l'année 2022 en imagerie

Modérateurs : Alain Berrebi (Paris), Eric Parrens (Bordeaux)

- **Echocardiographie** : *Arnaud Maudière (Marseille)*

- IRM cardiaque : *Olivier Lairez (Toulouse)*

- Scanner cardiaque : *Julien Rosencher (Neuilly)*

- Imagerie en cardio-onco : *Mathilde Baudet (Paris)*

l'année 2022 en imagerie

Echocardiographie

Arnaud Maudière (Marseille)

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HOPITAL SAINT JOSEPH MARSEILLE

Statement of Financial Interest

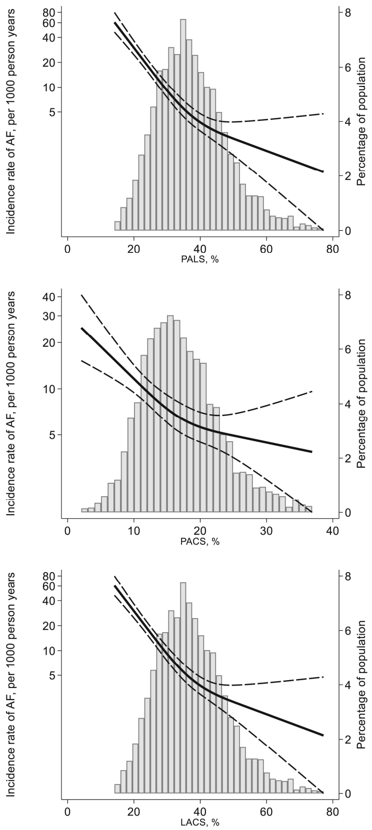
I currently have, or have had over the last two years, an affiliation or financial interests or interests of any order with a company or I receive compensation or fees or research grants with a commercial company :

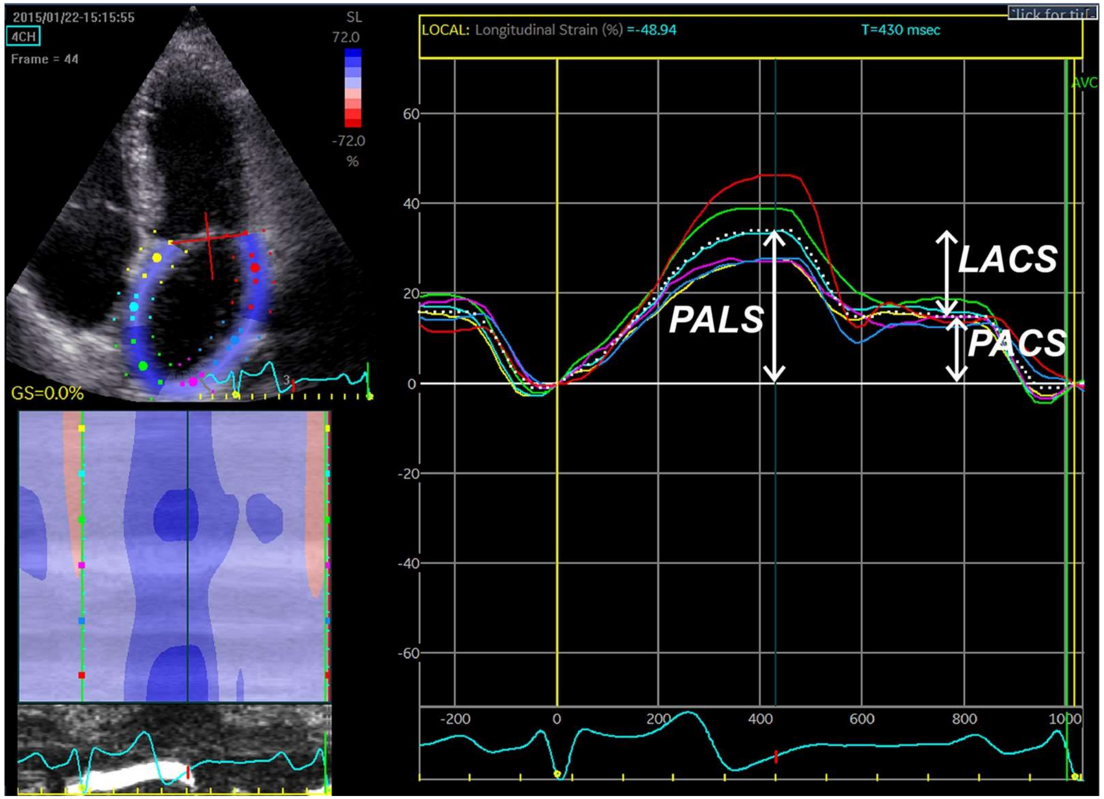
Speaker's name : Arnaud Maudière, Marseille

☑ I do not have any potential conflict of interest

Left atrial strain predicts incident atrial fibrillation in the general population: the Copenhagen City Heart Study

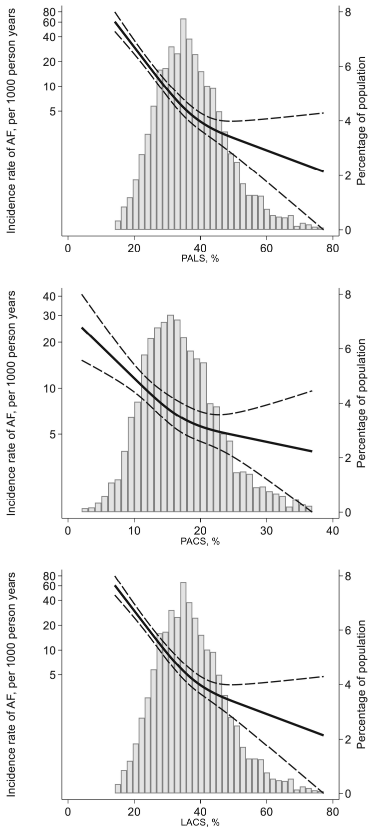
- Peak atrial longitudinal strain (PALS) is a measure of LA reservoir function,
- peak atrial contraction strain (PACS) represents the late diastolic contraction phase of the LA
- LA strain during the conduit phase (LACS) is the difference between PALS and PACS and represents the passive filling of the left ventricular (LV) in early ventricular diastole.





Eur Heart J Cardiovasc Imaging, Volume 23, Issue 1, January 2022, Pages 52–60, https://doi.org/10.1093/ehjci/jeab202.

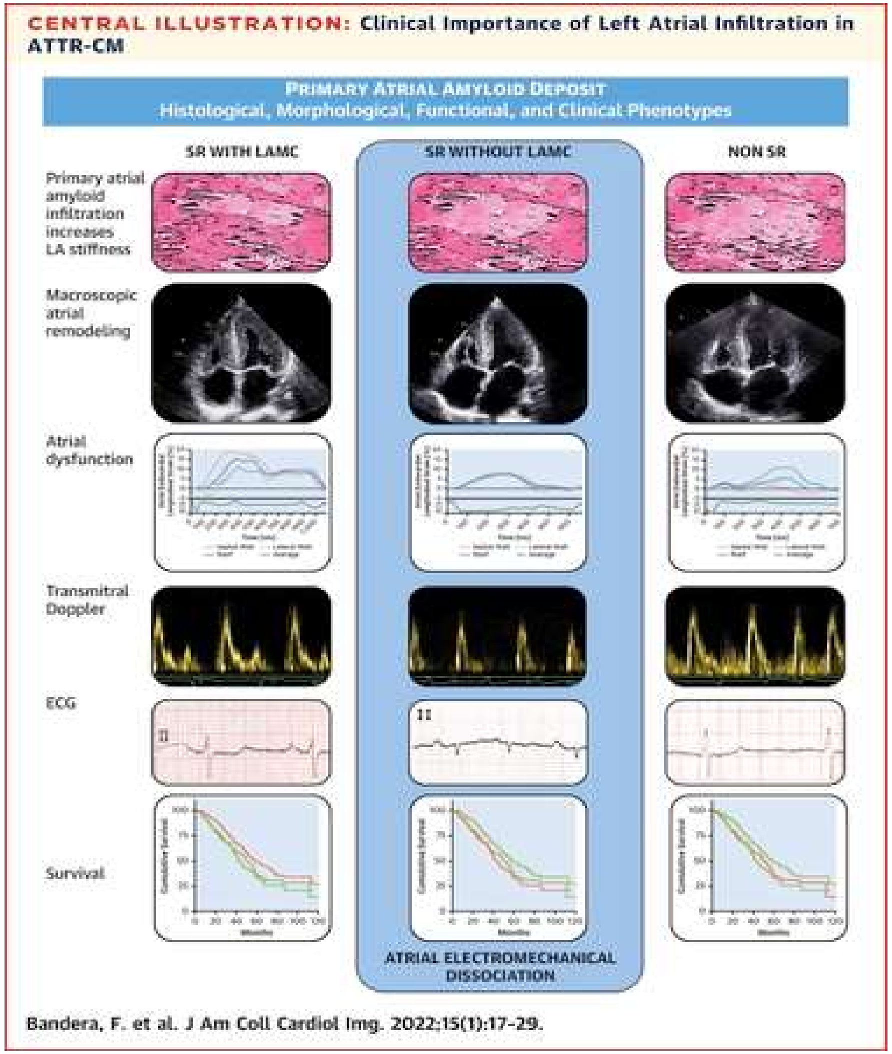
Figure 2 Association between left atrial speckle-tracking measurements and incident rate of AF, per 1000 person-years. ...



Eur Heart J Cardiovasc Imaging, Volume 23, Issue 1, January 2022, Pages 52–60, https://doi.org/10.1093/ehjci/jeab202

Clinical Importance of Left Atrial Infiltration in Cardiac Transthyretin Amyloidosis

- **Perspectives**
- **COMPETENCY IN MEDICAL KNOWLEDGE:** The LA involvement in ATTR-CM is not limited to chamber dilatation but implies the loss of physiological function (reservoir, conduit, and contraction) related to increased stiffness chamber.
- **COMPETENCY IN PATIENT CARE AND PROCEDURAL SKILLS:** The LA strain, as assessed by echocardiography, is a reliable method to quantify the contractile function. This approach, matched with electrocardiographic (ECG) rhythm analysis, helps in identifying patients with electromechanical dissociation (loss of contraction despite P wave at ECG) at increased risk of death.
- **TRANSLATIONAL OUTLOOK:** The LA infiltration occurring in ATTR-CM has impact on the wall structure, physical properties (ie, stiffness), and phasic functions of the chamber. The stages of atrial remodeling are associated with the risk of death. Further studies are needed to explore the expected link with heart failure and thromboembolic events, typically affecting ATTR-CM, and to expand the indications for thromboembolic prophylactic therapy.



Bandera F, Martone R, Chacko L, et al. Clinical Importance of Left Atrial Infiltration in Cardiac Transthyretin Amyloidosis. *J Am Coll Cardiol Img.* 2022 Jan, 15 (1) 17–29.**https://doi.org/10.1016/j.jcmg.2021.06.022**.

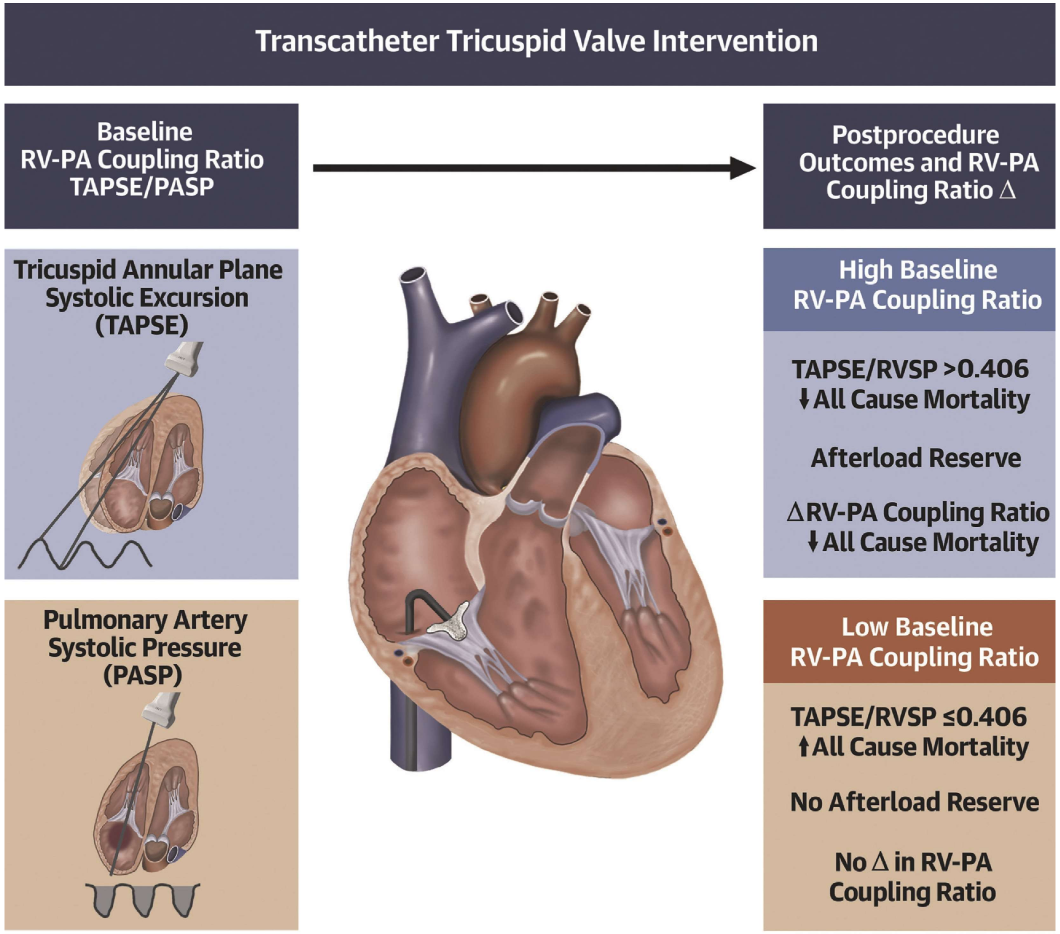
Comprehensive risk assessment in pulmonary arterial hypertension (three-strata model)

Clinical observations and modifiable variables

Determinants of prognosis (1 year mortality)	Low risk < 5 %	Intermediate risk 5-20 %	High risk > 20 %
Echocardiography	**RA area <18 cm2 TAPSE/sPAP >0.32 mm/mmHg No pericardial effusion**	**RA area 18–26 cm2 TAPSE/sPAP 0.19–0.32 mm/mmHg Minimal pericardial effusion**	**RA area >26 cm2 TAPSE/sPAP <0.19 mm/mmHg Moderate or large pericardial effusion**
cMRI	**RVEF >54% SVI >40 mL/m2 RVESVI >42 mL/m2**	**RVEF 37–54% SVI 26–40 mL/m2 RVESVI 42–54 mL/m2**	**RVEF <37% SVI <26 mL/m2 RVESVI >54 mL/m2**
Haemodynamics	**RAP <8 mmHg CI ≥2.5 L/min/m2 SVI >38 mL/m2 SvO2 >65%**	**RAP 8–14 mmHg CI 2.0–2.4 L/min/m2 SVI 31–38 mL/m2 SvO2 60–65%**	**RAP >14 mmHg CI <2.0 L/min/m2 SVI <31 mL/m2 SvO2 <60%**

Humbert guidelines ESC/ERS European Heart Journal (2022) 43, 3618–3731 https://doi.org/10.1093/eurheartj/ehac237

Right Ventricular-Pulmonary Arterial Coupling and Afterload Reserve in Patients Undergoing Transcatheter Tricuspid Valve Repair



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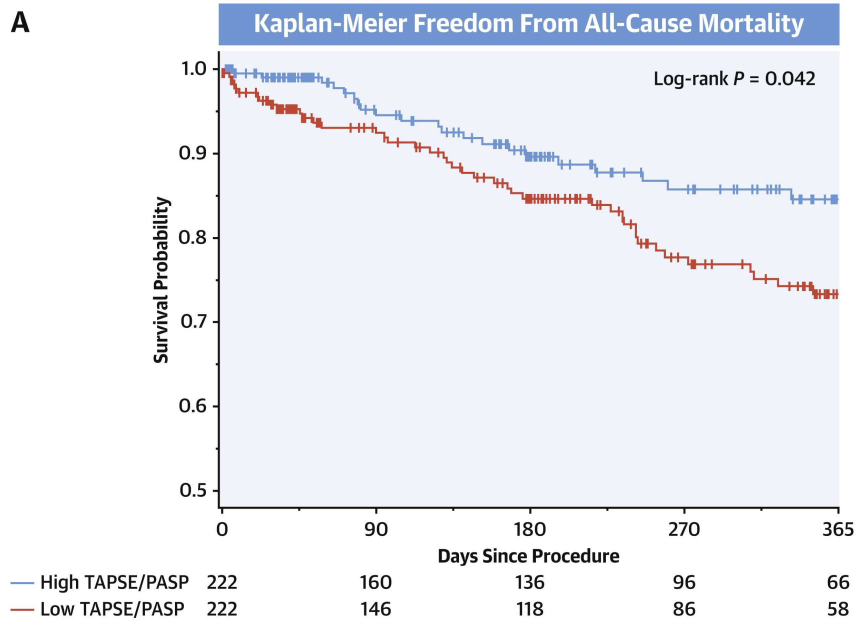

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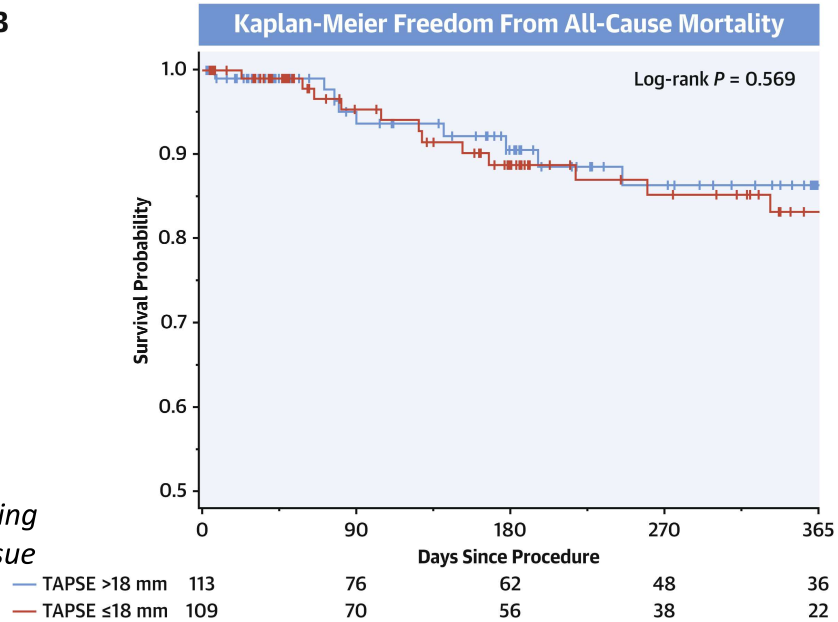


Brener, Right Ventricular-Pulmonary Arterial Coupling and Afterload Reserve in Patients Undergoing Transcatheter Tricuspid Valve Repair,Journal of the American College of Cardiology,Volume 79, Issue 5,2022,Pages 448-461,ISSN 0735-1097,https://doi.org/10.1016/j.jacc.2021.11.031.

PARTNER 3; Right Ventricle–Pulmonary Artery Coupling in Low Surgical Risk Patients With Severe, Symptomatic Aortic Stenosis

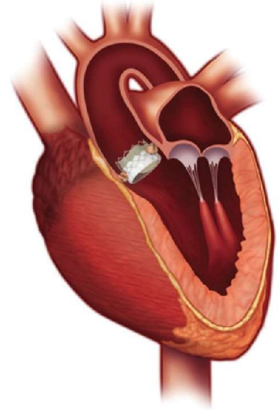
Baseline

RV-PA coupling
assessed by TAPSE/PASP
ratio on transthoracic echo (N = 570)

RV-PA Uncoupling
TAPSE/PASP ≤0.55
(n = 222)
39%

RV-PA Coupling
TAPSE/PASP >0.55
(n = 348)
61%

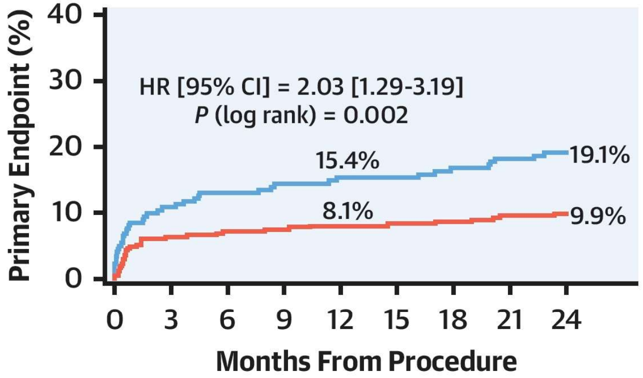
Aortic Valve Replacement



Patients received SAVR or transfemoral TAVR with the SAPIEN 3 valve

Outcome at 2 Years

Composite primary endpoint of all-cause mortality, stroke, and heart failure-rehospitalization



No. at risk:

T/P ≤0.55	222	185	171
T/P >0.55	348	315	298

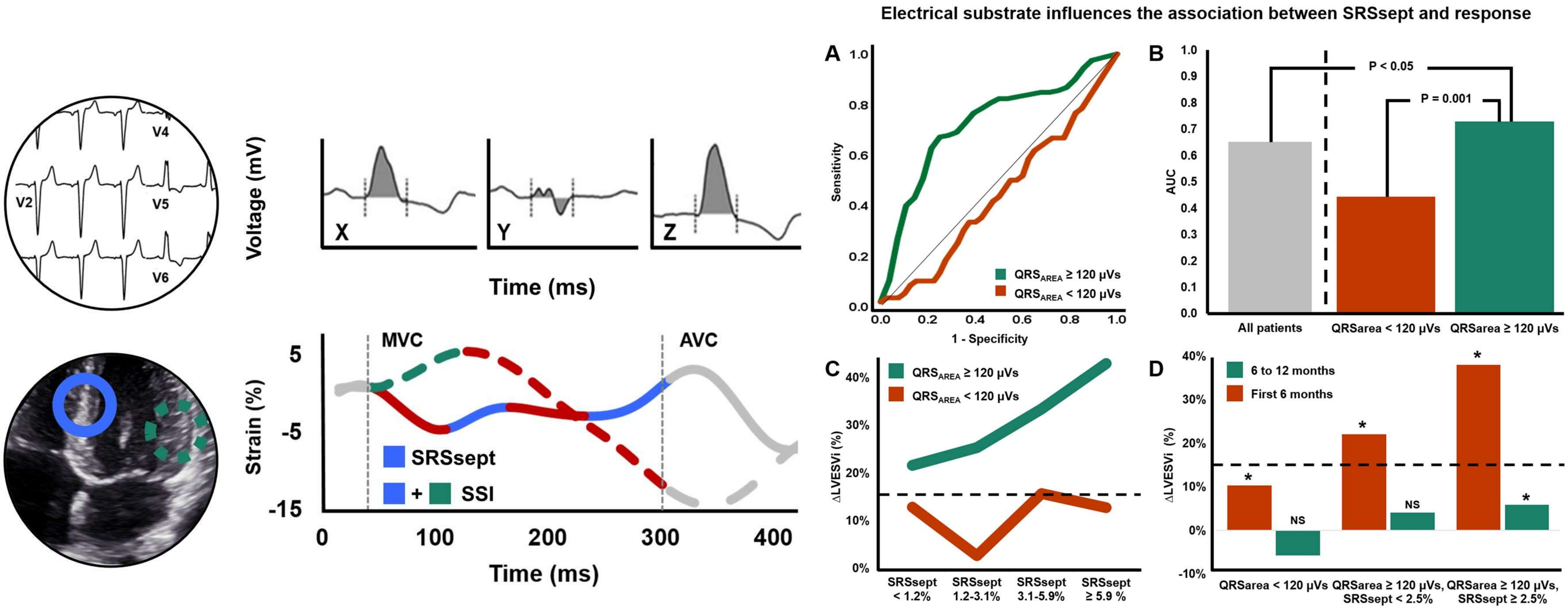
TAPSE/PASP ≤0.55 — TAPSE/PASP >0.55

Primary Endpoint Components	RV-PA Uncoupling	RV-PA Coupling	*P* Value
All-Cause Mortality	5.9%	0.6%	0.0001
All Stroke	3.2%	2.9%	0.81
HF Rehospitalization	13.5%	7.3%	0.02

Baseline RV-PA uncoupling is associated with adverse clinical outcomes at 2 years in low-risk patients with severe AS undergoing TAVR or SAVR in the PARTNER 3 trial

Cahill TJ, et al. J Am Coll Cardiol Intv. 2022;15(18):1823–1833.

Does mechanical dyssynchrony in addition to QRS area ensure sustained response to cardiac resynchronization therapy?



Eur Heart J Cardiovasc Imaging, Volume 23, Issue 12, December 2022, Pages 1628–1635, https://doi.org/10.1093/ehjci/jeab264

KU LEUVEN

UZ LEUVEN

Contact: alexis.puvrez@kuleuven.be

Cardiac resynchronization therapy (CR
(1) the failure to recognize the need fo
therapy costs. A better patient screen

The presence of mechanical dyssynch
Several markers of dyssychrony were
performed poorly. Promising new ma

Within a heart failure population elig
(1) confirm the correlation betwee
(2) compare the old and new mark

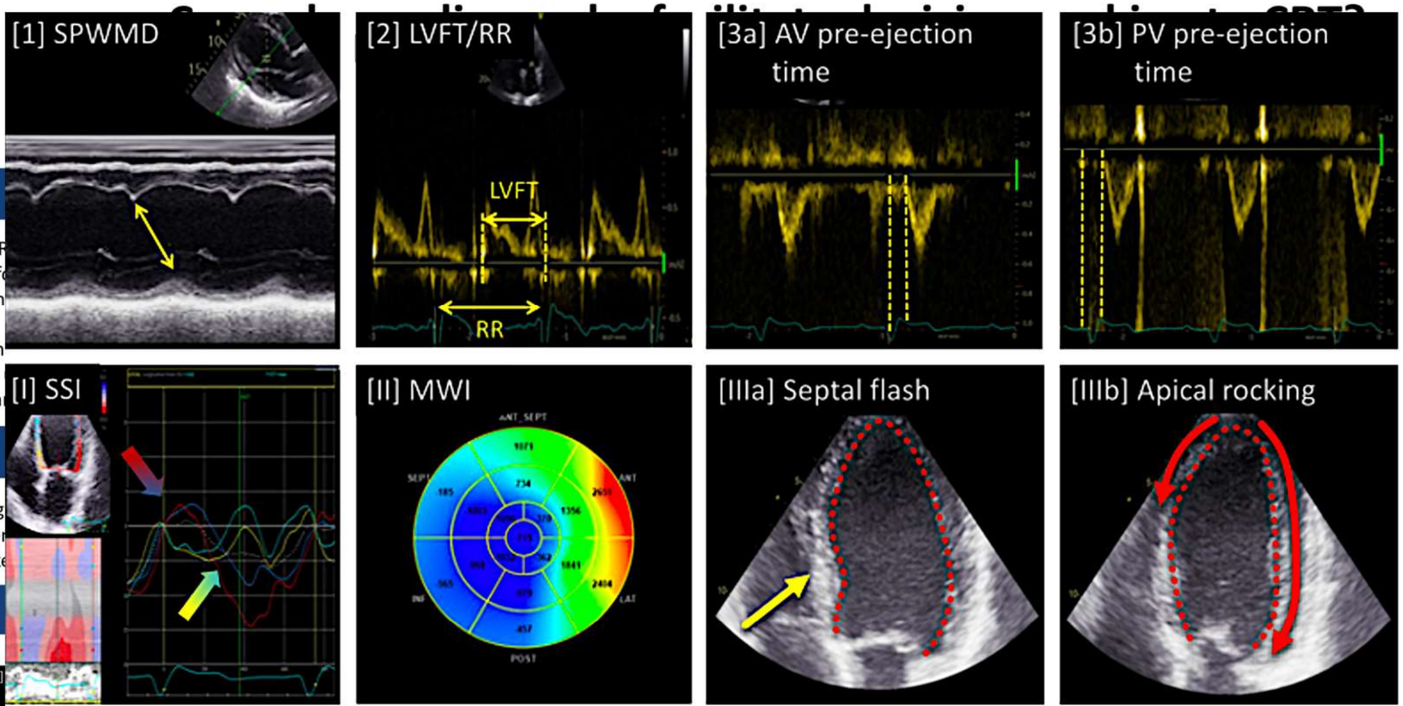
Pre-CRT — Echo *Markers*

± 1 month

CRT

± 5 years

Status — Alive / Dead *Cardiac?*

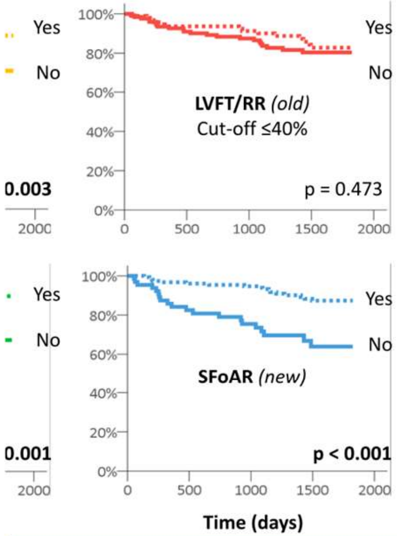


1. Septal-to-posterior wall motion delay (SPWMD)
2. Left ventricular filling time over cardiac cycle (LVFT/RR)
3. Interventricular mechanical delay (IVMD)

"Old" Marker

I. Systolic stretch index (SSI)
II. Myocardial work index (MWI)
III. Septal flash or apical rocking (SFoAR)

"New" Marker



	HR (95% CI)	P value
	0.57 (0.30 – 1.10)	0.094
	0.38 (0.19 – 0.75)	**0.005**
	0.78 (0.40 – 1.53)	0.474
	0.30 (0.15 – 0.57)	**<0.001**
	0.26 (0.12 – 0.54)	**<0.001**
	0.28 (0.14 – 0.53)	**<0.001**

10

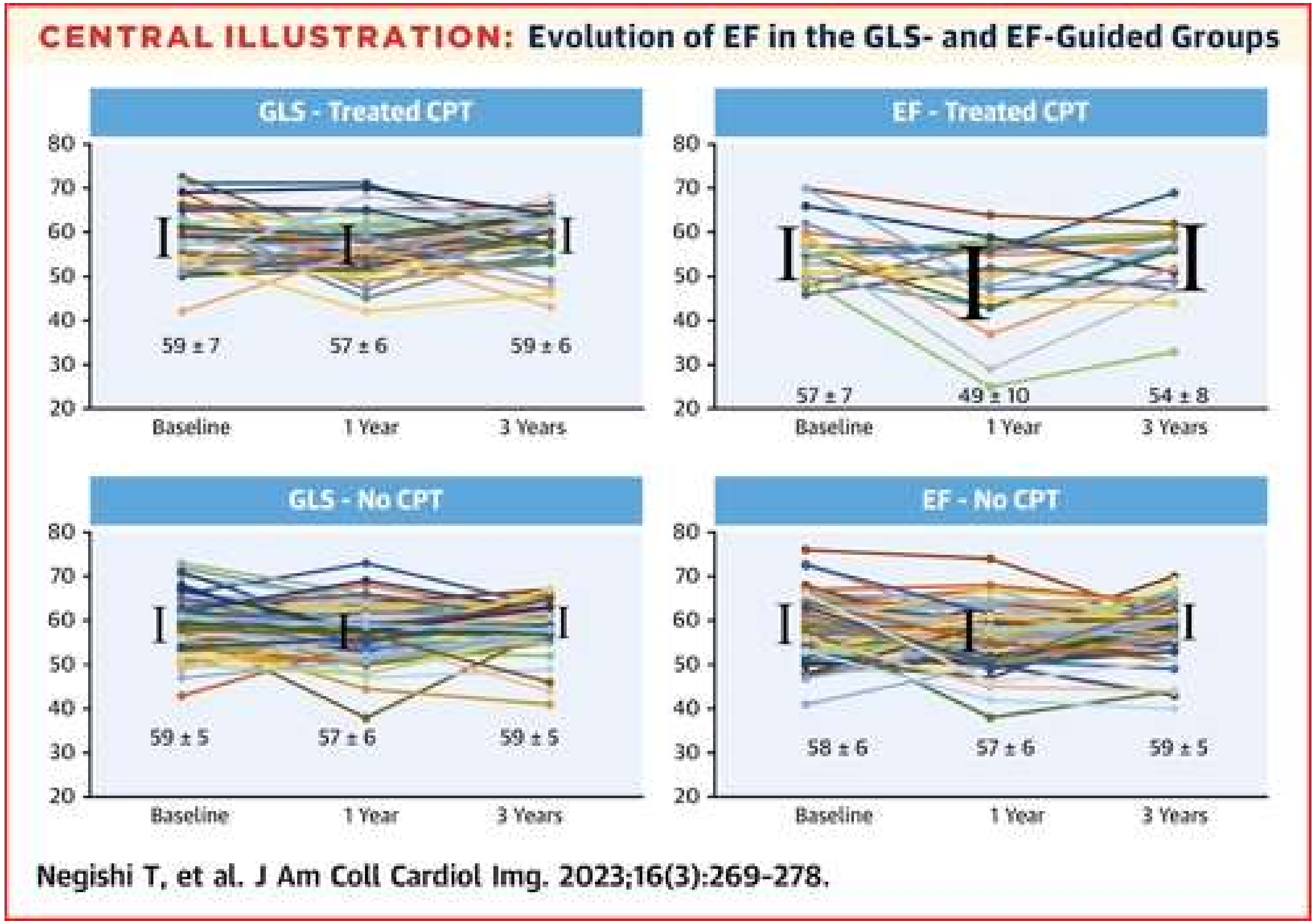
…h mechanical dyssynchrony on echocardiography
…thin 5 years after CRT. If either of these markers is
present in patients with a broad QRS (≥130ms) and reduced LVEF (≤35%) clinicians should refer for or proceed to CRT.

Cardiac imaging in cardio-oncology

- Cardiac imaging is indicated at baseline and should be performed at any time if patients receiving cardiotoxic therapies present with new cardiac symptoms.
- The frequency of cardiac imaging monitoring during therapy should be adapted according to the estimated baseline risk and the expected CTR-CVT manifestation
- The cardiac imaging technique used should be based on local expertise and availability, and the same imaging modality (i.e. 3D-TTE, 2D-TTE, CMR) is recommended throughout the entire treatment to decrease inter-technique variability
- including 3D-LVEF and GLS assessment (threshold -15 %)

Alexander R Lyon, 2022 ESC Guidelines on cardio-oncology (ESC), European Heart Journal, Volume 43, Issue 41, 1 November 2022, Pages 4229–4361, https://doi.org/10.1093/eurheartj/ehac244

Cardioprotection Using Strain-Guided Management of Potentially Cardiotoxic Cancer Therapy: 3-Year Results of the SUCCOUR Trial



Among patients taking potentially cardiotoxic chemotherapy for cancer, the 3-year data showed

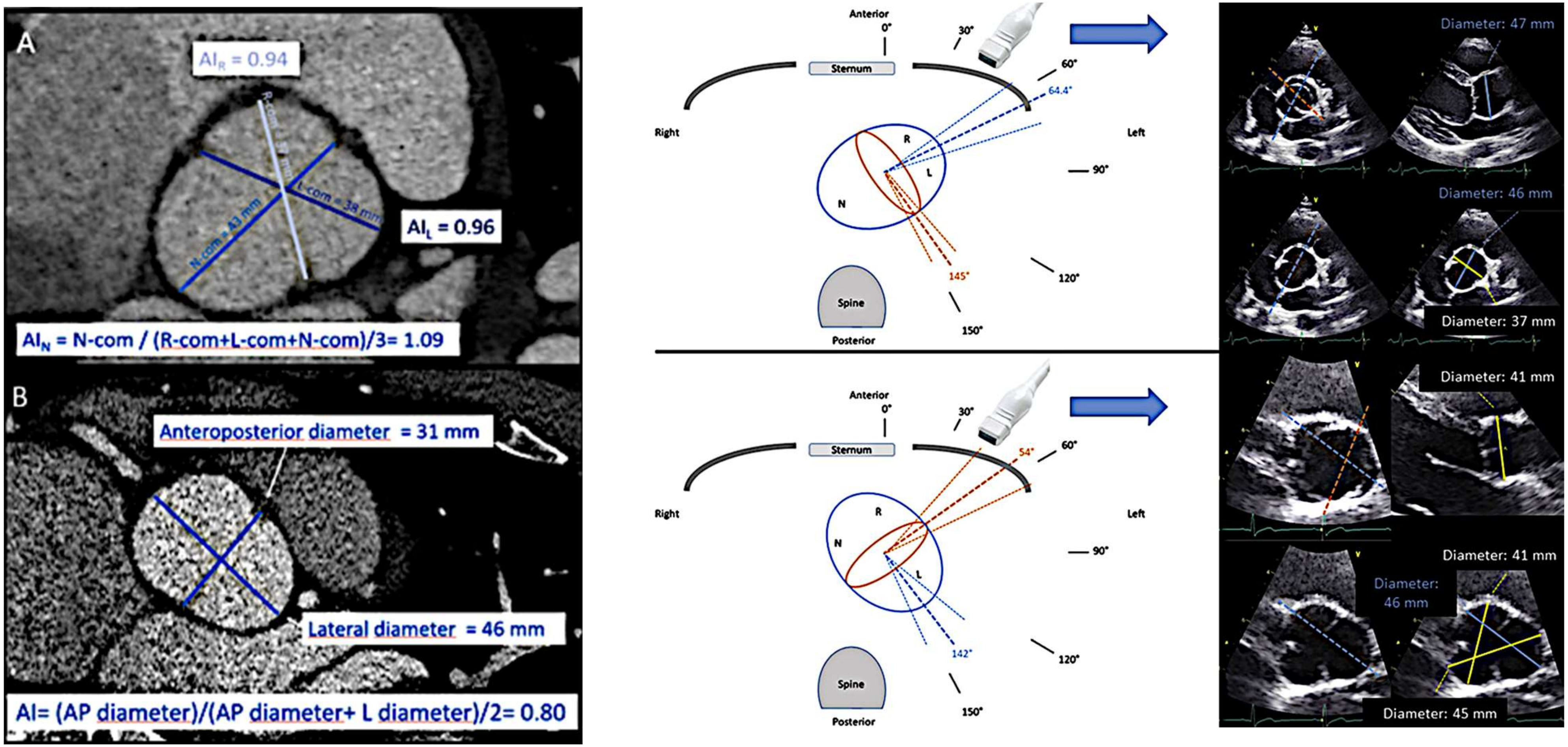
Most anthracycline, trastuzumab (breast cancer)

improvement of LV dysfunction compared with 1 year,

with no difference in ΔEF between GLS- and EF-guided cardioprotection

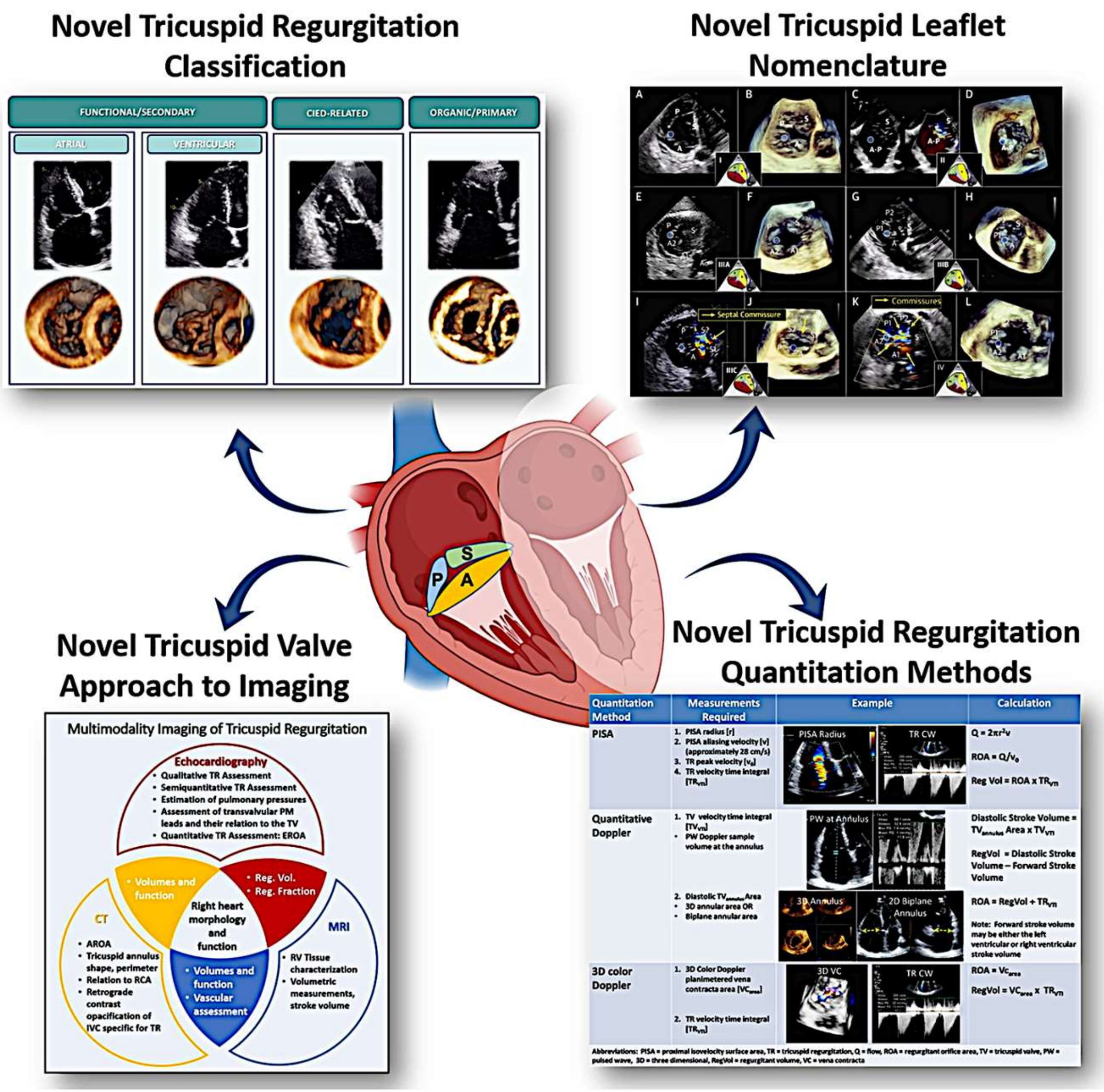
Aortic Root Anatomy Is Related to the Bicuspid Aortic Valve Phenotype

parasternal long-axis view on TEE underestimates maximal aortic root diameter in N-R BAV



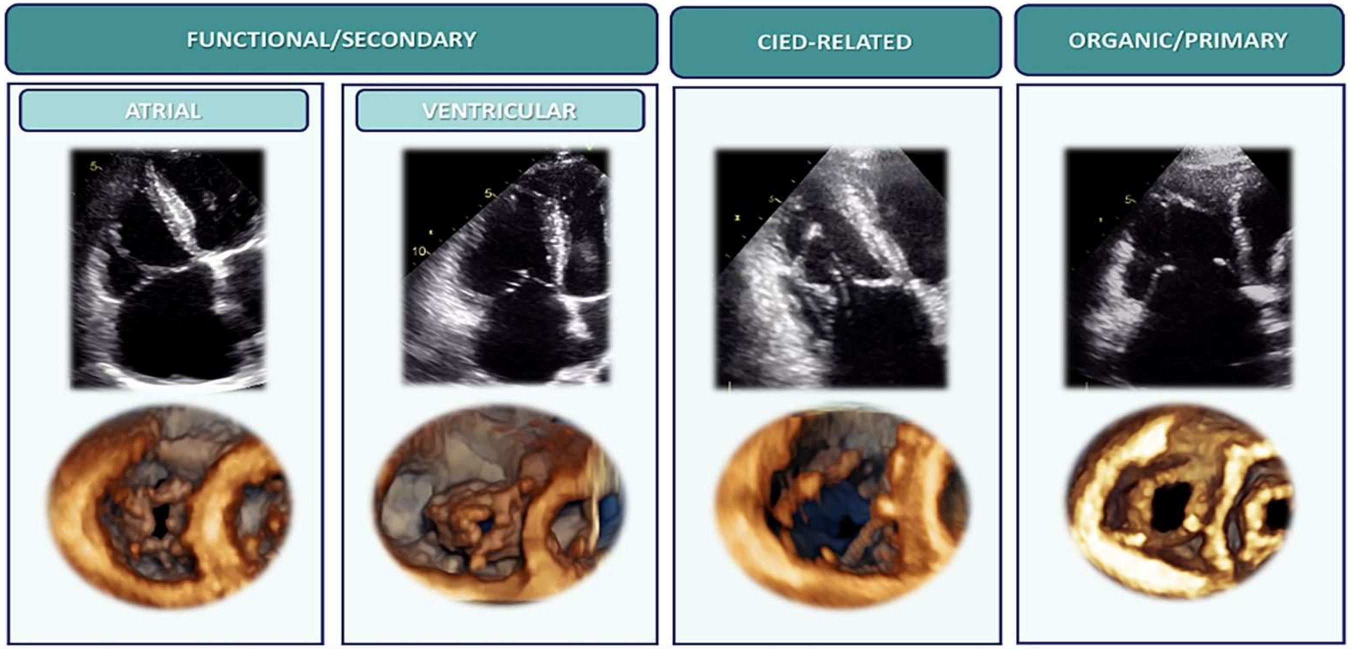
O Milleron,Aortic root anatomy Journal of the American Society of Echocardiography Volume 35 Issue 3 Pages 278-286 (March 2022) DOI: 10.1016/j.echo.2021.11.012

Tricuspide approche nouvelle



Hahn Tricuspid regurgitation: recent advances in understanding pathophysiology, severity grading and outcome, European Heart Journal - Cardiovascular Imaging, Volume 23, Issue 7, July 2022, Pages 913–929, [*https://doi.org/10.1093/ehjci/jeac009*](https://doi.org/10.1093/ehjci/jeac009)

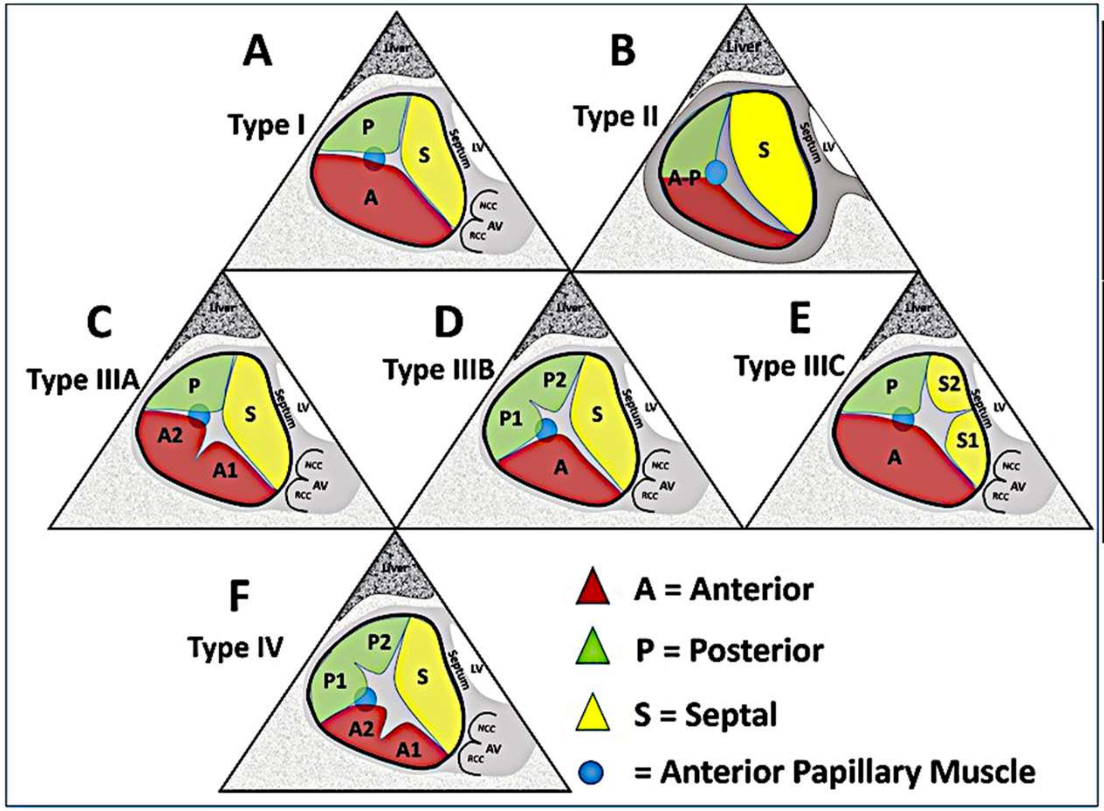
Classification des fuites tricuspides



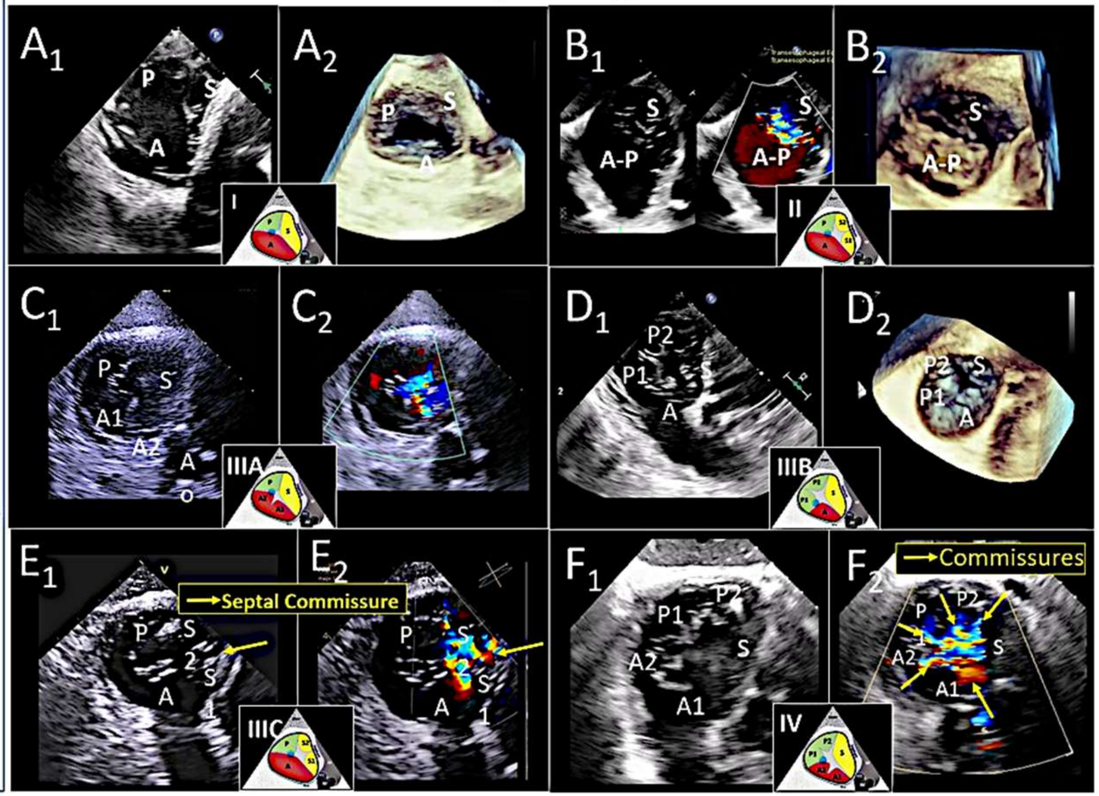
Parameter	Atrial FTR	Ventricular FTR	CIED-Related	Primary TR	
				Prolapse (I)	RHD (IIIA)
Leaflet Tethering	-	+++	++	-	-
Leaflet Restriction	-	Systole	Systole/Diastole	-	Diastole
RA/TA Dilatation	+++	++	+/-	++	++
RV Dilatation	+/-	+++	+/-	+/-	+/-
RV Dysfunction	+/-	+++	+/-	+/-	+/-

Hahn Tricuspid regurgitation: recent advances in understanding pathophysiology, severity grading and outcome, European Heart Journal - Cardiovascular Imaging, Volume 23, Issue 7, July 2022, Pages 913–929, https://doi.org/10.1093/ehjci/jeac009

1. Proposed Tricuspid Nomenclature



2. Echocardiographic Examples of Tricuspid Valve Morphologies



Hahn Tricuspid regurgitation: recent advances in understanding pathophysiology, severity grading and outcome, European Heart Journal - Cardiovascular Imaging, Volume 23, Issue 7, July 2022, Pages 913–929, https://doi.org/10.1093/ehjci/jeac009

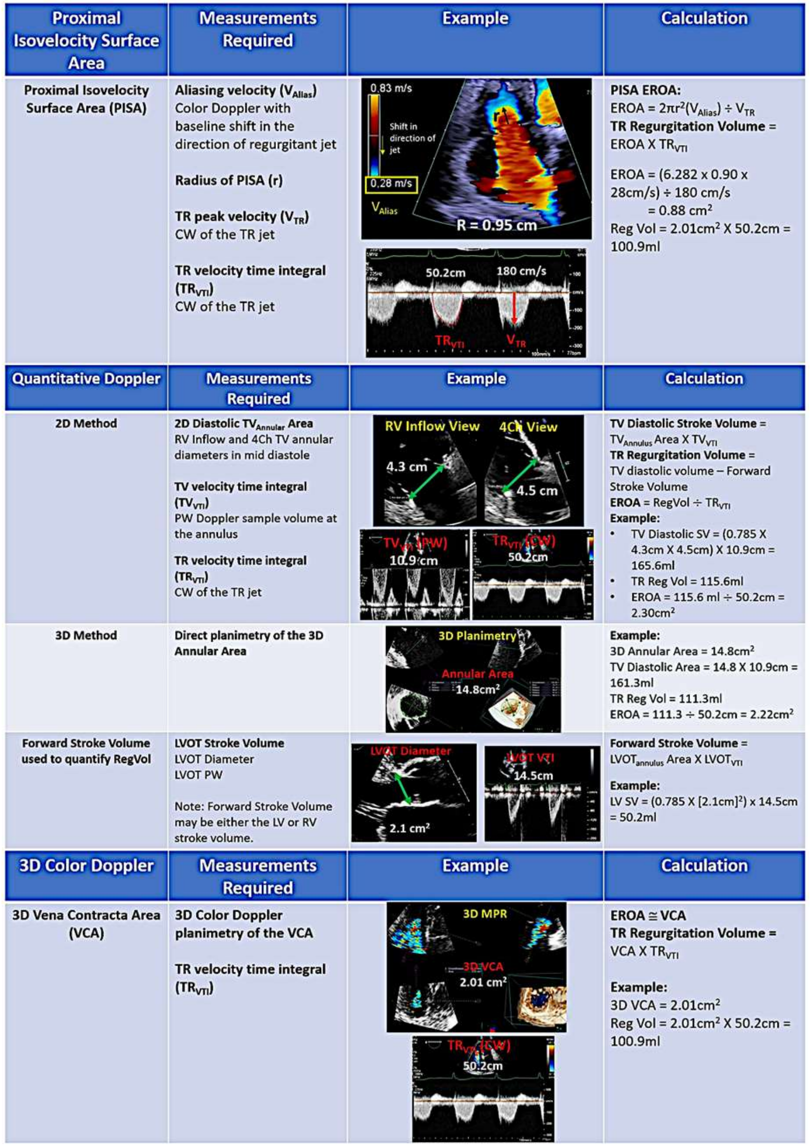
Quantification des IT

Parameters	Mild	Moderate	Significant/ moderate-severe	Severe	Massive	Torrential
Vena contracta width	<3 mm	3–6.9 mm	6–6.9 mm	7–13 mm	14–20 mm	≥21 mm
EROA	20 mm^2	20–29 mm^2	30–39 mm^2	40–59 mm^2	60–79 mm^2	≥80 mm^2
Regurgitant volume	<15 mL	15–29 mL	30–44 mL	45–59	60–74	≥75
Regurgitant fraction 3D Echo (MRI)[a]	<25% (30%)[a]	25–44% (30–49%)[a]		≥45% (50%)[a]		
3D vena contracta				75–94 mm^2	95–114 mm^2	≥115 mm^2

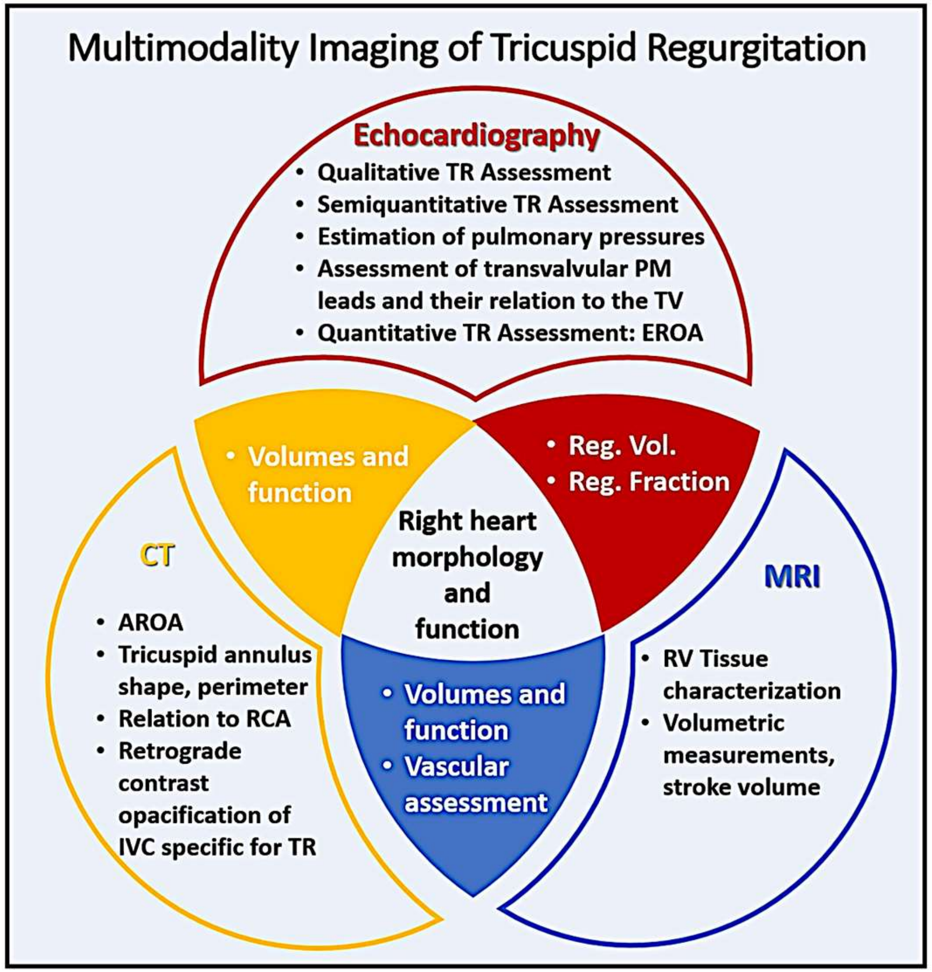
[a]3D Echo cutoffs from Muraru et al.[76] and MRI cutoffs from Zhan et al.[97]

Hahn Tricuspid regurgitation: recent advances in understanding pathophysiology, severity grading and outcome, European Heart Journal - Cardiovascular Imaging, Volume 23, Issue 7, July 2022, Pages 913–929, https://doi.org/10.1093/ehjci/jeac009

Quantification des IT



Proximal Isovelocity Surface Area	Measurements Required	Example	Calculation
Proximal Isovelocity Surface Area (PISA)	**Aliasing velocity (V_{Alias})** Color Doppler with baseline shift in the direction of regurgitant jet **Radius of PISA (r)** **TR peak velocity (V_{TR})** CW of the TR jet **TR velocity time integral (TR_{VTI})** CW of the TR jet	0.83 m/s; Shift in direction of jet; 0.28 m/s; V_{Alias}; r; R = 0.95 cm 50.2cm; 180 cm/s; TR_{VTI}; V_{TR}	**PISA EROA:** EROA = $2\pi r^2(V_{Alias}) \div V_{TR}$ **TR Regurgitation Volume =** EROA X TR_{VTI} EROA = (6.282 x 0.90 x 28cm/s) ÷ 180 cm/s = 0.88 cm² Reg Vol = 2.01cm² X 50.2cm = 100.9ml
Quantitative Doppler	**Measurements Required**	**Example**	**Calculation**
2D Method	**2D Diastolic $TV_{Annular}$ Area** RV Inflow and 4Ch TV annular diameters in mid diastole **TV velocity time integral (TV_{VTI})** PW Doppler sample volume at the annulus **TR velocity time integral (TR_{VTI})** CW of the TR jet	RV Inflow View; 4.3 cm; 4Ch View; 4.5 cm TV_{VTI} (PW); 10.9 cm; TR_{VTI} (CW); 50.2cm	**TV Diastolic Stroke Volume =** $TV_{Annulus}$ Area X TV_{VTI} **TR Regurgitation Volume =** TV diastolic volume – Forward Stroke Volume **EROA** = RegVol ÷ TR_{VTI} **Example:** • TV Diastolic SV = (0.785 X 4.3cm X 4.5cm) X 10.9cm = 165.6ml • TR Reg Vol = 115.6ml • EROA = 115.6 ml ÷ 50.2cm = 2.30cm²
3D Method	**Direct planimetry of the 3D Annular Area**	3D Planimetry; Annular Area; 14.8cm²	**Example:** 3D Annular Area = 14.8cm² TV Diastolic Area = 14.8 X 10.9cm = 161.3ml TR Reg Vol = 111.3ml EROA = 111.3 ÷ 50.2cm = 2.22cm²
Forward Stroke Volume used to quantify RegVol	**LVOT Stroke Volume** LVOT Diameter LVOT PW Note: Forward Stroke Volume may be either the LV or RV stroke volume.	LVOT Diameter; 2.1 cm²; LVOT VTI; 14.5cm	**Forward Stroke Volume =** $LVOT_{annulus}$ Area X $LVOT_{VTI}$ **Example:** LV SV = (0.785 X [2.1cm]²) x 14.5cm = 50.2ml
3D Color Doppler	**Measurements Required**	**Example**	**Calculation**
3D Vena Contracta Area (VCA)	**3D Color Doppler planimetry of the VCA** **TR velocity time integral (TR_{VTI})**	3D MPR; 3D VCA; 2.01 cm² TR_{VTI} (CW); 50.2cm	**EROA ≅ VCA** **TR Regurgitation Volume =** VCA X TR_{VTI} **Example:** 3D VCA = 2.01cm² Reg Vol = 2.01cm² X 50.2cm = 100.9ml



Hahn Tricuspid regurgitation: recent advances in understanding pathophysiology, severity grading and outcome, European Heart Journal - Cardiovascular Imaging, Volume 23, Issue 7, July 2022, Pages 913–929, https://doi.org/10.1093/ehjci/jeac009

Multimodality Imaging in Arrhythmogenic Right Ventricular Cardiomyopathy

Major	Minor
I. Global or regional dysfunction and structural alterations	
By 2D echocardiogram	By 2D echocardiogram
Regional RV akinesia, dyskinesia, or aneurysm *and* 1 of the following (end-diastole):	Regional RV akinesia, dyskinesia, or aneurysm and 1 of the following (end-diastole):
PLAX RVOT ≥32 mm (PLAX/BSA ≥19 mm/m²)	29 mm ≤PLAX RVOT <32 mm (16 ≤PLAX/BSA <19 mm/m²)
PSAX RVOT ≥36 mm (PSAX/BSA ≥21 mm/m²)	32 ≤PSAX RVOT <36 mm (18 ≤PSAX/BSA <21 mm/m²)
Or RV-FAC ≤33%	Or 33% <RV-FAC ≤40%
By MRI	By MRI
Regional RV akinesia or dyskinesia or dyssynchronous RV contraction *and* 1 of the following:	Regional RV akinesia or dyskinesia or dyssynchronous RV contraction and 1 of the following:
RV end-diastolic volume/BSA ≥110 mL/m² (male) or ≥100 mL/m² (female)	100 mL/m² ≤RV end-diastolic volume/BSA <110 mL/m² (male) or 90 mL/m² ≤RV end-diastolic volume/BSA <100 mL/m² (female)
Or RV ejection fraction ≤40%	Or 40% <RV ejection fraction ≤45%
By RV angiography	
Regional RV akinesia, dyskinesia, or aneurysm	
II. Tissue characterization of RV wall	
Residual myocytes <60% by morphometric analysis (or <50% if estimated), with fibrous replacement of the RV free wall myocardium in ≥1 sample, with or without fatty replacement of tissue on endomyocardial biopsy	Residual myocytes 60% to 75% by morphometric analysis (or 50% to 65% if estimated), with fibrous replacement of the RV free wall myocardium in ≥1 sample, with or without fatty replacement of tissue on endomyocardial biopsy

Malik,Multimodality Imaging in Arrhythmogenic Right Ventricular Cardiomyopathy. Circ Cardiovasc Imaging. 2022 Feb;15(2):e013725. doi: 10.1161/CIRCIMAGING.121.013725. Epub 2022 Feb 11. PMID: 35147040.

Multimodality Imaging in Arrhythmogenic Right Ventricular Cardiomyopathy

Adding Diagnostic and Prognostic Performance of Select Echocardiographic, CMR, and MDCT Imaging Markers in ARVC
new in 2022

Markers for diagnosis			Markers for prognosis		
Parameter	**End point**	**Citation**	**Parameter**	**End point**	**Citation**
Echocardiography					
RV-FAC <48%	Se 100%, Sp 73% for RVEF <45% by CMR	Wang et al[35]	RV-FAC ≤33%	MACE, median 5.3 y (IQR, 1.8–9.8): HR, 3.12 (95% CI, 1.42–6.87; *P*=0.005)	Saguner et al[33]
TAPSE <16.8 mm	Se 80%, Sp 87% for RVEF <45% by CMR	Wang et al[35]	TAPSE <17 mm	MACE, median 5.3 y (IQR, 1.8–9.8): HR, 2.15 (95% CI, 1.10–4.17; *P*=0.02)	Saguner et al[33]
S' <8.8 cm/s	Se 80%, Sp 79% for RVEF <45% by CMR	Wang et al[35]	RVEDA ≥28 cm^2	MACE, median 5.3 y (IQR, 1.8–9.8): HR, 2.96 (95% CI, 1.48–5.91; *P*=0.002)	Saguner et al[33]
RVGLS >-20.4%	Se 52.6%, Sp 100% for definite ARVC by 2010 TFC in adolescents	Pieles et al[37]	LVPSS of posterolateral wall >−12.5%	MACE, mean 5.9 y±2.3: HR, 4.9 (95% CI, 1.7–14.2; *P*=0.01)	Mast et al[38]
RVFWS >-17%	Se 96%, Sp 93% for RVEF <45% by CMR	Focardi et al[34]	RVFWS >−20%	Structural progression of RVOT-PSAX at median 3.6 y (IQR, 1.3–6.8): OR, 18.4 (95% CI, 2.7–125.8; *P*=0.003)	Malik et al[39]
			RV-FAC <33% and LVEF <50%	MACE, mean 10.7 y±7.7: HR, 6.3 (95% CI, 2.17–17.45; *P*<0.001)	Pinamonti et al[31]
			TR jet area >4 cm^2	MACE, mean 10.7 y±7.7: HR, 7.60 (95% CI, 2.60–22.0; *P*<0.001)	Pinamonti et al[31]
CMR					
Any RV wall motion abnormality (excluding hypokinesia) plus any pre- or post-contrast signal abnormality	Se 96%, Sp 100% for definite ARVC by 2010 TFC	Aquaro et al[40]	Normal CMR	MACE, median 4.3 y (IQR, 2.8–6.1): NPV of 96.9%	Aquaro et al[41]
				MACE, median 5 y (IQR, 2–8): NPV of 100%	Aquaro et al[42]
				MACE, mean 4.3 y±1.5: NPV of 98.8%	Deac et al[43]
RV or LV LGE	Concordance of 92% with endomyocardial biopsy for detection of myocardial fibrosis in patients with possible, borderline, or definite ARVC by 2010 TFC	Perazzolo Marra et al[44]	RVEF, per % decrease	Ventricular arrhythmia, median 4.83 y (IQR, 2.44–9.33), HR, 1.03 (95% CI, 1.01–1.04; *P*=0.002)	Cadrin-Tourigny et al[16]
Annular subepicardial LV-LGE pattern	Association with a nondesmosomal mutation vs desmosomal mutation vs negative genotype (76.5% vs 23.5% vs 0%, *P*=0.02)	Segura-Rodriguez et al[45]	LV Involvement by CMR	MACE, median 5 y (IQR, 2–8): HR, 4.2 (95% CI, 2.1–8.4; *P*=0.0001)	Aquaro et al[42]
			LV-GLS >−12.65%	MACE, mean 4.10 y±1.77: HR, 3.578 (95% CI, 1.139–11.245; *P*=0.029)	Shen et al[46]
MDCT					
CT scoring system	Se 87%, Sp 94.4%, PPV 87% for definite ARVC by 2010 TFC	Nakajima et al[47]			
Fat extent >8.5% of RV free wall	Se 94%, Sp 92% for definite ARVC by 2010 TFC	Cochet et al[48]			

Malik, Multimodality Imaging in Arrhythmogenic Right Ventricular Cardiomyopathy. Circ Cardiovasc Imaging. 2022 Feb;15(2):e013725. doi: 10.1161/CIRCIMAGING.121.013725. Epub 2022 Feb 11. PMID: 35147040.

Recommendations for Multimodality Cardiovascular Imaging of Patients with Hypertrophic Cardiomyopathy: An Update from the American Society of Echocardiography, in Collaboration with the American Society of Nuclear Cardiology, the Society for Cardiovascular Magnetic Resonance, and the Society of Cardiovascular Computed Tomography

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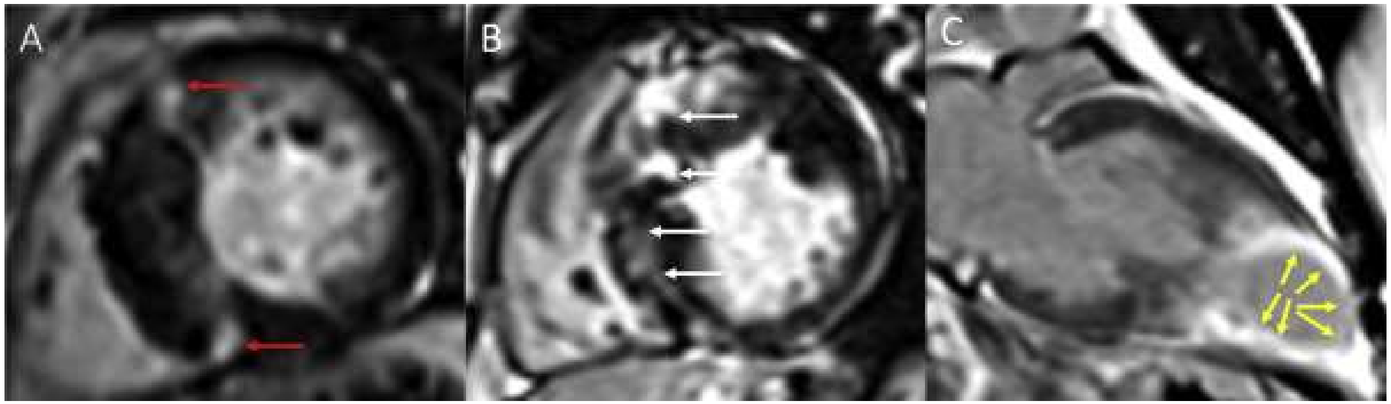

Algorithm for evaluation of dynamic obstruction in patients with known or suspected diagnosis of hypertrophic cardiomyopathy

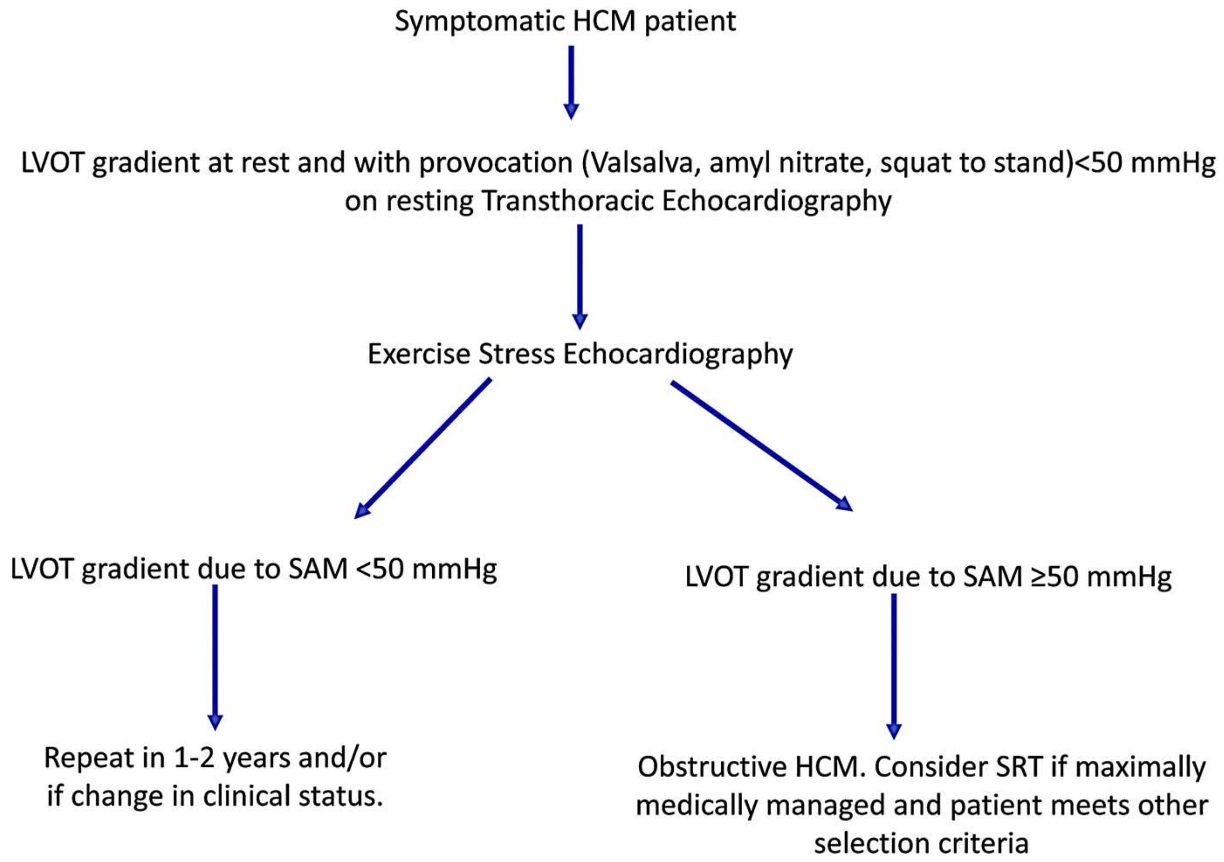

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Table 3 Summary of Key Imaging Markers and Approach in SCD Risk Stratification

Imaging Parameter	SCD risk threshold	Imaging Approach	Practical Points and/or Caveats
Established markers			
LV maximal wall thickness *	Highest risk in those with LVH ≥ 30 mm, although relationship between wall thickness and SCD is continuous	Echo or CMR	Limited negative predictive value of 30 mm threshold, most SCD occurs below this threshold
Late gadolinium enhancement**	Highest risk in those with LGE > 15%, although relationship between LGE and SCD is continuous	CMR	Abnormal threshold of >6SD above normal myocardium
LVOT obstruction	>30 mm Hg	Echo	Varies according to loading conditions and activities
LV apical aneurysm*	Presence associated with increased risk even in those > 60 years old	Echo or CMR	CMR more sensitive, suspect in those with mid cavity obliteration
Left atrial size	LA volume (> 34 ml/m^2) using biplane LA volumes or anteroposterior diameter (>48 mm)	Echo	Single 2-D measurement may erroneously estimate size
LV ejection fraction*	LV ejection fraction <50%	Echo or CMR	Consider use of contrast echo or CMR to optimally assess LVEF
Emerging marker			
LV global longitudinal strain	No clear threshold value, abnormal results portend a worse prognosis	Echo (CMR approaches emerging)	Further standardization needed between platforms

*** Major risk factor for SCD and if present, is considered class IIA indication for ICD implantation.**
**** In HCM patients without major risk factors for SCD and uncertain on whether to implant ICD, decision on ICD implantation may be reached based on late gadolinium enhancement findings.**

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Résumé

- Strain OG
- Couplage ventriculo artériel
- Désynchronisation mécanique
- Cardioprotection en oncologie non limitée au GLS
- Mesures de l’aorte en cas de bicuspidie
- Nouvelle prise en charge des fuites tricuspides
- Recommandations; CMH, DVDA, cardio-oncologie