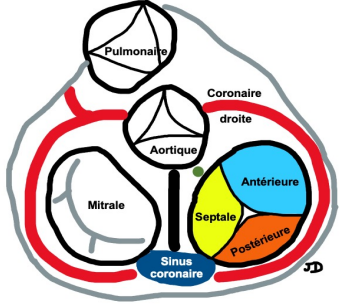
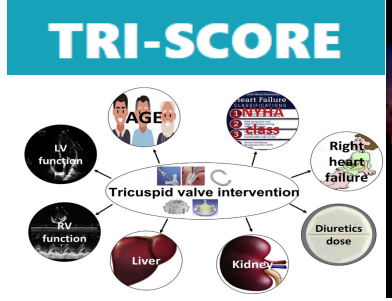
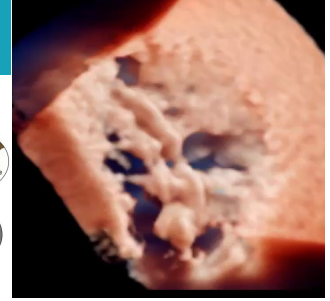







2025

Valvular Heart Disease

Guidelines for the management of valvular heart disease

Nice, 13 septembre 2025

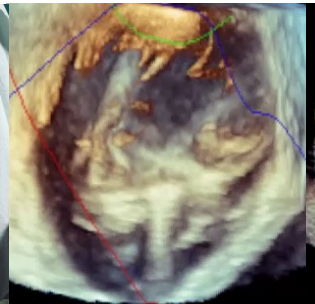
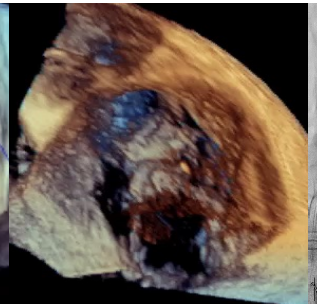
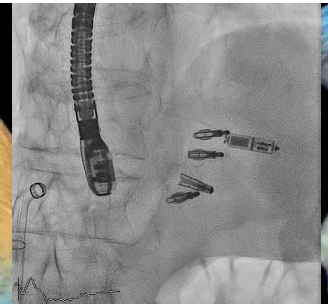
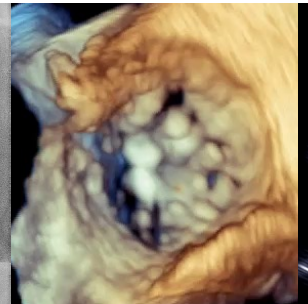
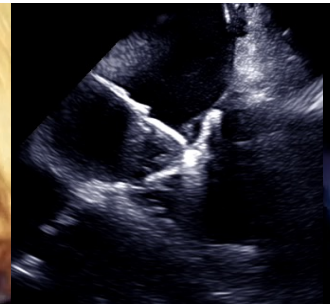
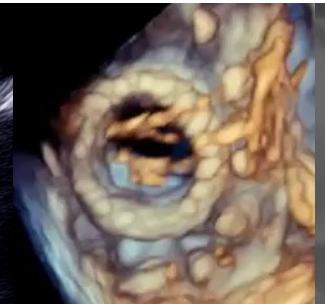
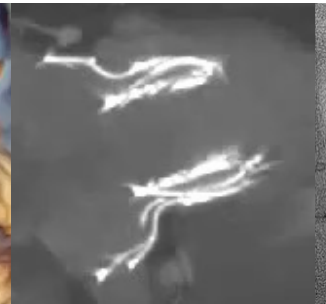
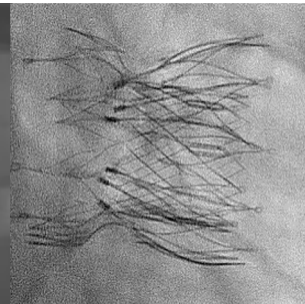
La Tricuspide en 2025

ESC European Society of Cardiology

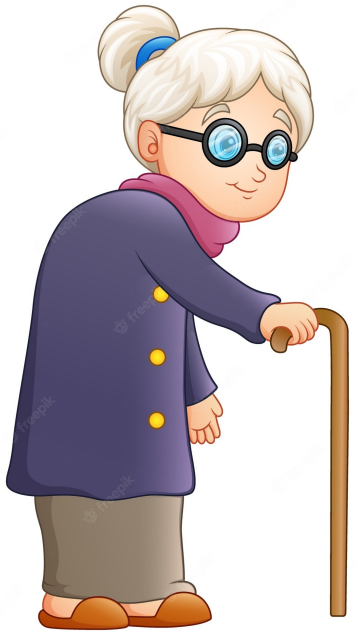
EACTS European Association For Cardio-Thoracic Surgery

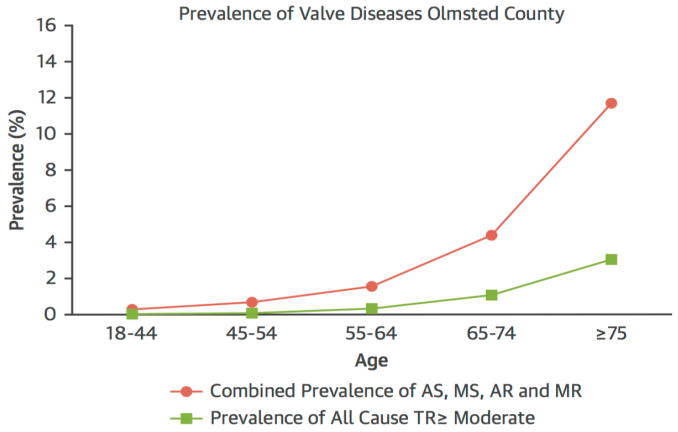
Julien DREYFUS, MD, PhD, FESC

Centre Cardiologique du Nord, Saint-Denis, FRANCE

Prevalence of Tricuspid Regurgitation (TR)





	75+ (n = 408)
Female	4.40 (3.89-4.96)
Male	3.16 (2.58-3.84)
Overall	3.96 (3.56-4.39)

Topilsky Y et al. JACC CVI 2019

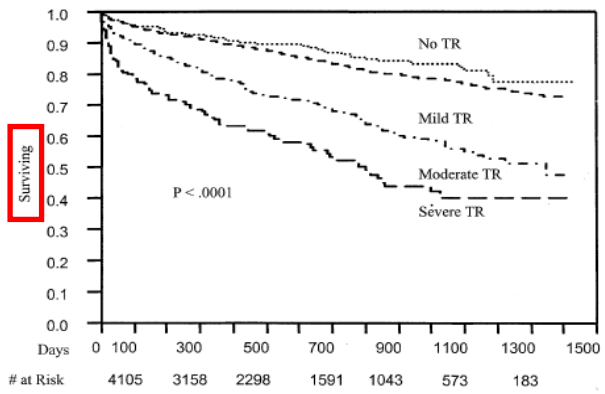
TABLE 2. Estimated structural heart disease opportunity: United States

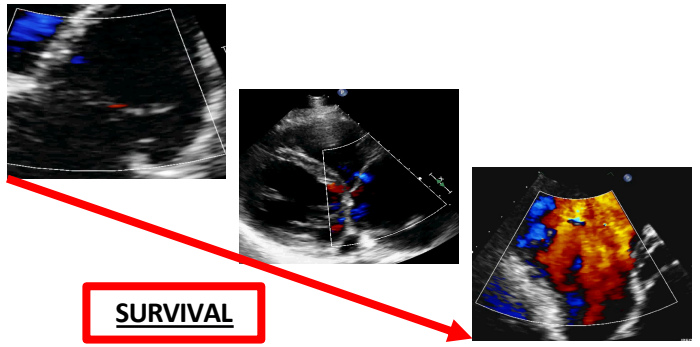
	Patient population
Mitral regurgitation	
Moderate to severe	2,300,000[2,3]
Severe	220,000[2,3]
Aortic stenosis	
All grades	749,000[2,4]
Severe	125,000†[2,4,5]
Tricuspid regurgitation	
Moderate to severe	1,600,000‡[2,3]

Stuge O et al. JTCVS 2006

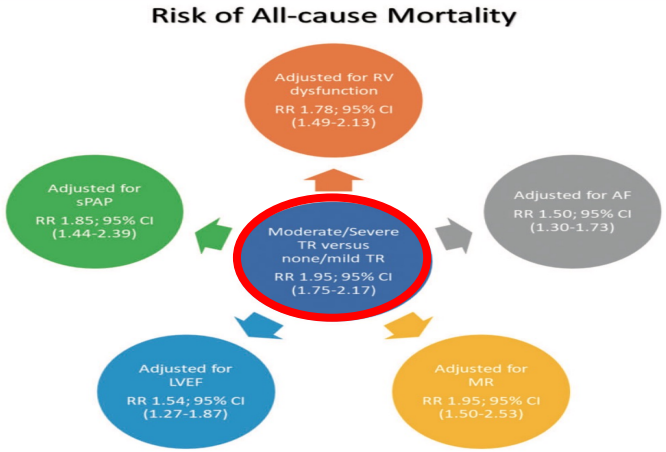
Prognosis of TR

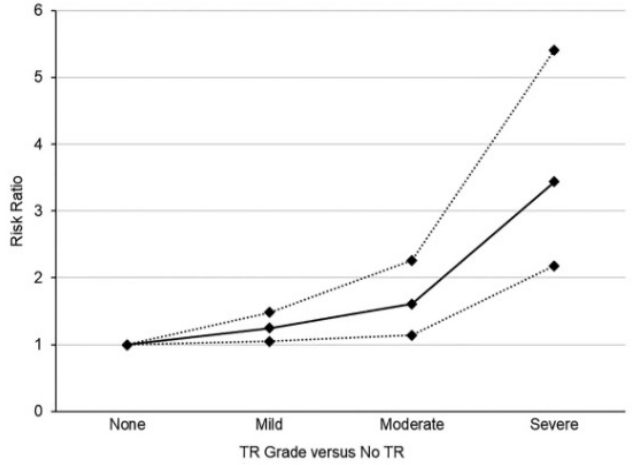
- **TR is an independent prognosis factor associated with significant mortality that increases with TR grade**



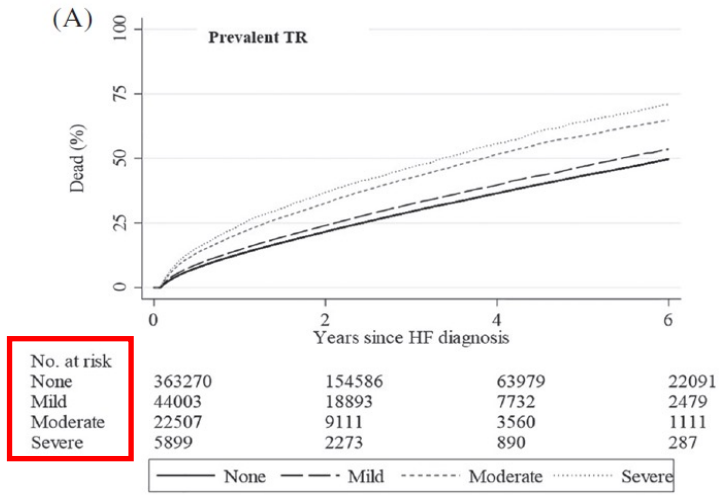


Nath J et al. JACC 2004



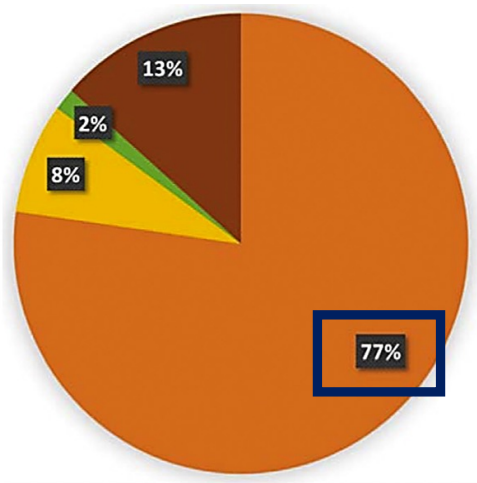


Wang N et al. EHJ 2018



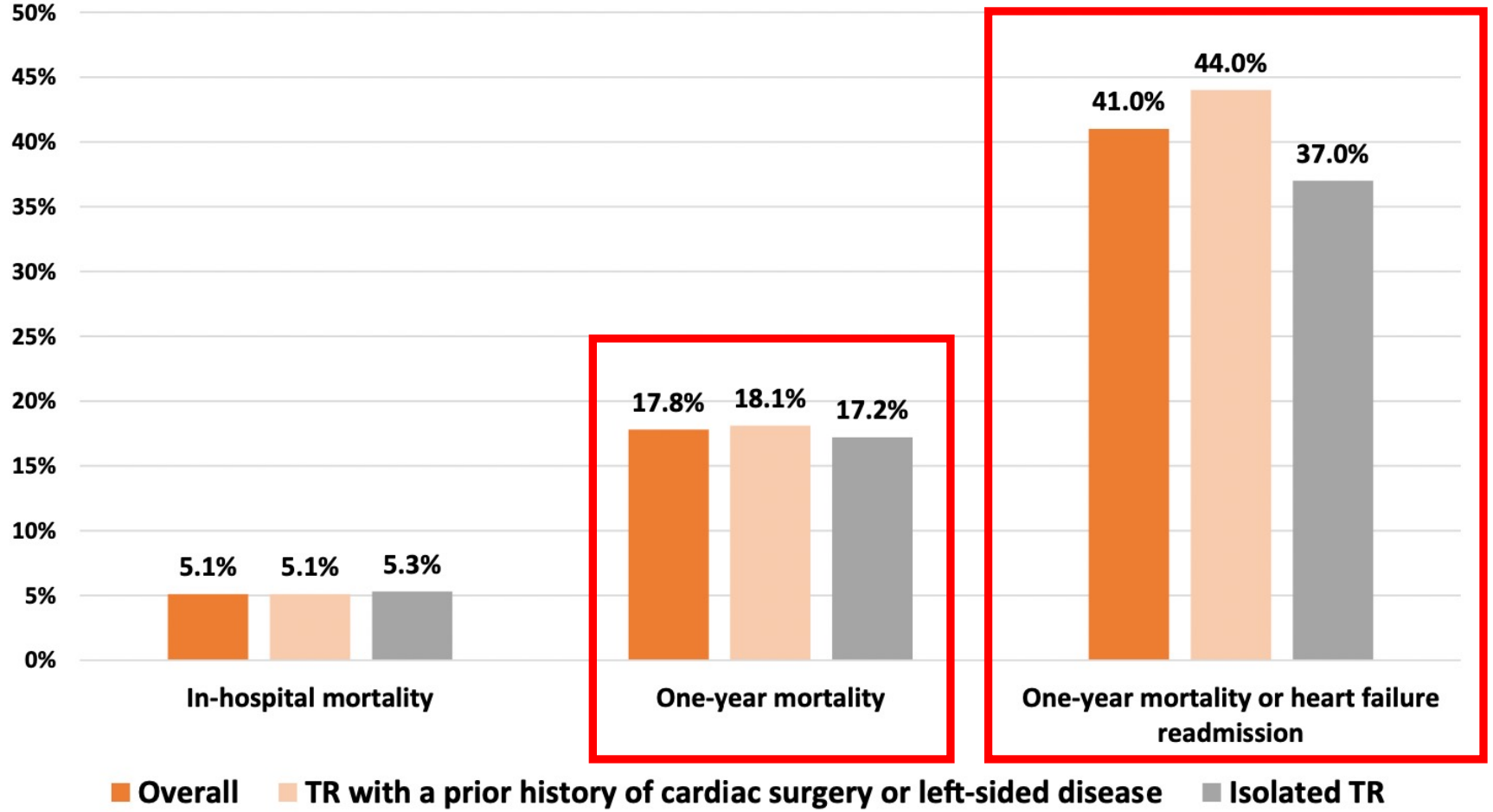
Messika-Zeitoun D et al. EJHF 2020

Prognosis of TR



- Conservative management
- Combined TV surgery
- Isolated TV surgery
- Non-tricuspid cardiac intervention

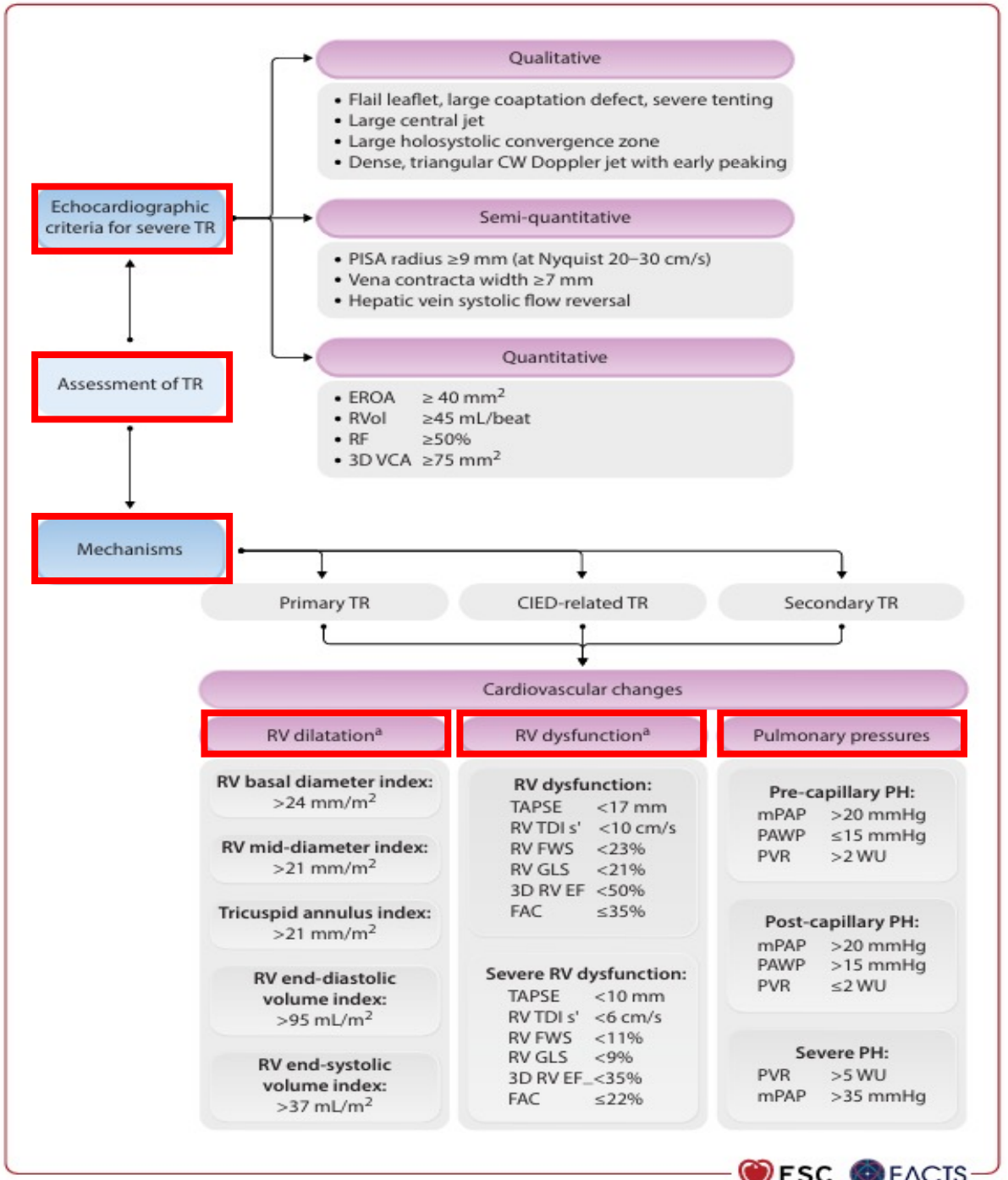
N=13 654



Messika-Zeitoun D et al. Can J Cardiol 2020

Management of patients with TR

Recommendations	Class[a]	Level[b]
Careful evaluation of TR aetiology, stage of the disease (i.e. degree of TR severity, RV and LV dysfunction, and PH), patient operative risk, and likelihood of recovery by a multidisciplinary Heart Team is recommended in patients with severe TR prior to intervention.[691,742]	I	C



Praz F et al. EHJ 2025

Management of patients with tricuspid regurgitation (TR)

New

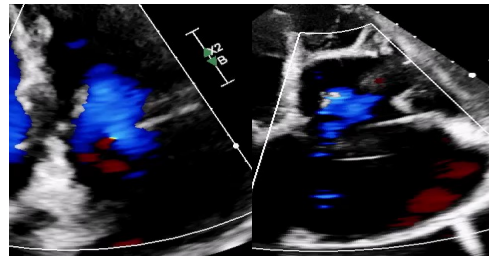
Recommendations	Class	Level
Careful evaluation of TR aetiology, stage of the disease (i.e. degree of TR severity, RV and LV dysfunction, and PH), patient operative risk, and likelihood of recovery by a multidisciplinary Heart Team is recommended in patients with severe TR prior to intervention.	I	C

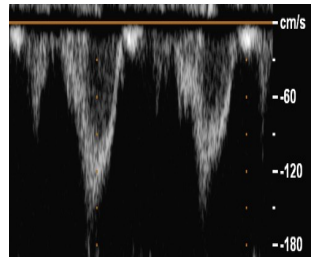
Assessment of TR

Echocardiographic criteria for severe TR

Qualitative

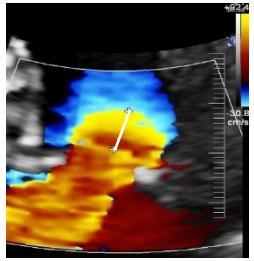
- Flail leaflet, large coaptation defect, severe tenting
- Large central jet
- Large holosystolic convergence zone
- Dense, triangular CW Doppler jet with early peaking

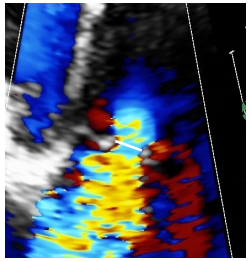


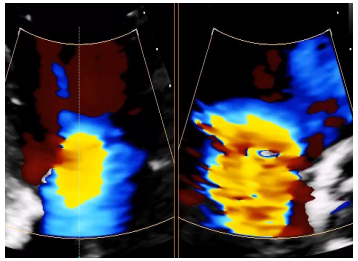


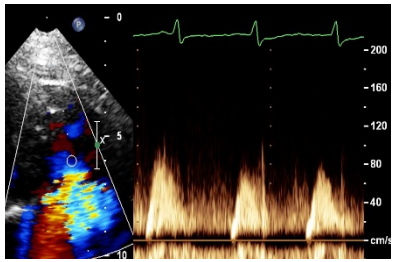
Semi-quantitative

- PISA radius ≥9 mm (at Nyquist 20–30 cm/s)
- Vena contracta width ≥7 mm
- Hepatic vein systolic flow reversal



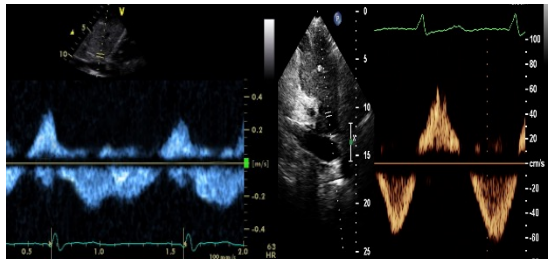


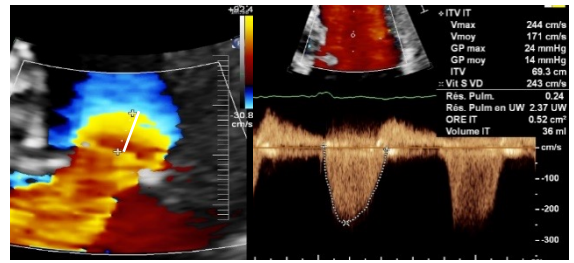




Quantitative

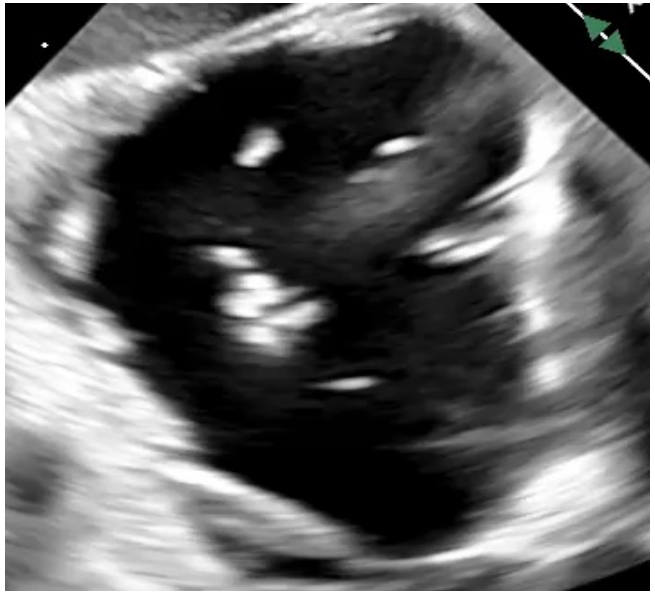
- EROA ≥ 40 mm^2
- RVol ≥45 mL/beat
- RF ≥50%
- 3D VCA ≥75 mm^2

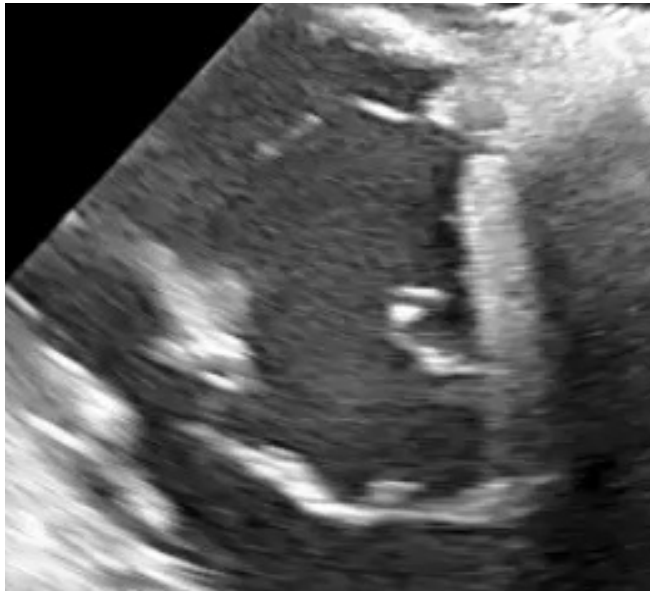


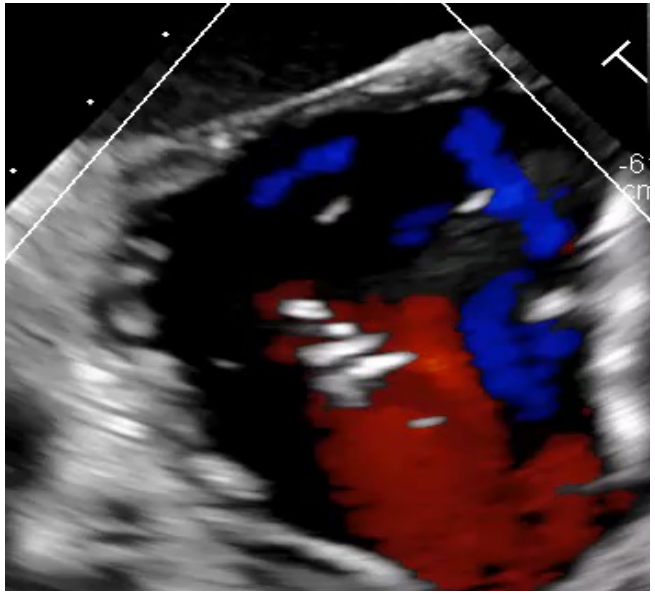


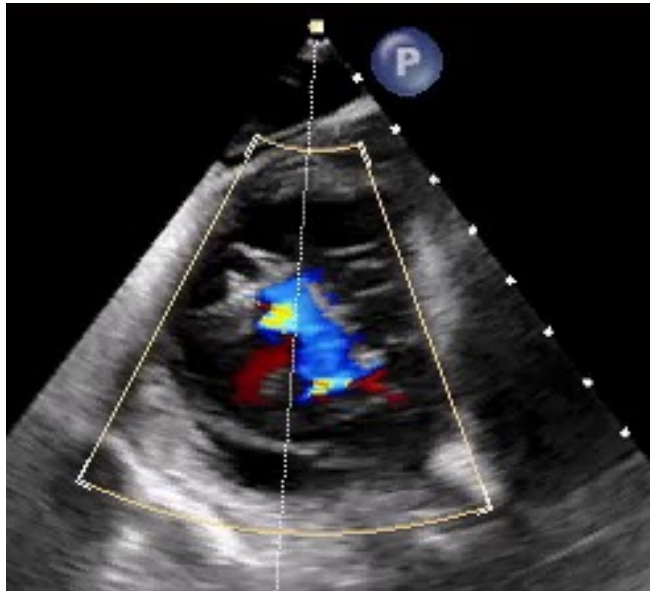
Praz F et al. EHJ 2025

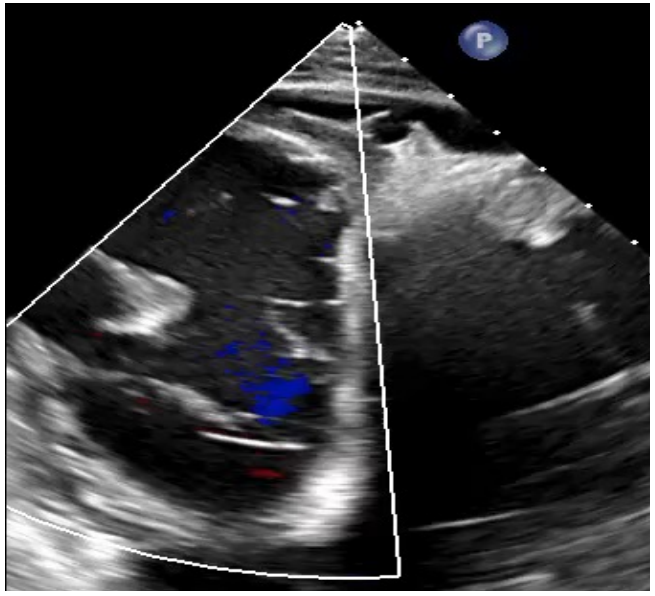
Echocardiographic assessment of TR grade



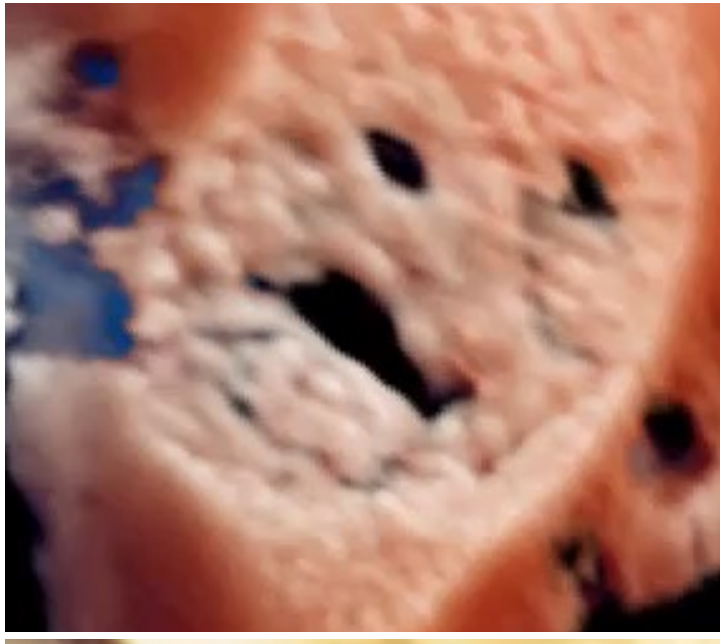


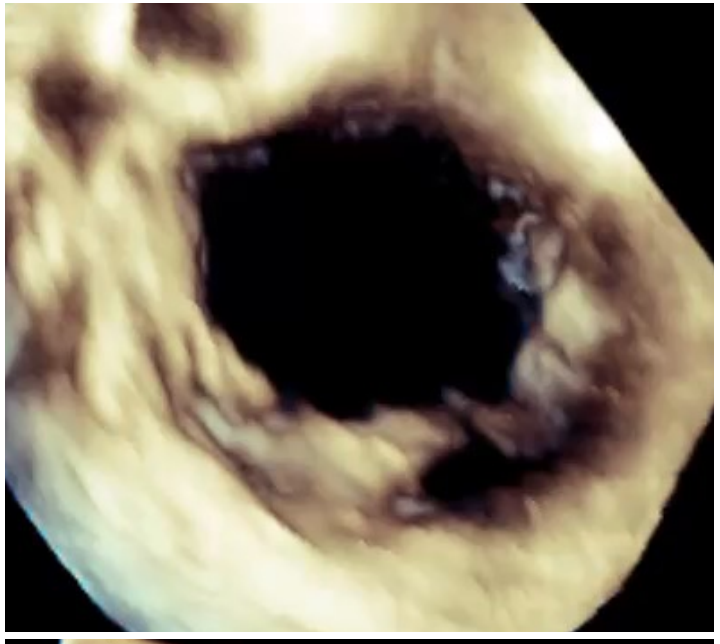




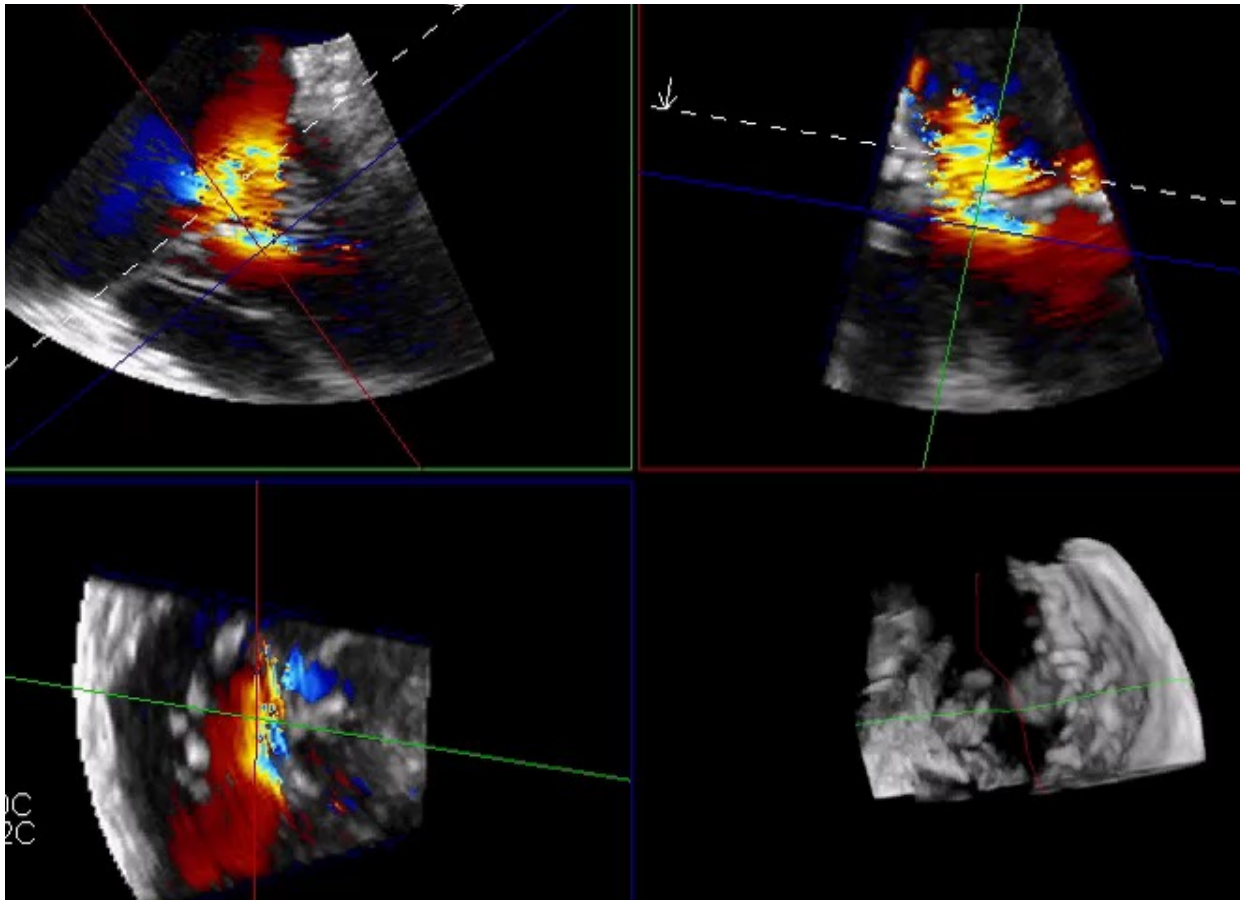


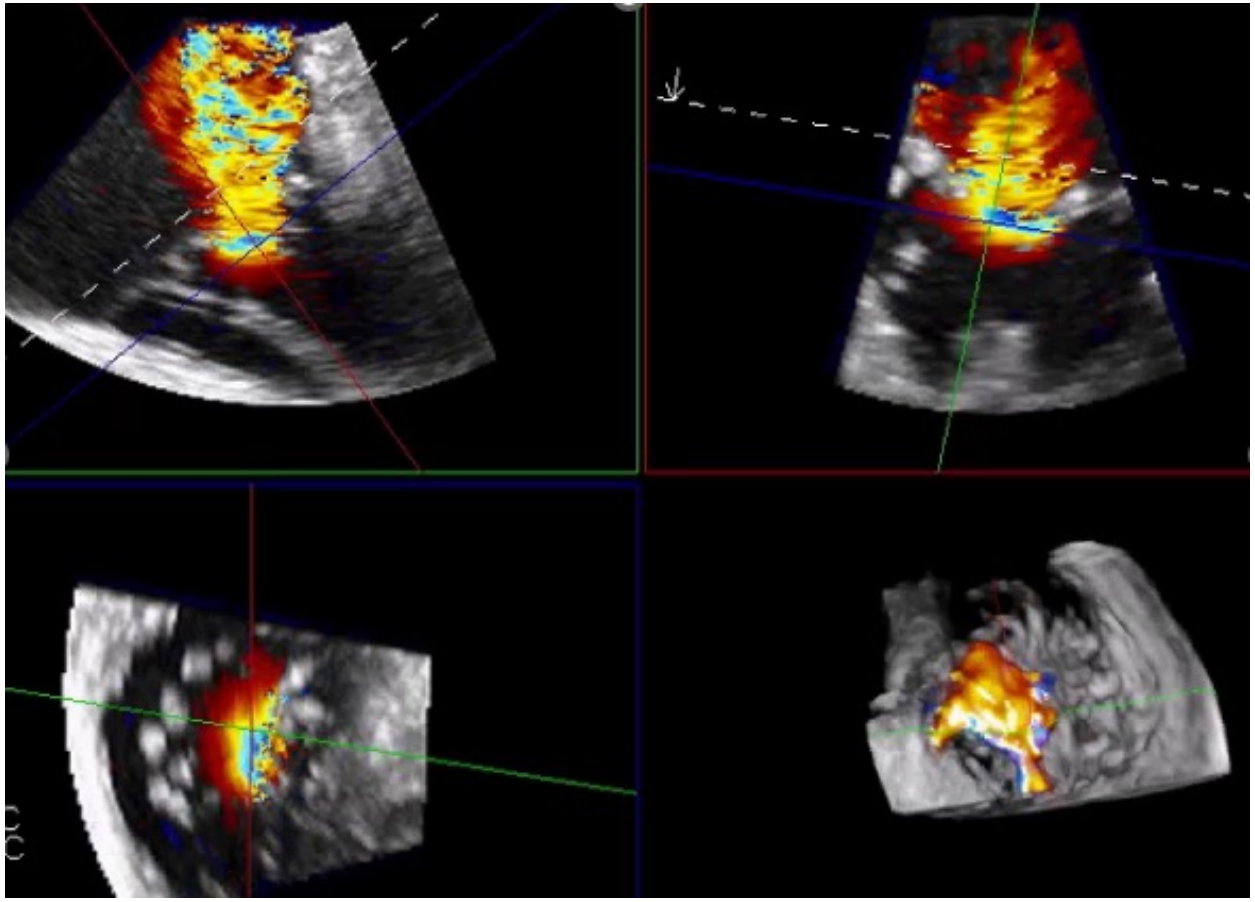
Echocardiographic assessment of TR grade






Echocardiographic assessment of TR grade

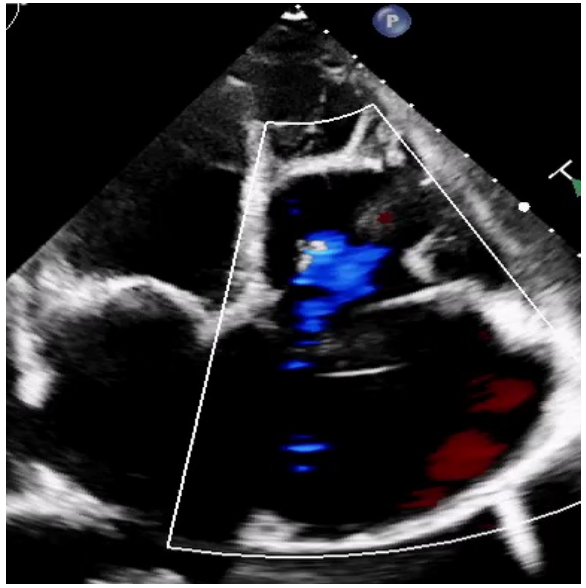


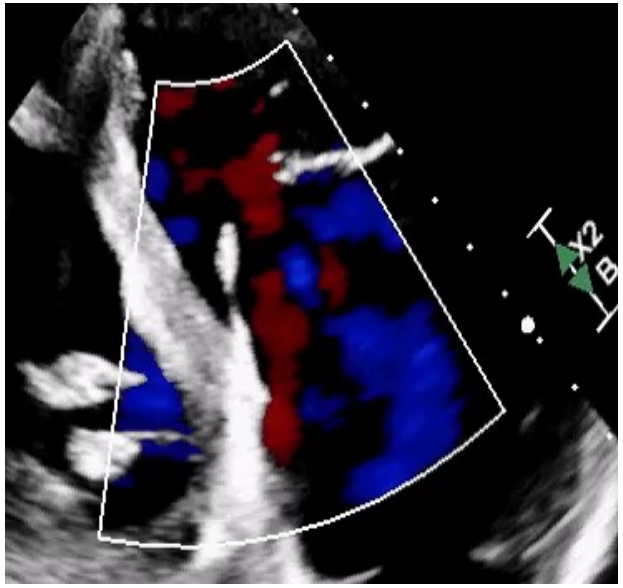


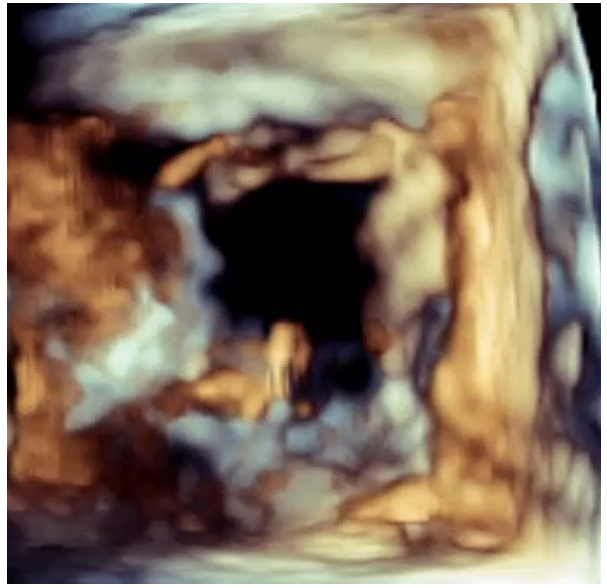
	Mild (1+)	Moderate (2+)	Severe (3+)	Massive (4+)	Torrential (5+)
3D VCA, mm^2	–	–	75-94.9	95-114.9	≥115

Hahn R et al. JACC 2023

Assessment of TR grade after diuretic treatment

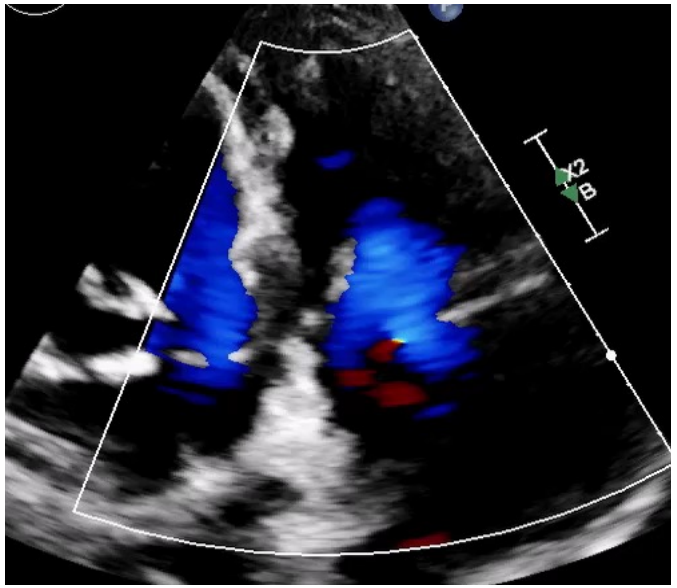






DIURETICS

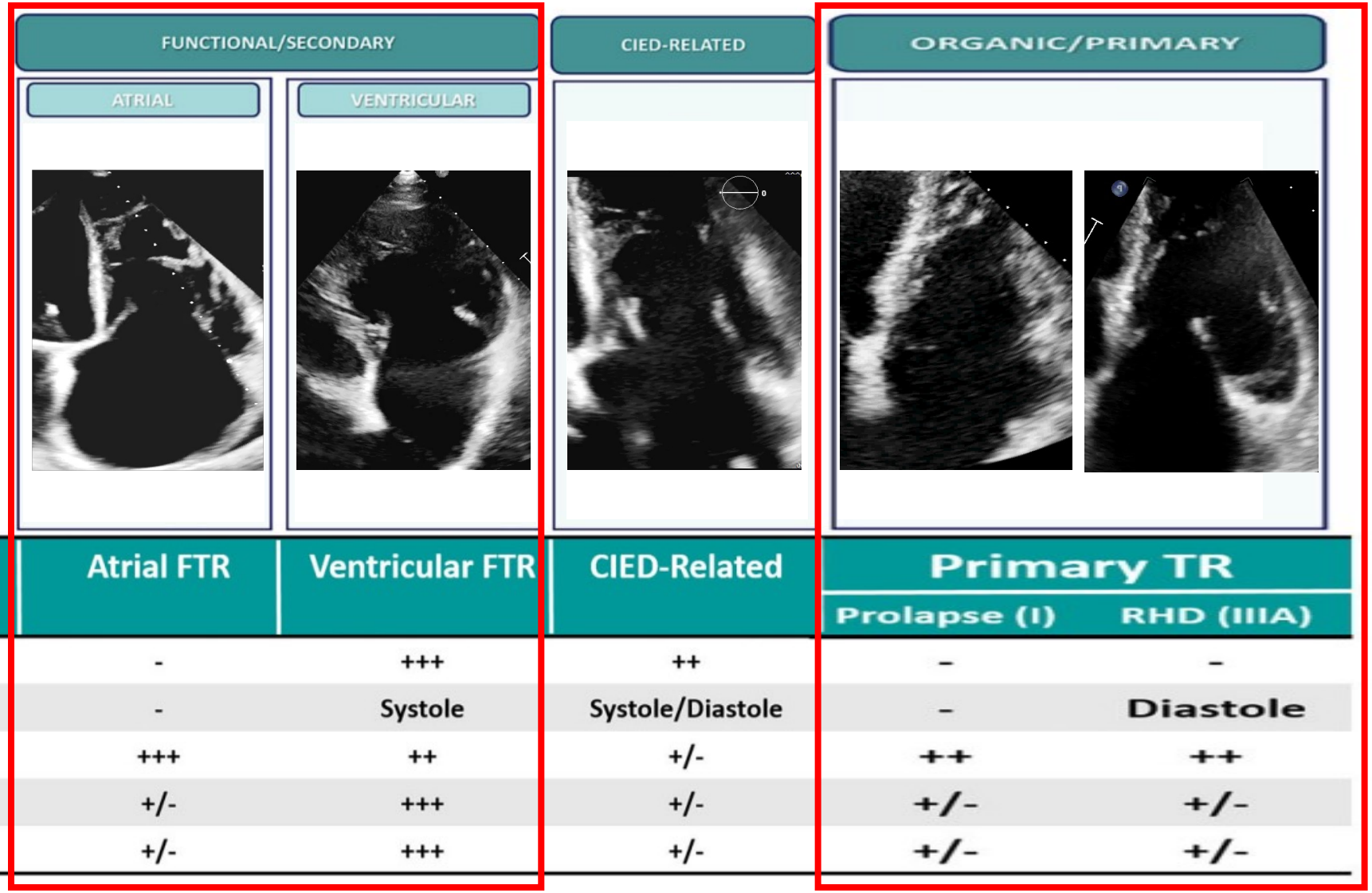
DIURETICS



TR mechanisms

Recommendations

Careful evaluation of TR aetiology, stage of the disease (i.e. degree of TR severity, RV and LV dysfunction, and PH), patient operative risk, and likelihood of recovery by a multidisciplinary Heart Team is recommended in patients with severe TR prior to intervention.[691,742]



Parameter	Atrial FTR	Ventricular FTR	CIED-Related	Primary TR	
				Prolapse (I)	RHD (IIIA)
Leaflet Tethering	-	+++	++	-	-
Leaflet Restriction	-	Systole	Systole/Diastole	-	Diastole
RA/TA Dilatation	+++	++	+/-	++	++
RV Dilatation	+/-	+++	+/-	+/-	+/-
RV Dysfunction	+/-	+++	+/-	+/-	+/-

Hahn R et al. Eur Heart J CVI 2022; Praz F et al. EHJ 2025

Atrial vs Ventricular TR

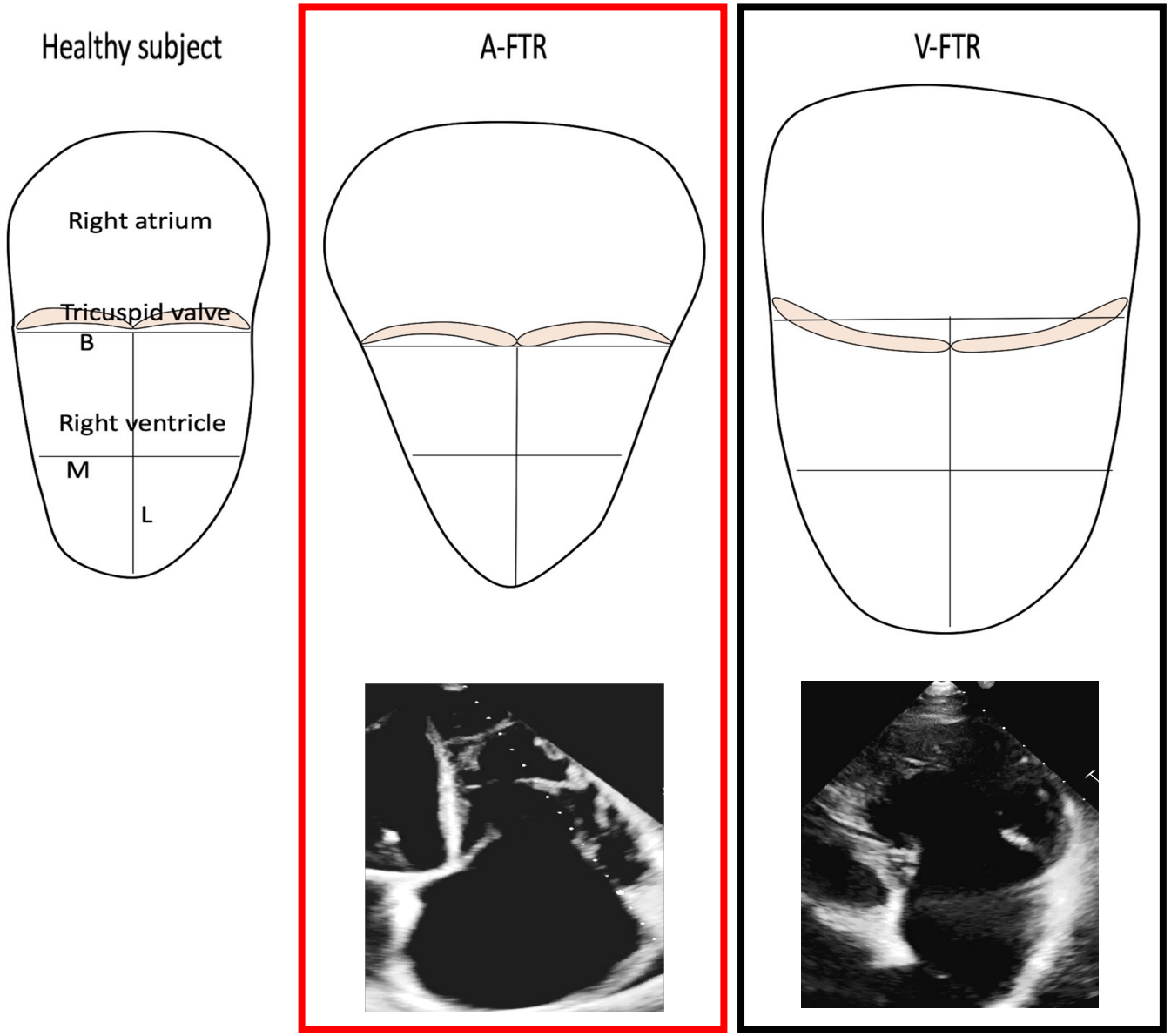


TABLE 3 Suggested Anatomic and Functional Parameters to Define Atrial and Ventricular Secondary Tricuspid Regurgitation[a]

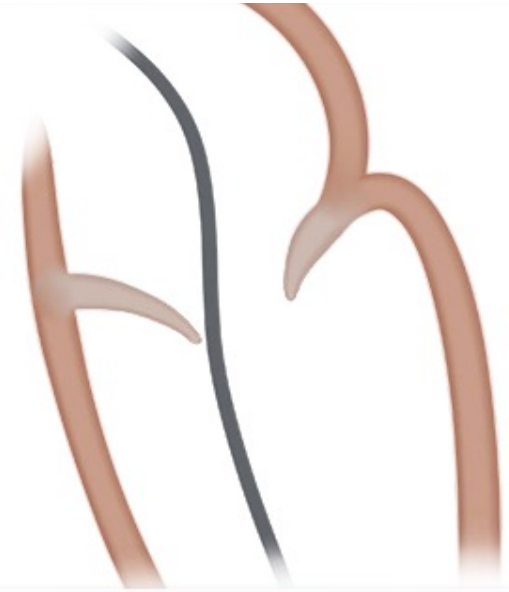
	A-STR Phenotype[b]	V-STR Phenotype[b]
Leaflet morphology[c]		
Tenting height (4Ch), mm	≤9	>9
Tenting area (4Ch), cm^2	<2.1	≥2.1
Tenting volume, mL	<2.5[d]	≥2.5
Right heart chamber size[c]		
RV midventricular diameter, mm	≤38[d]	>38
RV midventricular diameter index, mm/m^2	<21	≥21
RV end-diastolic volume index, mL/m^2	<80	≥80
RV end-systolic volume index, mL/m^2	<21	≥21
2D sphericity index[e]	<55	≥55
End-systolic RA to RV area ratio[e]	≥1.5	<1.5
Right ventricular systolic function[c]		
TAPSE, mm	>17	≤17
FAC, %	≥35	<35
RVFWS, %	≥20	<20
RV TDI S', cm/s	≥9	<9
3D RVEF, %	≥50	<50
LVEF	≥50[d]	Variable[f]
Invasive pulmonary vascular hemodynamics[c]		
PCWP, mm Hg	≤15	Variable[f]
mPAP, mm Hg	<20	Usually >20[f]
PVR, WU	<2.0	Variable[f]

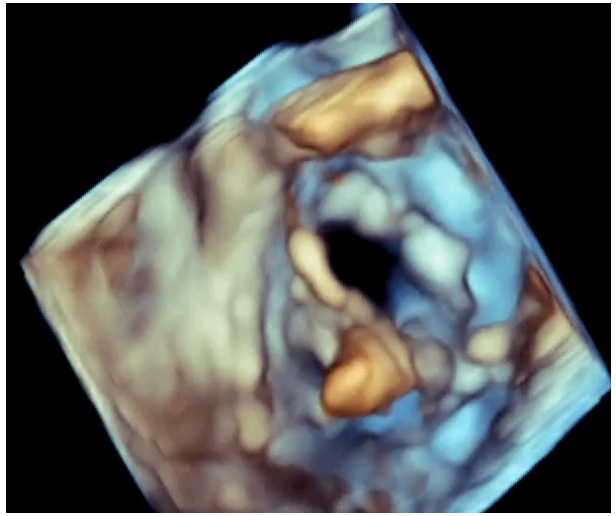
Florescu DR et al. EHJ CVI2023

Hahn R et al. JACC 2023

TR and CIED

Lead-associated TR





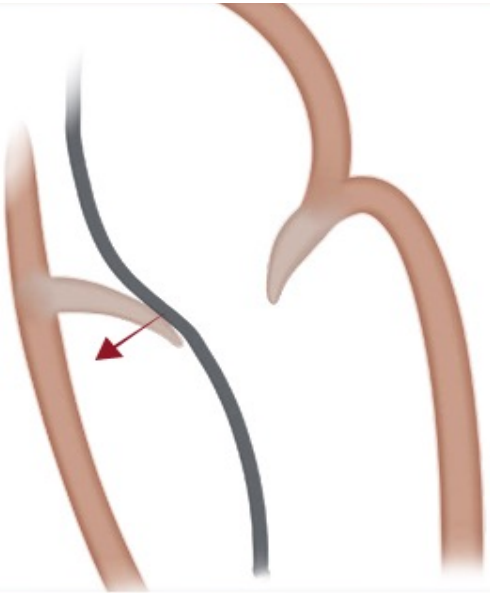
No clear causative relationship between CIED and TR

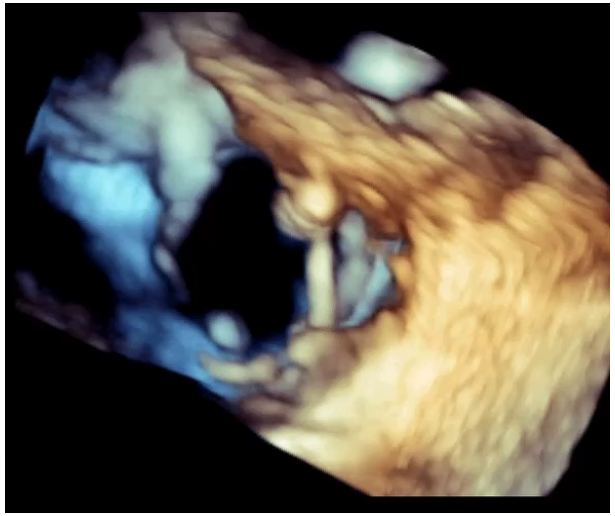
Prevalence of at least moderate TR after CIED implantation: **7–30%**

Evolution of TR dependent on the **usual risk factors**

Lead-related TR

= **Lead-induced TR**





Established causative relationship between CIED and TR

TR worsens by at least 1 grade in about **20%** of the patients after CIED implantation

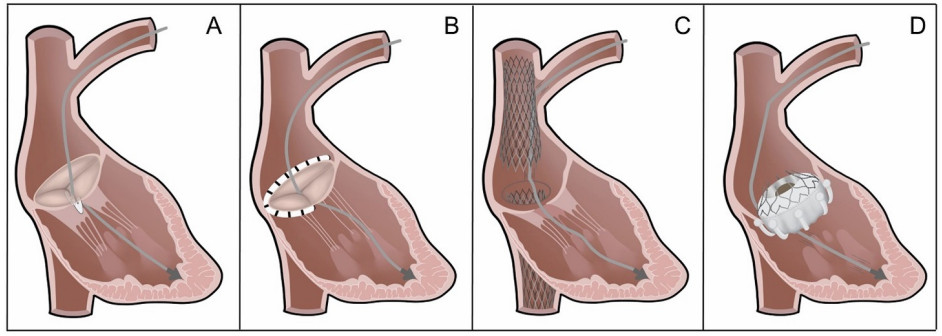
Leaflet impingement occurs in **14%**

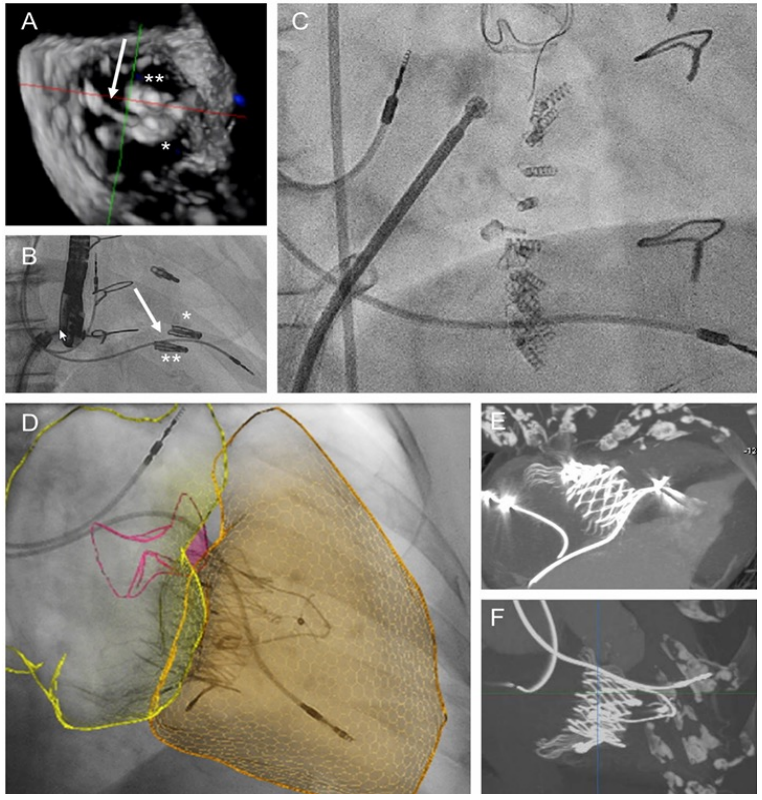
Severe lead-related TR in **4–7%**

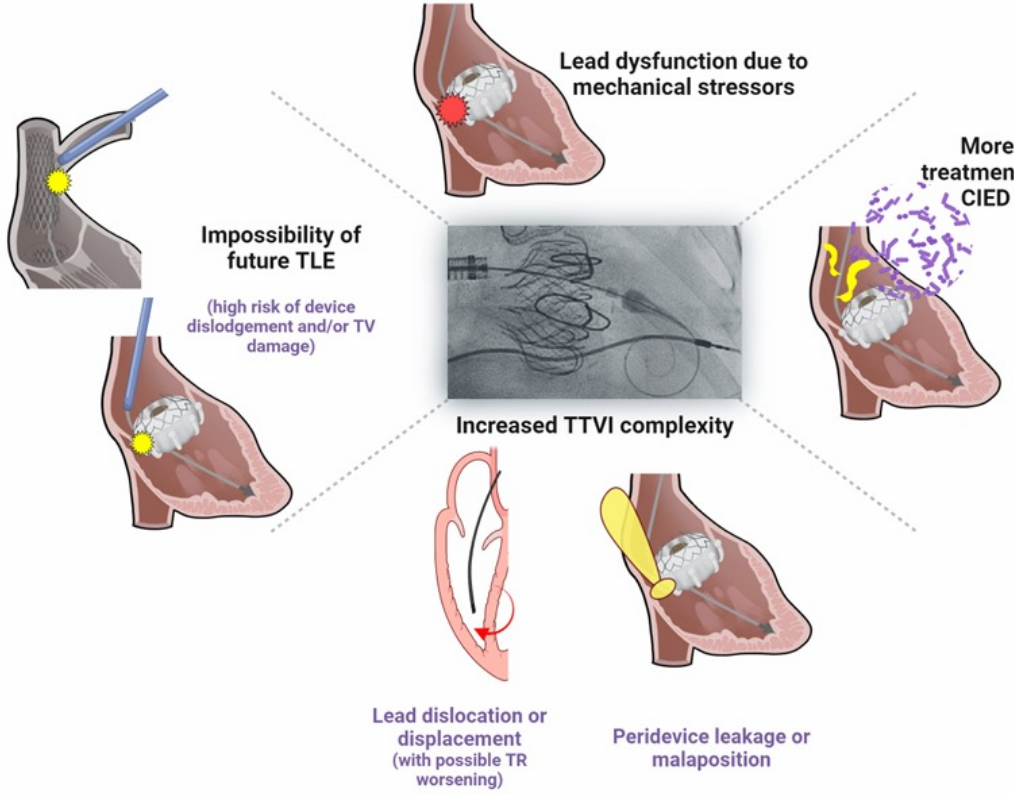
Accelerated TR evolution

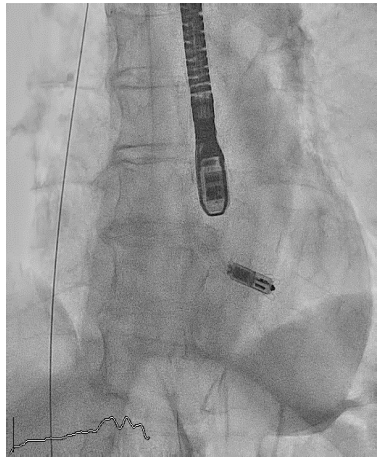
Andreas M et al. EHJ 2023

Management of patients with transvalvular right ventricular leads undergoing transcatheter tricuspid valve interventions. A scientific statement of the European Heart Rhythm Association (EHRA) and the European Association of Percutaneous Cardiovascular Interventions (EAPCI) of the ESC endorsed by the Heart Rhythm Society (HRS), the Asian Pacific Heart Rhythm Society (APHRS) and the Canadian Heart Rhythm Society (CHRS)









Deharo JC, Dreyfus J, Praz F et al et al. Europace et Eurointervention 2025

Management of patients with tricuspid regurgitation (TR)

New

Recommendations	Class	Level
Careful evaluation of TR aetiology, stage of the disease (i.e. degree of TR severity, RV and LV dysfunction, and PH), patient operative risk, and likelihood of recovery by a multidisciplinary Heart Team is recommended in patients with severe TR prior to intervention.	I	C

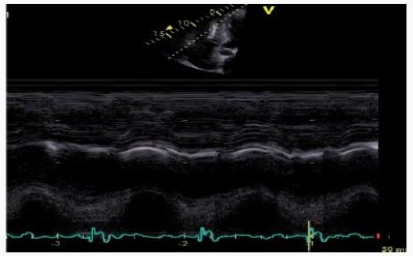
Echocardiographic and invasive assessment of TR

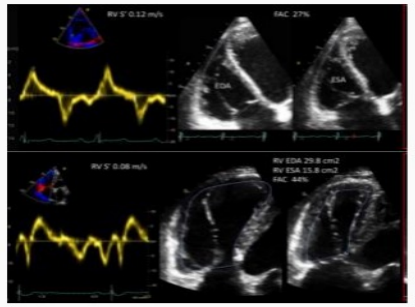
Cardiovascular changes

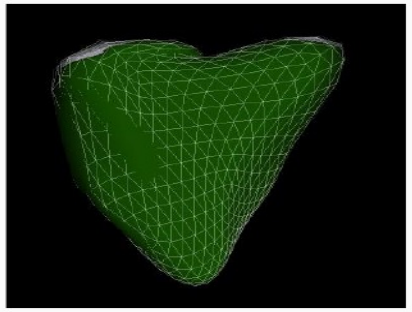
RV dilatation[a]	RV dysfunction[a]	Pulmonary pressures
RV basal diameter index: >24 mm/m²	**RV dysfunction:** TAPSE <17 mm; RV TDI s' <10 cm/s; RV FWS <23%; RV GLS <21%; 3D RV EF <50%; FAC ≤35%	**Pre-capillary PH:** mPAP >20 mmHg; PAWP ≤15 mmHg; PVR >2 WU
RV mid-diameter index: >21 mm/m²		
Tricuspid annulus index: >21 mm/m²	**Severe RV dysfunction:** TAPSE <10 mm; RV TDI s' <6 cm/s; RV FWS <11%; RV GLS <9%; 3D RV EF <35%; FAC ≤22%	**Post-capillary PH:** mPAP >20 mmHg; PAWP >15 mmHg; PVR ≤2 WU
RV end-diastolic volume index: >95 mL/m²		
RV end-systolic volume index: >37 mL/m²		**Severe PH:** PVR >5 WU; mPAP >35 mmHg

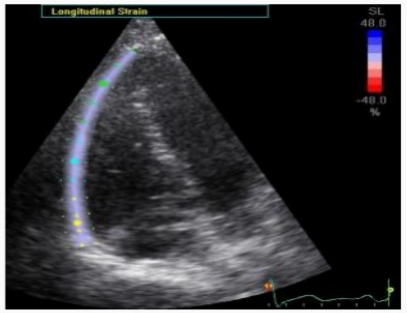
TVARC, Hahn et al, Eur Heart J 2023
Mukherjee et al, JASE 2025

Standard Echo → **Advanced Echo**



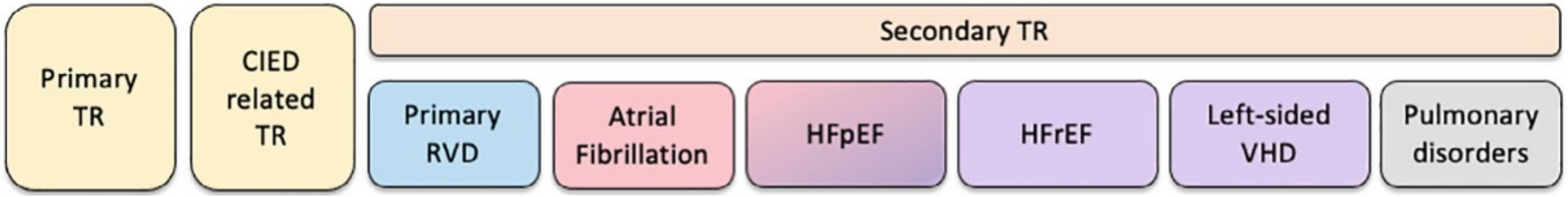


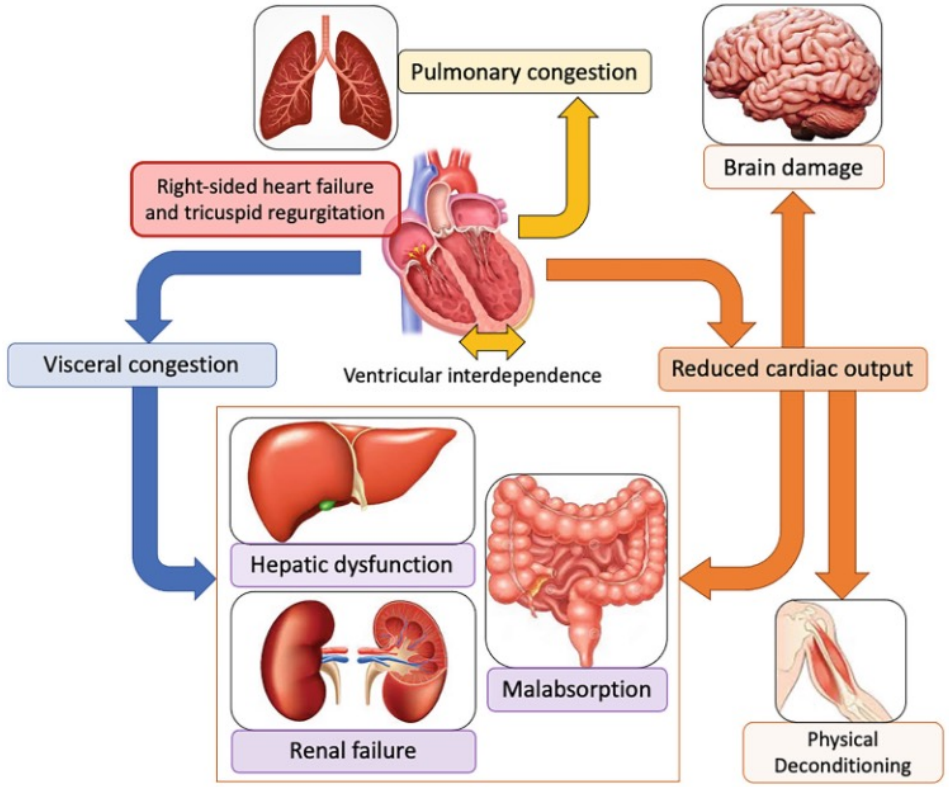




Praz F et al. EHJ 2025

TR = Many Phenotypes !





Adamo M et al. EJHF 2024

Performance of Transcatheter Direct Annuloplasty in Patients With Atrial and Nonatrial Functional Tricuspid Regurgitation

Jennifer von Stein, MD,[a,*] Philipp von Stein, MD,[a,*] Thorsten Gietzen, MD,[a] Jan Althoff, MD,[a] Caroline Hasse, MD,[a] Clemens Metze, MD,[a] Christos Iliadis, MD,[a] Muhammed Gerçek, MD,[b] Daniel Kalbacher, MD,[c,d] Johannes Kirchner, MD,[b] Felix Rudolph, MD,[b] Benedikt Köll, MD,[c,d] Volker Rudolph, MD,[b] Stephan Baldus, MD,[a] Roman Pfister, MD,[a] Maria Isabel Körber, MD[a]

Editorial Commentary

Functional tricuspid regurgitation: is prognosis mostly driven by phenotype or severity?

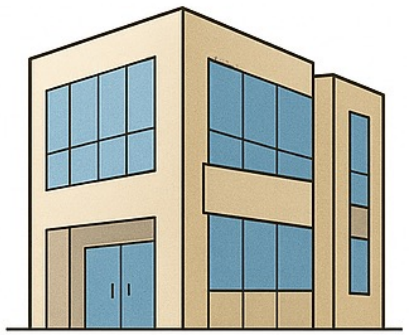
Julien Dreyfus[1]^, David Messika-Zeitoun[2]

[1]Cardiology Department, Centre Cardiologique du Nord, Saint-Denis, France; [2]Division of Cardiology, University of Ottawa Heart Institute, Ottawa, Ontario, Canada

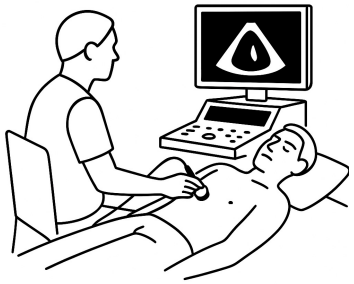
Correspondence to: Julien Dreyfus, MD, PhD. Department of Cardiology, Centre Cardiologique du Nord, 32-36 Rue des Moulins Gémeaux, 93200 Saint-Denis, France. Email: dreyfusjulien@yahoo.fr.

Dreyfus J, Messika-Zeitoun D, Cardiovascular Diagnosis and Therapy 2025

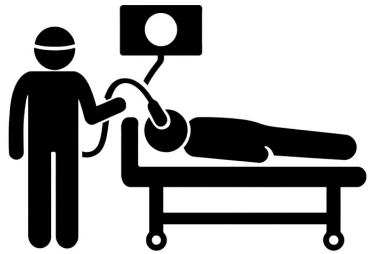
Heart Team Management at Heart Valve Center (HVC)



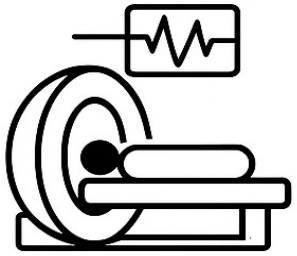
Heart Valve Center



TTE

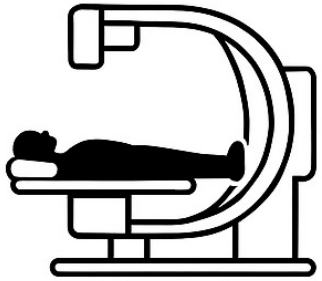


TEE



CT

MRI



RHC

Relevant TR

Referral to a multidisciplinary Tricuspid Heart Valve Center

EP

Cardiac surgeon

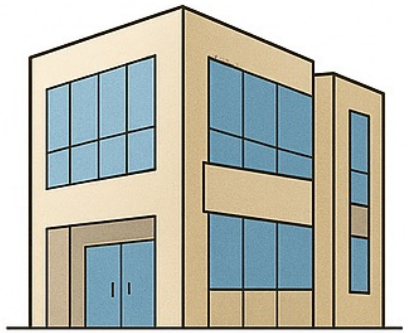
HF

Imaging specialist

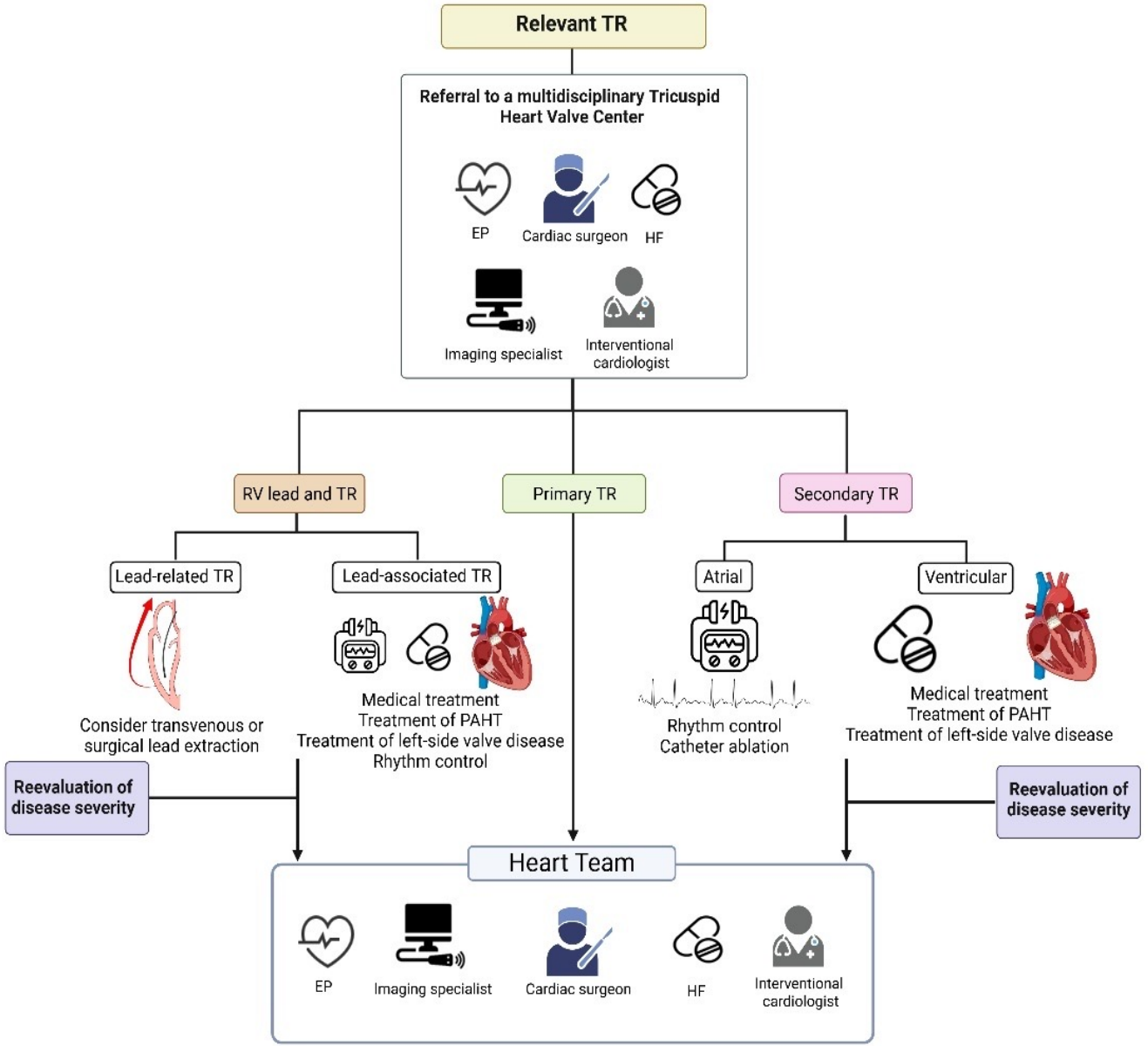
Interventional cardiologist

Heart Team

Heart Team Management at HVC

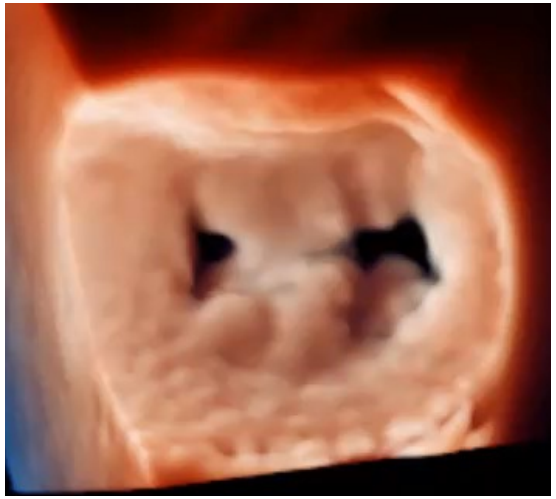


Heart Valve Center



Courtesy of F. Praz

Tricuspid valve (TV) surgery
at the time of left-sided valve surgery
(mitral valve +++)



Management of tricuspid regurgitation (TR)

↓

Need for left-sided valve surgery?

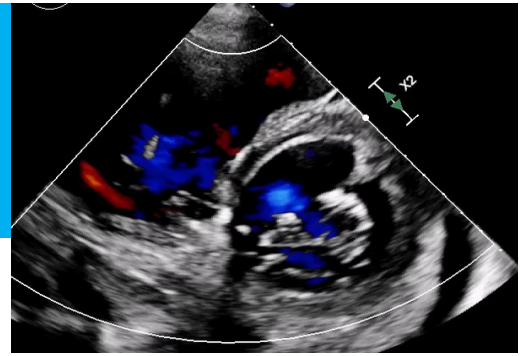
↓

YES

↓

COMBINED
Tricuspid Valve Surgery
at the time of left-sided valve surgery

Frequency and grade of TR among patients with severe left-sided valvular heart disease



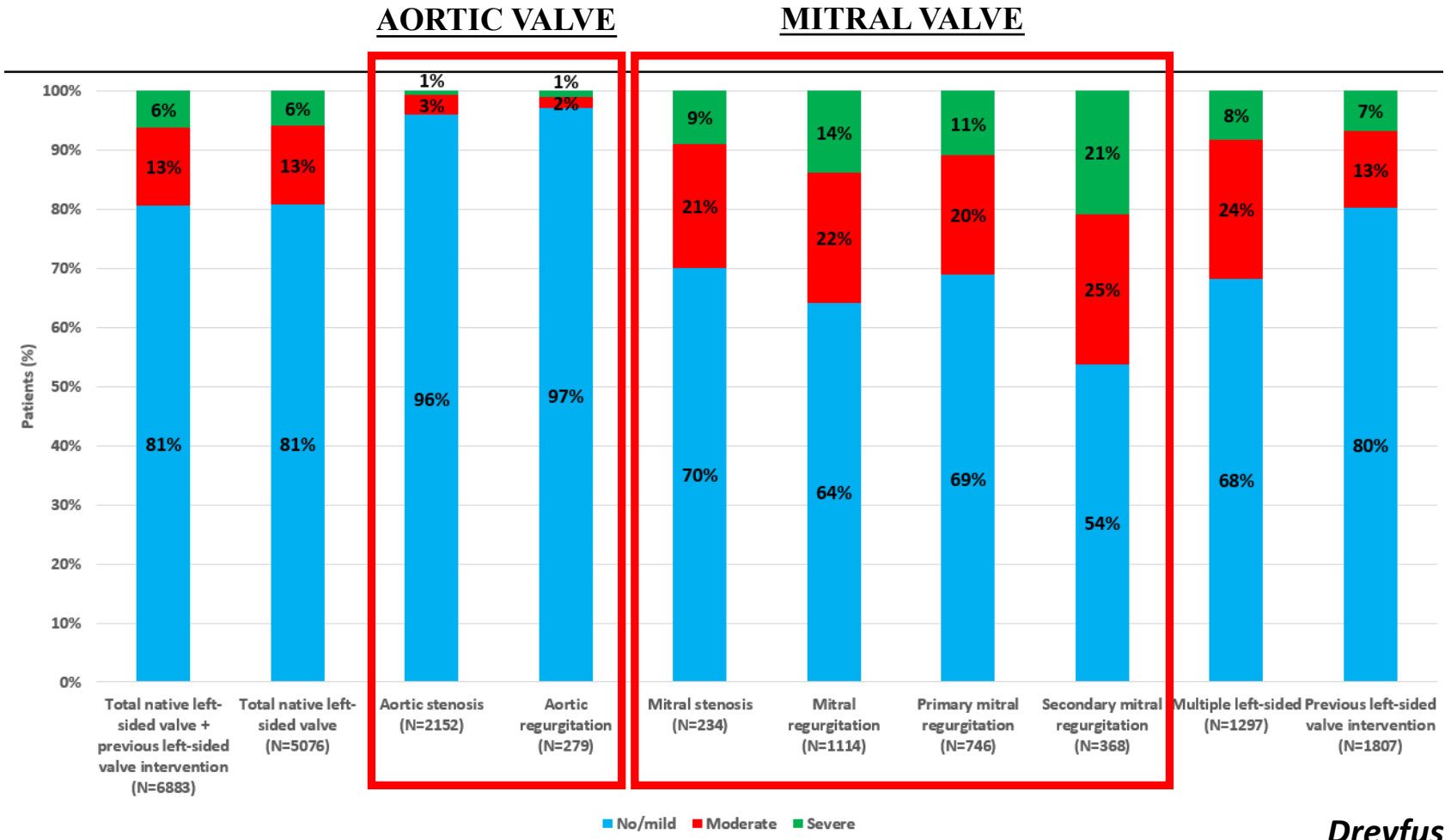
➢ **ESC/EORP Valvular Heart Survey II (222 centers - 28 countries)**

N=6883

No/mild TR: N=5548

Moderate TR: N=911

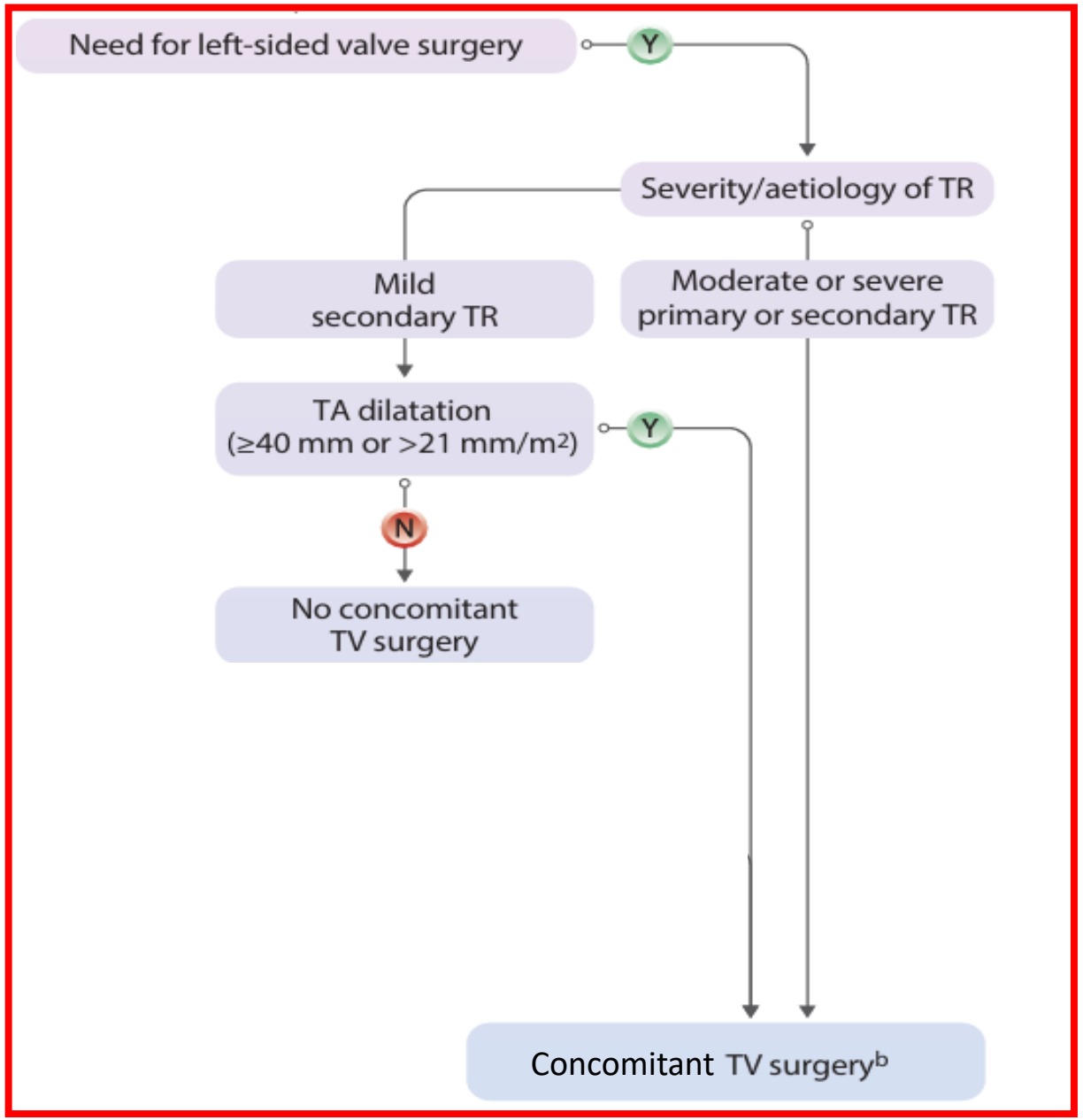
Severe TR: N=424



Dreyfus J et al. EJHF 2024

Recommendations for intervention at the time of left-sided VHD surgery

Patients with tricuspid regurgitation and left-sided valvular heart disease requiring surgery		
Concomitant TV surgery[c] is recommended in patients with severe primary or secondary TR.[725,731,743,744]	I	B
Concomitant TV repair should be considered in patients with moderate primary or secondary TR, to avoid progression of TR and RV remodelling.[723,724,726,731]	IIa	B
Concomitant TV repair may be considered in selected patients with mild secondary TR and tricuspid annulus dilatation (≥40 mm or >21 mm/m^2), to avoid progression of TR and RV remodelling.[723–726,731,743]	IIb	B



Praz F et al. EHJ 2025

Factors to be considered during Heart Team discussion regarding concomitant TV intervention at the time of left-sided VHD surgery

Factors favouring concomitant TV surgery	Factors not favouring concomitant TV surgery
TR moderate or more	TR mild
Tricuspid annular dilatation	No tricuspid annular dilatation
Chronic AF	First-degree atrioventricular block, pre-existing left bundle branch block
Significant RA dilatation	Normal RA dimension
RV dilatation or (non-severe) dysfunction	Normal RV function and diameter
Presence of (non-severe) TV leaflet tethering	Absence of TV leaflet tethering
Pulmonary hypertension SPAP ≥50 mmHg	Normal pulmonary pressures
Reversible renal and liver dysfunction	No other comorbidities

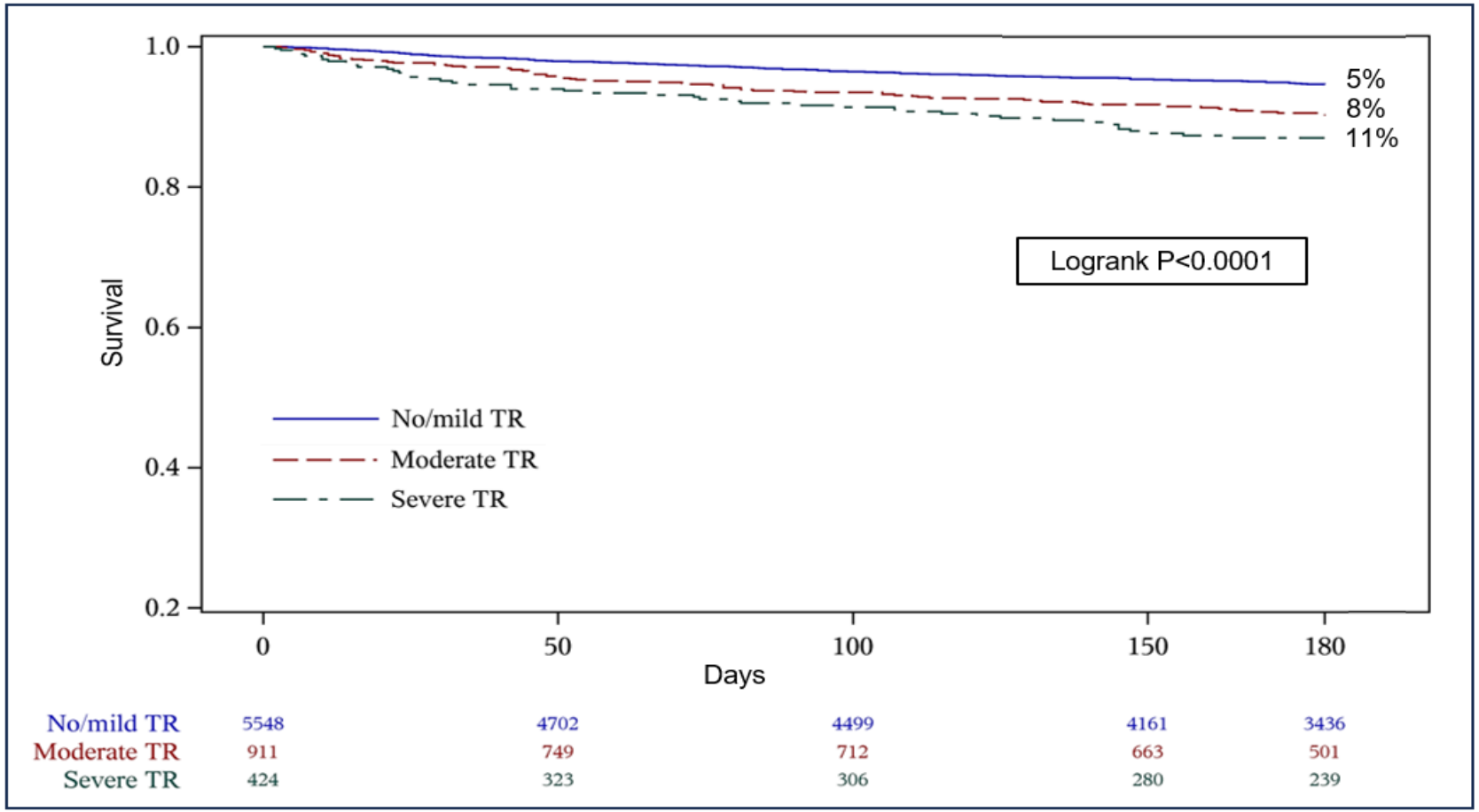
Rheumatic valve

Praz F et al. EHJ 2025

TR prognosis: Survival according to TR grade

- **Patients with severe left-sided valvular heart disease**

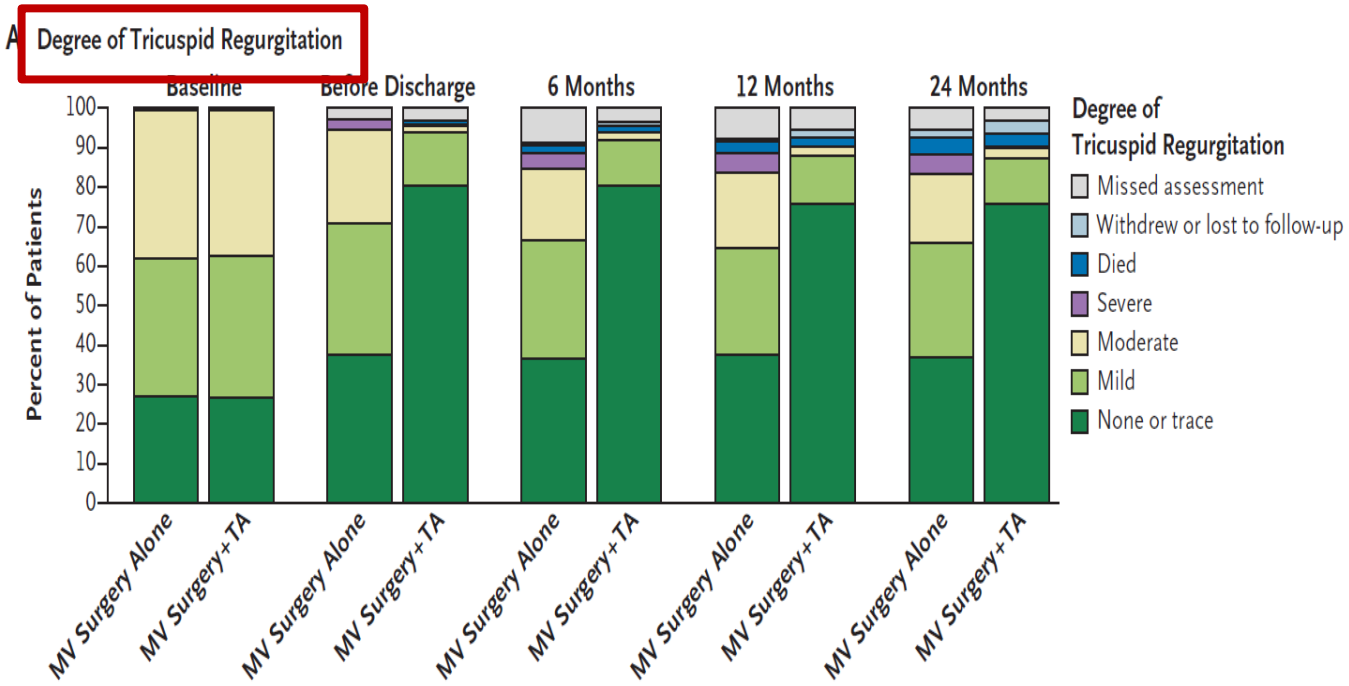
ESC/EORP Valvular Heart Survey II (222 centers - 28 countries)

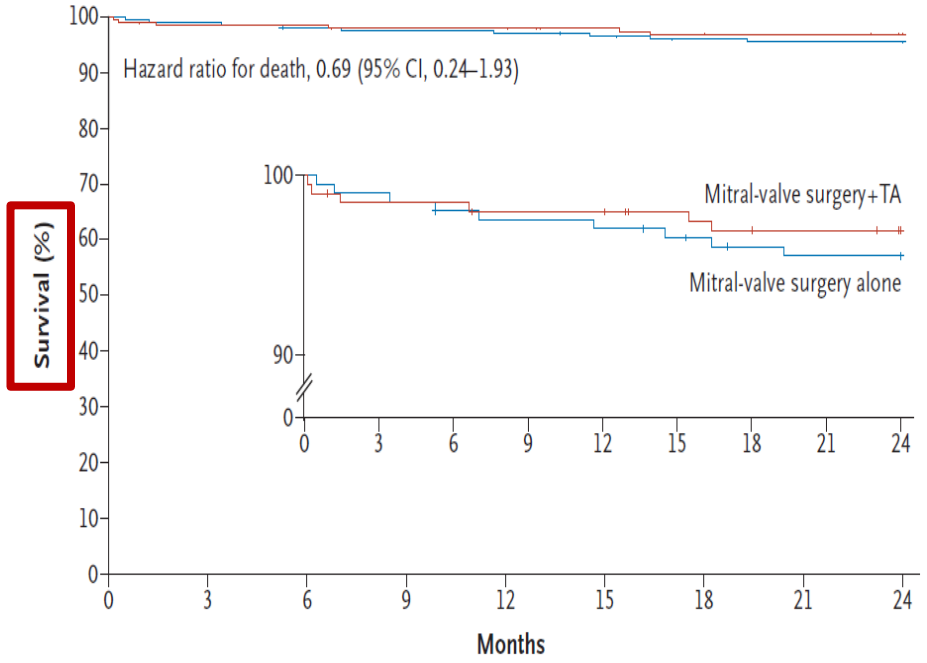


Dreyfus J et al. EJHF 2024

Concomitant TV surgery
at the time of mitral valve surgery

- **<u>Degenerative mitral regurgitation</u>: 400 patients, TR <severe and TA >40mm, randomized with or without TV annuloplasty**





Gammie JS et al. NEJM 2021

Concomitant TV intervention at the time of mitral valve surgery

➢ **Higher rate of permanent pacemaker implantation**

- **62,118 patients undergoing MVR, STS database, 2011-2014**

new pacemaker rates	without	5.4% (2,621 of 48,540)
	with TVr	14.7%(1,258 of 8,558)

Badhwar V et al. Ann Thor Surg 2016

- **Degenerative mitral regurgitation: 400 patients, TR <severe and TA >40mm, randomized with or without TV annuloplasty**

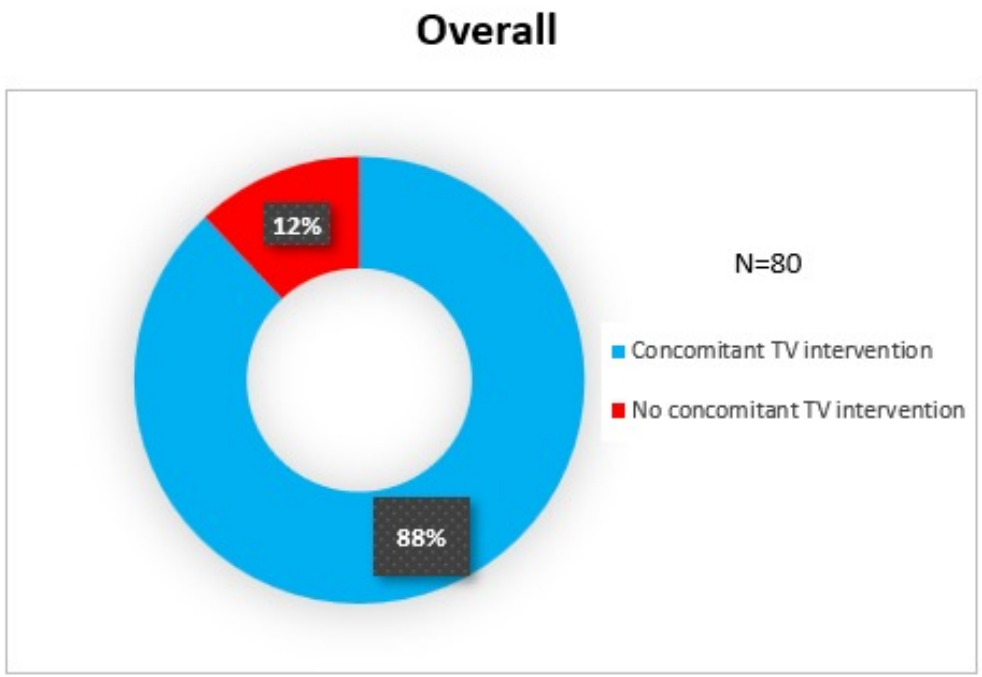
Variable	Mitral-Valve Surgery Alone (N=203)			Mitral-Valve Surgery plus TA (N=198)			Rate Ratio (95% CI)
	Patients	Events	Rate	Patients	Events	Rate	
	no. (%)	*no.*	*no./24 patient-mo*	*no. (%)*	*no.*	*no./24 patient-mo*	
Cardiac conduction abnormalities or sustained bradycardia leading to permanent pacemaker	5 (2.5)	5	0.026	28 (14.1)	28	0.147	5.75 (2.27–14.60)

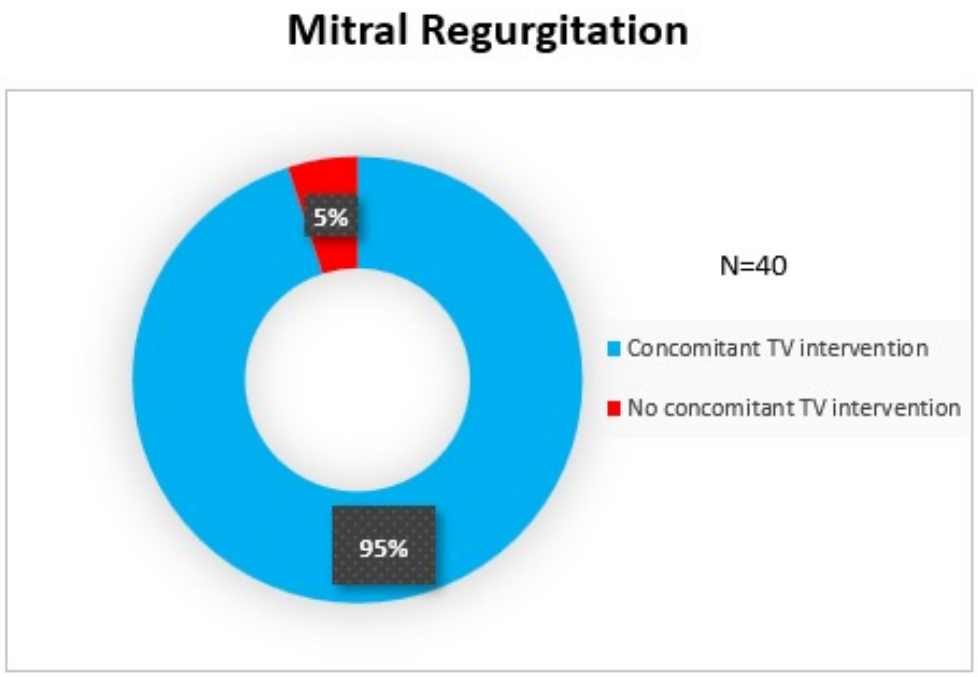
Gammie JS et al. NEJM 2021

Concordance between class I indications (severe TR) for concomitant TV intervention and therapeutic decision at the time of left-sided valvular heart surgery

➢ **<u>ESC/EORP Valvular Heart Survey II</u> (222 centers - 28 countries)**

Severe TR





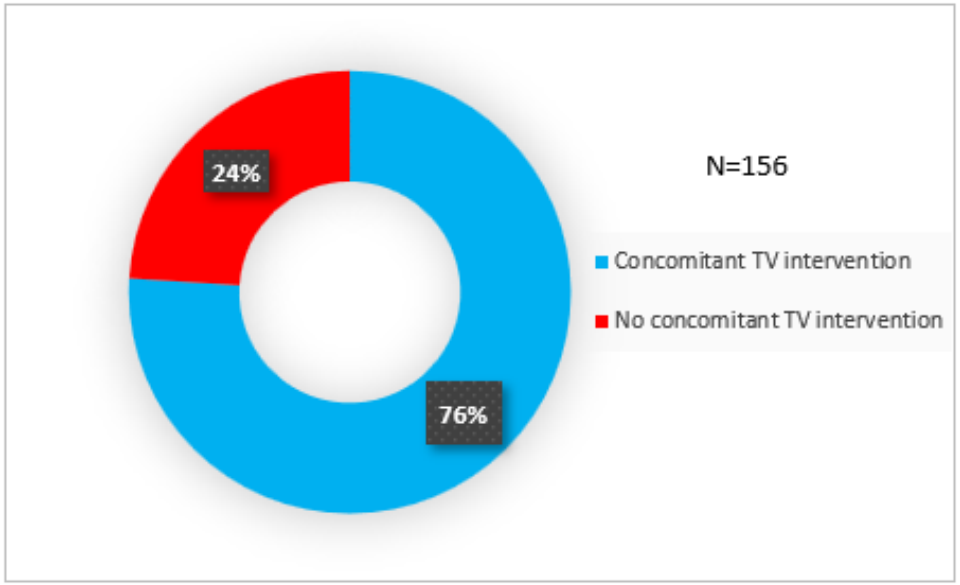
Dreyfus J et al. **EJHF 2024**

Concordance between class IIa indications (moderate TR) for concomitant TV intervention and therapeutic decision at the time of left-sided valvular heart surgery

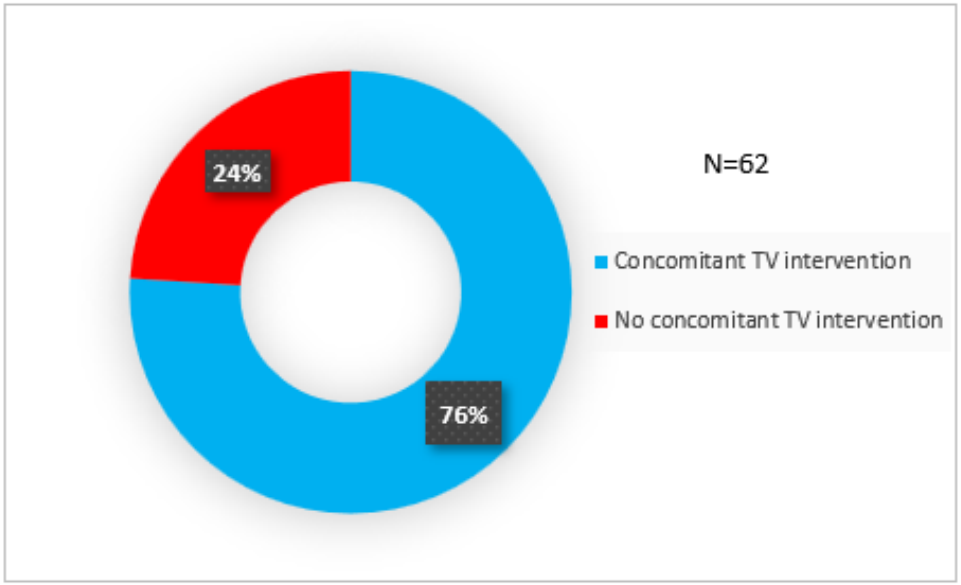
➢ **<u>ESC/EORP Valvular Heart Survey II</u> (222 centers - 28 countries)**

Moderate TR

Overall

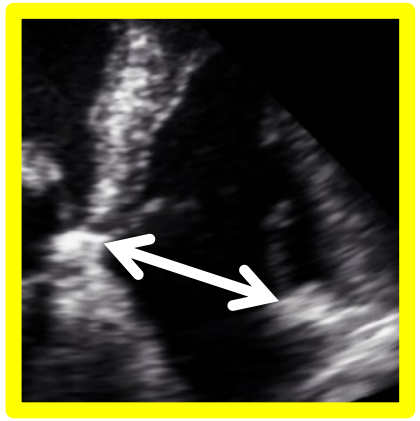


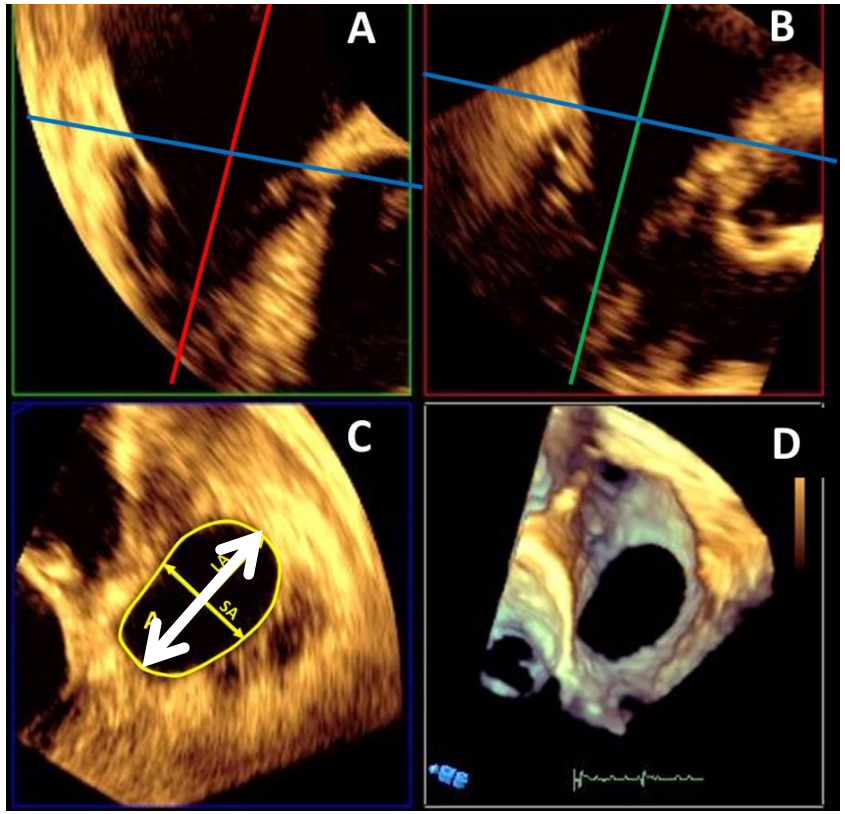
Mitral Regurgitation



Dreyfus J et al. **EJHF 2024**

Comparison between A4C and 3D-TEE long axis





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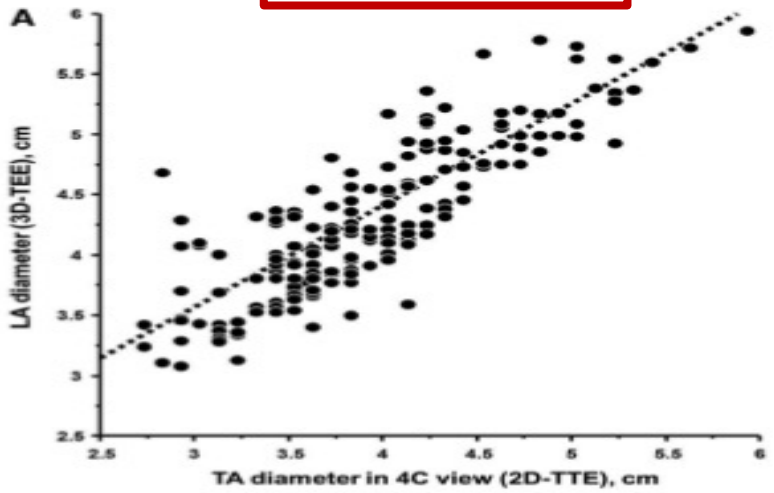
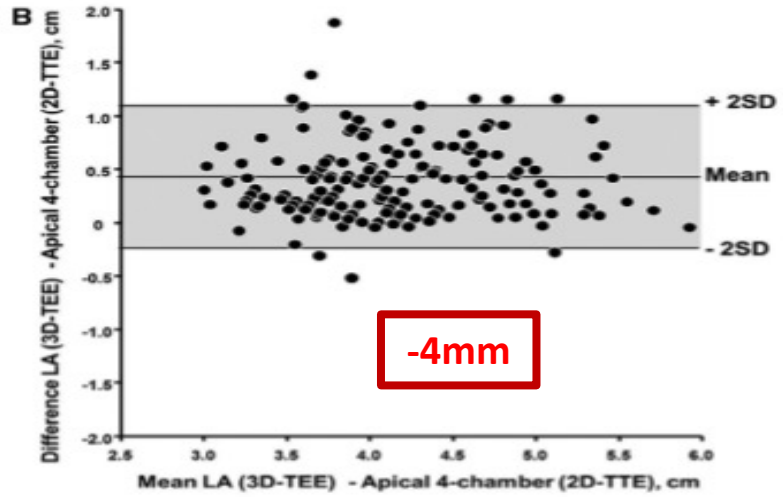


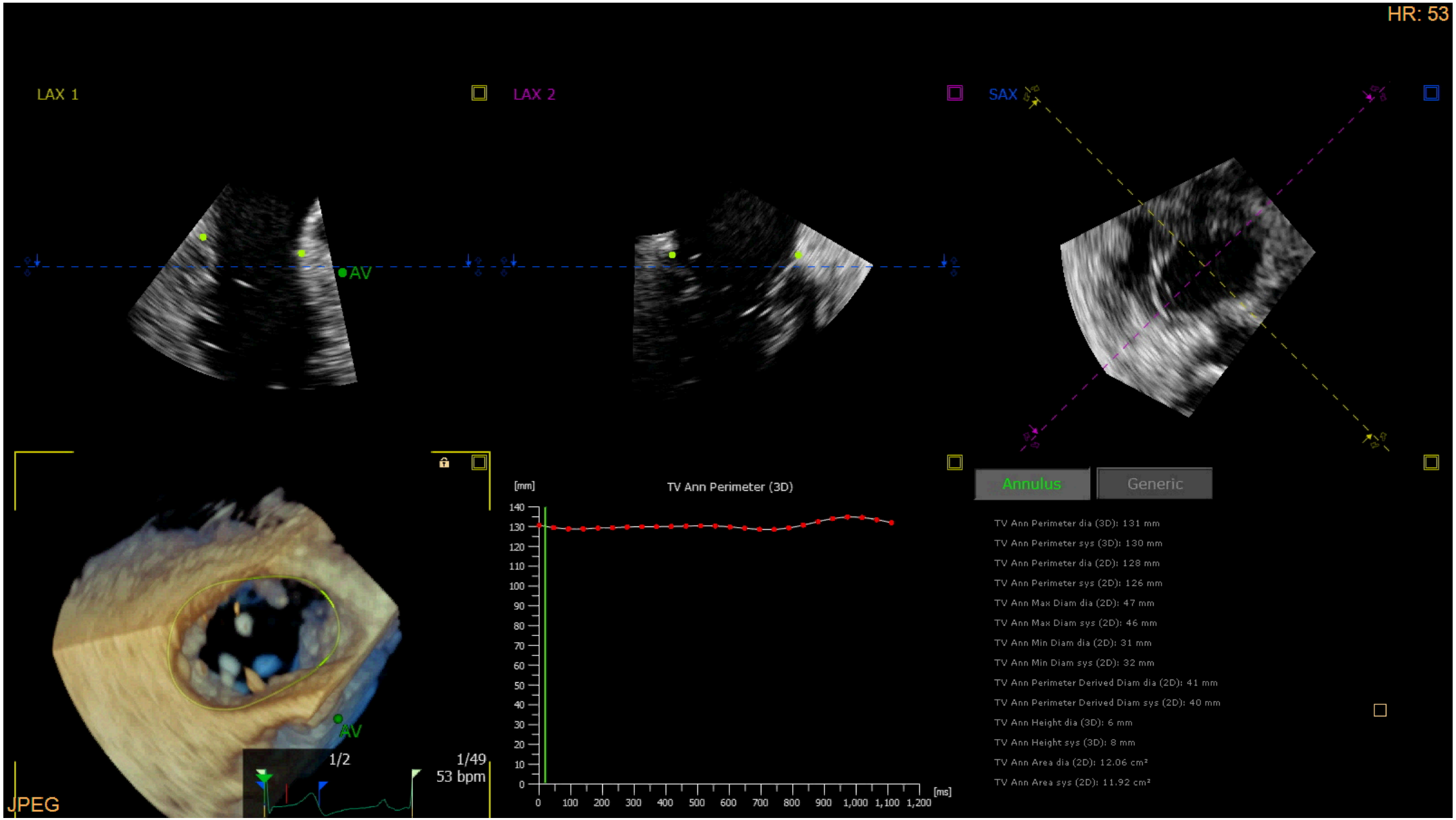


-4mm

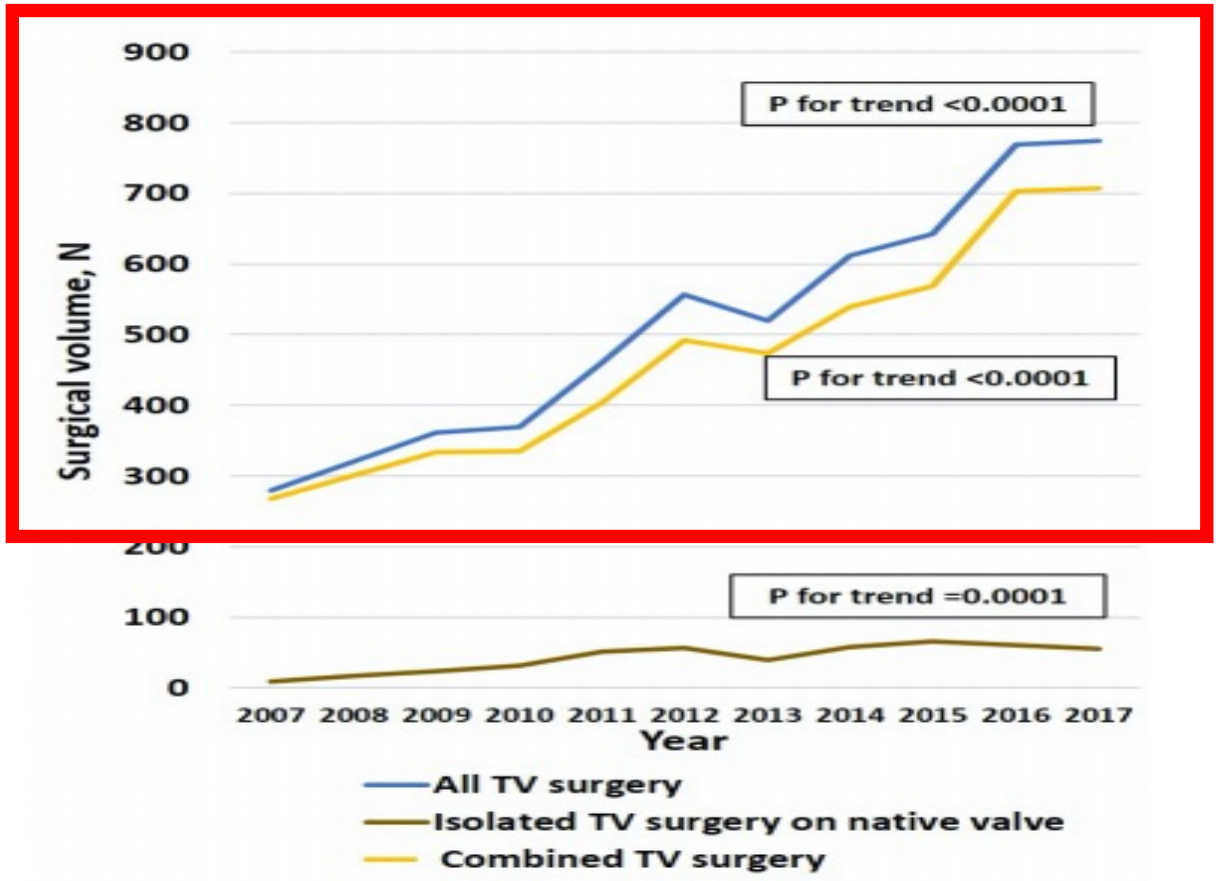
015

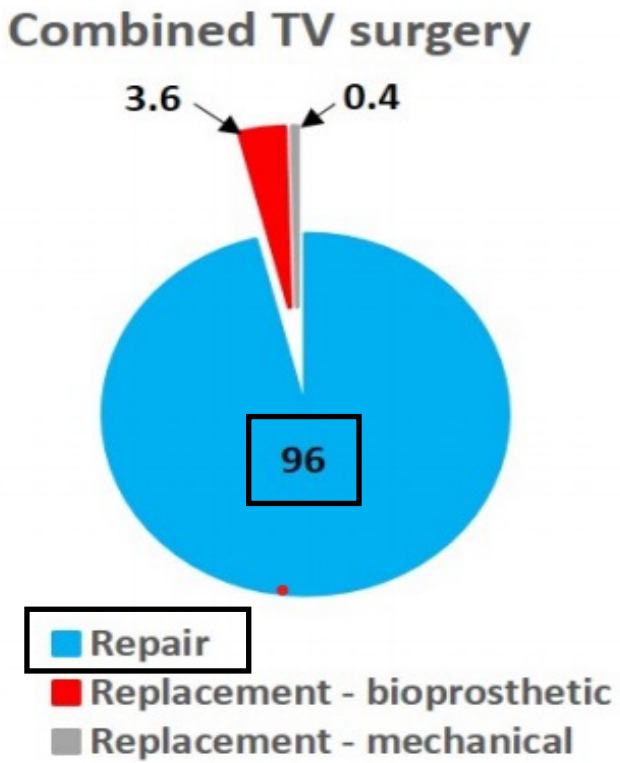
Dreyfus J et al. Circulation CVI 2015

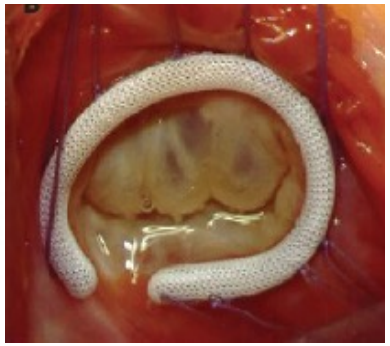
Tricuspid annulus dimensions



Trends of tricuspid valve surgery at the time of left-sided valve surgery







Dreyfus J et al. **EHJ 2020**

Recommendations for intervention when severe TR without left-sided VHD

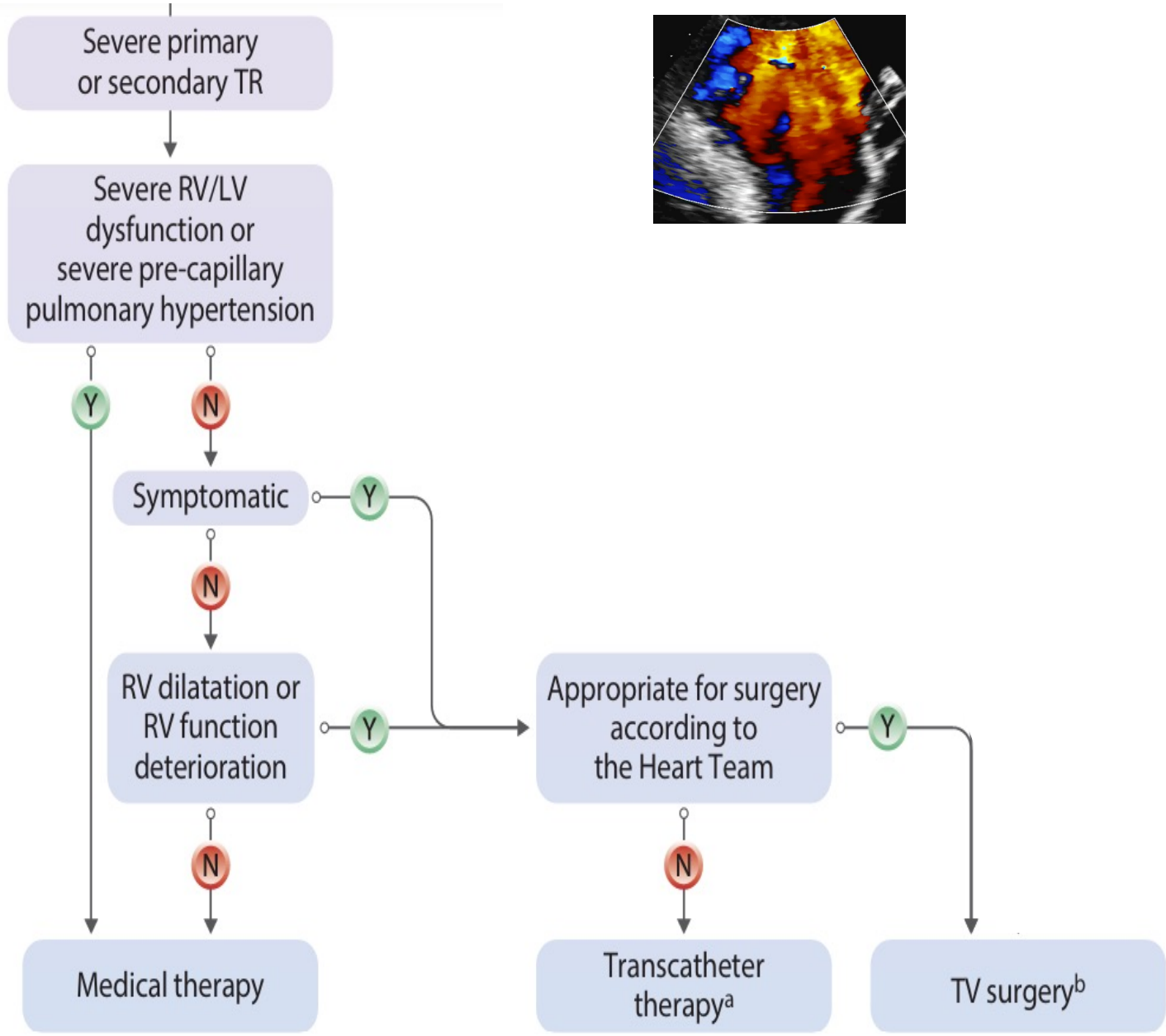
Patients with severe tricuspid regurgitation without left-sided valvular heart disease requiring surgery

SURGERY:

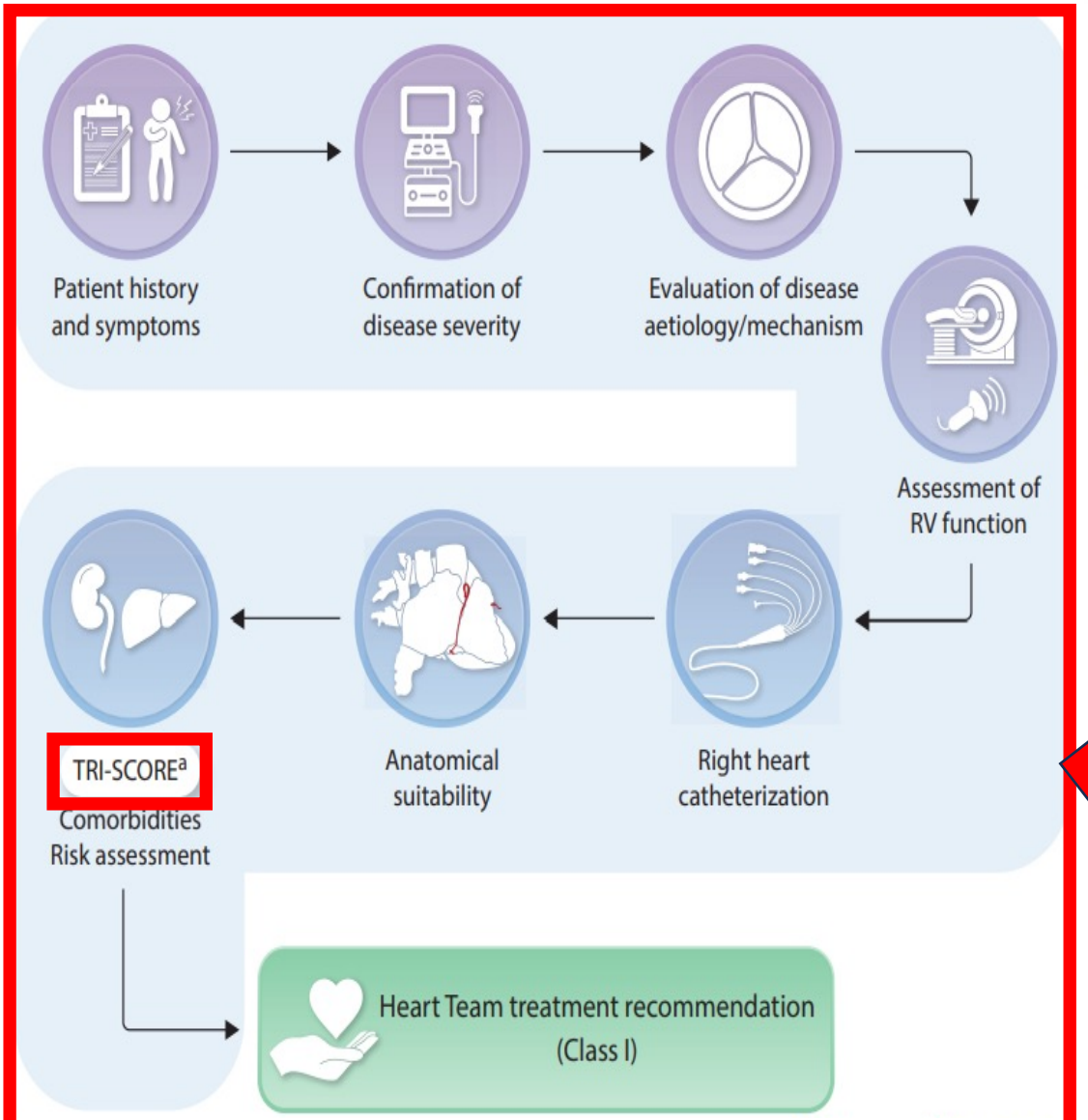
TV surgery[c] is recommended in symptomatic patients with severe primary TR without severe RV dysfunction or severe PH.	I	C
TV surgery[c] should be considered in asymptomatic patients with severe primary TR who have RV dilatation/RV function deterioration, but without severe LV/RV dysfunction or severe PH.	IIa	C
TV surgery[c] should be considered in patients with severe secondary TR who are symptomatic or have RV dilatation/RV function deterioration, but without severe LV/RV dysfunction or PH.[685,720,745–747]	IIa	B

TRANSCATHETER:

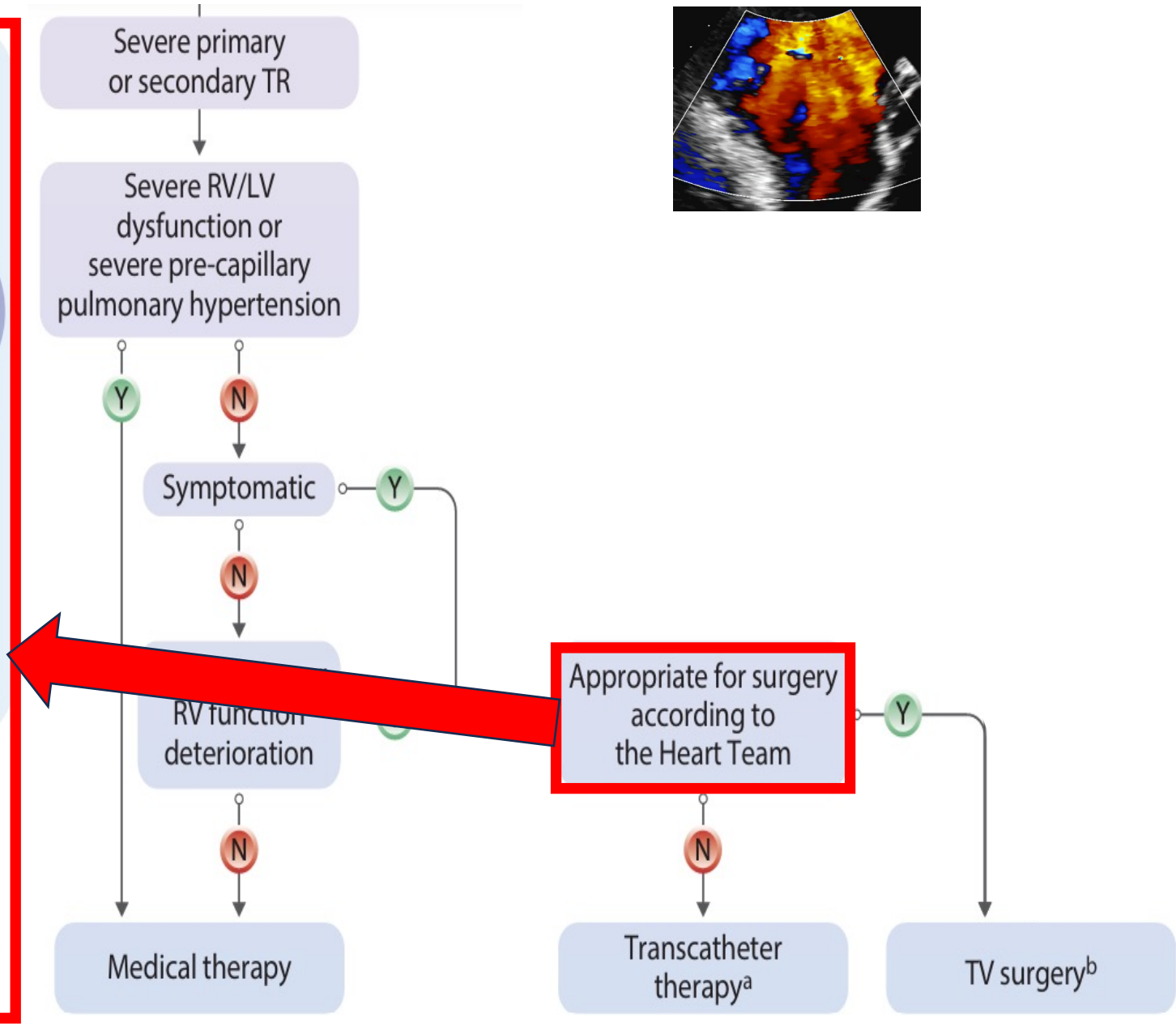
Transcatheter TV treatment should be considered to improve quality of life and RV remodelling in high-risk patients with symptomatic severe TR despite optimal medical therapy in the absence of severe RV dysfunction or pre-capillary PH.[713,733,735,738,748–751]	IIa	A



Recommendations for intervention when severe TR without left-sided VHD



[a] www.tri-score.com



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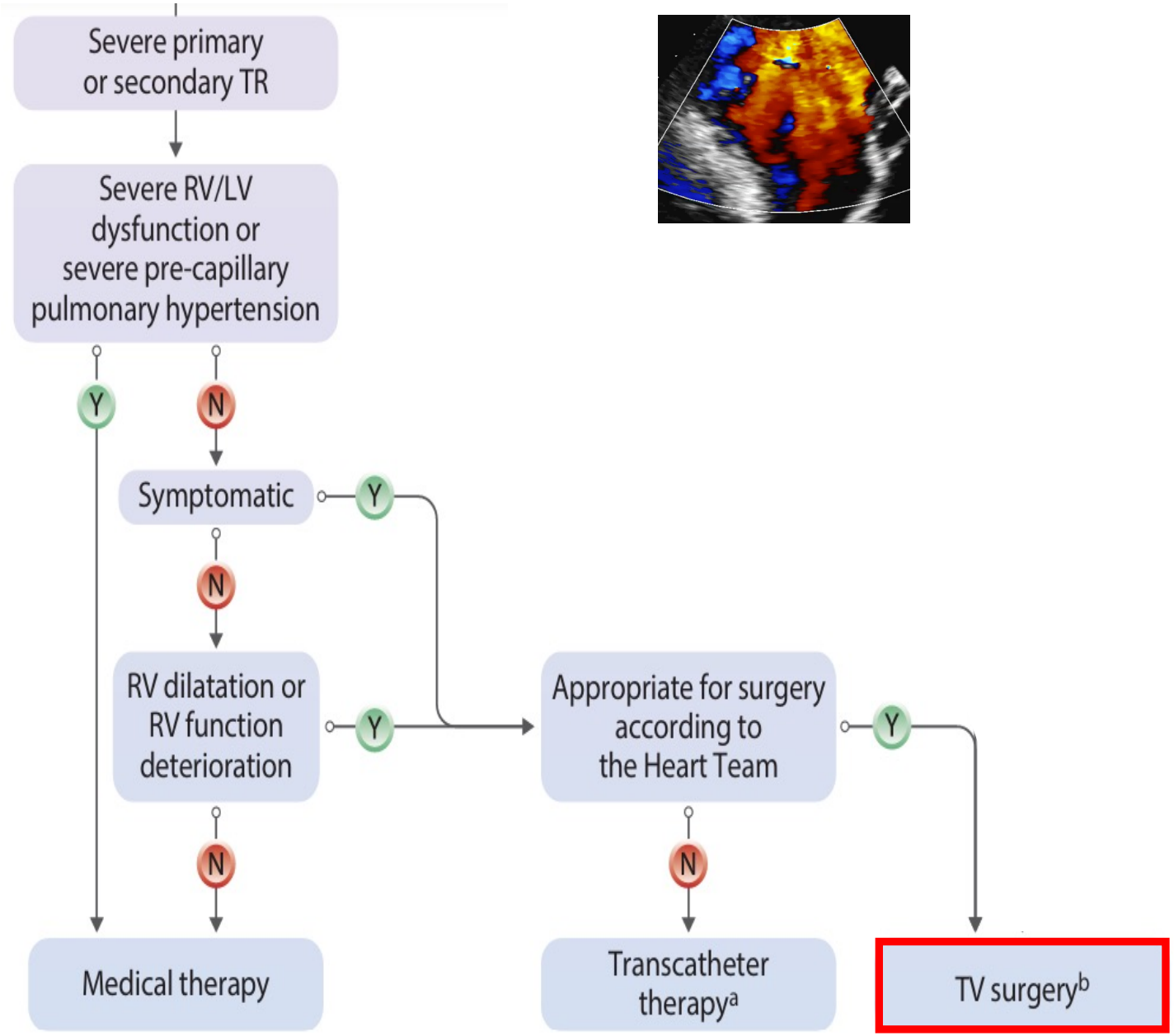
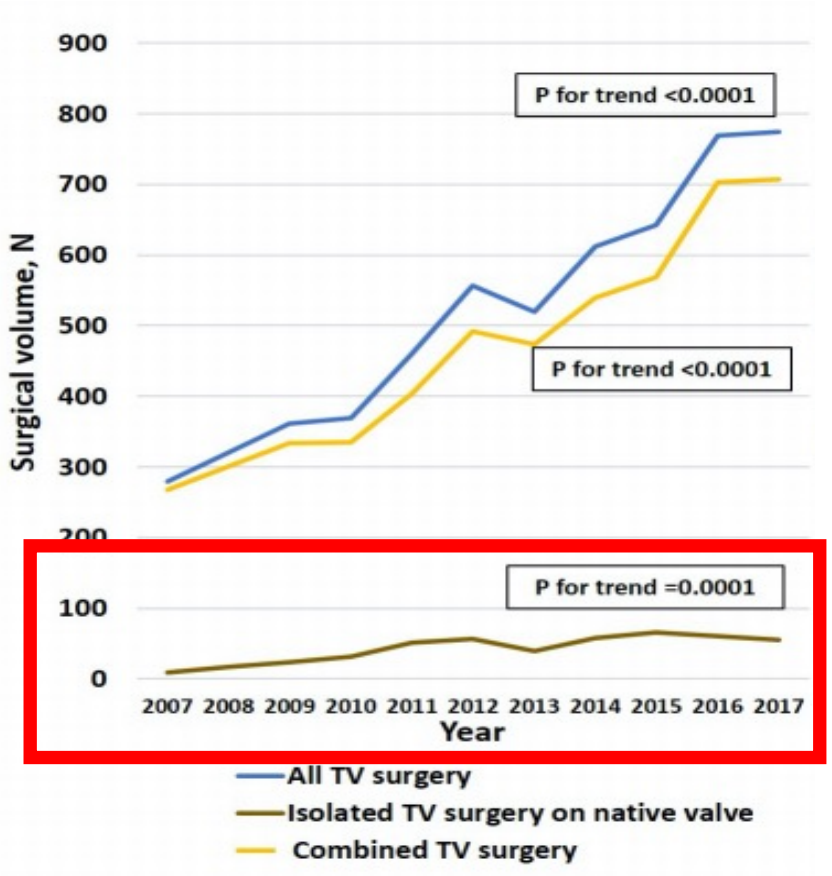


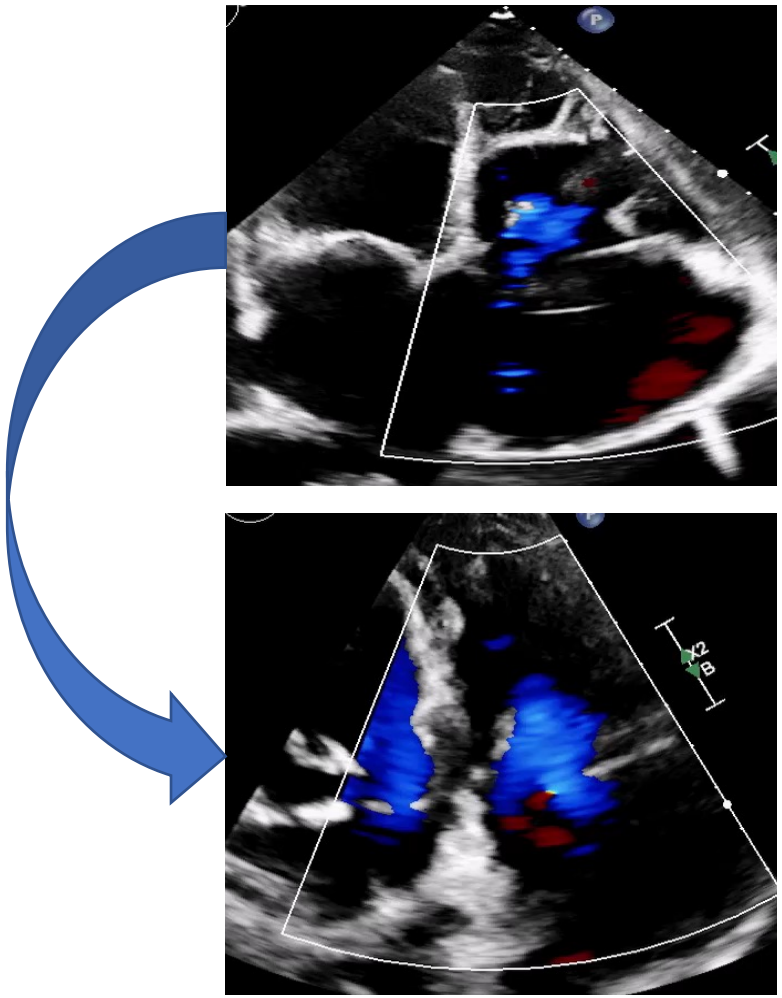
Isolated Tricuspid Valve Surgery (ITVS)



Dreyfus J et al. EHJ 2020

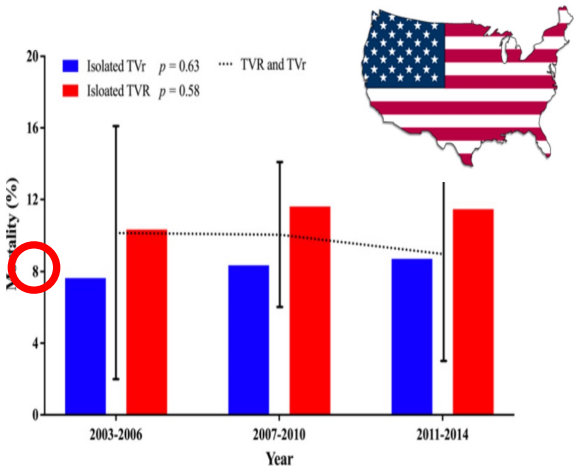
Management of TR

- **Medical treatment: diuretics**



Isolated Tricuspid Valve Surgery (ITVS)

➢ In-hospital mortality



France (PMSI), 2013-2014:

10%

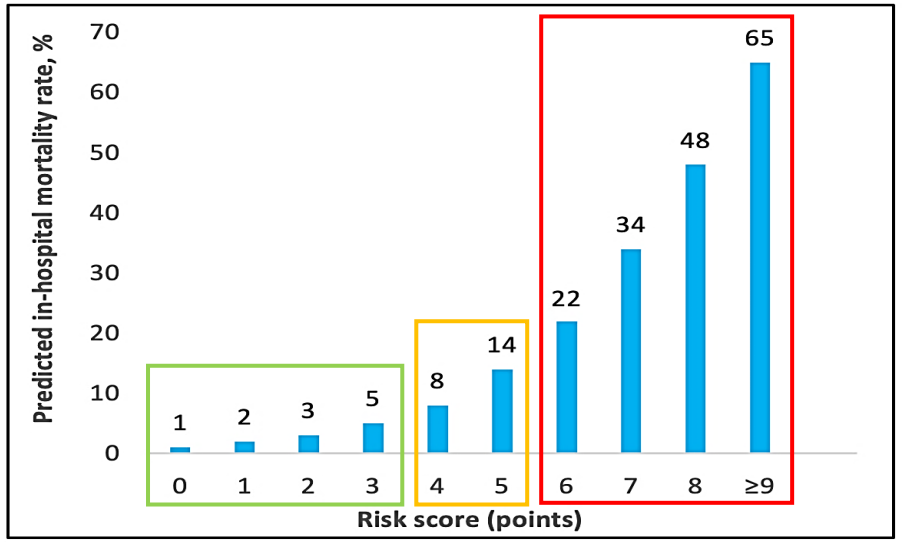
Alqahtani F et al. JAHA 2017

Dreyfus J et al. AJC 2018

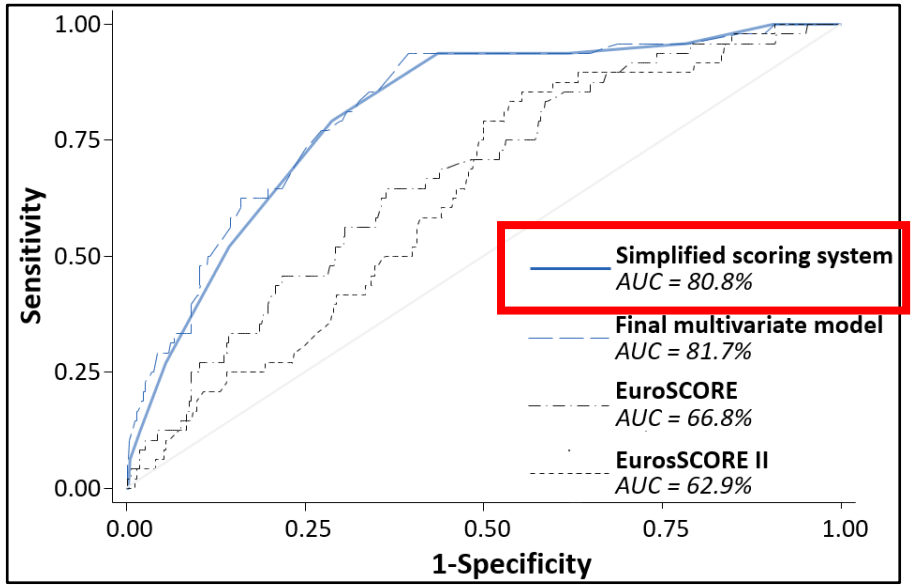
TRI-SCORE: dedicated risk score model to predict in-hospital mortality after ITVS

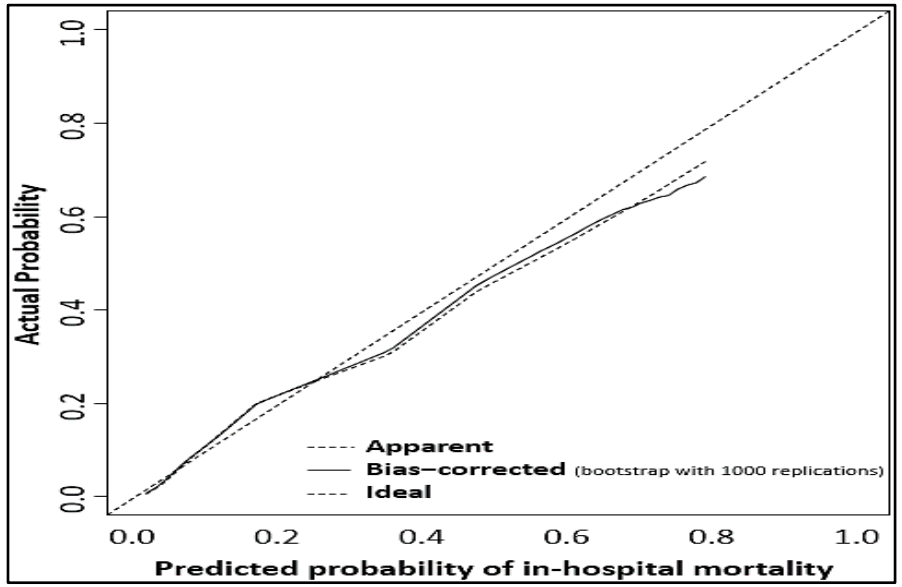
TRI-SCORE

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



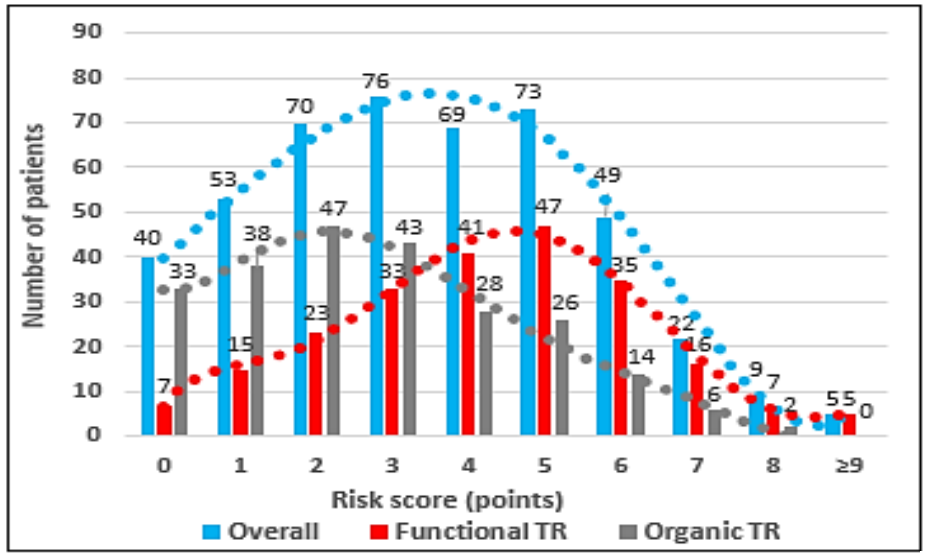
Risk: Low | Intermediate | High

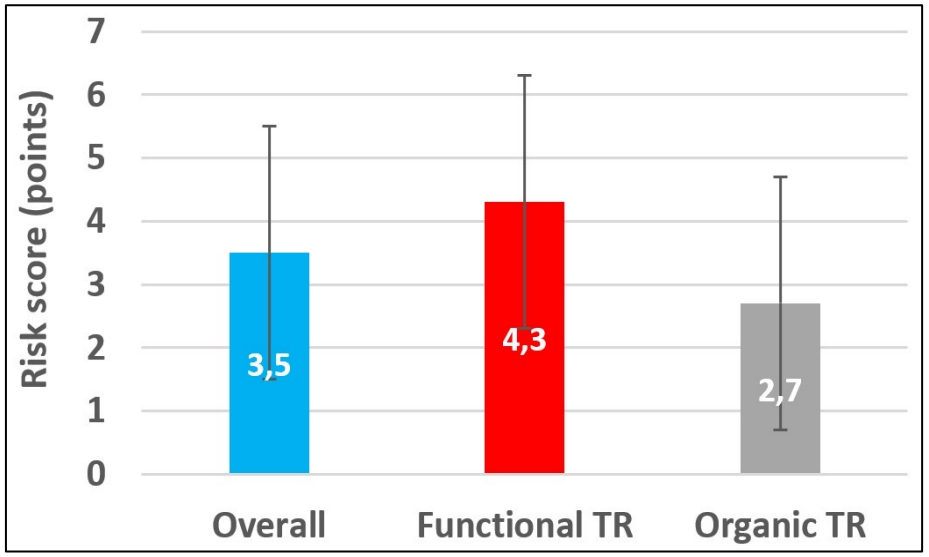


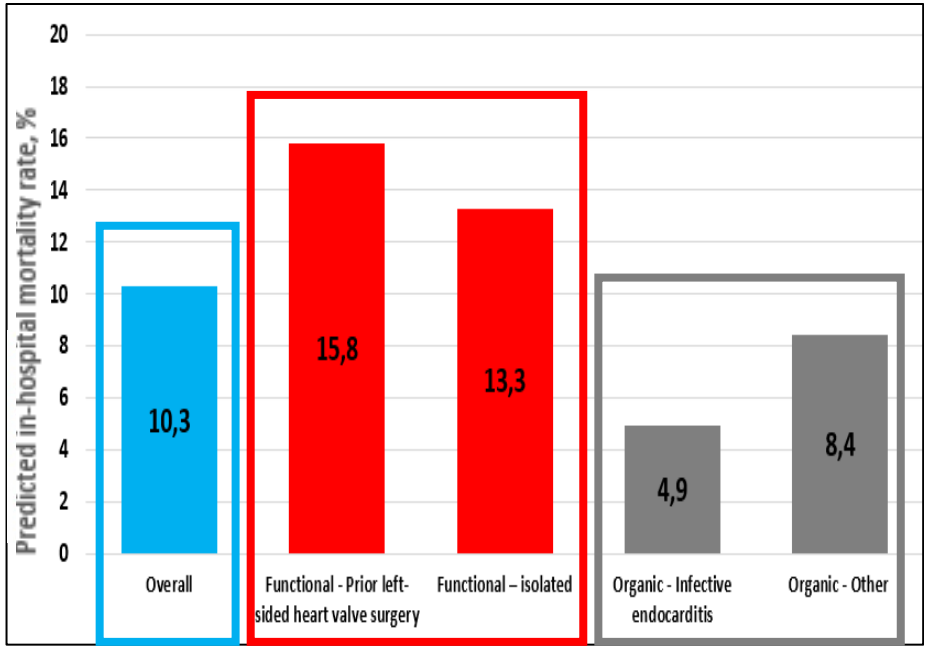


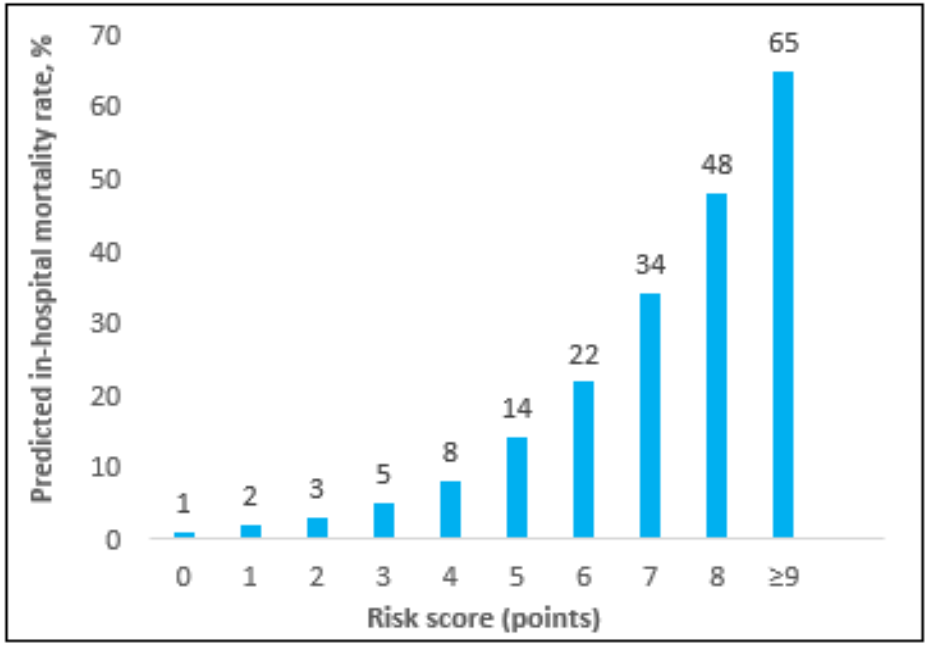
Dreyfus J, Messika-Zeitoun D et al. EHJ 2021

Prediction of in-hospital mortality after ITVS





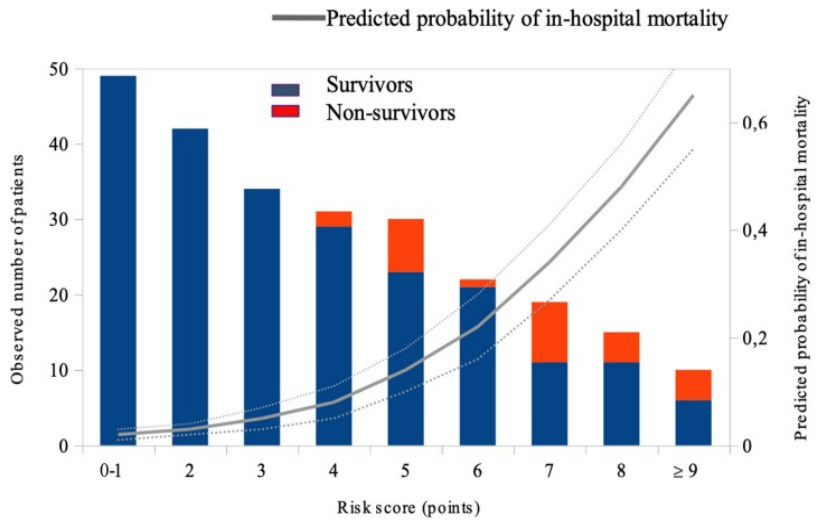


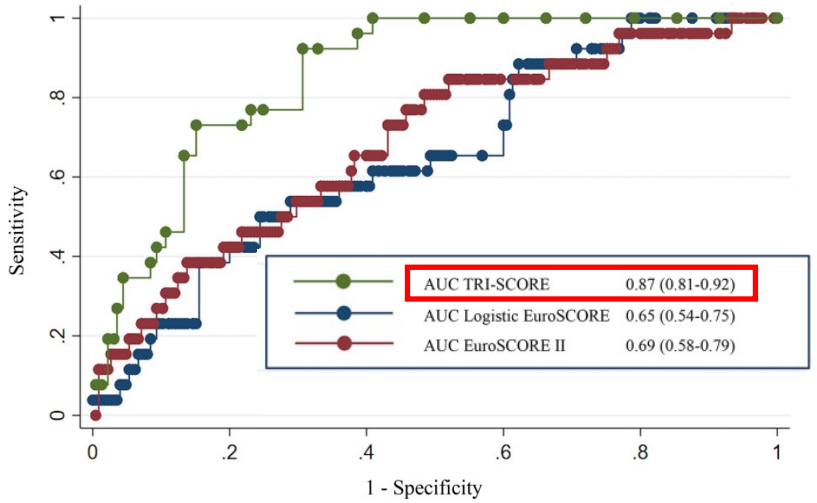


Dreyfus J, Messika-Zeitoun D et al. EHJ 2020; Dreyfus J, Messika-Zeitoun D et al. EHJ 2021

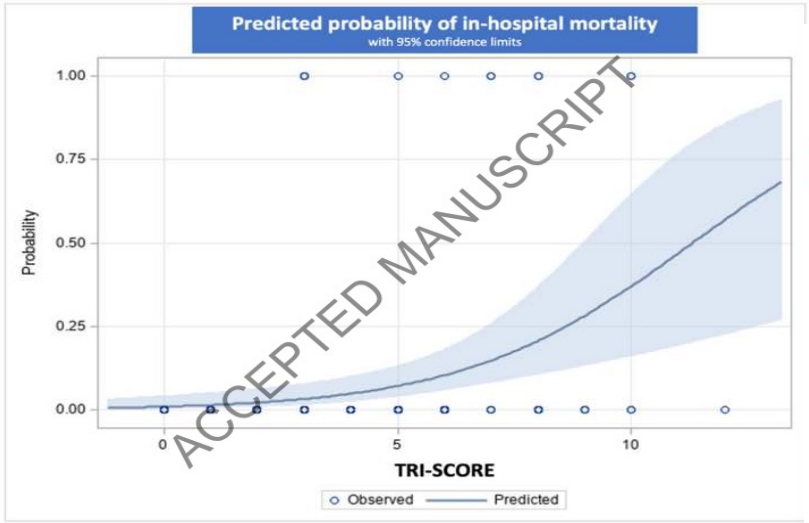
External validation of the TRI-SCORE to predict in-hospital mortality after ITVS

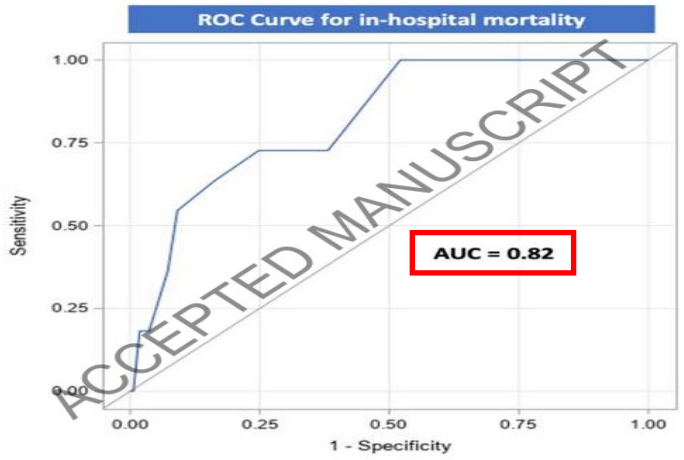
➢ Spain



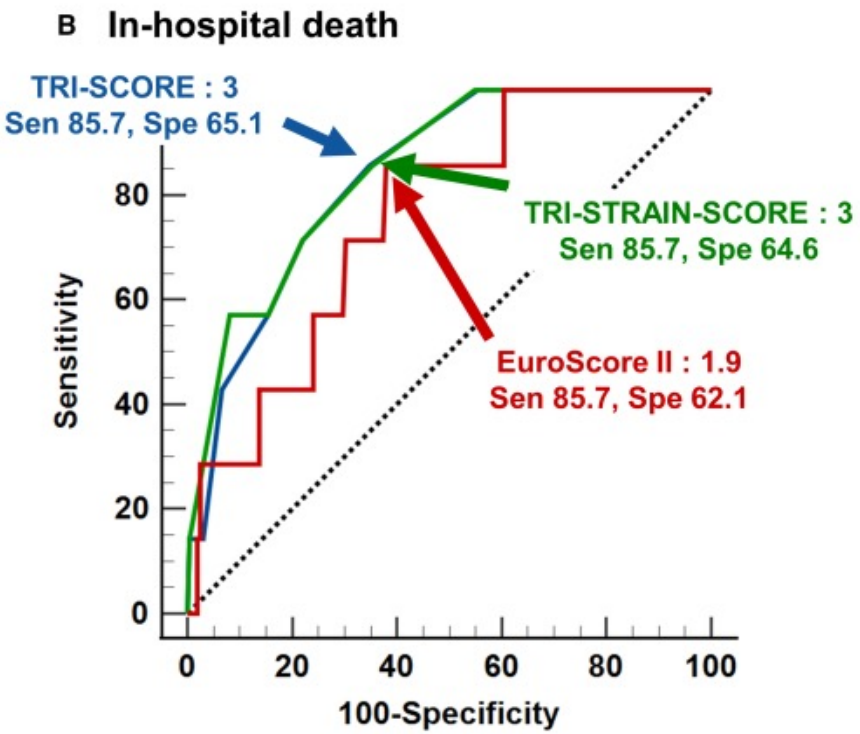


➢ Italy





➢ Asia



	AUC (95% CI)	*P* value
TRI-SCORE	0.84 (0.78-0.89)	<0.001
TRI-STRAIN-SCORE	0.85 (0.79-0.90)	<0.001
EuroScore II	0.76 (0.69-0.81)	0.002

Anguita-Gamez M et al. Heart 2023; Sala A et al. Interdiscip Cardiovasc Thorac Surg 2023; Kim DY et al. JAHA 2024

TRI-SCORE Calculator

Free online calculator:

www.tri-score.com

\+

Free App

GET IT ON Google Play

Download on the App Store

Parameters

- Age ≥ 70 years
- Female
- NYHA functional class III or IV
- Right-sided heart failure signs [1]
- Prior left-sided heart valve intervention
- Permanent pacemaker / defibrillator
- Atrial fibrillation / flutter
- Daily dose of furosemide ≥ 125 mg
- Glomerular filtration rate < 30 ml/min [2]
- Elevated total bilirubin [3]
- Left ventricular ejection fraction < 60% [4]
- Moderate/severe right ventricular dysfunction [5]
- Mechanism of tricuspid regurgitation
  - Secondary
  - Primary
  - Mixed

SUBMIT RESET

TRI-SCORE

Prediction

TRI-SCORE

6/12

Predicted in-hospital mortality after isolated tricuspid valve surgery

22%

Risk

LOW | INTERM | HIGH

TRIGISTRY

2413 patients (33 centers – 10 countries)

with severe isolated functional tricuspid regurgitation on native valve

and TRI-SCORE available

1217 patients

MEDICAL THERAPY

551 patients

ISOLATED TRICUSPID VALVE SURGERY

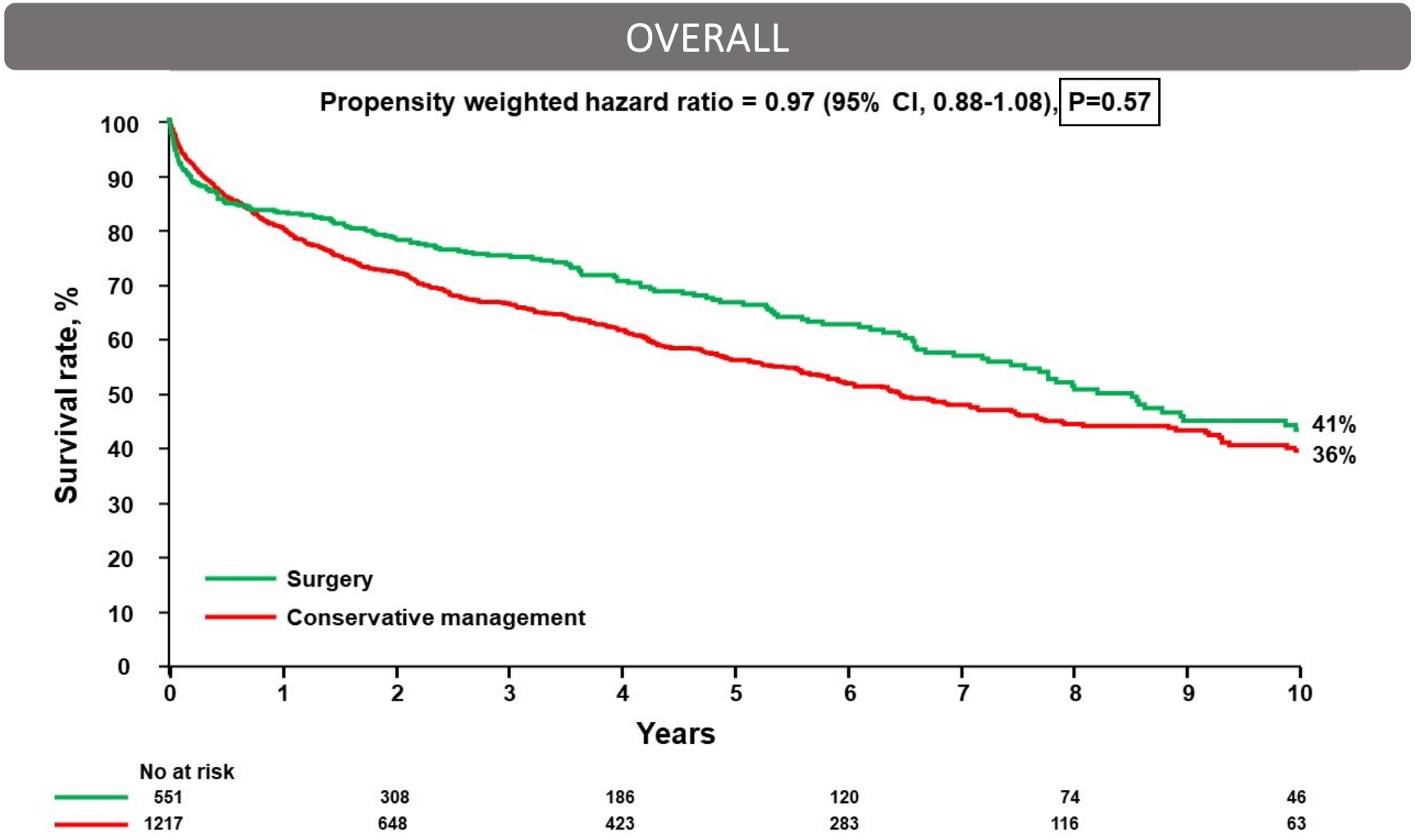
645 patients

TRANSCATHETER VALVE REPAIR

Dreyfus J, Messika-Zeitoun D et al. EHJ 2023

TRIGISTRY: IMPACT OF TREATMENT MODALITY ON SURVIVAL

- **Surgery vs medical therapy**



Dreyfus J, Messika-Zeitoun D et al. EHJ 2024

TRIGISTRY: IMPACT OF TREATMENT MODALITY

➢ **Surgery:**

Low TRI-SCORE (≤3)	Intermediate TRI-SCORE (4-5)	High TRI-SCORE (≥6)
In-hospital mortality: - Surgery=2.7%	**In-hospital mortality**: - Surgery=9.2%	**In-hospital mortality**: - Surgery=16.9%

Dreyfus J, Messika-Zeitoun D et al. EHJ 2024

Can we decrease in-hospital mortality after TV surgery ?

LEvOsimendaN vs. Placebo Before Tricuspid VAlve Surgery in Patients with Right Ventricular Dysfunction (LEONARD)

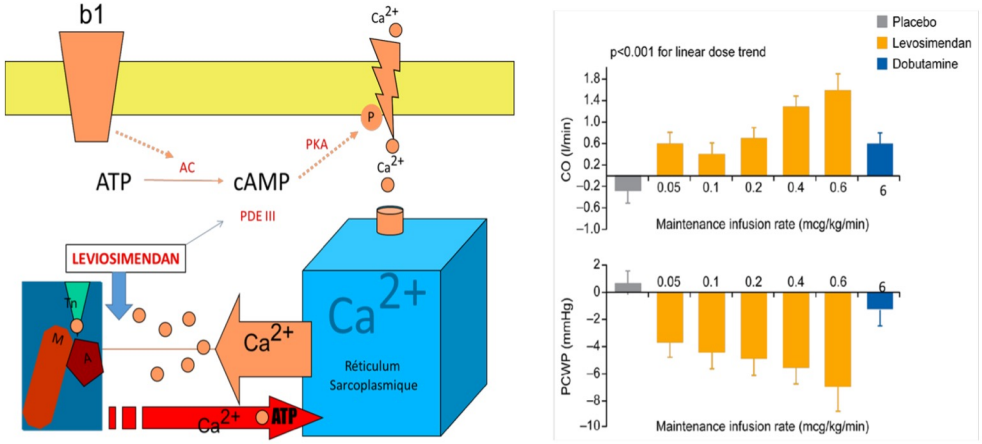


Figure 3: Levosimendan is a calcium sensitizer and potassium channel opener that exerts a long acting inotropic and vasodilatator effects. The inotropic effect of the current dose use (0. 2µg/kg/min) is equivalent to 6µg/kg/min of dobutamine. The main advantage of levosimendan is a prolonged effect over at least one week and the absence of increase in myocardial oxygen consumption.

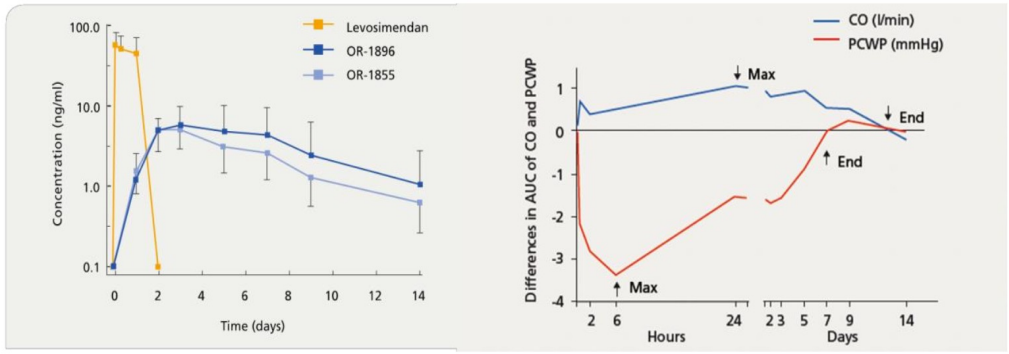
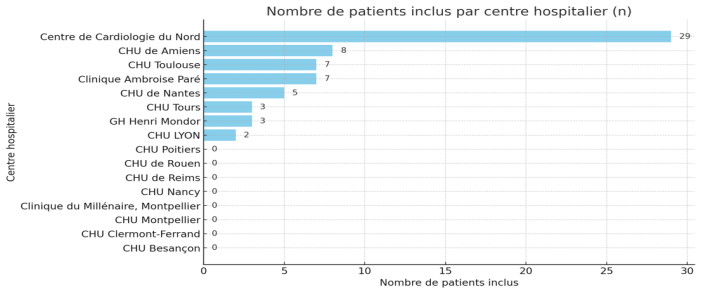


Figure 6: Levosimendan concentration after 0.2µg/kg/min during 24H (left panel) and hemodynamic effects during the first hours and week (right panel)

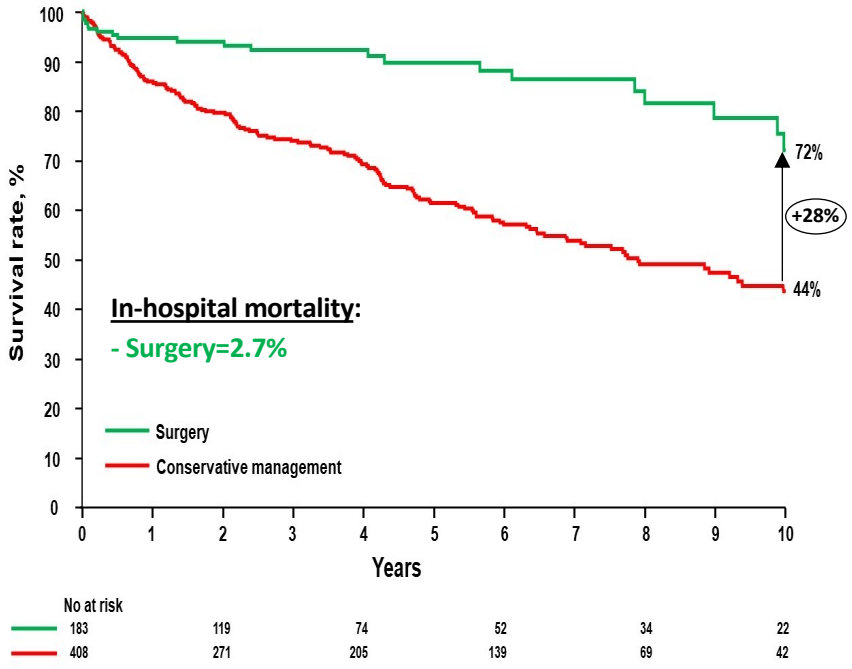


Number of participants included	N=230 (n=115 for each group)
Number of centres	National, multicentre study (n=17)
Duration of the study	- inclusion period: 24 months - participation period : 3 months
Main objective and primary endpoint	To assess the ability of preoperative levosimendan to prevent post-operative low cardiac output in high-risk patients referred to cardiac surgery for correcting functional tricuspid regurgitation. The primary end point is a composite element that includes peri-operative mortality and low cardiac output syndrome at day-90: 1) catecholamine infusion persisting beyond 48 hours after cardiac surgery, 2) the need for circulatory mechanical assist devices in the postoperative period, 3) or the need for renal replacement therapy at any time during intensive care unit stay. If a patient had at least 1 of these criteria, he or she was considered as meeting the primary end point.
Secondary objectives and endpoints	The secondary end points were 1) each component of the primary end point, and 2) the study drug safety defined as refractory hypotension 3) the time it takes to leave the hospital.

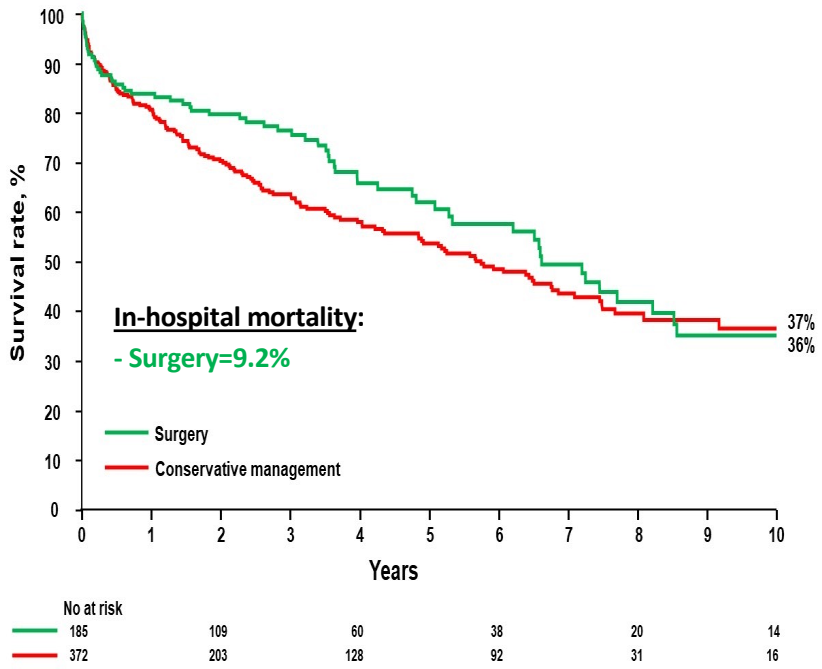
TRIGISTRY: IMPACT OF TREATMENT MODALITY ON SURVIVAL

➢ **Surgery vs medical therapy**

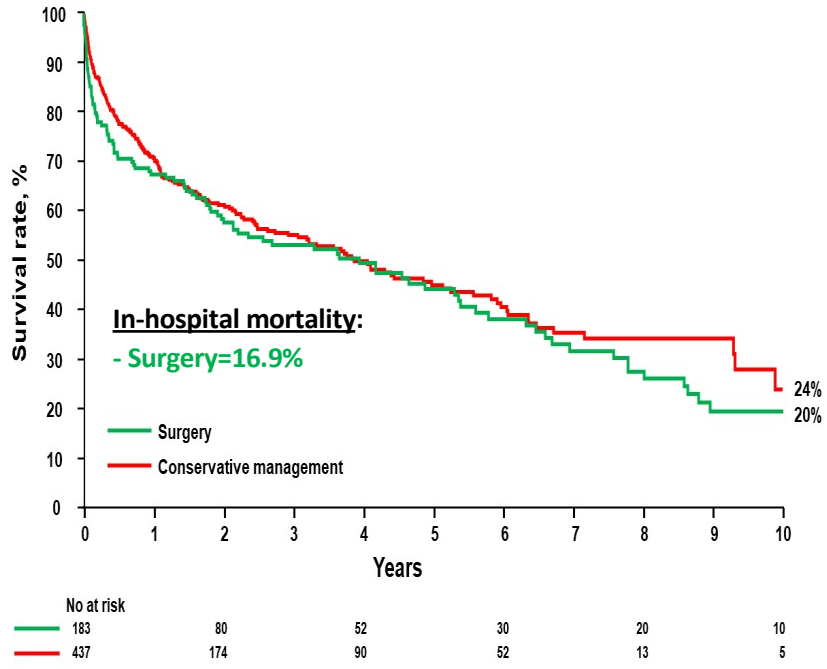
Low TRI-SCORE (≤3)



Intermediate TRI-SCORE (4-5)



High TRI-SCORE (≥6)



Propensity weighted hazard ratio

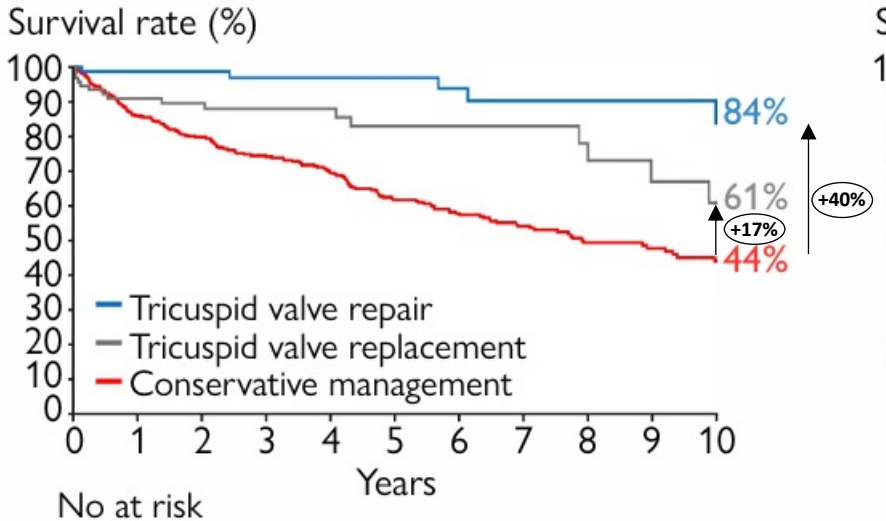
Low TRI-SCORE (≤3)	Intermediate TRI-SCORE (4-5)	High TRI-SCORE (≥6)
0.27 (95% CI, 0.20-0.37), P<0.0001	1.17 (95% CI, 0.98-1.40), P=0.09	1.06 (95% CI, 0.91-1.25), P=0.45

Dreyfus J, Messika-Zeitoun D et al. EHJ 2024

TRIGISTRY: IMPACT OF TREATMENT MODALITY ON SURVIVAL

➢ **Surgical repair vs surgical replacement vs medical therapy**

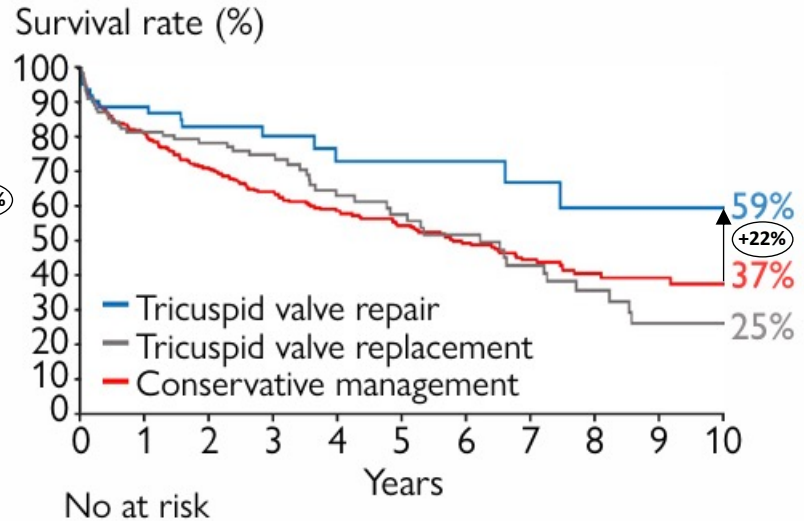
Low TRI-SCORE (≤ 3)



No at risk

83	62	38	27	19	13
100	57	36	24	15	9
408	271	205	139	69	42

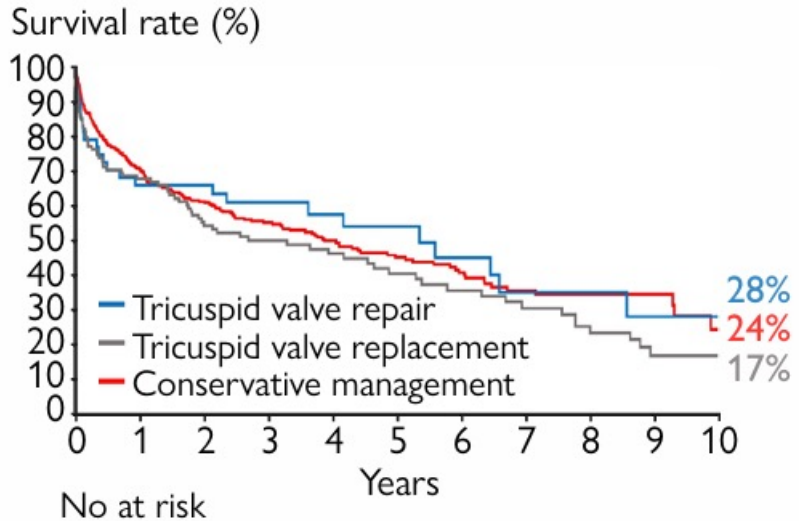
Intermediate TRI-SCORE (4–5)



No at risk

62	38	20	14	8	6
123	71	40	24	12	8
372	203	128	92	31	16

High TRI-SCORE (≥ 6)



No at risk

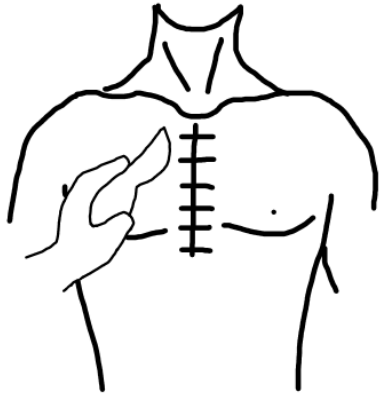
55	27	17	9	6	4
128	53	35	21	14	6
437	174	90	52	13	5

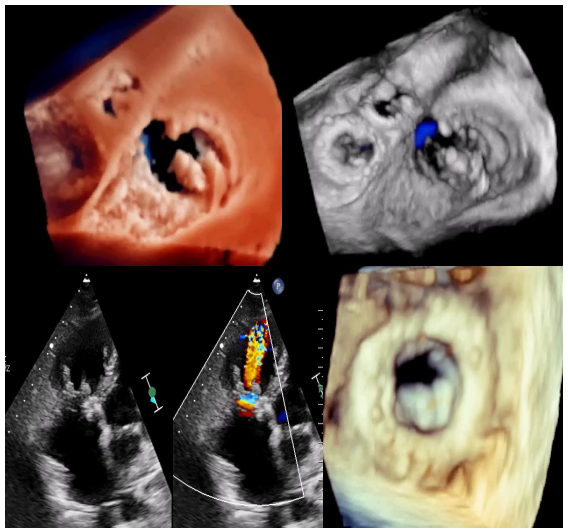
Propensity weighted hazard ratio

	Low TRI-SCORE (≤ 3)	Intermediate TRI-SCORE (4–5)	High TRI-SCORE (≥ 6)
Repair vs conservative management	0.11 (95% CI, 0.06–0.19), P < 0.0001	0.49 (95% CI, 0.35–0.68), P < 0.0001	0.86 (95% CI, 0.68–1.08), P = 0.20
Replacement vs conservative management	0.65 (95% CI, 0.47–0.90), P = 0.009	1.43 (95% CI, 1.18–1.72), P = 0.0002	1.58 (95% CI, 1.35–1.86), P < 0.0001
Repair vs replacement	0.17 (95% CI, 0.09–0.32), P < 0.0001	0.34 (95% CI, 0.24–0.48), P < 0.0001	0.54 (95% CI, 0.43–0.68), P < 0.0001

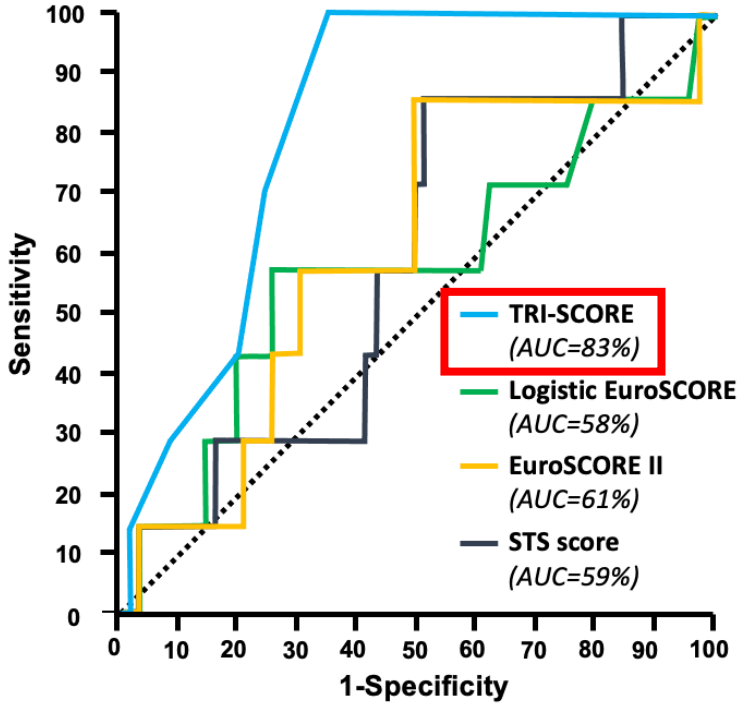
Dreyfus J, Messika-Zeitoun D et al. EHJ 2024

TRI-SCORE and redo ITVS





Characteristics	In-hospital death (N=7)	Discharged alive (N=63)	P-value
Logistic EuroSCORE	14.9 ± 12.5 (15.7 [3.3-23.7])	11.2 ± 12.7 (6.6 [3.3-16.0])	0.50
EuroSCORE II	6.0 ± 3.7 (5.8 [4.1-8.0])	5.1 ± 3.5 (4.0 [2.5-6.1])	0.35
STS Predicted Risk of Mortality	4.8 ± 4.1 (3.2 [2.5-7.0])	4.1 ± 3.8 (2.6 [1.4-5.6])	0.43
TRI-SCORE	6.6 ± 1.5 (6 [5-8])	3.7 ± 2.5 (4 [2-6])	**0.005**



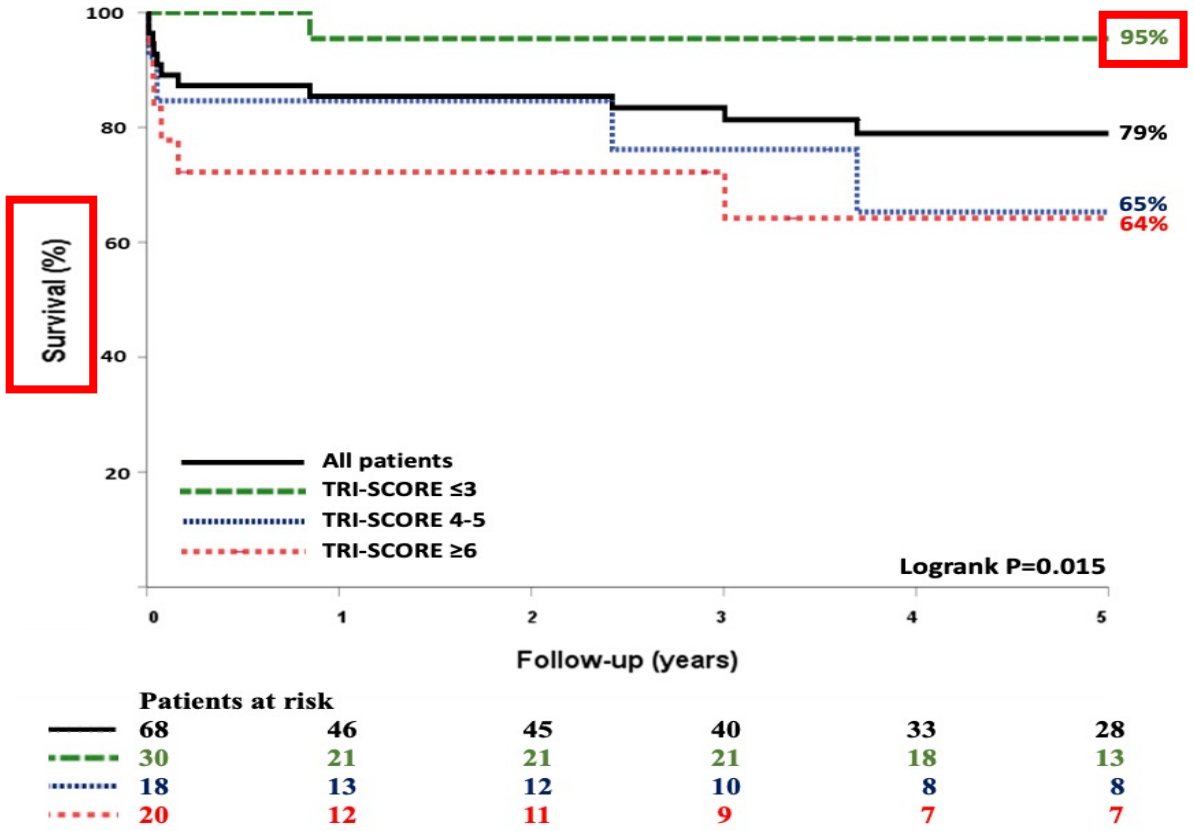
TRI-SCORE	In-hospital Mortality	
	Observed	Predicted
0-3	0 (0%)	1 (3%)
4-5	2 (11%)	2 (11%)
≥6	5 (25%)	8 (38%)

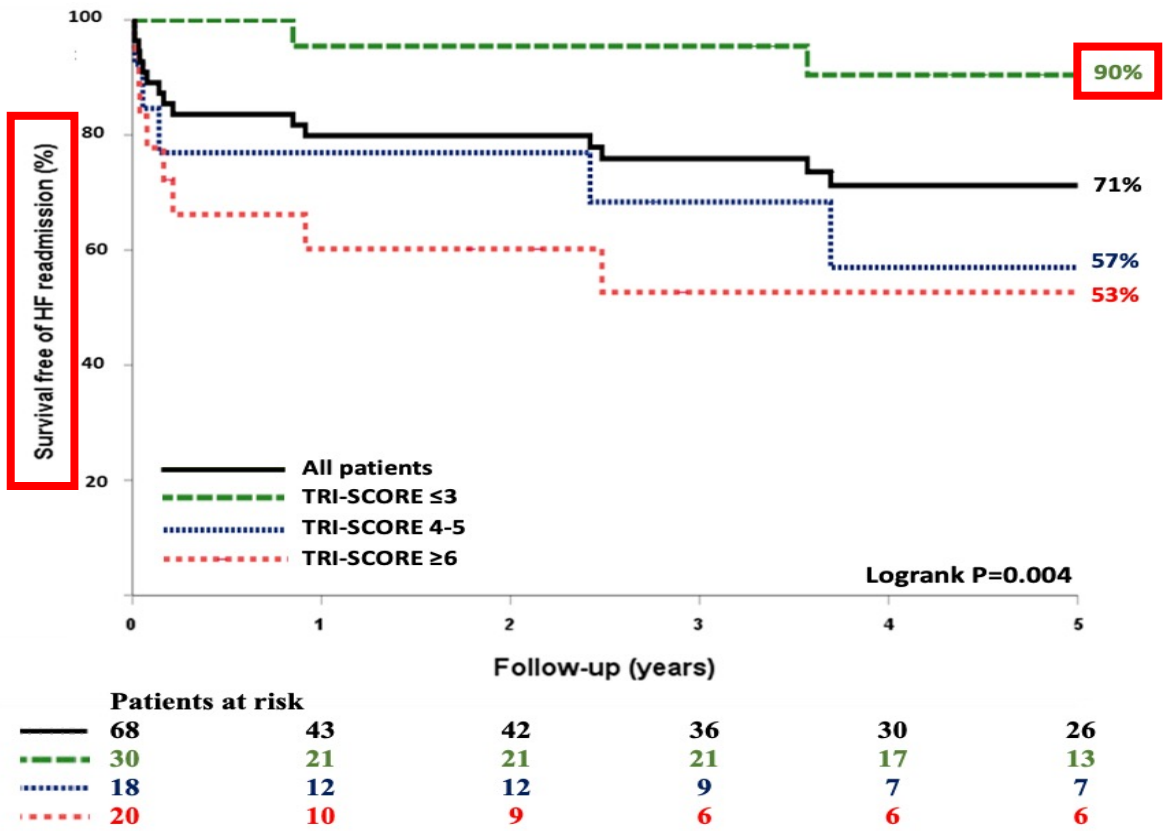
TRI-SCORE	Observed	
	In-Hospital mortality	Major post-operative complications*
0-3	0 (0%)	3 (10%)
4-5	2 (11%)	8 (44%)
≥6	5 (25%)	13 (65%)

***Death, shock, tamponade, acute renal failure requiring dialysis or prolonged (>72 hours) mechanical ventilation**

Dreyfus J, Messika-Zeitoun D et al. Heart 2023

TRI-SCORE and redo ITVS





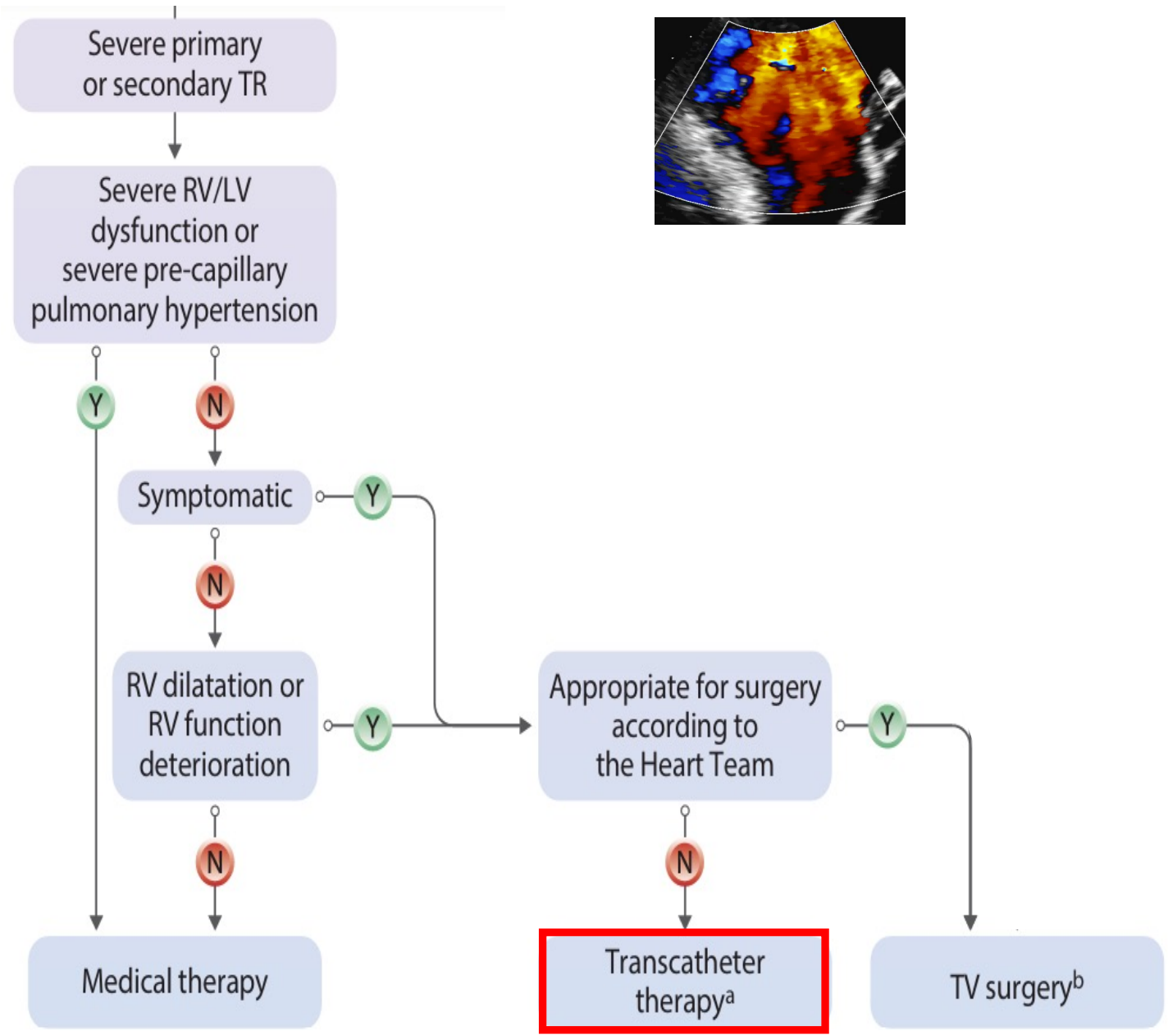
Dreyfus J, Messika-Zeitoun D et al. Heart 2023

Recommendations for intervention when severe TR without left-sided VHD

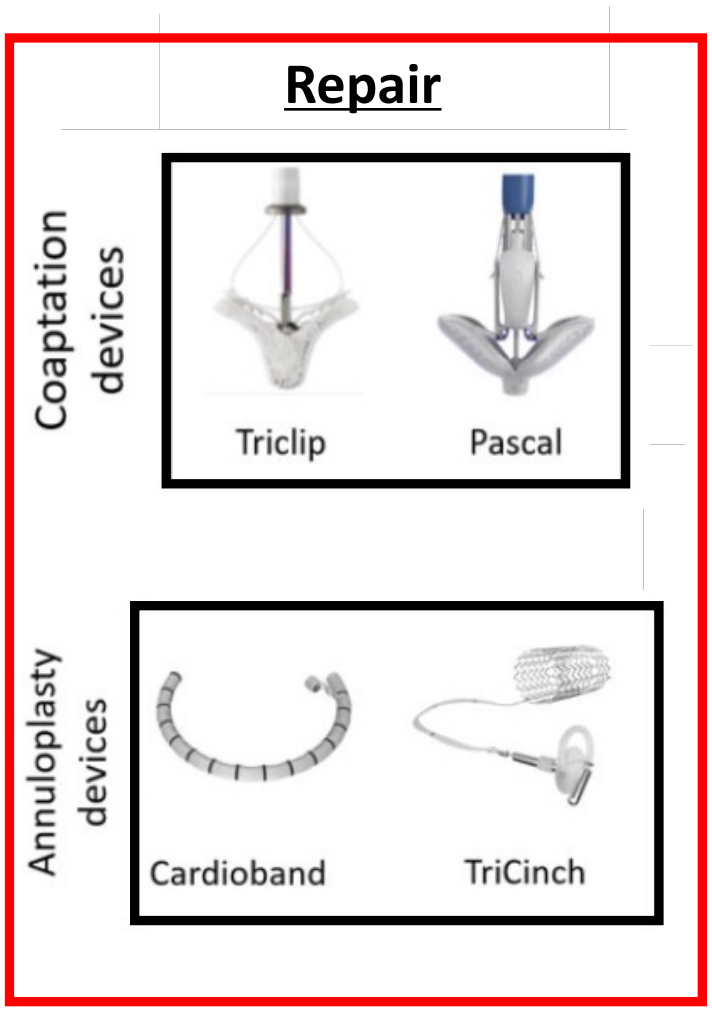
Patients with severe tricuspid regurgitation without left-sided valvular heart disease requiring surgery

TRANSCATHETER:

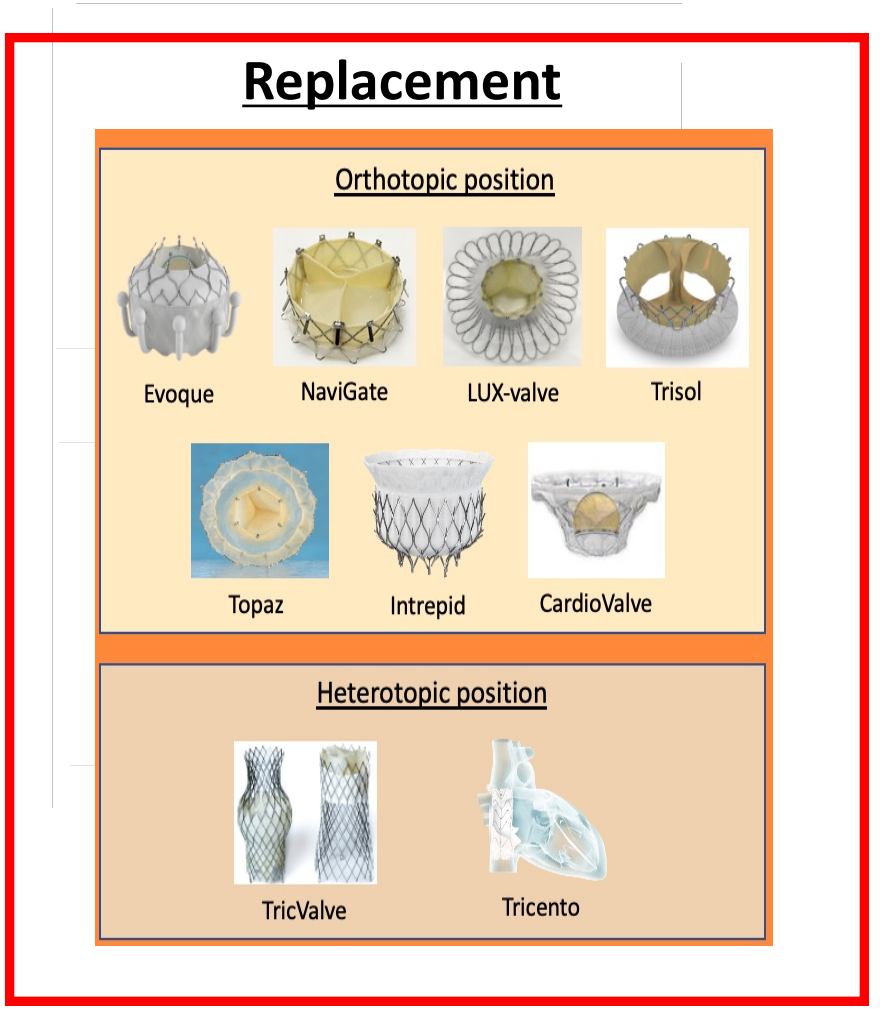
Transcatheter TV treatment should be considered to improve quality of life and RV remodelling in high-risk patients with symptomatic severe TR despite optimal medical therapy in the absence of severe RV dysfunction or pre-capillary PH.[713,733,735,738,748–751]	IIa	A



Transcatheter treatment for TR



Adapted from Hell MM et al. EHJ CVI 2020



Adapted from Dreyfus J et al. Prog CardioVasc Med. 2022

Patient selection for TV edge-to-edge repair

Transcatheter treatment for tricuspid valve disease

State of the Art by EuroIntervention

Fabien Praz[1]*, MD; Denisa Muraru[2], MD; Felix Kreidel[3], MD; Philipp Lurz[4], MD; Rebecca T. Hahn[5], MD; Victoria Delgado[6], MD; Michele Senni[7], MD; Ralph Stephan von Bardeleben[3], MD; Georg Nickenig[8], MD; Jörg Hausleiter[9], MD; Antonio Mangieri[10], MD; Jose L. Zamorano[11], MD; Bernard Prendergast[12], MD; Francesco Maisano[13], MD

Table 3. Anatomical criteria for device selection.

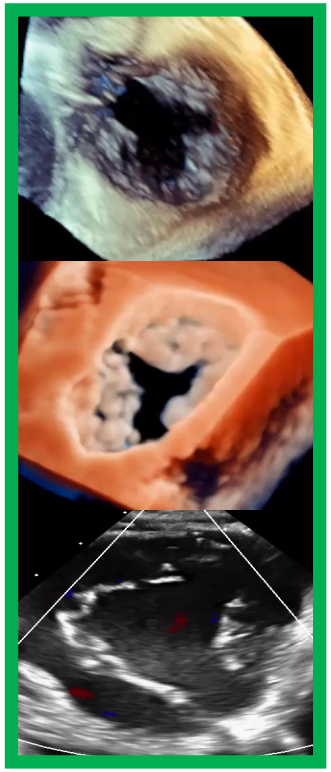
Strategy	Favourable anatomy	Feasible anatomy	Unfavourable anatomy
Leaflet approximation	Small septolateral gap ≤7 mm[10] Anteroseptal jet location Confined prolapse or flail Trileaflet morphology	Septolateral coaptation gap >7 but ≤8.5 mm[65] Posteroseptal jet location Non-trileaflet morphology Incidental CIED RV lead (i.e., without leaflet impingement)	Large septolateral coaptation gap >8.5 mm[65] Leaflet thickening/shortening (rheumatic, carcinoid)/perforation Dense chordae with marked leaflet tethering Anteroposterior jet location Poor echocardiographic leaflet visualisation CIED RV lead leaflet impingement Unfavourable device angle of approach

Praz F et al. Eurointervention 2021

Patient selection for TV edge-to-edge repair

<u>Predictors of ≤Moderate TR following T-TEER</u>:

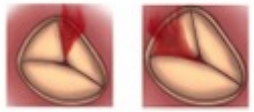
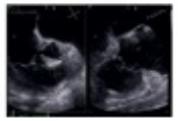
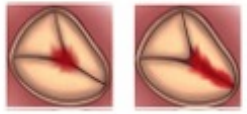
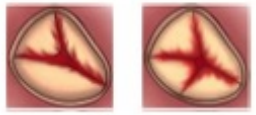
- **Septo-lateral Coaptation Gap ≤7mm** (avoid coaptation defect >10-15 mm)
- **Leaflet Morphology (≤3)** with **oval/linear vena contracta**
- **Location of jet (central, anteroseptal,** avoid large AP gap)
- **TR severity (<torrential**, avoid EROA of >1.5 cm2 or VCA >11 cm)
- **Chordal density modest**
- **No CIED-induced TR**
- **Tenting area ≤1.9 cm2**
- **Low RA Volume**



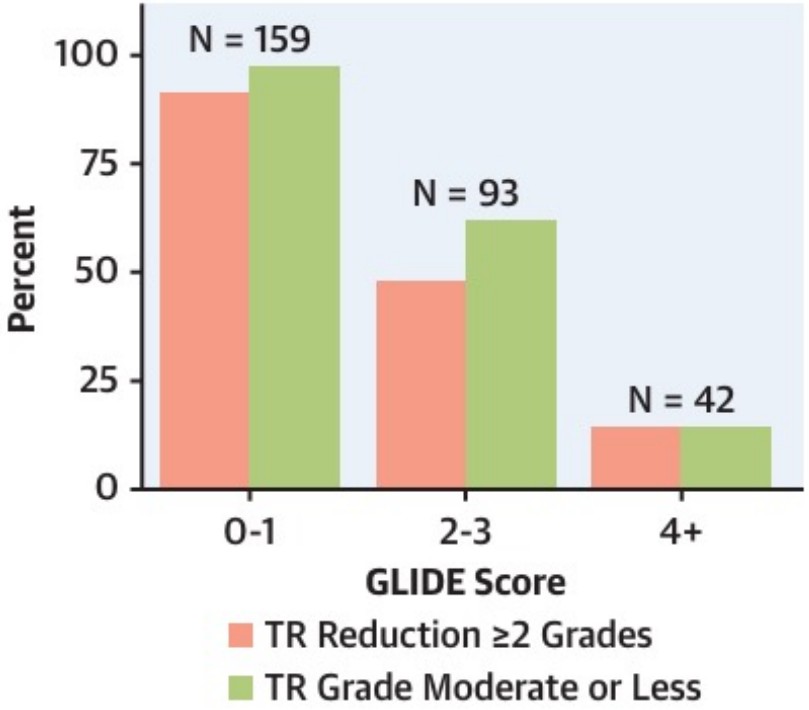
Hahn R, … Dreyfus J et al. JACC Imaging 2025

Patient selection for TV edge-to-edge repair: GLIDE score

The GLIDE Scoring System

Parameters	Straightforward (0 points)	Complex (1 point)
Septolateral Gap	0-5 mm 	≥6 mm 
Predominant Jet Location	Anteroseptal/ Central 	Posteroseptal/ Anteroposterior/Diffuse 
Image Quality	Good 	Limited 
Chordal Structure Density	Modest 	High 
En-Face TR Jet Morphology	Oval/Linear 	Star-Shaped 

Procedural Success in Each GLIDE Score Group



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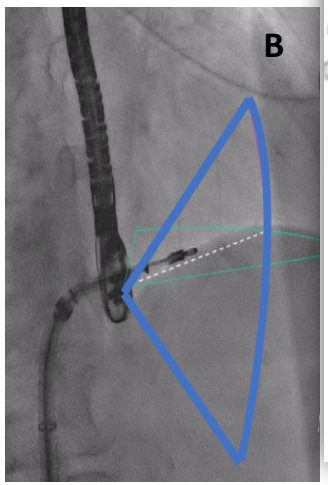
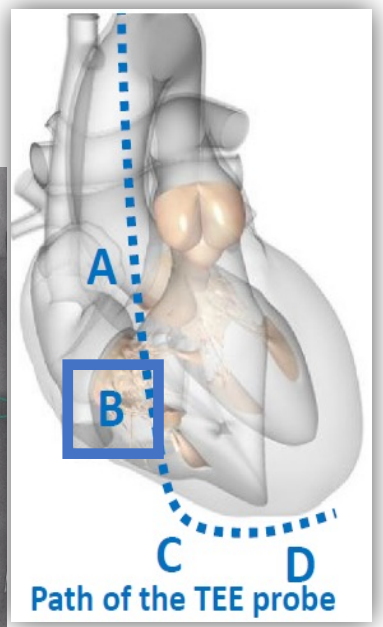
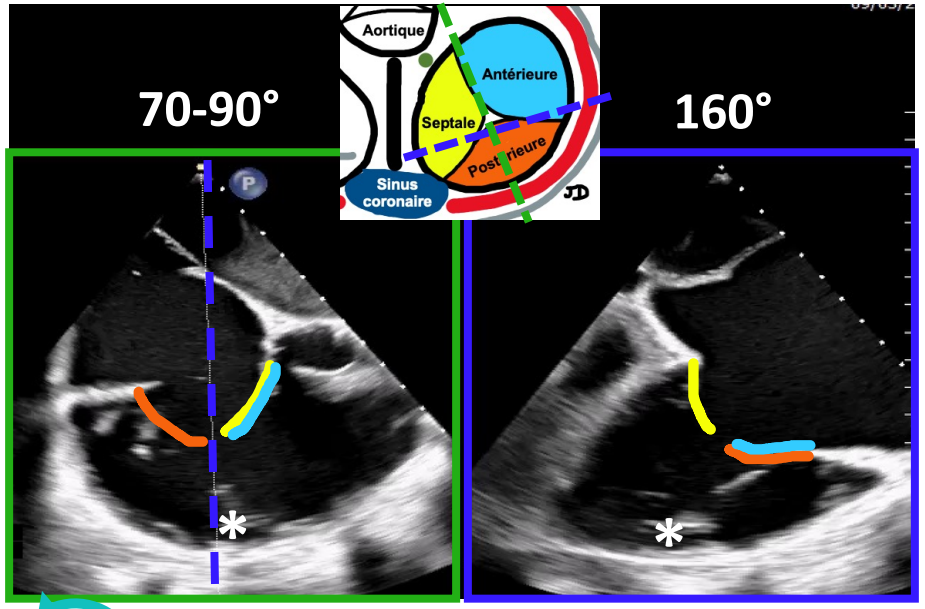
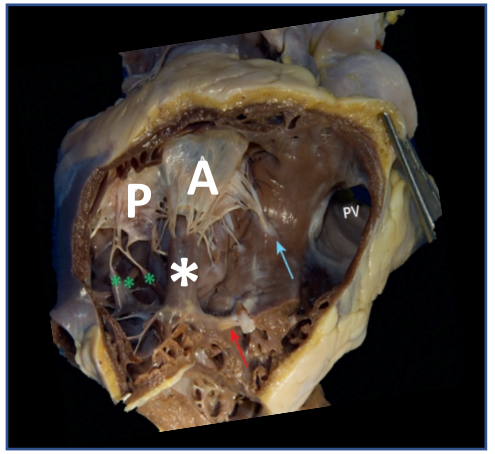
TEE: mid/distal oesophageal views, X-plane and 3D









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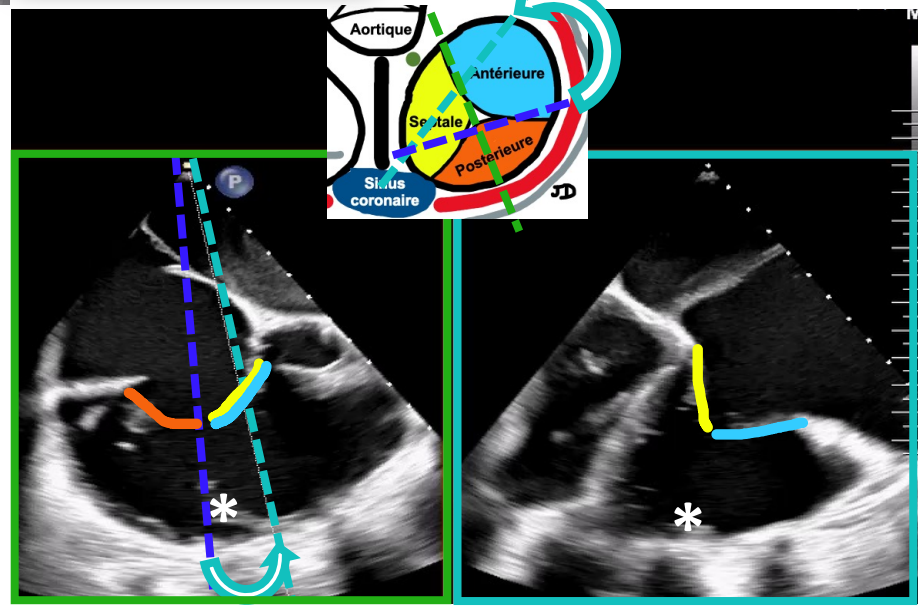
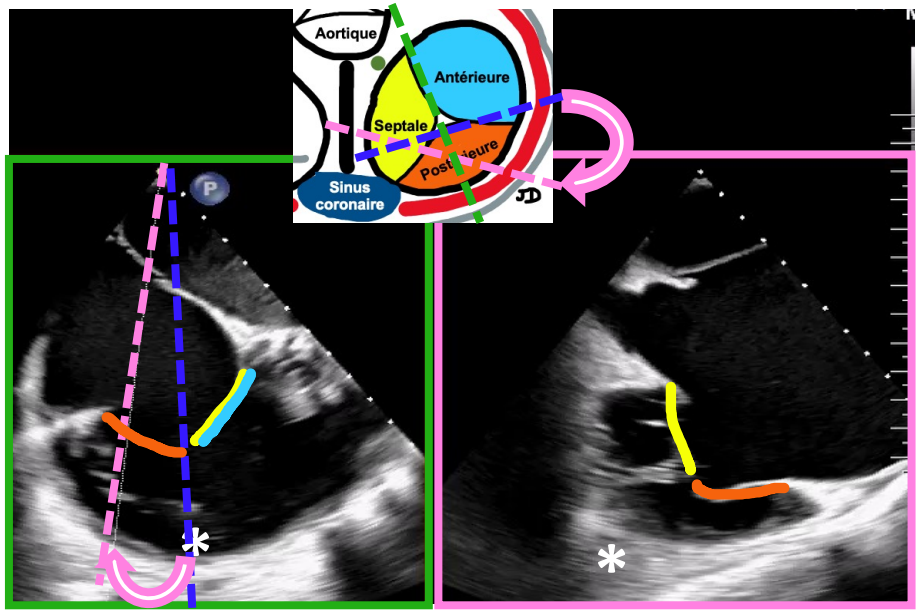
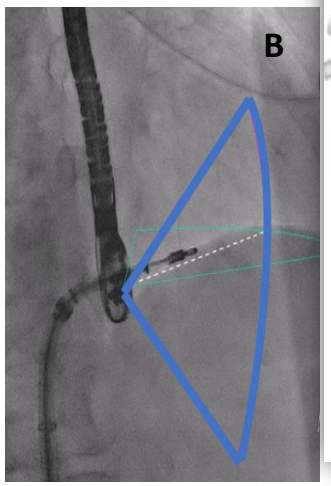
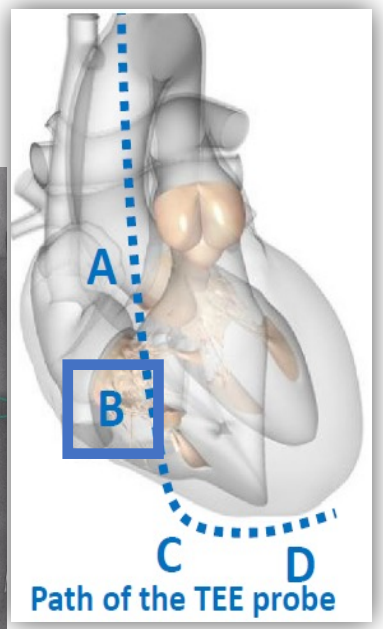
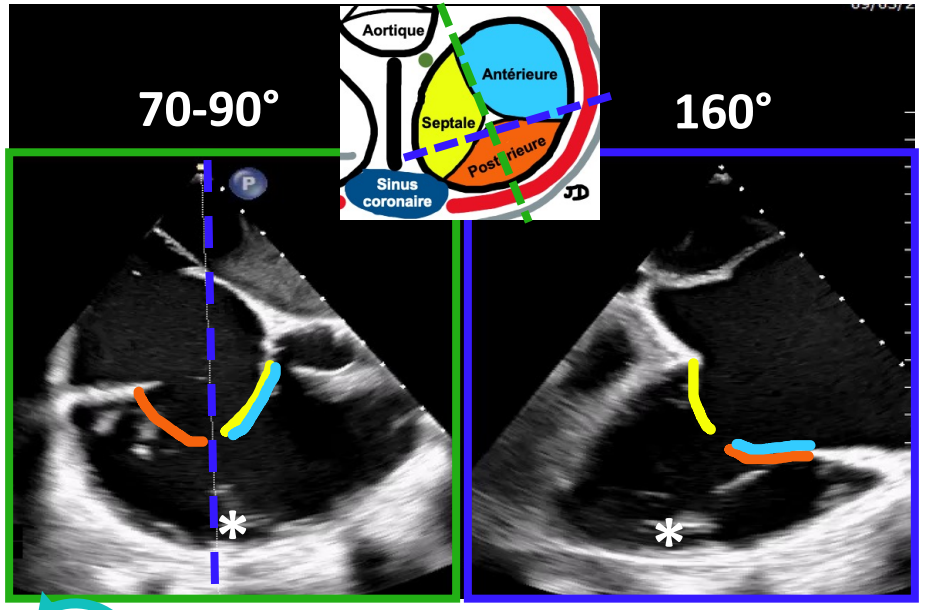


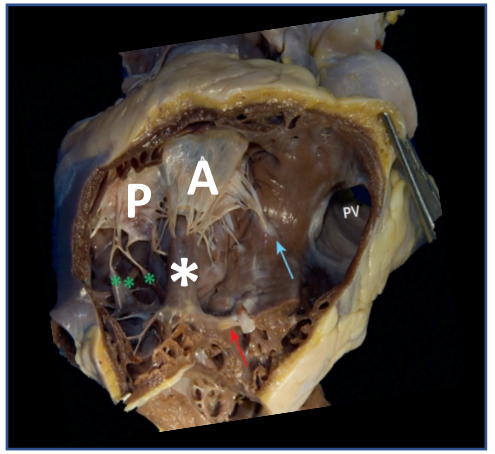


TEE: mid/distal oesophageal views, X-plane and 3D

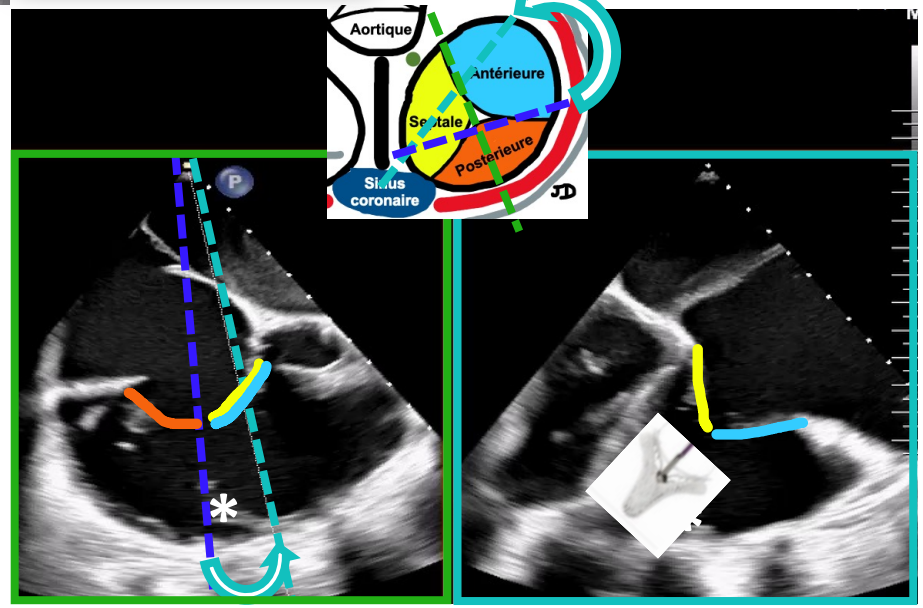


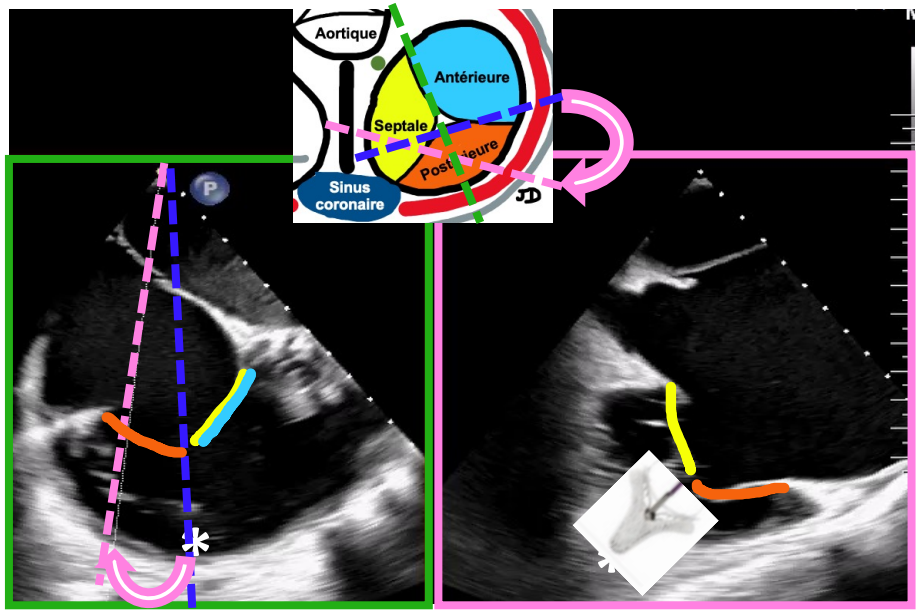




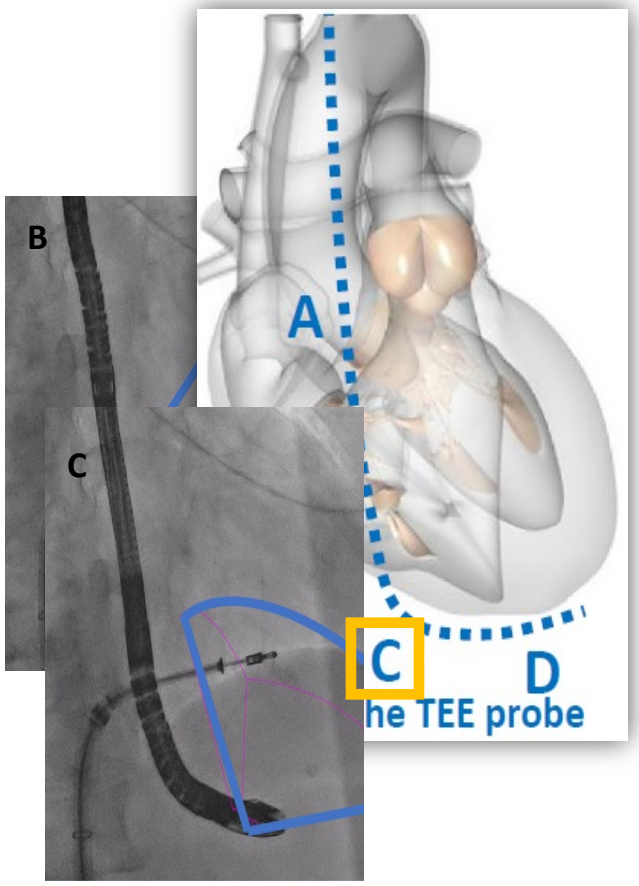


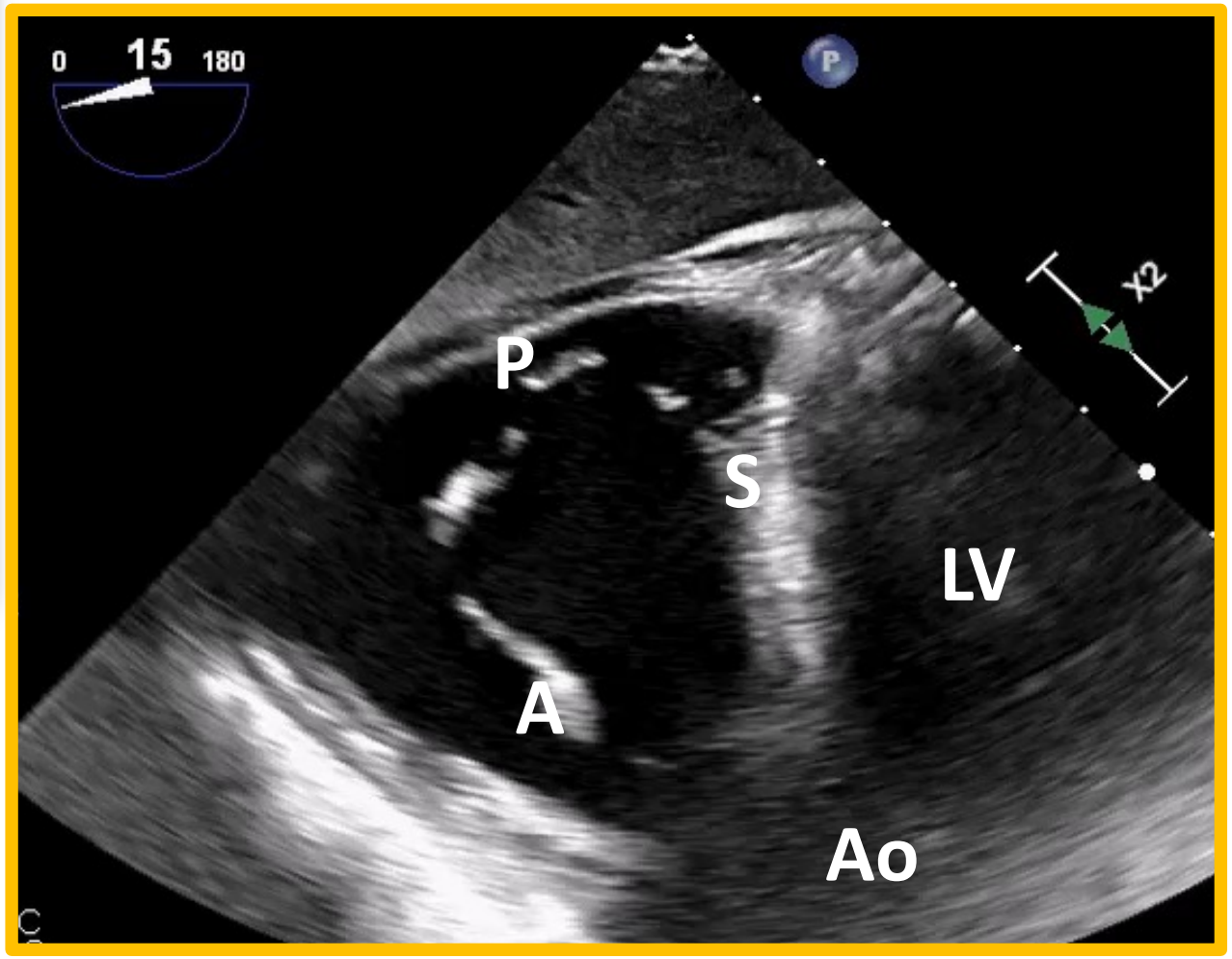
Dahou A et al. JACC Imaging 2019



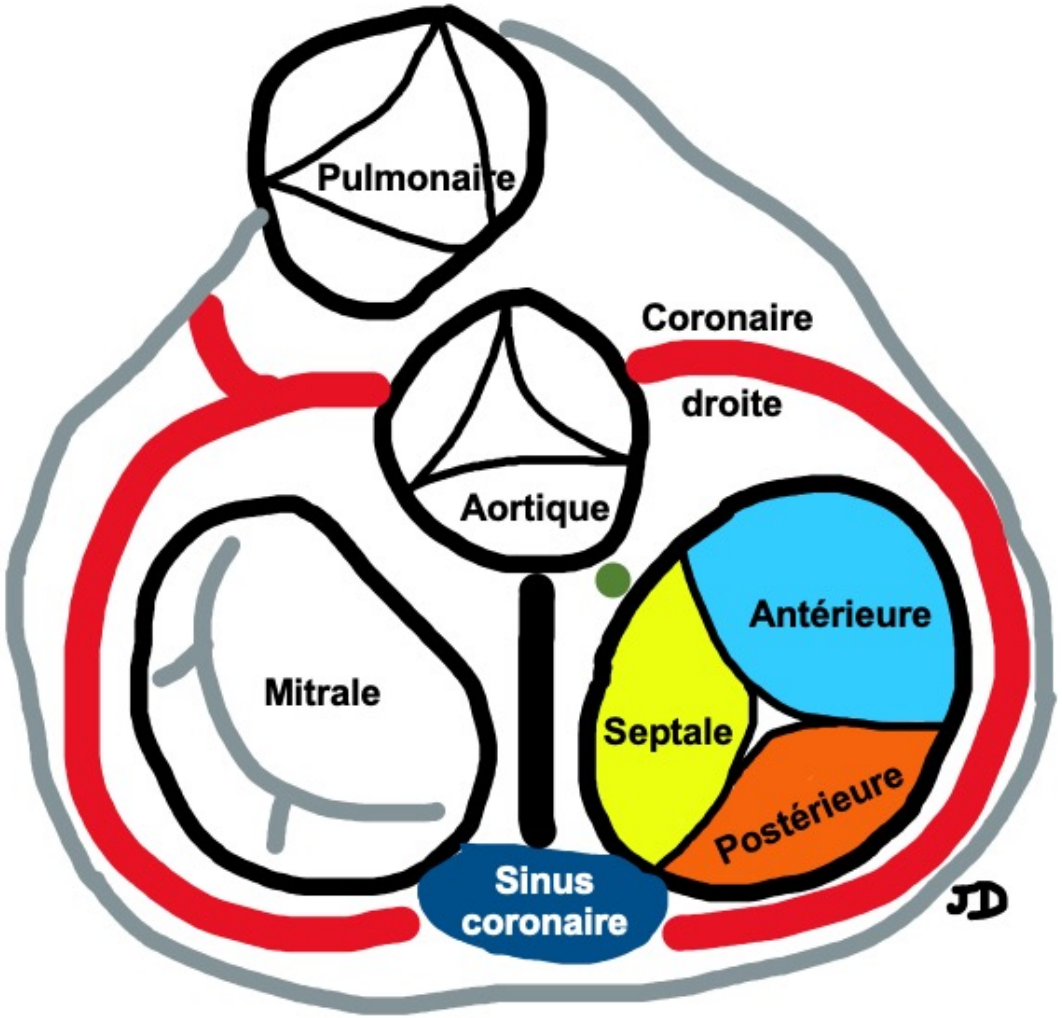


TEE: transgastric view





TEE: 3D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Coronaire
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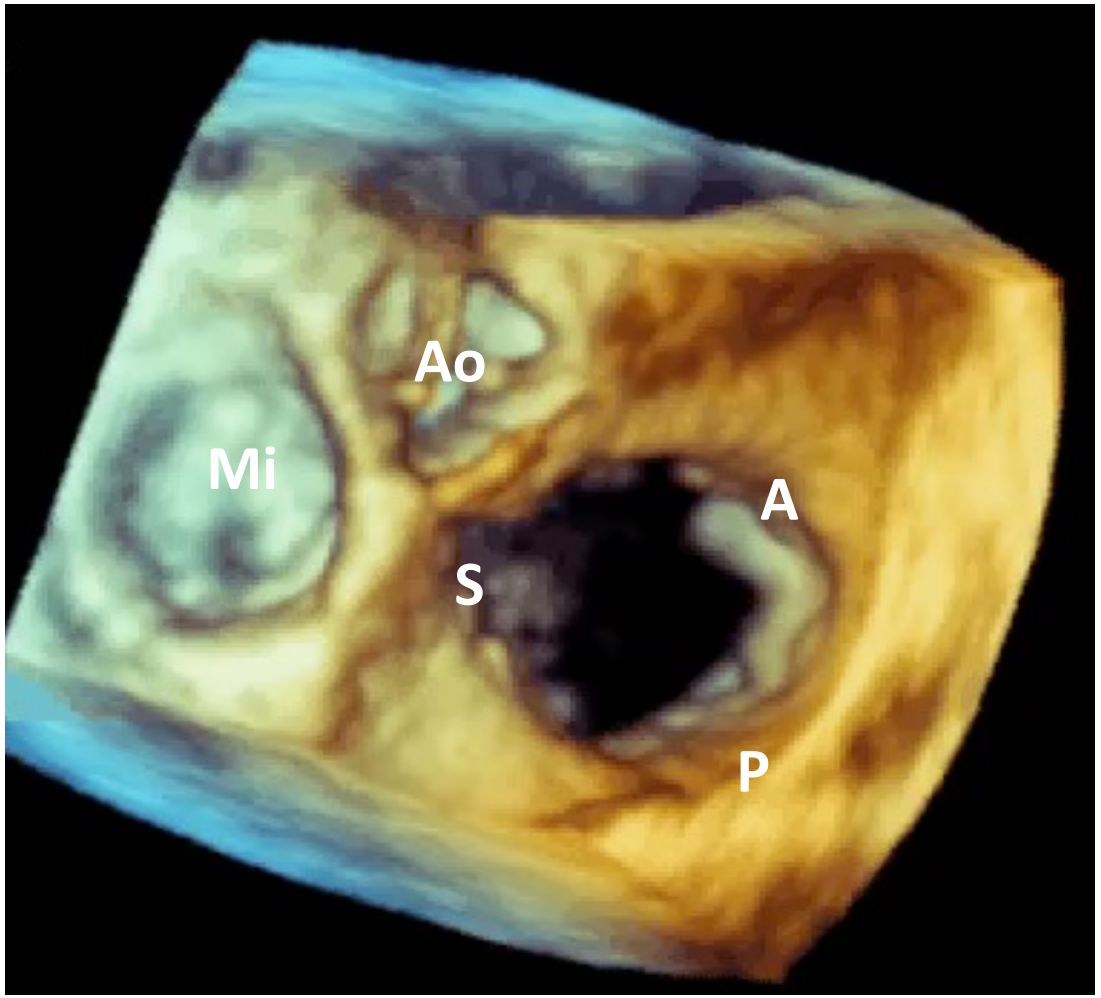
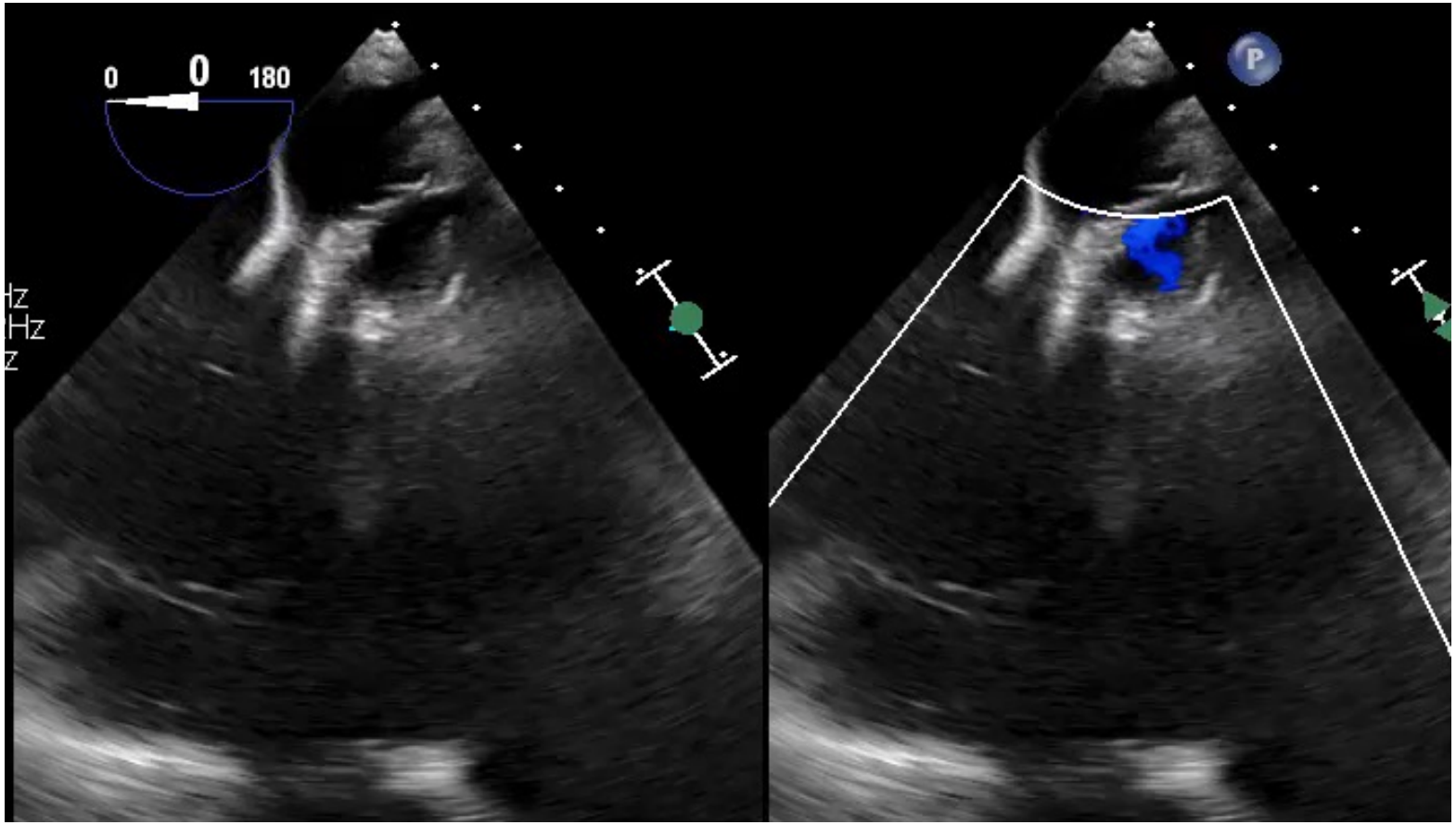
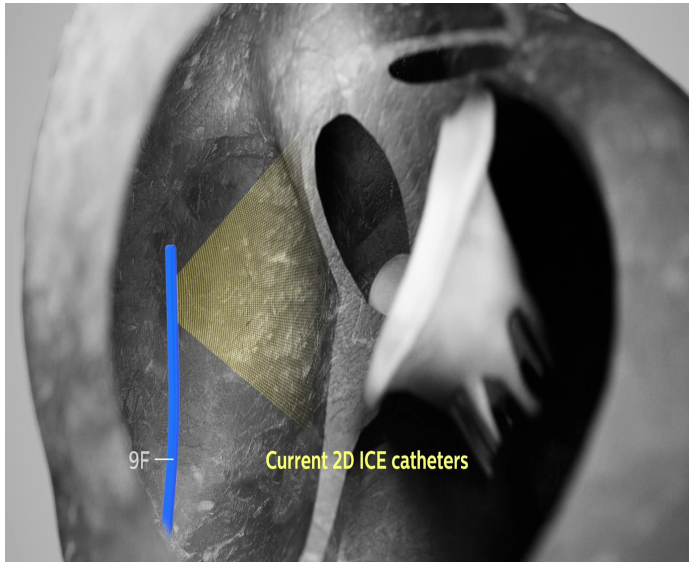
Aortique
Mitrale
Antérieure
Septale
Postérieure
Sinus
coronaire
JD

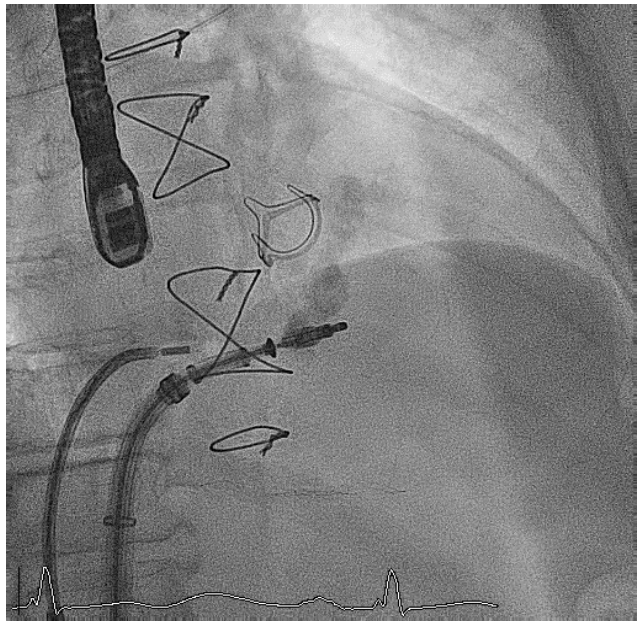

Ao
Mi
A
S
P

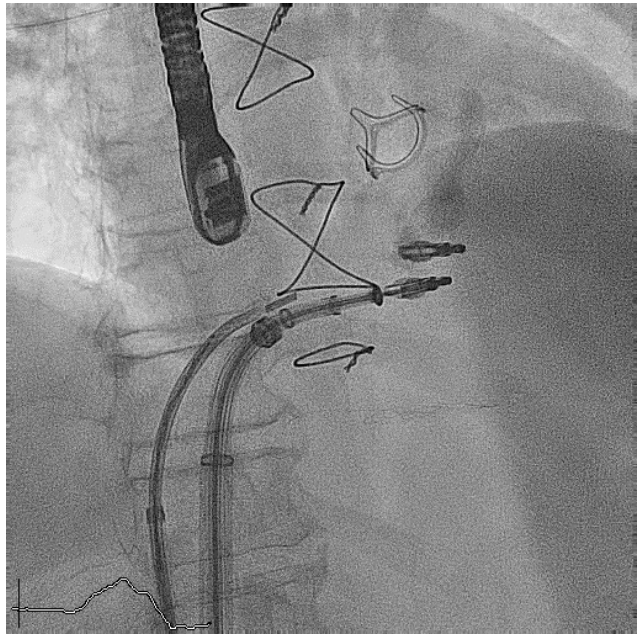
TEE views

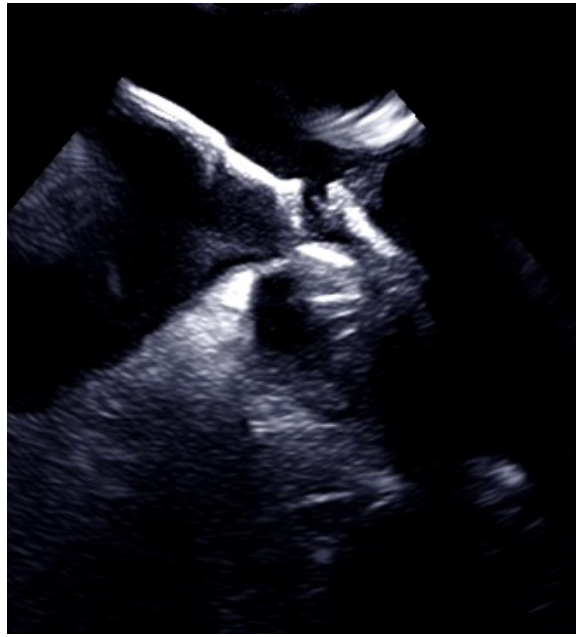


Intra-Cardiac Echocardiography (ICE)

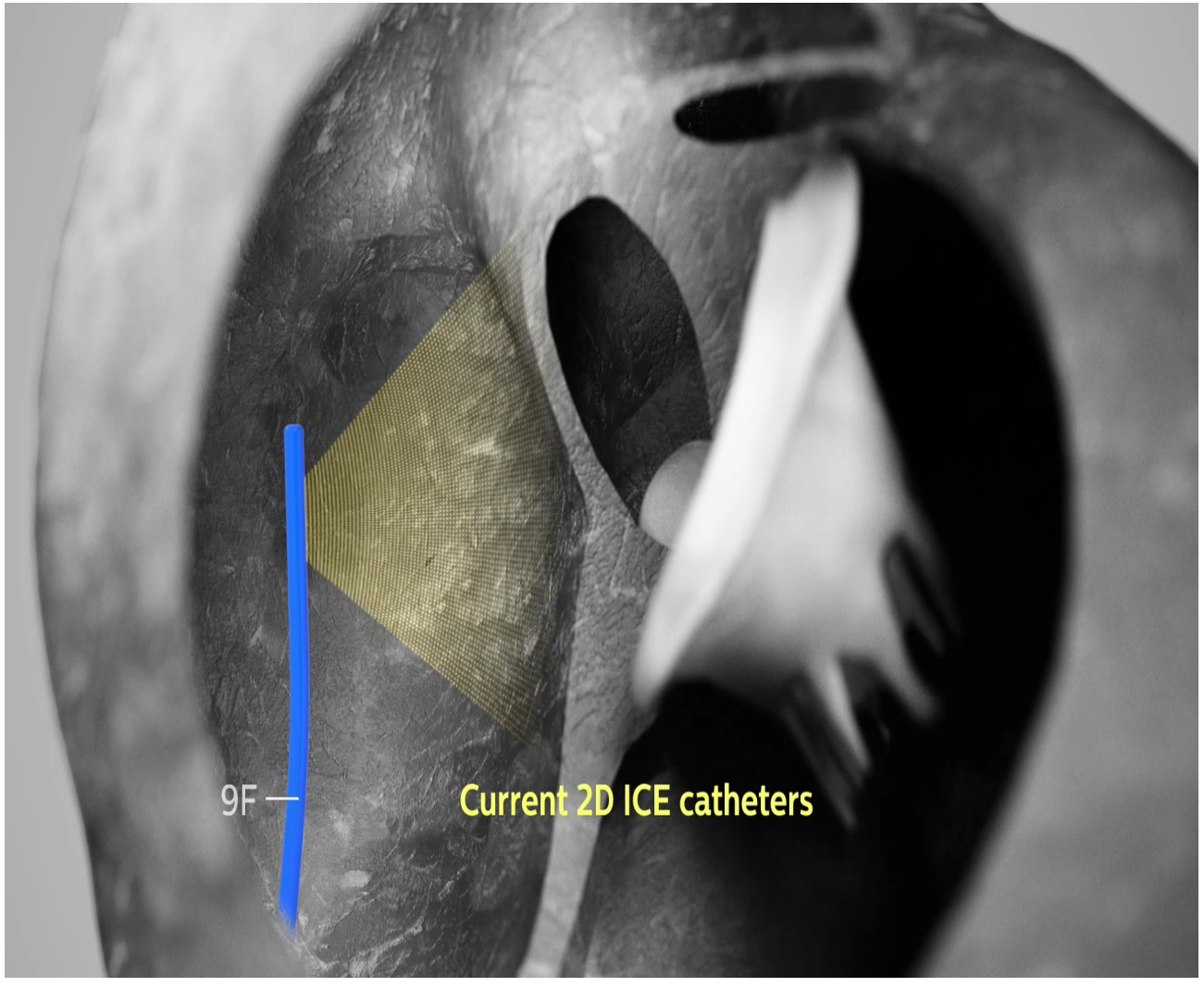


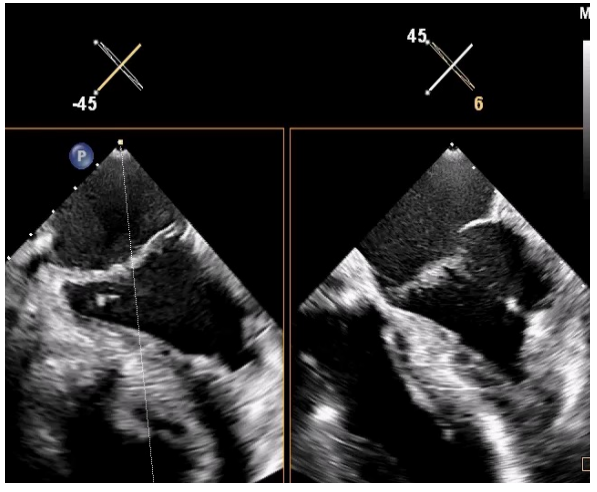


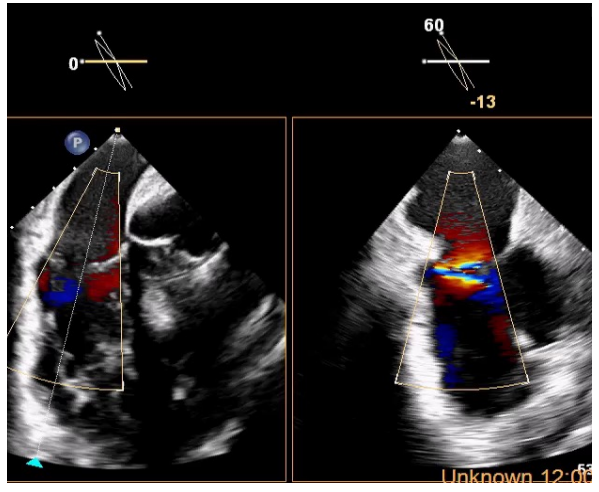


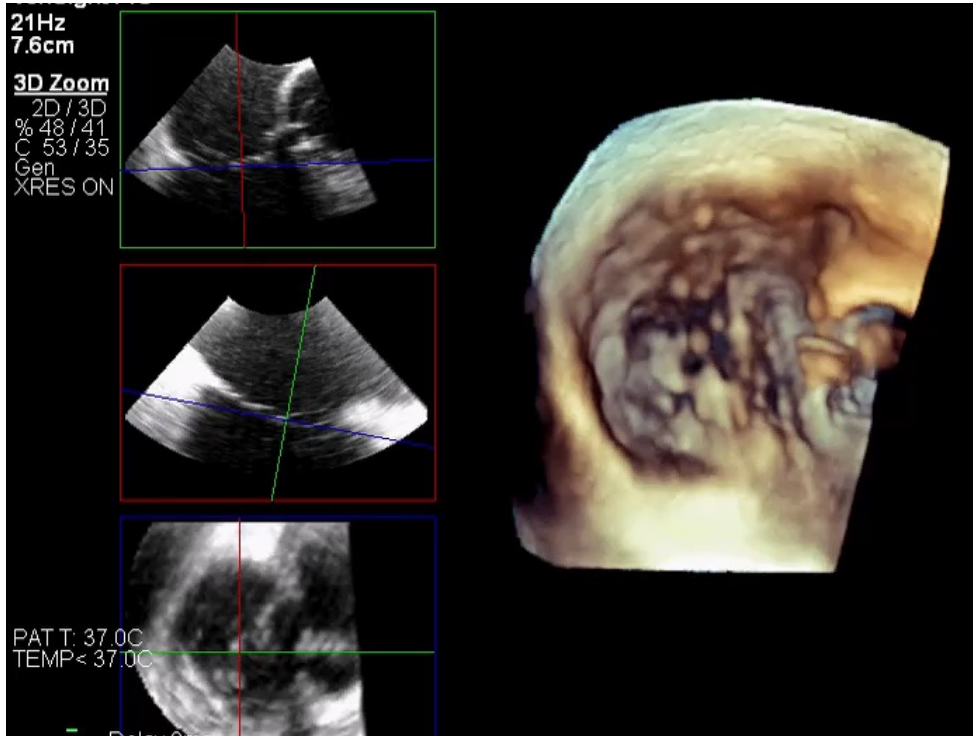


Intra-Cardiac Echocardiography (4D-ICE)



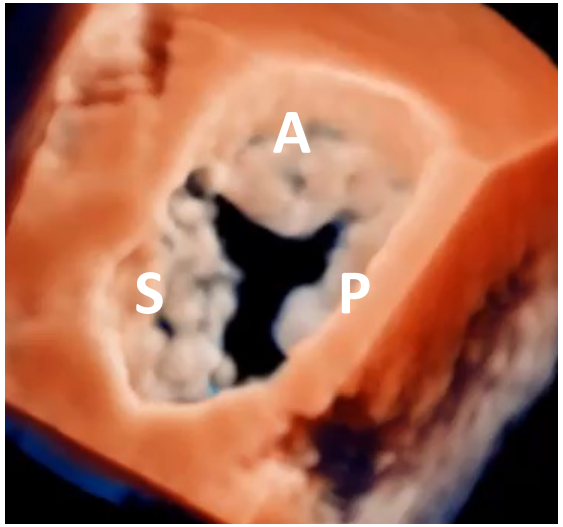


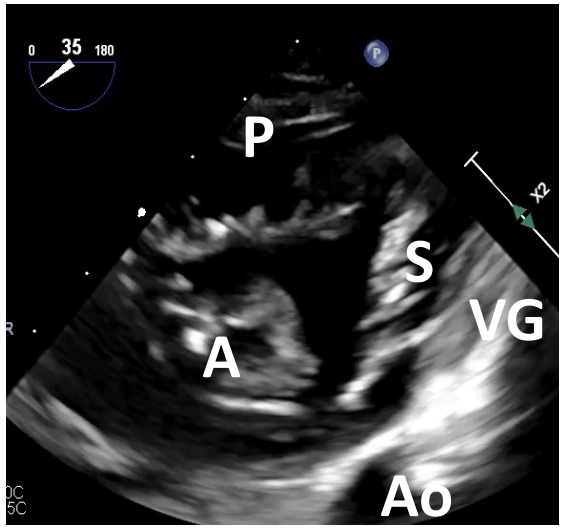


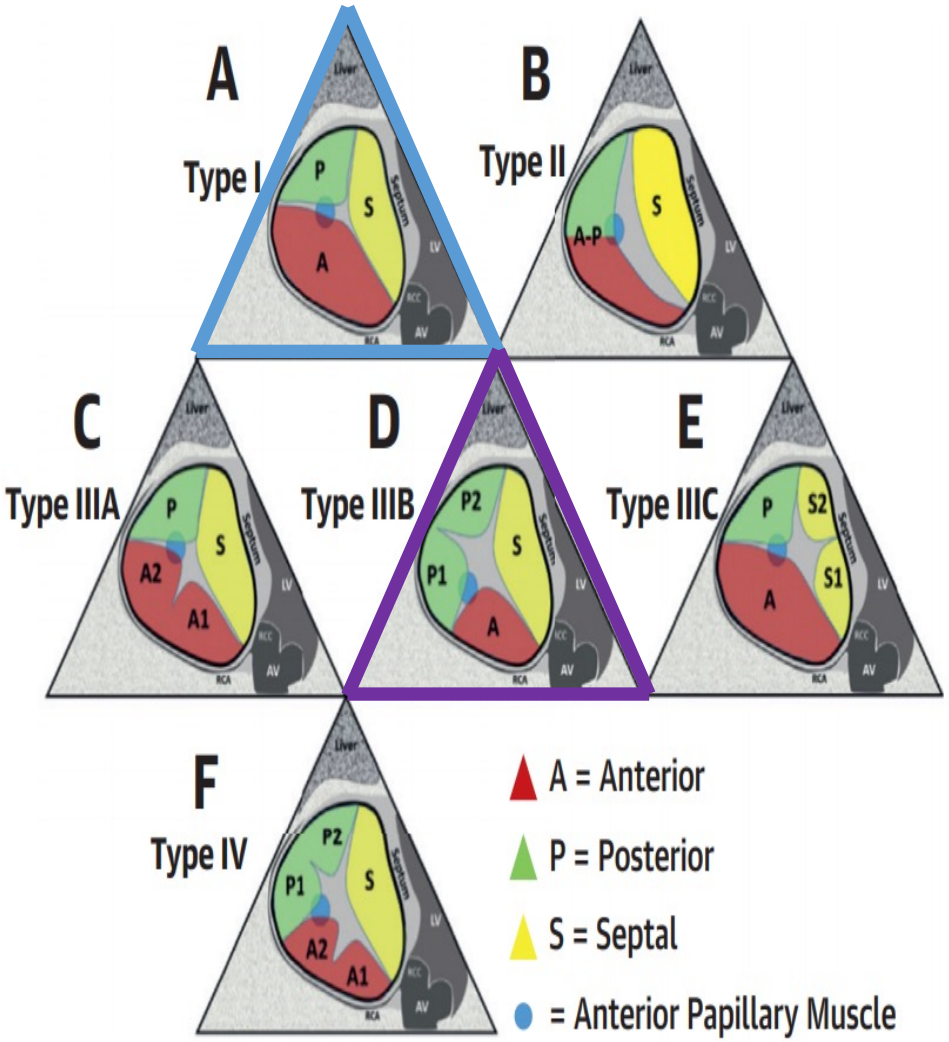


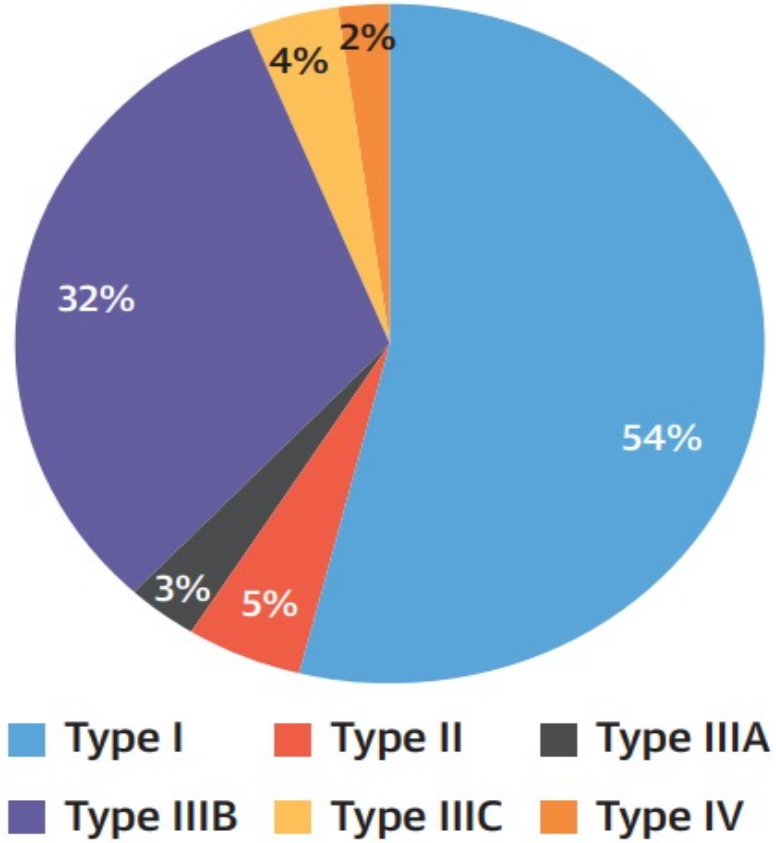
Courtesy Philips

Nomenclature of TV leaflets









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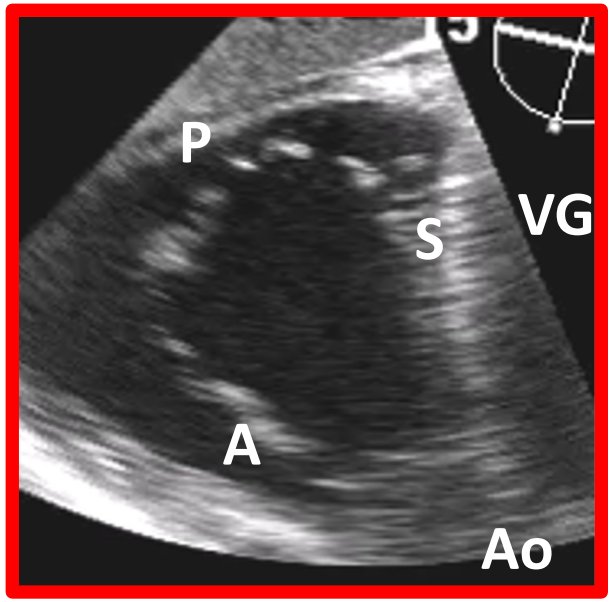
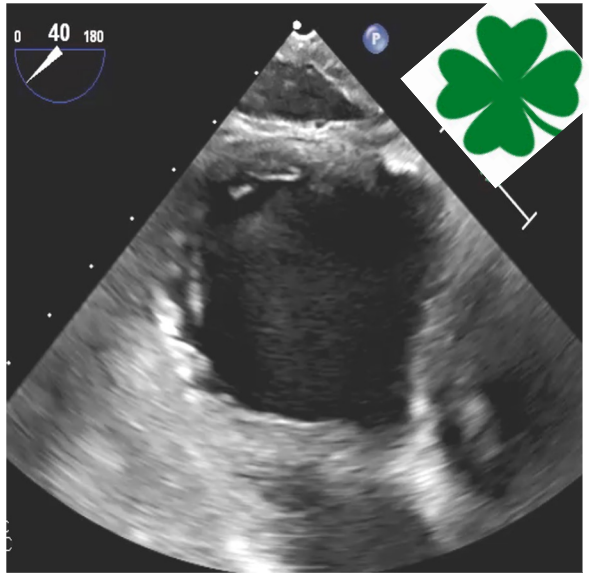
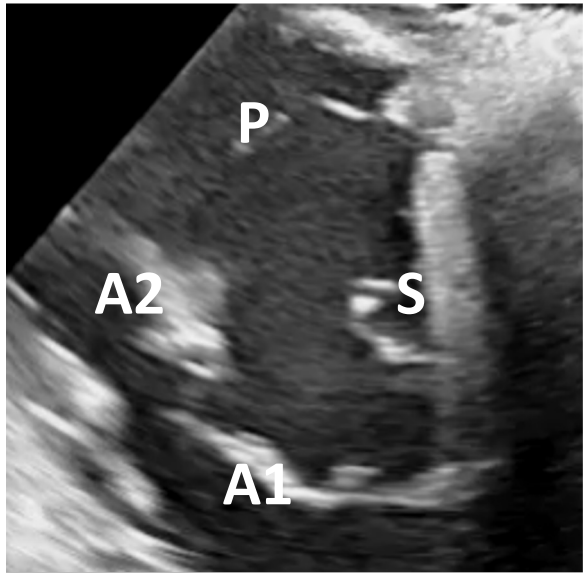
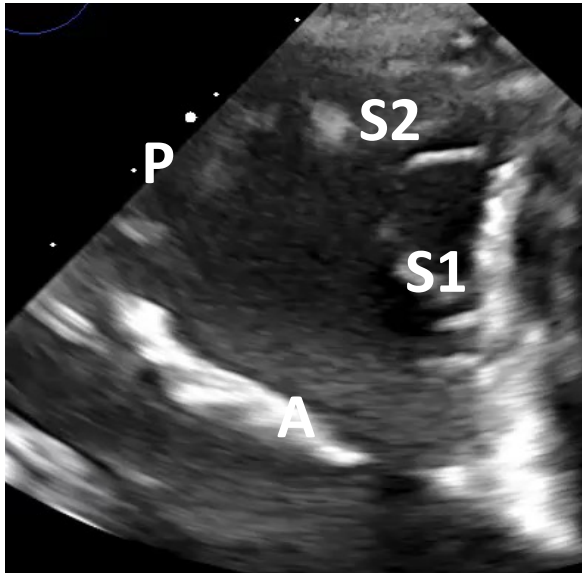
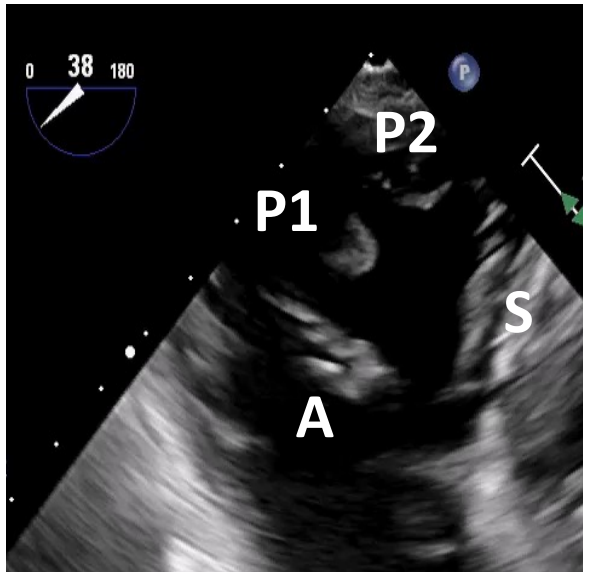
TV leaflets analysis



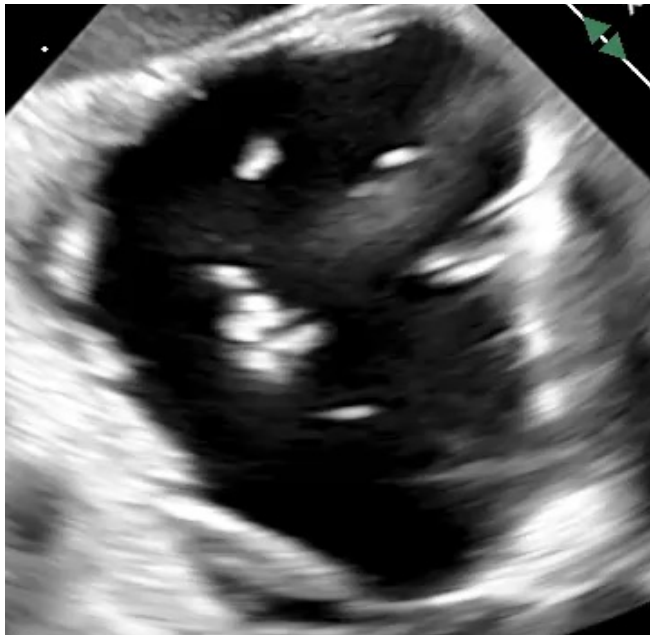


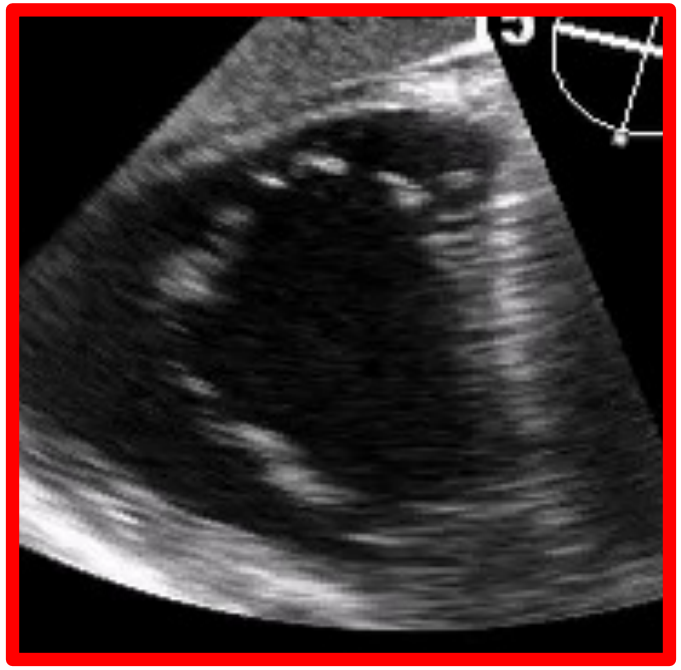


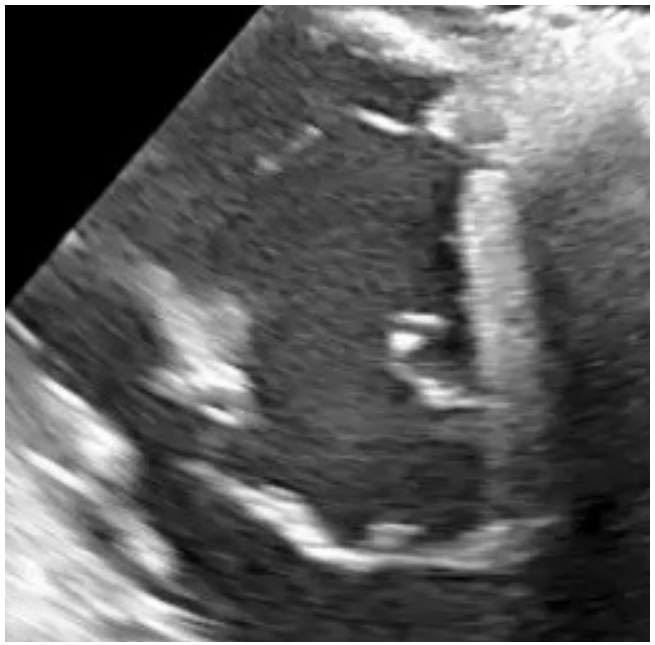


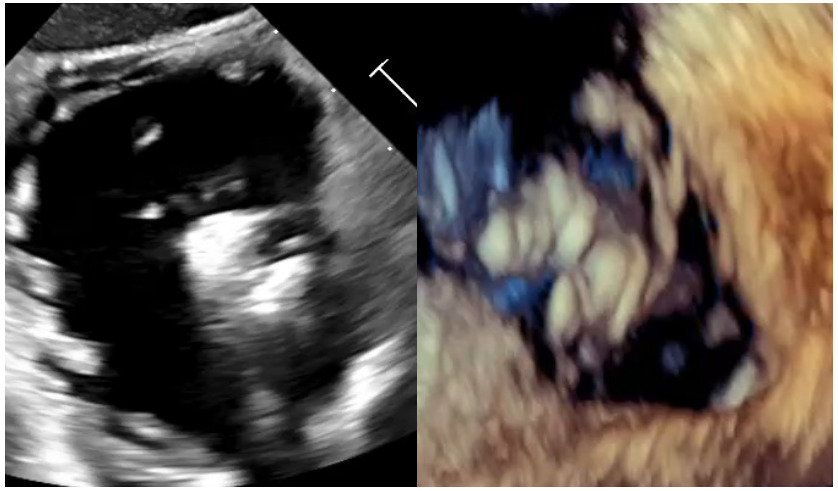


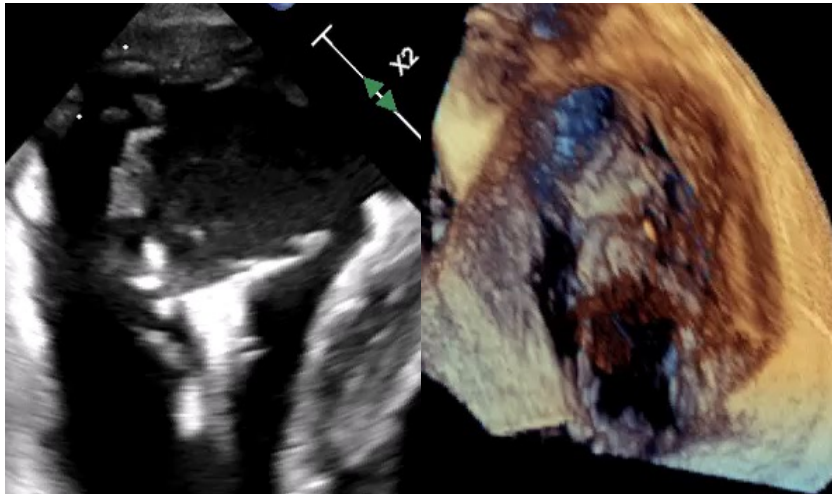
TV leaflets analysis

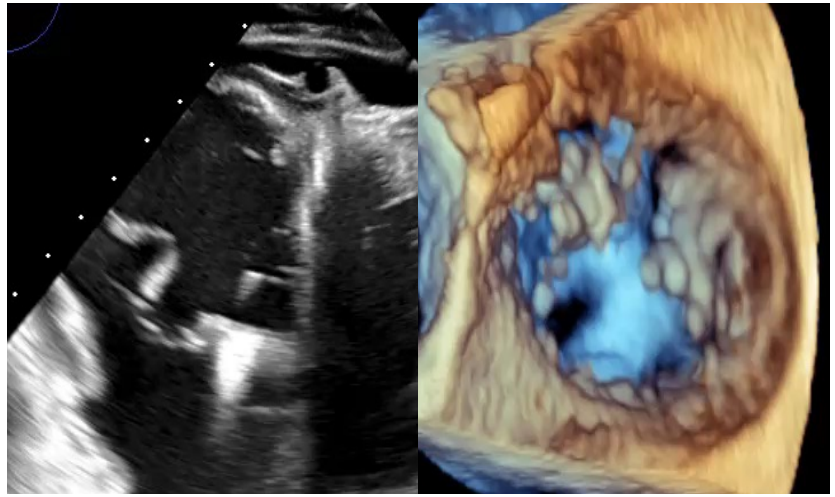












Pathologic Insights into Tricuspid Valve Morphology: Impact on the Standard Echocardiographic Nomenclature

Monica De Gaspari, Julien Dreyfus, Francesco Maisano, Alessandro Barbugian, Rebecca Hahn, Cristina Basso

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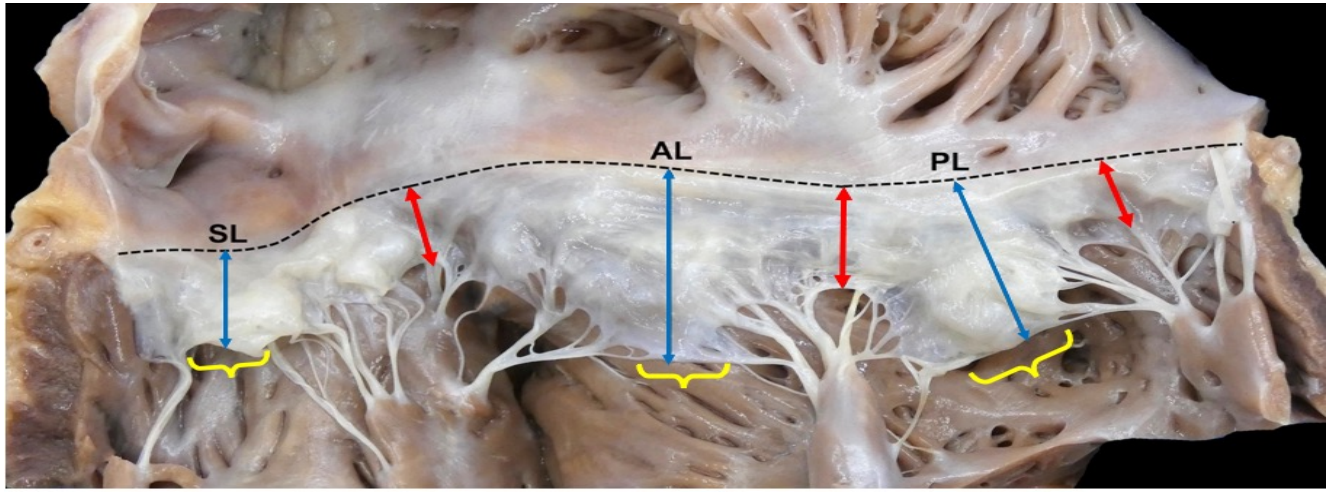
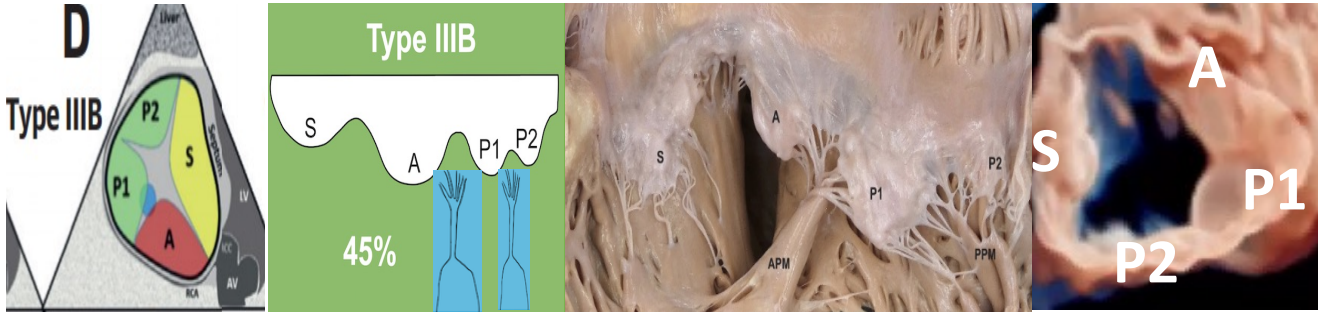
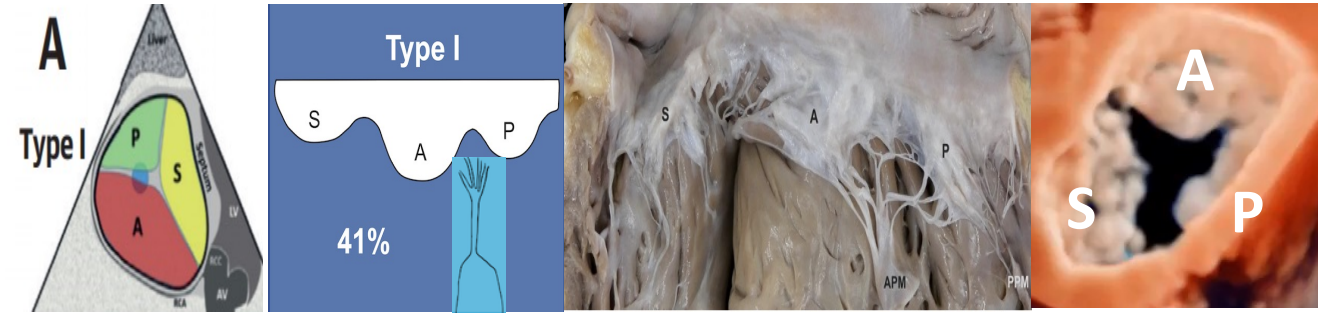
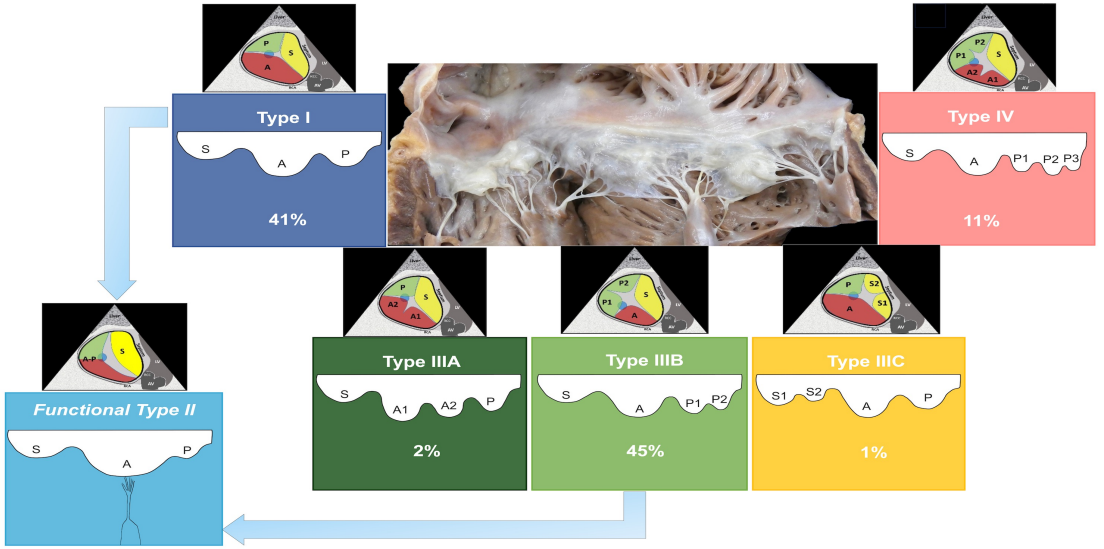
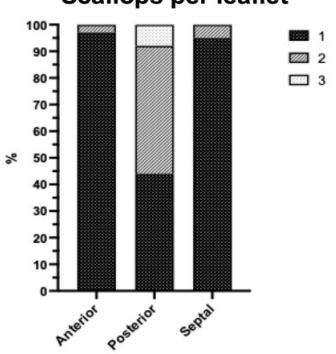








97% 44% 95%



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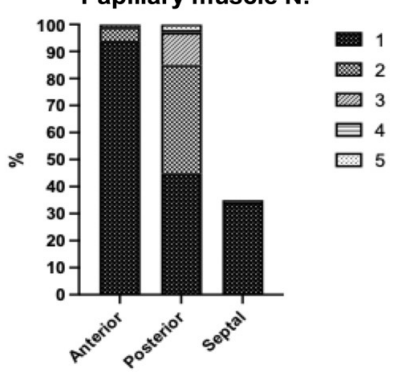

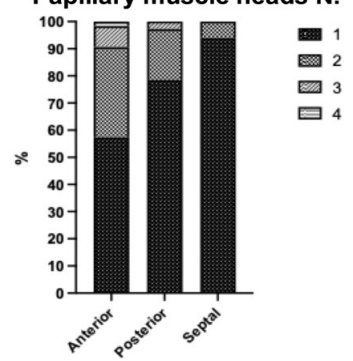

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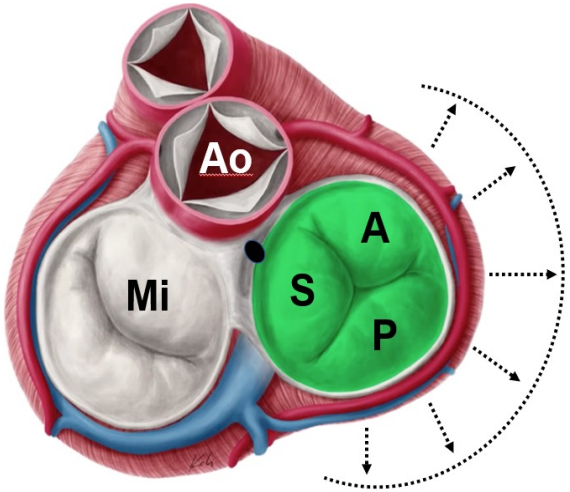
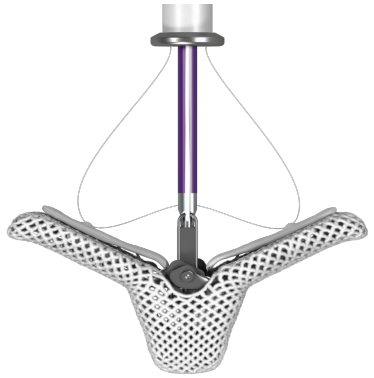
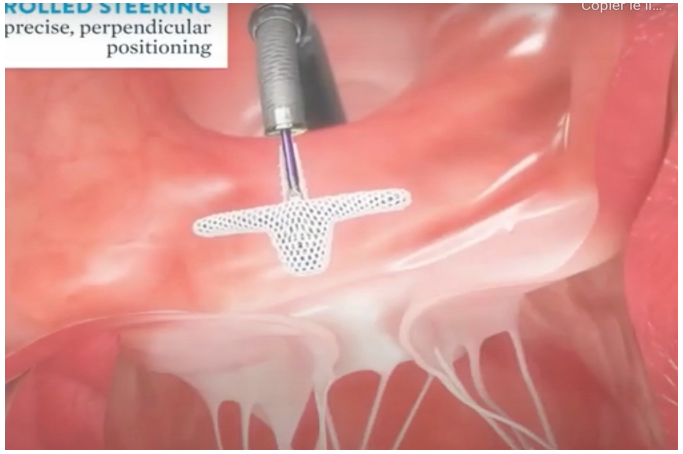
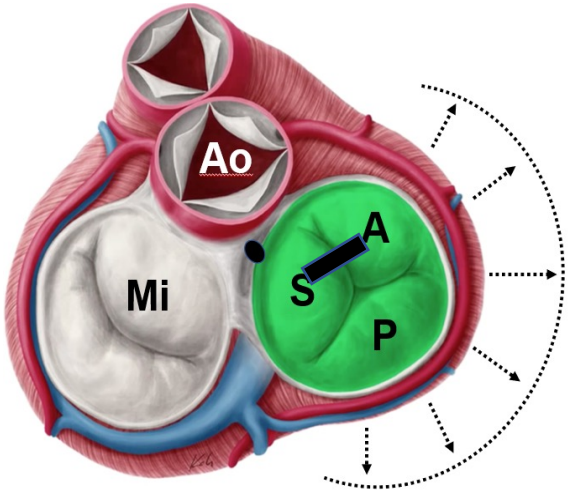
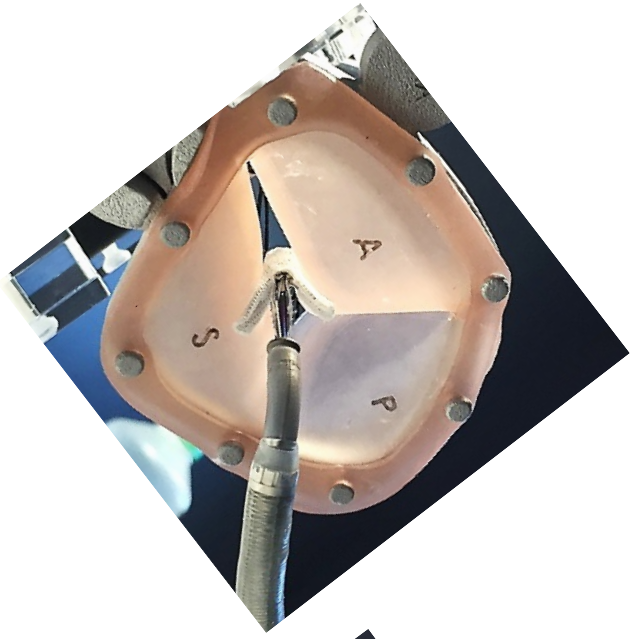
Transcatheter edge-to-edge TV Repair

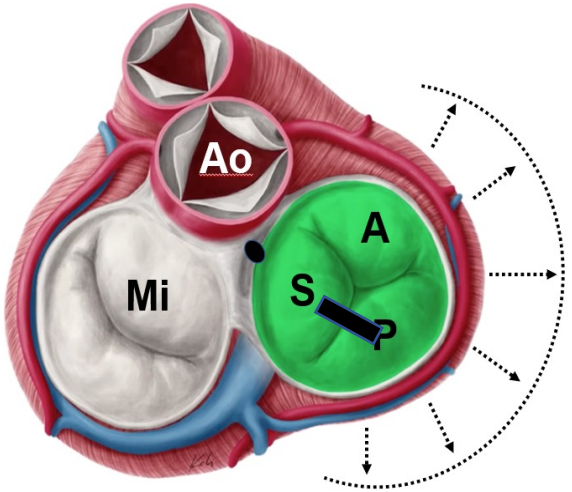


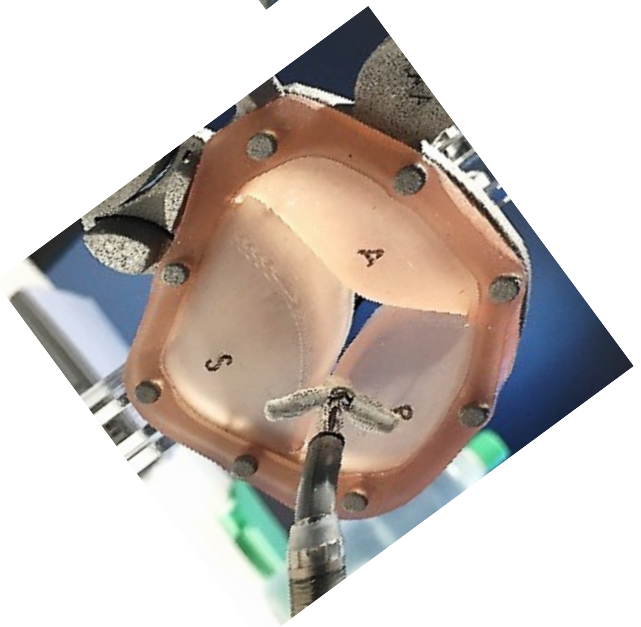






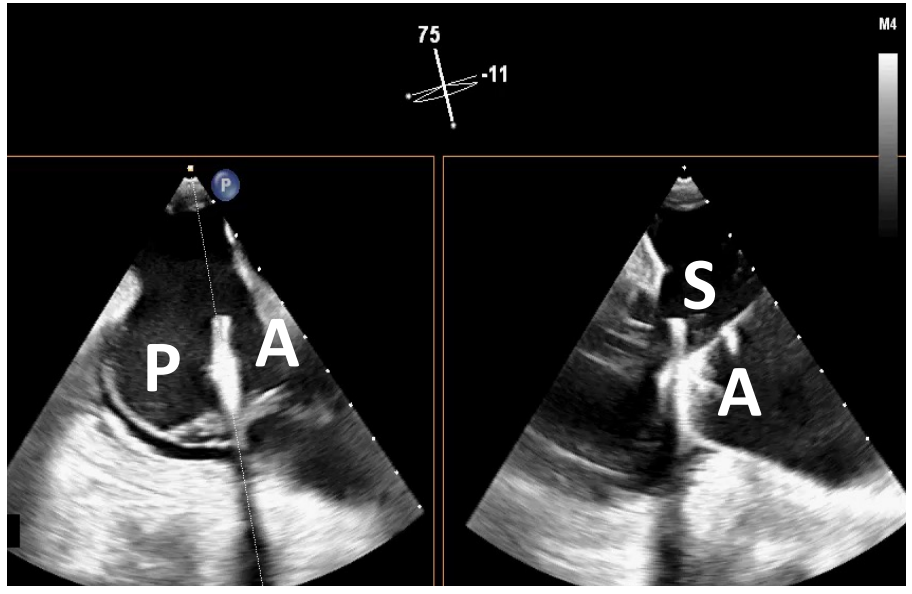


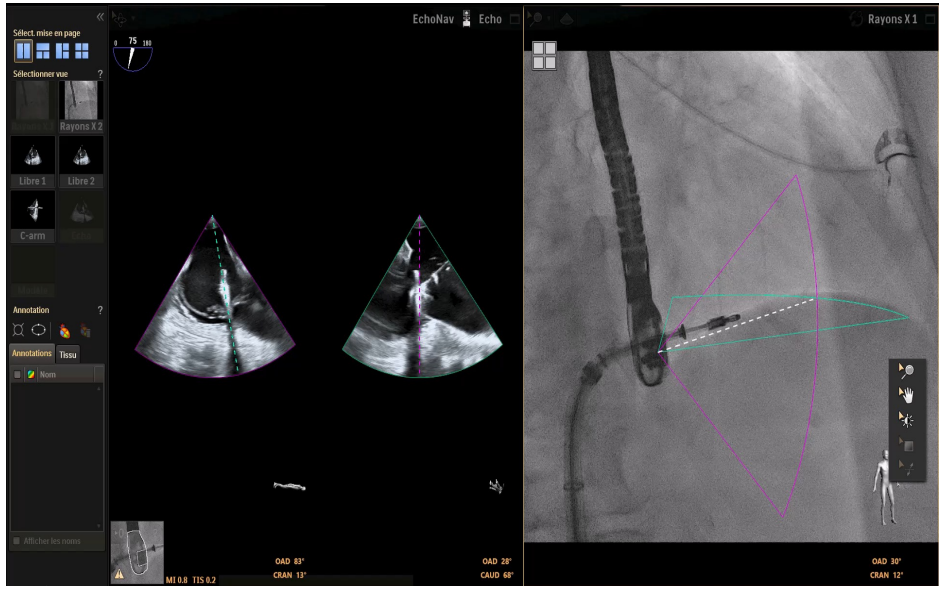


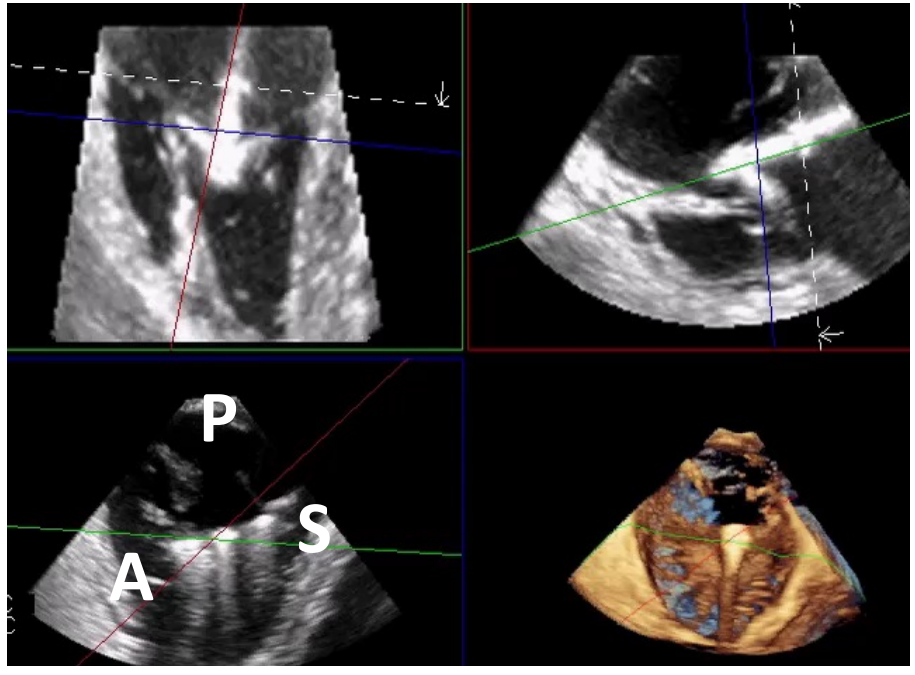


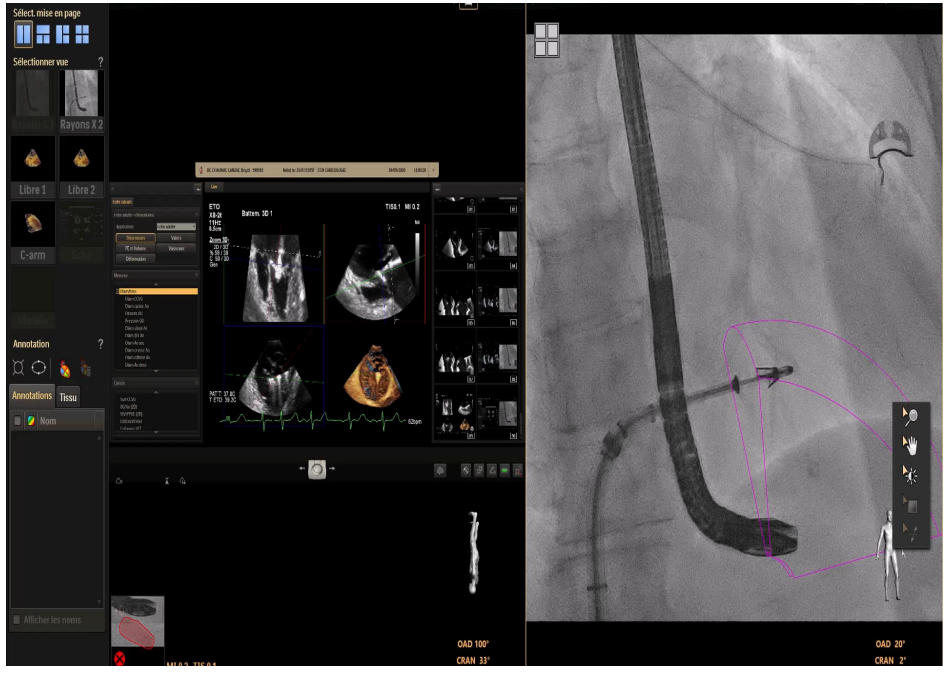
Courtesy from ABBOTT

Transcatheter edge-to-edge TV Repair

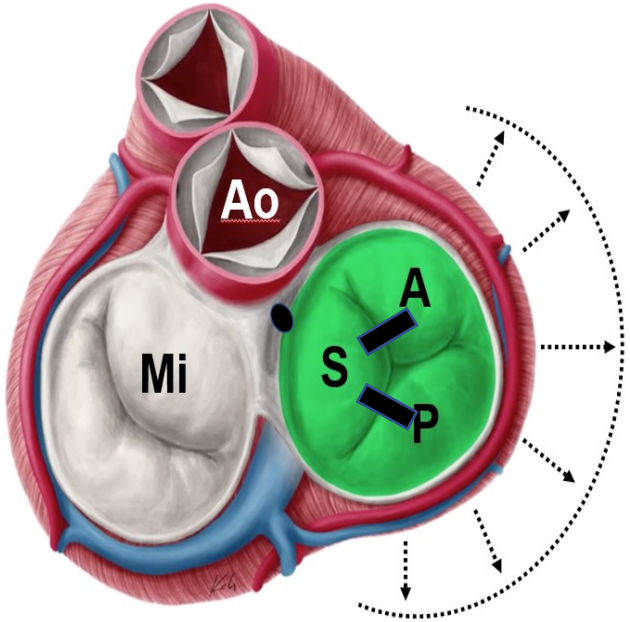


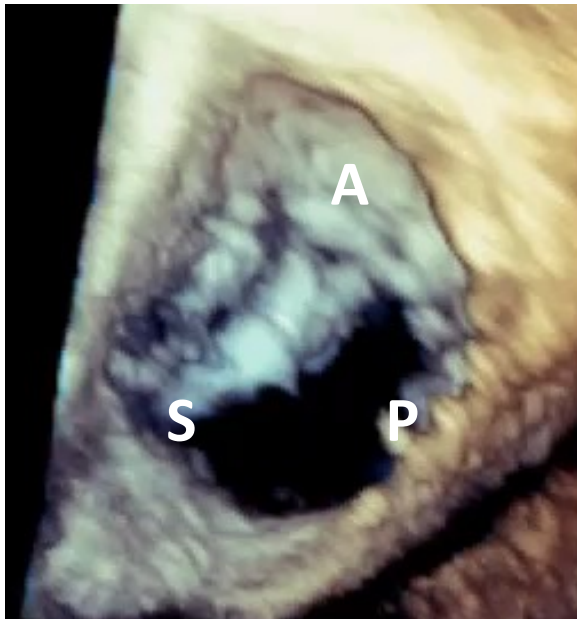


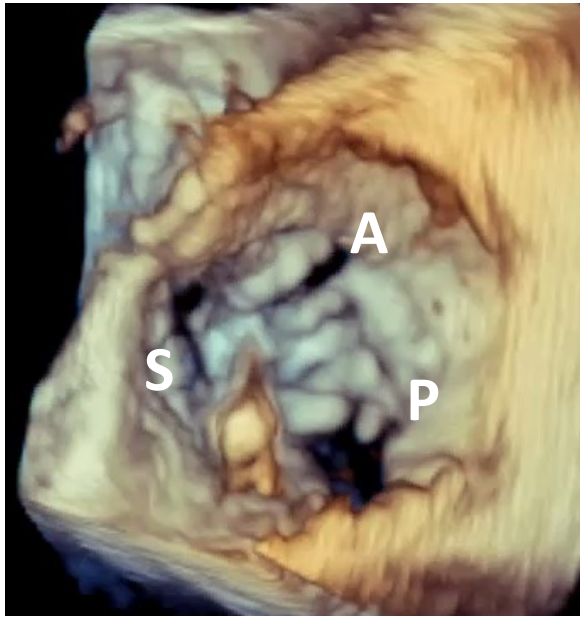


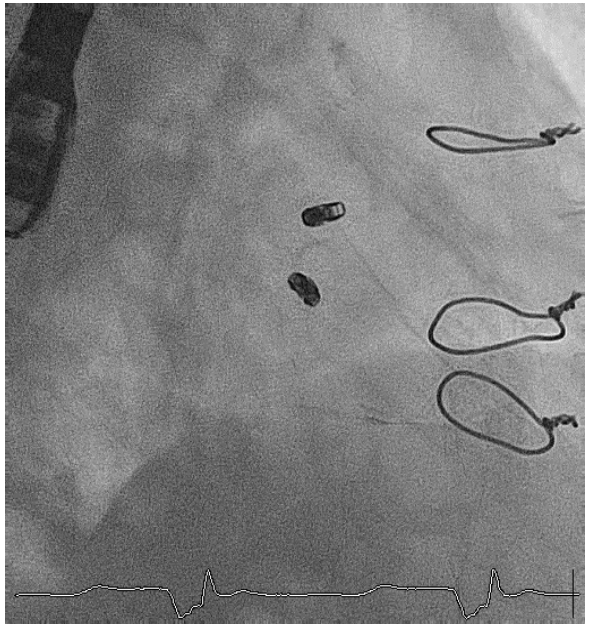


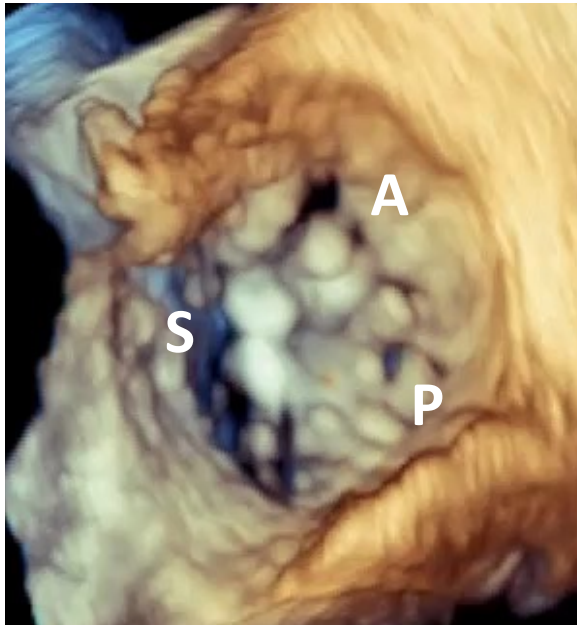
Transcatheter edge-to-edge TV Repair

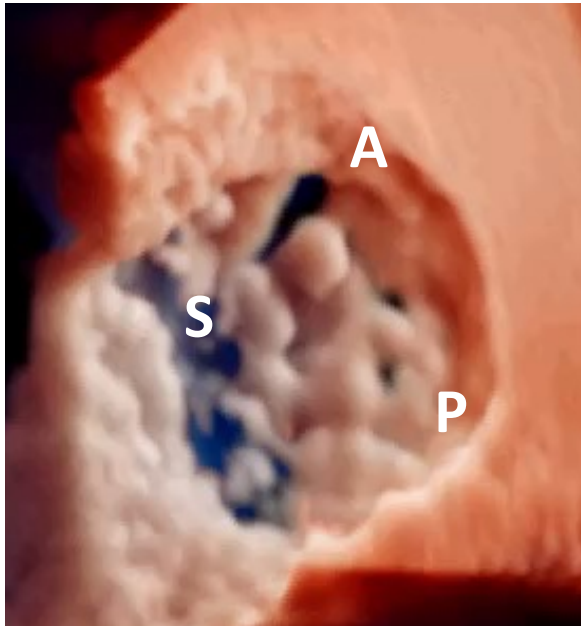




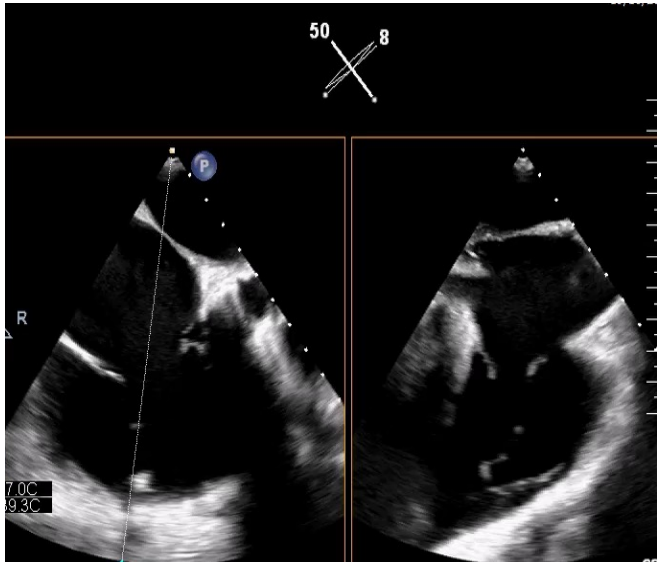


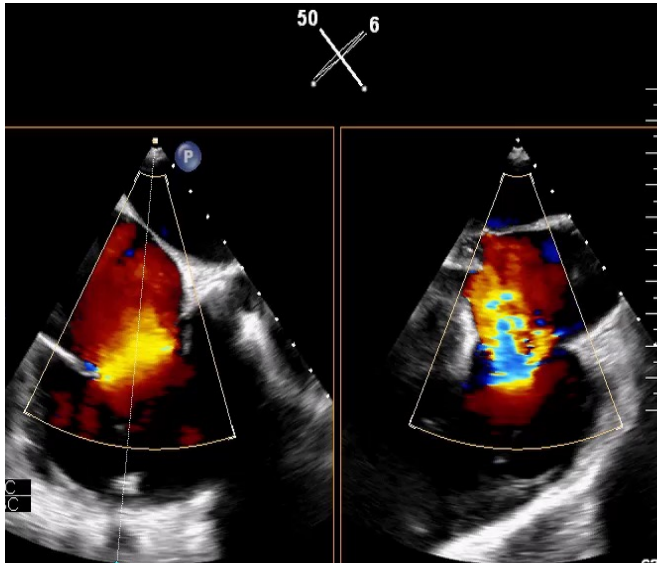




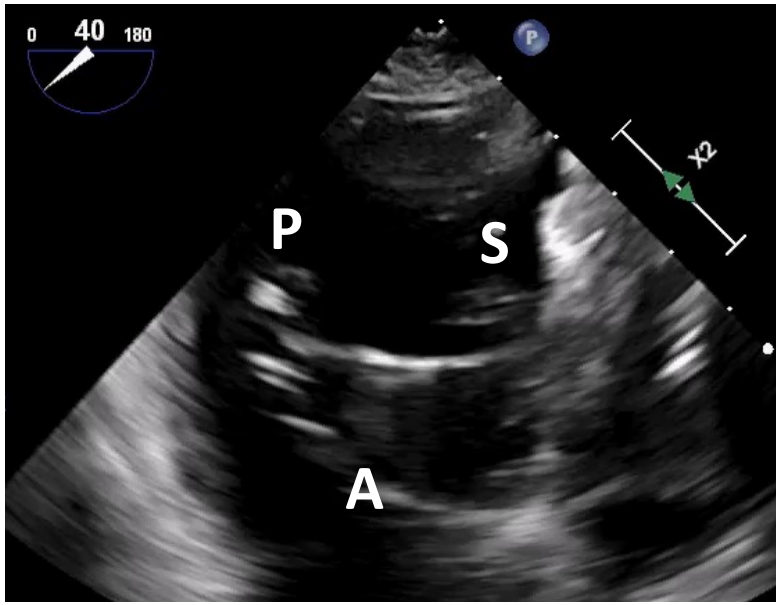


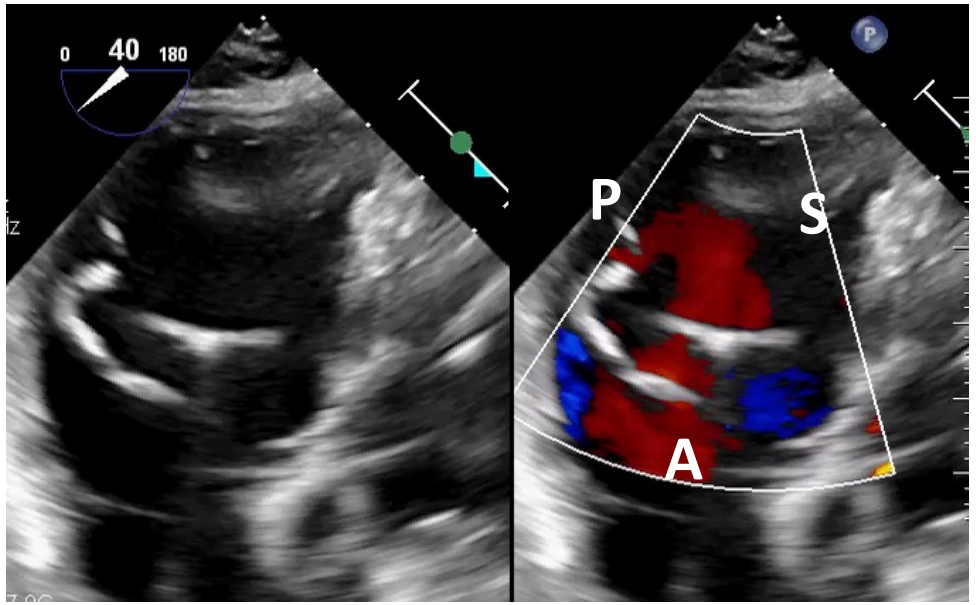
Transcatheter TV Replacement ?

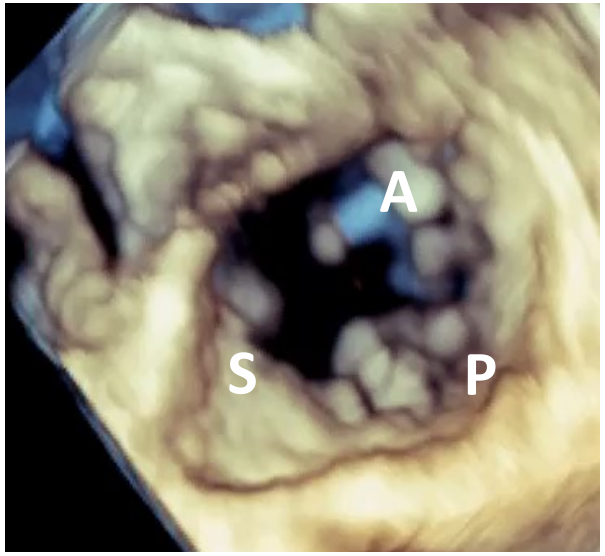


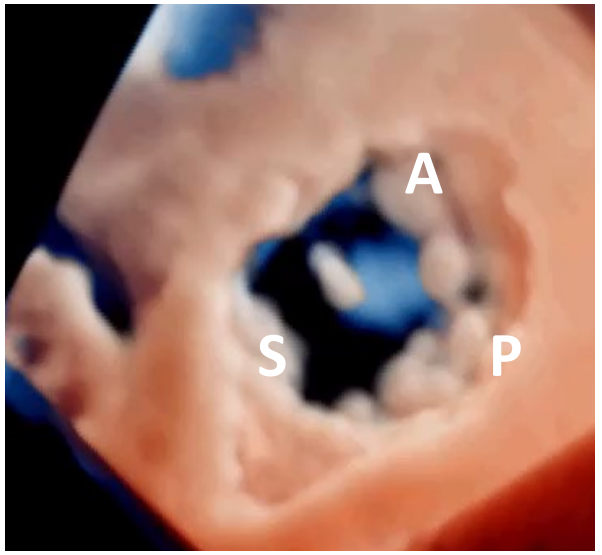


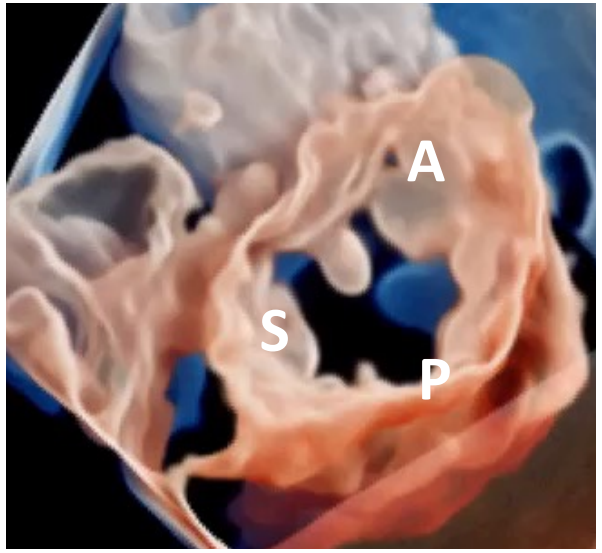
Transcatheter TV Replacement ?



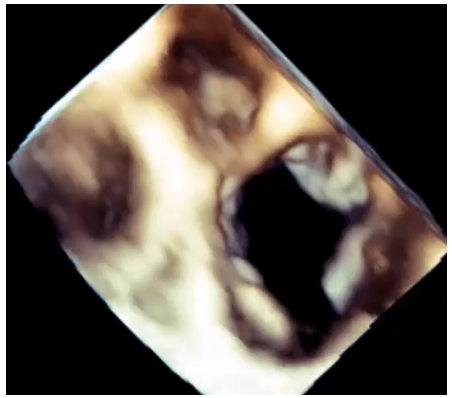


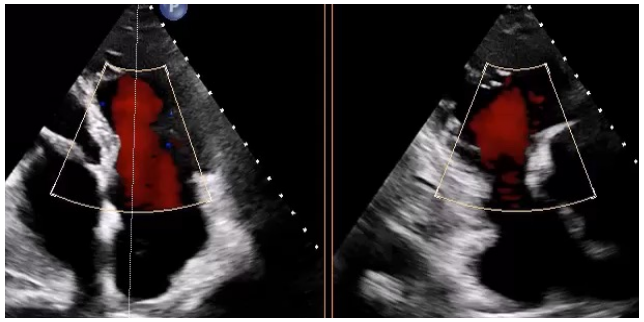






Transcatheter tricuspid valve replacement: TOPAZ

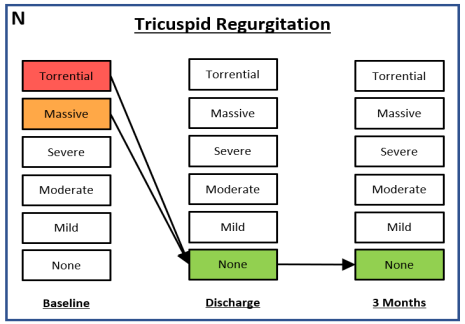


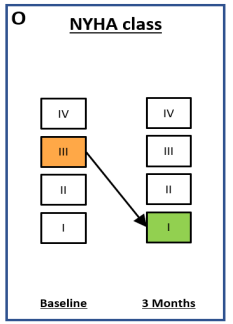


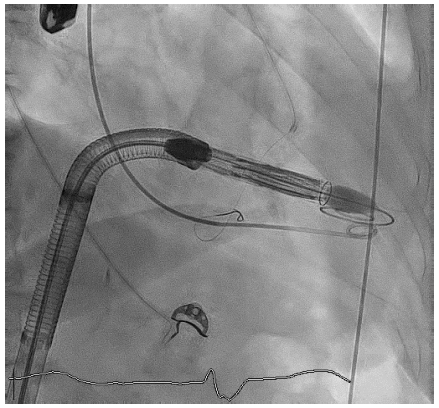
First-in-human implantation of the Topaz transcatheter tricuspid valve replacement system

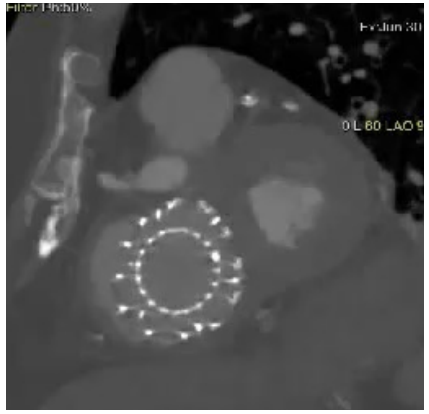
Emmanuel Teiger[1]*, MD, PhD; Mohammed Nejjari[2], MD; Pascal Lim[1], MD; Tobias Ruf[3], MD; Philipp Blanke[4], MD; Ulrich Schäfer[5], MD; Hendrik Treede[6], MD, PhD; Romain Gallet[1], MD, PhD; Julien Dreyfus[2], MD

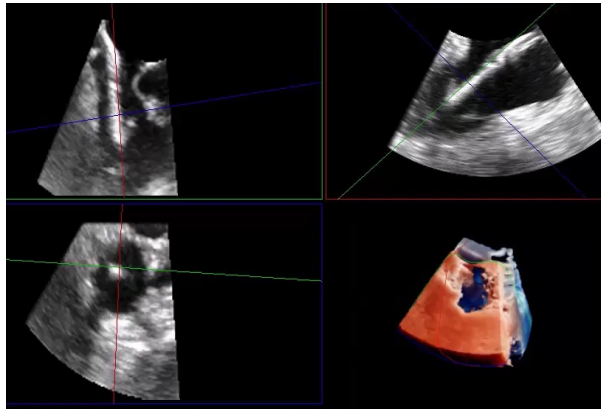
EuroIntervention 2022;18-online publish-ahead-of-print August 2022











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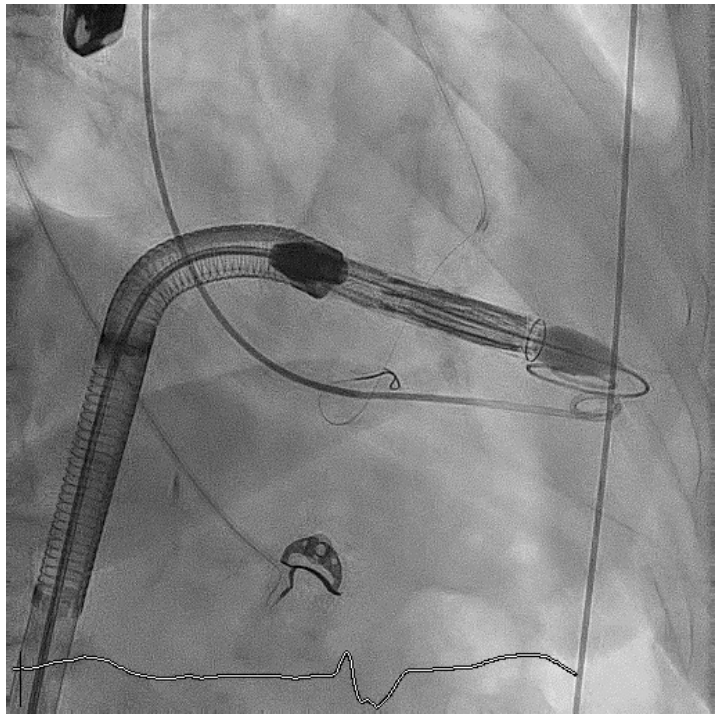
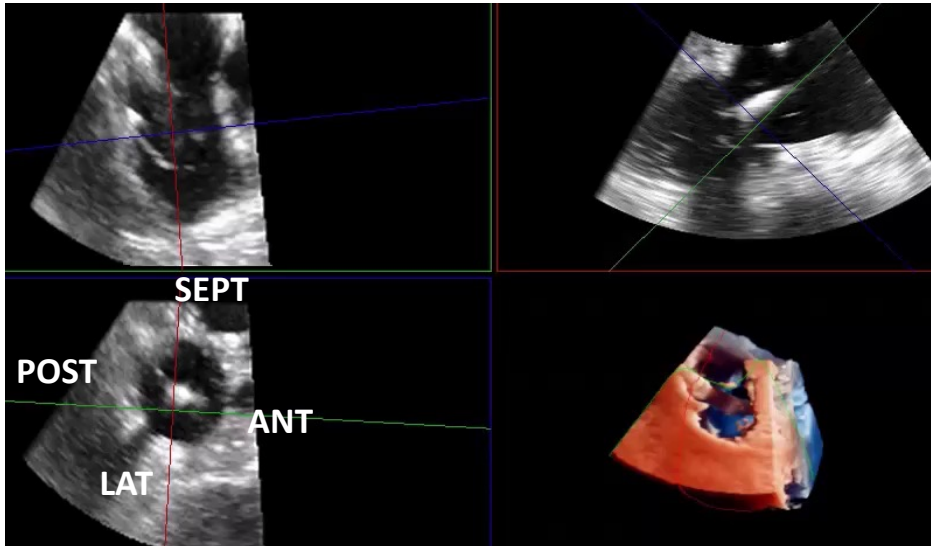
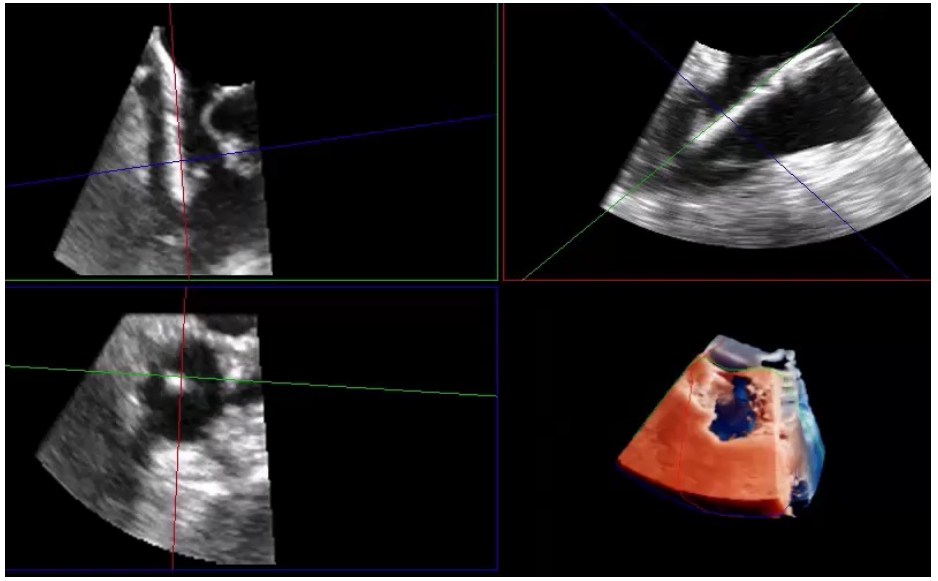
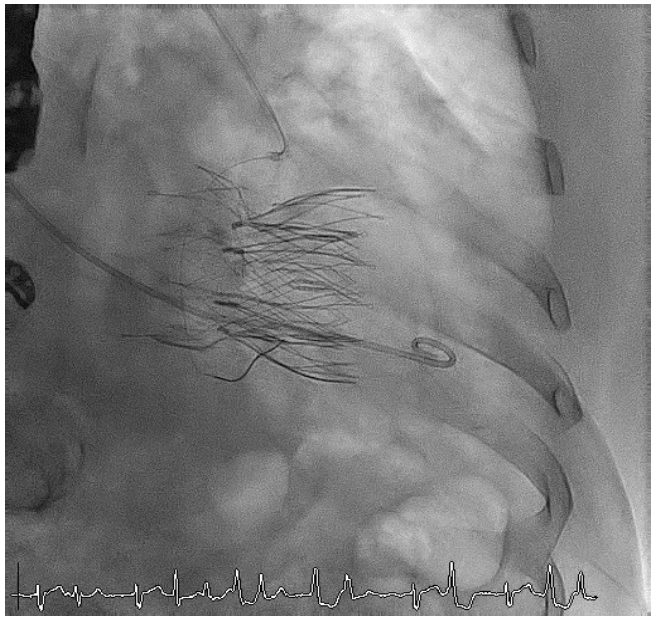
Transcatheter tricuspid valve replacement

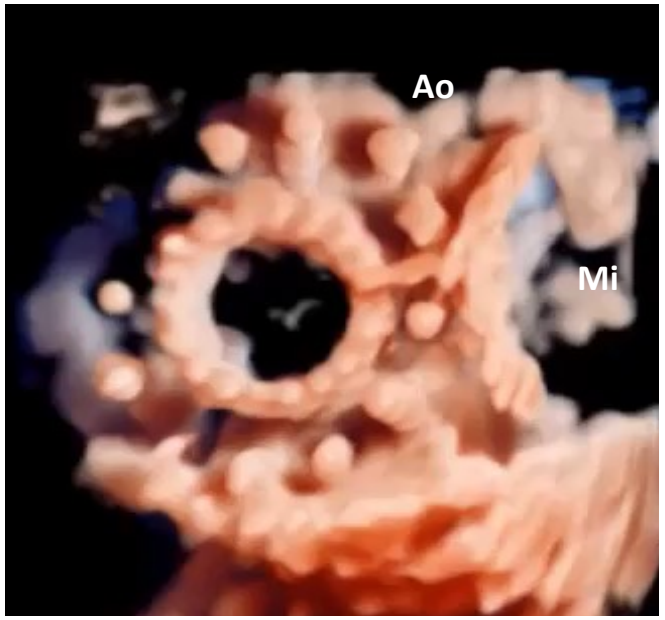


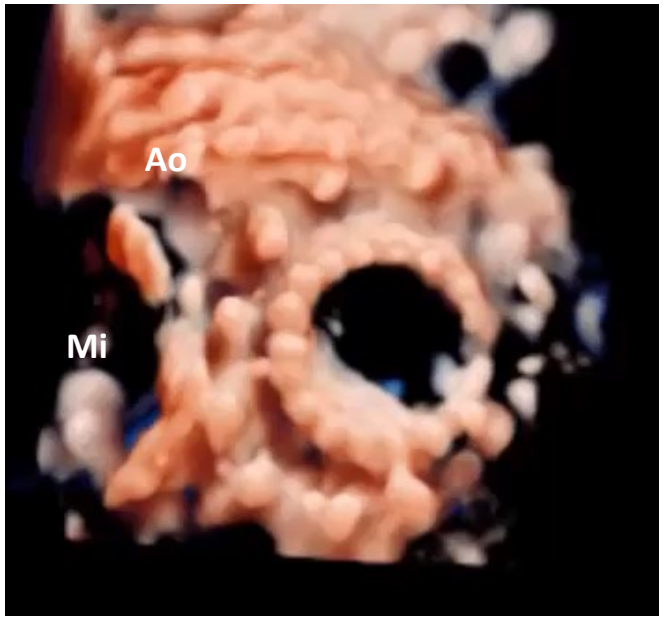


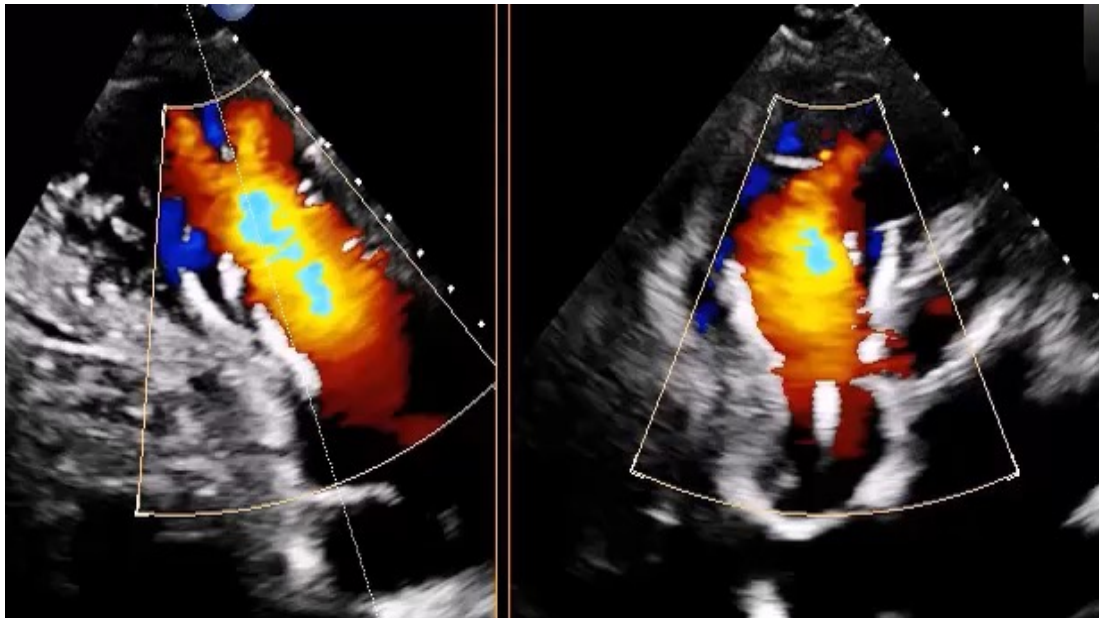


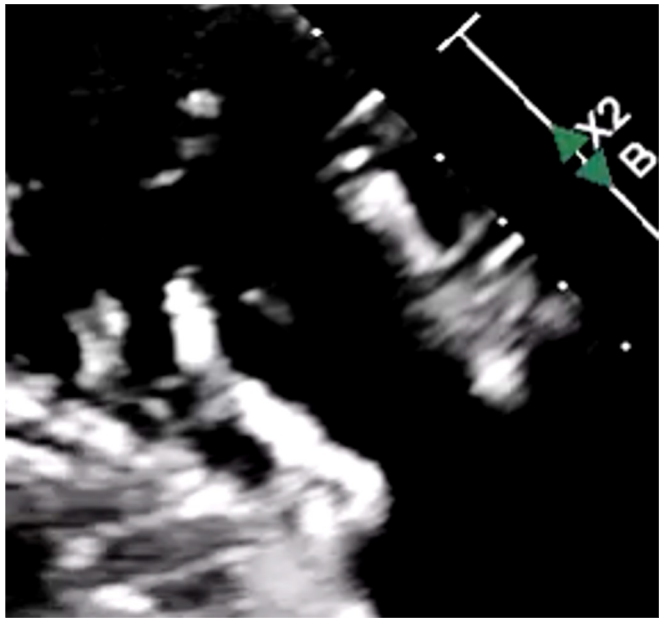
Transcatheter tricuspid valve replacement

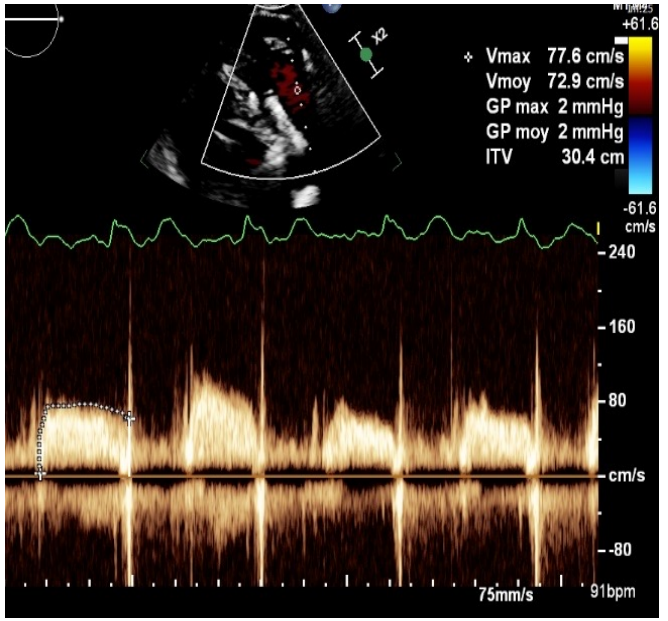




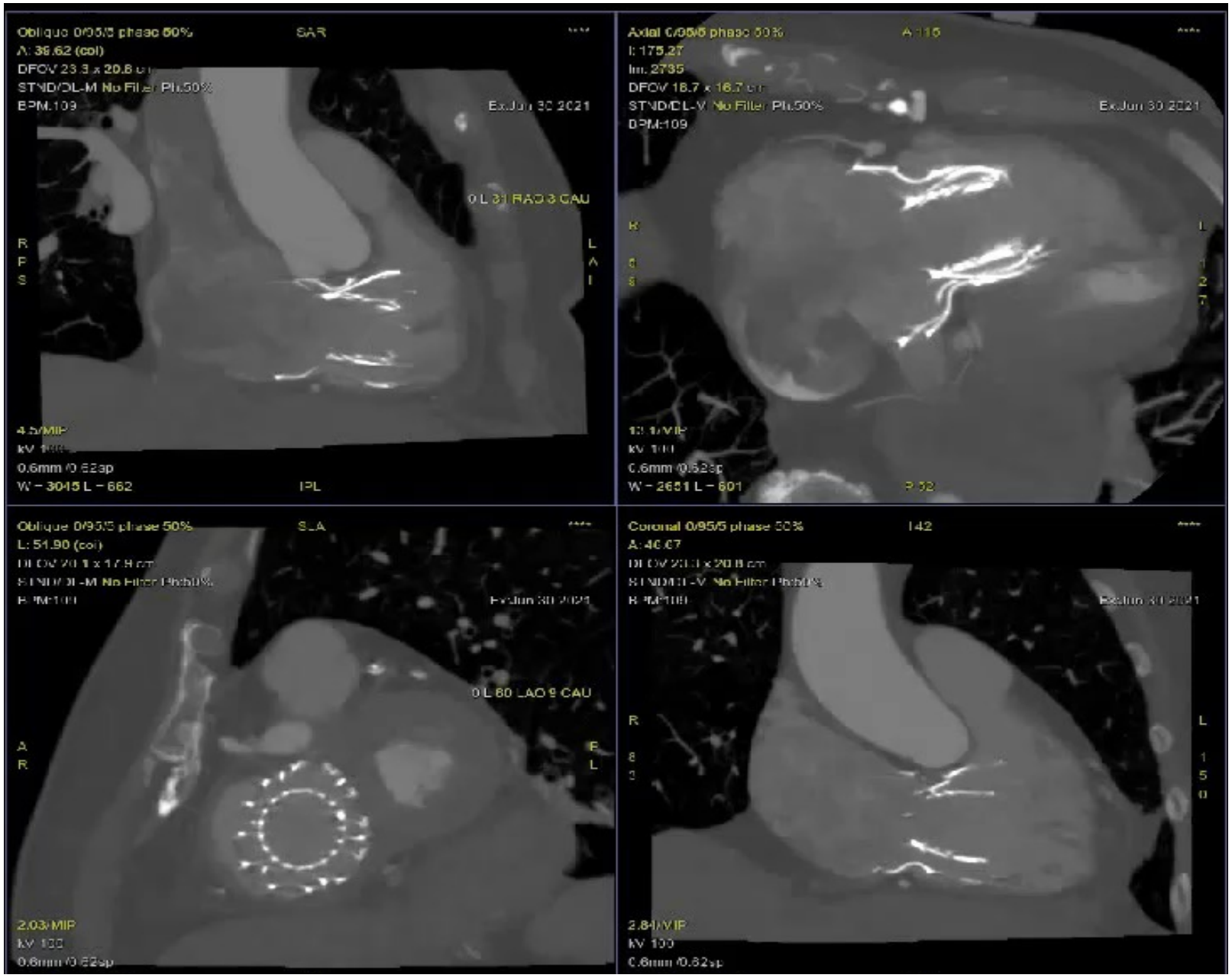


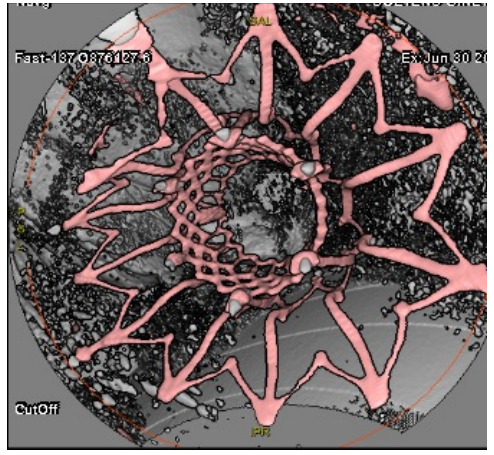


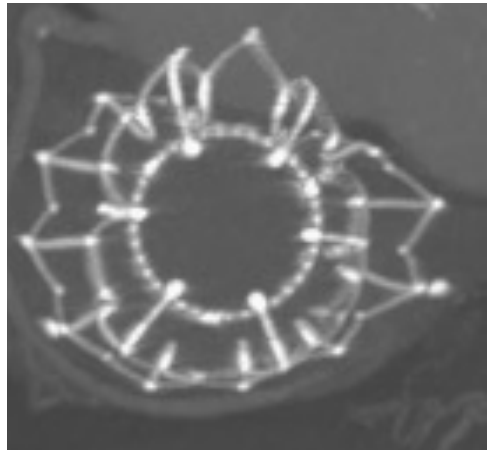




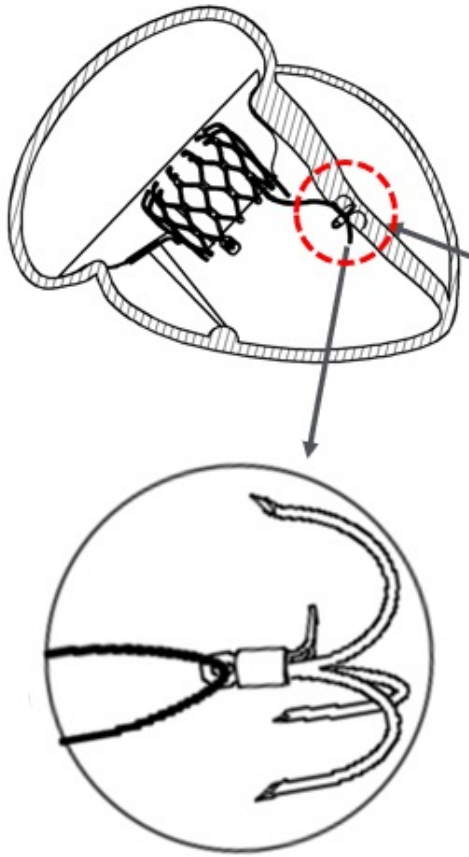
Transcatheter tricuspid valve replacement: TOPAZ

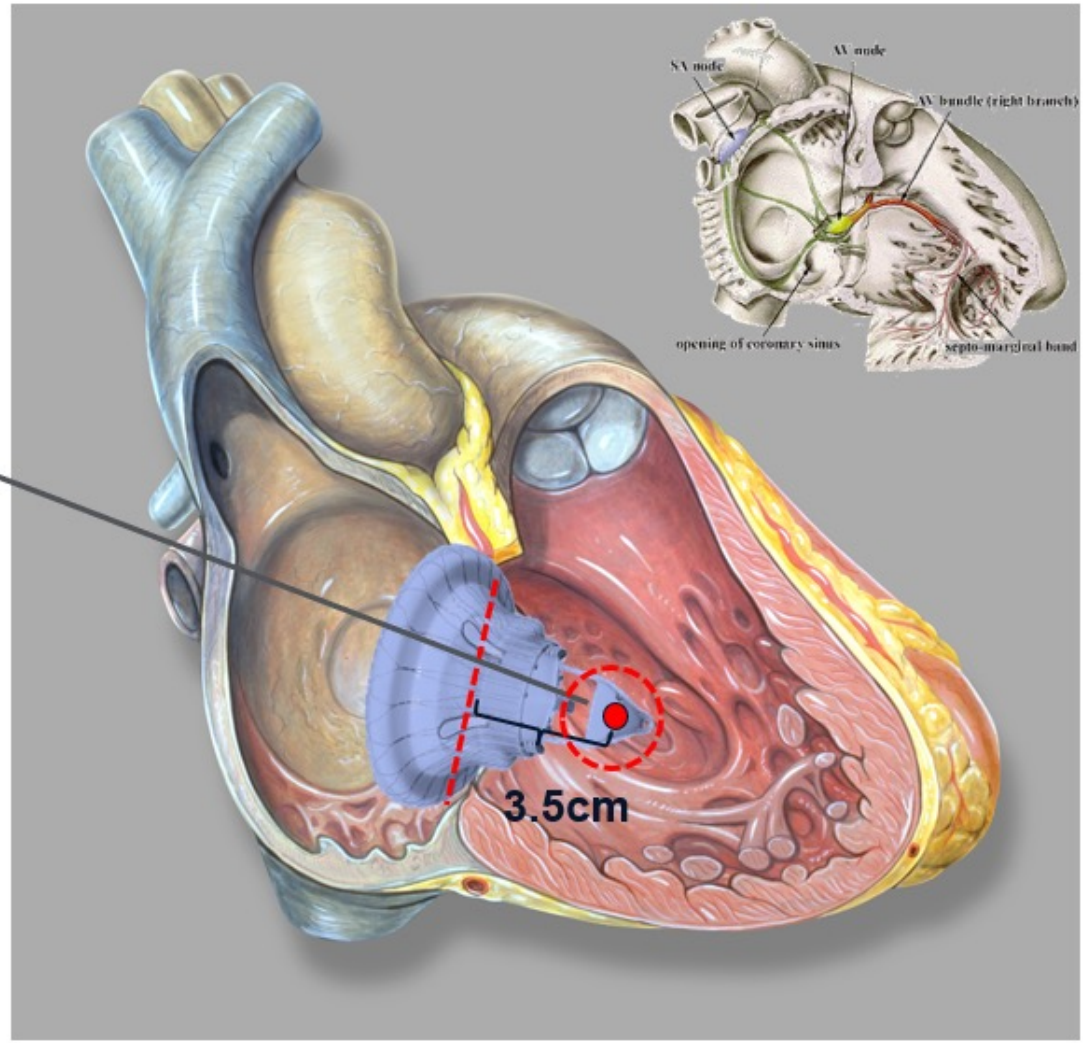




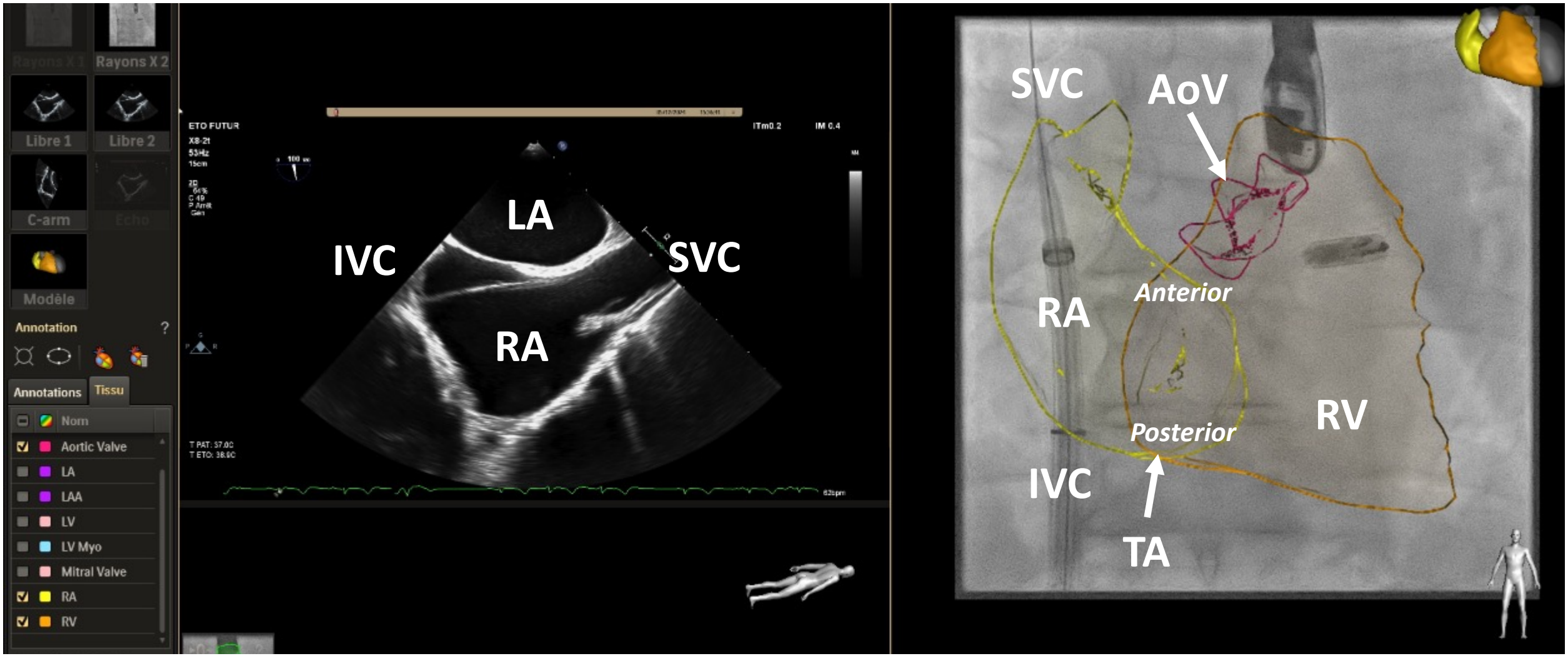


Transcatheter tricuspid valve replacement: LUX-valve

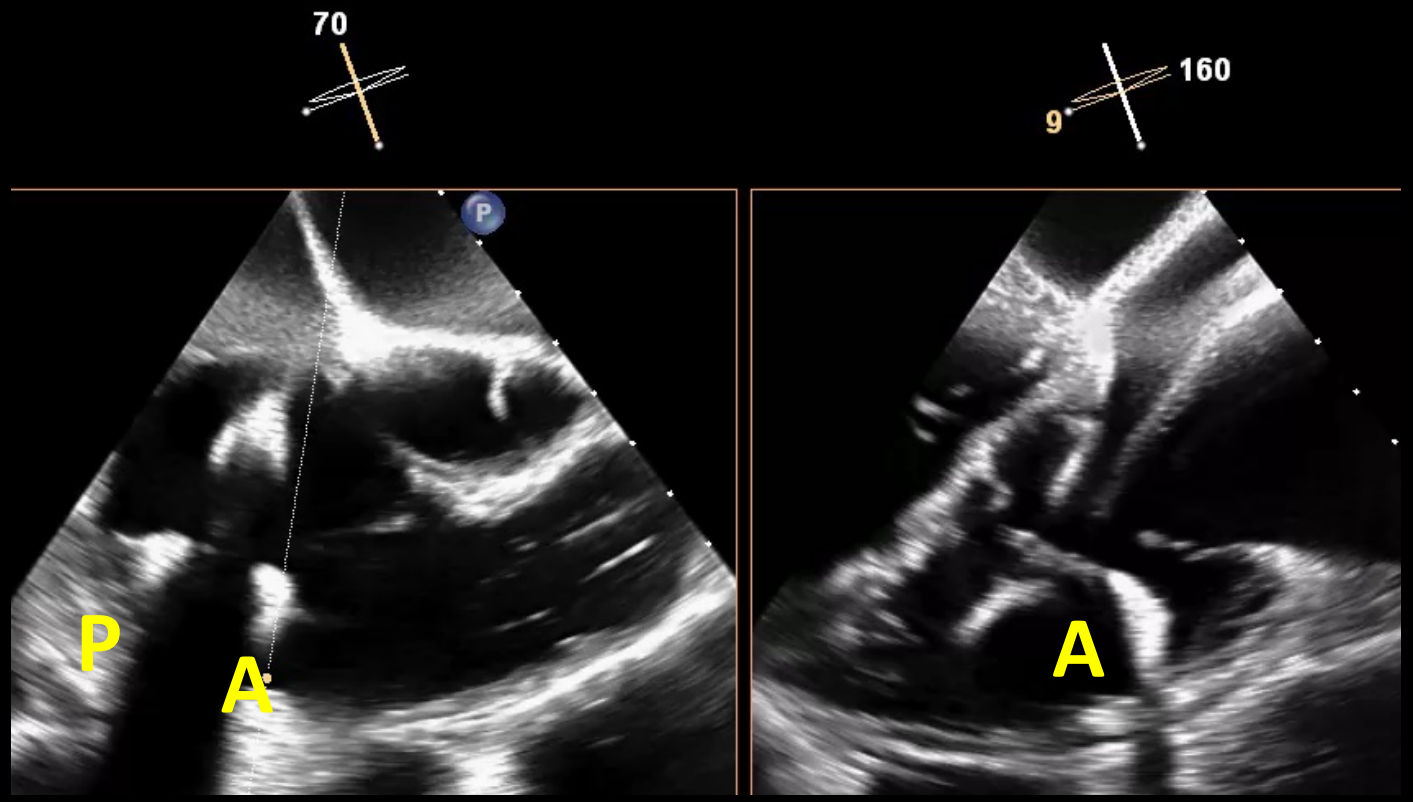


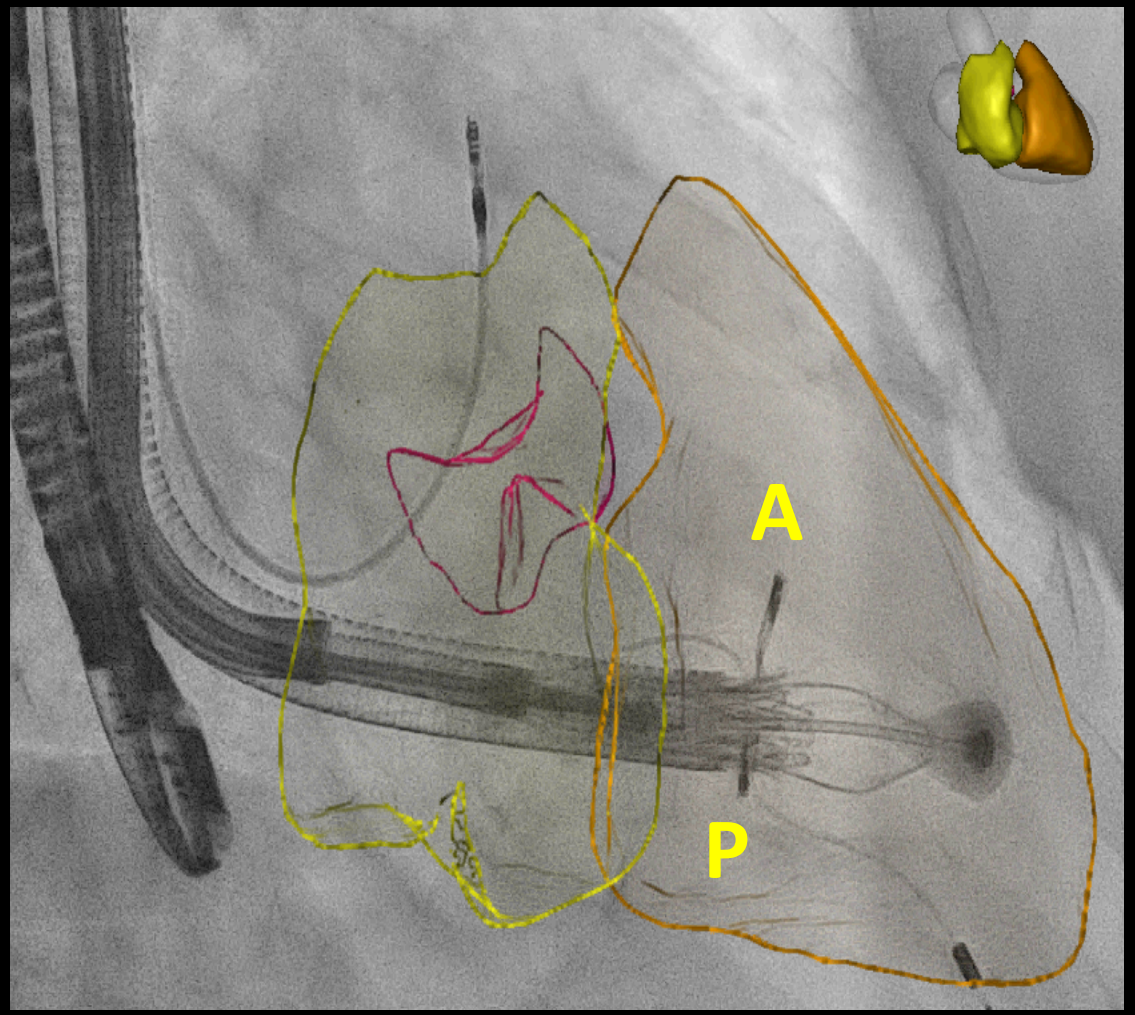


Fusion imaging

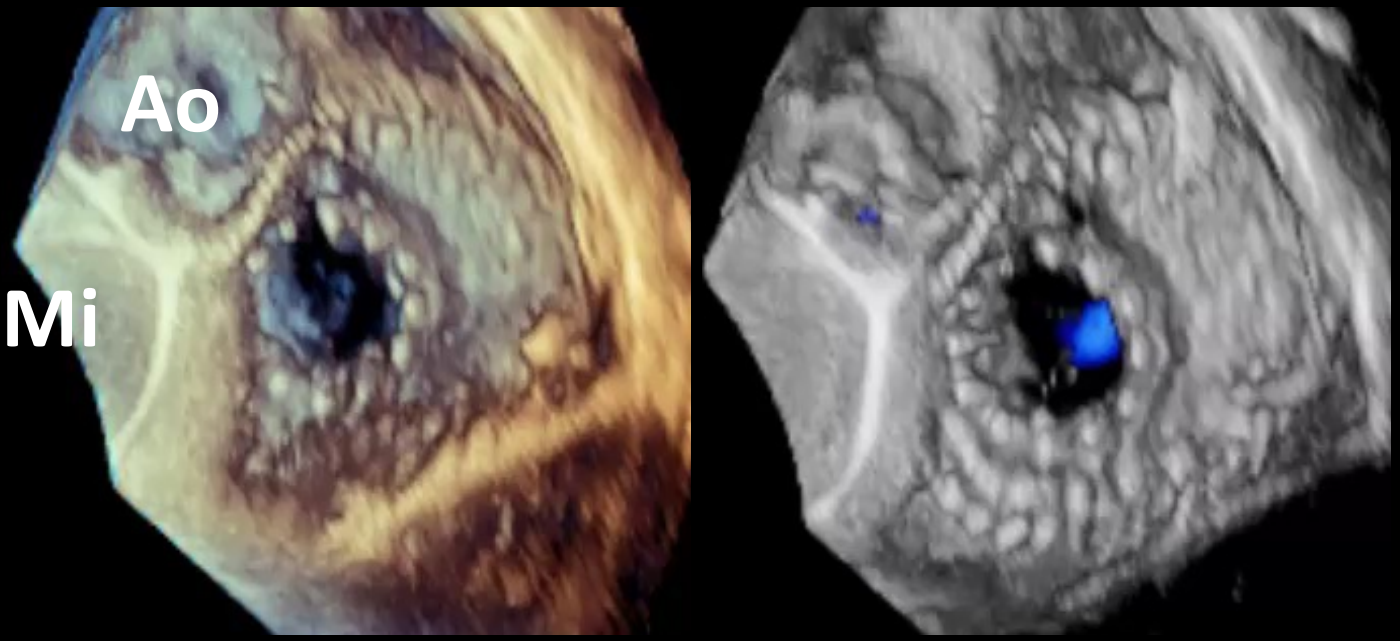


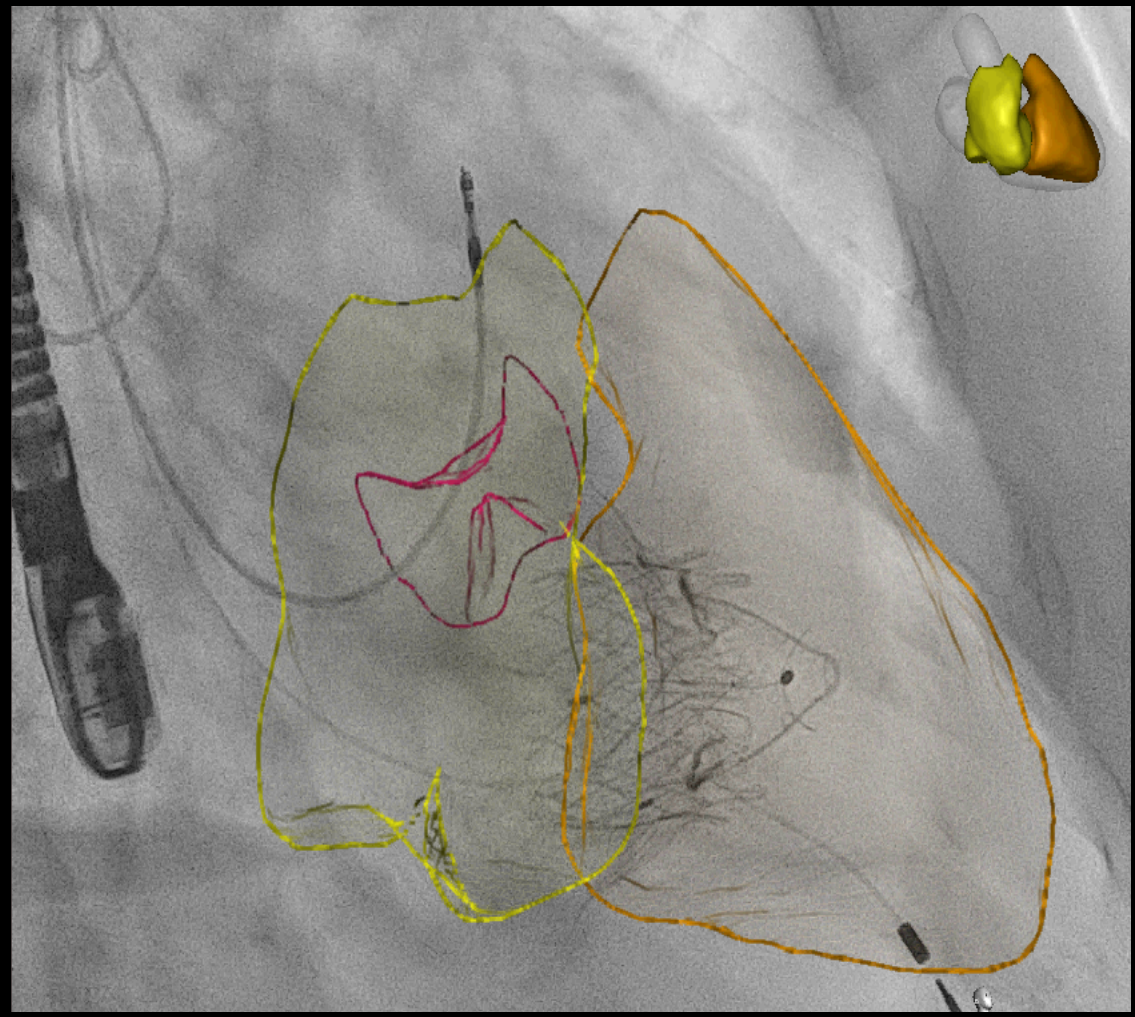
TTVR WITH LUX-VALVE



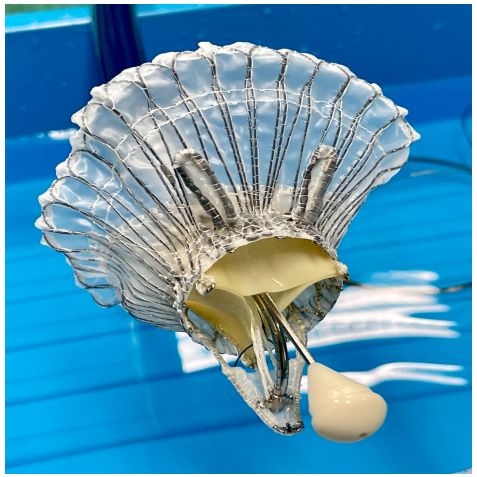


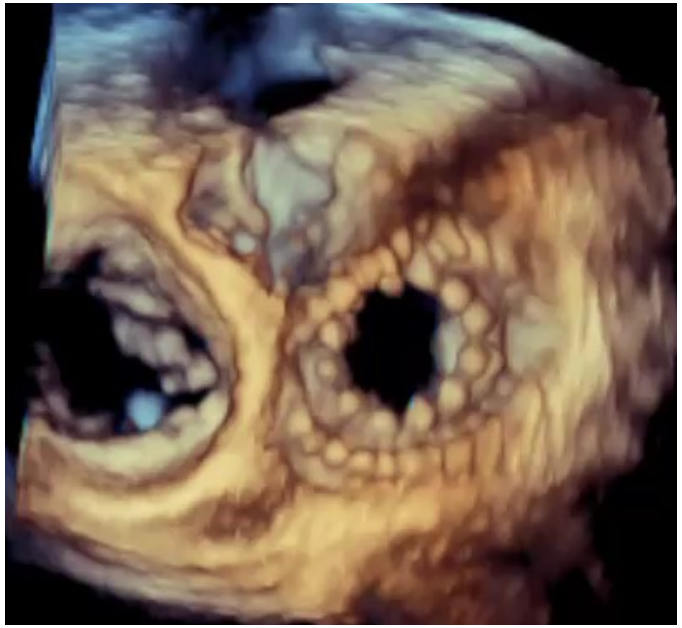
TTVR WITH LUX-VALVE

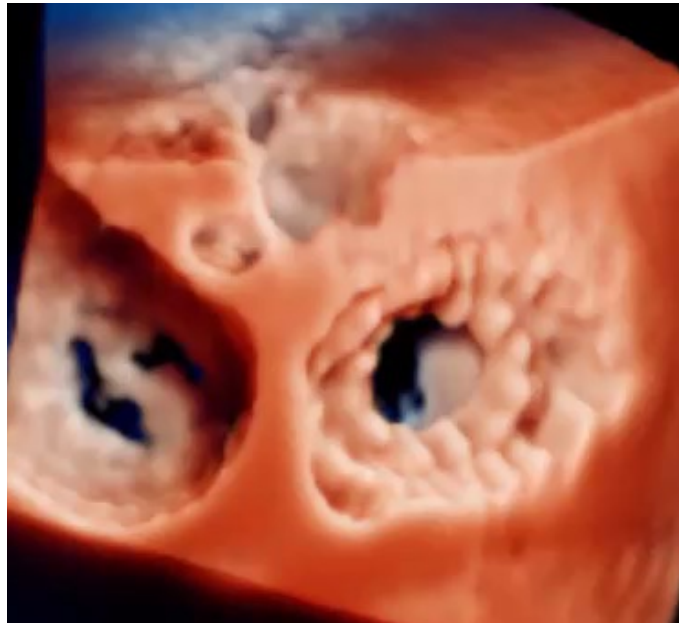


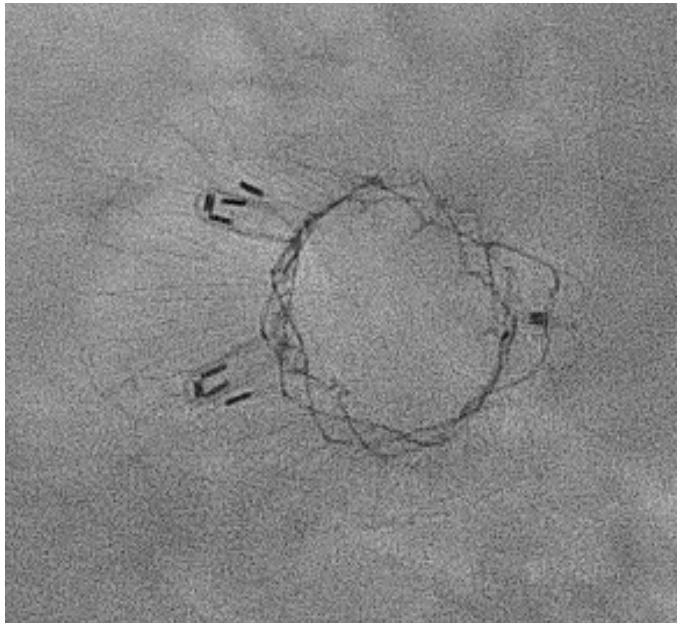


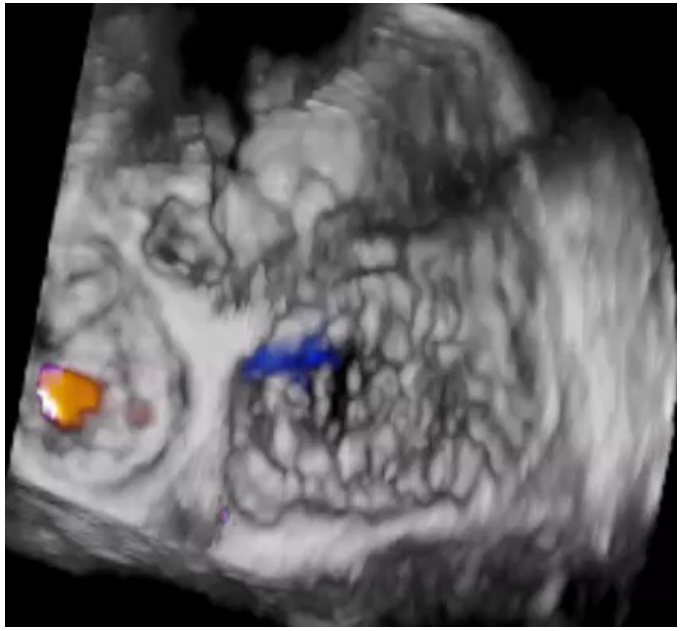
Transcatheter tricuspid valve replacement: LUX-valve

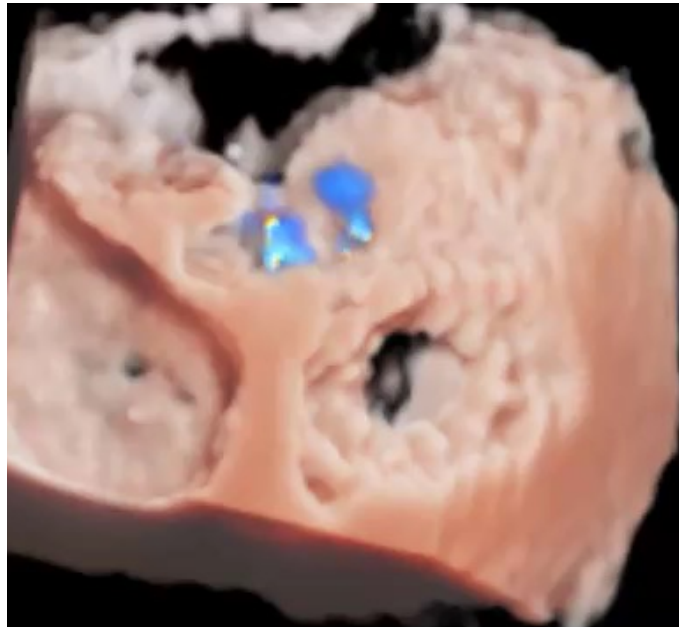


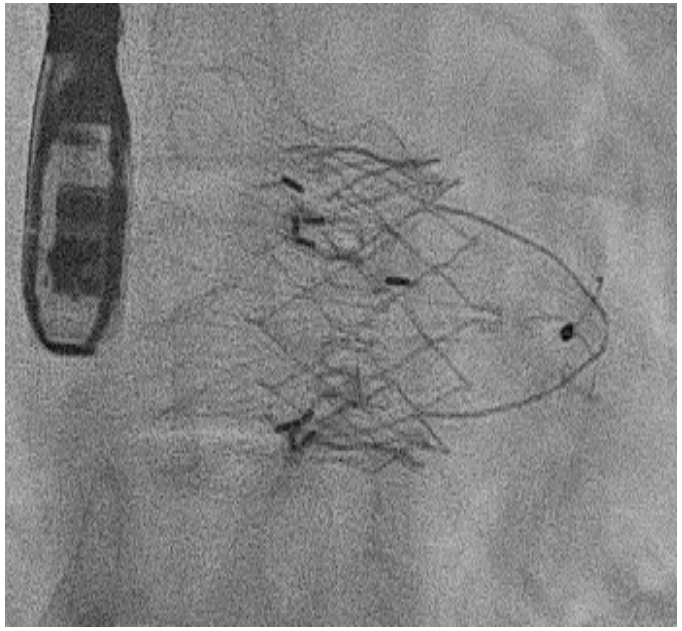






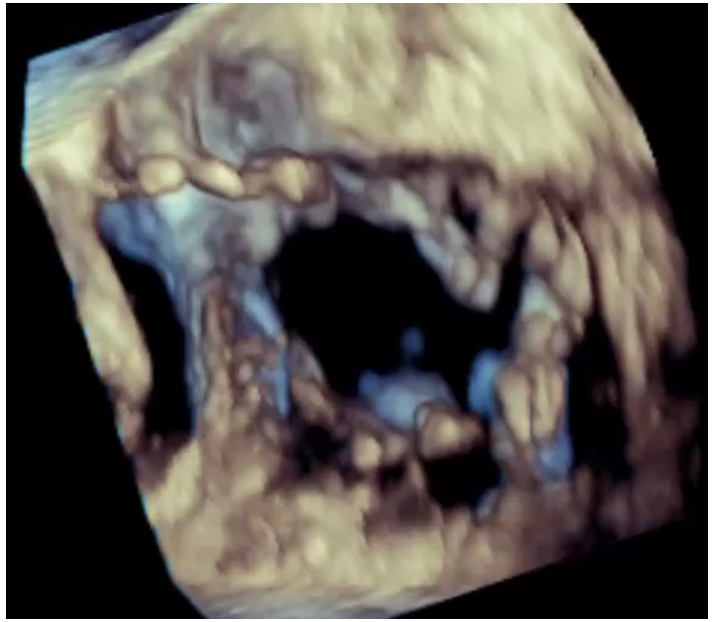


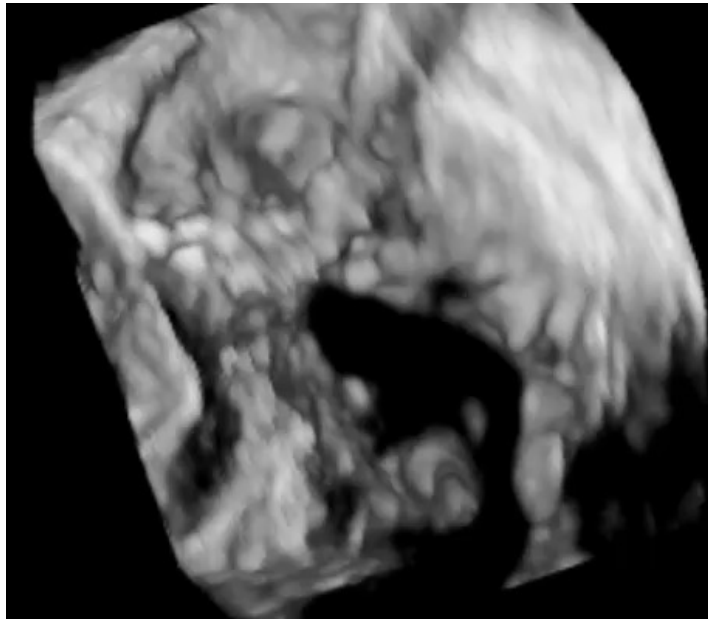




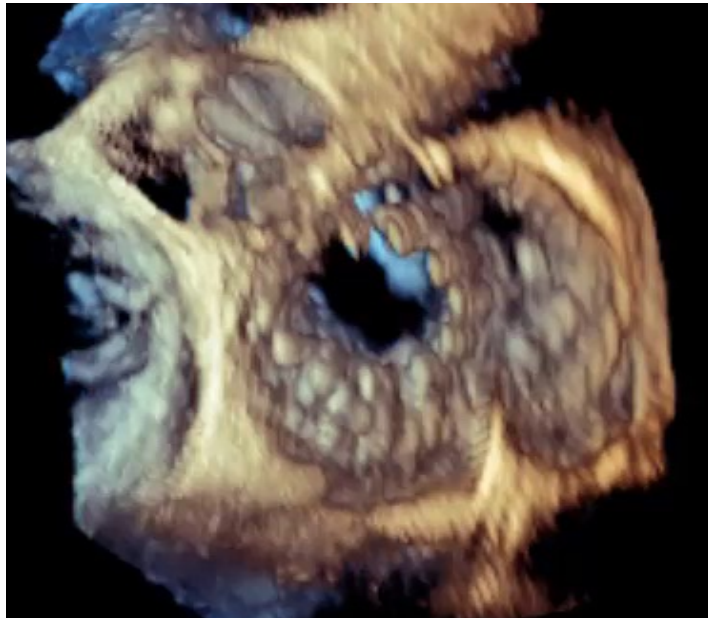
Transcatheter tricuspid valve replacement and pacemaker: LUX-valve

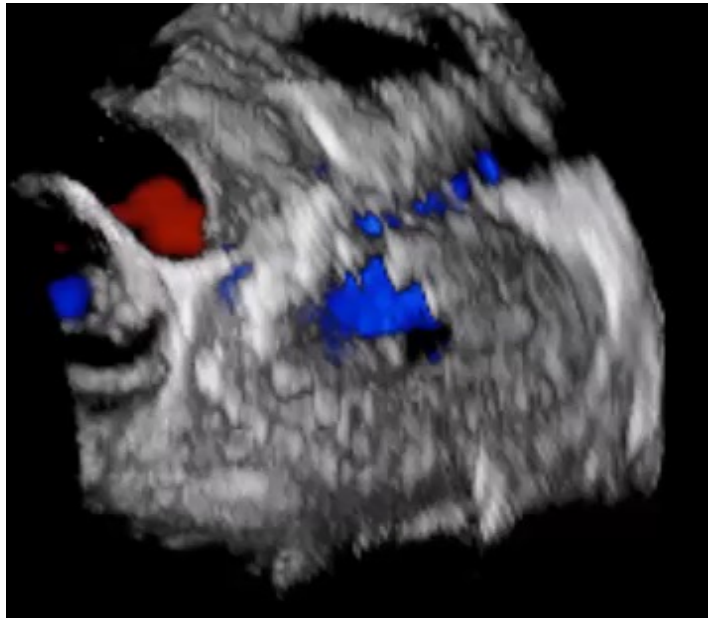
Before



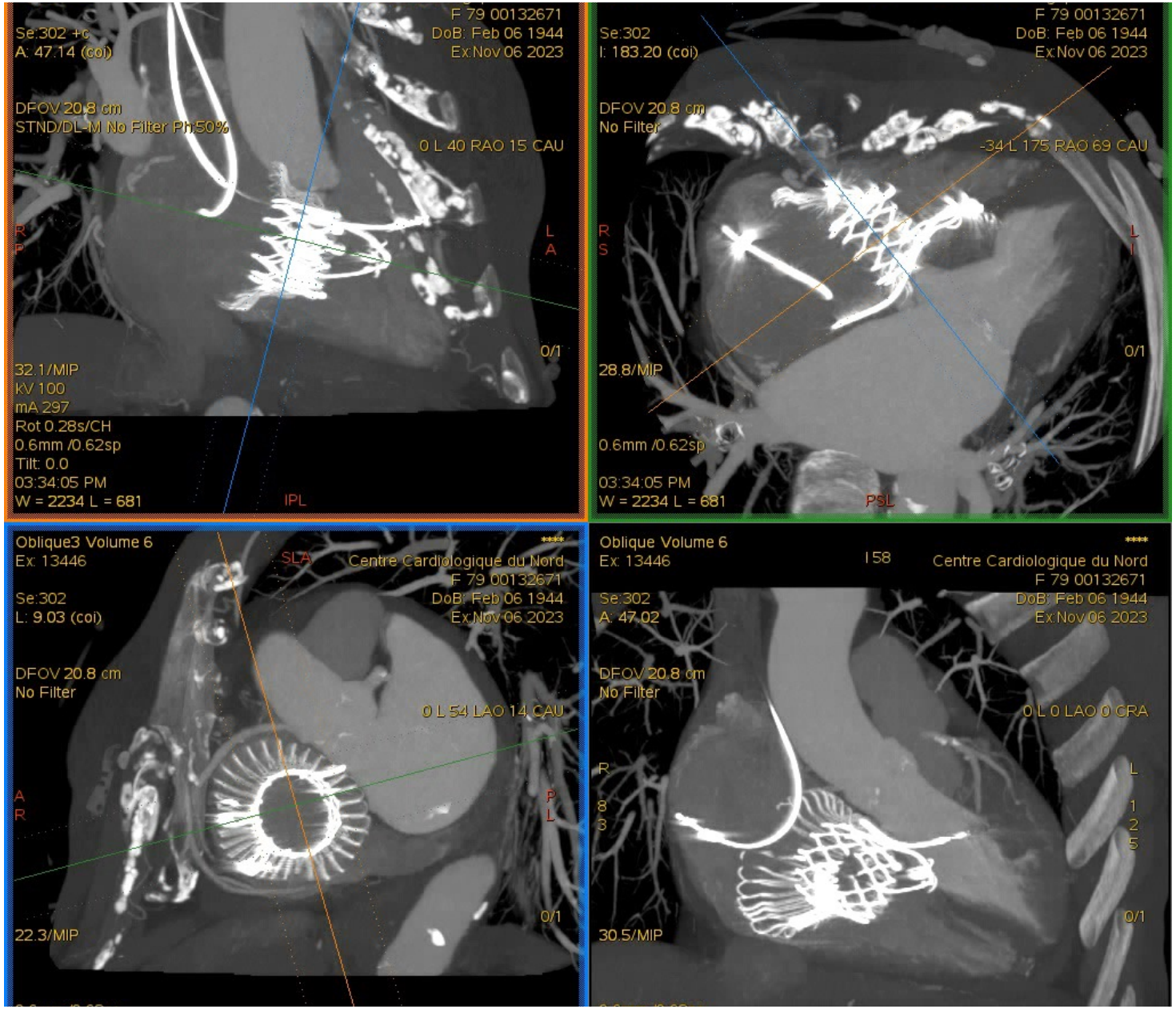


After

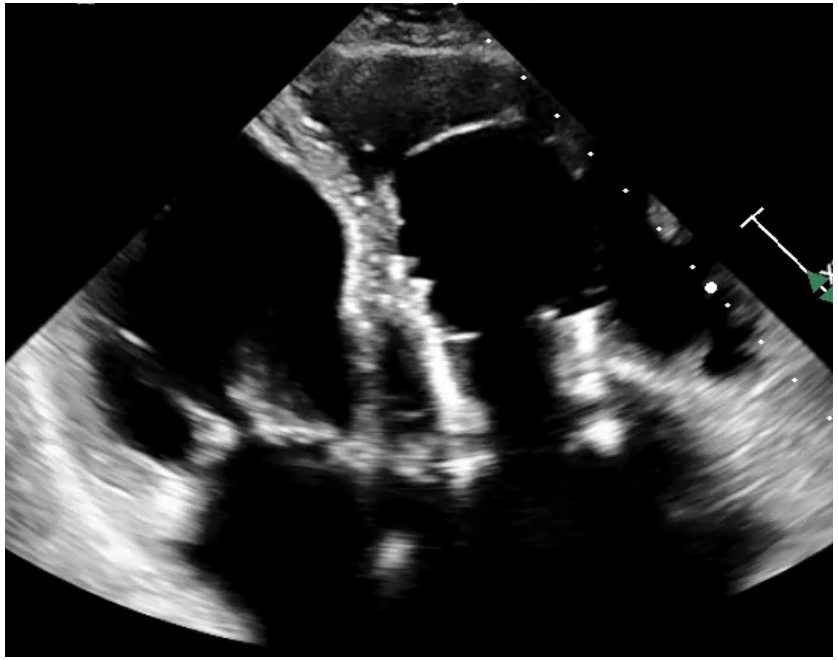


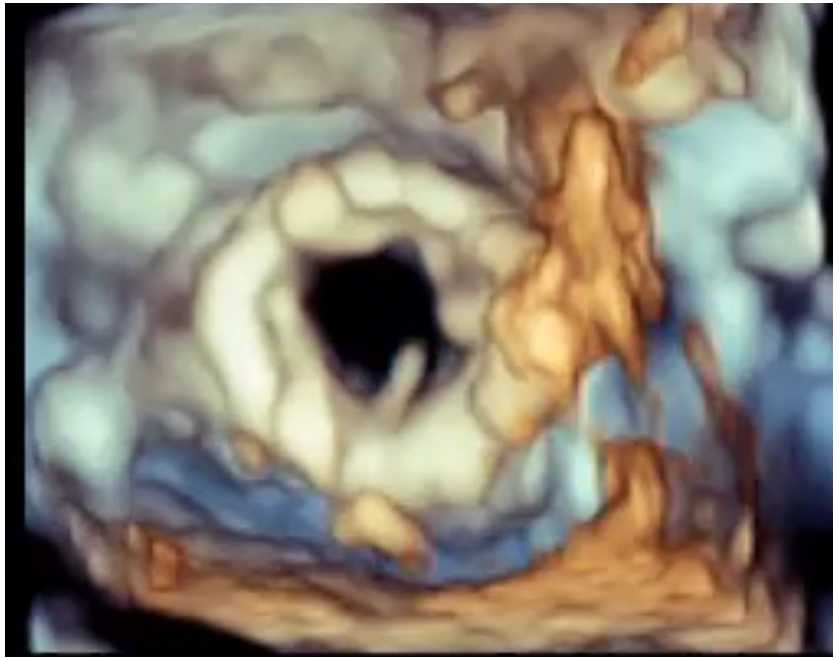


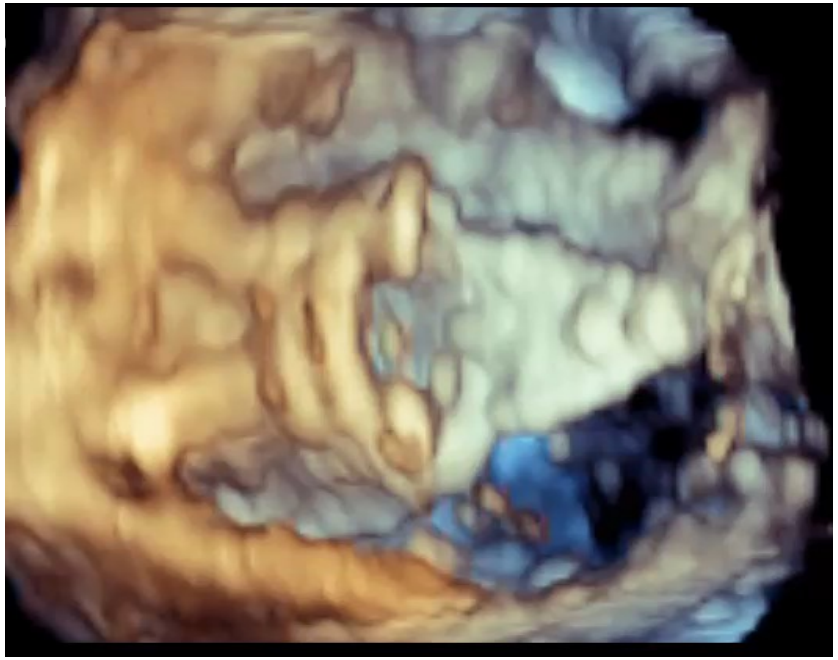
Transcatheter tricuspid valve replacement and pacemaker: LUX-valve

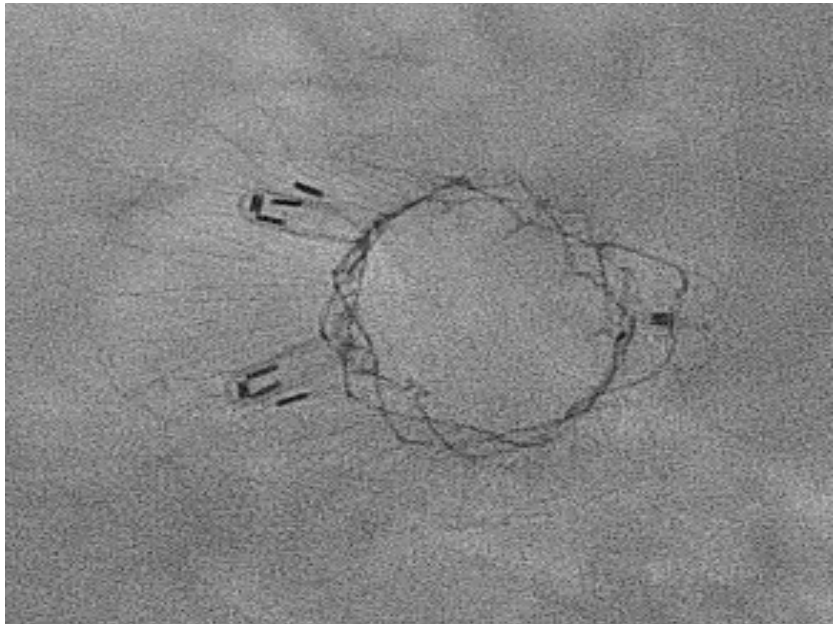


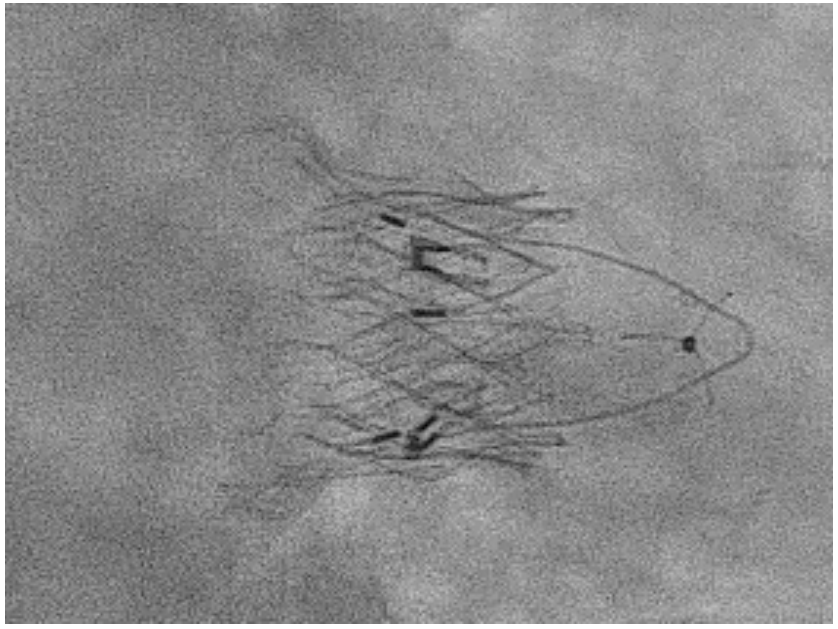
Transcatheter tricuspid valve replacement: LUX-valve

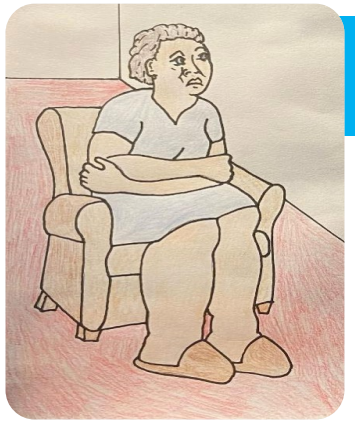








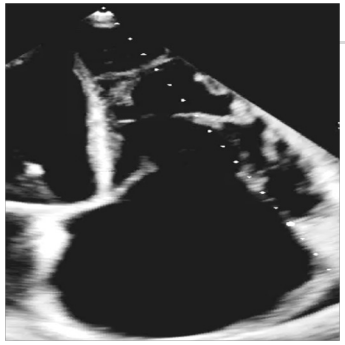




BASELINE CHARACTERISTICS IN REGISTRIES AND RCT

Demographics

Symptomatic History

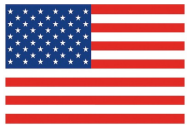


Medical History

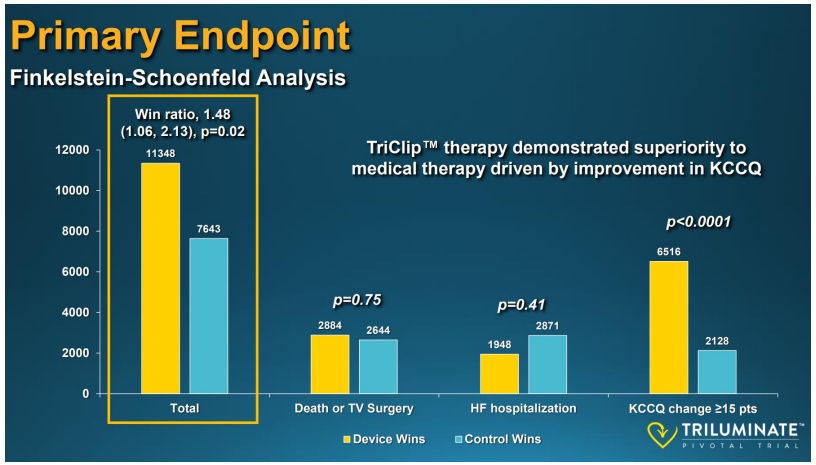
	REGISTRIES				RCT		
	TRIGISTRY N=645	**bRIGHT Study N=511**	**EuroTR N=761**	**TRISCEND N=176**	**TRILUMINATE RCT N=350**	**TRI-FR RCT N=300**	**TRISCEND 2 N=392**
Age, mean (years)	**77 ± 8**	**79 ± 7**	**78 ± 9**	**79 ± 7**	**78 ± 7**	**79±6**	**79**
Male/Female	**40%/60%**	**44%/56%**	**47%/53%**	**29%/71%**	**45%/55%**	**36%/64%**	**24%/76%**
NYHA Class III/IV	**87%**	**80%**	**88%**	**75%**	**58%**	**43%**	**71%**
KCCQ score, mean		44.52 ± 22.56			55.1 ± 23.8	54.0 ± 24.1	52
Prior Heart Failure Hospitalization (1 Year Pre-Index Procedure)		40.3%		41%	25.1%	40%	35%
Hypertension		86.7%		84%	80.9%	69.3%	91%
Atrial Fibrillation	**85%**	**86.3 %**	**91%**	**92%**	**90.0%**	**95%**	**94%**
Mitral Regurgitation (≥ Moderate)	0%	6.0%			3.0%	14%	
Prior Aortic Intervention	34%	9.2%		19	15.4%	10%	
Prior Mitral Intervention		26.8%		26	24.9%	1%	
Prior CABG		11.5%		17%	19.1%		16%
Diabetes	25%	22.3%			15.7%	16%	
Renal Disease		39.5%		59%	35.4%	6.6%	56%
Chronic Obstructive Pulmonary Disease	21%	13.1%			12.3%	6.7%	17%
Peripheral Vascular Disease		11.0%		11%	9.7%	9.3%	
Prior Stroke		8.0%		14%	8.6%	14.7%	12%
Permanent Pacemaker/ICD	**29%**	**22.5%**	**30%**	**32%**	**14.9%**	**7%**	**39%**

COMPOSITE ENDPOINTS AT 1 YEAR IN RCT

TRILUMINATE TRIAL



Triclip



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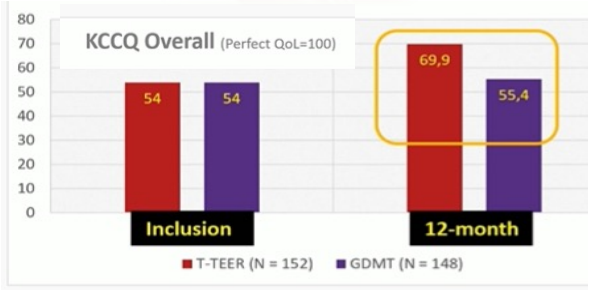
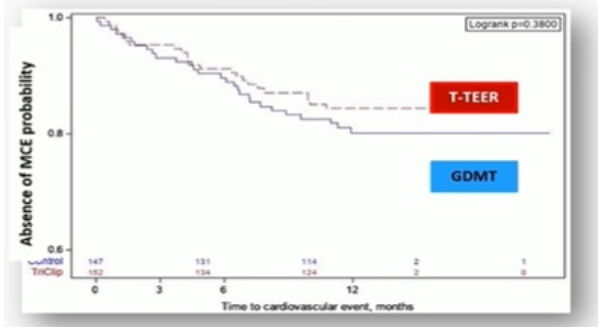
TRI-FR TRIAL

Triclip



Hierarchical composite endpoint of time to death or tricuspid valve surgery, or heart failure hospitalizations, and improvement of ≥ 15 points in KCCQ score at 1 yr.	2.06 (1.38-3.08)	0.0004



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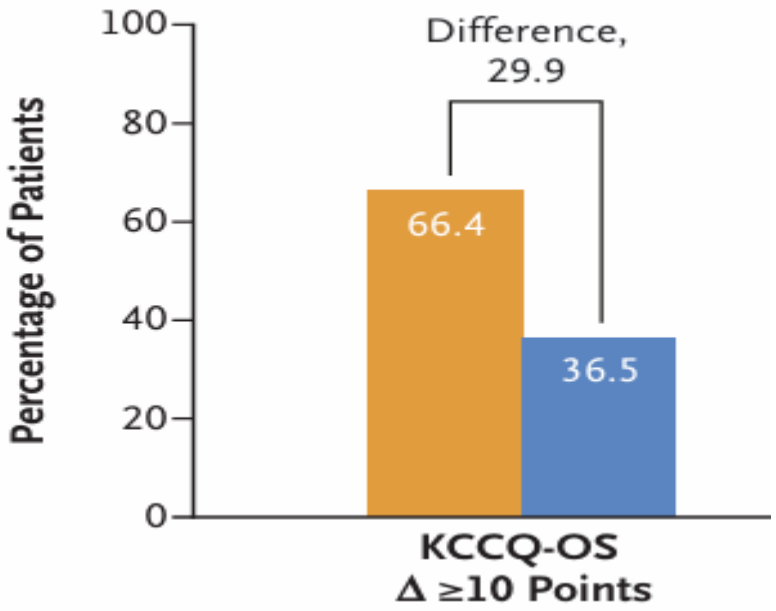
TRISCEND 2

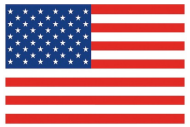
Evoque



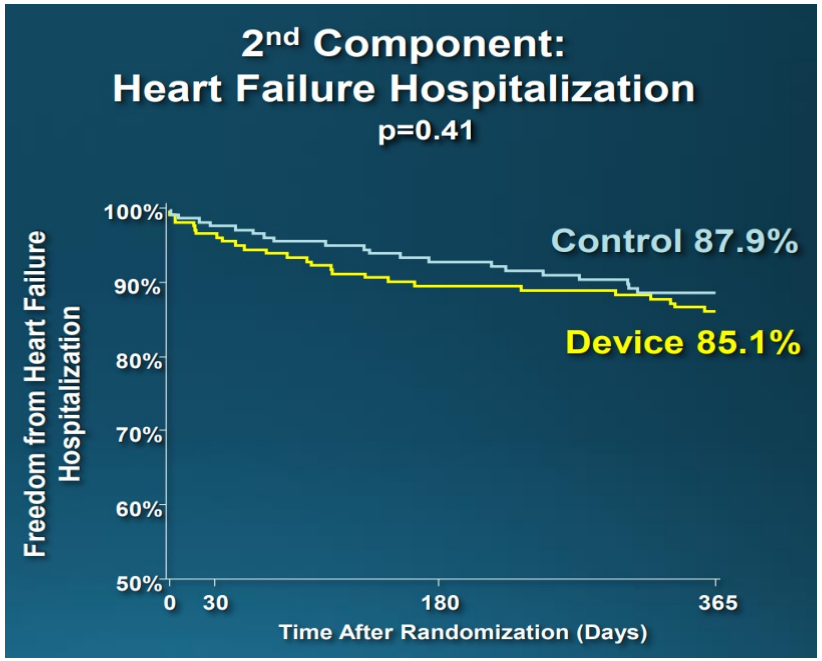
Hahn R et al. NEJM 2024

HEART FAILURE HOSPITALIZATION AT 1 YEAR IN RCT

TRILUMINATE TRIAL



Triclip



Sorajja P et al. NEJM 2023

TRI-FR TRIAL

Triclip

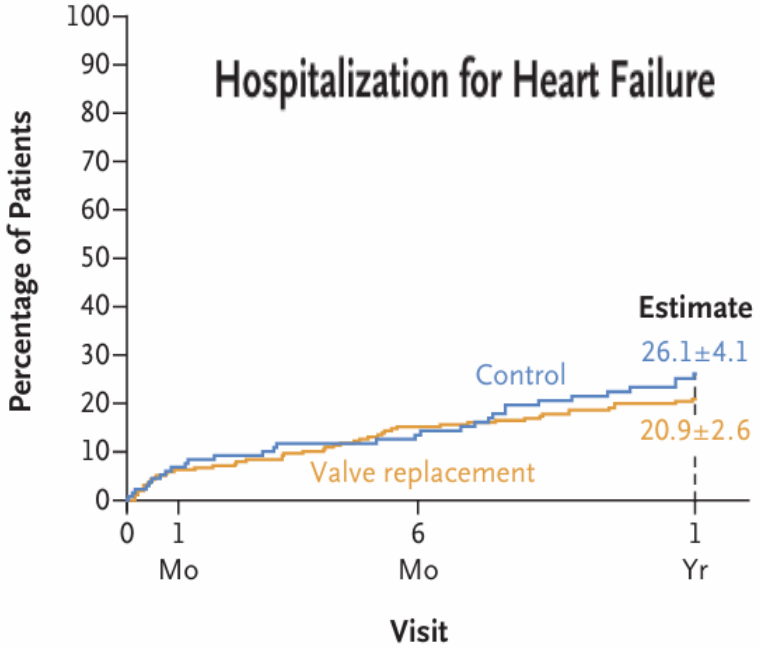
No difference

	Control N=148	TrClip device N=152
HF hospitalization	20 (13.5%)	15 (9.9%)

Donal E et al. JAMA 2024

TRISCEND 2

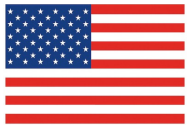
Evoque



Hahn R et al. NEJM 2024

HEART FAILURE HOSPITALIZATION AT 2 YEARS IN RCT

TRILUMINATE TRIAL

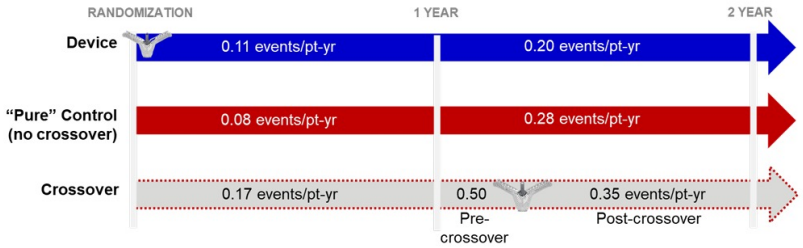


Triclip

Device (N=172)

Crossover (N=111)

“Pure” Control (N=44)
(crossovers excluded)



TRI-FR TRIAL

Triclip

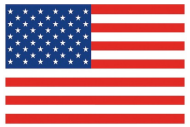
TRISCEND 2

Evoque

Kar S et al. Circulation 2025

HEART FAILURE HOSPITALIZATION AT 2 YEARS IN RCT

TRILUMINATE TRIAL



Triclip

Device (N=172)

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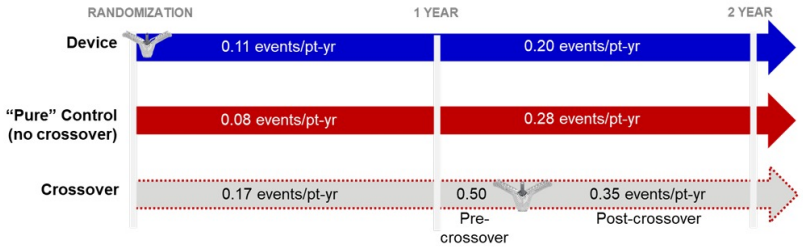


Kar S et al. Circulation 2025

TRI-FR TRIAL

Triclip

?

TRISCEND 2

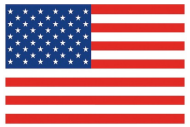
Evoque

?

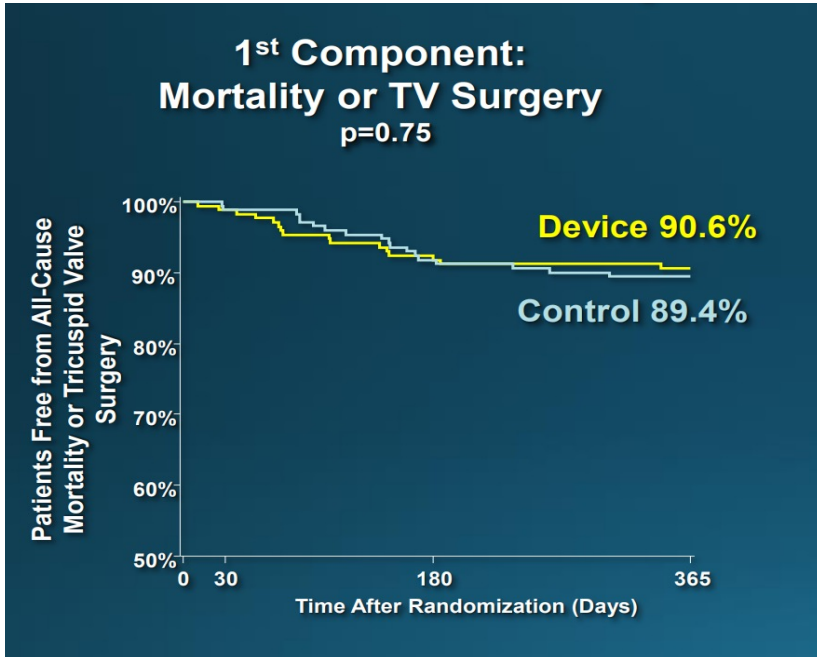
Donal et al...

SURVIVAL AT 1 YEAR IN RCT

TRILUMINATE TRIAL



Triclip



Sorajja P et al. NEJM 2023

TRI-FR TRIAL

Triclip

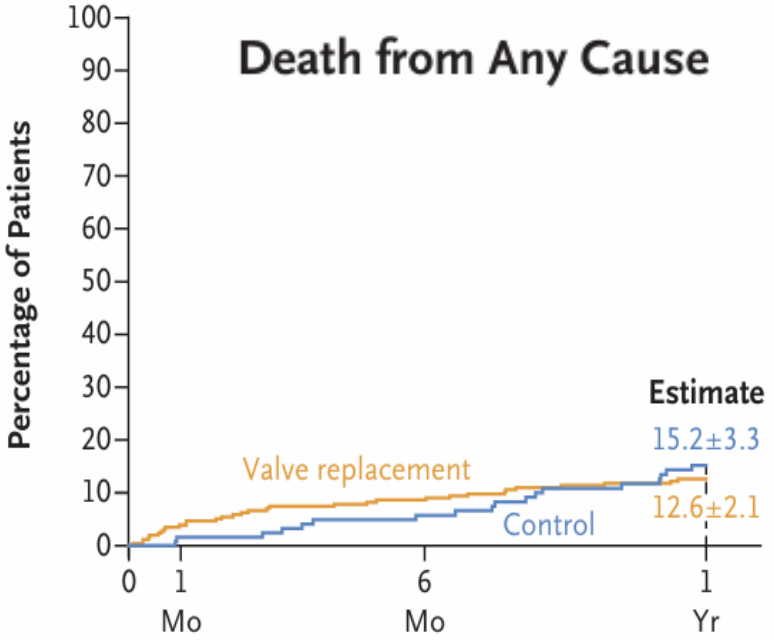
No difference

	Control N=148	TrClip device N=152
Death	8 (5.4%)	5 (3.3%)

Donal E et al. JAMA 2024

TRISCEND 2

Evoque



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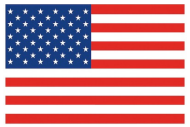
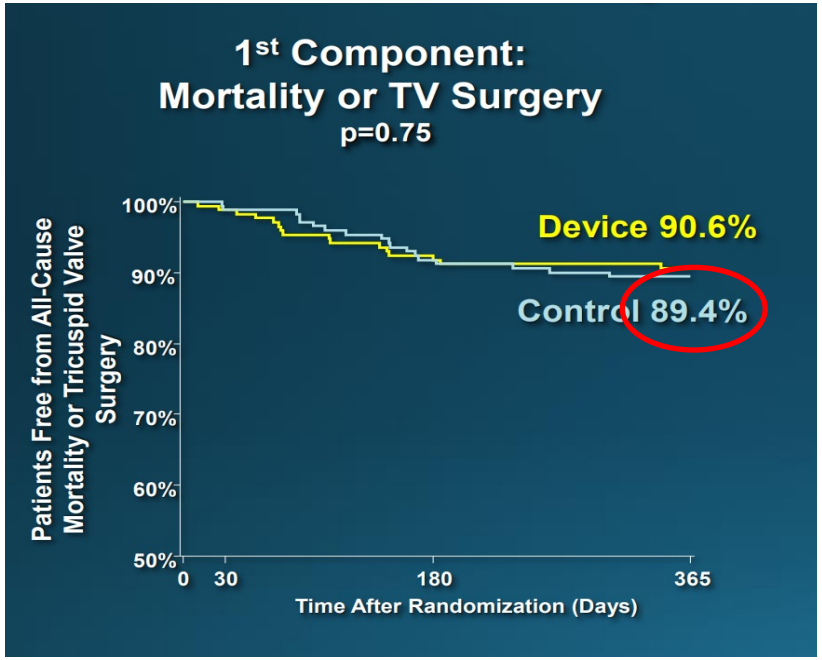
SURVIVAL AT 1 YEAR IN RCT

TRILUMINATE TRIAL



Triclip



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TRI-FR TRIAL

Triclip

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	Control N=148	TrClip device N=152
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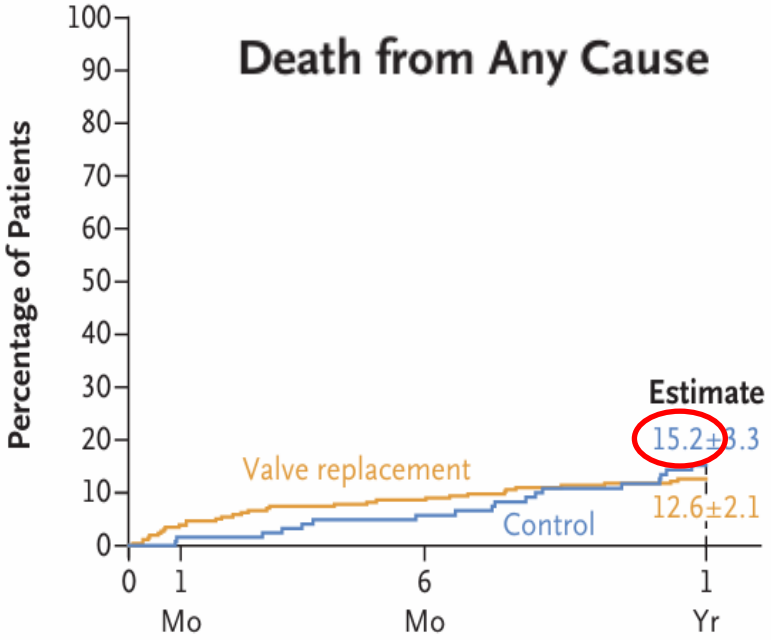
Donal E et al. JAMA 2024

TRISCEND 2

Evoque



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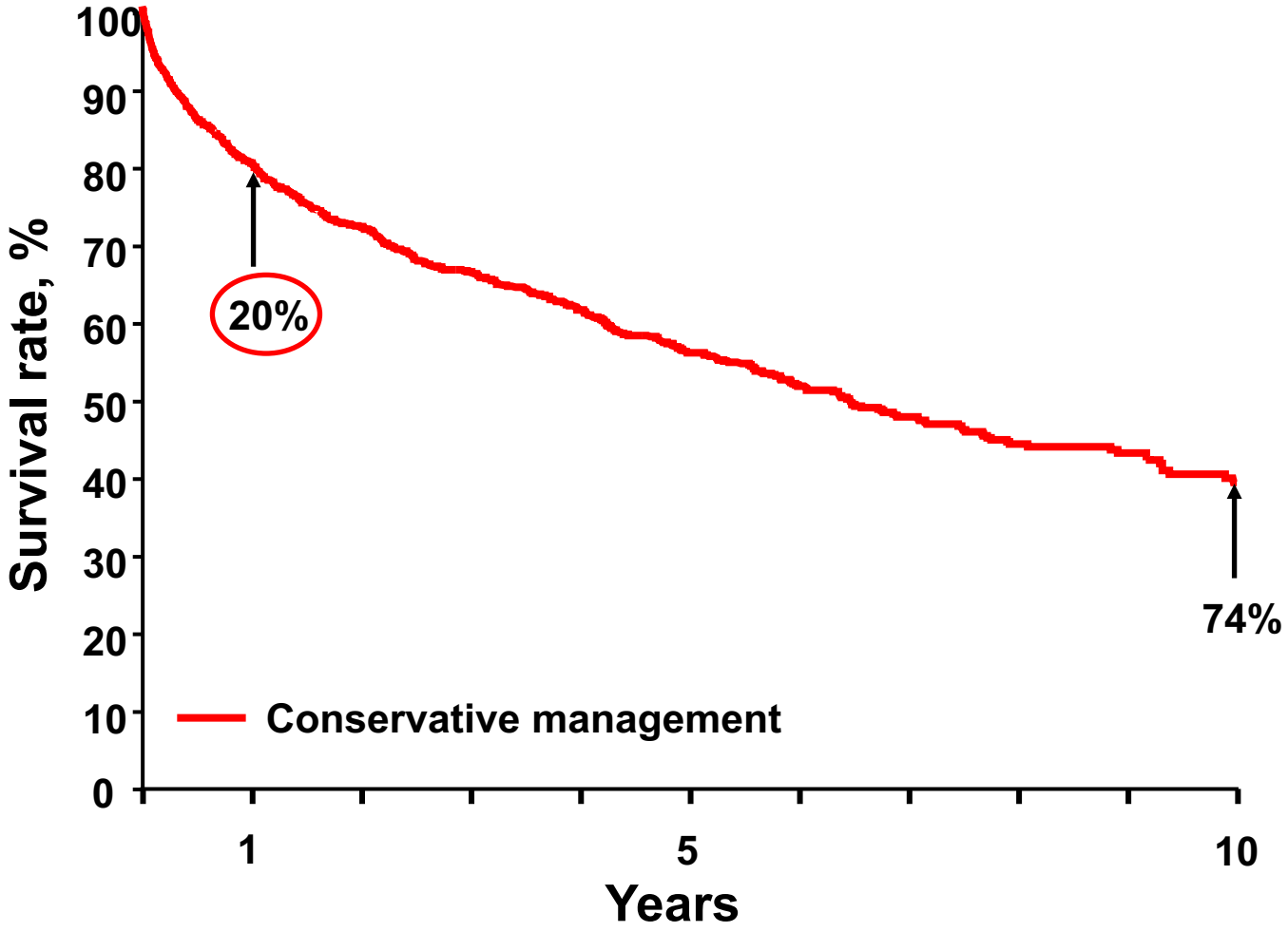
SURVIVAL IN THE MEDICAL GROUP

TRIGISTRY



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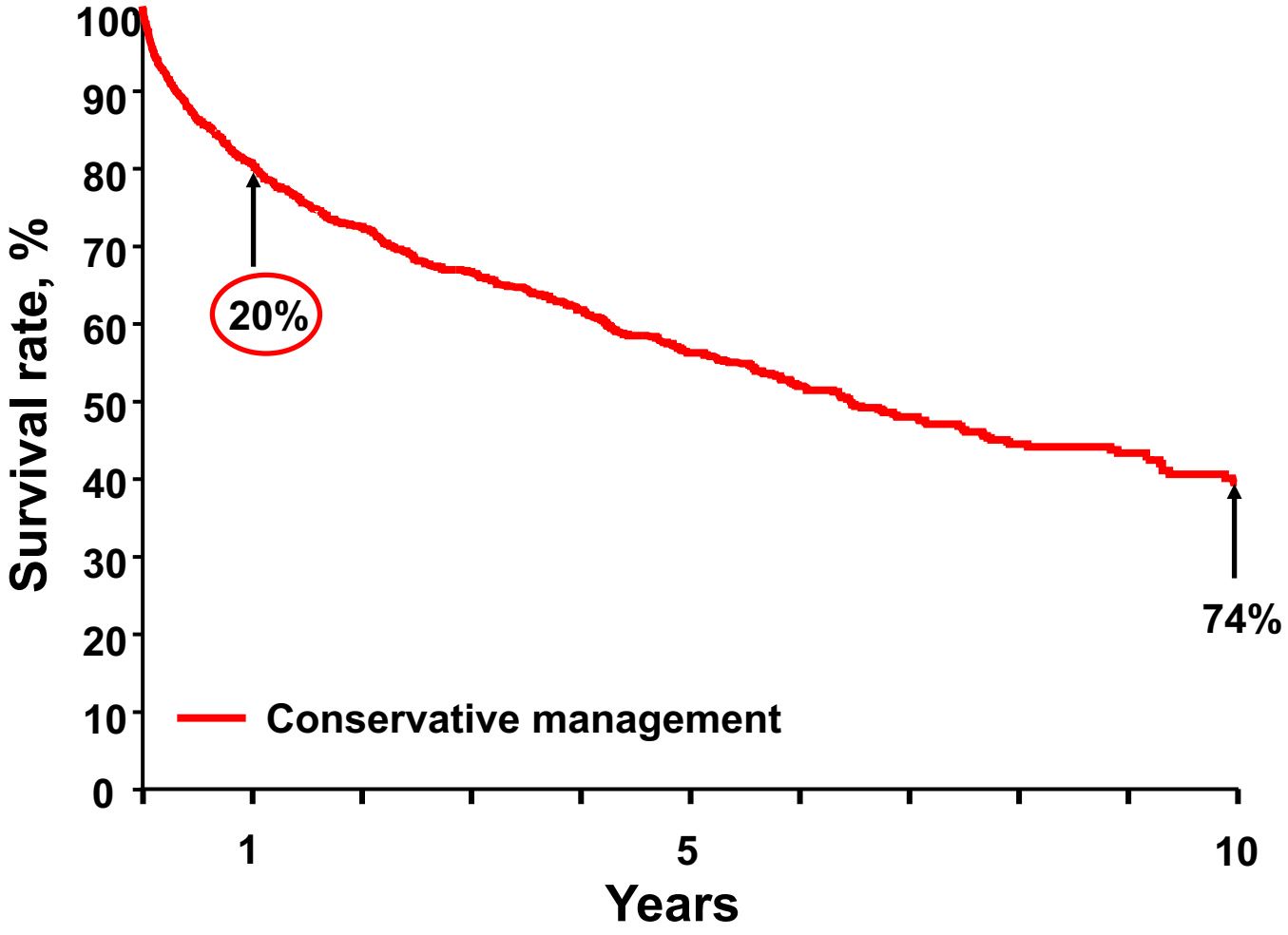
SURVIVAL IN THE MEDICAL GROUP

TRIGISTRY



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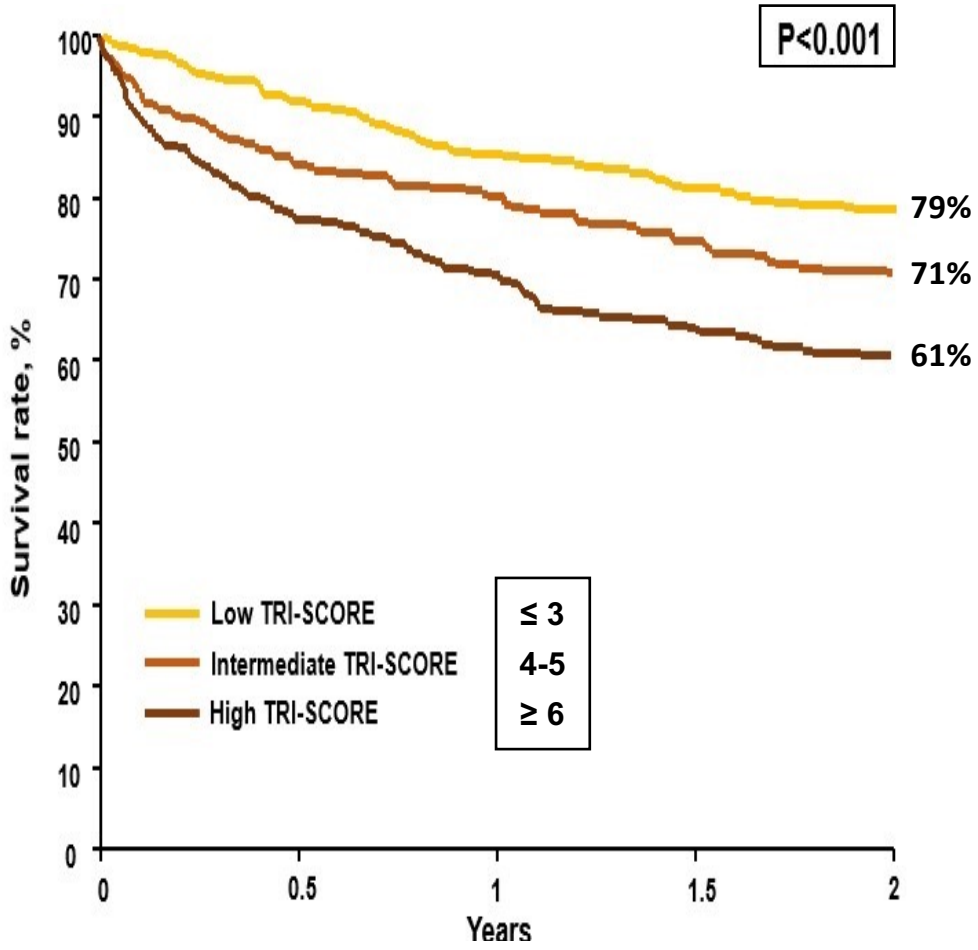

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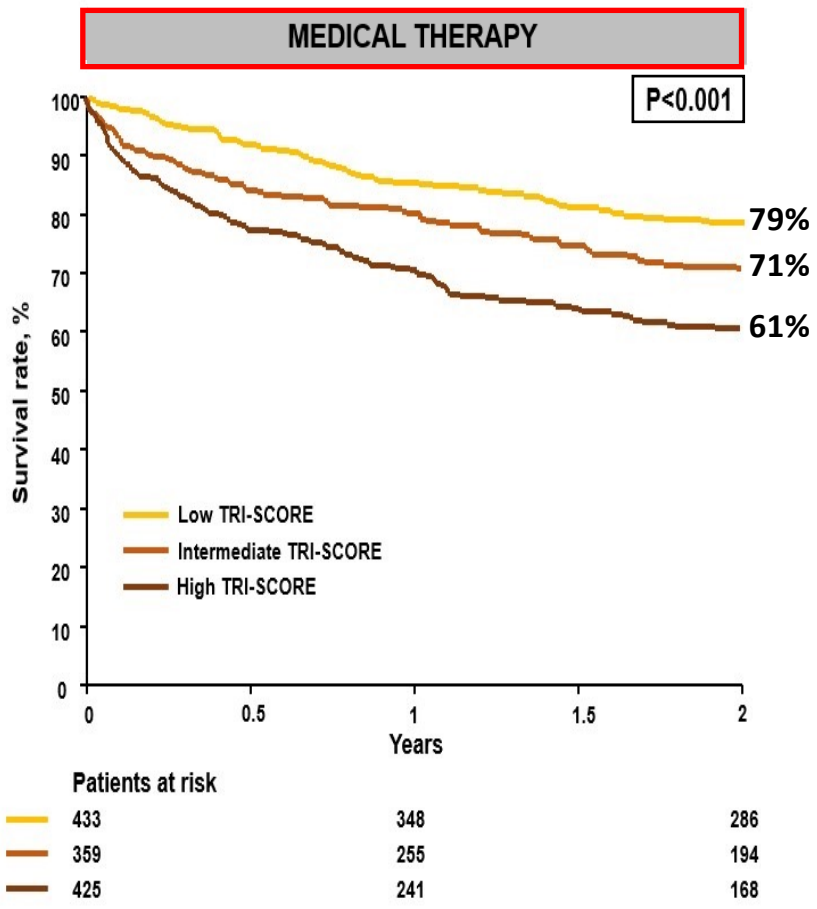
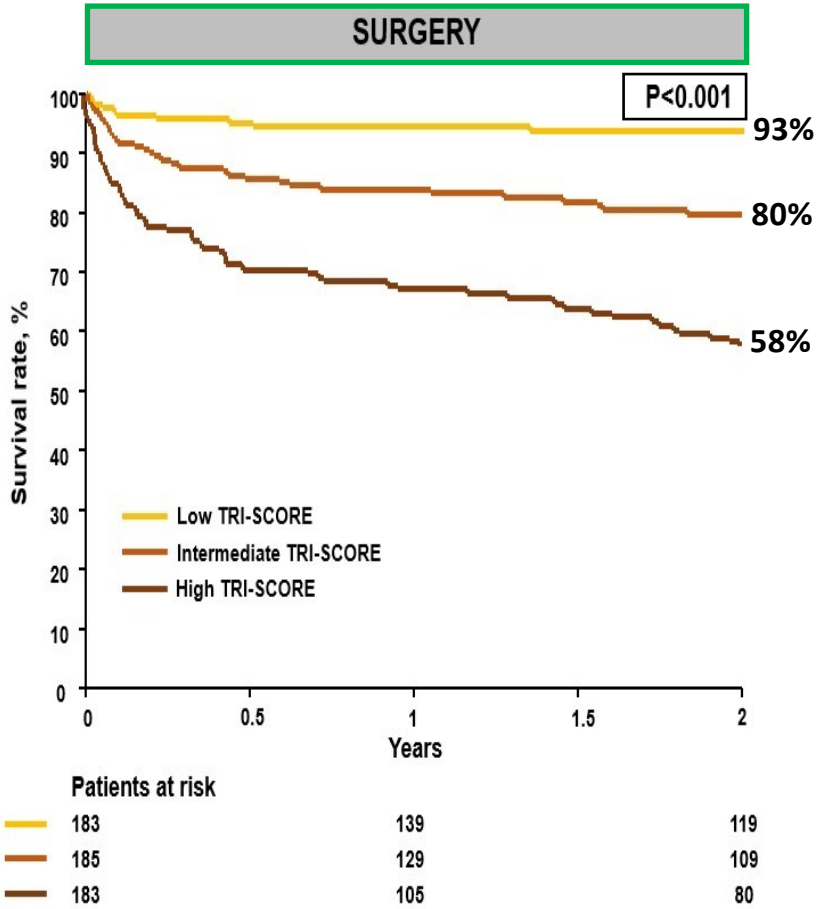
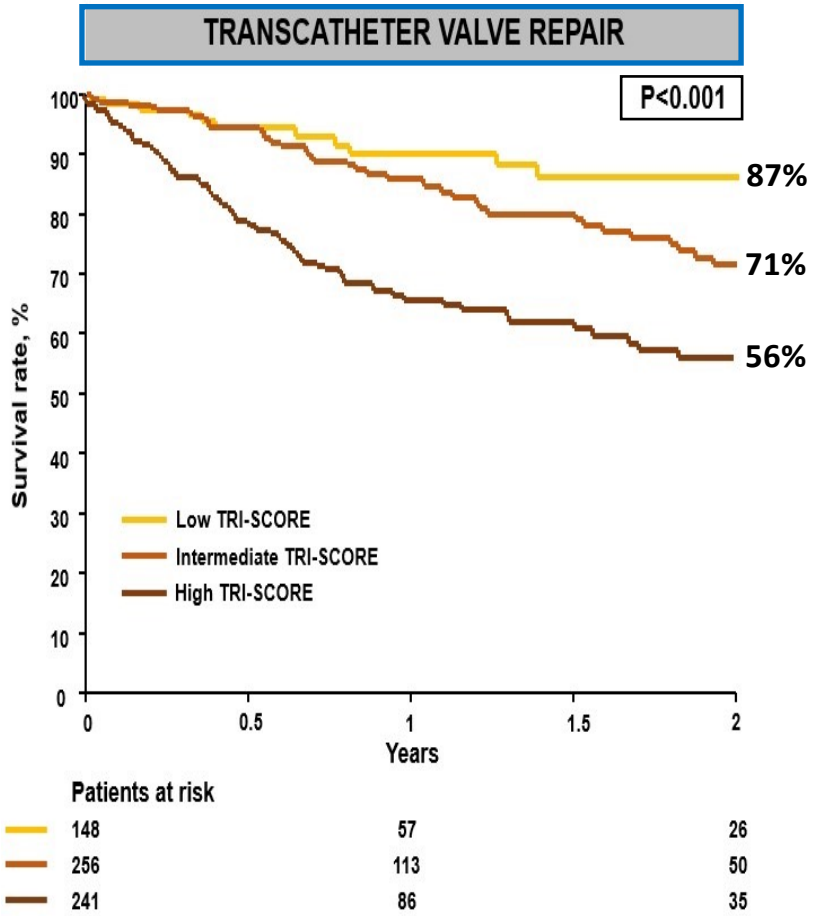
TRIGISTRY: IMPACT OF TRI-SCORE ON SURVIVAL







Results remained unchanged after adjustment for age, sex, atrial fibrillation and comorbidities* (all P<0.001)

*diabetes, chronic lung disease, coronary artery disease, and prior left heart valve intervention

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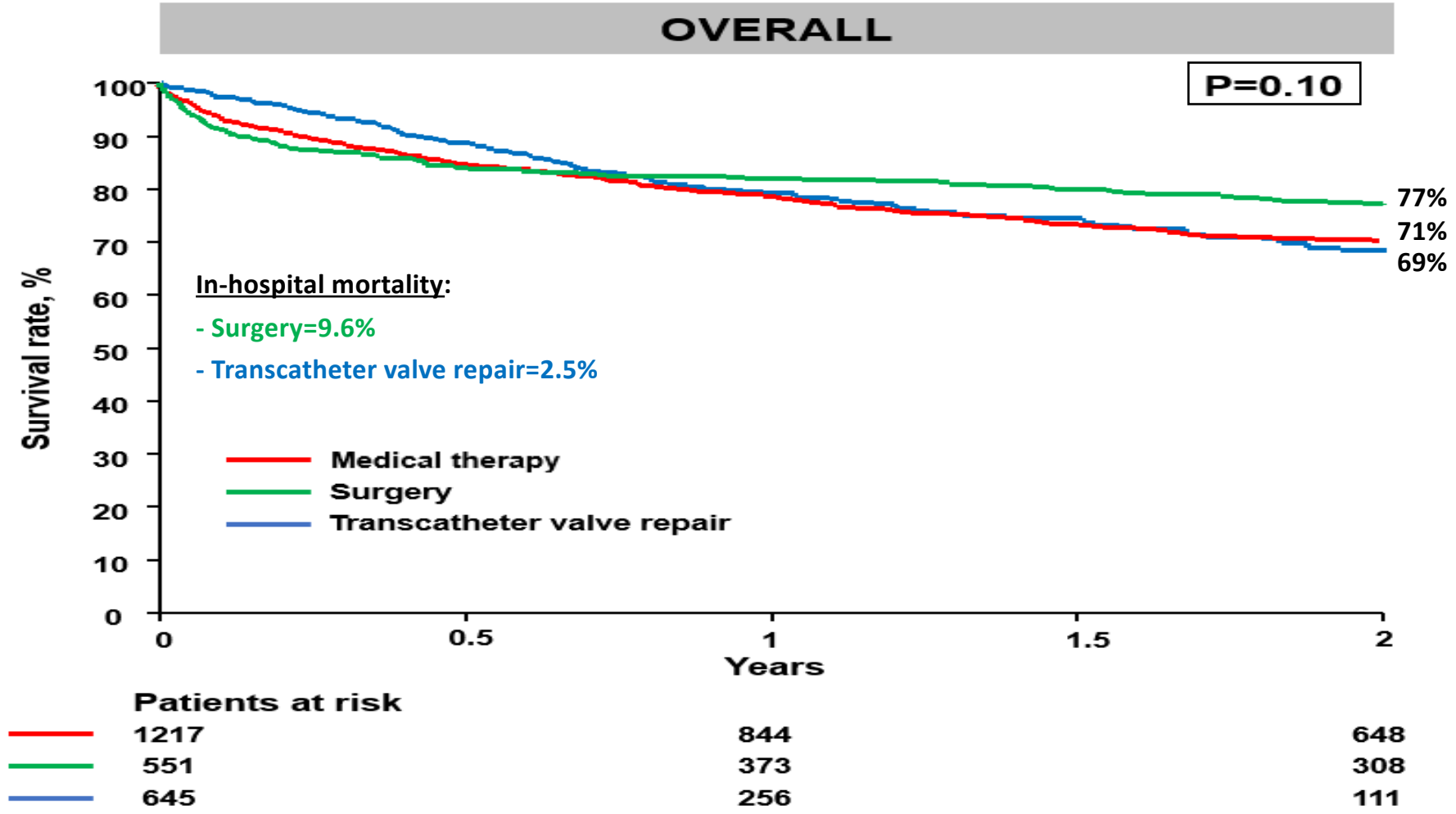
TRIGISTRY: IMPACT OF TREATMENT MODALITY ON SURVIVAL



Result remained unchanged after adjustment for age, sex, atrial fibrillation and comorbidities (P=0.23)

*diabetes, chronic lung disease, coronary artery disease, and prior left heart valve intervention

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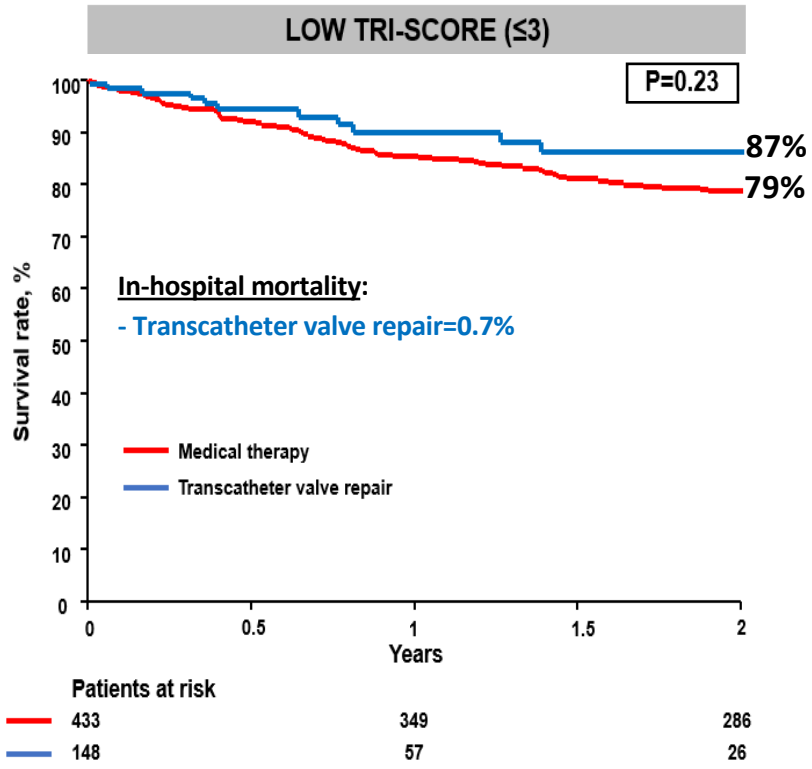
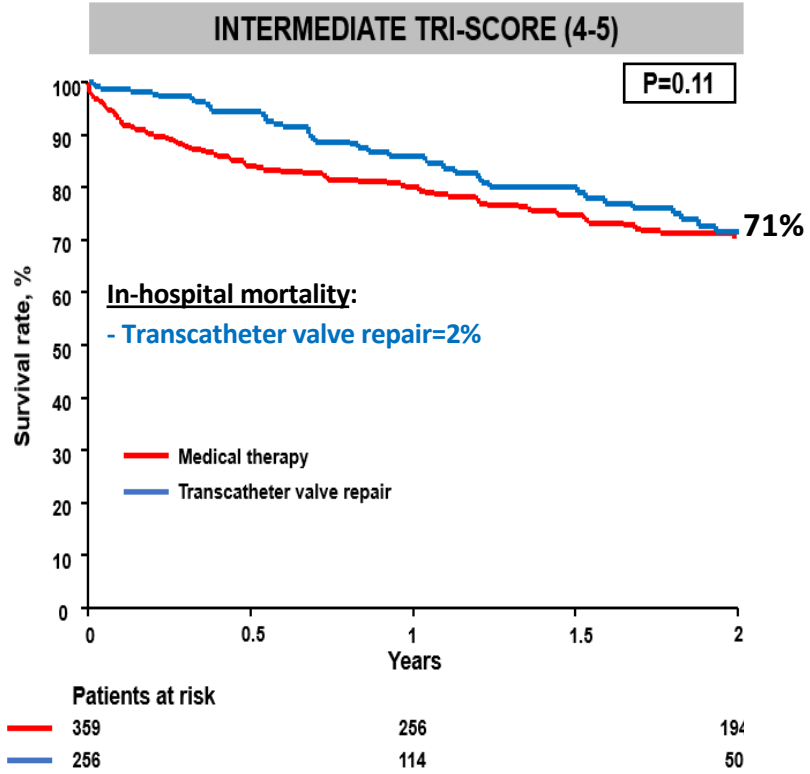
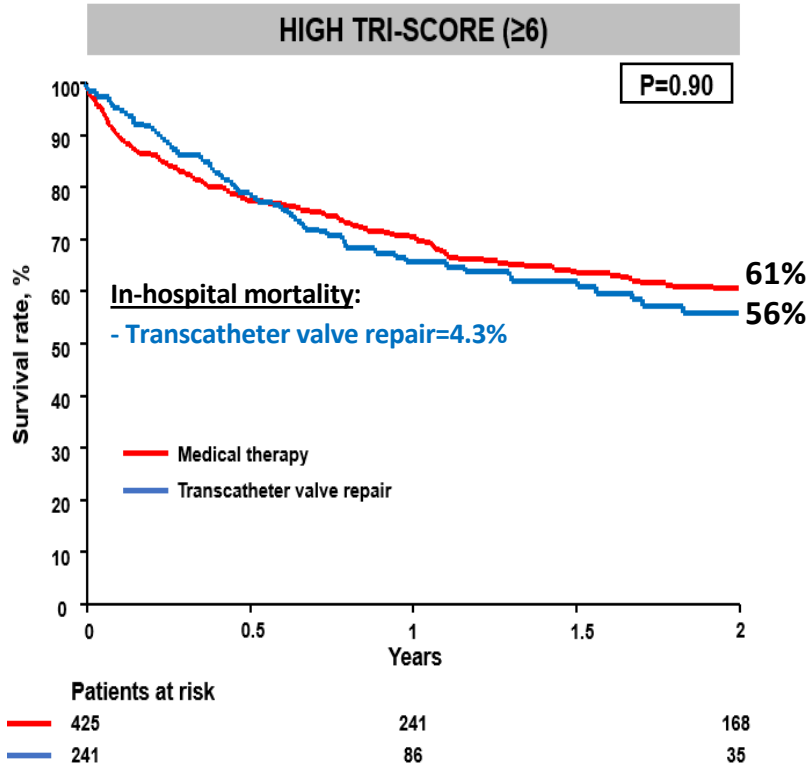
TRIGISTRY: IMPACT OF TREATMENT MODALITY ON SURVIVAL

Transcatheter valve repair vs medical therapy







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TRIGISTRY: IMPACT OF RESIDUAL TR ON SURVIVAL

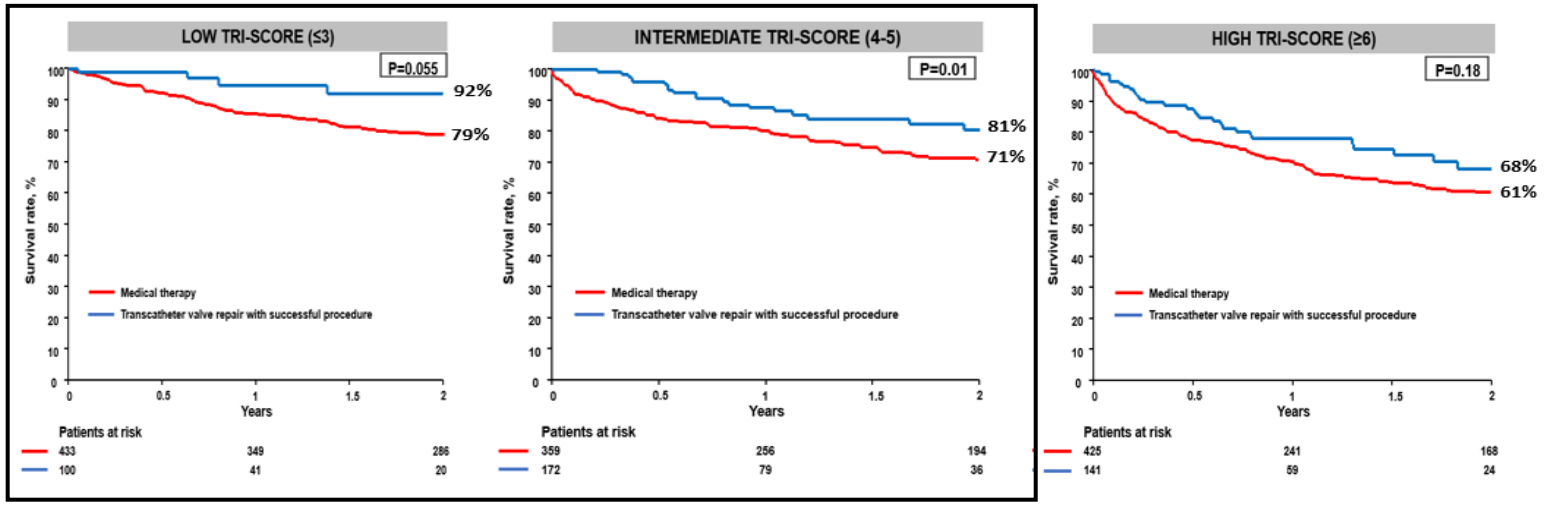
Procedural success :

= TR ≤ mild-to-moderate (2+) at discharge

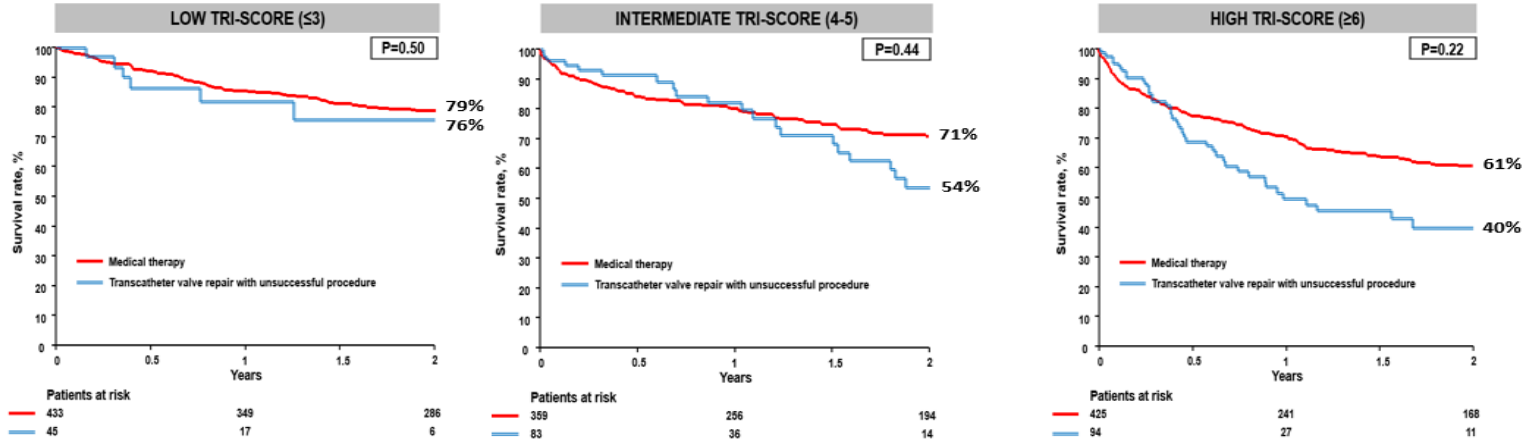
- 97% of patients after surgery

- 65% after transcatheter repair

➢ **Transcatheter valve repair with SUCCESSFUL procedure vs medical therapy**



➢ **Transcatheter valve repair with UNSUCCESSFUL procedure vs medical therapy**



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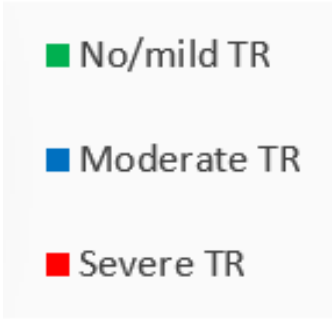
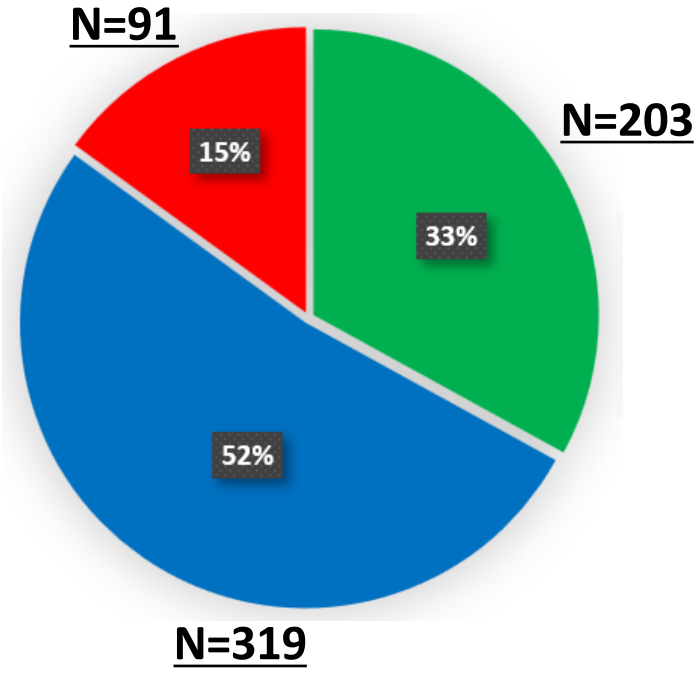
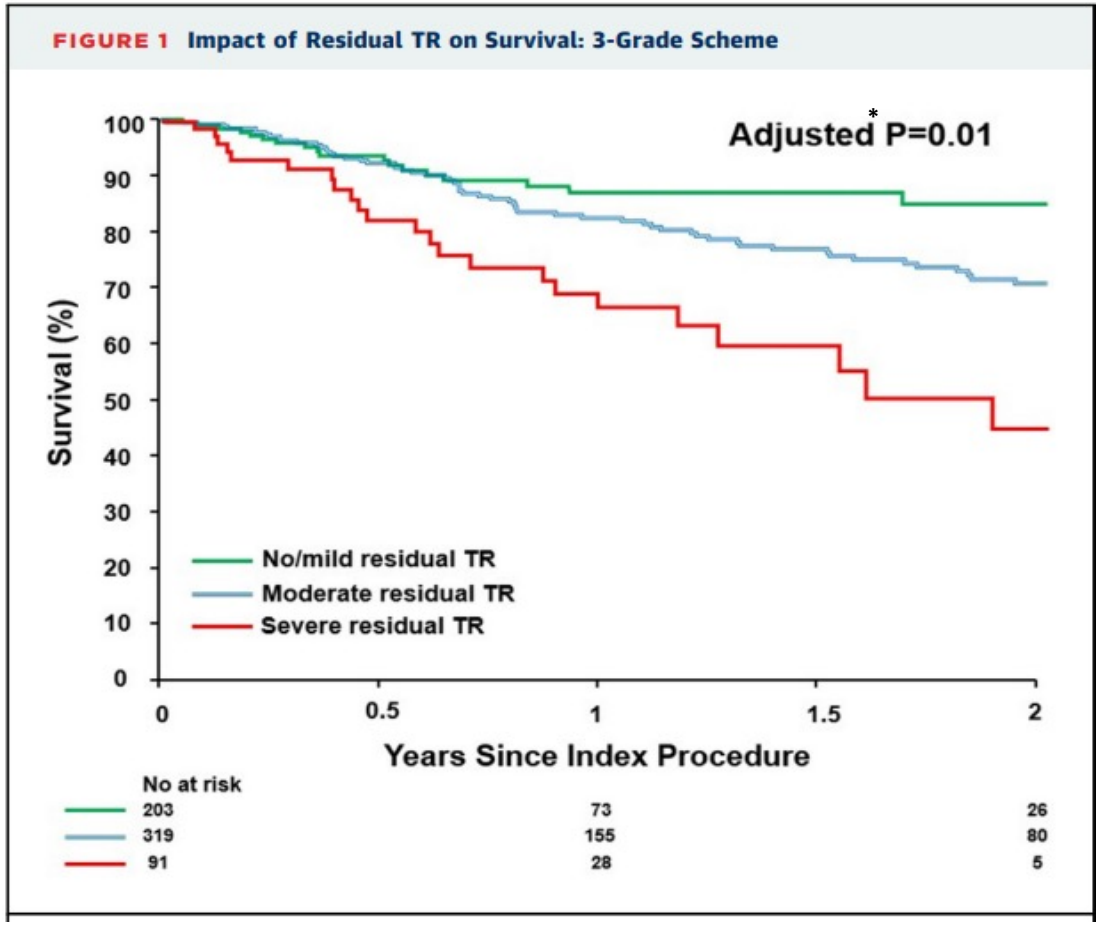
TRIGISTRY: IMPACT OF RESIDUAL TR AFTER TRANSCATHETER TV REPAIR

➢ 3-grade scheme







85%

70%

*P=0.25

*P=0.04

44%

*Adjusted (Restricted Mean Survival Time method) for age (as a continuous variable), sex, atrial fibrillation, diabetes, chronic lung disease, coronary artery disease, prior left-sided heart valve intervention and for the TRI-SCORE

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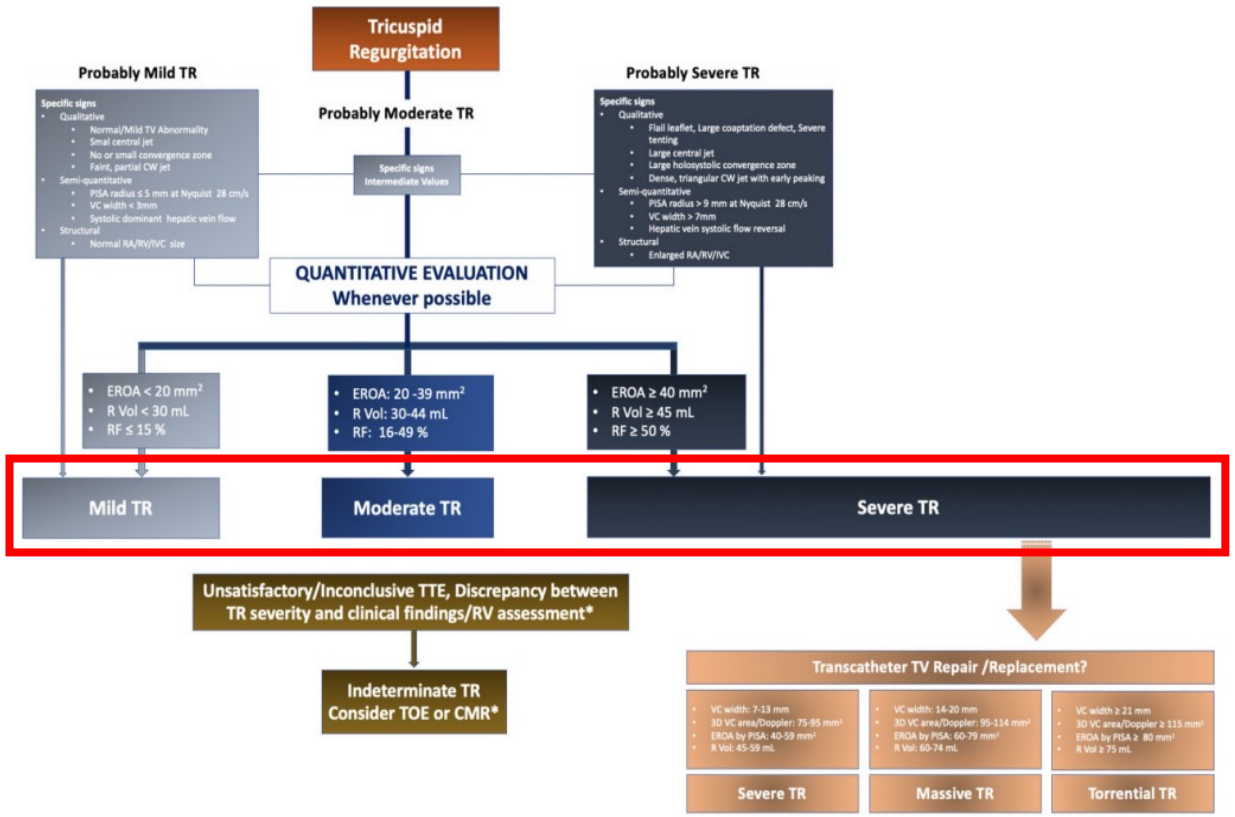
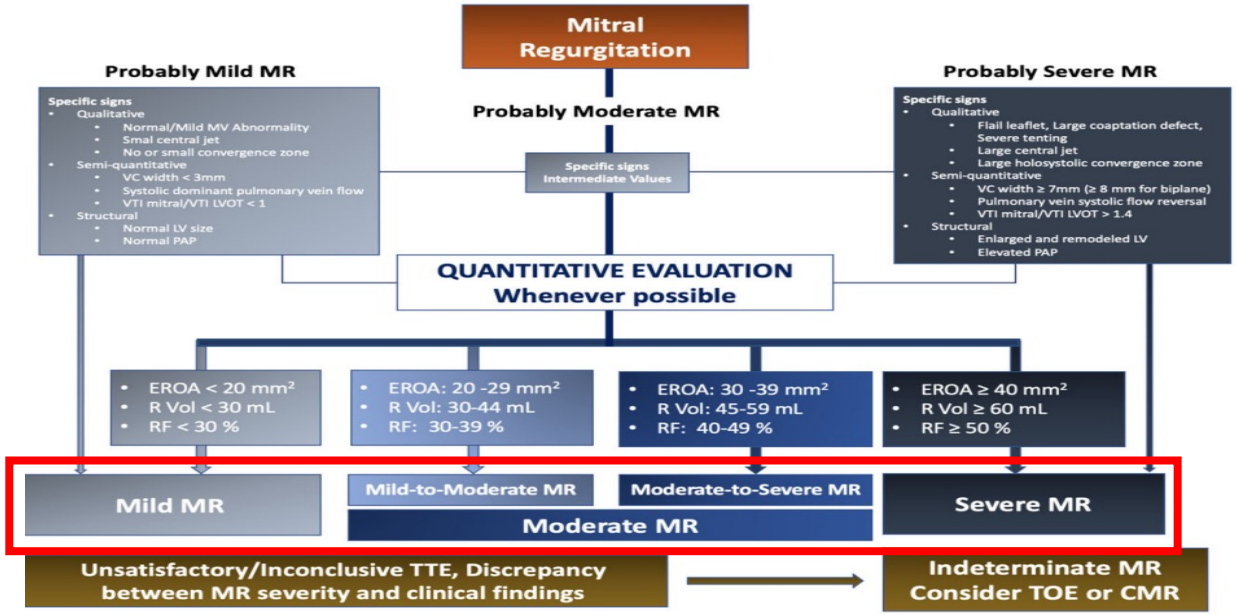
Mitral and Tricuspid regurgitation grading

3-grade scheme for TR

VS

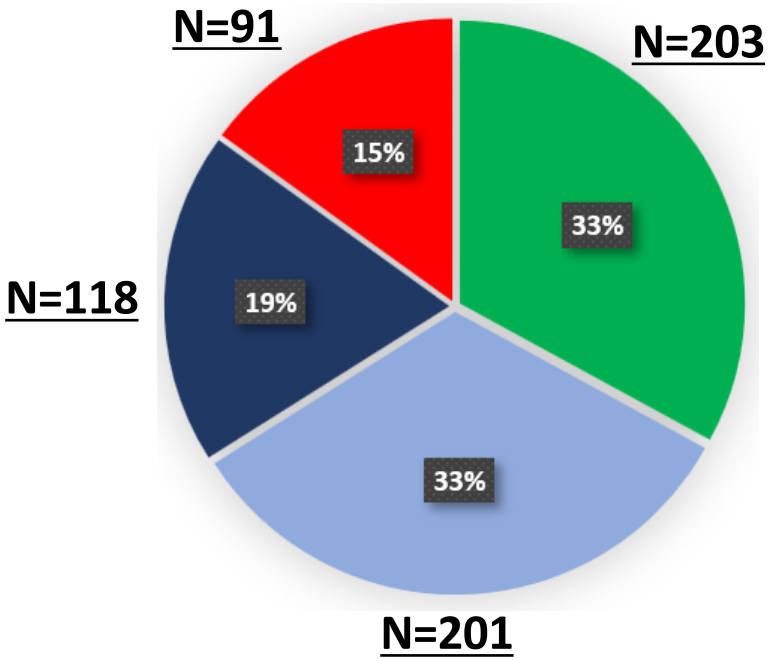
4-grade scheme for MR

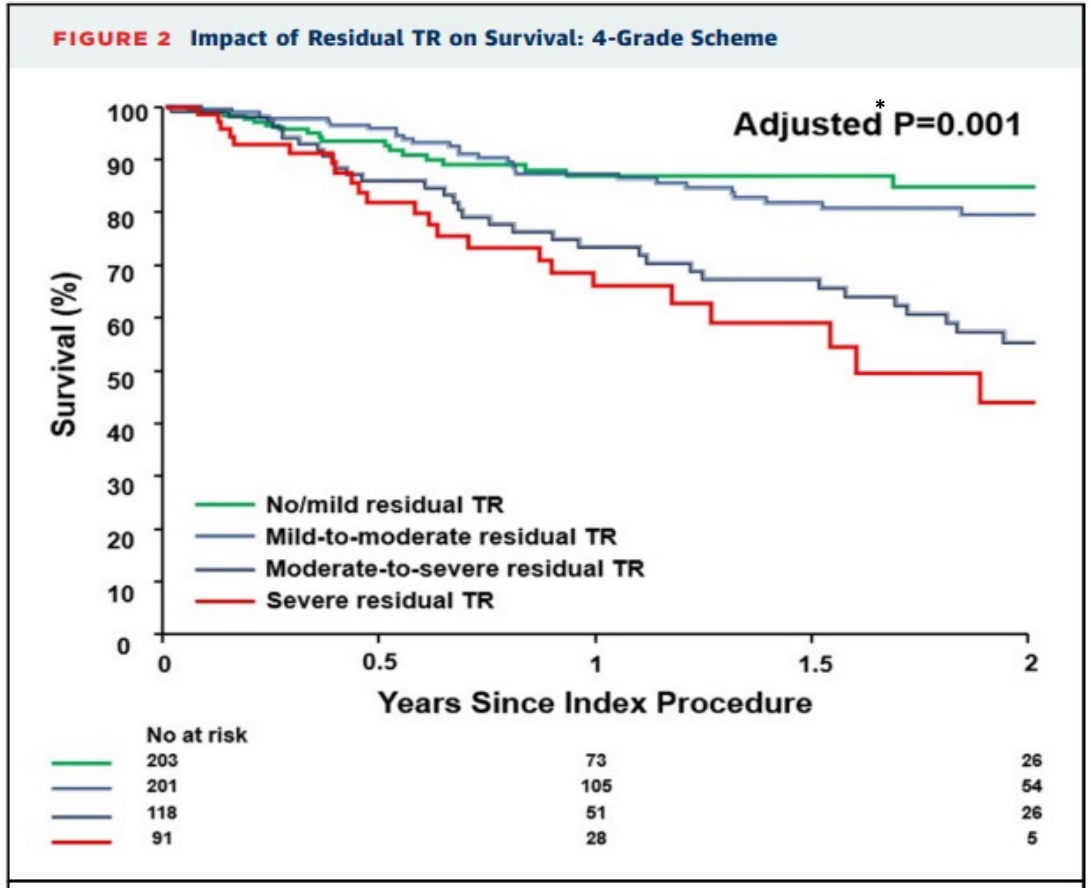




TRIGISTRY: IMPACT OF RESIDUAL TR AFTER TRANSCATHETER TV REPAIR

➢ 4-grade scheme





85%
80%
55%
44%

*P=0.67

*P=0.006

*P=0.96

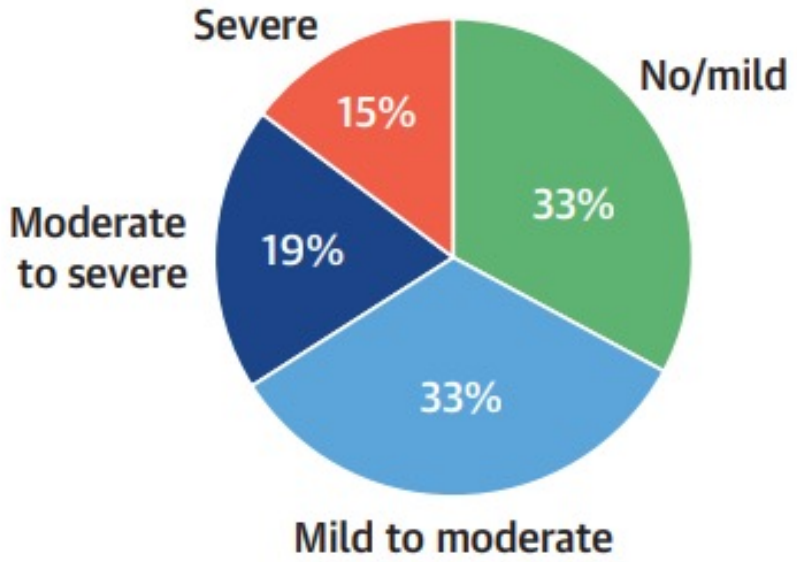
*Adjusted (Restricted Mean Survival Time method) for age (as a continuous variable), sex, atrial fibrillation, diabetes, chronic lung disease, coronary artery disease, prior left-sided heart valve intervention and for the TRI-SCORE

Dreyfus J, Messika-Zeitoun D et al. JACC Intv 2024

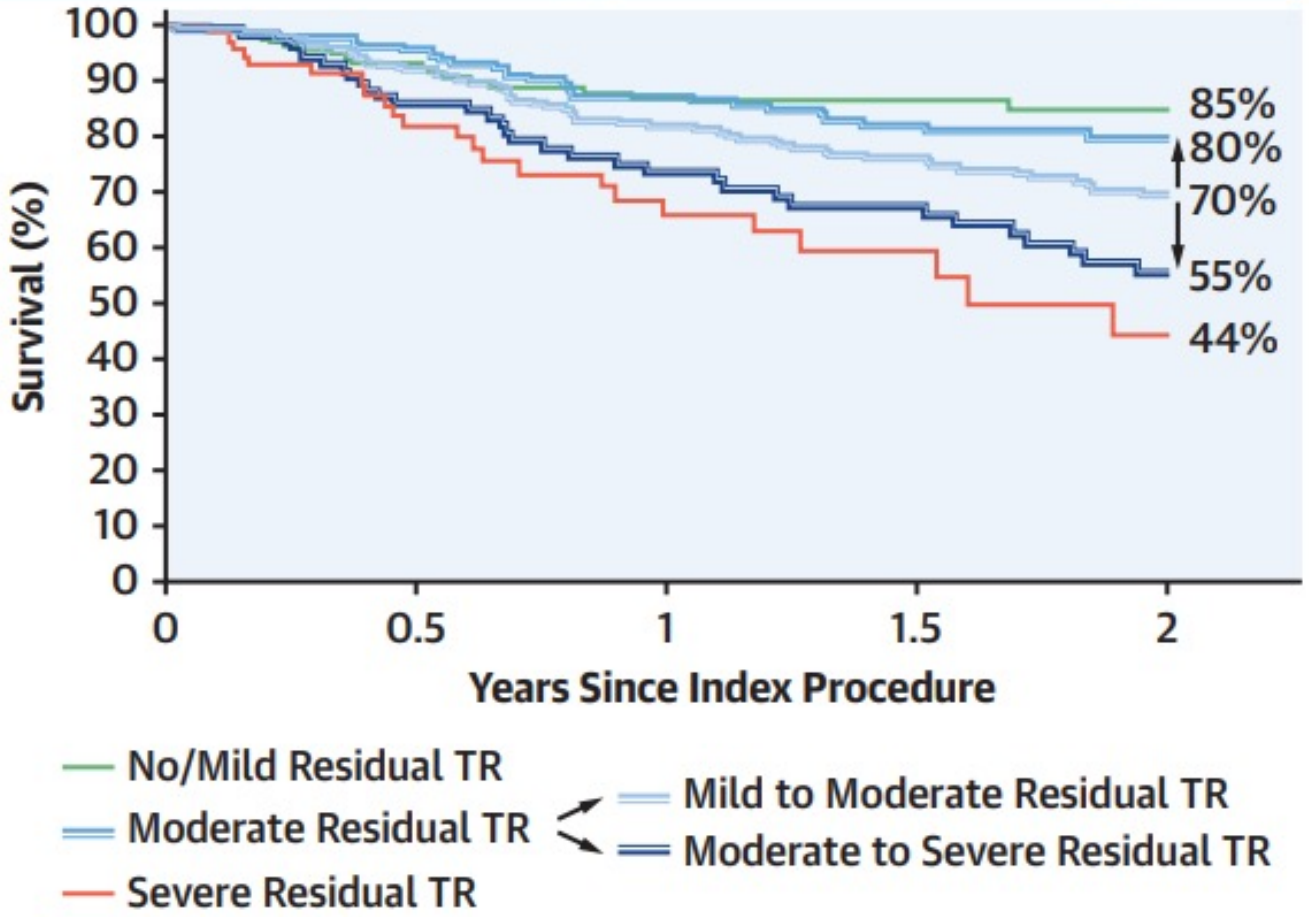
TRIGISTRY: IMPACT OF RESIDUAL TR AFTER TRANSCATHETER TV REPAIR

TRIGISTRY: Transcatheter Tricuspid Valve Repair in Severe Isolated Functional Tricuspid Regurgitation, N = 613

A Residual TR at Discharge



B Survival According to Residual TR Severity



Dreyfus J, Messika-Zeitoun D et al. JACC Intv 2024

European Heart Journal
Cardiovascular Imaging

EACVI
European Association of Cardiovascular Imaging
European Society of Cardiology

JOURNAL ARTICLE ACCEPTED MANUSCRIPT

Refining the Grading of Tricuspid Regurgitation: Enhancing Outcome Prediction and Patient Management

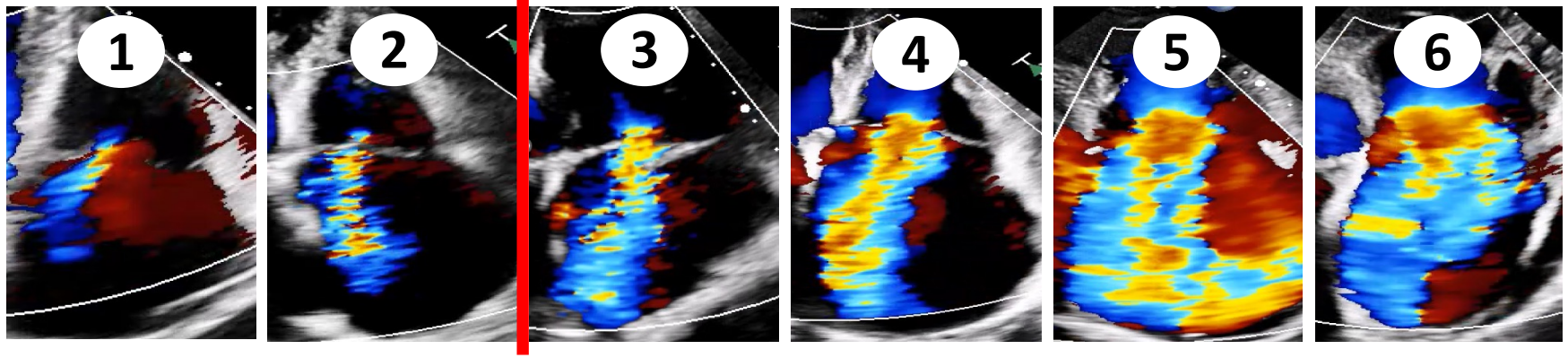
Get access >

Julien Dreyfus, MD, PhD ✉, Patrizio Lancellotti, MD, PhD, Ian G Burwash, MD, David Messika-Zeitoun, MD, PhD

European Heart Journal - Cardiovascular Imaging, jeae141,

Proposal for a Refined Tricuspid Regurgitation Grading

ASE	Mild	Moderate		Severe		
EACVI	Mild	Moderate		Severe	Massive	Torrential
Refined grading	Mild	Mild-to-moderate	Moderate-to-severe	Severe	Massive	Torrential
EROA (PISA)	<20mm²	20-29mm²	30-39mm²	40-59mm²	60-79mm²	≥80mm²



ASE = American Society of Echocardiography; EACVI = European Association of CardioVascular Imaging; EROA = Effective Regurgitant Orifice Area

ESC European Society of Cardiology
European Heart Journal - Case Reports (2023) 7, 1–5
https://doi.org/10.1093/ehjcr/ytad475

CASE REPORT
Structural intervention

Transcatheter edge-to-edge TV Repair

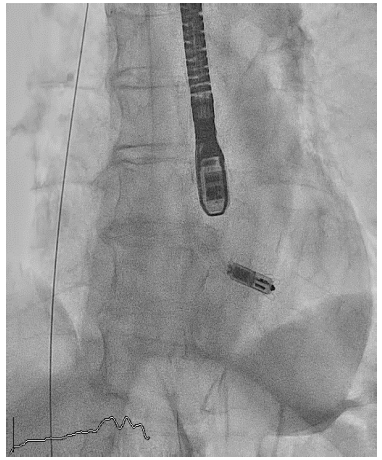
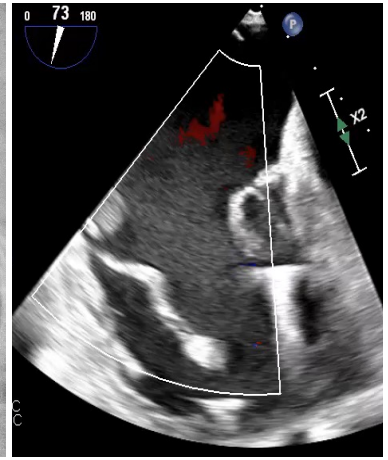
Tailored pre-procedural management and four-clip trans-catheter edge-to-edge repair procedure to efficiently treat torrential tricuspid regurgitation: a case report

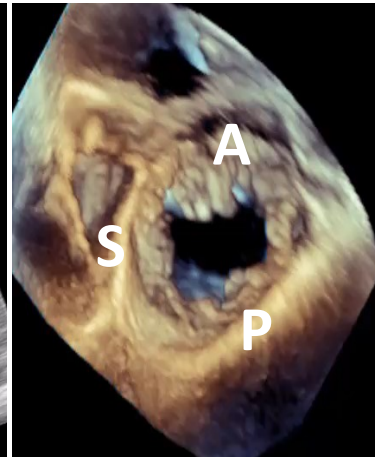
Julien Dreyfus *, Ariel Nakache, and Mohammed Nejjari

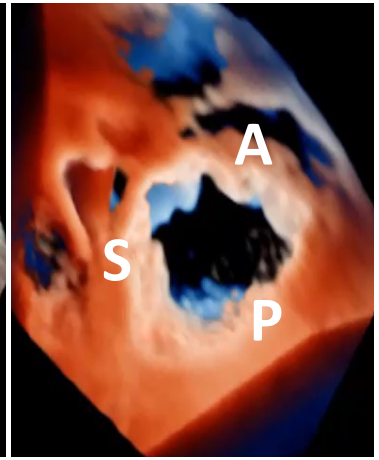
Cardiology Department, Centre Cardiologique du Nord, 32-36 Rue des Moulins Gémeaux, Saint-Denis 93200, France

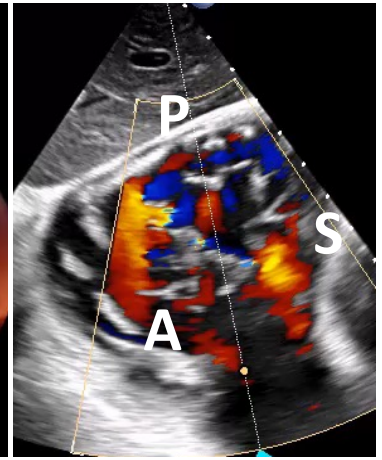
Received 1 April 2023; revised 15 September 2023; accepted 27 September 2023; online publish-ahead-of-print 30 September 2023

Before TEER

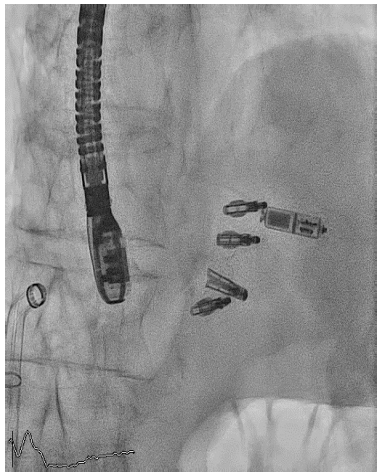
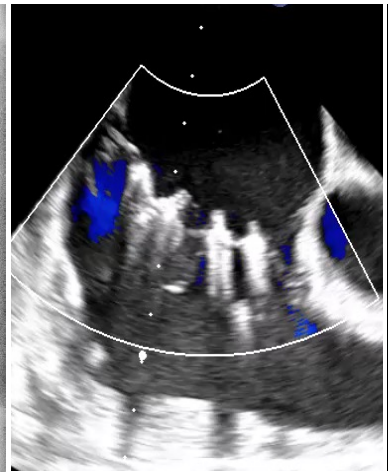
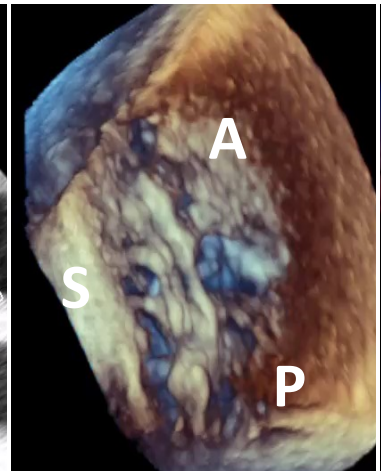



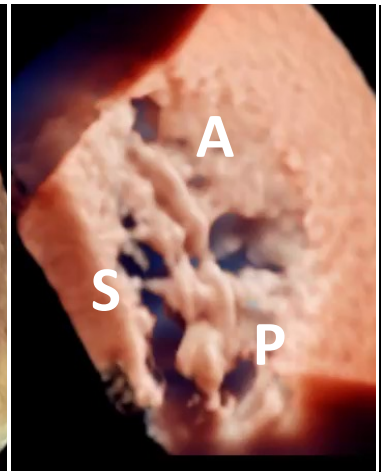


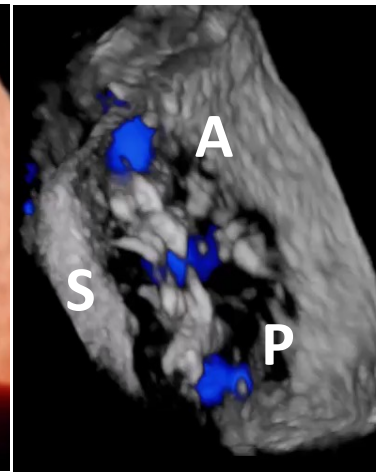


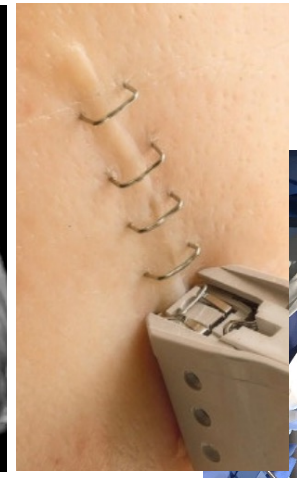


After TEER



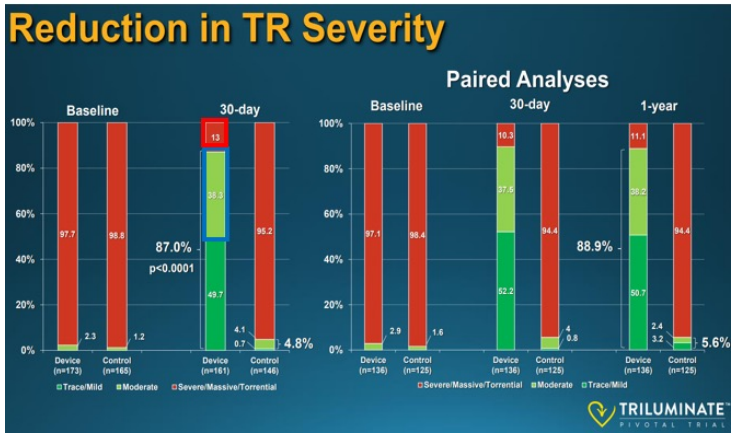





Dreyfus J et al. EHJ Case Report. 2023

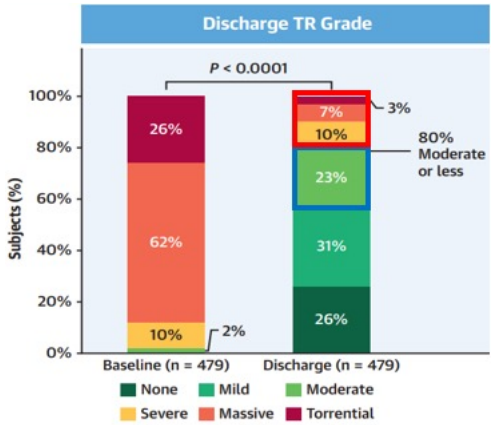
Residual TR after transcatheter edge-to-edge TV repair

- **TRILUMINATE**: ≥moderate residual TR = 50%
  → **25-30% ≥ moderate to severe ?**



Sorajja P et al. NEJM 2023

- **bRIGHT**: ≥moderate residual TR = 43%
  → **25-30% ≥ moderate to severe ?**



Lurz P et al. JACC 2023

- **EuroTR**: ≥moderate residual TR = 58%
  → **30% ≥ moderate to severe ?**

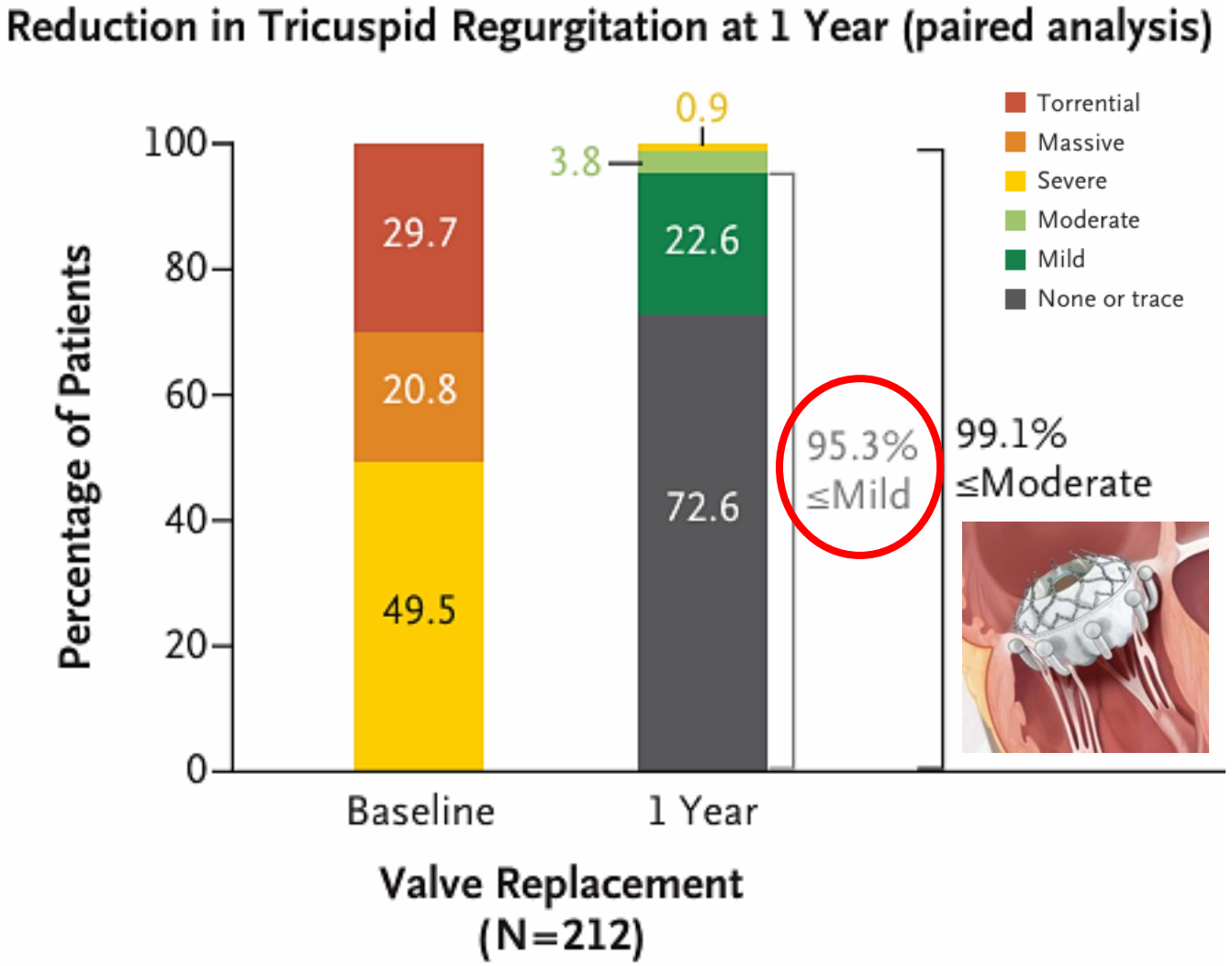
	All patients ($n = 885$)
Residual TR severity, *n* (%)	
1+	545 (42.4)
2+	515 (40.0)
3+	192 (14.9)
4+	25 (1.9)
5+	9 (0.7)

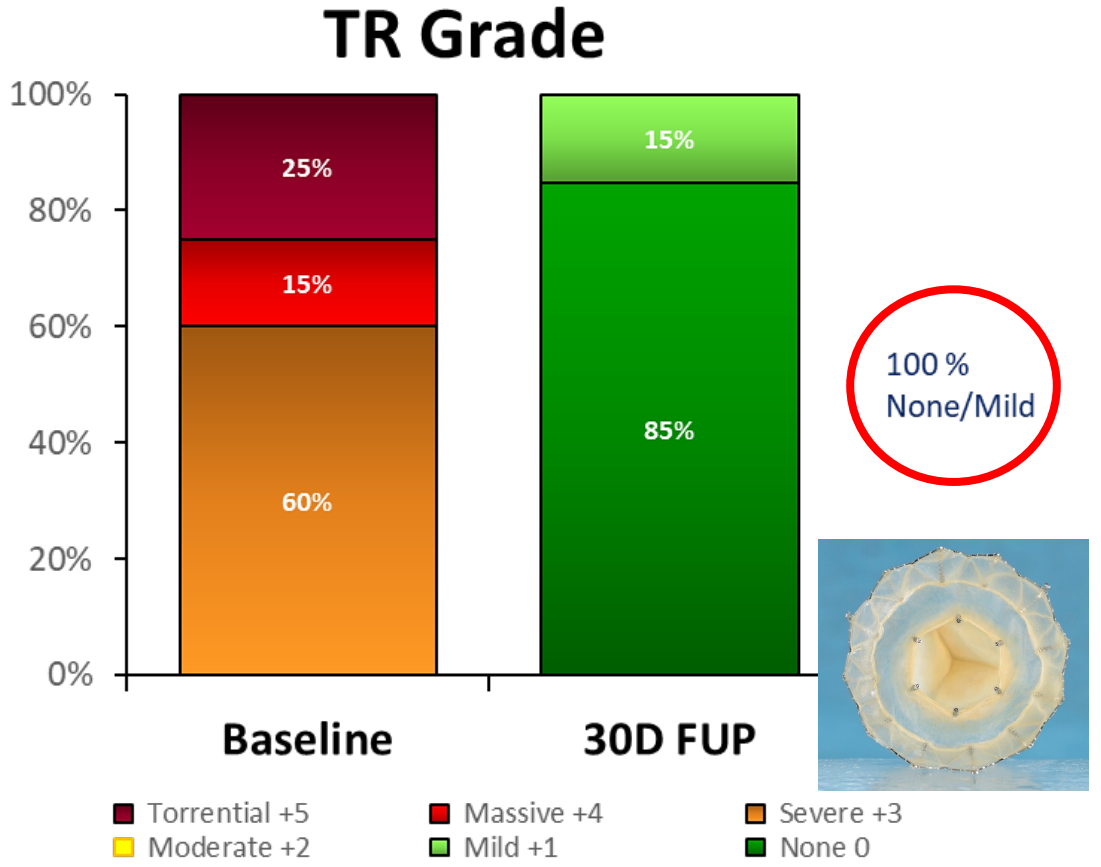
Stolz L et al. EJHF 2024

- **TRIGISTRY**: ≥moderate residual TR = 52%
  → **35% ≥ moderate to severe ?**

Dreyfus J et al. EHJ 2024

Residual TR after transcatheter TV replacement

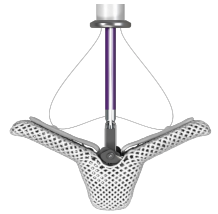


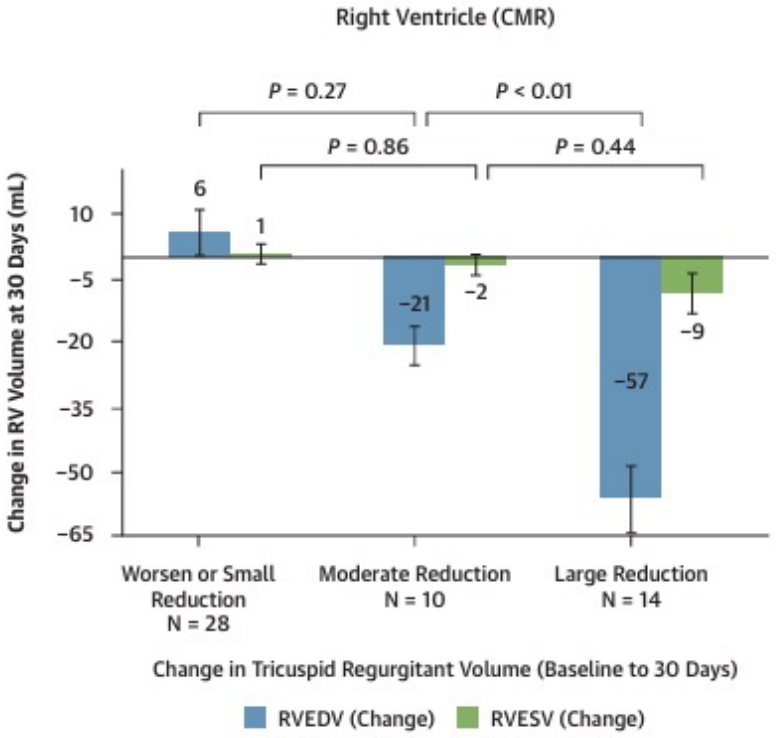


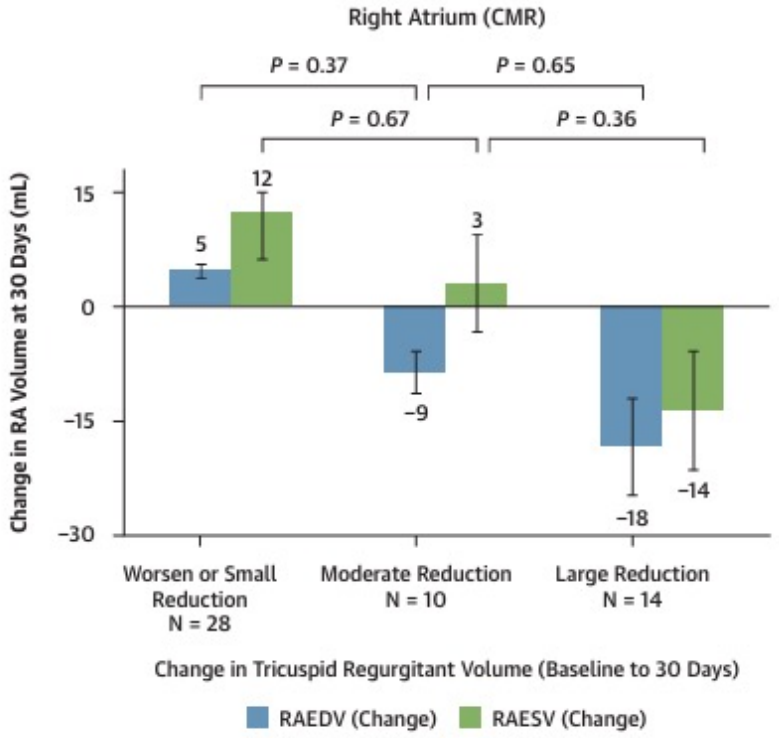
Hahn R et al. NEJM 2024

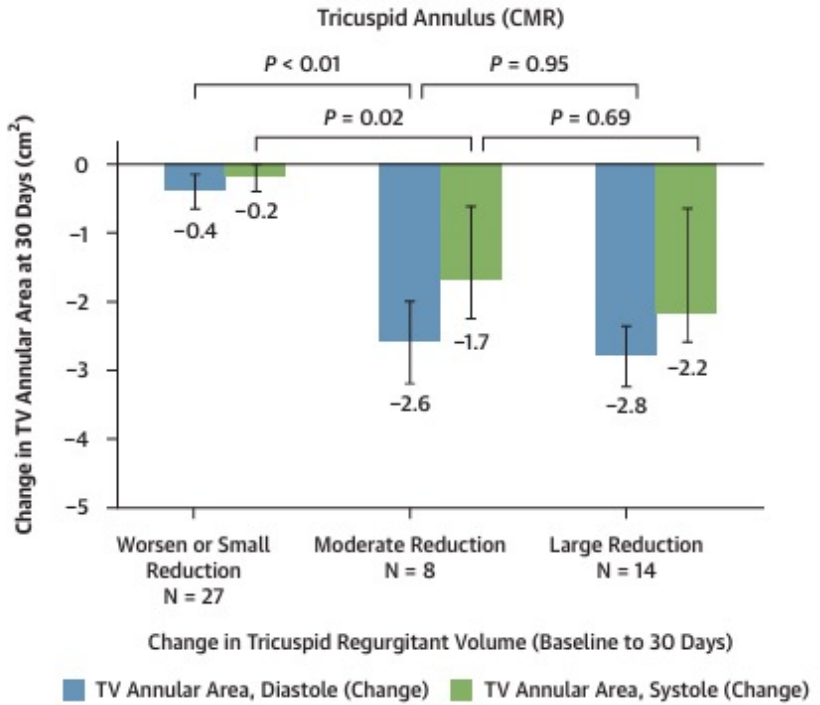
Teiger E, Dreyfus J et al. Submitted

Reverse remodeling after transcatheter tricuspid valve repair



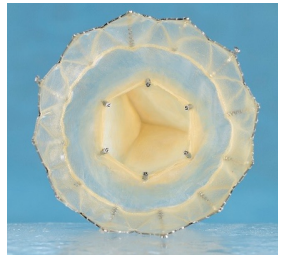


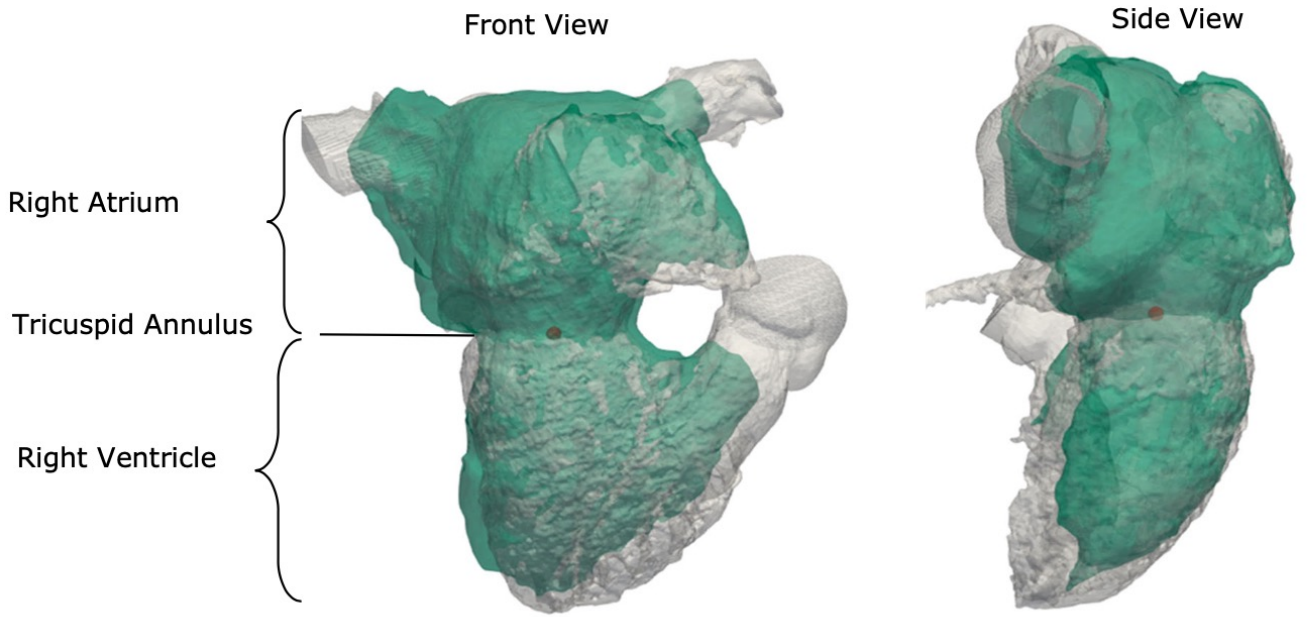




Cavalcante J et al. JACC 2025

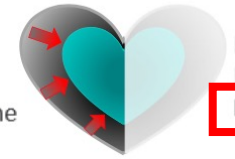
Reverse remodeling after transcatheter tricuspid valve replacement





Baseline end diastolic volume

6 Month FUP end diastolic volume

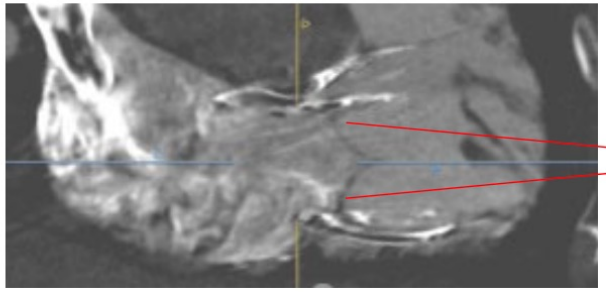


RVED Volume **Baseline** 163.2 ml

RVED Volume **6M FUP** 115.8 ml

Remodeling: reduction of **29%** of Right Ventricular Volume

Of note diuretic drug treatment stopped immediately post intervention



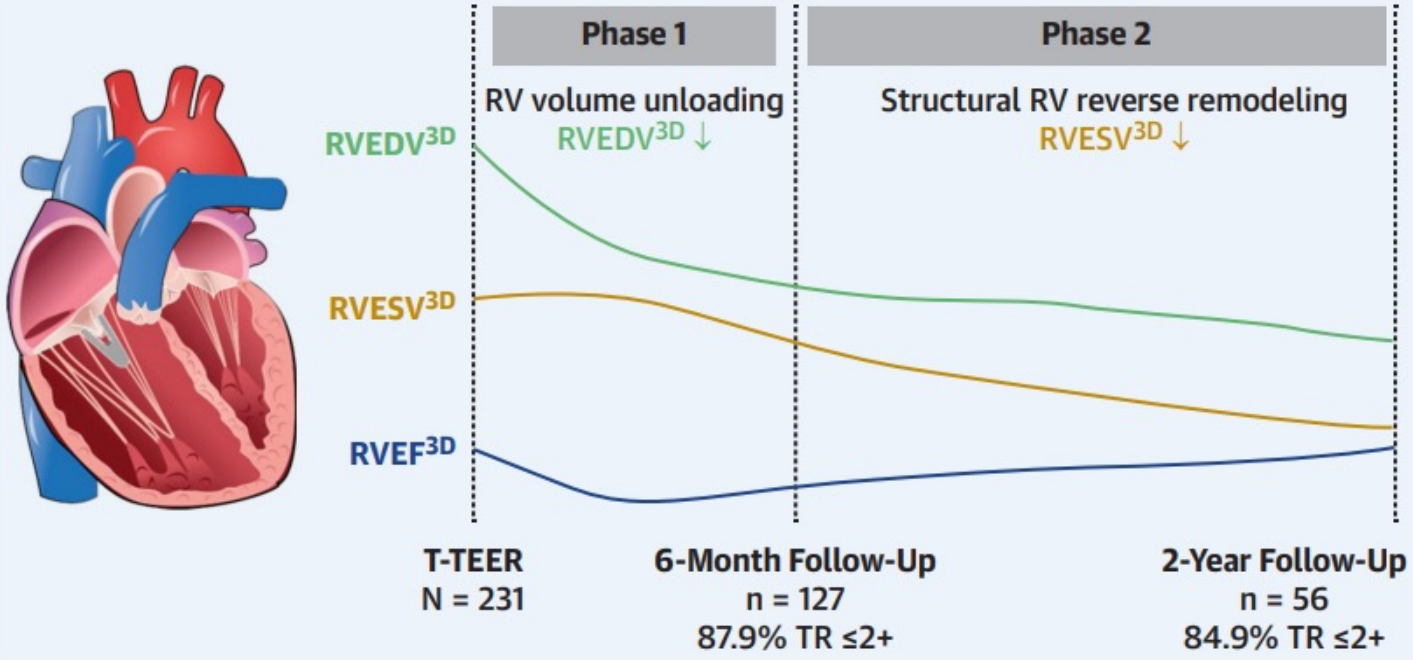
CT image of closure of Topaz Valve leaflets (dark lines) in the inner stent at 6 months follow up.

Courtsey TRICARES

RV size and function after transcatheter TV intervention

Biphasic Right Ventricular Reverse Remodeling Following T-TEER, N = 231

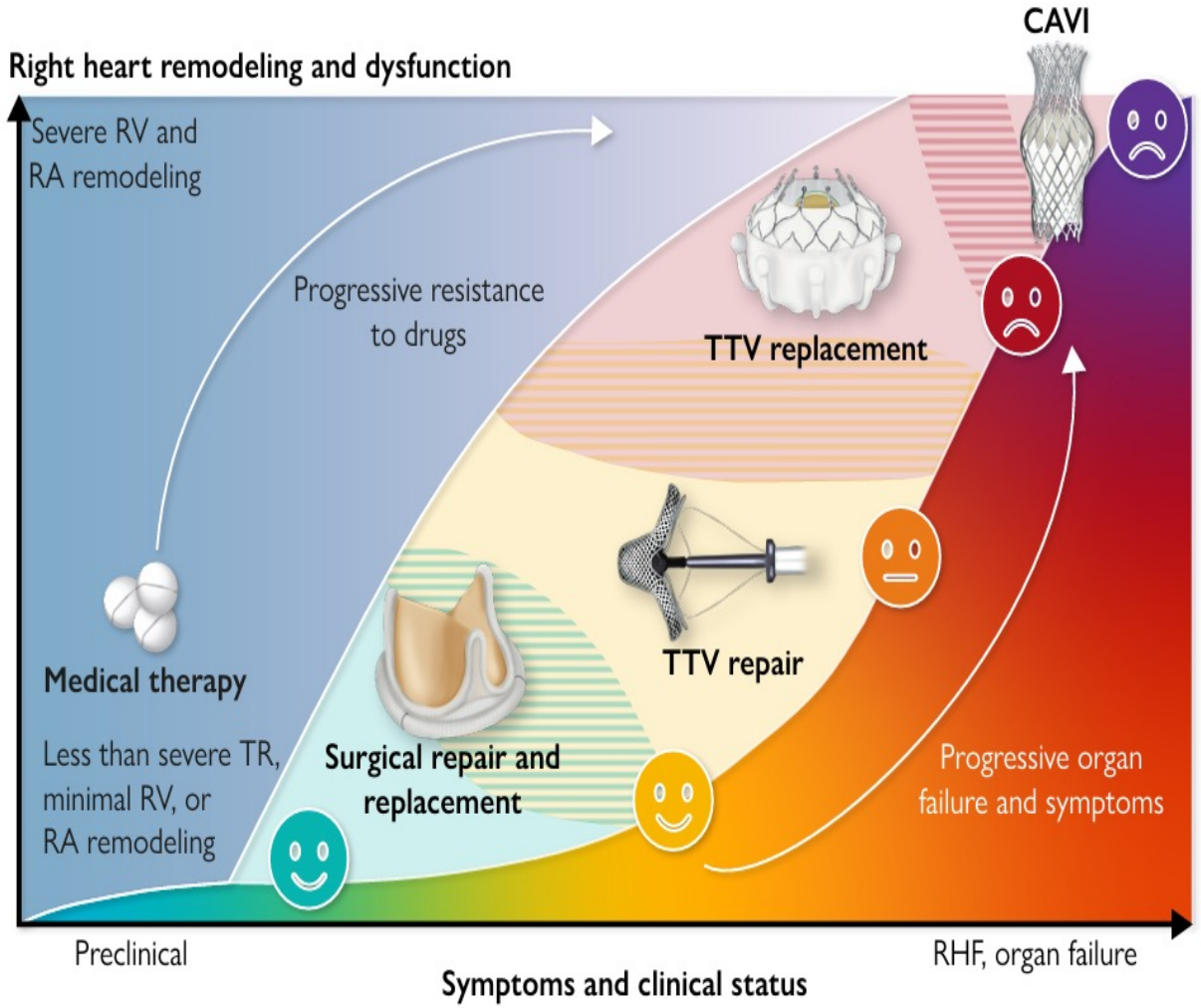
Consecutive Patients With 3D Echocardiograms of the RV



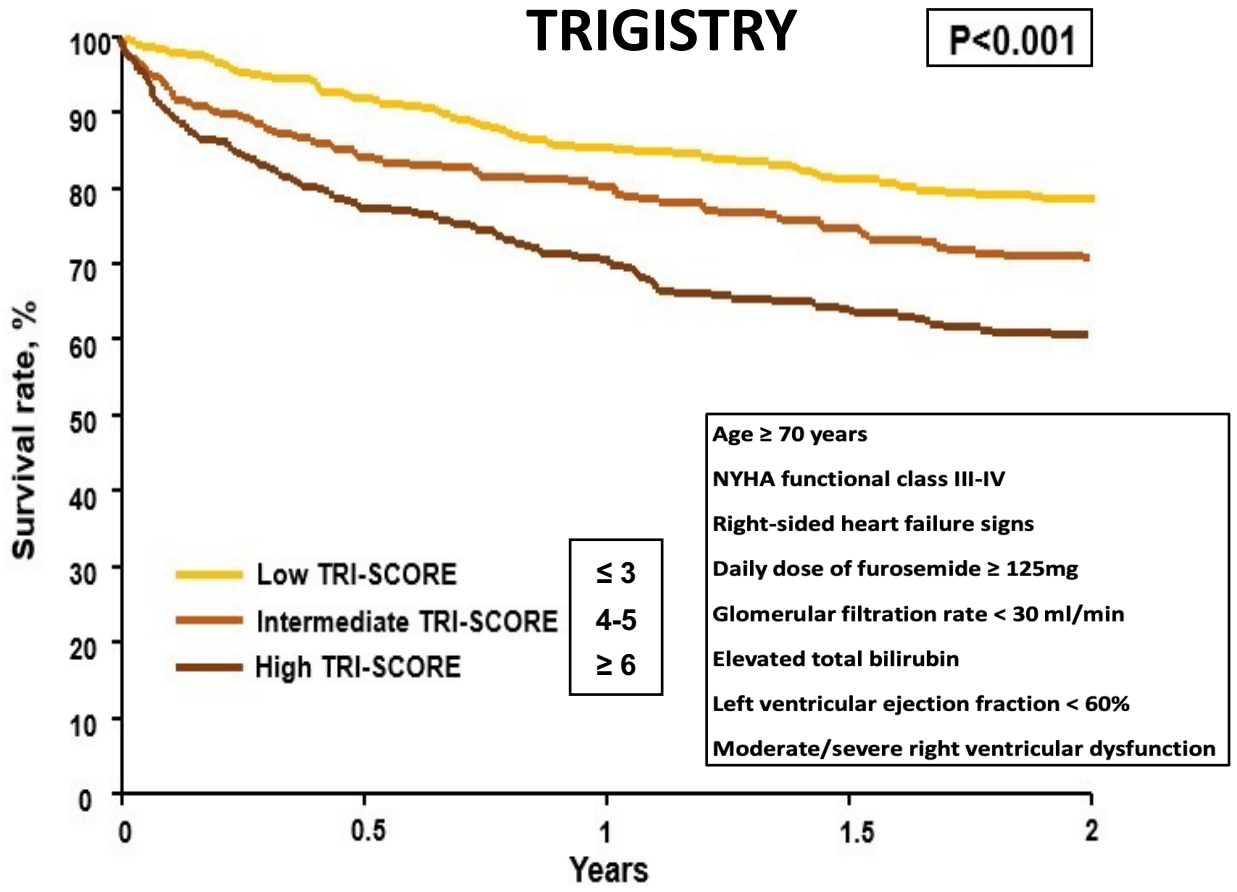
- RVRR after T-TEER is a dynamic and biphasic process including:
  - early volume unloading of the RV (phase 1) resulting in reduced $RVEDV^{3D}$
  - later structural RVRR (phase 2) characterized by decreasing $RVESV^{3D}$
  - an early decline in RV function with improvement over the course of follow-up
  - a durable increase in LV forward stroke volume at follow-up
- In an exploratory analysis, RV volume unloading and structural reverse remodeling were associated with increased rates of 2-year survival

Stolz L et al. JACC Intv 2024

When to refer to a Heart Valve Center ? Timing is key

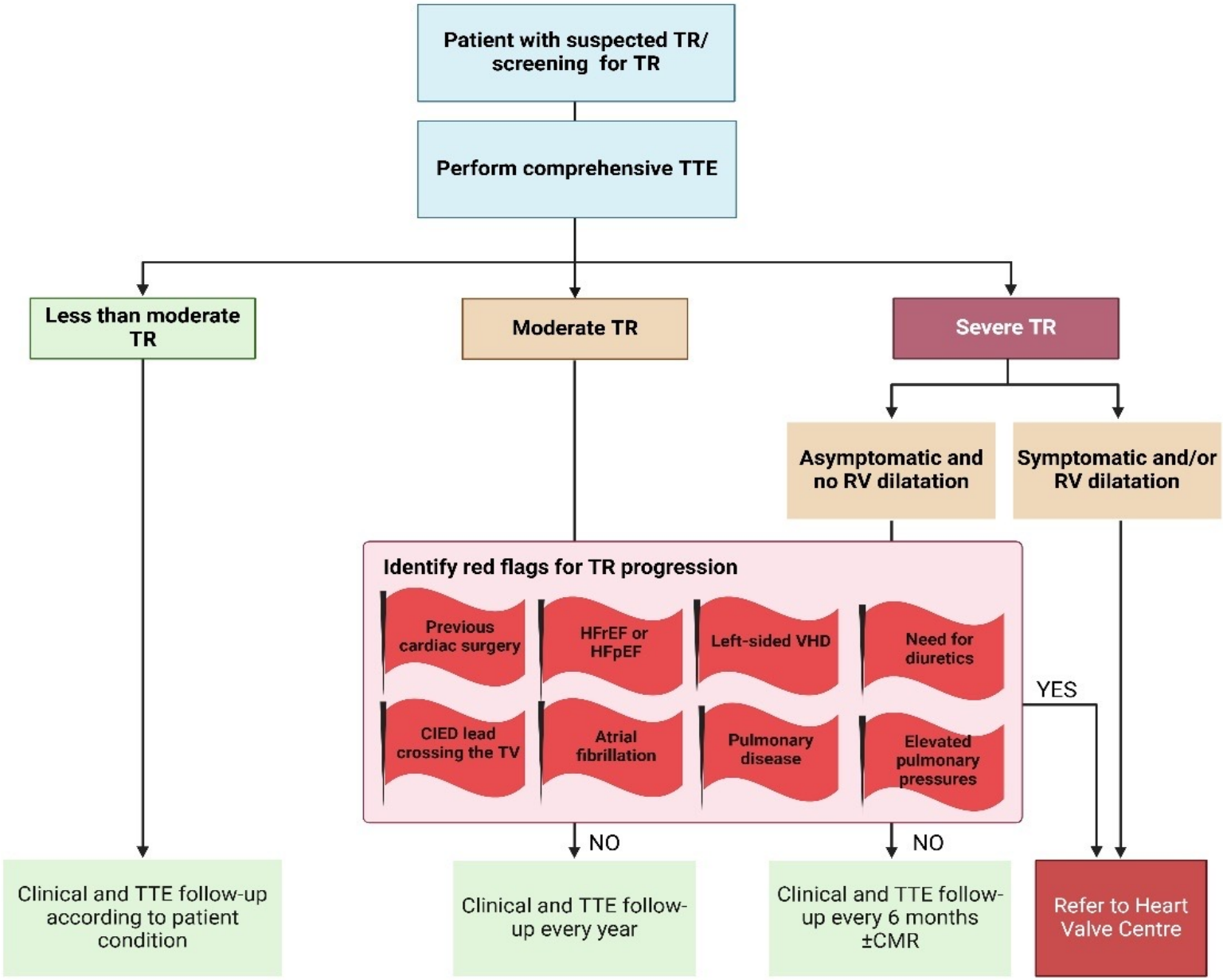


Maisano F et al. EHJ 2024



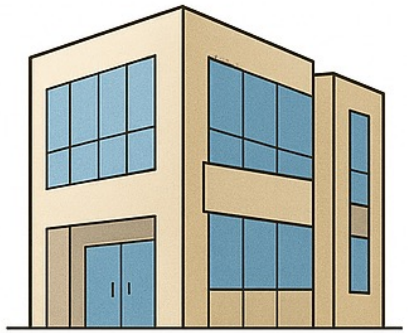
Dreyfus J, Messika-Zeitoun D et al. EHJ 2023

When to refer to a Heart Valve Center ? Timing is key



Dreyfus J, Praz F et al.

Heart Team Management at Heart Valve Center



Heart Valve Center

Relevant TR

Referral to a multidisciplinary Tricuspid Heart Valve Center

EP

Cardiac surgeon

HF

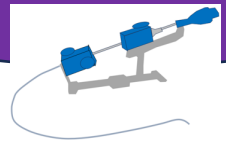
Imaging specialist

Interventional cardiologist

Heart Team

CONSERVATIVE MANAGEMENT

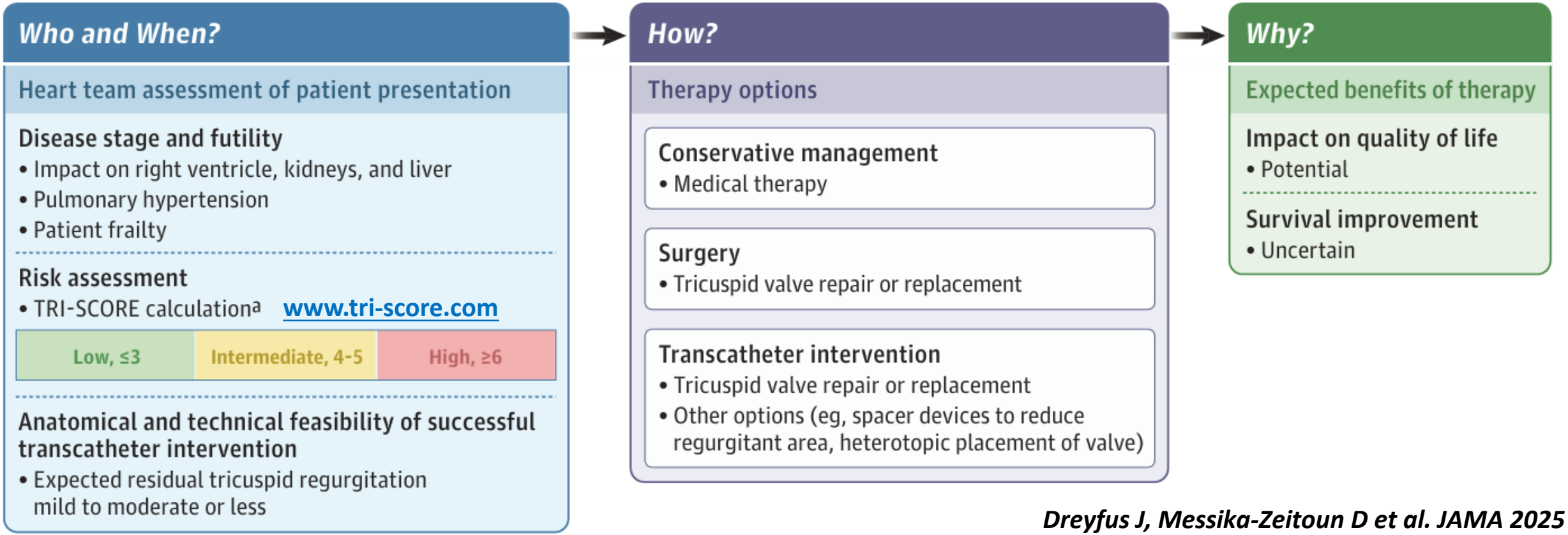
TRANSCATHETER



SURGERY

Management of Tricuspid Regurgitation—What's Next?

Julien Dreyfus, MD, PhD; David Messika-Zeitoun, MD, PhD

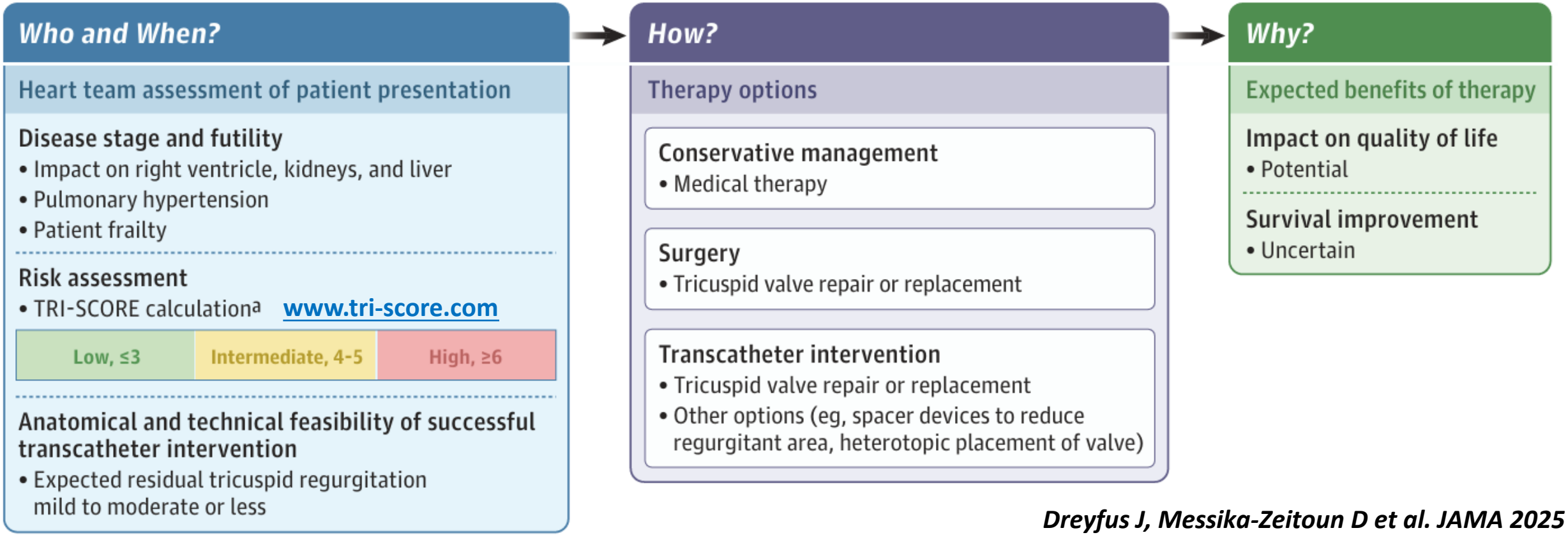


Dreyfus J, Messika-Zeitoun D et al. JAMA 2025

INTEGRATING CLINICAL TRIALS AND PRACTICE

Management of Tricuspid Regurgitation—What's Next?

Julien Dreyfus, MD, PhD; David Messika-Zeitoun, MD, PhD



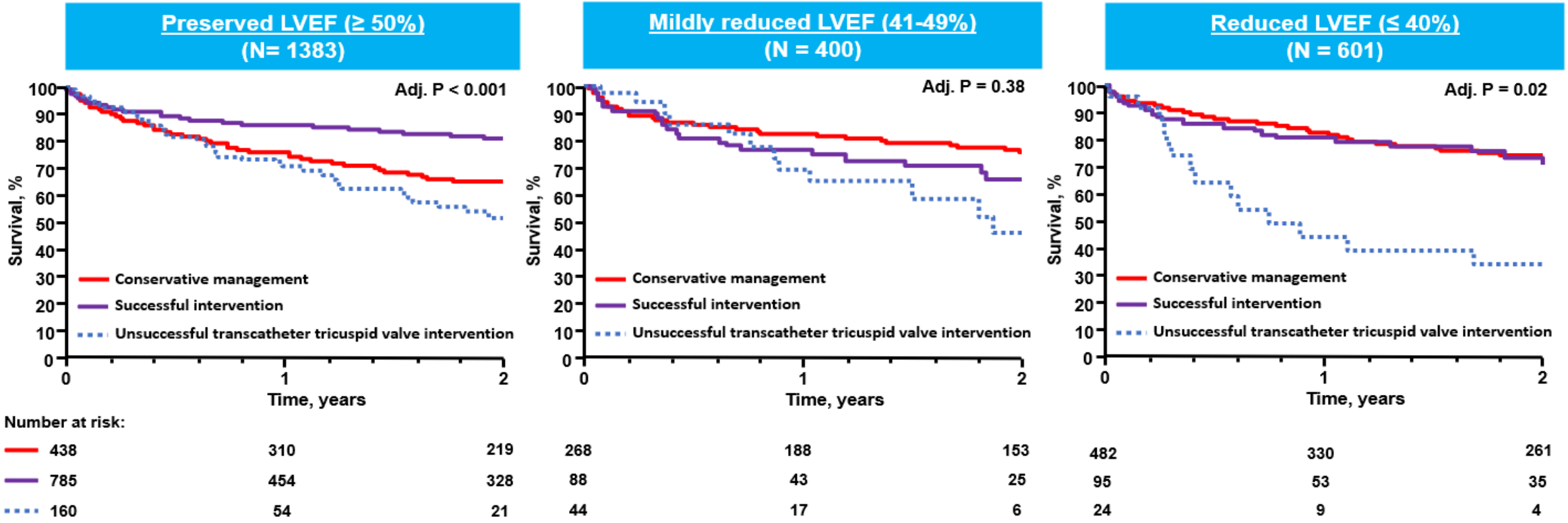
Dreyfus J, Messika-Zeitoun D et al. JAMA 2025

Recommendations	Class	Level
Careful evaluation of TR aetiology, stage of the disease (i.e. degree of TR severity, RV and LV dysfunction, and PH), patient operative risk, and likelihood of recovery by a multidisciplinary Heart Team is recommended in patients with severe TR prior to intervention.	I	C

Praz F et al. EHJ 2025

LVEF and benefit of TV interventions

TRIGISTRY: Impact of treatment in isolated severe tricuspid regurgitation across the left ventricular ejection fraction spectrum (N = 2384)



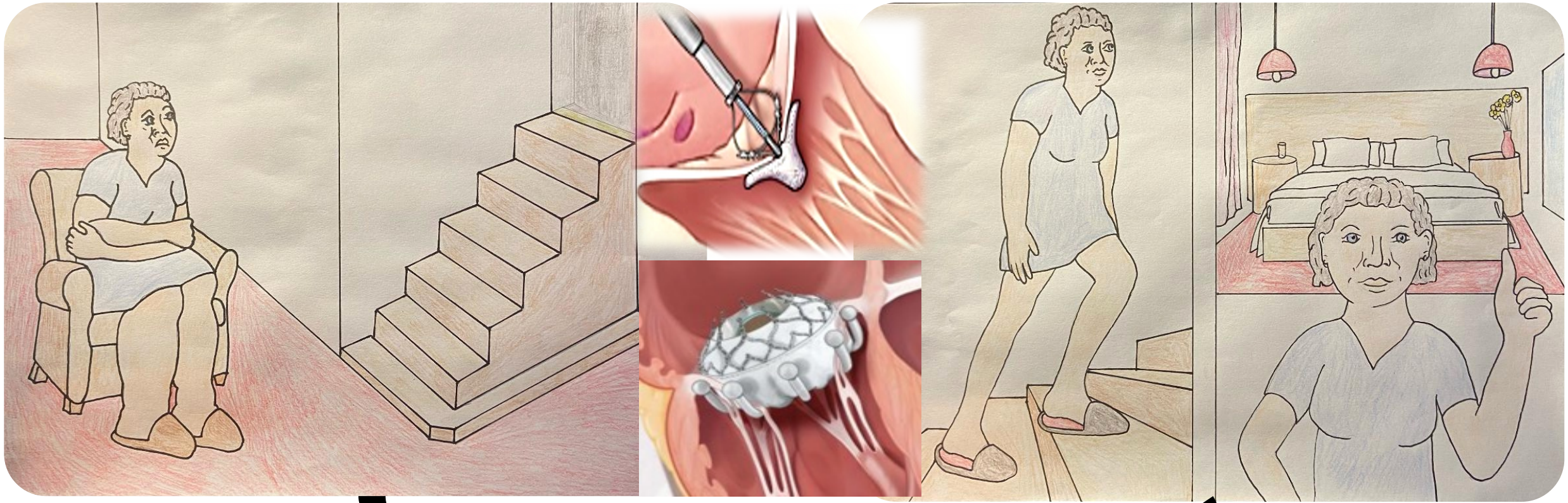
- We observed a survival benefit from tricuspid valve intervention, regardless of modality, in patients with preserved LVEF (≥50%) while no benefit was observed in those with mildly reduced LVEF (40–49%) or reduced LVEF (<40%).
- We confirmed the prognostic significance of residual TR across the entire LVEF spectrum.
- These results underscore the need for cautious consideration of tricuspid interventions in patients with reduced LVEF and highlight the importance of future randomized controlled trials to validate these findings.

Heitzinger G, Dreyfus J, Messika-Zeitoun D et al. EJHF 2025

CONCLUSION

- **Benefit of TR correction will depend on :**

1) Procedural success



Efficient correction of TR

CONCLUSION

➢ **Benefit of TR correction will depend on :**

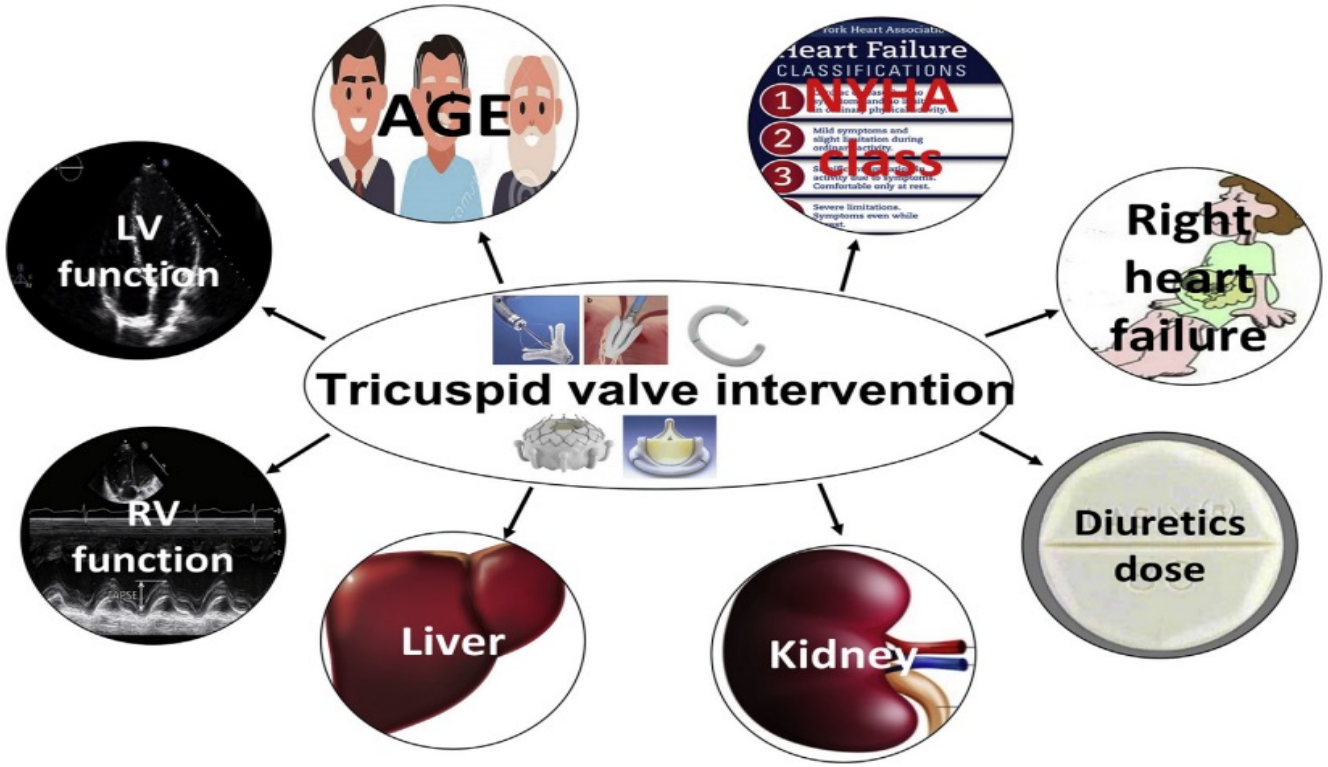
2) Stage of the disease as assessed by the TRI-SCORE (early stage+++)

Tricuspid Transcatheter Edge-to-Edge Valve Repair

Sooner Rather Than Later*

David Messika-Zeitoun, MD, PhD,[a] Ian G. Burwash, MD,[a] Julien Dreyfus, MD[b]

FIGURE 1 Important Prognostic Parameters to Consider Before a Tricuspid Valve Intervention



Messika-Zeitoun D et al. JACC Intv 2022

Global Adoption of the TRI-SCORE powered by Digital Tools

2025 Valvular Heart Disease
Guidelines for the management of valvular heart disease

ESC European Society of Cardiology | EACTS

Accurate Prediction: The TRI-SCORE accurately predicts in-hospital mortality in patients undergoing **isolated tricuspid valve surgery**, as well as mid-term outcomes in those **managed conservatively** or with **transcatheter interventions**.

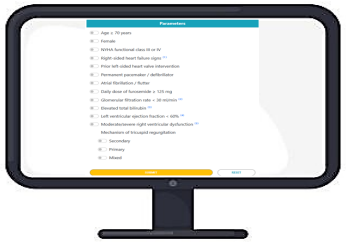
Guideline-Endorsed: The TRI-SCORE is now **integrated** into the **decision-making algorithm of the 2025 ESC/EACTS Guidelines** for **isolated severe tricuspid regurgitation.**

Free and User-Friendly Digital Tools: The TRI-SCORE can be **easily calculated** using free, user-friendly digital tools (**Web-based** calculator **and Mobile apps** for iOS and Android).

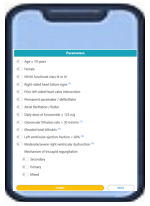
Clinical Utility: These digital tools offer a unique opportunity **to assess the real-life clinical presentation and risk profile of patients with tricuspid regurgitation**, particularly when considering a tricuspid valve intervention.

36 001 Calculations in 1 year

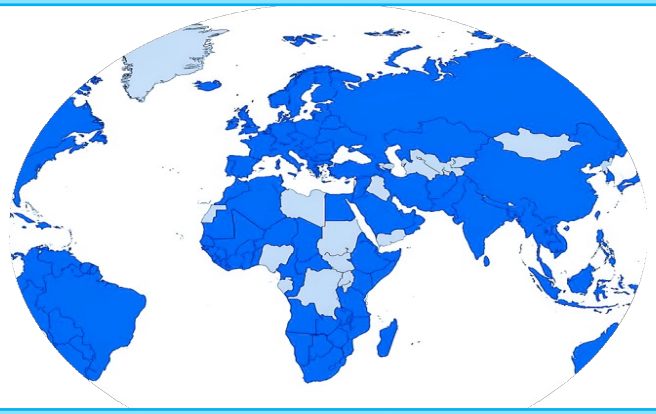
83% website (www.tri-score.com)



17% mobile apps



117 Countries — All Continents



Users

66% Cardiologist

21% Cardiac surgeon

54% Academic Hospital

25% Community Hospital

Patient Profile

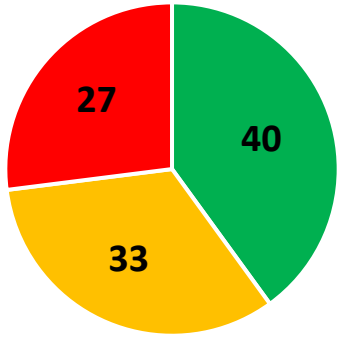
8 TRI-SCORE parameters:

✅ ≥70 years	70%
✅ NYHA III-IV	58%
✅ Right heart failure signs	58%
✅ Daily dose of loop diuretics ≥125mg	21%
✅ Glomerular filtration rate <30ml/min	3%
✅ Elevated total bilirubin	19%
✅ Left ventricular ejection fraction <60%	42%
✅ Moderate/severe RV dysfunction	37%

Additional parameters:

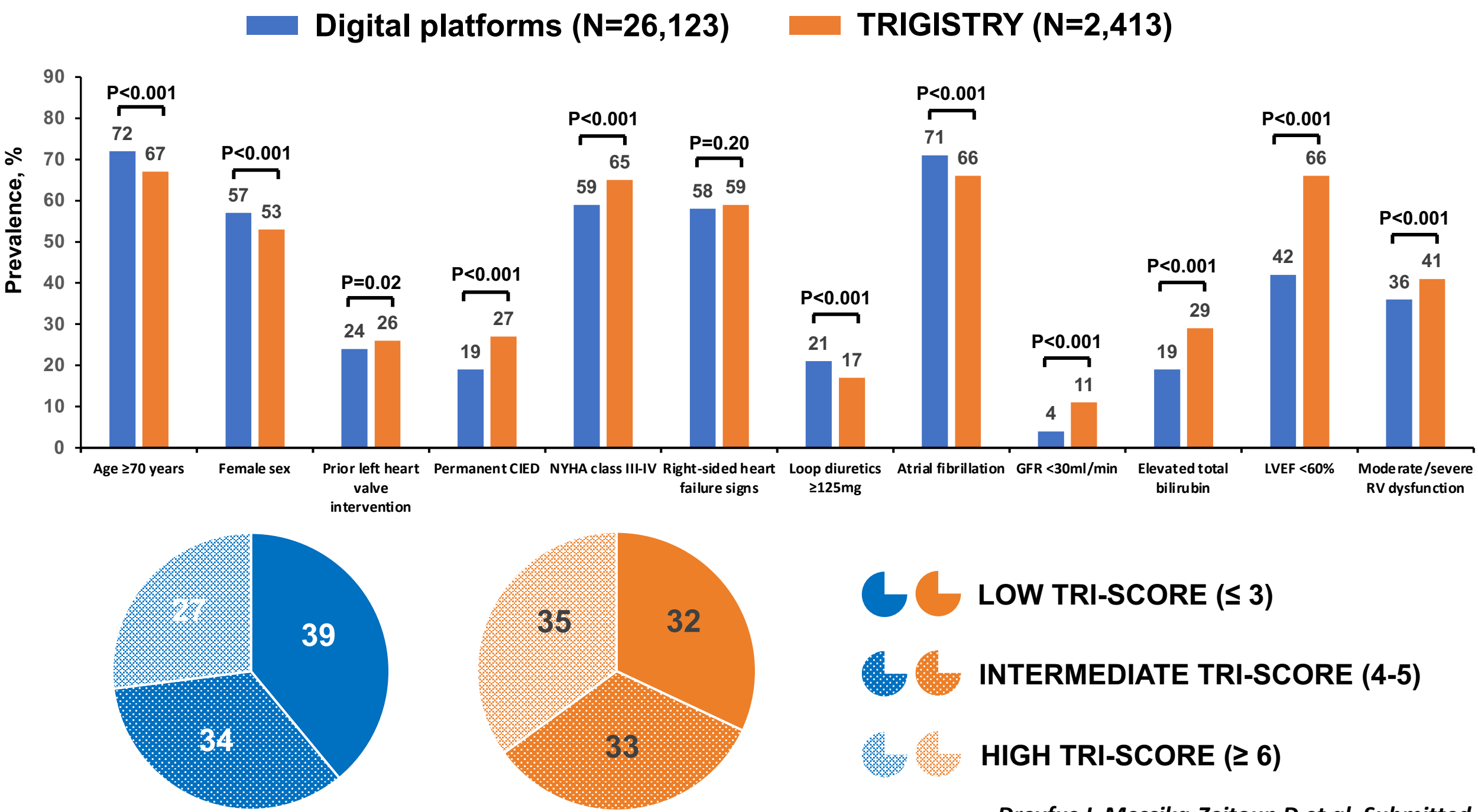
✅ Women	58%
✅ Prior left heart valve intervention	24%
✅ Permanent pacemaker / defibrillator	20%
✅ Atrial fibrillation / flutter	70%
✅ TR mechanism:	
- Functional	73%
- Primary	15%
- Mixed	12%

TRI-SCORE Categories



Low (≤ 3)
Intermediate (4-5)
High (≥6)

Dreyfus J, Messika-Zeitoun D et al. Submitted



Dreyfus J, Messika-Zeitoun D et al. Submitted

Lifetime management of heart valve disease—treat it early and treat it right, first time

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Comment

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- ✓ **Early referral = better survival**
- ✓ **Multidisciplinary heart teams**
- ✓ **Tailored strategy**: surgery vs transcatheter
- ✓ **Optimize first intervention**
- ✓ **Balance short- & long-term outcomes**
- ✓ **Preserve surgical expertise**
- ✓ **Improve patient care & system efficiency**

Doenst T, Zacharias J et al. The Lancet 2025

How to use the TRI-SCORE in daily practice?

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