Recommandations ESC sur la prise en charge des valvulopathies
---L'insuffisance tricuspide---

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DÉCLARATION DE LIENS D'INTÉRÊT AVEC LA PRÉSENTATION

Nom de l'orateur : Guillaume LEURENT, Rennes

☑ Je déclare les liens d'intérêt potentiel suivants :

Consultant : Abbott

Honoraires : Abbott

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European Heart Journal (2021) 00, 1–72
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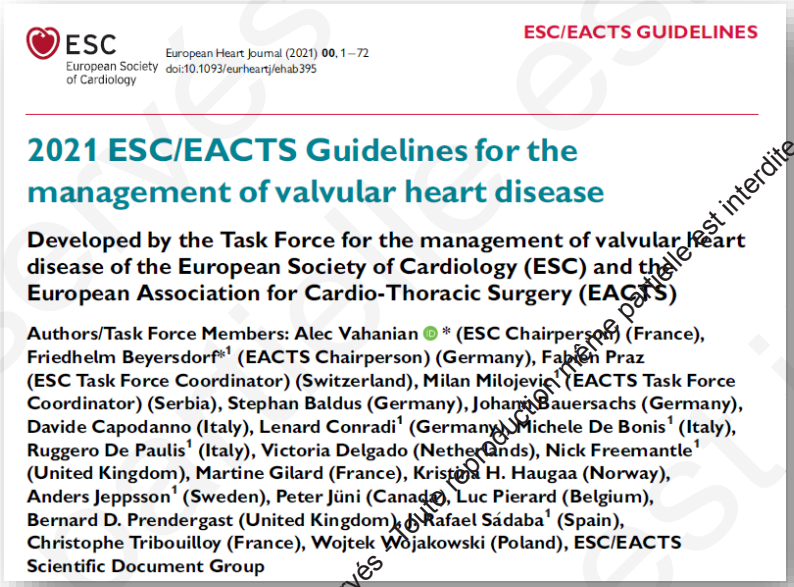

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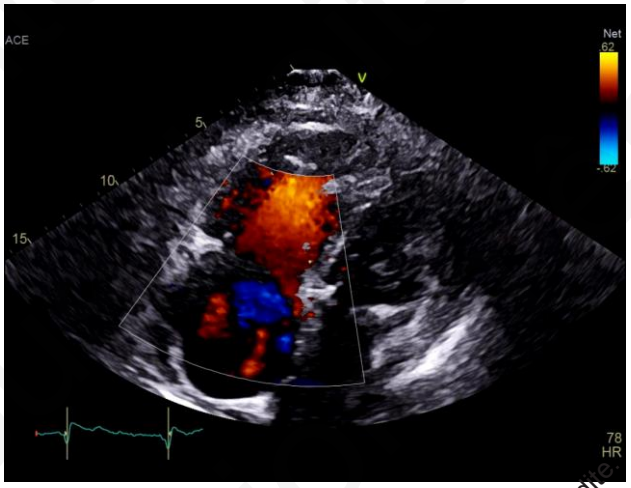

« *Recently,* a new grading scheme *including two additional grades (‘massive’ and ‘torrential’) has been proposed and used in clinical studies on transcatheter interventions. Studies showed an incremental prognostic value of the two additional grades (massive and torrential) in terms of mortality and rehospitalization for heart failure in patients with advanced disease.* »

Une nouvelle classification

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European Heart Journal - Cardiovascular Imaging (2017) **18**, 1339–1343
doi:10.1093/ehjci/jex139

EDITORIAL

The need for a new tricuspid regurgitation grading scheme

Rebecca T. Hahn[1] and Jose L. Zamorano[2]*

Table I Proposed expansion of the 'Severe' grade

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

VC, vena contracta; EROA, effective regurgitant orifice area; 3D VCA, three-dimensional vena contracta area.
[a]3D VCA and quantitative Doppler EROA cut-offs may be larger than PISA EROA.

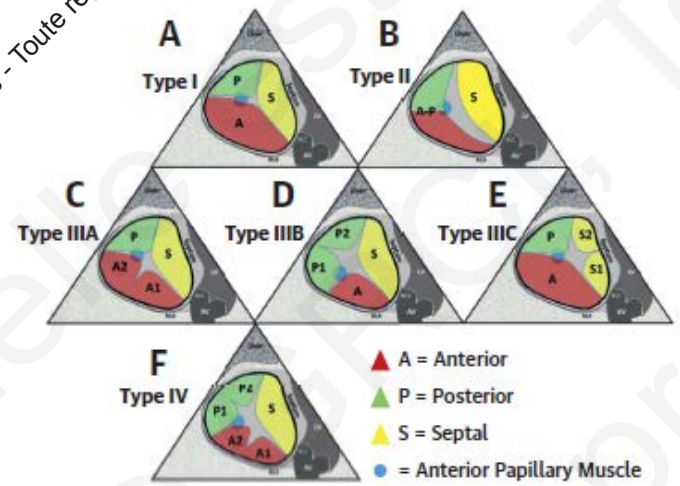
JACC: CARDIOVASCULAR IMAGING VOL. 14, NO. 7, 2021

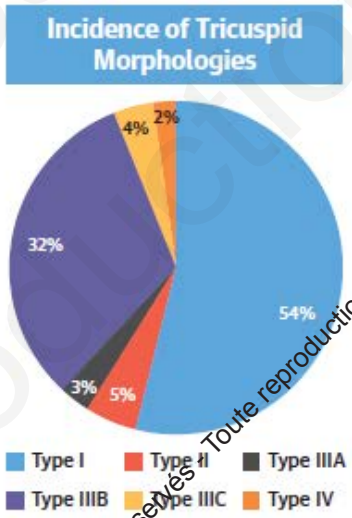
ORIGINAL RESEARCH

Proposal for a Standard Echocardiographic Tricuspid Valve Nomenclature

Rebecca T. Hahn, MD,[a] Ludwig T. Weckbach, MD,[b] Thilo Noack, MD, PhD,[c] Nadira Hamid, MD,[a] Mitsunobu Kitamura, MD,[c] Richard Bae, MD,[d] Philipp Lurz, MD, PhD,[c] Susheel K. Kodali, MD,[a] Paul Sorajja, MD,[d] Jörg Hausleiter, MD,[b] Michael Nabauer, MD[b]

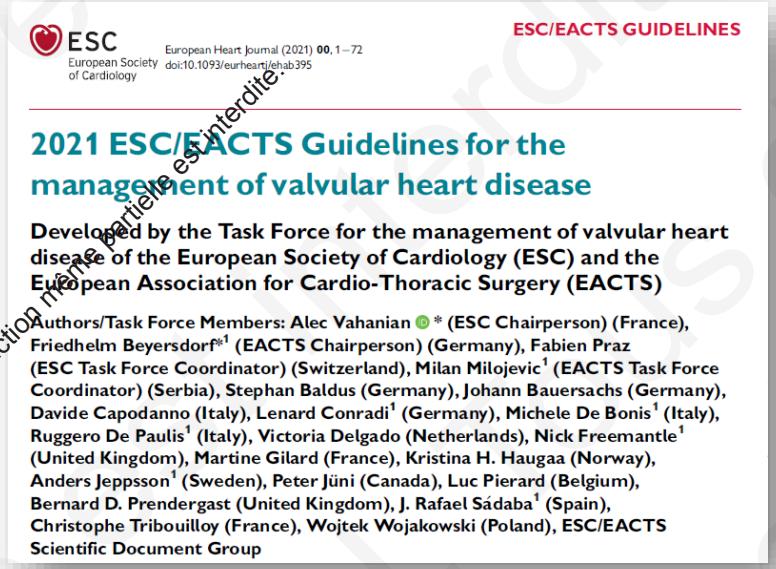
CENTRAL ILLUSTRATION Tricuspid Valve Nomenclature Classification Scheme





Hahn, R.T. et al. J Am Coll Cardiol Img. 2021;14(7):1299-305.

(Left) A proposed tricuspid valve nomenclature classification scheme is shown. The anterior papillary muscle is indicated as a **blue circle** and defines the separation of the anterior from the posterior leaflets. **(A)** Type I: 3-leaflet configuration. **(B)** Type II: 2-leaflet configuration. **(C to E)** Type III: 4-leaflet configurations. **(F)** Type IV: 5-leaflet configuration. **(Right)** Incidence of each morphology in the present study of 579 patients. A = anterior leaflet; AV = aortic valve; LV = left ventricle; NCC = noncoronary cusp; P = posterior leaflet; RCC = right coronary cusp; S = septal leaflet.



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Place de la chirurgie

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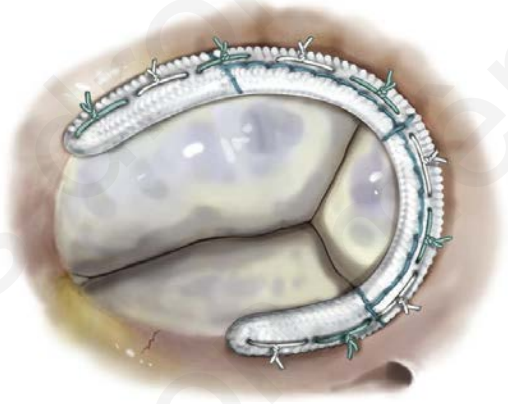


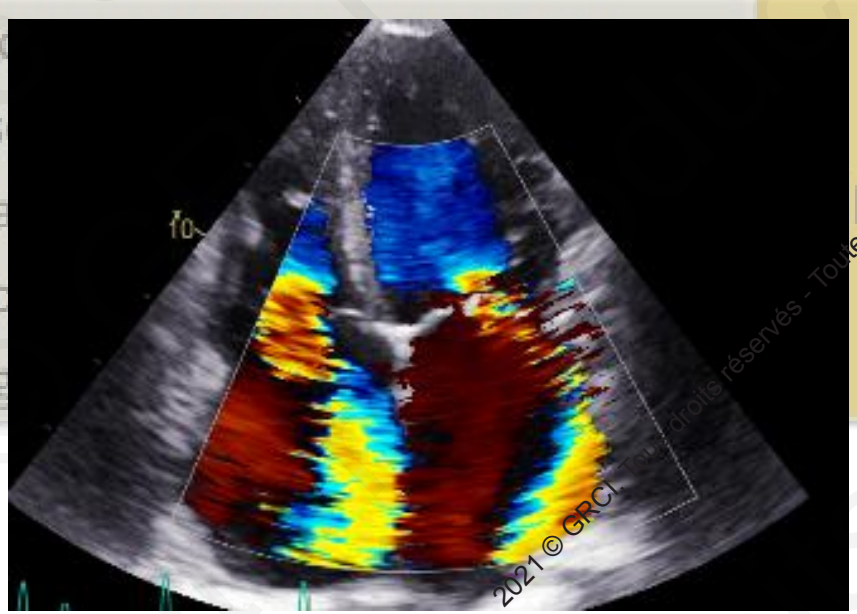
"Whenever possible, annuloplasty with prosthetic rings is preferable to valve replacement, which should only be considered when the tricuspid valve leaflets are tethered and the annulus severely dilated.

In presence of a cardiac implantable electronic device lead, the technique used should be adapted to the patient's condition and the surgeon's experience."

Place de la chirurgie

Recommendations on secondary tricuspid regurgitation

Surgery is recommended in patients with severe secondary tricuspid regurgitation undergoing left-sided valve surgery.[423–427]	I	B
Surgery should be c… mild or moderate s… …ion with a dilated a… mm/m^2 by 2D echo… left-sided valve surg…	I…	B



Place de la chirurgie

Recommendations on secondary tricuspid regurgitation		
Surgery is recommended in patients with severe secondary tricuspid regurgitation undergoing left-sided valve surgery.[423–427]	I	B
Surgery should be considered in patients with mild or moderate secondary tricuspid regurgitation with a dilated annulus (≥40 mm or >21 mm/m^2 by 2D echocardiography) undergoing left-sided valve surgery.[423,425–427]	IIa	B

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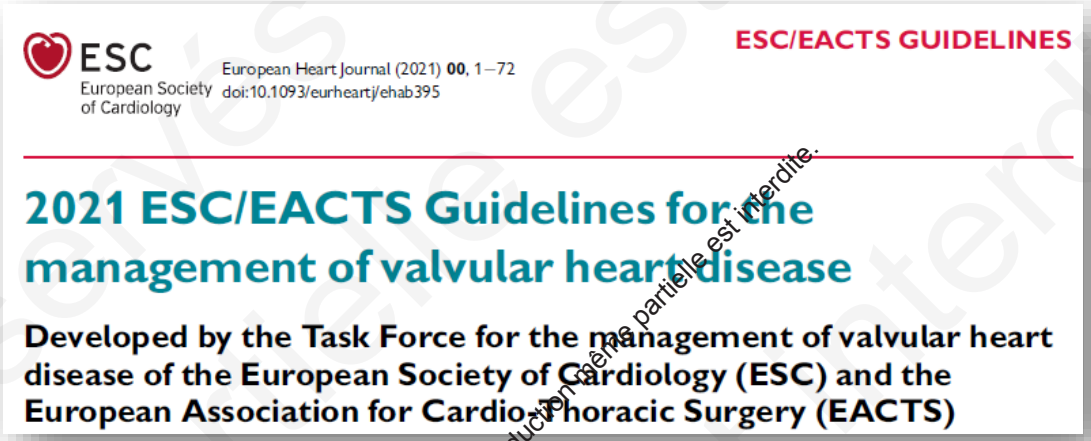


"According to observational data, tricuspid valve repair should be performed liberally during left-sided surgery in patients with secondary tricuspid regurgitation. Indeed, it does not increase operative risk, but promotes reverse remodelling of the RV and improves functional status when annular dilatation is present, even in the absence of severe tricuspid regurgitation. »

ORIGINAL ARTICLE

Concomitant Tricuspid Repair in Patients with Degenerative Mitral Regurgitation

J.S. Gammie, M.W.A. Chu, V. Falk, J.R. Overbey, A.J. Moskowitz, M. Gillinov, M.J. Mack, P. Voisine, M. Krane, B. Yerokun, M.E. Bowdish, L. Conradi, S.F. Bolling, M.A. Miller, W.C. Taddei-Peters, N.O. Jeffries, M.K. Parides, R. Weisel, M. Jessup, E.A. Rose, J.C. Mullen, S. Raymond, E.G. Moquete, K. O'Sullivan, M.E. Marks, A. Iribarne, F. Beyersdorf, M.A. Borger, A. Geirsson, E. Bagiella, J. Hung, A.C. Gelijns, P.T. O'Gara, and G. Ailawadi, for the CSTN Investigators*

TRIAL DESIGN

Key Inclusion Criteria:

MVS for degenerative MR with:

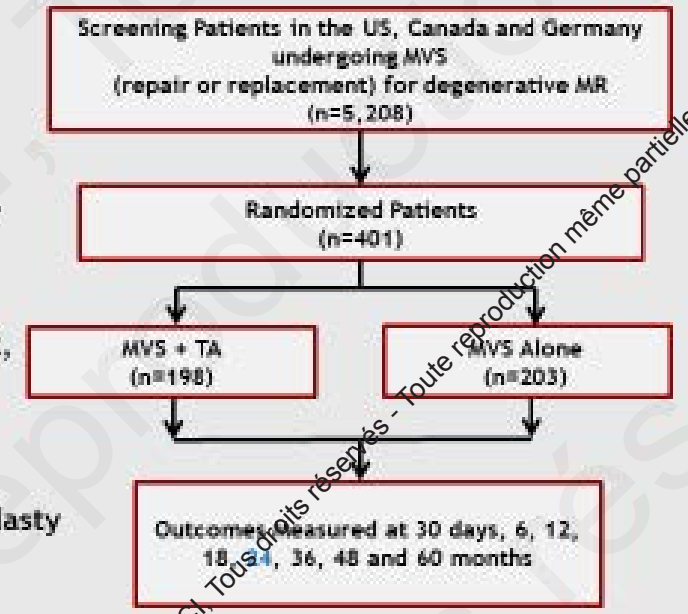
moderate TR *or*

none/trace or mild TR with tricuspid annular dilation (≥ 40 mm or index: ≥21mm/M² BSA)

Key Exclusion Criteria:

Primary tricuspid valve disease, Secondary MR, Sub-optimal volume management

Undersized (26-30)
Rigid nonplanar annuloplasty



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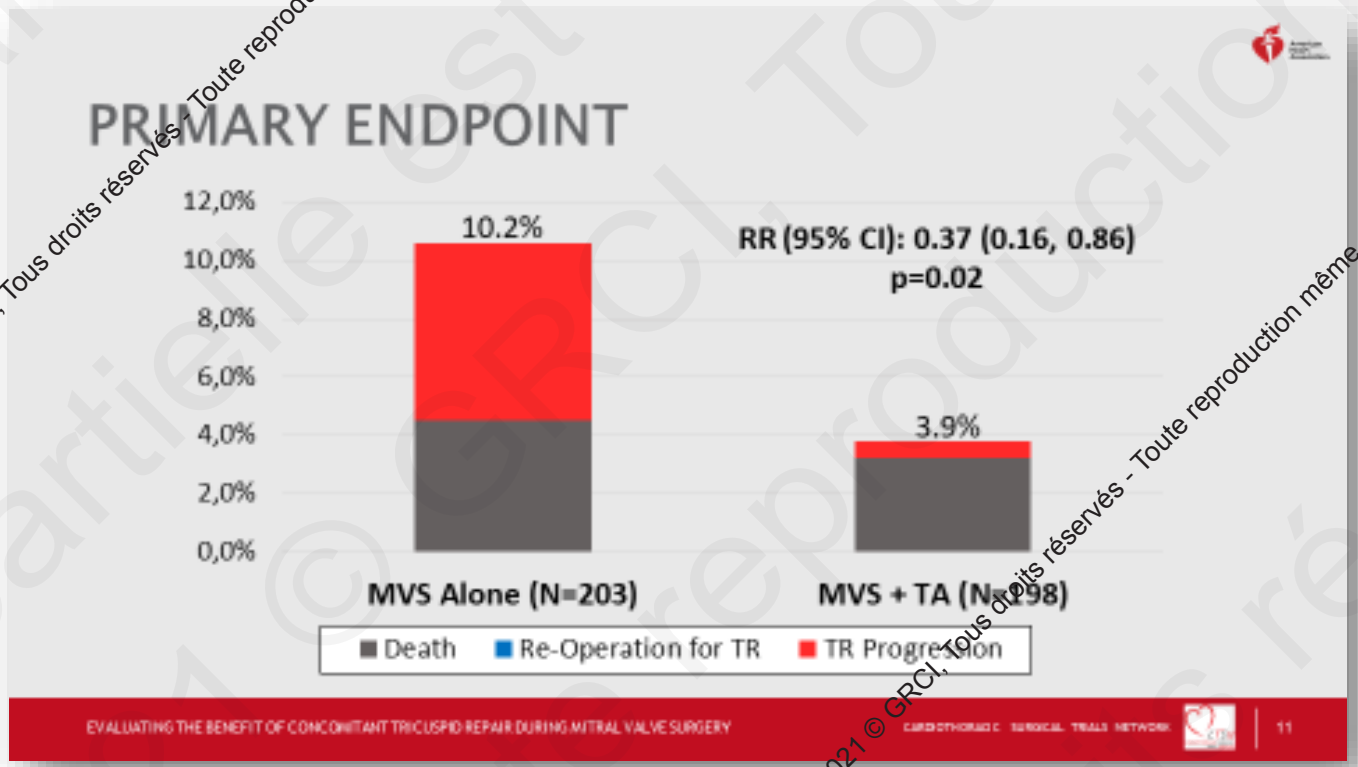

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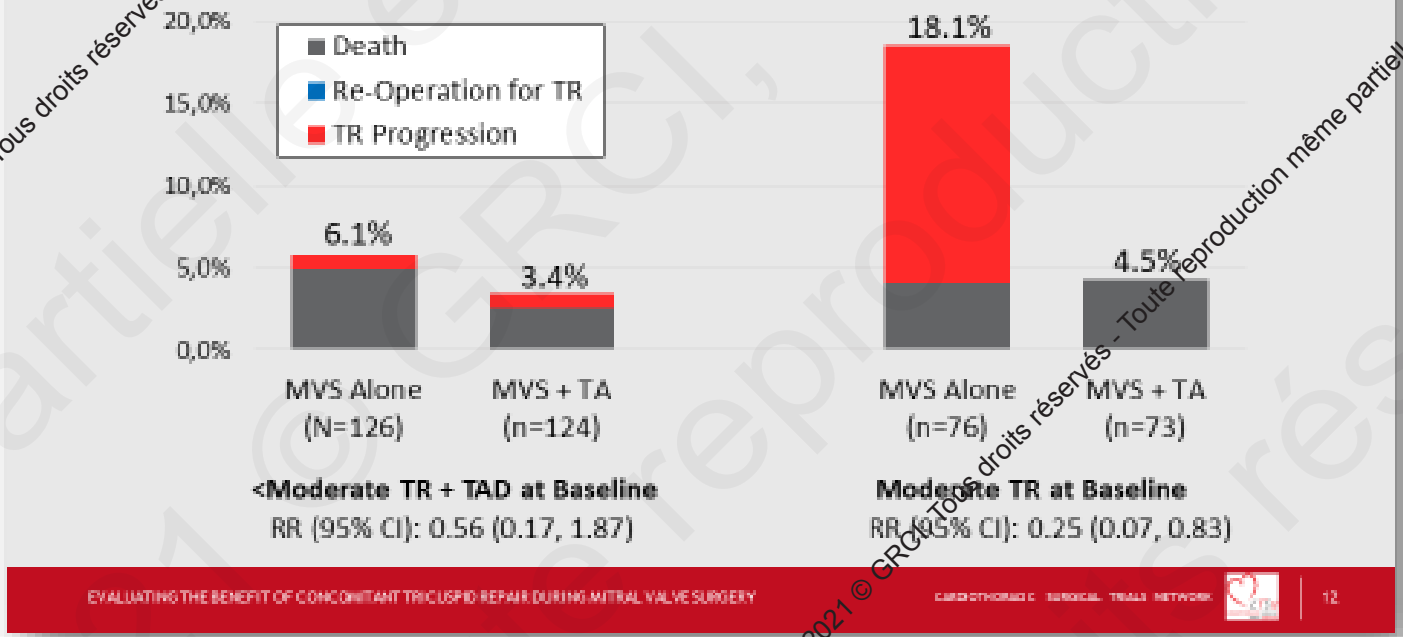
PRIMARY ENDPOINT BY BASELINE TR



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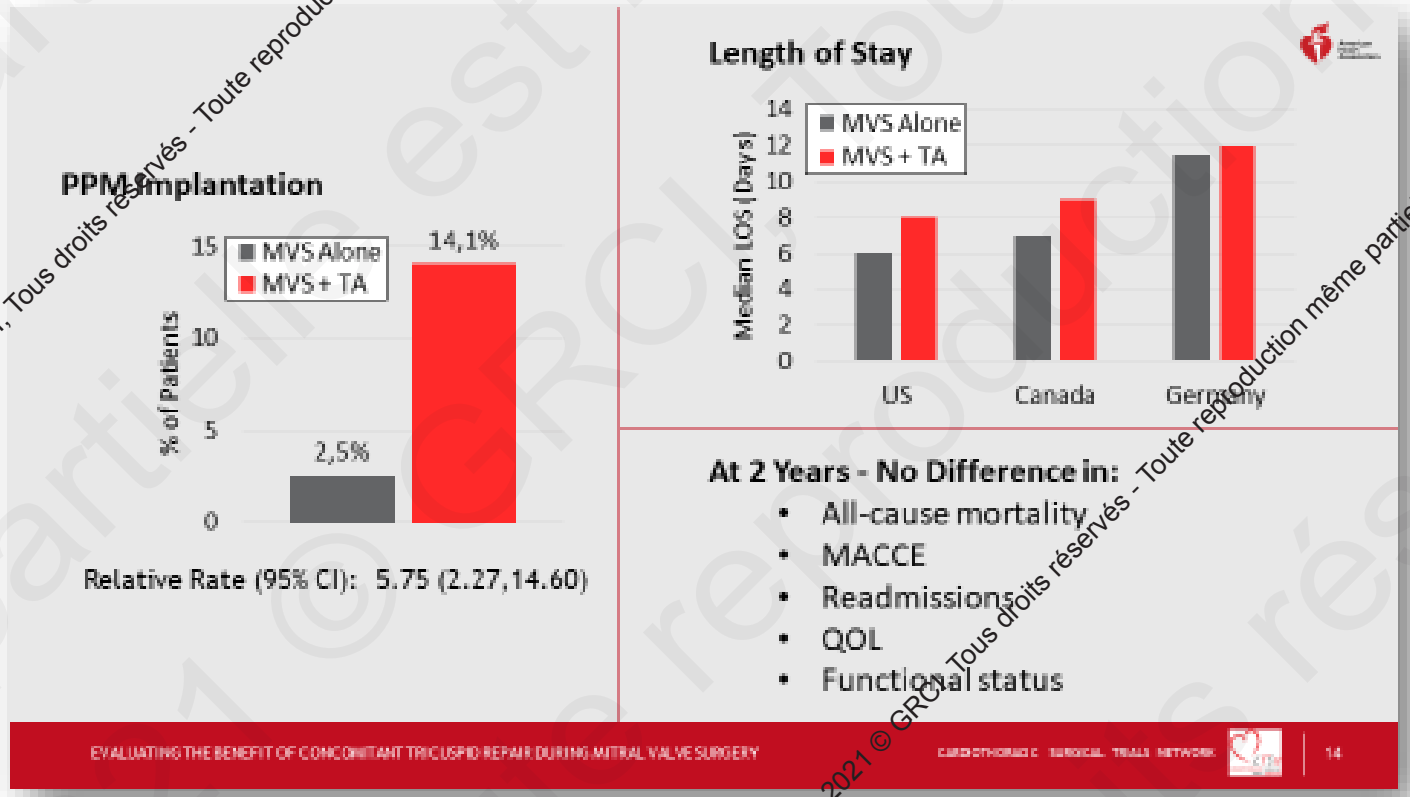

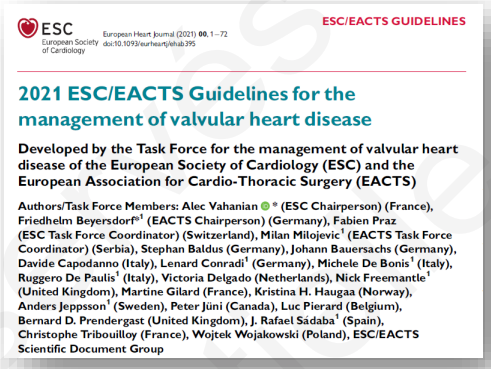

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Surgery should be considered in patients with severe secondary tricuspid regurgitation (with or without previous left-sided surgery) who are symptomatic or have RV dilatation, in the absence of severe RV or LV dysfunction and severe pulmonary vascular disease/hypertension.[418,433 e]	IIa	B

*"The **benefit of surgical correction** of isolated secondary tricuspid regurgitation compared to medical treatment **is not well established** and the procedure has a non-negligible risk of periprocedural mortality and morbidity when patients present late."*

ORIGINAL RESEARCH ARTICLE

Outcomes of patients with severe tricuspid regurgitation and congestive heart failure

Amer N Kadri ,[1] Vivek Menon,[1] Yasser M Sammour,[2] Rama D Gajulapalli,[1] Chandramohan Meenakshisundaram,[1] Leen Nusairat,[1] Divyanshu Mohananey,[1] Adrian V Hernandez,[3,4] Jose Navia,[5] Amar Krishnaswamy,[2] Brian Griffin,[2] Leonardo Rodriguez,[2] Serge C Harb ,[2] Samir Kapadia[2]

534 patients with isolated severe TR,
54 (10,3%) underwent tricuspid valve surgery
Appariement sur: âge, endocardite, valvulopathie gauche, FEVG ≤40%

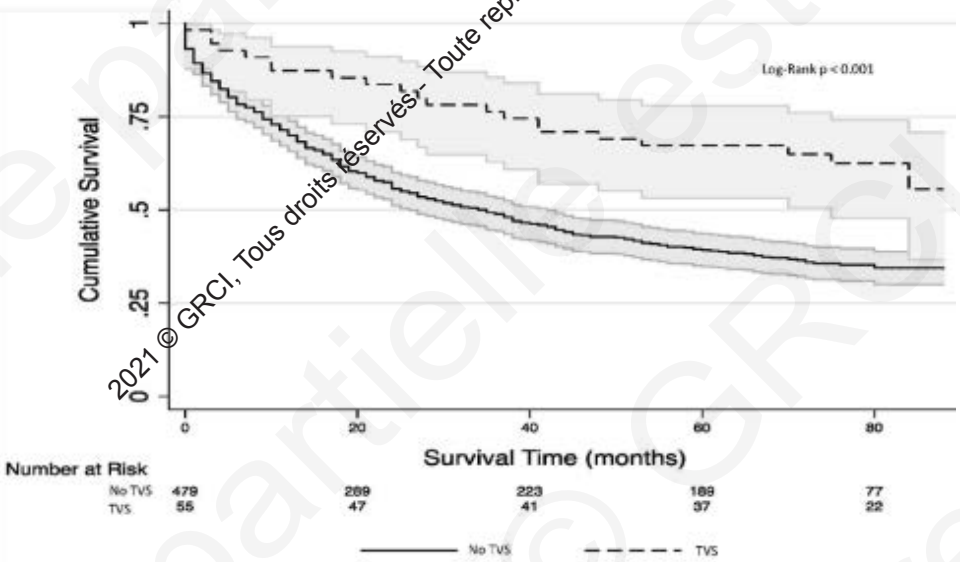

Figure 1 Kaplan-Meier curve for survival according to TVS patient group. TVS, tricuspid valve surgery.

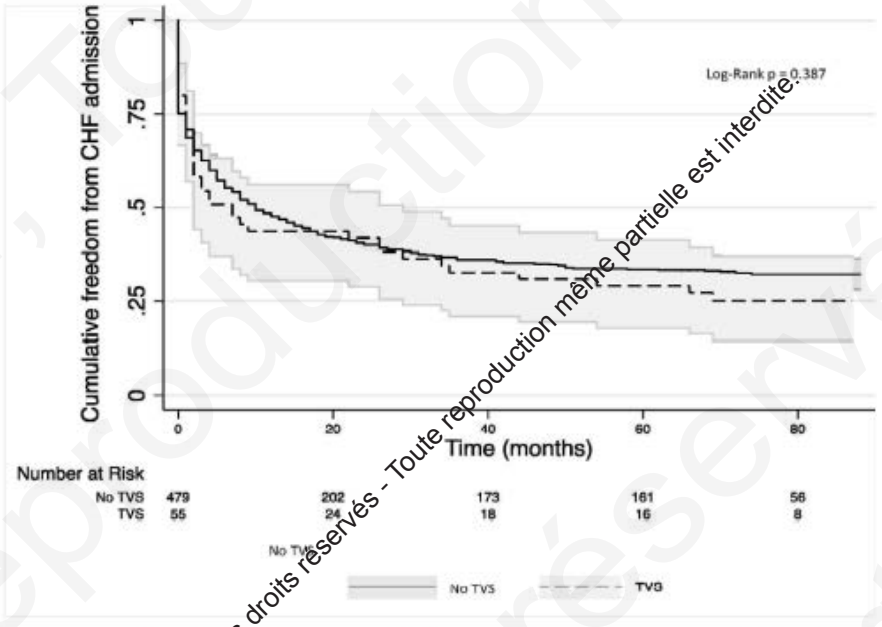

Figure 3 Kaplan-Meier curve for heart failure-related hospitalisation according to TVS patient group. CHF, congestive heart failure; TVS, tricuspid valve surgery.

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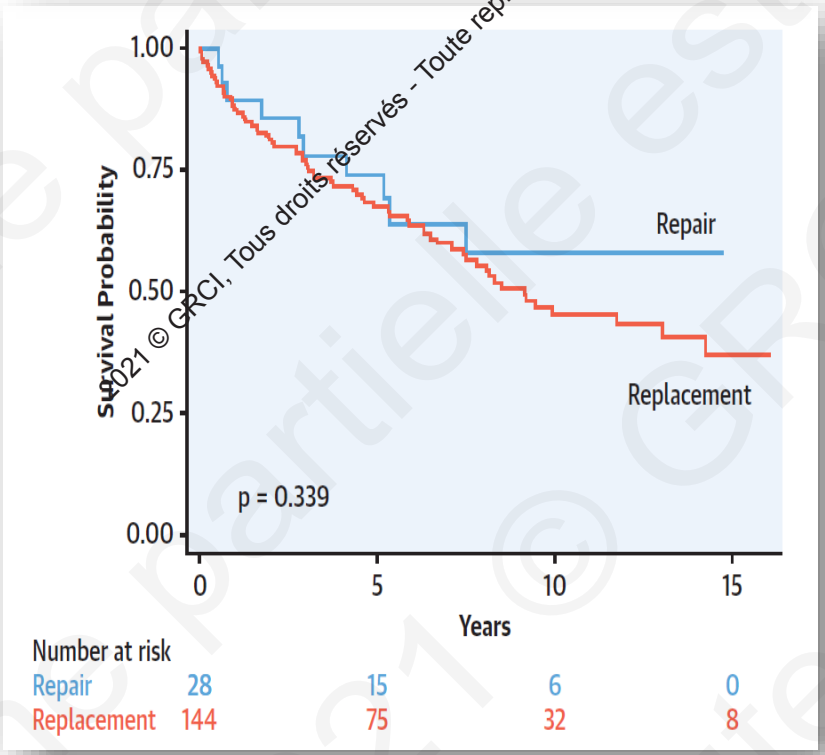
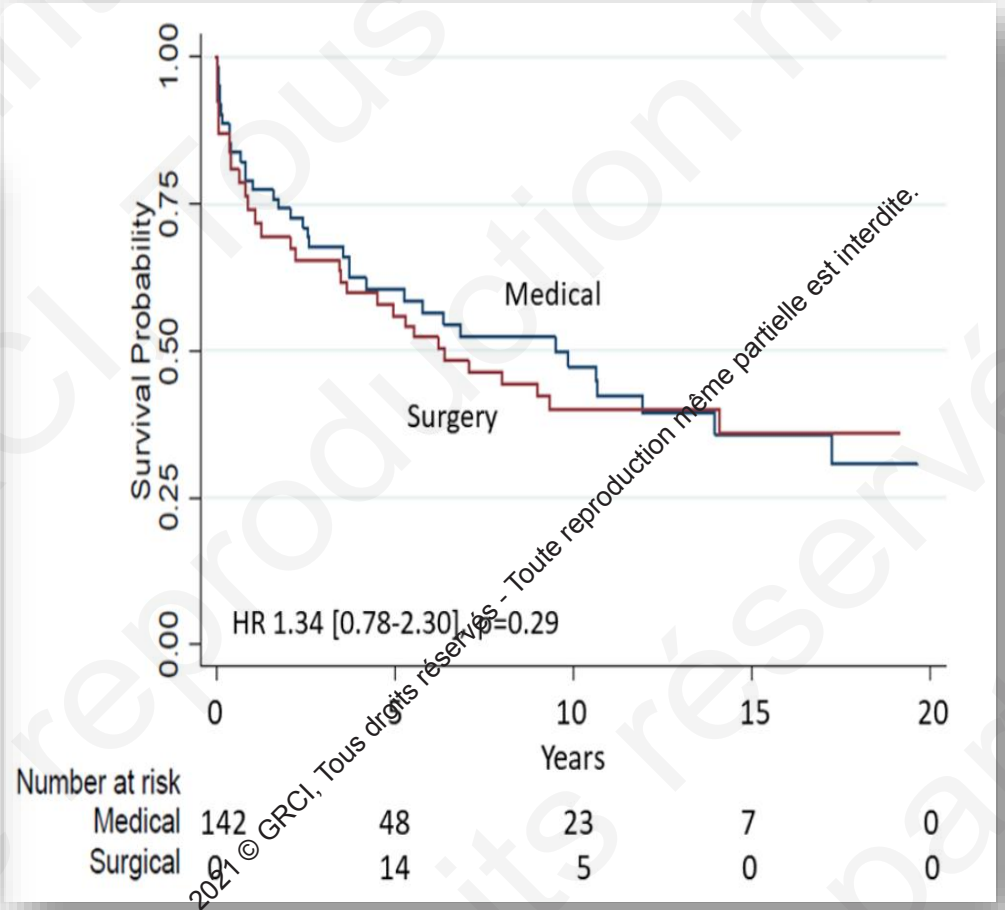
ORIGINAL INVESTIGATIONS

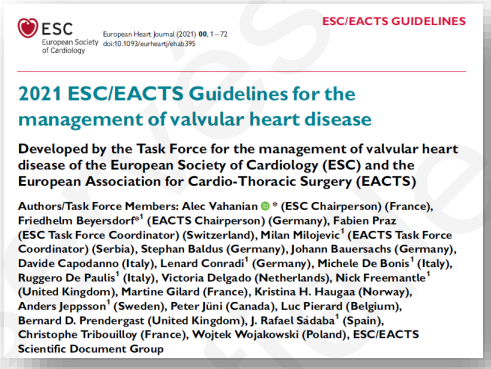
Surgery Does Not Improve Survival in Patients With Isolated Severe Tricuspid Regurgitation

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



3,276 patients with isolated severe TR,
171 (5%) underwent tricuspid valve surgery





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"The benefit of ***surgical correction*** *of isolated secondary tricuspid regurgitation compared to medical treatment is not well established and the procedure has* ***a non-negligible risk of periprocedural mortality and morbidity*** *when patients present late."*

Isolated Tricuspid Valve Surgery on Native Valve (N=466)

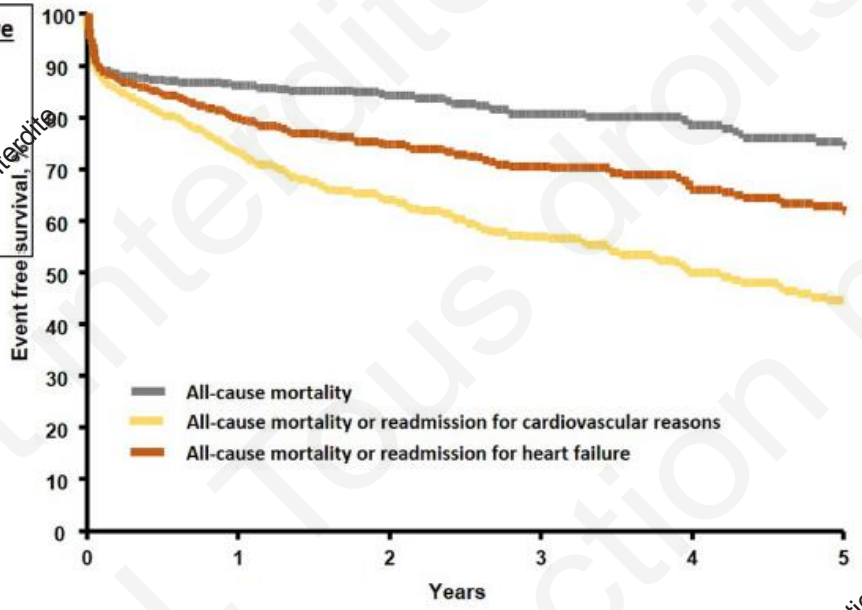
- **Functional tricuspid regurgitation (N=229)**
  - Prior left-sided heart valve surgery (N=101)
  - Isolated (N=128)
- **Organic tricuspid regurgitation (N=237)**
  - Infective endocarditis (N=142)
  - Other (N=95)

Pre-operative presentation

- **Clinical** (NYHA class II/IV, right heart failure signs)
- **Biological** (lower prothrombin time, lower glomerular filtration rate)
- **Echocardiography** (moderate/severe RV dysfunction or dilatation)

Outcome

- **In-hospital death: 10%**
- **In-hospital major complications: 31%**
- **Overall survival, survival free of cardiovascular readmission and survival free of heart failure readmission at 5 years were 75%, 44% and 62%.**

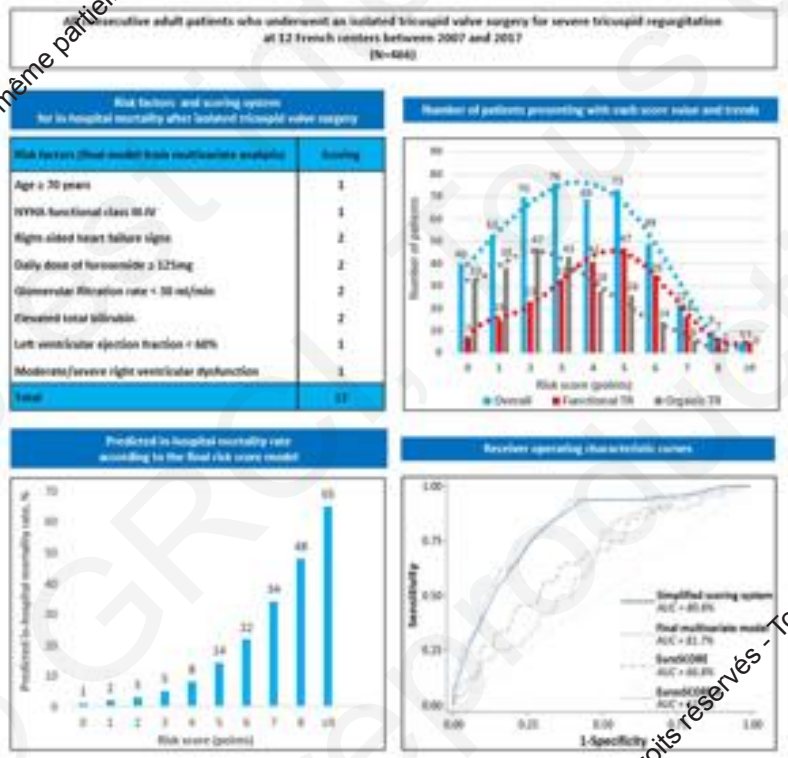


Isolated tricuspid valve surgery is associated with high mortality and morbidity, both in-hospital and during follow-up, predicted by the severity of the pre-operative clinical, biological and echocardiographic presentation but not by etiology or the mechanism tricuspid regurgitation mechanism

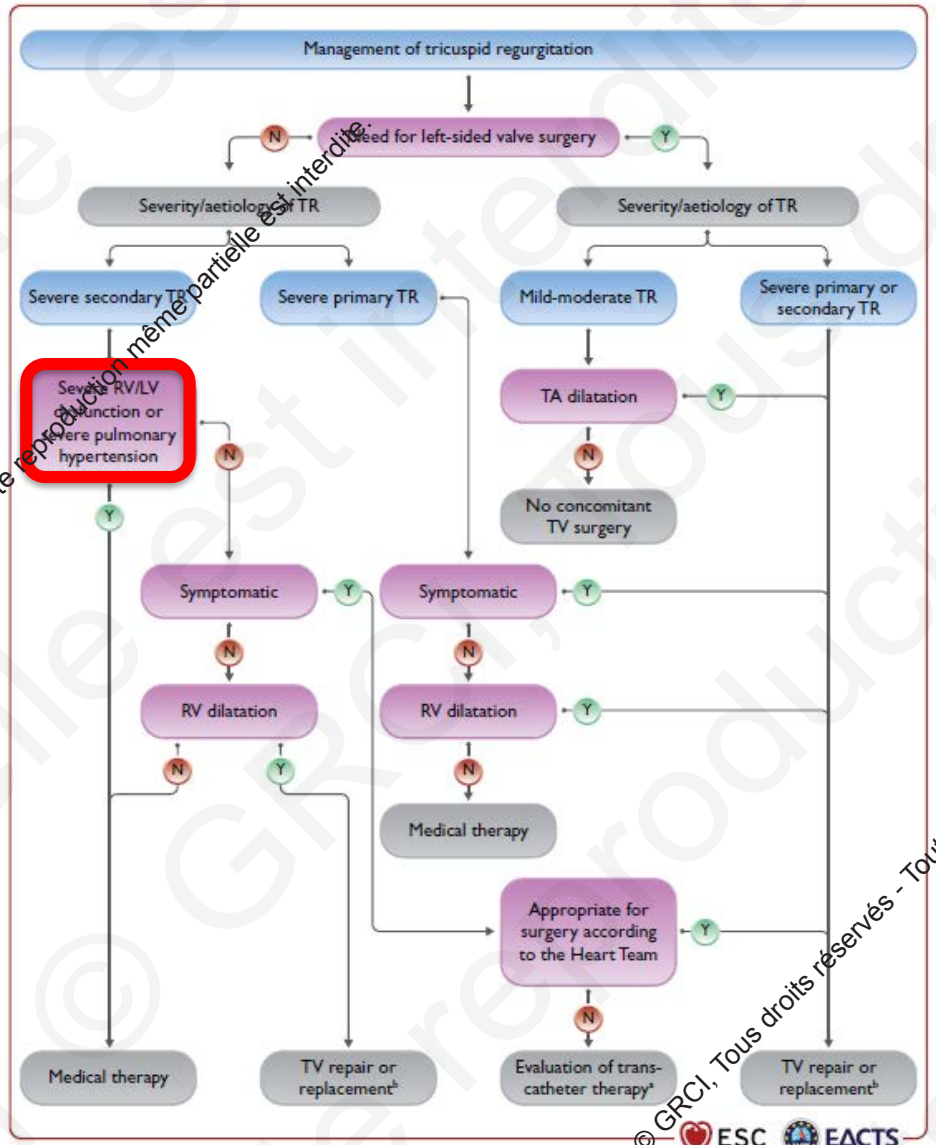
Take home figure Isolated tricuspid valve surgery is associated with high mortality and morbidity, both in hospital and during follow-up, predicted by the severity of the pre-operative clinical, biological, and echocardiographic presentation but not by tricuspid regurgitation mechanism. NYHA, New York Heart Association.

Dreyfus J. Eur Heart J. 2020

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



Eur Heart J, ehab679, https://doi.org/10.1093/eurheartj/ehab679



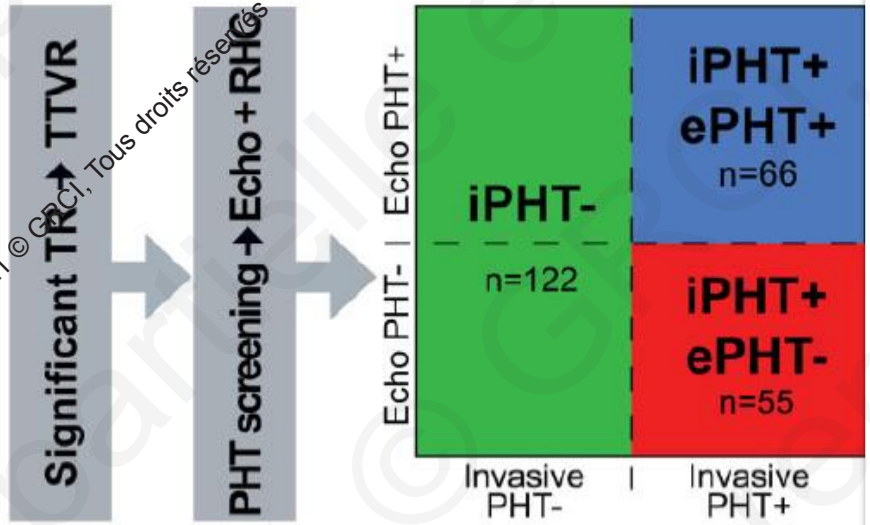
Le rôle du cathétérisme droit

ESC European Society of Cardiology
European Heart Journal (2020) 41, 2785–2795
doi:10.1093/eurheartj/ehaa138

CLINICAL RESEARCH
Valvular heart disease

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

Philipp Lurz[1]*†, Mathias Orban[2,3]†, Christian Besler[1], Daniel Braun[2], Florian Schlotter[1], Thilo Noack[4], Steffen Desch[1], Nicole Karam[2,5], Karl-Patrik Kresoja[1], Christian Hagl[6], Michael Borger[4], Michael Nabauer[2], Steffen Massberg[2,3], Holger Thiele[1], Jörg Hausleiter[2,3‡], and Karl-Philipp Rommel[1‡]



Take home figure Flow for risk assessment of patients with tricuspid regurgitation (TR) undergoing transcatheter tricuspid valve repair (TTVR) according to pulmonary hypertension (PHT) using echocardiography (Echo, e) and right heart catheter (RHC, invasive, *i*).

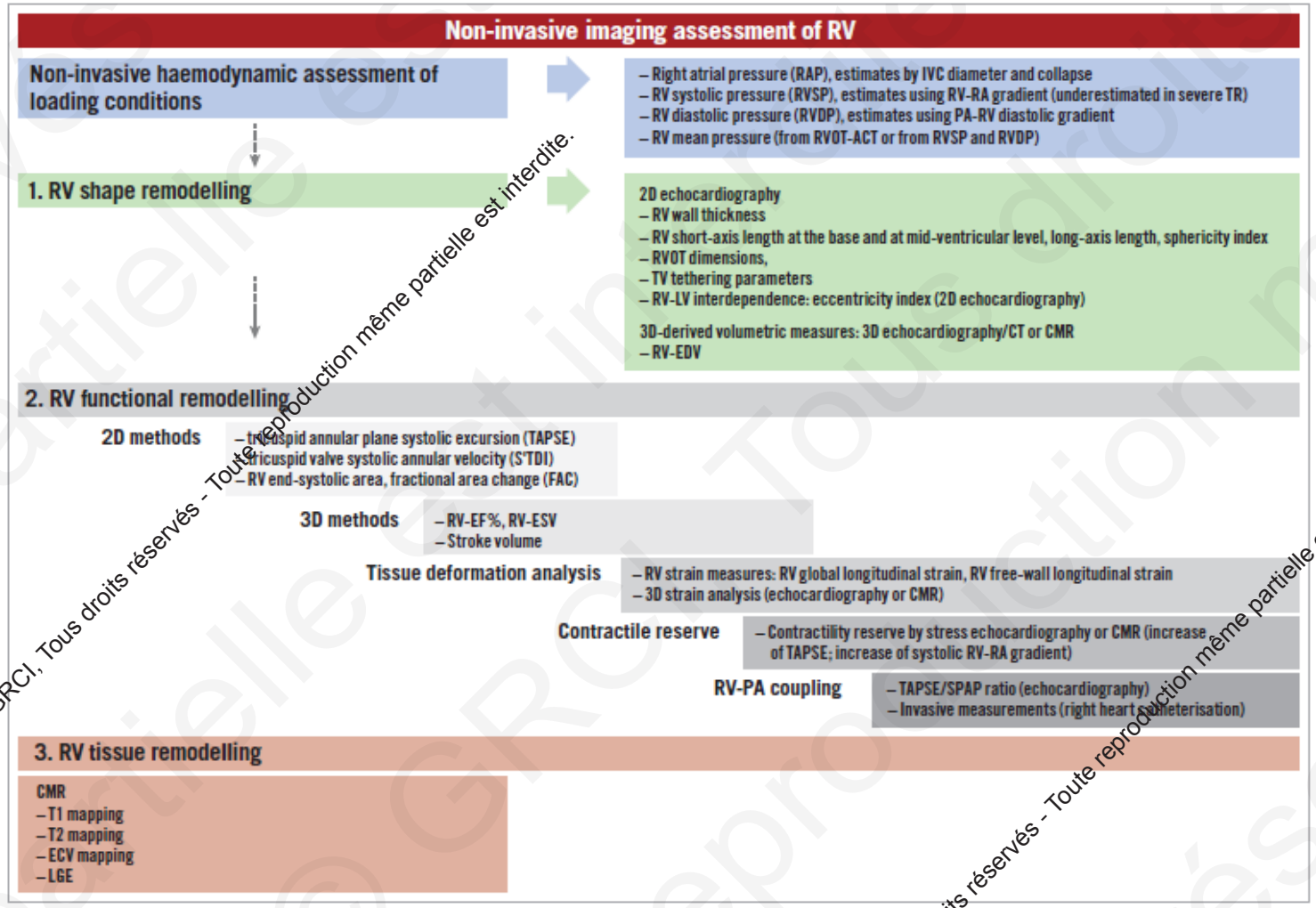


Figure 2. *Imaging assessment of the right ventricle. 2D: two-dimensional; 3D: three-dimensional; ACT: acceleration time; CMR: cardiac magnetic resonance; CT: computed tomography; ECV: extracellular volume; EDV: end-diastolic volume; EF: ejection fraction; ESV: end-systolic volume; IVC: inferior vena cava; LGE: late gadolinium enhancement; LV: left ventricle; PA: pulmonary artery; RV: right ventricle; RVOT: right ventricular outflow tract; SPAP: systolic pulmonary artery pressure; TV: tricuspid valve*

Praz F. EuroIntervention 2021

ESC European Society of Cardiology
European Heart Journal (2021) 00, 1–72
doi:10.1093/eurheartj/ehab395

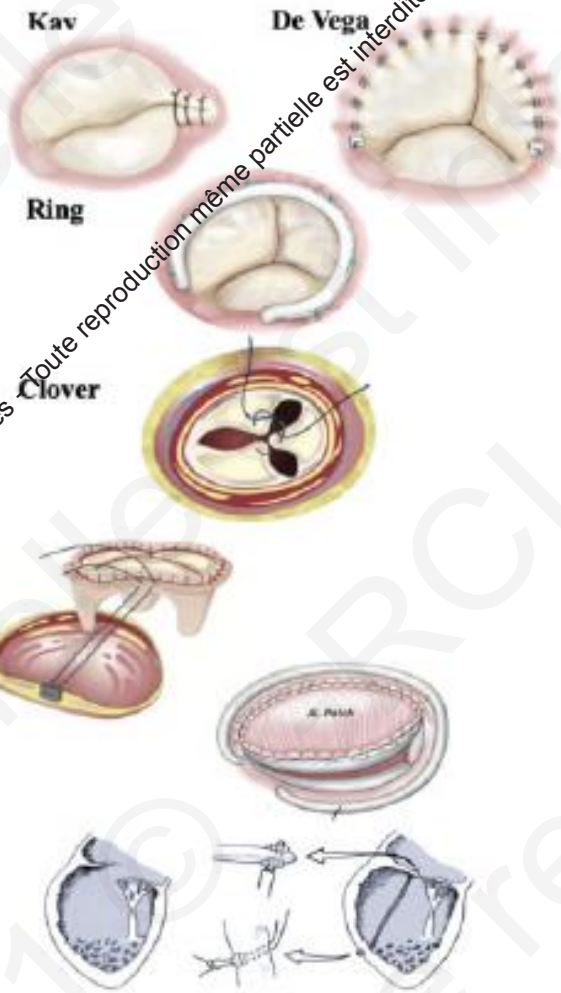
2021 ESC/EACTS Guidelines for the management of valvular heart disease

Developed by the Task Force for the management of valvular heart disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

New or Revised	Recommendations in 2017 version	Class	Recommendations in 2021 version	Class
Section 8: Indications for intervention in secondary tricuspid regurgitation				
Revised	After previous left-sided surgery and in absence of recurrent left-sided valve dysfunction, surgery should be considered in patients with severe tricuspid regurgitation who are symptomatic or have progressive RV dilatation/dysfunction, in the absence of severe RV or LV dysfunction and severe pulmonary vascular disease/hypertension.	IIa	Surgery should be considered in patients with severe secondary tricuspid regurgitation (with or without previous left-sided surgery) who are symptomatic or have RV dilatation, in the absence of severe RV or LV dysfunction and severe pulmonary vascular disease/hypertension.	IIa
New			Transcatheter treatment of symptomatic secondary severe tricuspid regurgitation may be considered in inoperable patients at a Heart Valve Centre with expertise in the treatment of tricuspid valve disease.	IIb

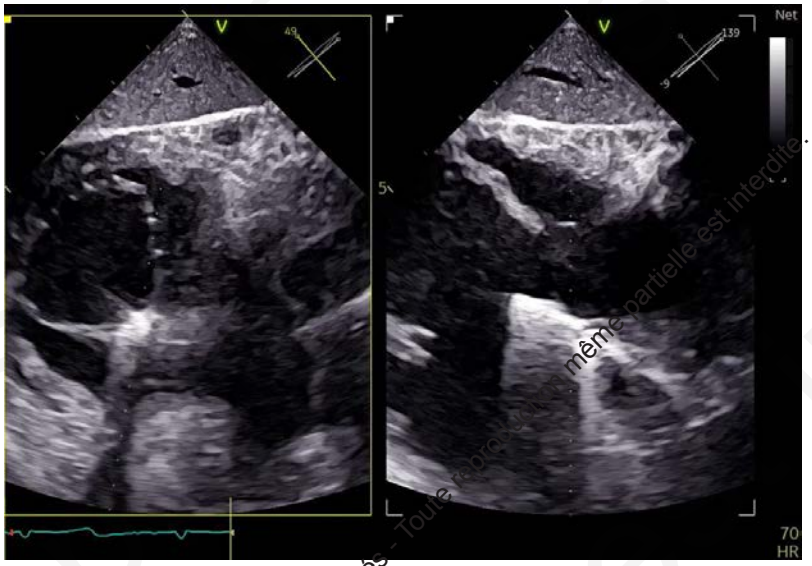
Surgical tricuspid landscape

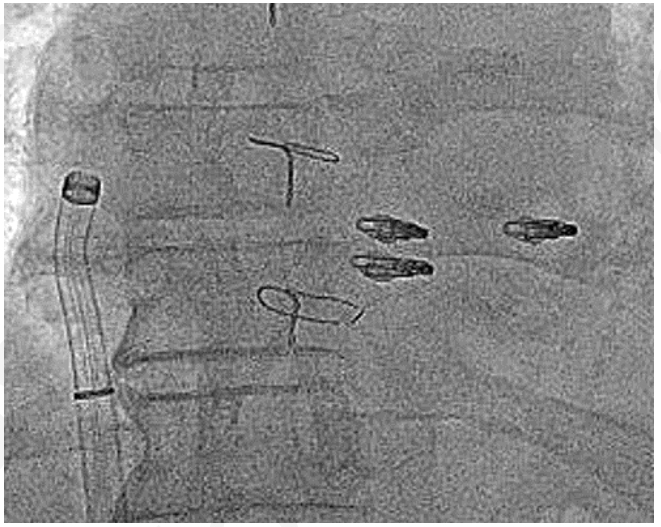
- Suture annuloplasty
- Ring annuloplasty
- Coaptation enhancement
- Replacement
- Leaflet augmentation
- Neochordae repair

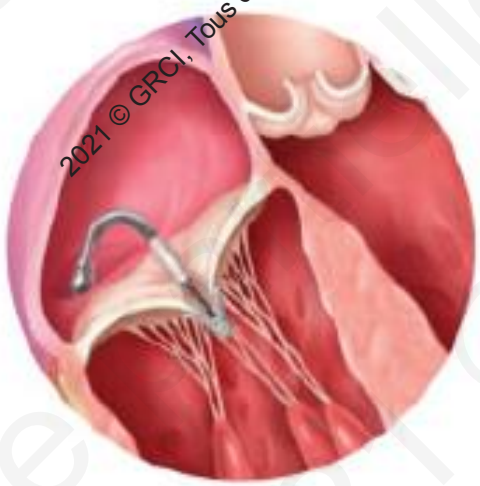


Transcatheter tricuspid landscape

Chang CC Eur Heart J 2020







2021 PCR london valves

Real-world Outcomes for Tricuspid Edge-to-Edge Repair: Initial 30-Day Results from the TriClip™ bRIGHT Study

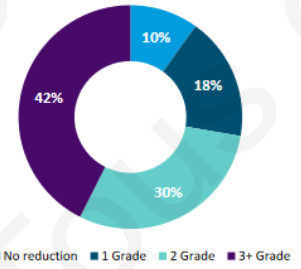
Philipp Lurz, Robert Schueler, Bjoern Goebel, Helge Moellmann, Georg Nickenig, Raffi Bekeredjian, Rodrigo Estevez, Iskandar Atmowihardjo, Alexander Schmeisser, Erwan Donal

TriClip™ bRIGHT Study is sponsored by Abbott

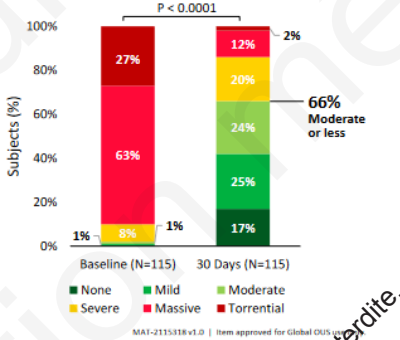
Significant TR Reduction

90% of subjects had TR reduced by at least 1 grade at 30 days with the majority (66%) reduced to moderate or less.

TR GRADE REDUCTION AT 30 DAYS (paired, N=115)



TR GRADE (CORE LAB)



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Strong Safety Profile

Only 1% of subjects experienced a major adverse event through 30 days, confirming the safety of the TriClip™ procedure.

EVENT	N=200
Major Adverse Event (MAE) through 30 Days	1.0% (2)
Cardiovascular Mortality	0.5% (1)
Myocardial Infarction	0% (0)
Stroke	0.5% (1)
New Onset Renal Failure	0% (0)
Non-elective CV Surgery, TVRS Device-related AE	0.5% (1)

EVENT	N=200
Other Clinical Safety Endpoints through 30 Days	
All-cause Mortality	0.5% (1)
Tricuspid Valve Re-intervention or Re-operation	1.5% (3)
Major Bleeding	7.0% (14)
New Onset Liver Failure	0% (0)
New Onset Atrial Fibrillation	0.5% (1)
Single Leaflet Device Attachment*	7.6% (10)
Embolization*	0% (0)
Tricuspid Valve Mean Gradient ≥ 5 mmHg*	1.7% (2)

*In subjects with a 30-day echo read by the core lab prior to data snapshot.

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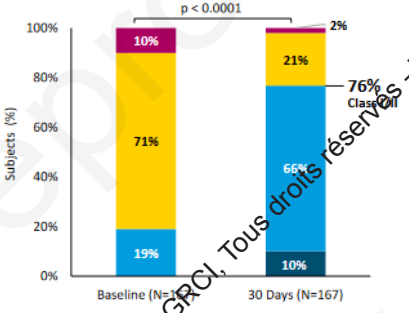
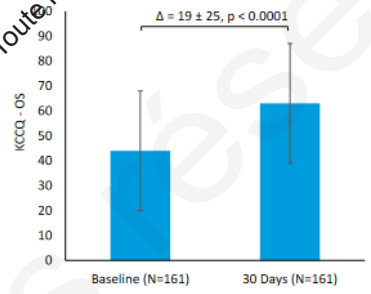
Significant Clinical Improvements

Majority of subjects experienced significant improvements in NYHA functional class and KCCQ-OS score.

NYHA FUNCTIONAL CLASS



KCCQ – OS



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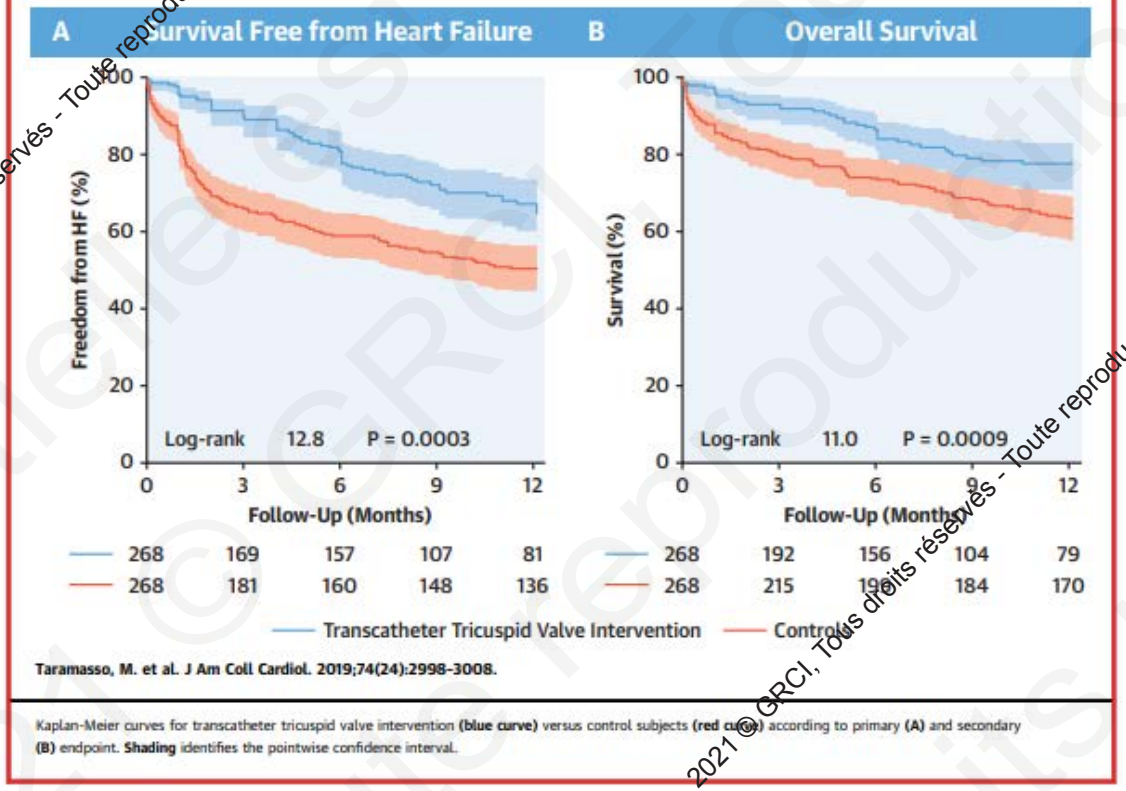
VOL. 74, NO. 24, 2019

Transcatheter Versus Medical Treatment of Patients With Symptomatic Severe Tricuspid Regurgitation

- patients TTVI < 472 patients /registre TriValve
- patients « controls » < 1169 patients avec IT > « moderate » traités médicalement
- matchés selon âge, EuroScore II, PAPs

CENTRAL ILLUSTRATION Transcatheter Treatment of Severe Tricuspid Regurgitation: Primary and Secondary Endpoints



Taramasso, M. et al. J Am Coll Cardiol. 2019;74(24):2998-3008.

Kaplan-Meier curves for transcatheter tricuspid valve intervention **(blue curve)** versus control subjects **(red curve)** according to primary **(A)** and secondary **(B)** endpoint. **Shading** identifies the pointwise confidence interval.

TRI-FR trial

Design	• Randomisation: TriClip (Device) Group vs. Medical Therapy (Control) Group • 300 patients
Primary endpoint	• Milton Packer clinical composite score (12 months)
Eligibility	• Severe and symptomatic TR despite OMT • Inclusion validated by a Clinical eligibility Committee

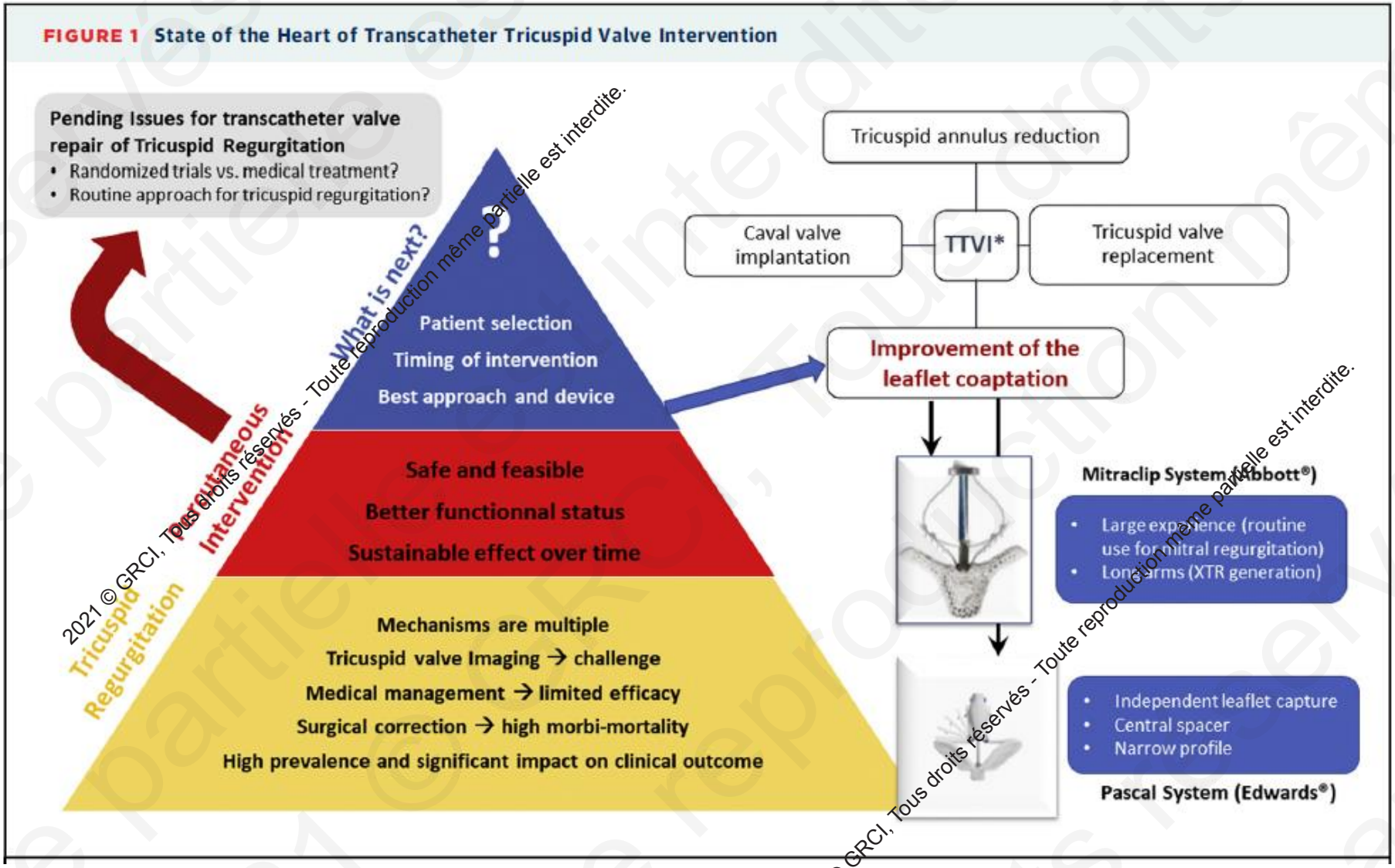
ClinicalTrials.gov Identifier: NCT04646811

Triluminate Pivotal trial

Design	• Randomisation: TriClip (Device) Group vs. Medical Therapy (Control) Group • 700 patients
Primary endpoint	• Hierarchical composite of all-cause mortality or tricuspid valve surgery, HF hospitalizations, and QoL improvement (KCCQ)
Eligibility	• Severe and symptomatic TR despite OMT • Exclusion crit: indication for left-side/pulm. valve intervention; PAPs >70mmHg; LVEF <20%

ClinicalTrials.gov Identifier: NCT03904147

FIGURE 1 State of the Heart of Transcatheter Tricuspid Valve Intervention



Leurent G, Collet JP. JACC Intv. 2020

State of the Art
by EuroIntervention

EuroIntervention 2021;17:1-18

Transcatheter treatment for tricuspid valve disease

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 1. Proposed new integrated classification of TR.

	Leaflet structure	Pathophysiology	Aetiology	Imaging
Secondary (functional)				
A. Atrial	Normal	RA enlargement and dysfunction leading to significant isolated annular dilation; RV often normal*	Carpentier I: Atrial fibrillation/flutter[101] Age[102] Heart failure with preserved ejection fraction[103,104]	Marked **TV annular dilation** is the dominant mechanism TV leaflet tethering is absent or minimal (except for late stages with secondary RV dysfunction) TV leaflet mobility is typically normal (Carpentier type I) RA is significantly dilated RV volume is typically normal (except in late stages)
B. Ventricular	Normal	RV enlargement and/or dysfunction leading to significant leaflet tethering and annular dilation	Carpentier IIIB: Left-sided ventricular or valve disease[11,12] Pulmonary hypertension[102] RV cardiomyopathy RV infarction	Marked **TV leaflet tethering** is the dominant mechanism TV leaflet mobility is typically restricted in systole (Carpentier type IIIB) TV annulus, RV and RA are dilated and/or dysfunctional
CIED-related	Normal/ abnormal	Leaflet impingement Leaflet/chordal entanglement/ chordal rupture Leaflet adherence Leaflet laceration/perforation Leaflet avulsion (following lead extraction)	Pacemaker Implantable cardiac defibrillator (ICD) Cardiac resynchronisation therapy (CRT) devices[105-108]	**TV leaflet structural abnormalities** may be present TV leaflet mobility is variable (all Carpentier types) TV annulus, RV and RA are typically dilated (except for acute TR)
Primary (organic)	Abnormal	Lack of leaflet coaptation due to intrinsic changes leading to restricted or excessive leaflet mobility or leaflet perforation	Carpentier I: Congenital Endocarditis Carpentier II: Myxomatous disease Traumatic Post biopsy Carpentier IIIA: Carcinoid[109] Rheumatic Radiotherapy Tumours	**TV leaflet structural abnormalities** characteristic of each primary aetiology are the dominant mechanisms TV leaflet mobility is variable (all Carpentier types) TV annulus, RV and RA are typically dilated (except for acute TR)

*RV basal diameter may appear abnormal due to the conical RV shape. CIED: cardiac implantable electronic device; CRT: cardiac resynchronisation therapy; ICD: implantable cardiac defibrillator; RA: right atrium; RV: right ventricle; TR: tricuspid regurgitation; TV: tricuspid valve

State of the Art
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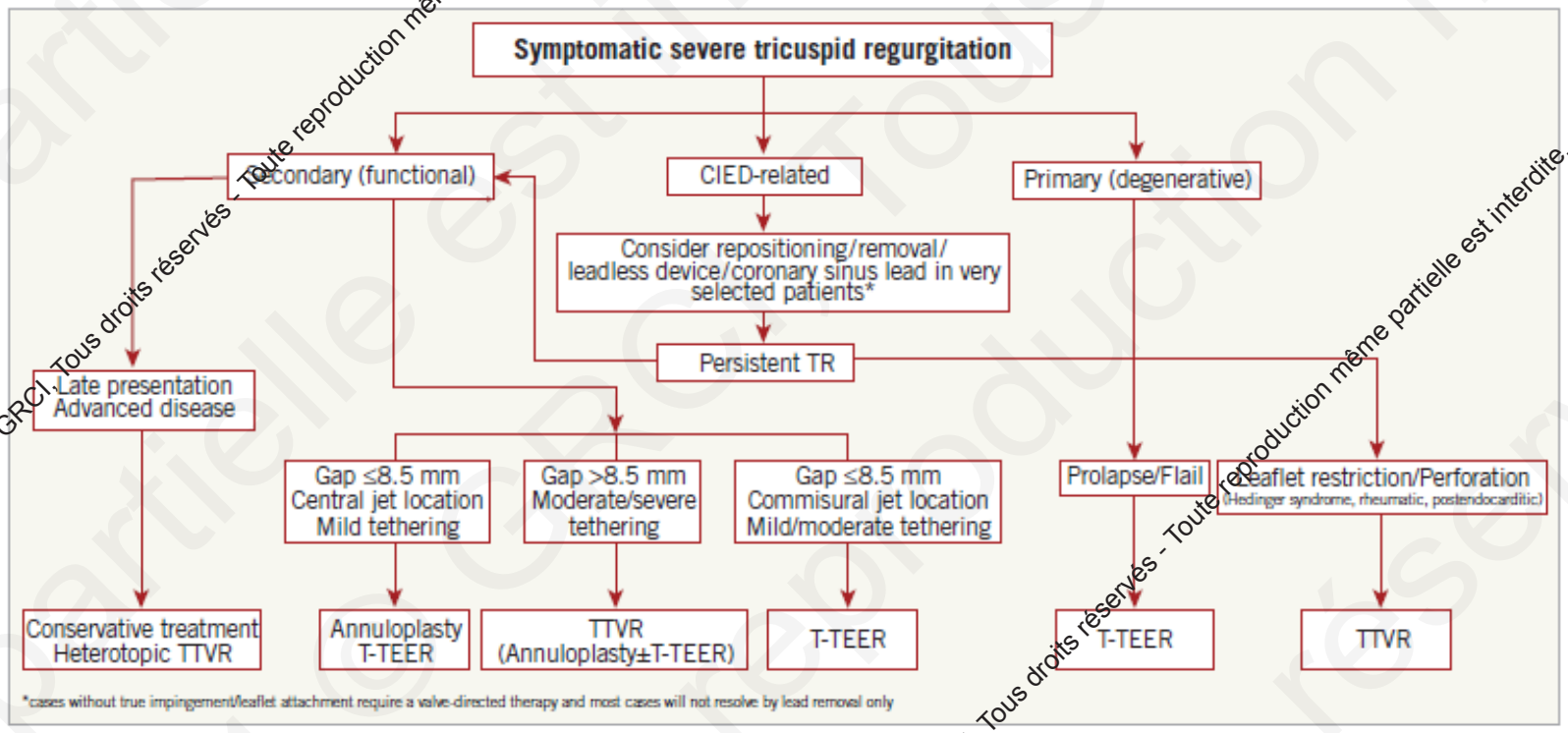

Figure 6. *Proposed algorithm for the selection of TTVI systems. CIED: cardiac implantable electronic device; T-TEER: tricuspid transcatheter edge-to-edge repair; TTVR: transcatheter tricuspid valve replacement*

Merci de votre attention

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