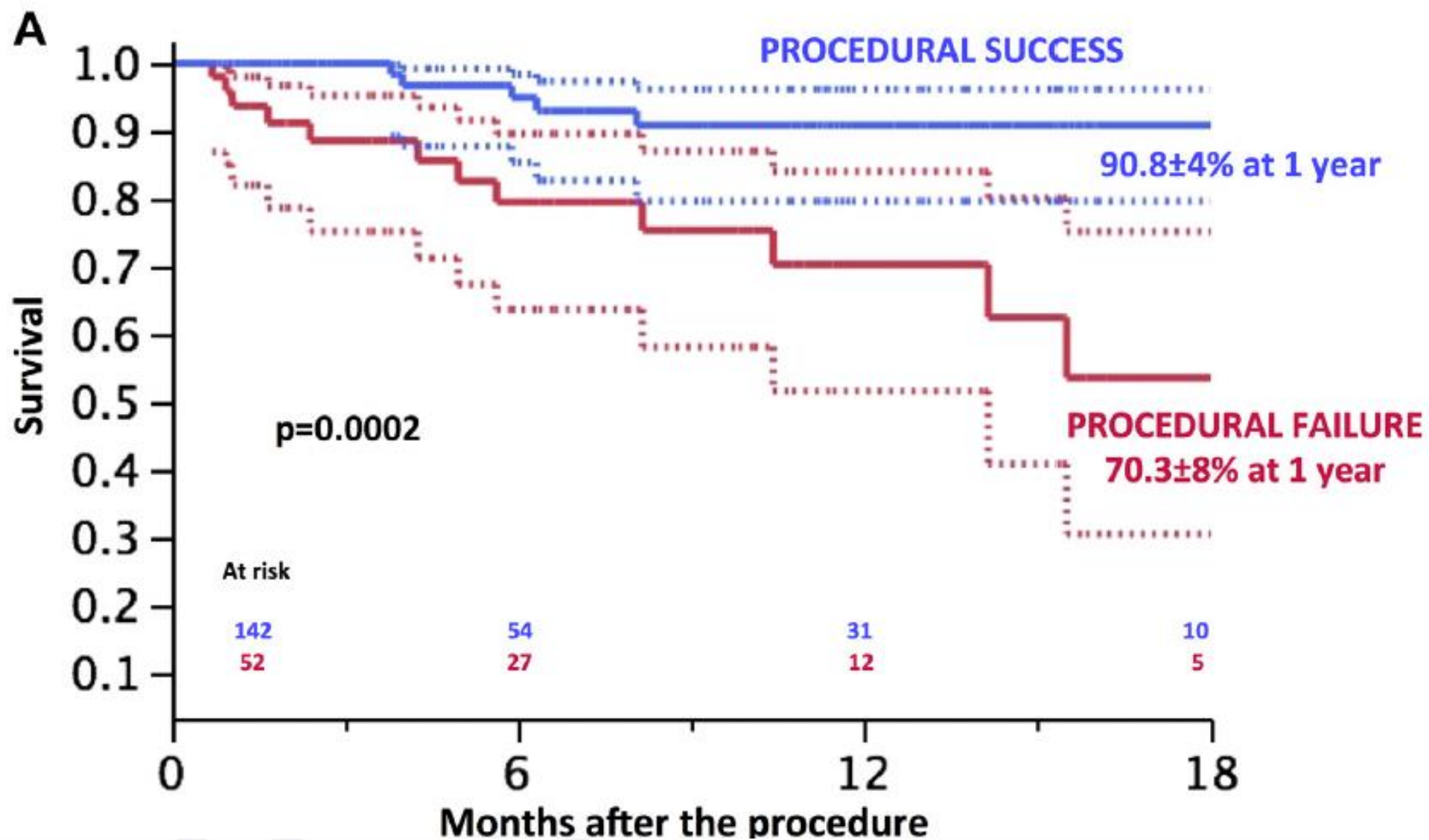


FIGURE 6 Actuarial Survival According to Procedural Success



6

**Incremento de
la coaptación**

Predictors of Procedural and Clinical Outcomes in Patients With Symptomatic Tricuspid Regurgitation Undergoing Transcatheter Edge-to-Edge Repair



117 consecutive patients with symptomatic TR treated with MitraClip

Christian Besler, MD,^{a,*} Mathias Orban, MD,^{b,c,*} Karl-Philipp Rommel, MD,^{a,*} Daniel Braun, MD,^b Mehul Patel, MD,^d Christian Hagl, MD,^e Michael Borger, MD, PhD,^f Michael Nabauer, MD,^b Steffen Massberg, MD,^{b,c} Holger Thiele, MD,^a Jörg Hausleiter, MD,^{b,c,†} Philipp Lurz, MD, PhD^{a,†}

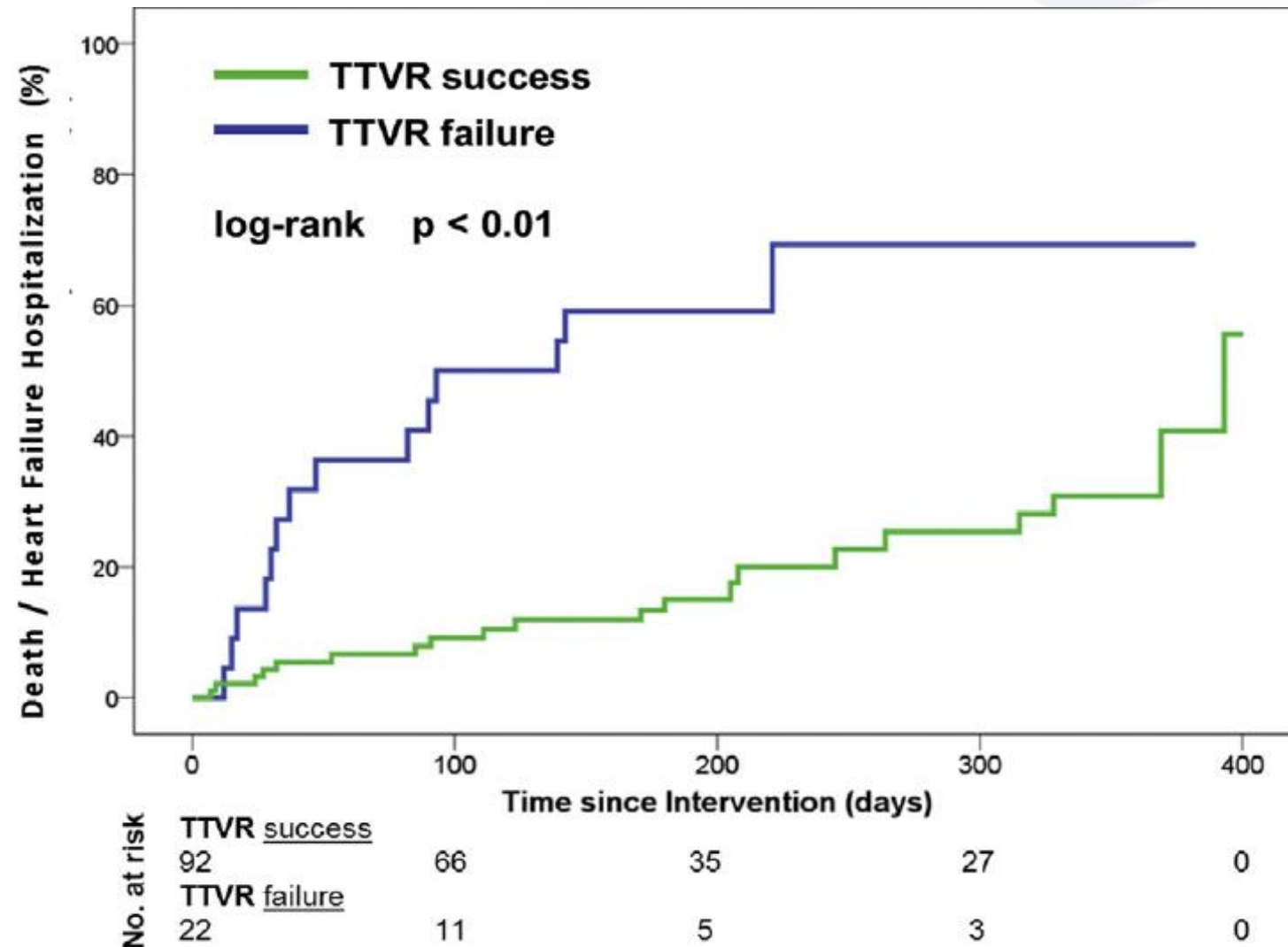
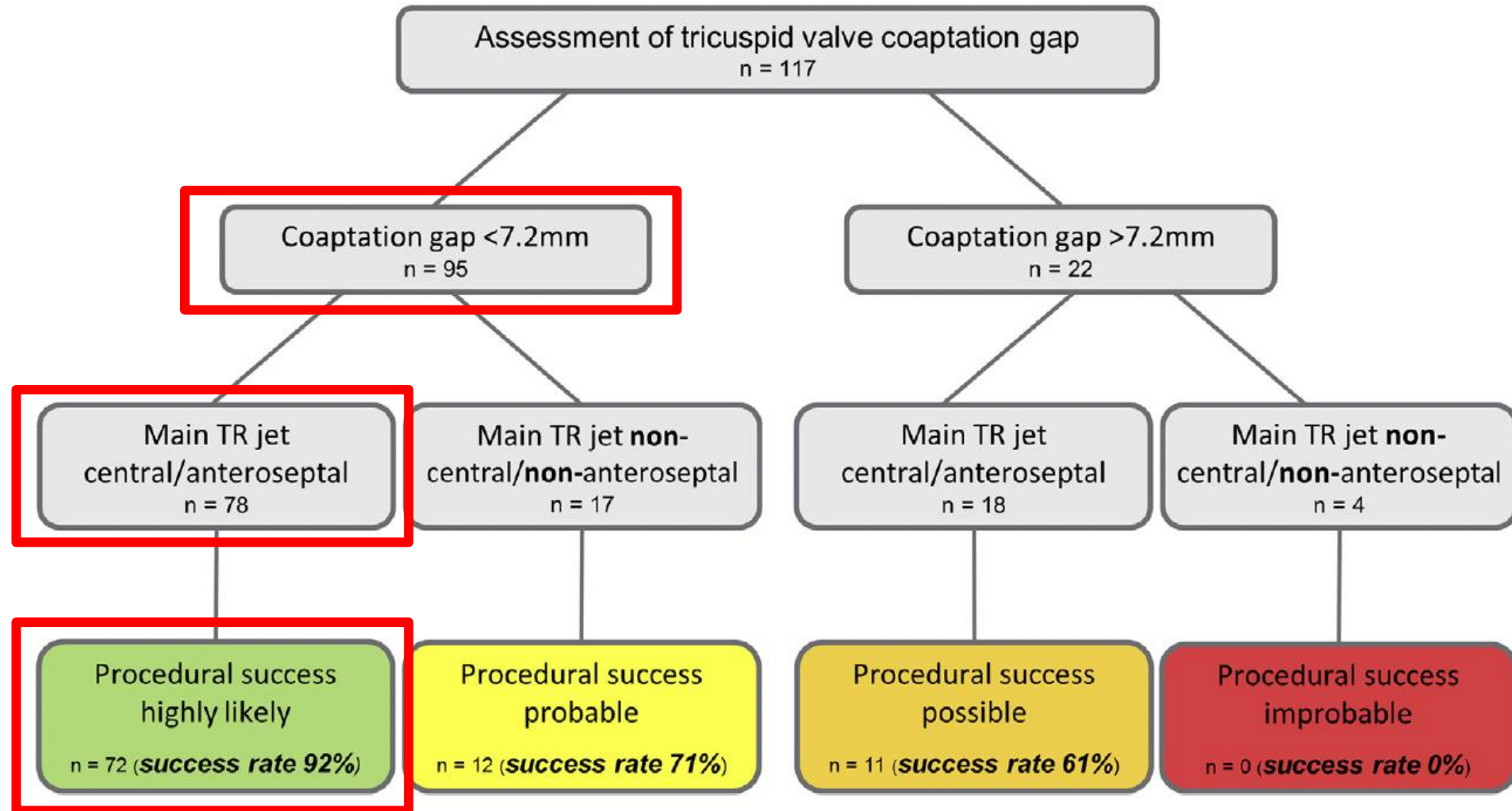


FIGURE 3 Patient Stratification According to Procedural Success



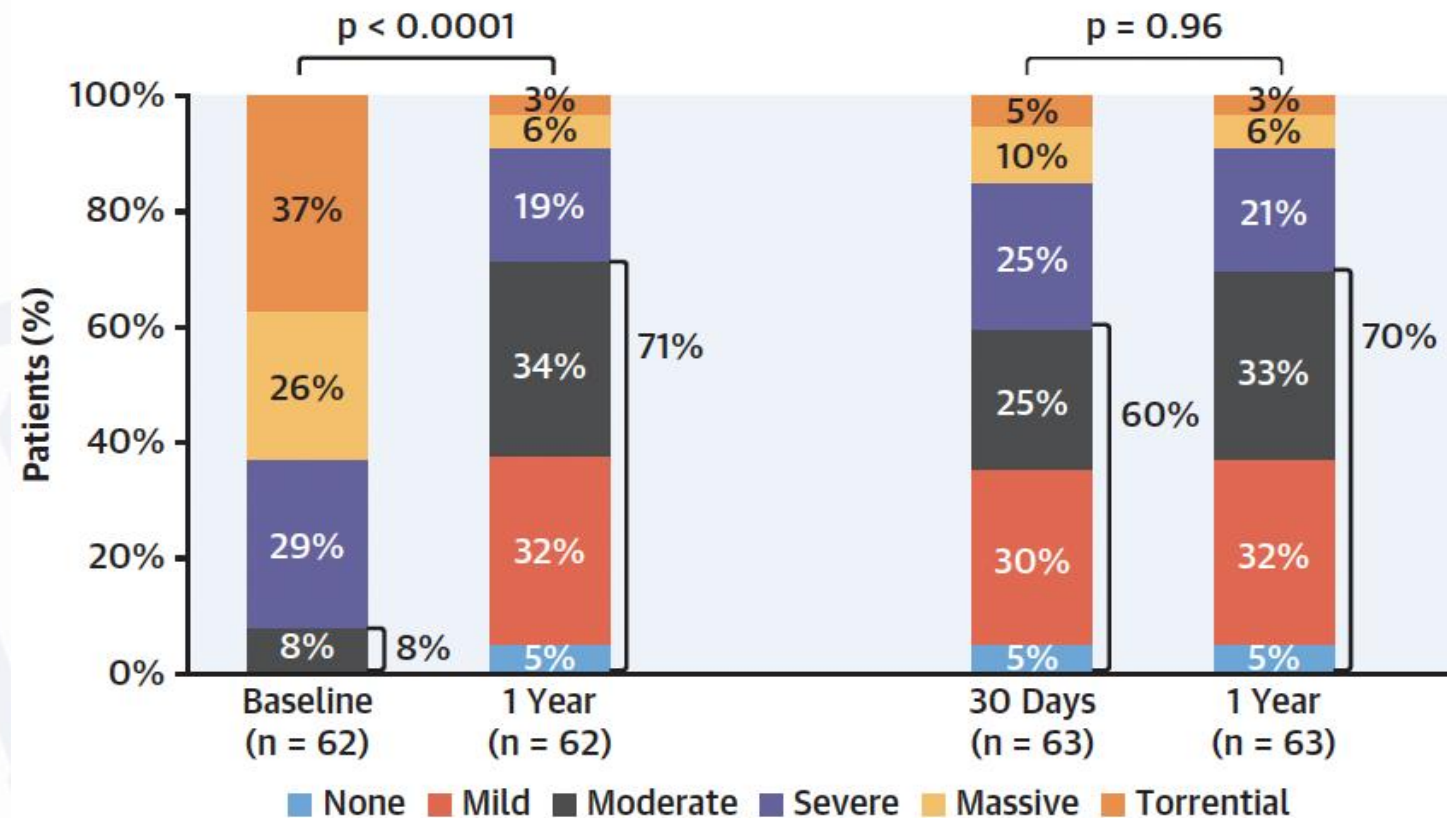
Proposed scheme for patient stratification for transcatheter tricuspid valve edge-to-edge repair according to the determined cut-off value of 7.2 mm for tricuspid valve coaptation gap and main tricuspid regurgitant jet orientation. TR = tricuspid regurgitation.

Transcatheter Edge-to-Edge Repair for Treatment of Tricuspid Regurgitation

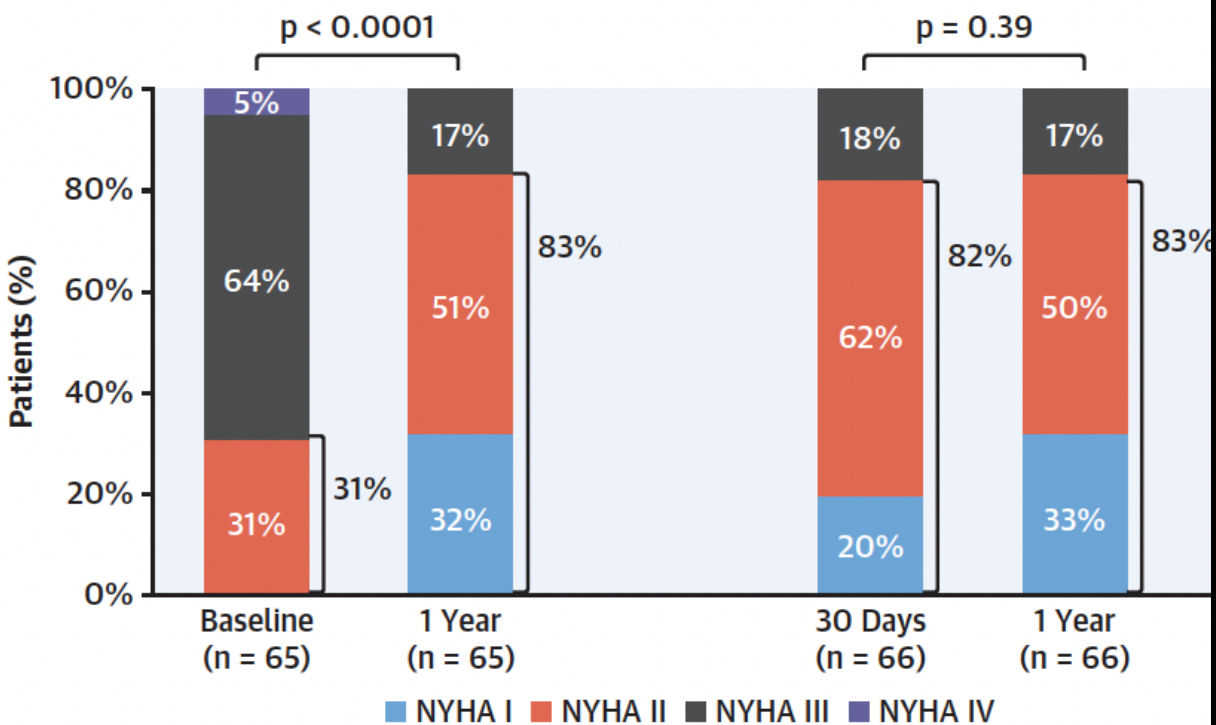
TRILUMINATE trial (TriClip, Abbott Vasc)

TR Reduction Sustained
at 1 Year (n=62)

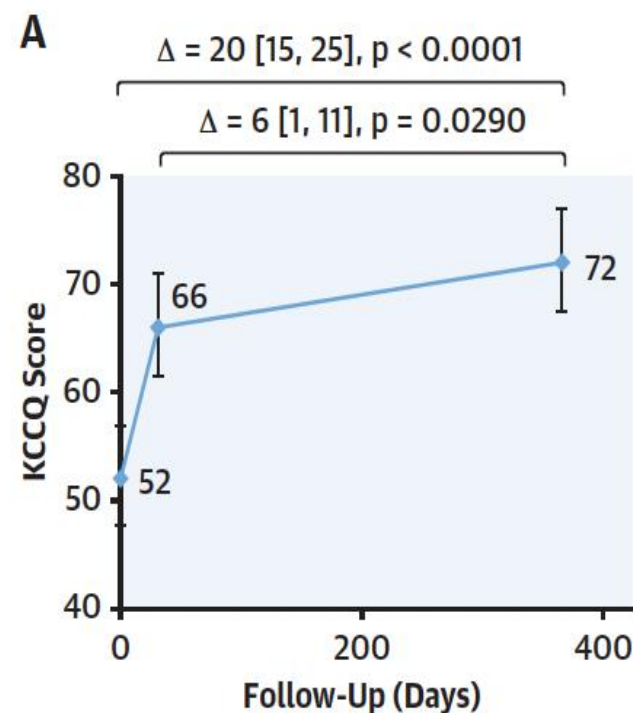
70% Moderate or less at 1Y



NYHA



KCCQ



6MWD

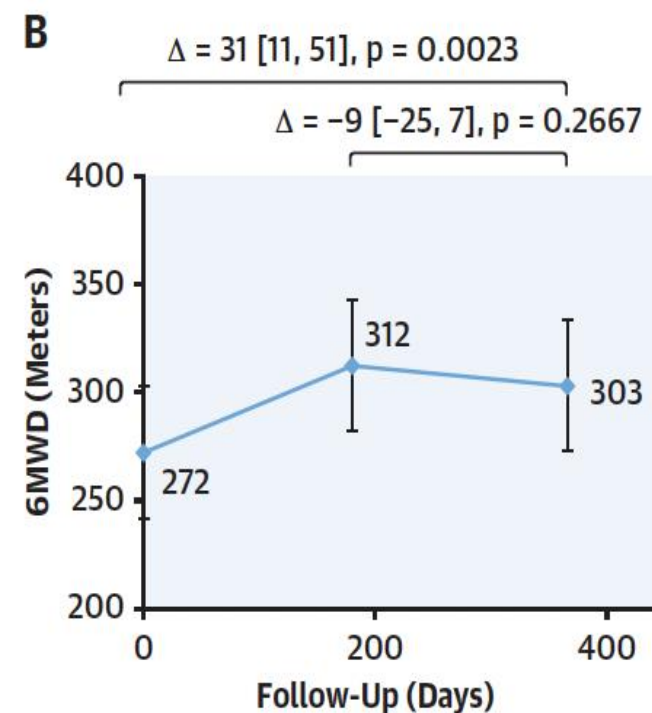
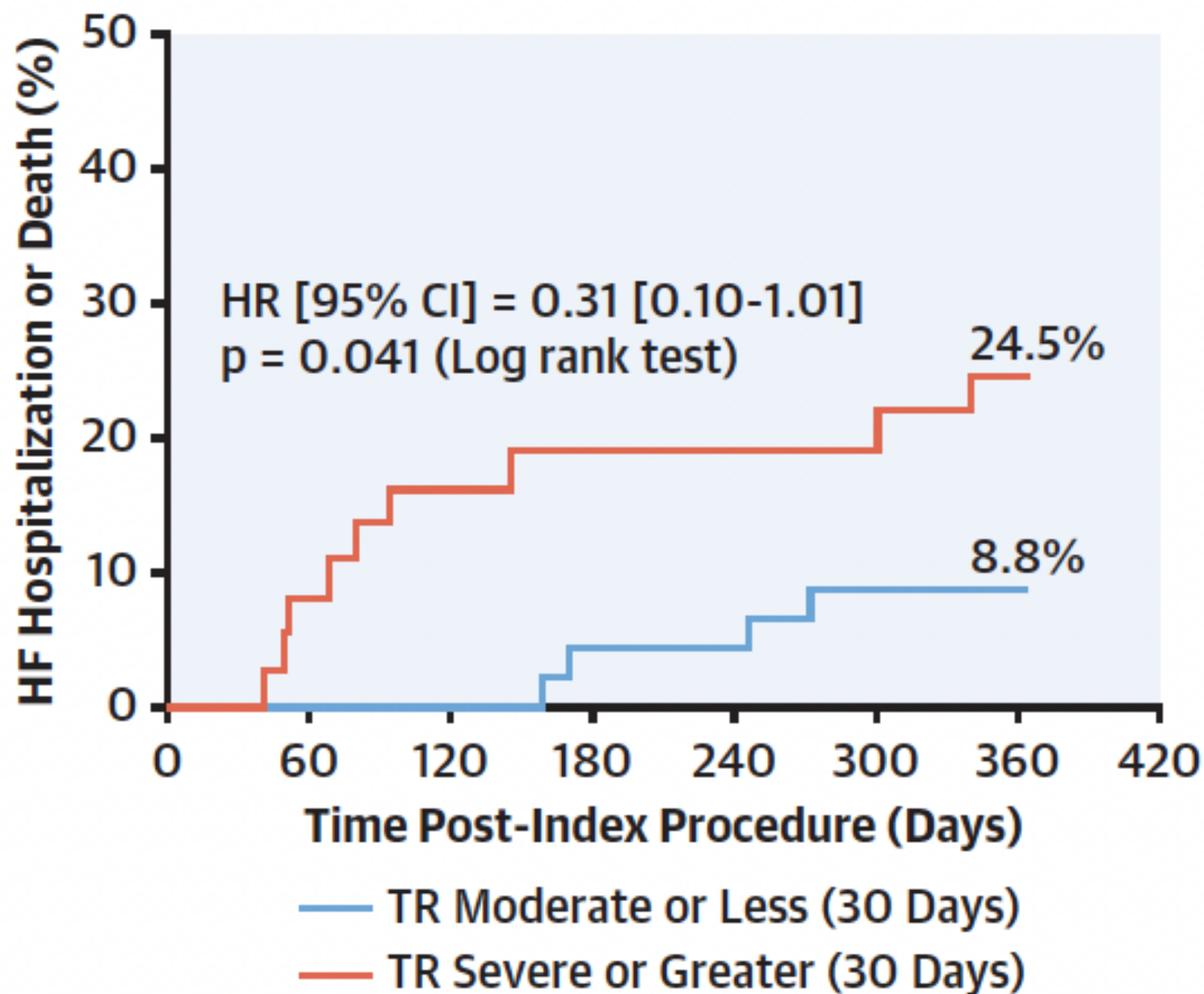


FIGURE 4 Effect of TR Reduction On Mortality and Heart Failure Hospitalization



7

**Anuloplastia
percutănea**

Early Feasibility Study of Cardioband Tricuspid System for Functional Tricuspid Regurgitation

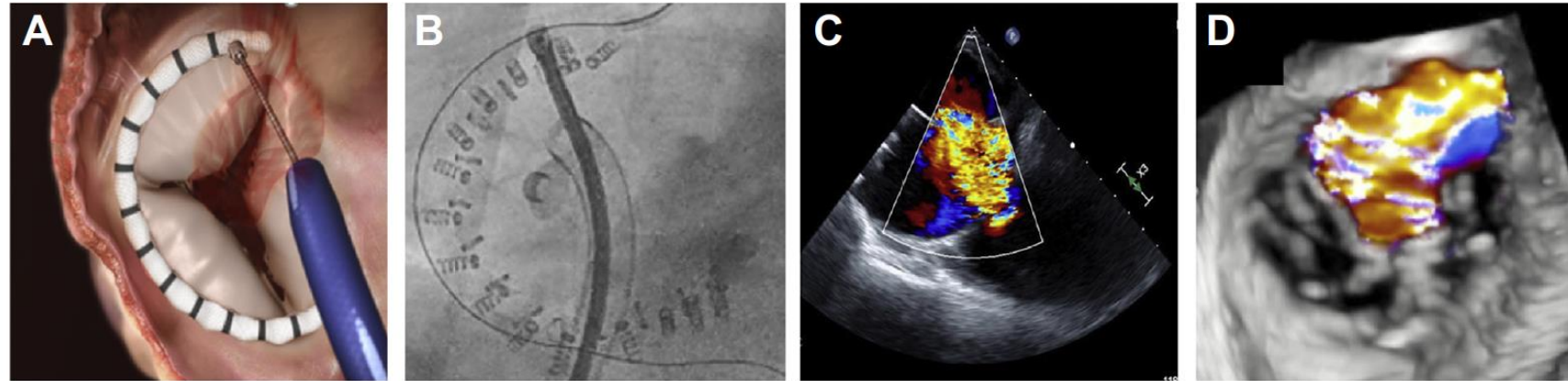


CENTRAL ILLUSTRATION Transcatheter Cardioband Tricuspid Valve Reconstruction System

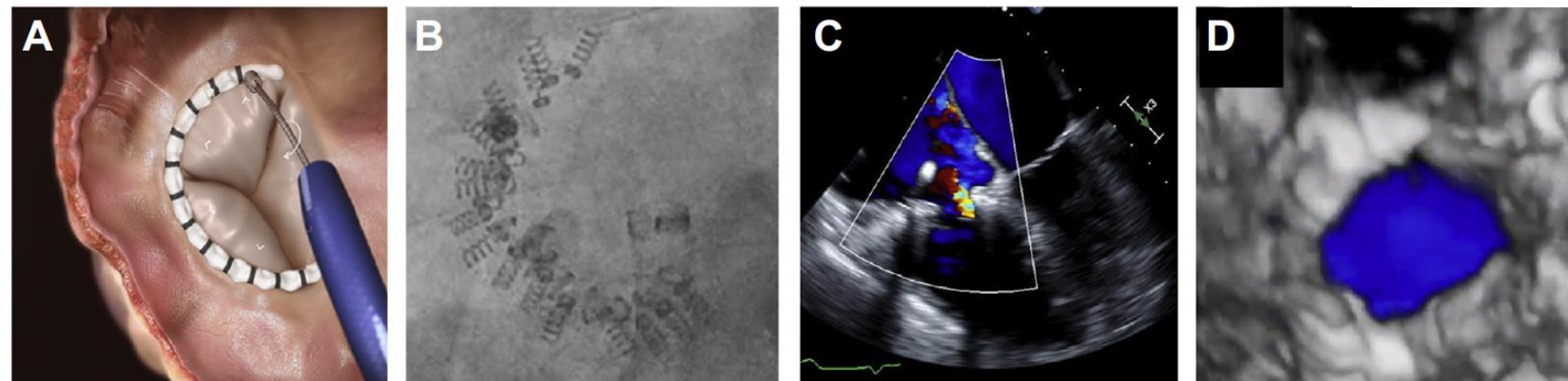
30-Day Outcomes

First U.S. Cardioband Feasibility Study (N=30)

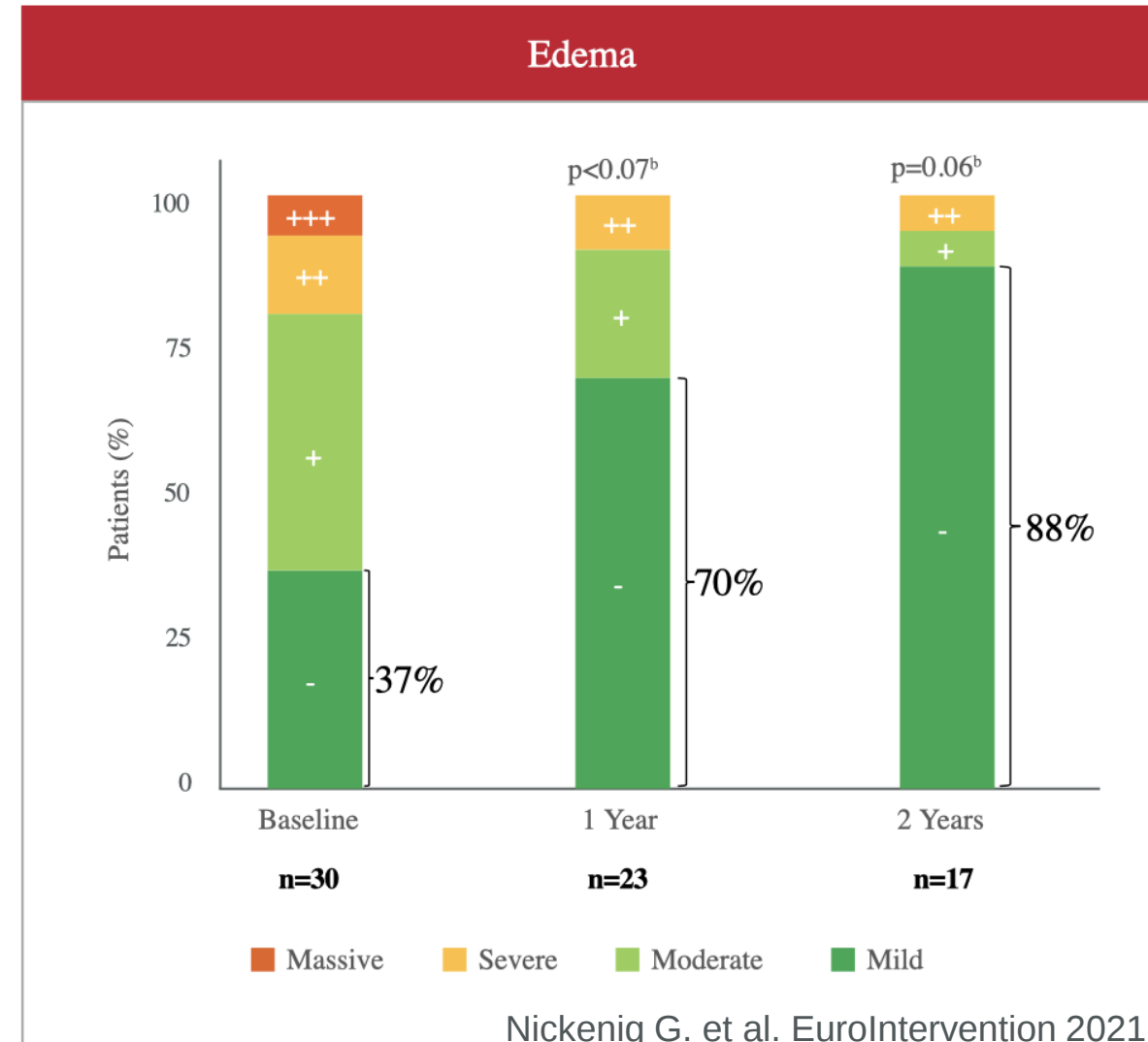
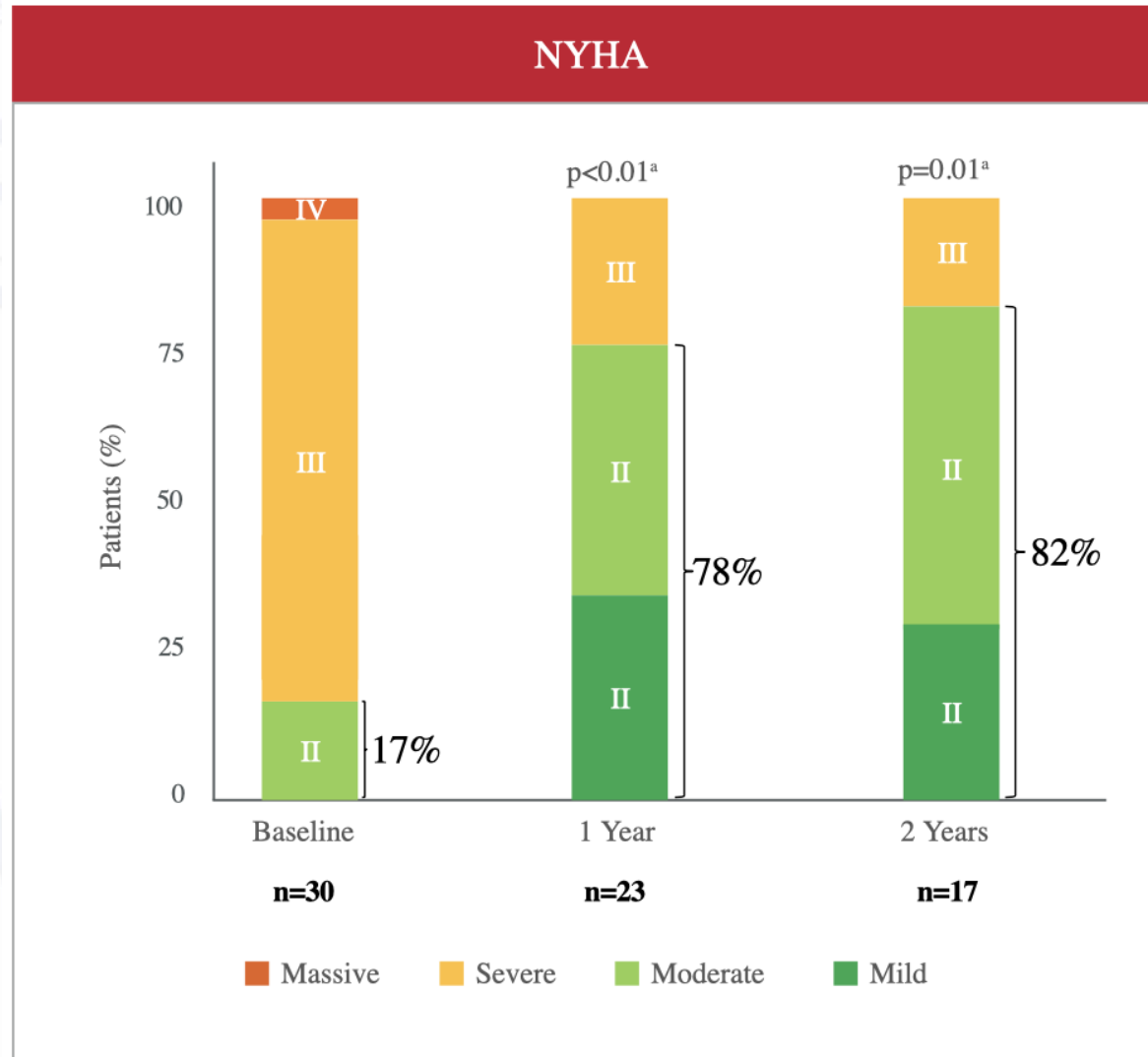
Pre-contraction



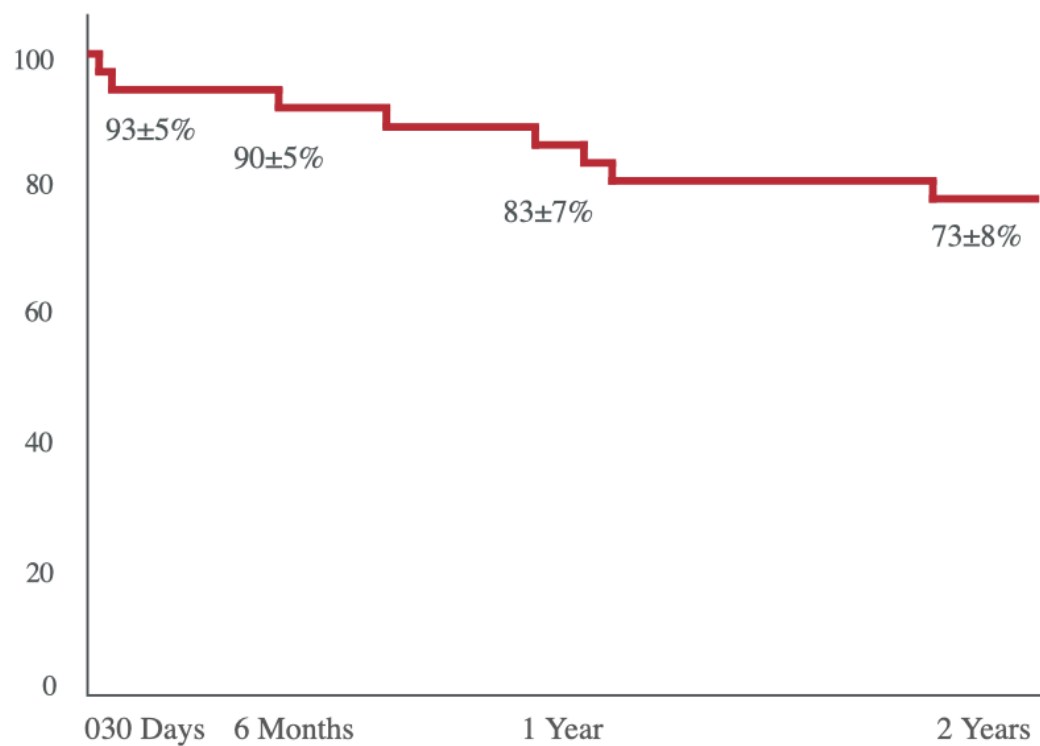
Post-contraction



Tricuspid valve repair with the Cardioband system: two-year outcomes of the multicentre, prospective TRI-REPAIR study



Survival

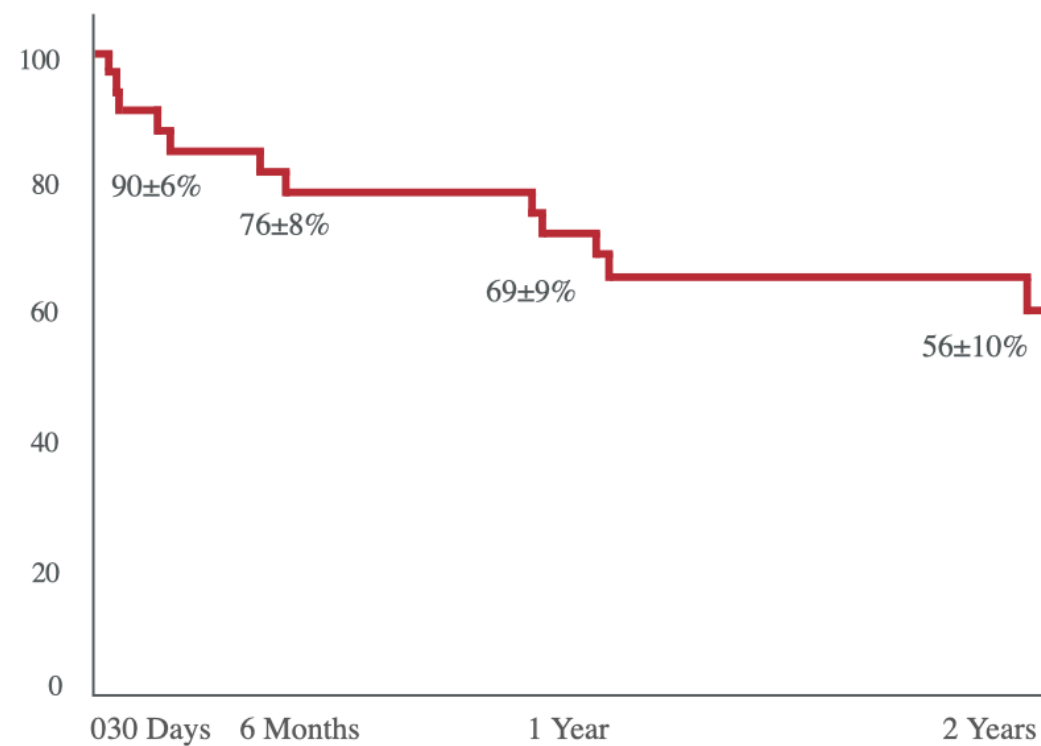


Time from Implant

Patients at risk

Time from Implant	030 Days	6 Months	1 Year	2 Years
Patients at risk	30	28	27	25
				10

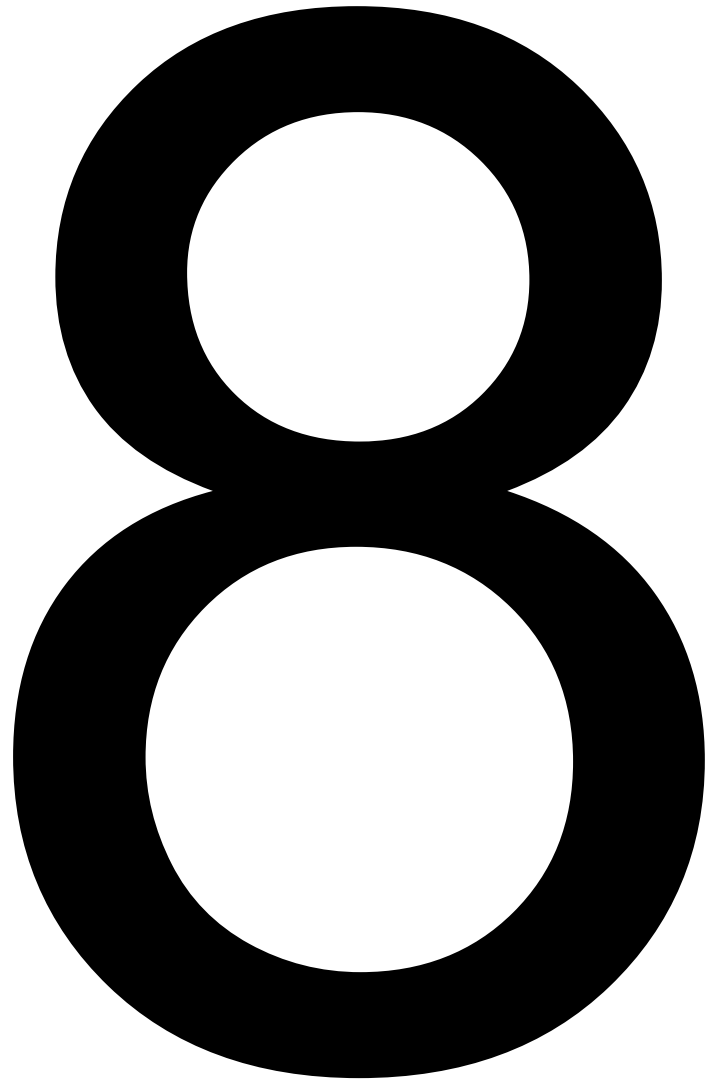
Freedom from HF hospitalization



Time from Implant

Patients at risk

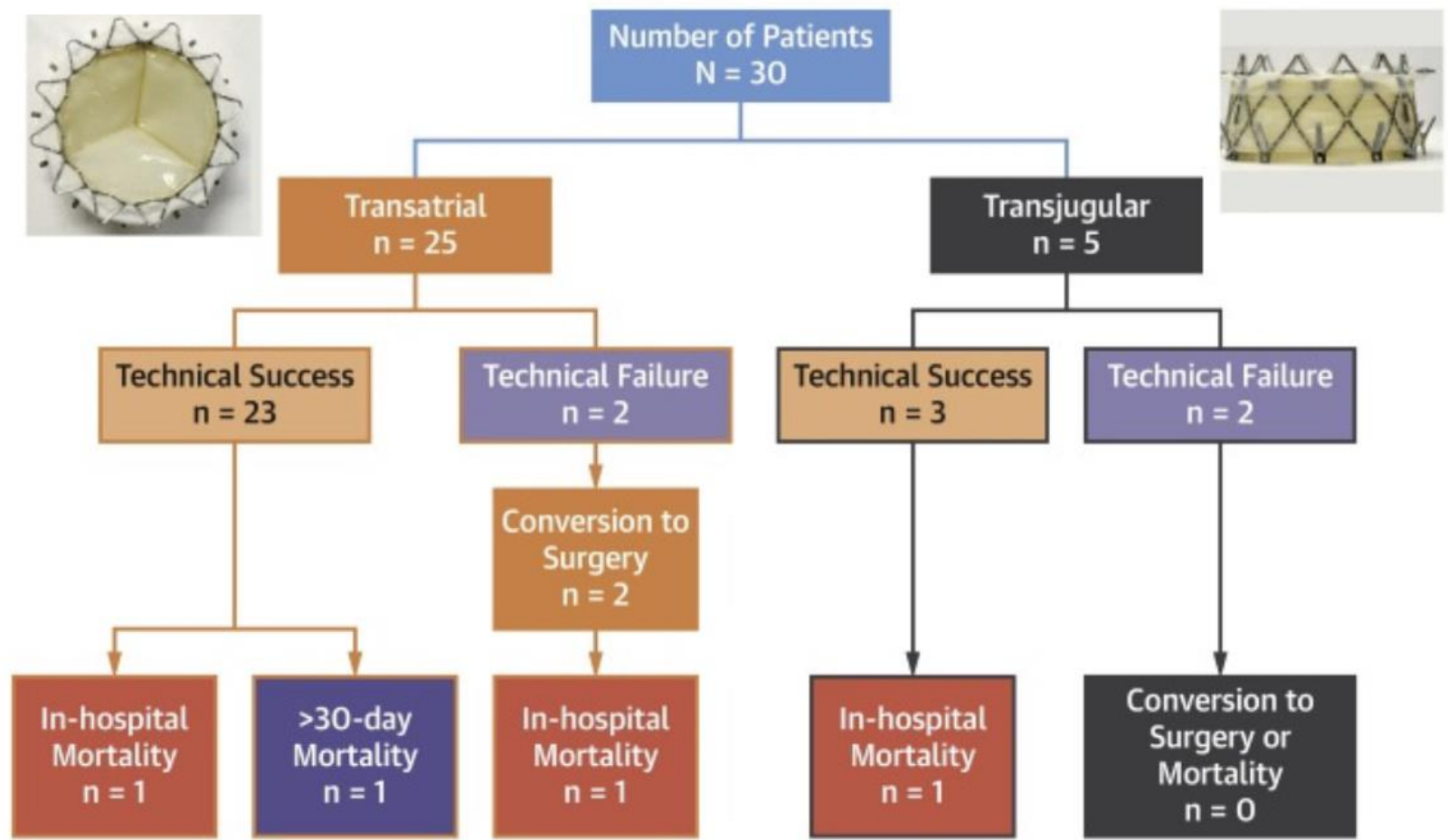
Time from Implant	030 Days	6 Months	1 Year	2 Years
Patients at risk	30	27	22	20
				8



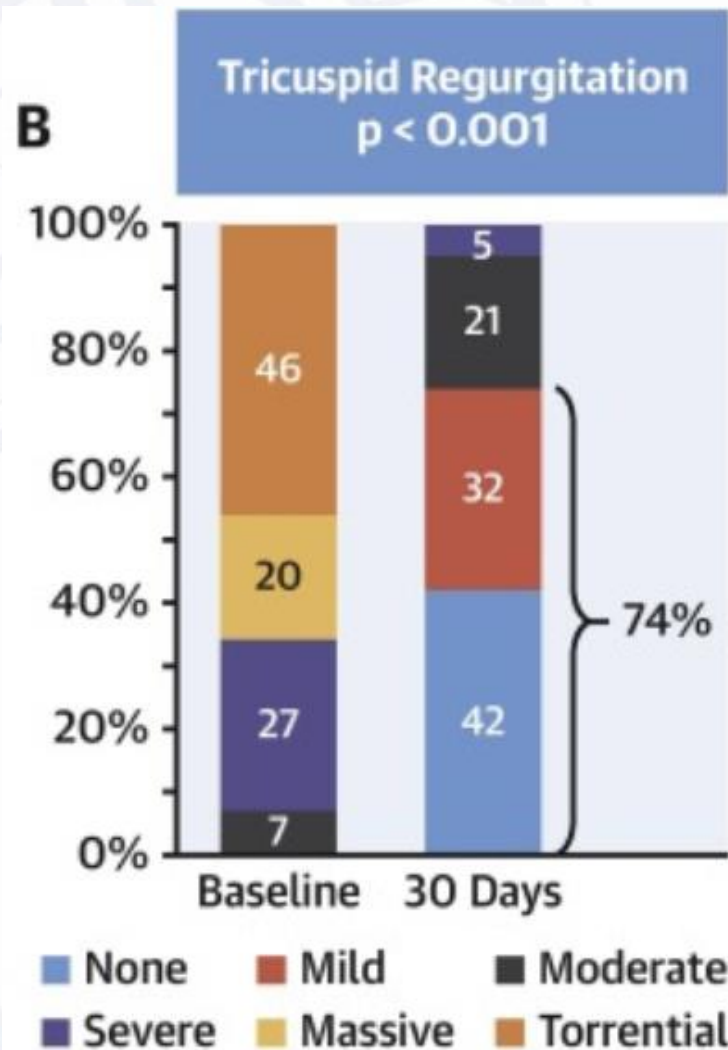
**Reemplazo
tricuspídeo
transcatéter**

Early Multinational Experience of Transcatheter Tricuspid Valve Replacement for Treating Severe Tricuspid Regurgitation

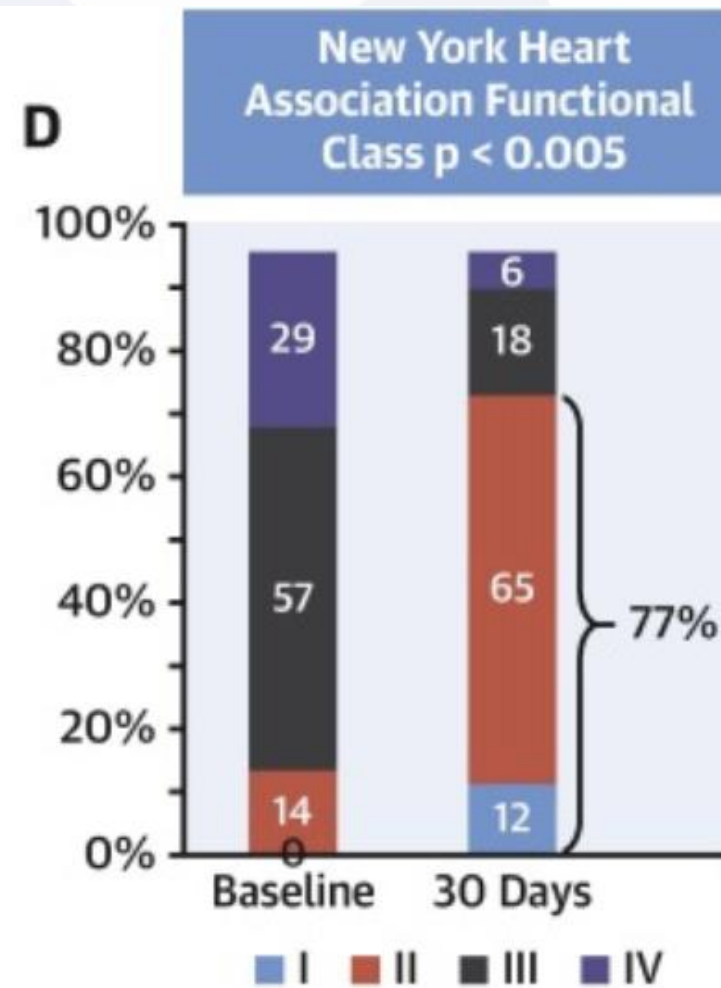
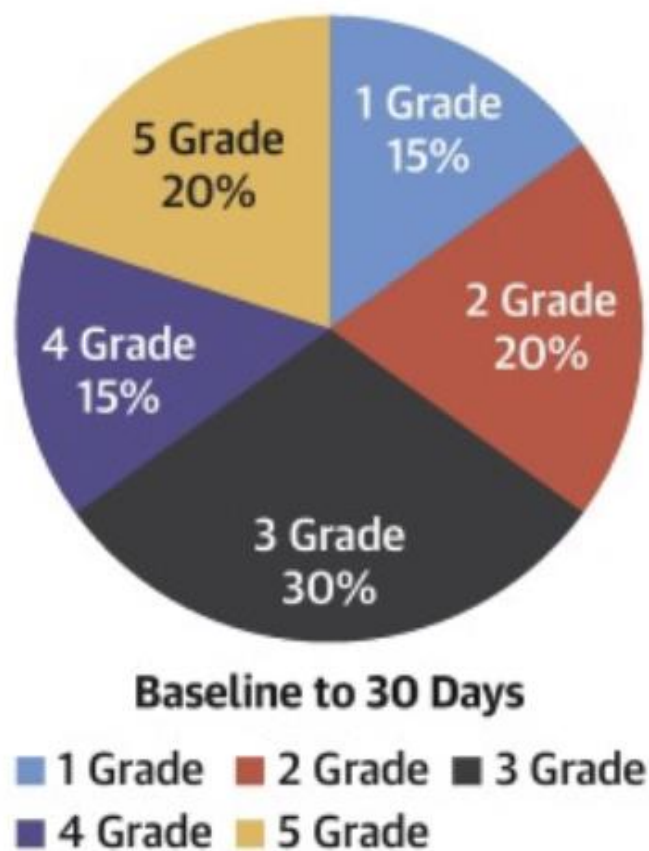
Rebecca T. Hahn MD ^a, Susheel Kodali MD ^a, Neil Fam MD ^b, Vinayak Bapat MBBS, MS, MCh ^a, Krzysztof Bartus MD, PhD ^c, Josep Rodés-Cabau MD, PhD ^d, Francois Dagenais MD ^d, Rodrigo Estevez-Loureiro MD ^e, Alberto Forteza MD ^e, Samir Kapadia MD ^f, Azeem Latib MD ^g, Francesco Maisano MD, PhD ^h, Patrick McCarthy MD ⁱ, Jose Navia MD ^f, Geraldine Ong MD ^b, Mark Peterson MD ^b, George Petrossian MD ^j, Alberto Pozzoli MD, PhD ^h, ... Andrea Colli MD, PhD ^o



***Technical Success:** Implantation of the Navigate device in intended position with successful removal of deliver catheter



C Tricuspid Regurgitation Reduction

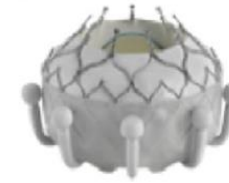


Transfemoral Transcatheter Tricuspid Valve Replacement With the EVOQUE System

A Multicenter, Observational, First-in-Human Experience

FIGURE 1 EVOQUE Transcatheter Tricuspid Valve Replacement System

A

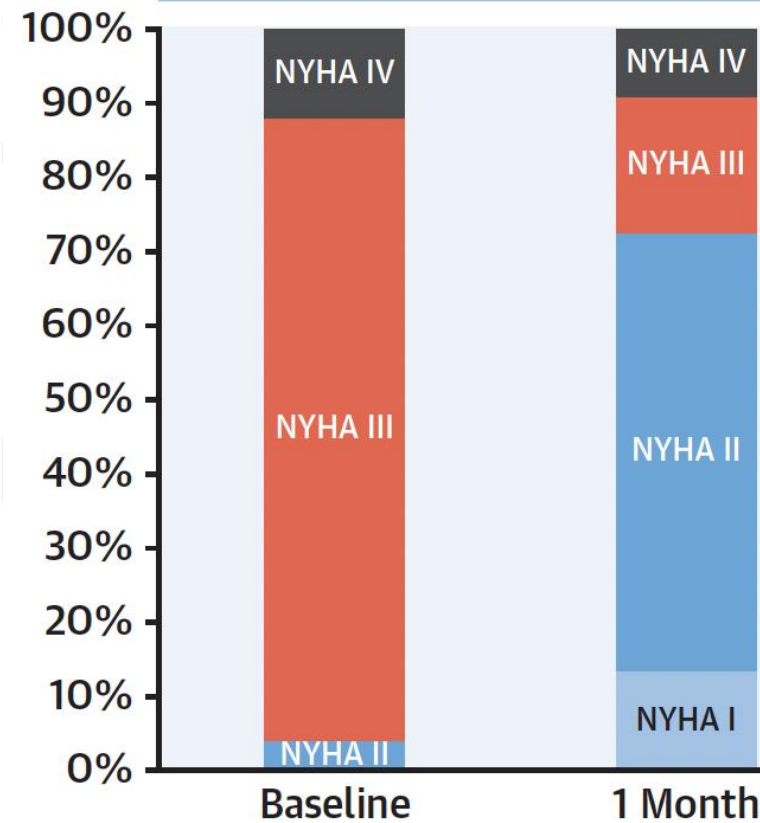


B



A

NYHA Functional Class



B

Tricuspid Regurgitation

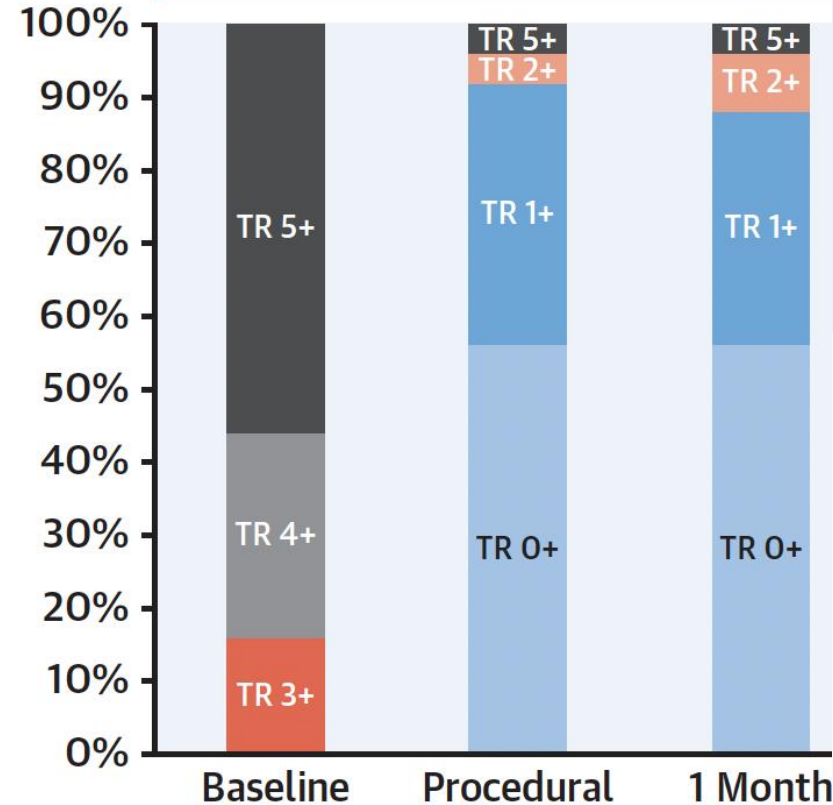


TABLE 3 Procedural Outcomes (n = 25)

Technical success	23 (92)
Mortality	0 (0)
Myocardial infarction	0 (0)
Stroke	0 (0)
Device embolization	0 (0)
Major bleeding	0 (0)
Conversion to surgery	0 (0)
Reintervention	1 (4)
Tricuspid regurgitation ≤1+	23 (92)
Procedure time (min)	140 ± 79

Values are n (%) or mean ± SD.

9

Valve in valve

Valve in ring

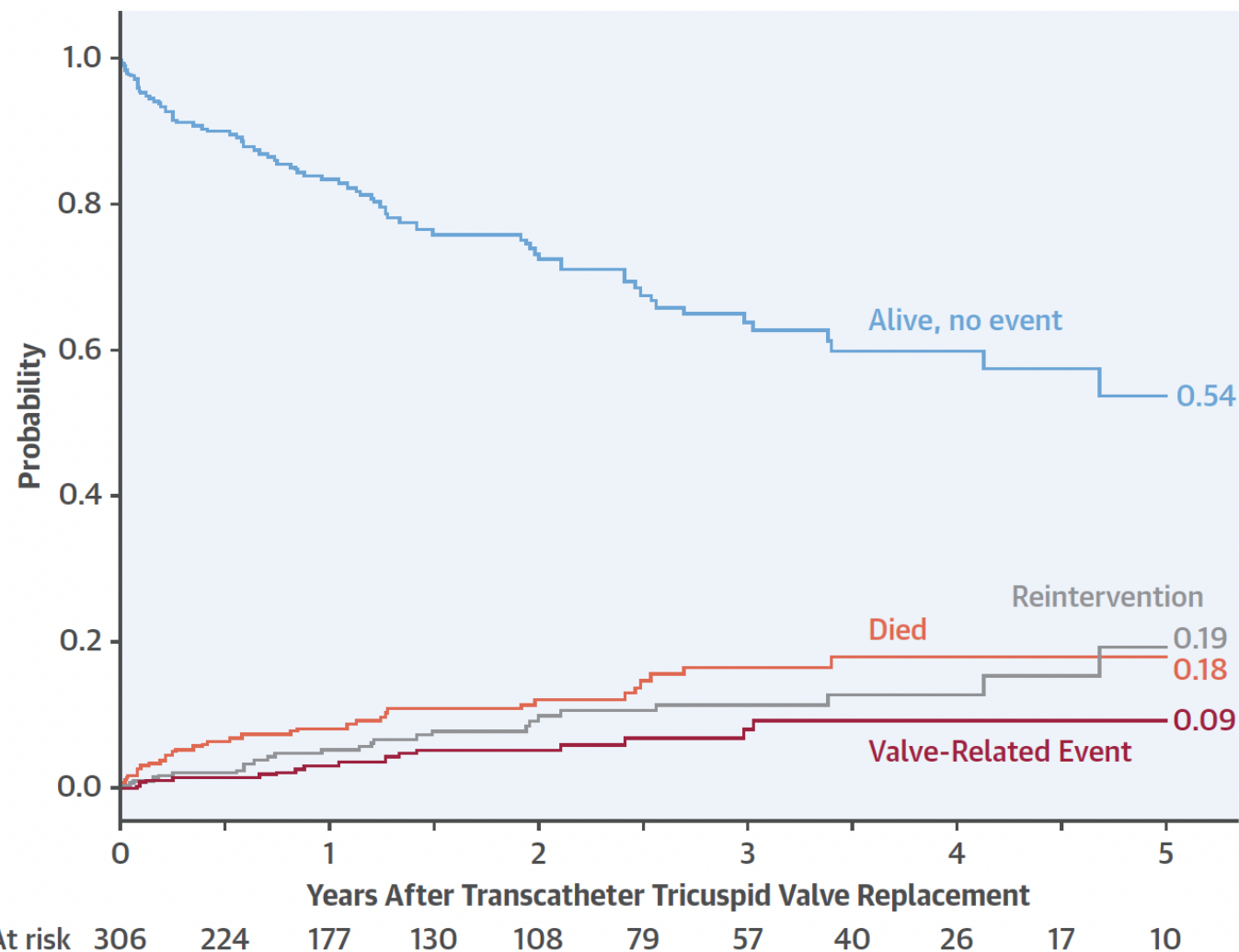
306 ptes

Mid-Term Valve-Related Outcomes After Transcatheter Tricuspid Valve-in-Valve or Valve-in-Ring Replacement

TABLE 1 Demographic and Diagnostic Data (N = 306)

Patient age, yrs	40 (1-86)
Etiology of original TV disease (before TV surgery)	
Congenital	181 (59)
Ebstein anomaly	100 (33)
Other CHD, abnormal TV, or secondary TR	62 (20)
TV injury related to CHD surgery or catheter intervention	15 (5)
Other	4 (1)
Acquired	125 (41)
Endocarditis	36 (12)
Associated with intravenous drug use	10 (3)
Rheumatic heart disease	39 (13)
TV injury related to biopsy, trauma, PM lead, or other	20 (7)
Functional TR with left heart disease	16 (5)
Other	14 (4)
Number of prior cardiac surgeries	2 (1-10)
Prior TV surgery type	
Replacement	284 (93)
Repair with annuloplasty ring	22 (7)
Age of current TV bioprosthesis or repair, yrs	8 (0.1-40)
Other prosthetic valves, aortic, mitral, pulmonary	107 (35)

CENTRAL ILLUSTRATION Competing Outcomes Over Time After Transcatheter Tricuspid Valve Replacement

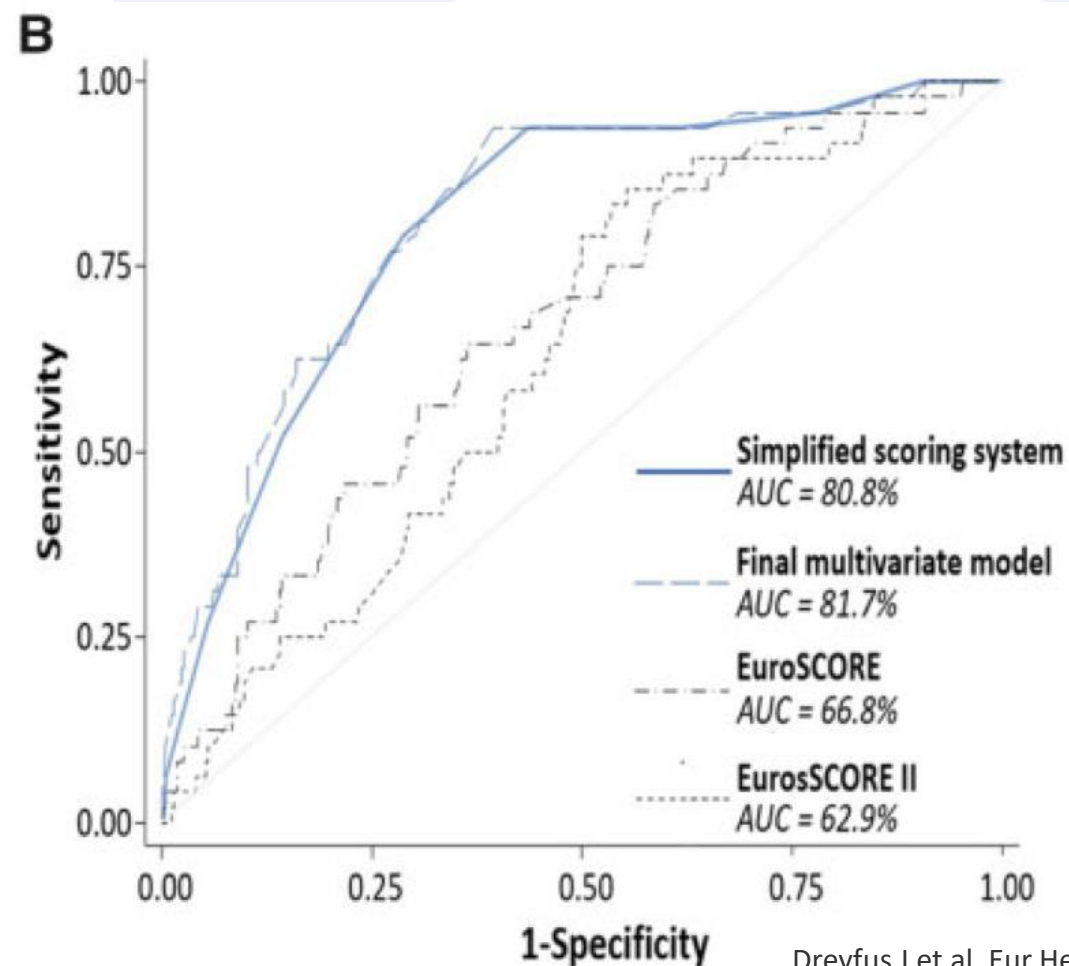
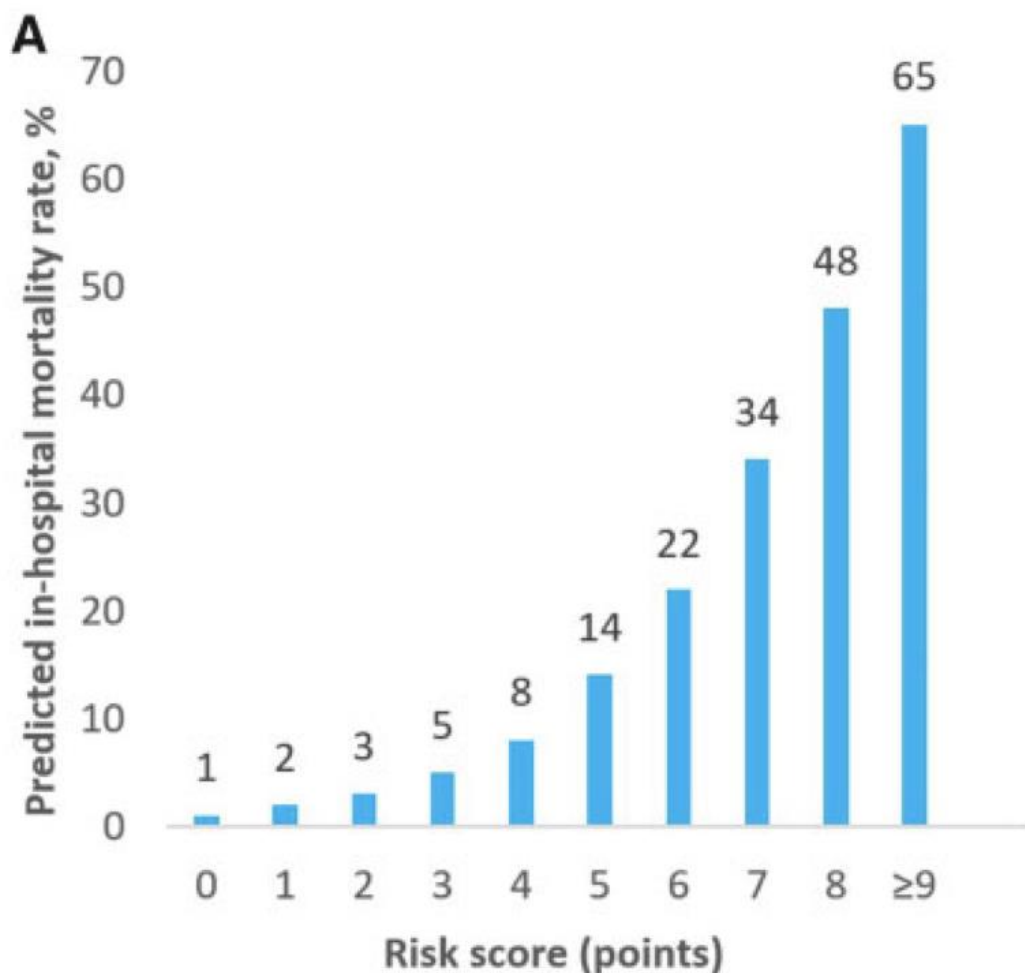


10

Entonces
qué...



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



What is TRI-SCORE ^{ref 1,2} ?



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Parameters

- ☒ Age $\geq$ 70 years
- ☒ NYHA functional class III or IV
- ☒ Right-sided heart failure signs ⁽¹⁾
- ☒ Daily dose of furosemide $\geq$ 125 mg
- ☐ eGFR $<$ 30 mL/min ⁽²⁾
- ☐ Elevated total bilirubin ⁽³⁾
- ☒ Left ventricular ejection fraction $<$ 60 % ⁽⁴⁾
- ☐ Moderate/severe right ventricular dysfunction ⁽⁵⁾

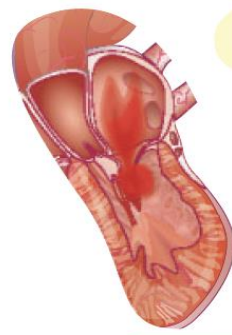
Prediction

TRI-SCORE

7/12

Predicted in-hospital mortality

34 %



Isolated Tricuspid Regurgitation

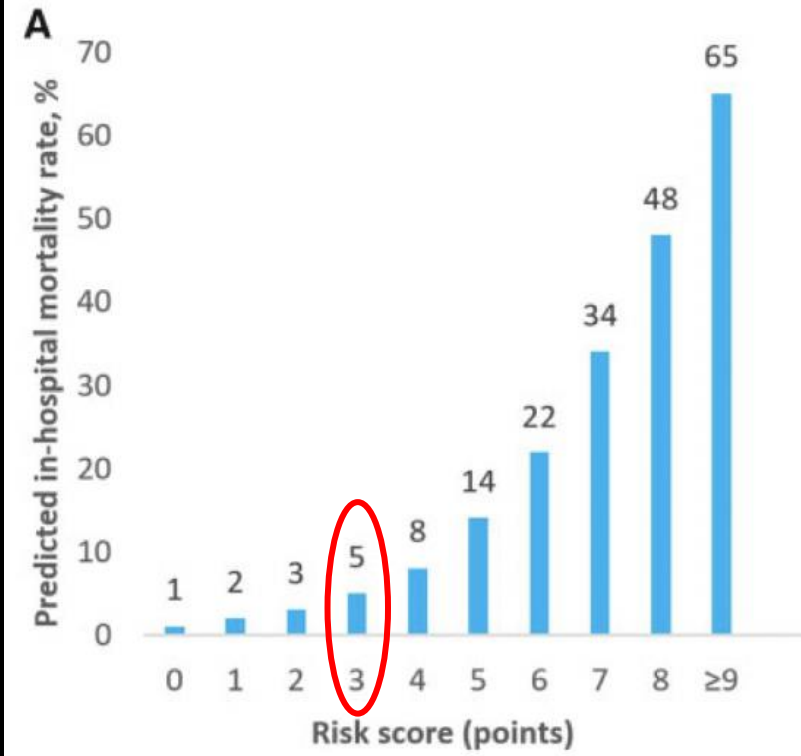
Heart Team Evaluation

Severe

Evaluate surgical
TRI-SCORE

Mild / Moderate

MEDICAL THERAPY



EDITORIAL COMMENT

The Tricuspid Valve

No Longer Forgotten But Still Not Well Understood*

Stephanie L. Mick, MD



*“ Es tan corto el amor
y tan largo el olvido...”*

Pablo Neruda