XIII CONGRESO INTERNACIONAL DE CARDIOLOGIA

CARDIOLOGIA INTERVENCIONISTA - LII JORNADA ACCI-SOLACI

DE LA

PREVENCIÓN

A LA **INTERVENCIÓN**

8, 9 y 10 de octubre

Lugar:

INTERCONTINENTAL
SAN JOSÉ, COSTA RICA

Organiza:

ASOCAR
Asociación Costarricense de Cardiología

ASOCAR
Capítulo de Enfermería

ACCI

JORNADAS SOLACI

Resonancia magnética cardiovascular en patología valvular mitral

Moisés Vásquez

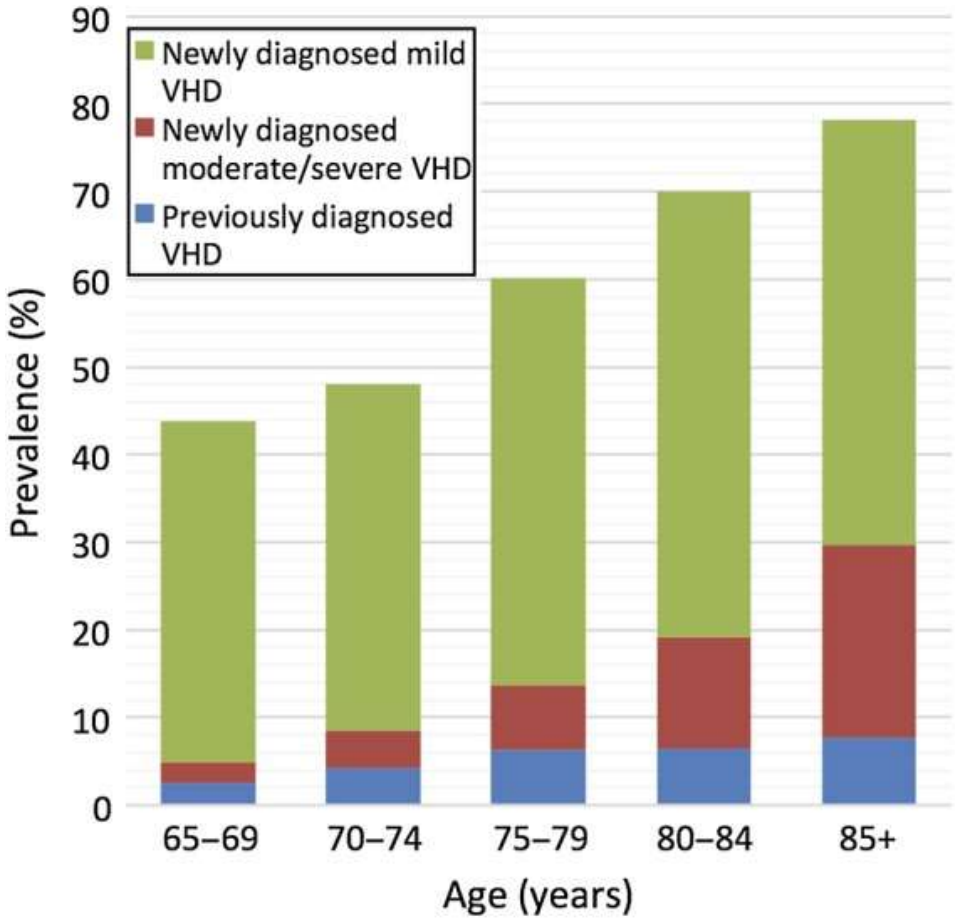
Hospital Rafael Ángel Calderón Guardia/Universidad de Costa Rica

moisesvasquez29@Gmail.com

Conflictos de interés

- Nada que declarar

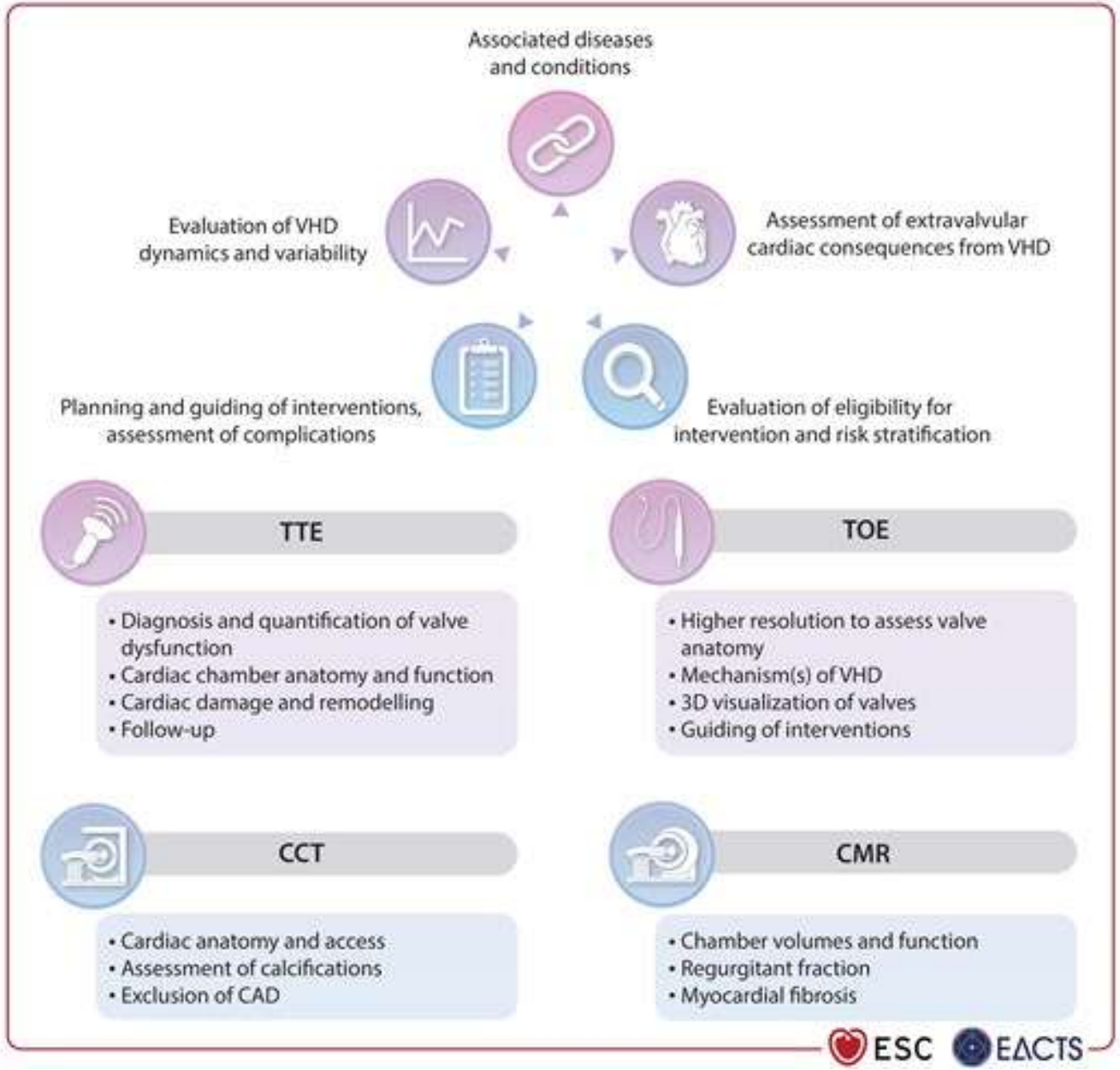
OxVALVE Population Cohort Study



- n= 2500
- 51% adultos > 65 años con VHD (mayoría leve)
- 11,3% significativa (moderada a severa)

European Heart Journal (2016) 37, 3515–3522
doi:10.1093/eurheartj/ehw229

Imagen multimodal: Nuevo standard de manejo



European Heart Journal (2025) **00**, 1–102
https://doi.org/10.1093/eurheartj/ehaf194

Imagen multimodal

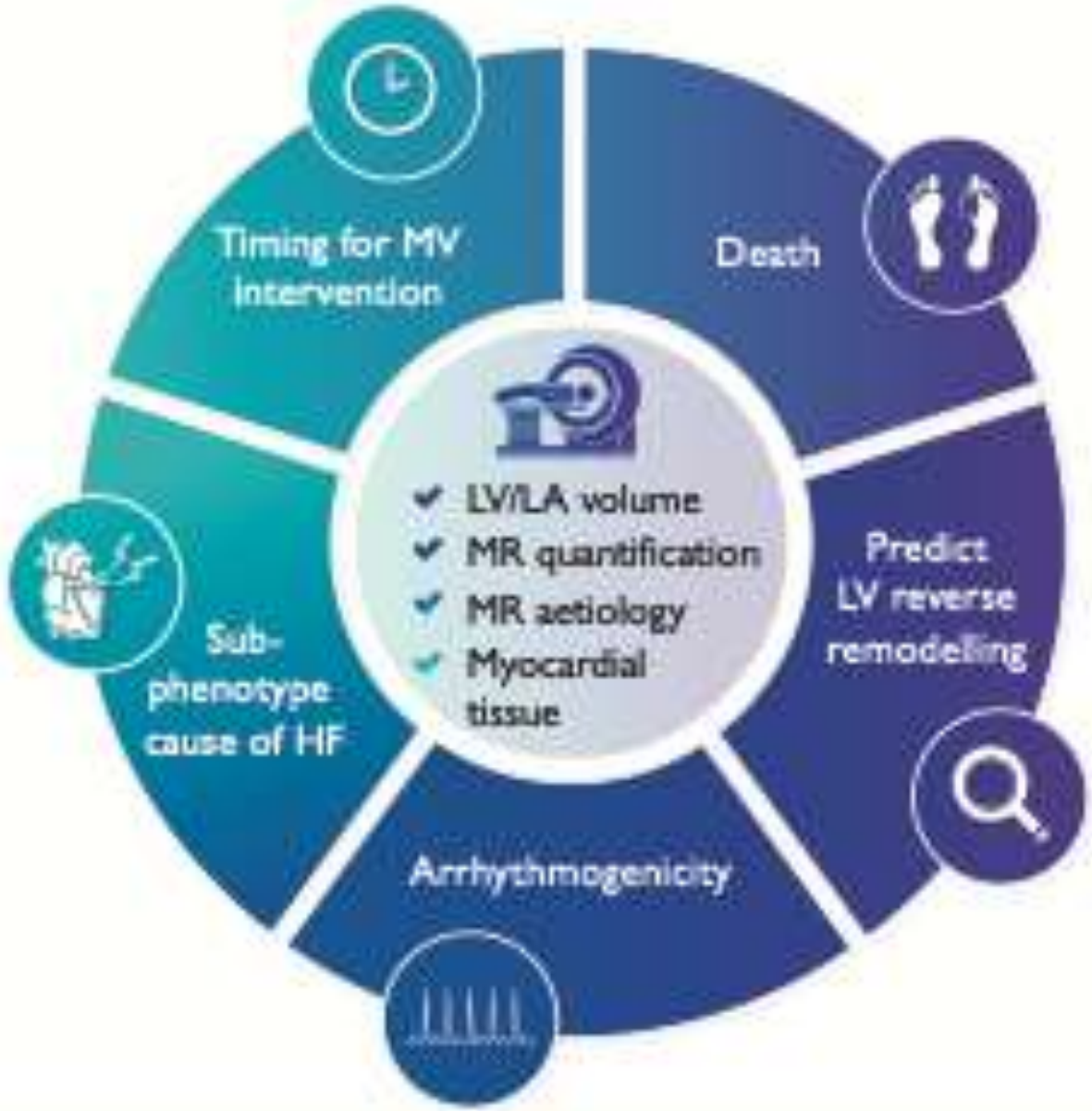
Table 1 Strength of each cardiac imaging technique

	Echo	CT	SPECT	CMR
LV function	++	+	+	+++
RV function	+	+	–	+++
Valvular anatomy	++	+	–	+/–
Valvular function	++	–	–	+/++
Infarct imaging	–	+/–	+	+++
Tissue characterisation	–	–	+	+++
Perfusion	+/–	+/–	++	+++
Coronary artery imaging	–	+++	–	+/–
Plaque imaging	–	++	+/–	+/–
FFR	–	+	–	–

FFR, fractional flow reserve; LV, left ventricle; RV, right ventricle.

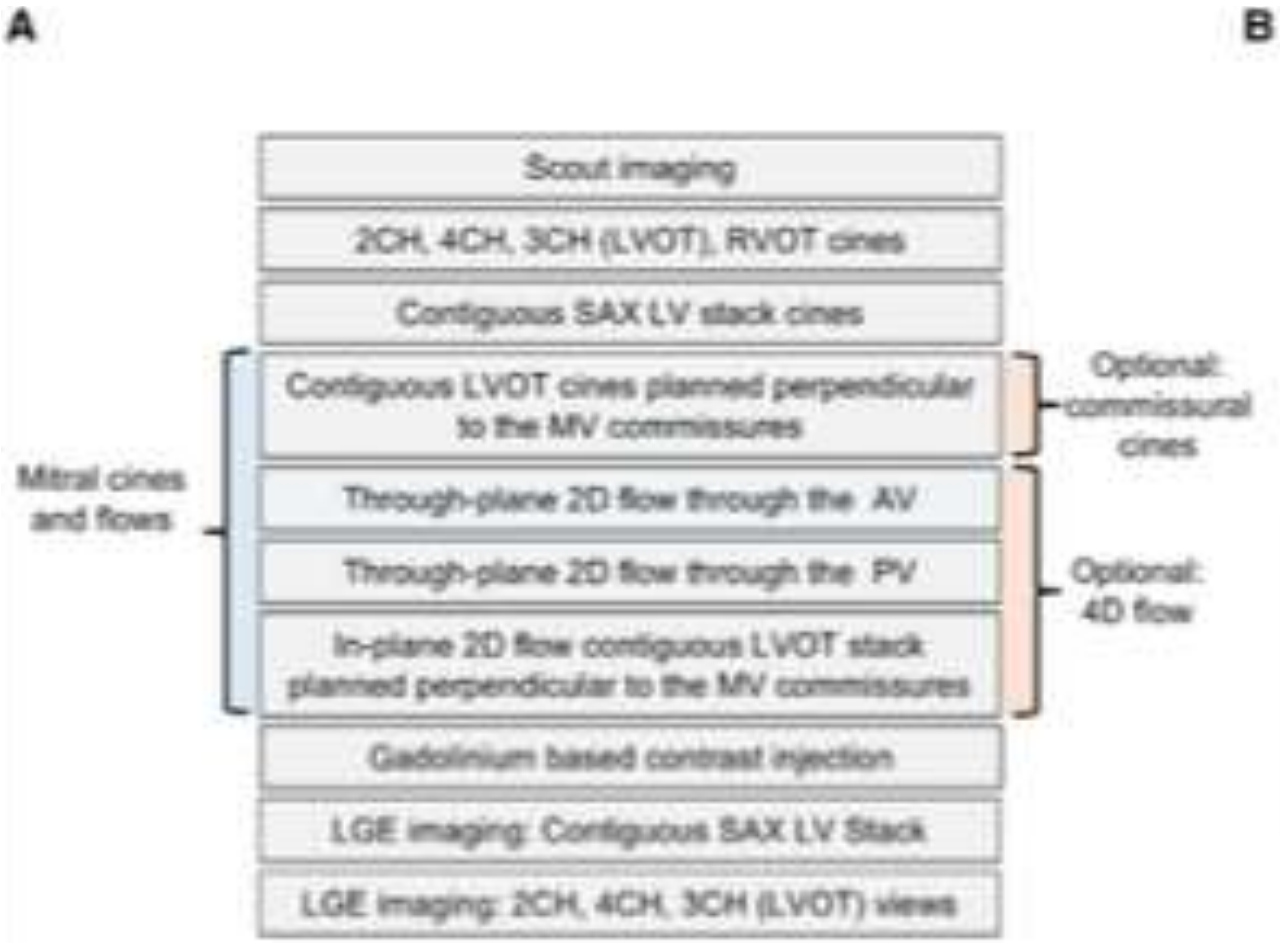
Vasquez M, Nagel E. *Heart* 2019;**105**:1755–1762. doi:10.1136/heartjnl-2018-312971

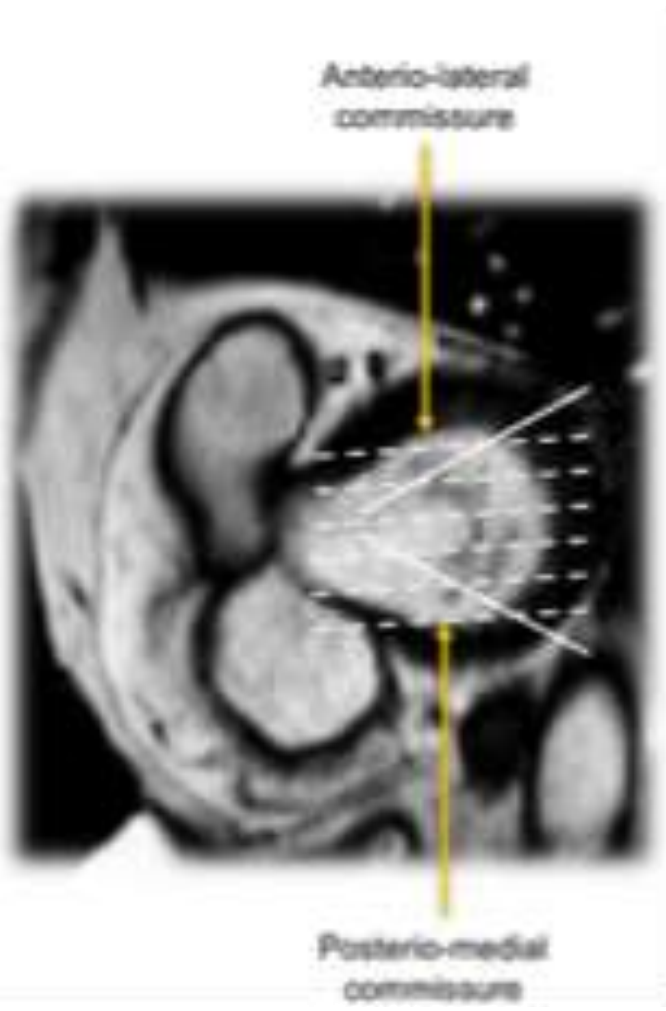
Role of cardiovascular magnetic resonance for mitral regurgitation assessment



European Heart Journal (2025) **46**, 606–619
https://doi.org/10.1093/eurheartj/ehae801

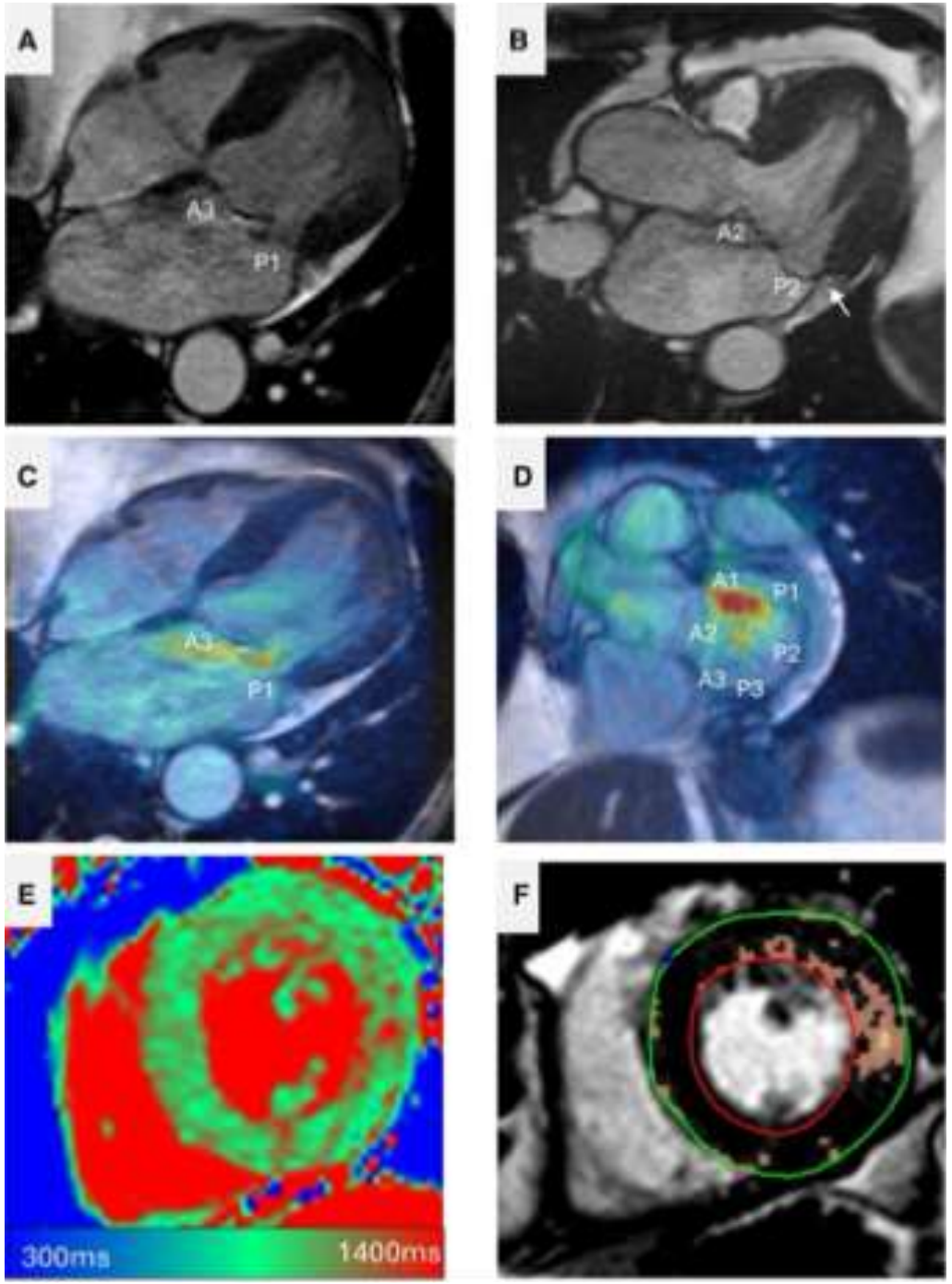
Protocolo

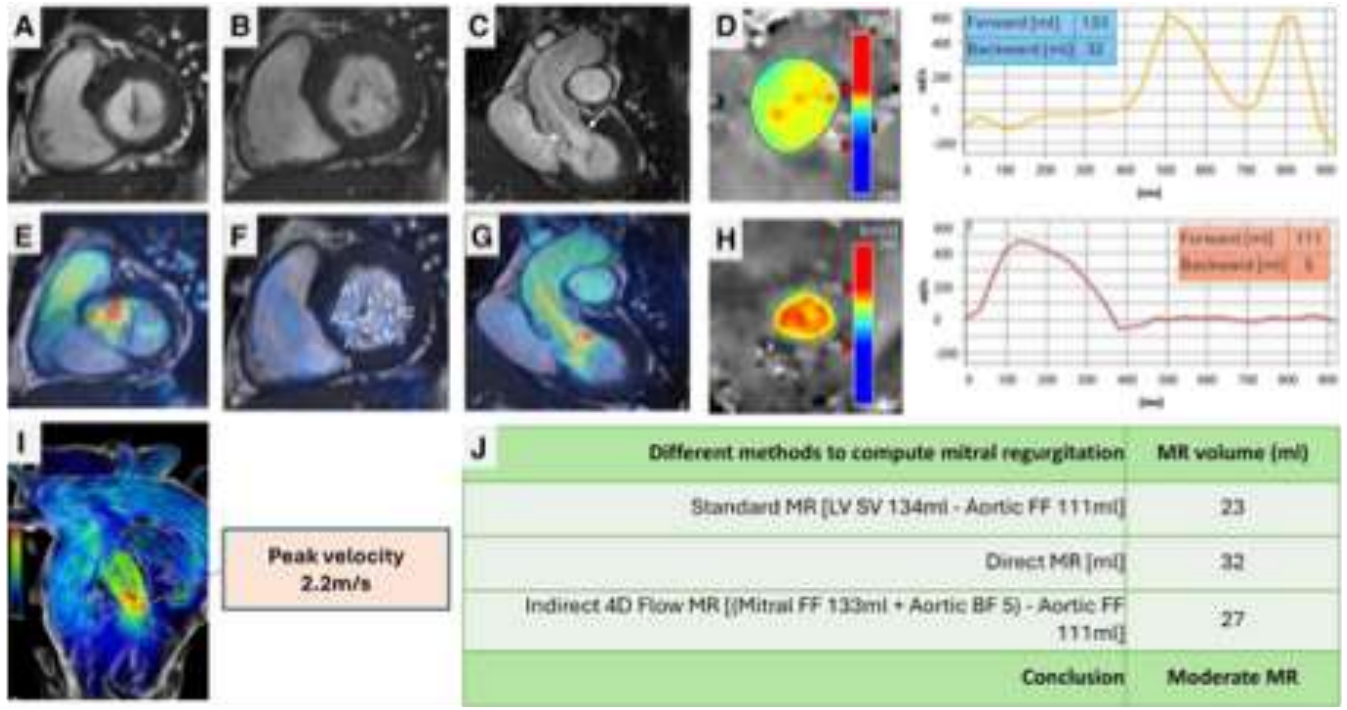




European Heart Journal (2025) 46, 606–619
https://doi.org/10.1093/eurheartj/ehae801

MR primaria



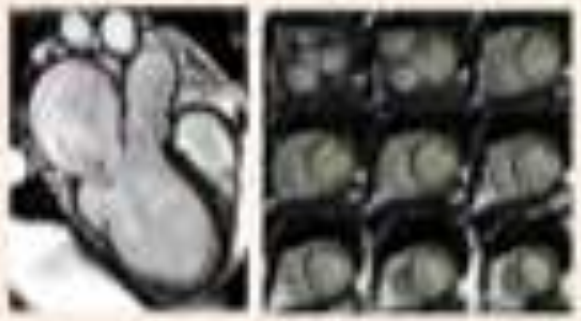


Different methods to compute mitral regurgitation	MR volume (ml)
Standard MR [LV SV 134ml - Aortic FF 111ml]	23
Direct MR [ml]	32
Indirect 4D Flow MR [(Mitral FF 133ml + Aortic BF 5) - Aortic FF 111ml]	27
Conclusion	Moderate MR

European Heart Journal (2025) **46**, 606–619
https://doi.org/10.1093/eurheartj/ehae801

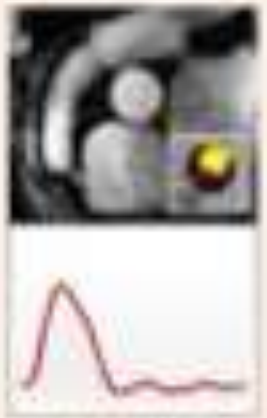
Cardiovascular magnetic resonance imaging for mitral valve assessment

Morphology, volumetric and functional assessment

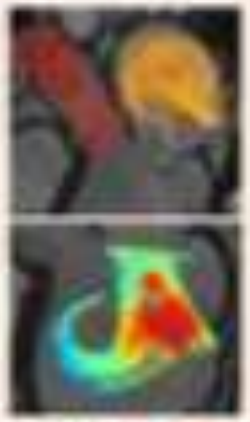


LV EF = 24%,LVSV = 56ml

Flow assessment



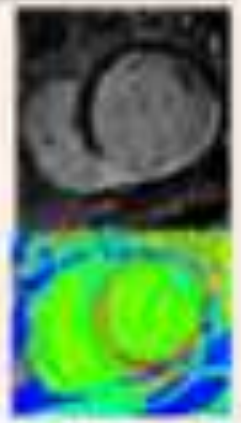
Aortic forward SV: 44ml
Standard CMR method
96 – 44 = 52ml



Direct MR jet: 55ml
Indirect method:
99 – 44 = 55ml

Myocardial tissue assessment

Native T1
>1100msec



Inferior basoseptal MI
ECV=28% 80% of LV
ECV=48% 22% of LV

	Cines	2D flow	4D flow	Native T1	LGE/ECV
Strengths	✓ Precise LV assessment ✓ Precise LA assessment ✓ Assess MV morphology	✓ Quantify blood flow in any vessel: mainly aorta and pulmonary artery	✓ Direct quantification of MR jet ✓ Indirect quantification of MR jet assisting cine segmentation	✓ Quantify oedema, fibrosis or scar	✓ Quantify myocardial fibrosis
Clinical Relevance	1. Differentiate primary vs. secondary MR 2. Assess leaflet prolapse and flail 3. Mitral valve area by planimetry 4. Quantify subclinical LV dysfunction	1. Quantify aortic forward SV to measure MR 2. Accurate and reproducible assessment of MR volume and fraction	1. Complimentary to 2D flow 2. Improves precision 3. Allows to do internal validation of flow quantification	1. Very sensitive to myocardial changes associated with mitral disease	1. Evaluate damage due to mitral valve disease on the myocardium 2. Evaluate prognosis and outcomes 3. Sub-phenotype heart failure aetiology

European Heart Journal (2025) 46, 606–619
https://doi.org/10.1093/eurheartj/ehae801

Cuantificación MR

Table 2 Grading MR severity by CMR

Type of MR		Grading of MR severity		
		Mild	Moderate	Severe
Primary[31,32]	MRF	<20%	20%–39%	>40%
	MR volume	<30 mL	30–55 mL	>55–60 mL
Secondary[33,34]	MRF	<20%	20–34%	≥35%
	MR volume	<30 mL	30–55 mL	>55–60 mL

European Heart Journal (2025) **46**, 606–619
https://doi.org/10.1093/eurheartj/ehae801

Estudios comparando TTE y CMR

Table 1 Studies comparing CMR and echocardiography in the assessment of MR

Study	Year	N	Echo method	Absolute agreement	Agreement if severe	Severe MR	
						Echo	CMR
Cawley et al.[17]	2013	26	PISA	13/23 (57%)	5/12 (42%)		
Uretsky et al.[18]	2015	103	PISA	27/103 (36%)	13/60 (22%)	58	15
Lopez-Mattei et al.[19]	2016	70	Doppler Vol	44/70 (63%)	2/10 (20%)	8	2
Sachdev et al.[20]	2016	50	PISA	23/50 (46%)	10/15 (66%)	14	11
Penicka et al.[21]	2017	258	PISA		62/123 (50%)	100	85
Uretsky et al.[22]	2022	152	PISA/ASE algorithm	79/152 (52%)	32/82 (39%)	79	32
Altes et al.[23]	2022	188	PISA	109/188 (58%)	61/140 (43%)	121	80
Altes et al.[23]	2022	188	Doppler RVol	100/188 (53%)	41/110 (37%)	71	80

ASE, American Society of Echocardiography; PISA, proximal isovelocity surface area; RVol, regurgitant volume.

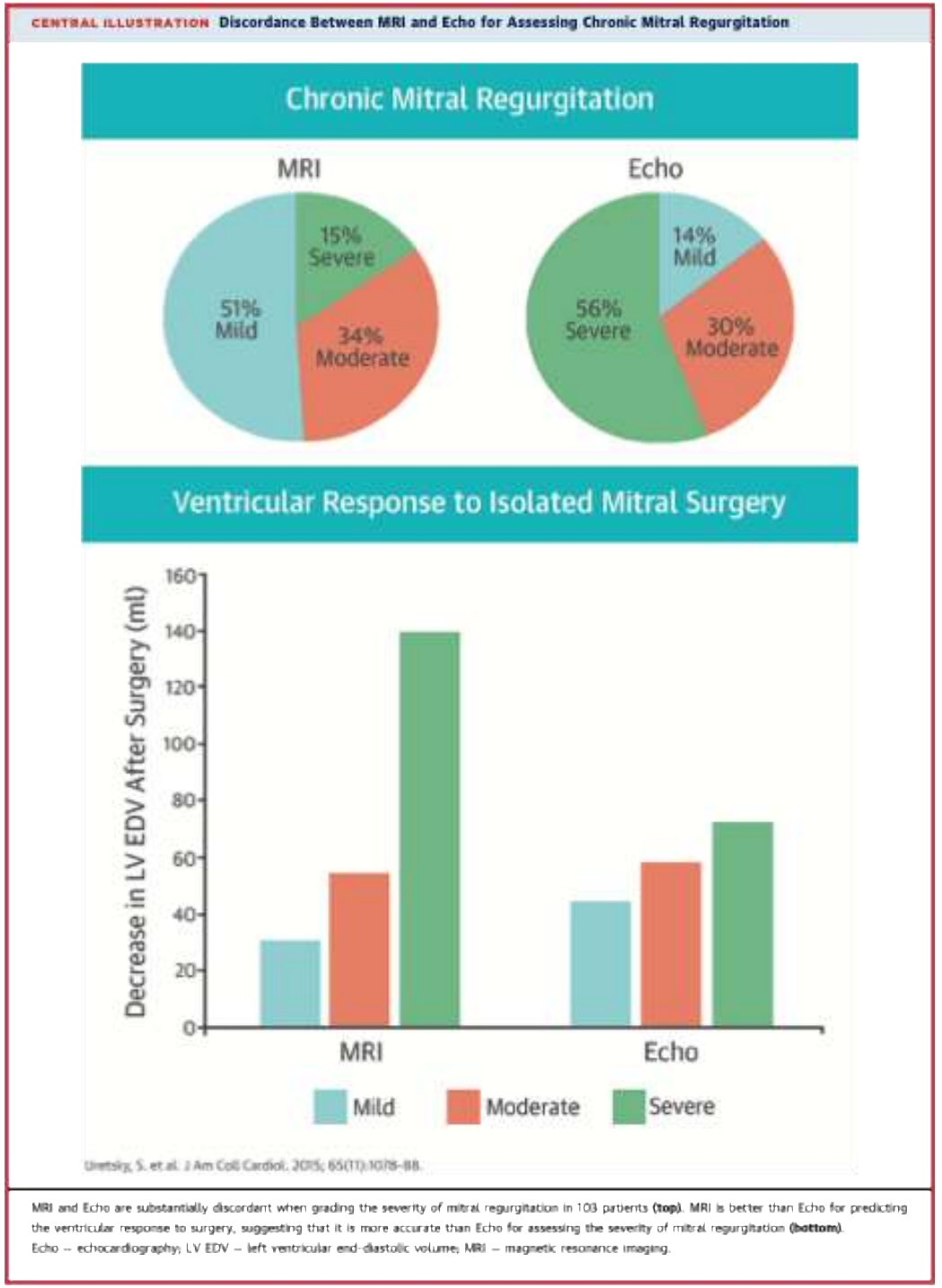
European Heart Journal (2025) 46, 606–619
https://doi.org/10.1093/eurheartj/ehae801

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY
© 2015 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER INC
VOL. 65, NO. 11, 2015
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2014.12.047

Discordance Between Echocardiography and MRI in the Assessment of Mitral Regurgitation Severity

A Prospective Multicenter Trial

- n=103 ptes (38 cirugía/26 CMR pre y post)
- Correlación severidad por CMR y remodelado reverso r=0.85, p<0.0001
- No correlación entre severidad por ECHO y remodelado reverso r=0.32, p=0.1



JACC: CARDIOVASCULAR IMAGING
VOL. 15, NO. 5, 2022

PUBLISHED BY ELSEVIER

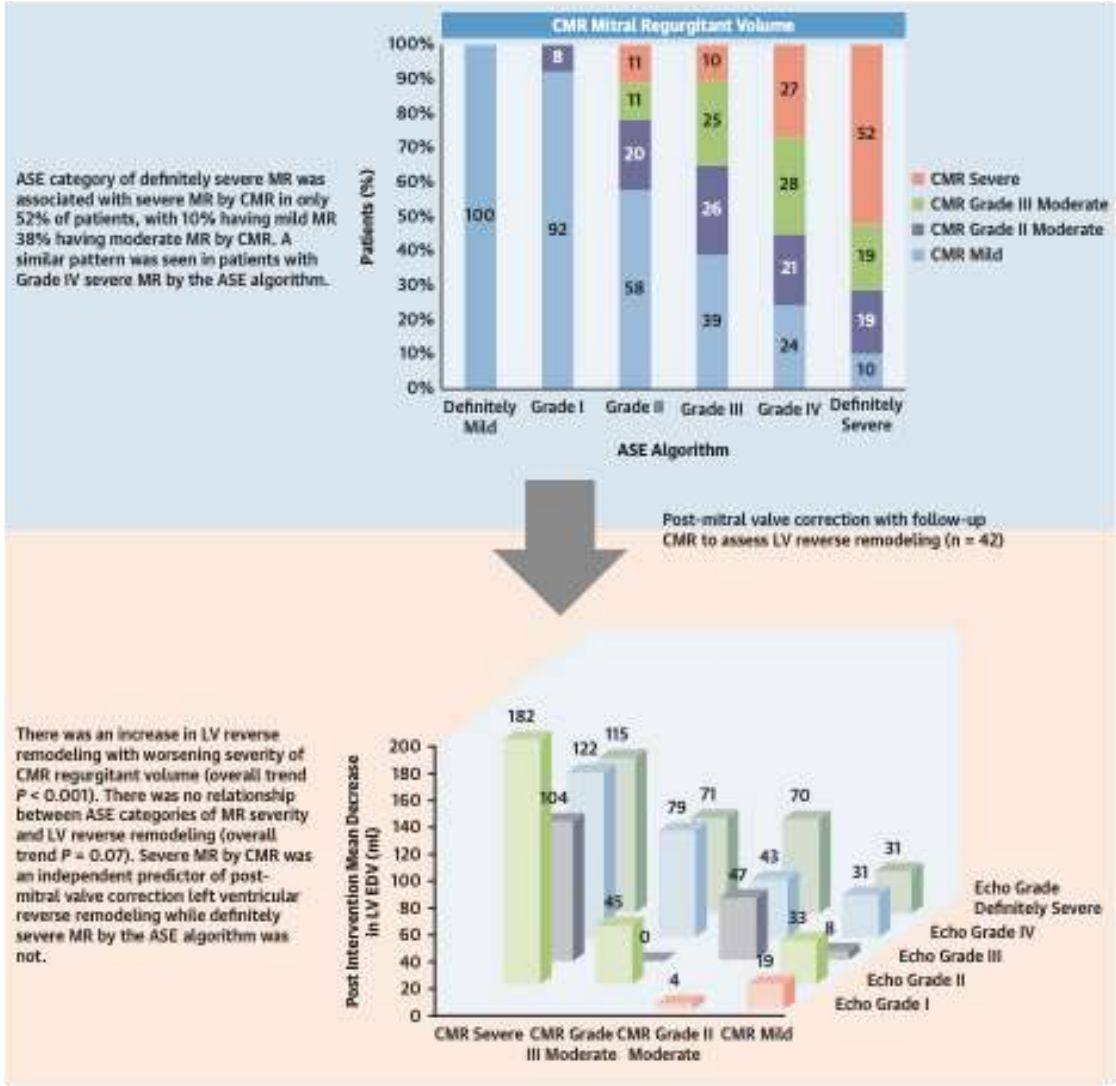
ORIGINAL RESEARCH

American Society of Echocardiography Algorithm for Degenerative Mitral Regurgitation

Comparison With CMR

- n=152 (63 Cx/48 CMR postop)
- 52% severa por ECHO concuerda CMR (10% leves en CMR)
- Remodelado reverso está relacionado con severidad CMR (p<0.0001) pero no con ECHO (p=0.07)

CENTRAL ILLUSTRATION Comparison of the American Society of Echocardiography Algorithm and Cardiac Magnetic Resonance in Quantifying Mitral Regurgitation Severity



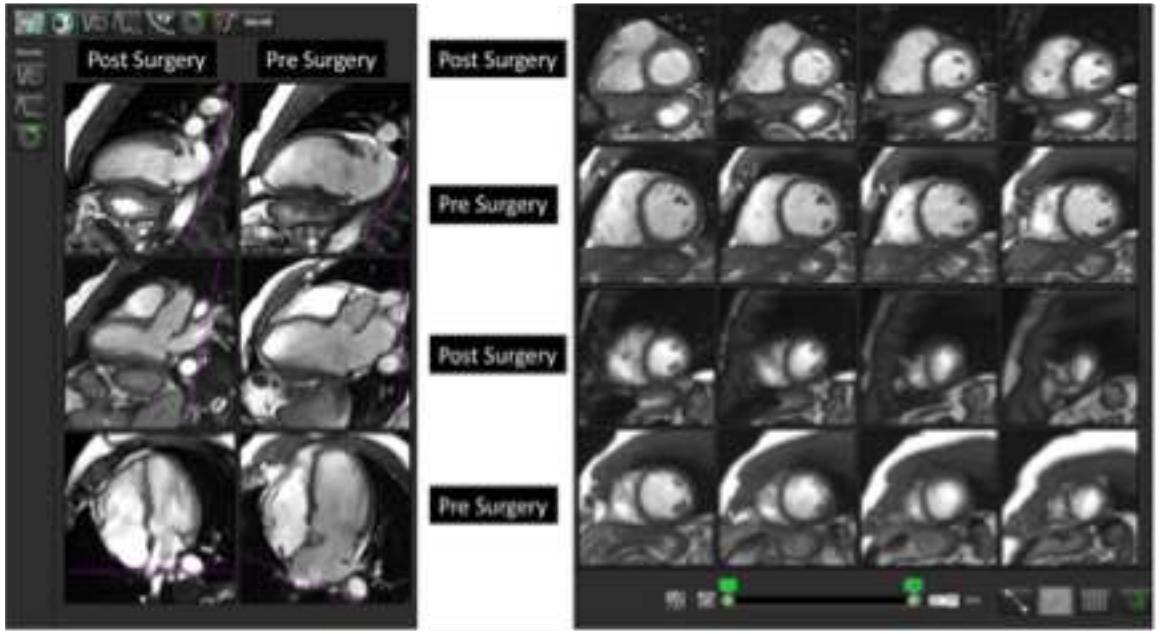
Uretsky S, et al. J Am Coll Cardiol Img. 2022;15(5):747-760.

ASE category of definitely severe MR was associated with severe MR by CMR in only 52% of patients, with 10% having mild MR and 38% having moderate MR by CMR. A similar pattern was seen in patients with grade IV severe MR by the ASE algorithm. There was an increase in LV reverse remodeling with worsening severity of CMR regurgitant volume (overall trend: $P < 0.001$). There was no relationship between the ASE categories of MR severity and LV reverse remodeling (overall trend: $P = 0.07$). Severe MR by CMR was an independent predictor of post mitral valve correction LV reverse remodeling, whereas definitely severe MR by the ASE algorithm was not. ASE = American Society of Echocardiography; CMR = cardiac magnetic resonance; LV = left ventricular; MR = mitral regurgitation.

Usefulness of Mitral Regurgitant Volume Quantified Using Magnetic Resonance Imaging to Predict Left Ventricular Remodeling After Mitral Valve "Correction"

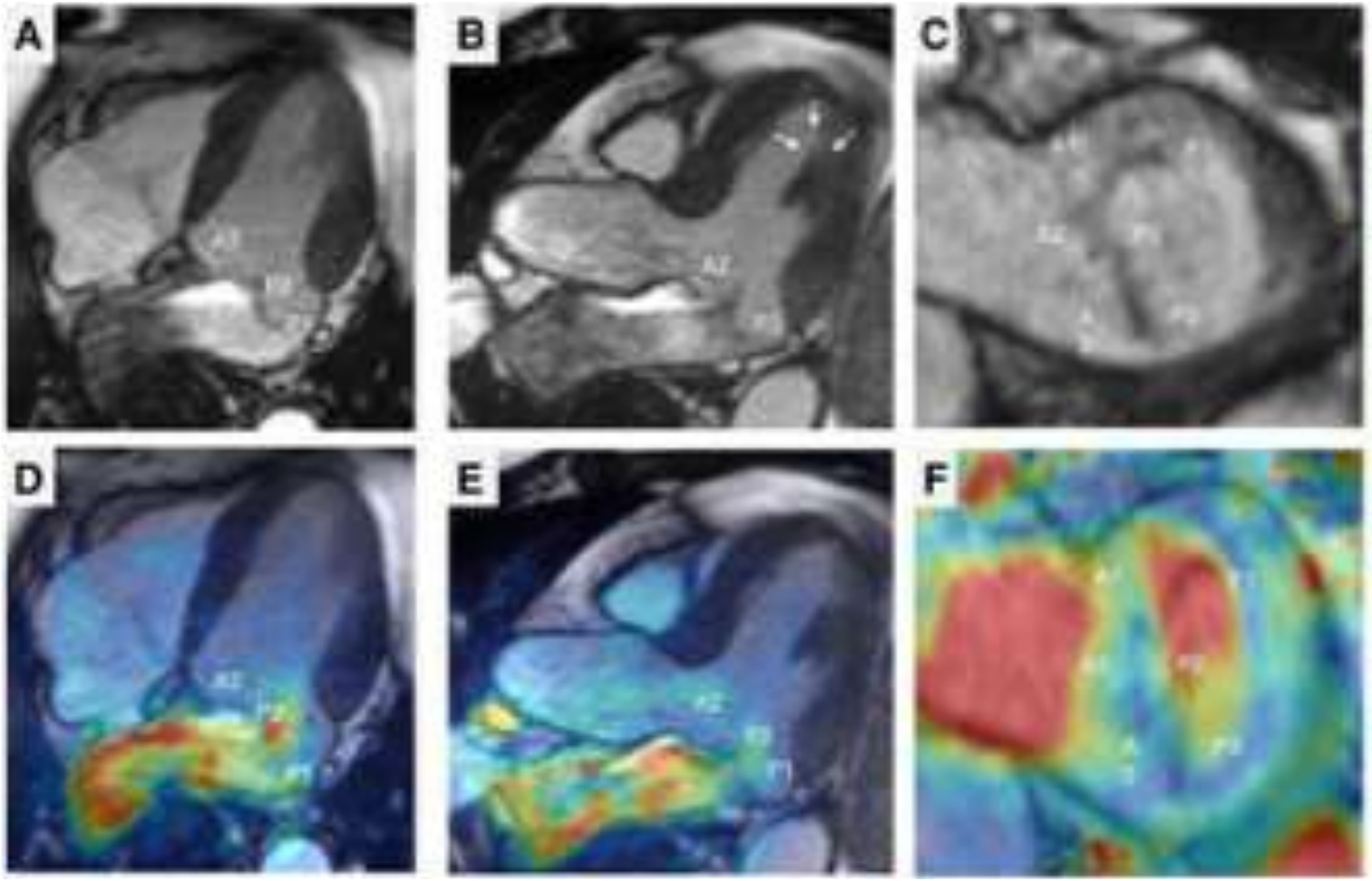
Seth Uretsky, MD[a,*], Dipan J. Shah, MD[b], Glenmore Lasam, MD[c], Stephen Horgan, MD[a], Dany Debs, MD[b], and Steven D. Wolff, MD, PhD[d]

- Predicción remodelado reverso LV EDV: mitral regurgitation volumen/ EF
- AUC: 0.77/0.87 (residual MR < 10mL)
- n=63 (97% remodelado reverso)



(Am J Cardiol 2020;00:1–7)

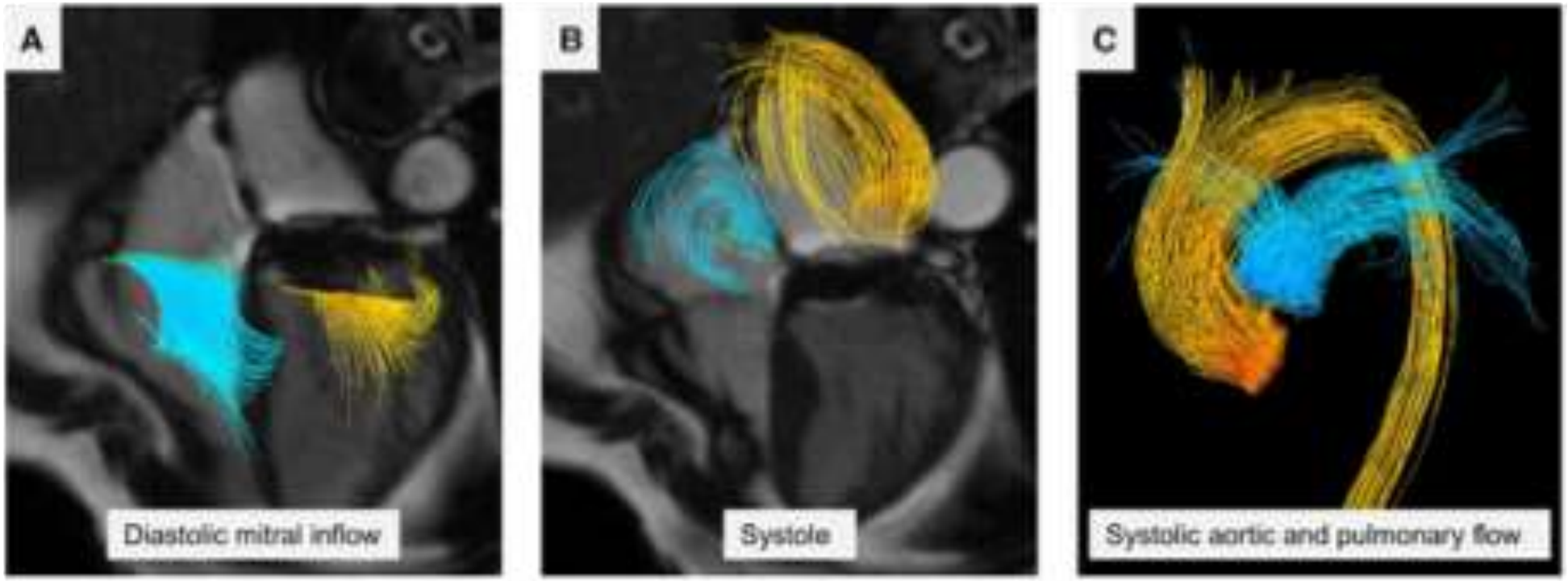
Cuantificación MR: Validación interna



G Different methods to compute mitral regurgitation	MR volume (ml)
Standard MR	51
Direct MR jet	54
Indirect 4D Flow MR	51
Agreement	**Excellent**
Conclusion	**Severe MR**
Confidence in report	**Strong**

European Heart Journal (2025) **46**, 606–619
https://doi.org/10.1093/eurheartj/ehae801

Prótesis valvulares



D	Tricuspid valve	Pulmonary valve	Mitral valve	Aortic valve
Flow Volume [ml]	53	55	54	55
Forward SV [ml]	67	56	90	58
Backward SV [ml]	14	1	36	3
Regurgitation Fraction (%)	21	1	40	6

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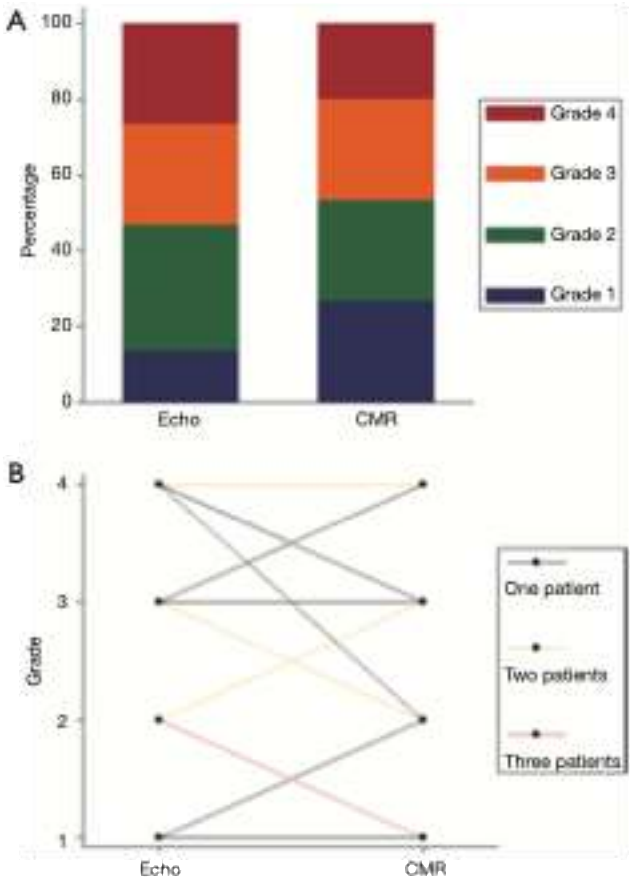
https://doi.org/10.1093/eurheartj/ehae801

Mitraclip: MR residual



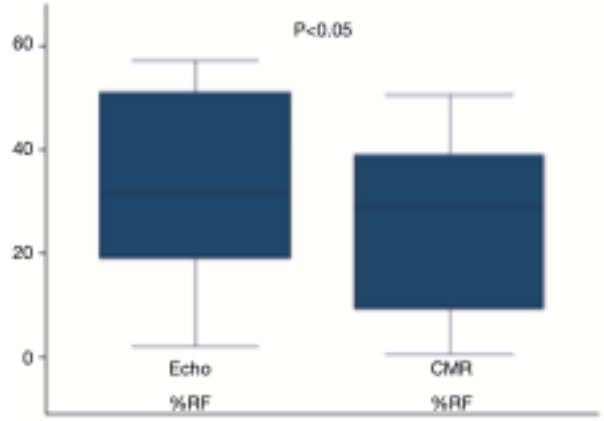


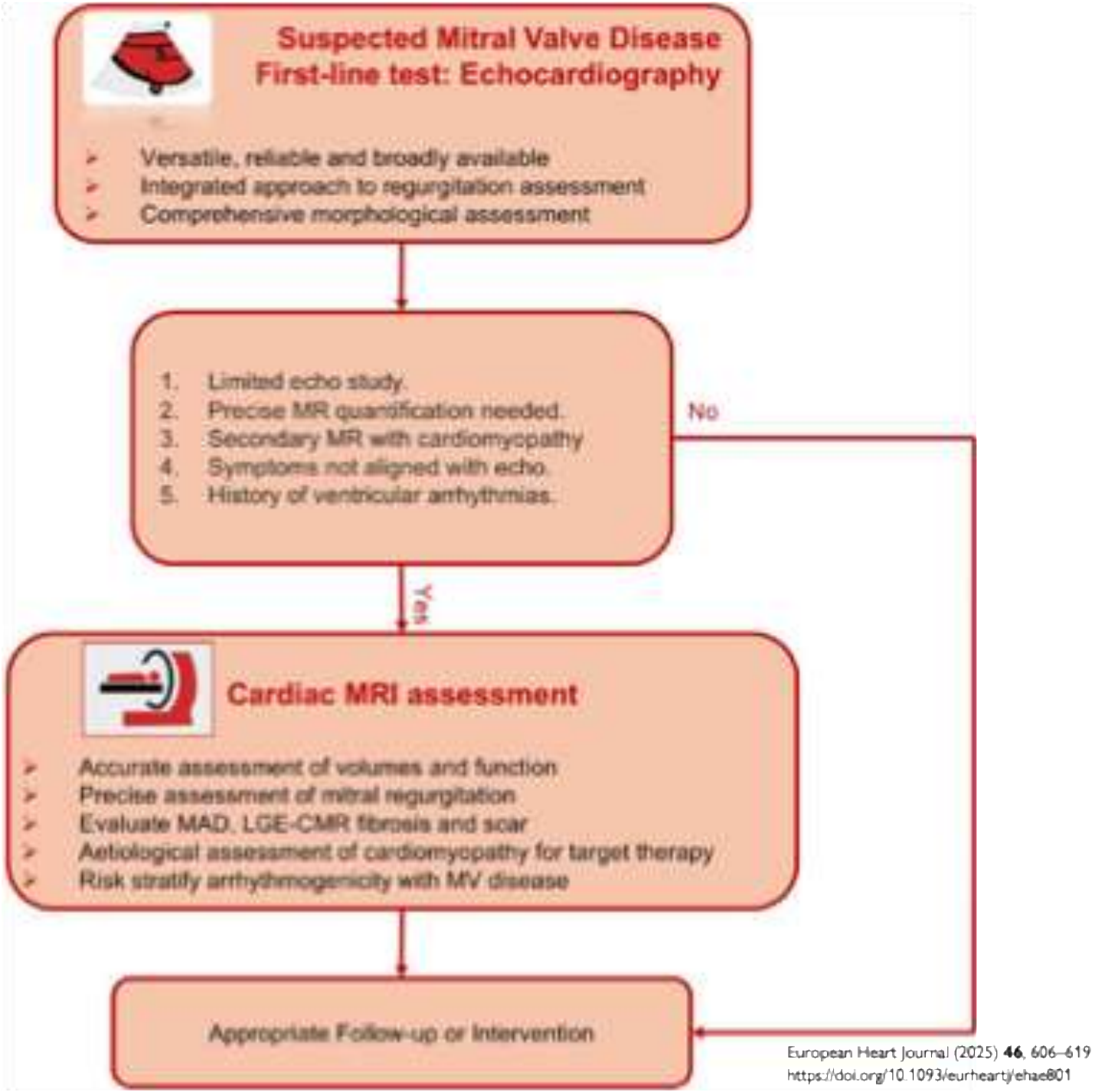
Table 3 Comparison of methods for quantitating residual MR: Pearson's correlations

Variables	Expert grading	$RVol_{Doppler}$	$RF\%_{Doppler}$	$RVol_{MRI\text{-}PC}$	$RF\%_{MRI\text{-}PC}$	$RVol_{MRI\text{-}SV}$	$RF\%_{MRI\text{-}SV}$
Pearson r	0.6	0.6	0.6	0.88	1	0.96	1
95% CI	0.2-0.8	0.2-0.9	0.1-0.9	0.66-0.96	0.9-1	0.88-0.99	0.9-1
R squared	0.4	0.4	0.4	0.77	0.9	0.92	0.9
P value	0.0125	0.0104	0.0158	<0.0001	<0.0001	<0.0001	<0.0001

MR, mitral regurgitation; $RVol_{Doppler}$, regurgitant volume by Doppler echocardiography method; $RF\%_{Doppler}$, regurgitant fraction by Doppler echocardiography method; $RVol_{MRI\text{-}PC}$, regurgitant volume by phase contrast method; $RF\%_{MRI\text{-}PC}$, regurgitant fraction by phase contrast method; $RVol_{MRI\text{-}SV}$, regurgitant volume by stroke volume method; $RF\%_{MRI\text{-}SV}$, regurgitant fraction by stroke volume method; CI, confidence interval.

Ann Cardiothorac Surg 2015;4(4):341-351

Flujo trabajo



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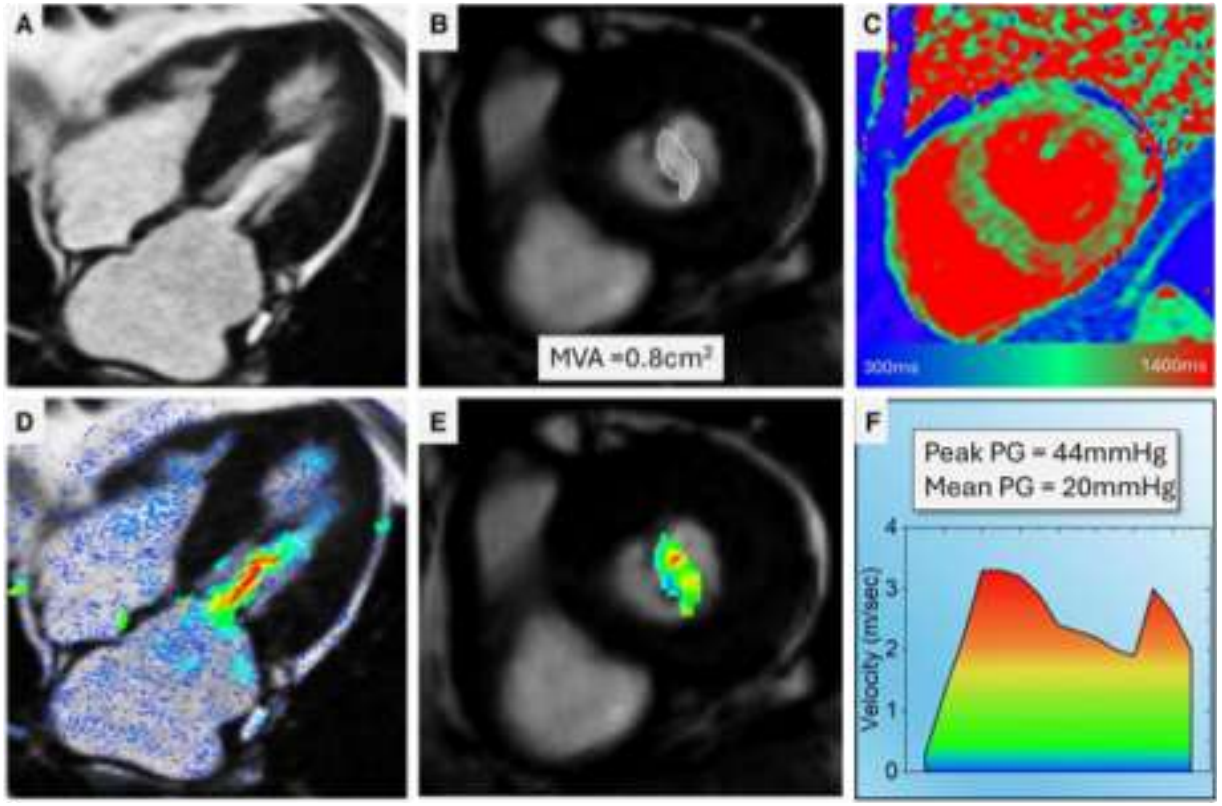
https://doi.org/10.1093/eurheartj/ehae801

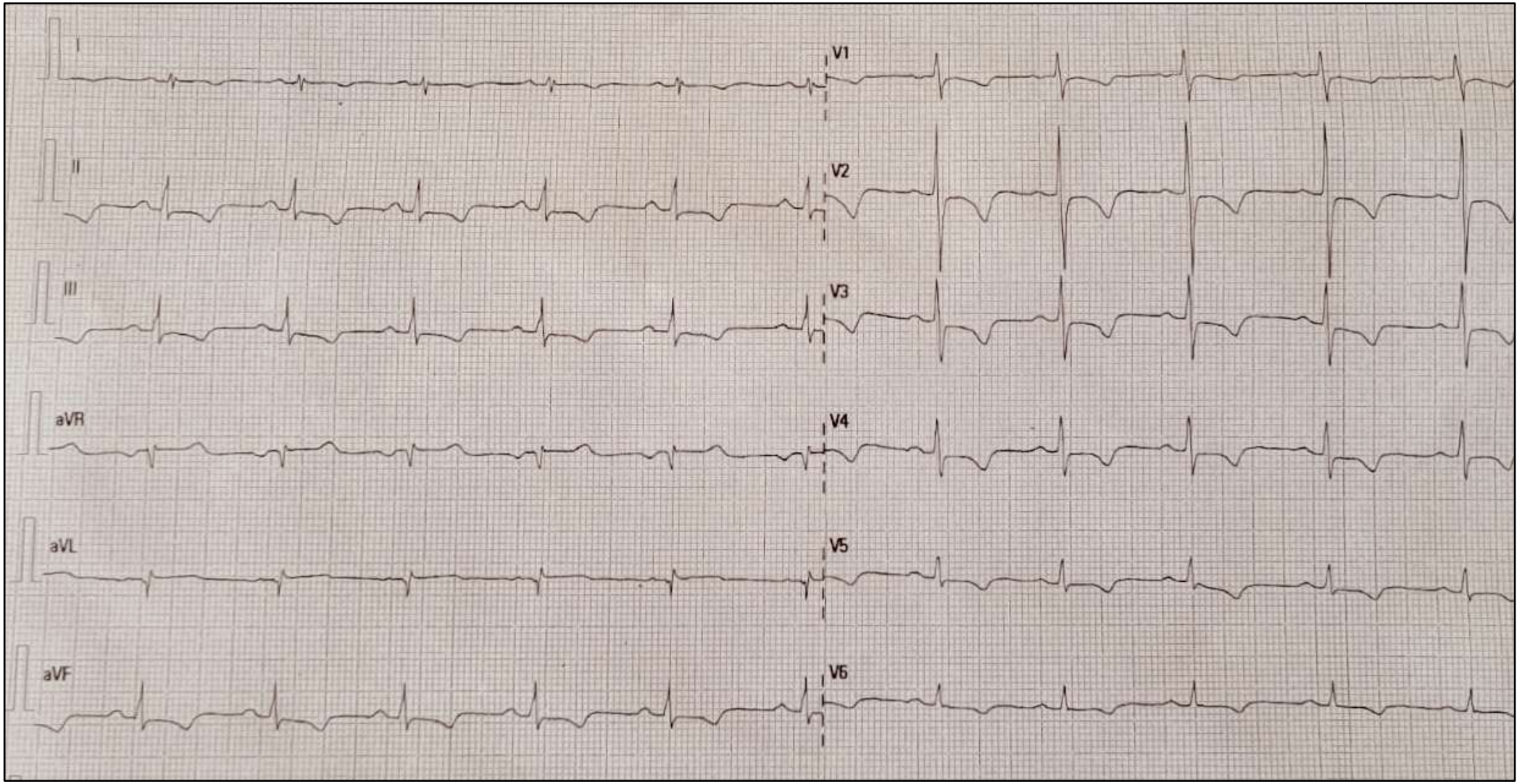
Estenosis mitral



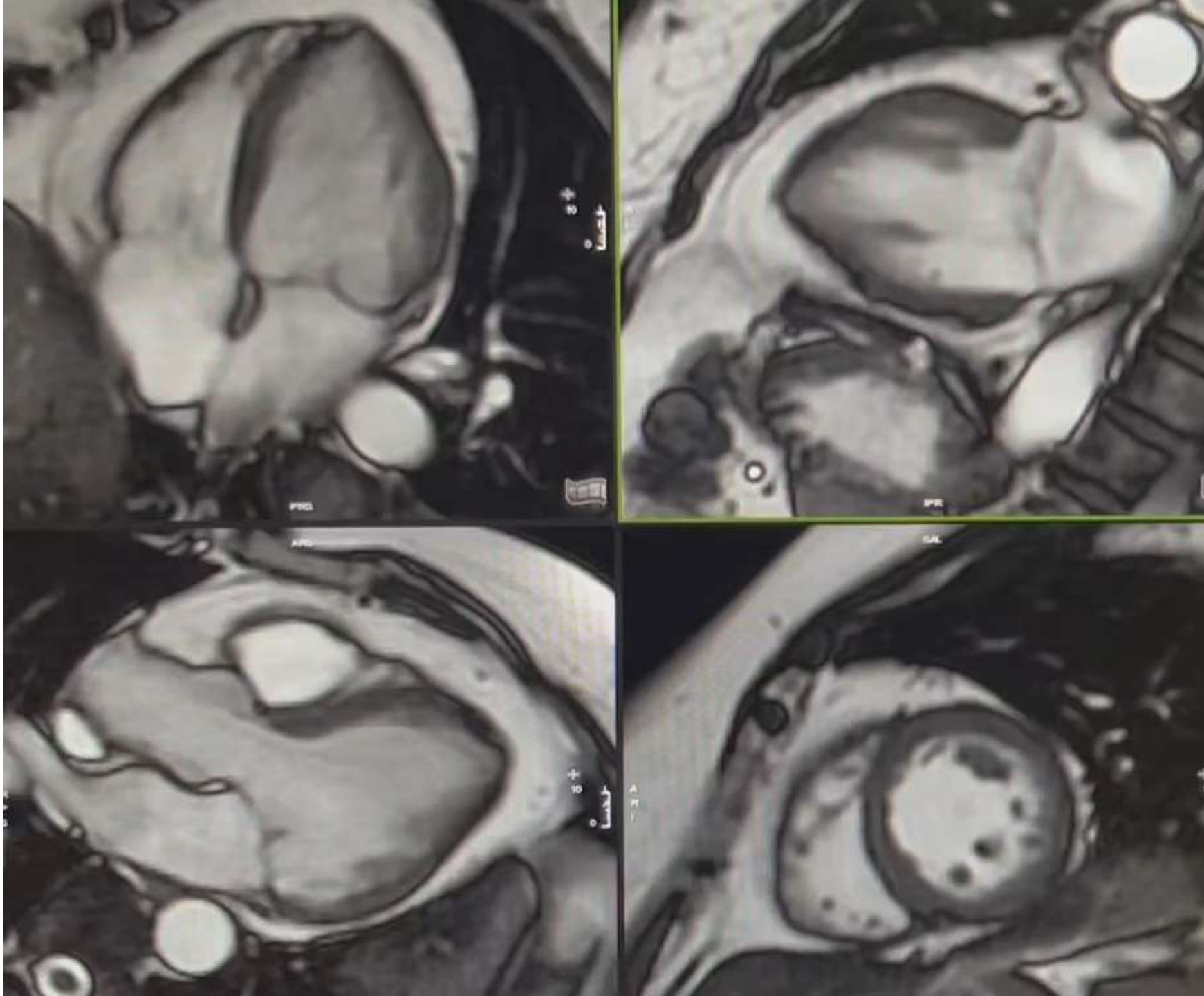
Caso Clínico

- 57 años
- Historia de dislipidemia y diabetes mellitus, tratada con rosuvastatina, liraglutida and metformina.
- Dolor torácico y palpitaciones consulta a urgencias
- Examen físico normal
- Troponinas, ECHO y Ecoestrés ejercicio normales
- Episodios recurrentes desde hace 5años con coronariografía normal previa

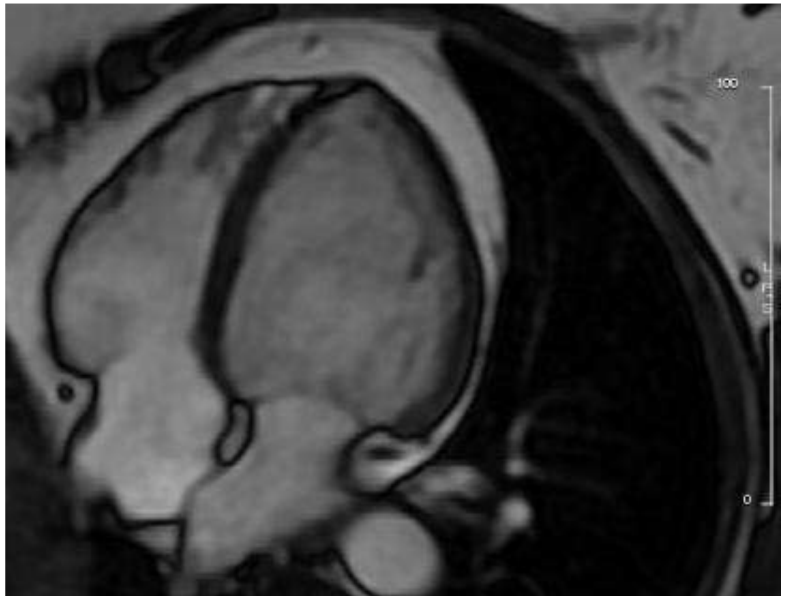
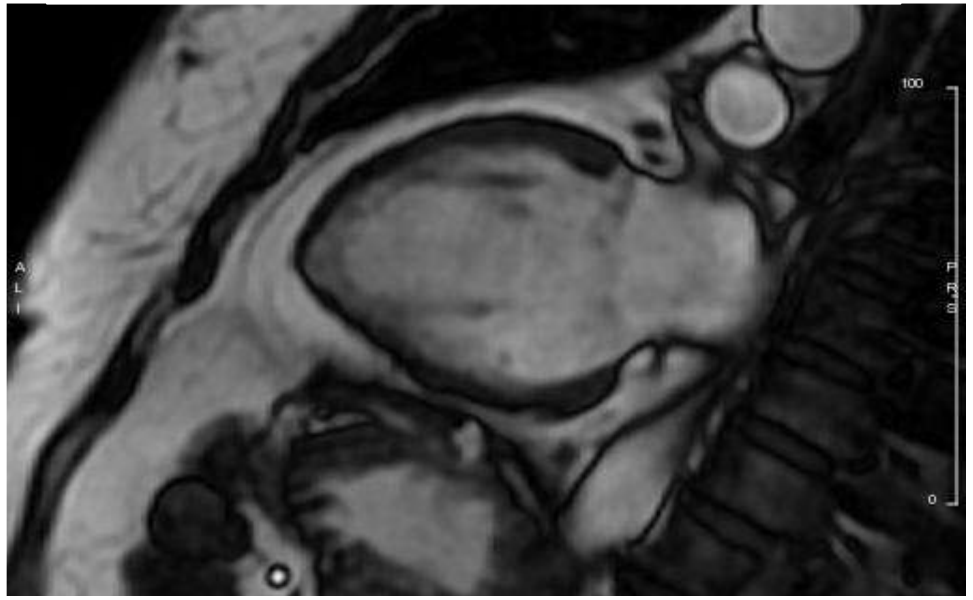
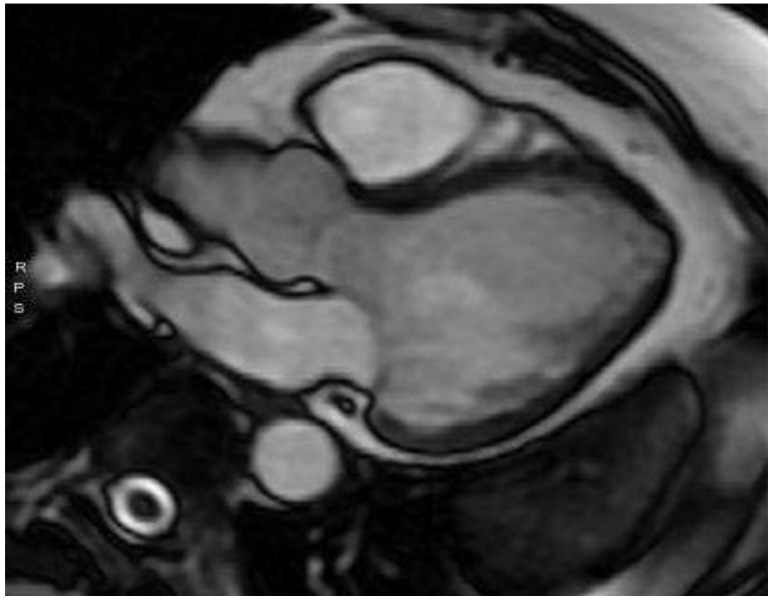
ECG



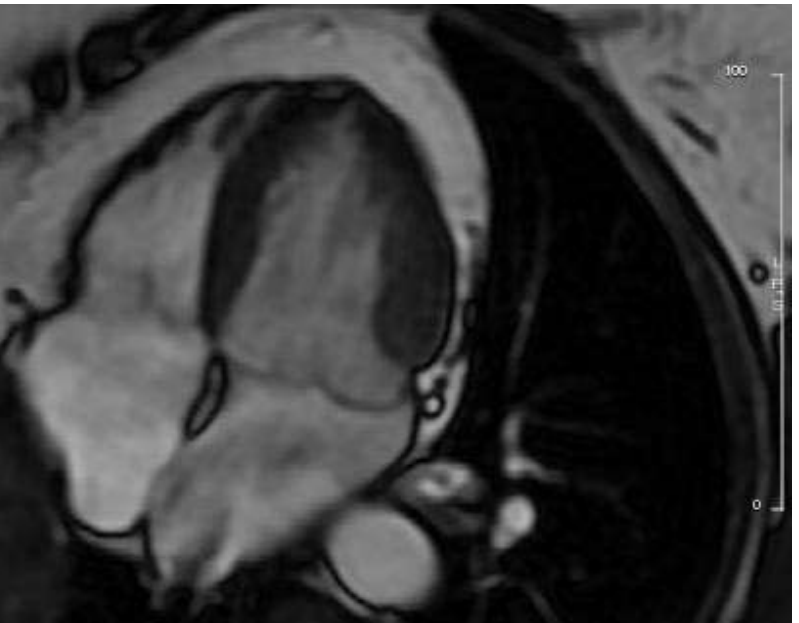
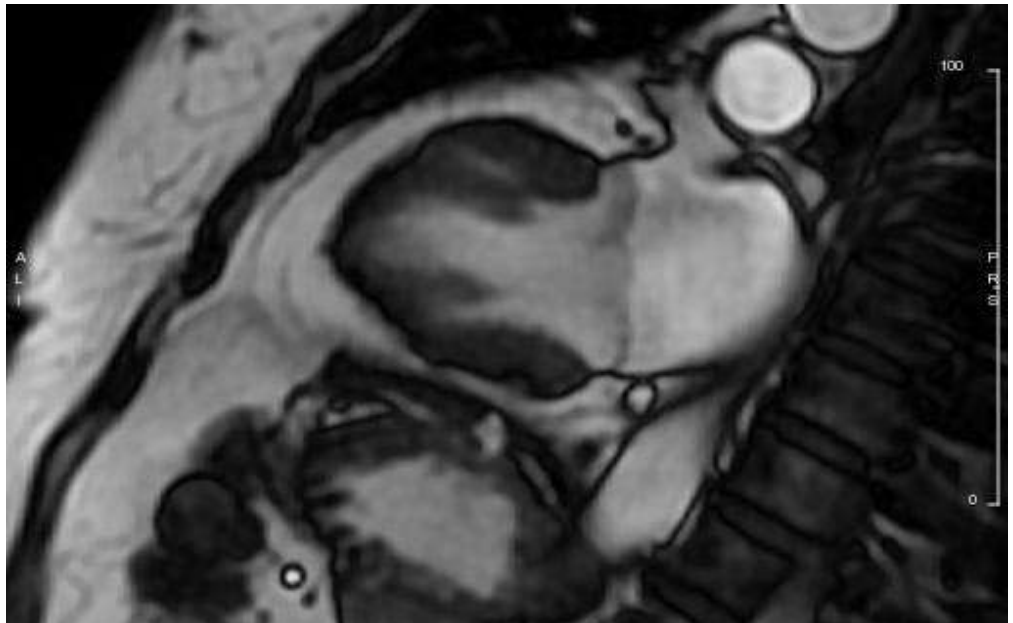
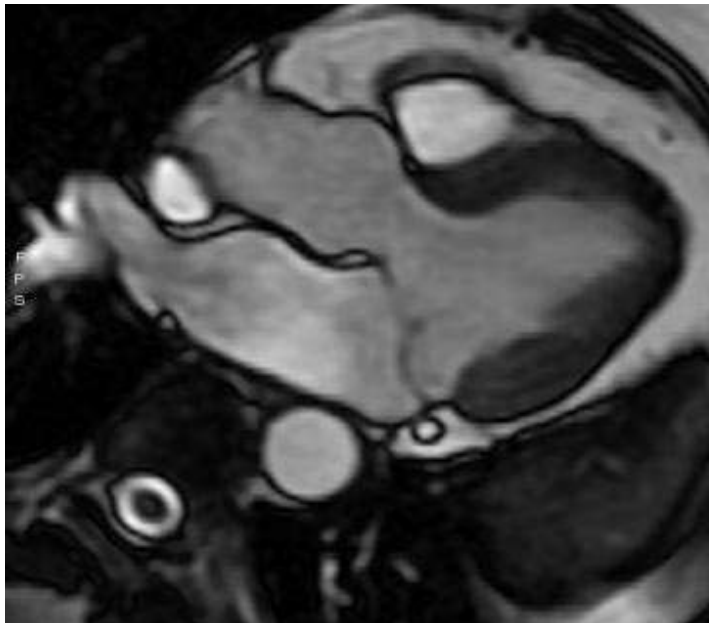
CMR



End-diastole

End-systole

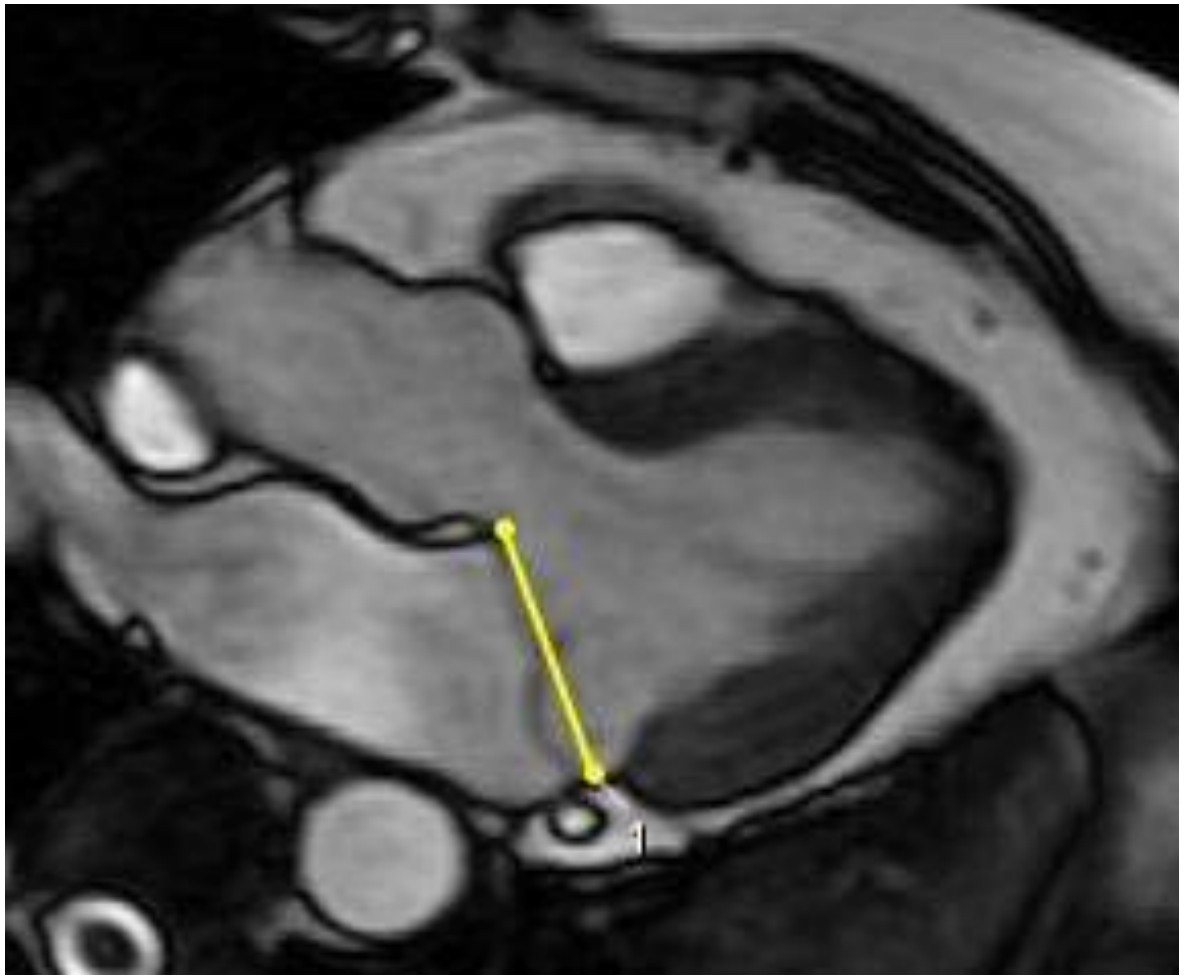




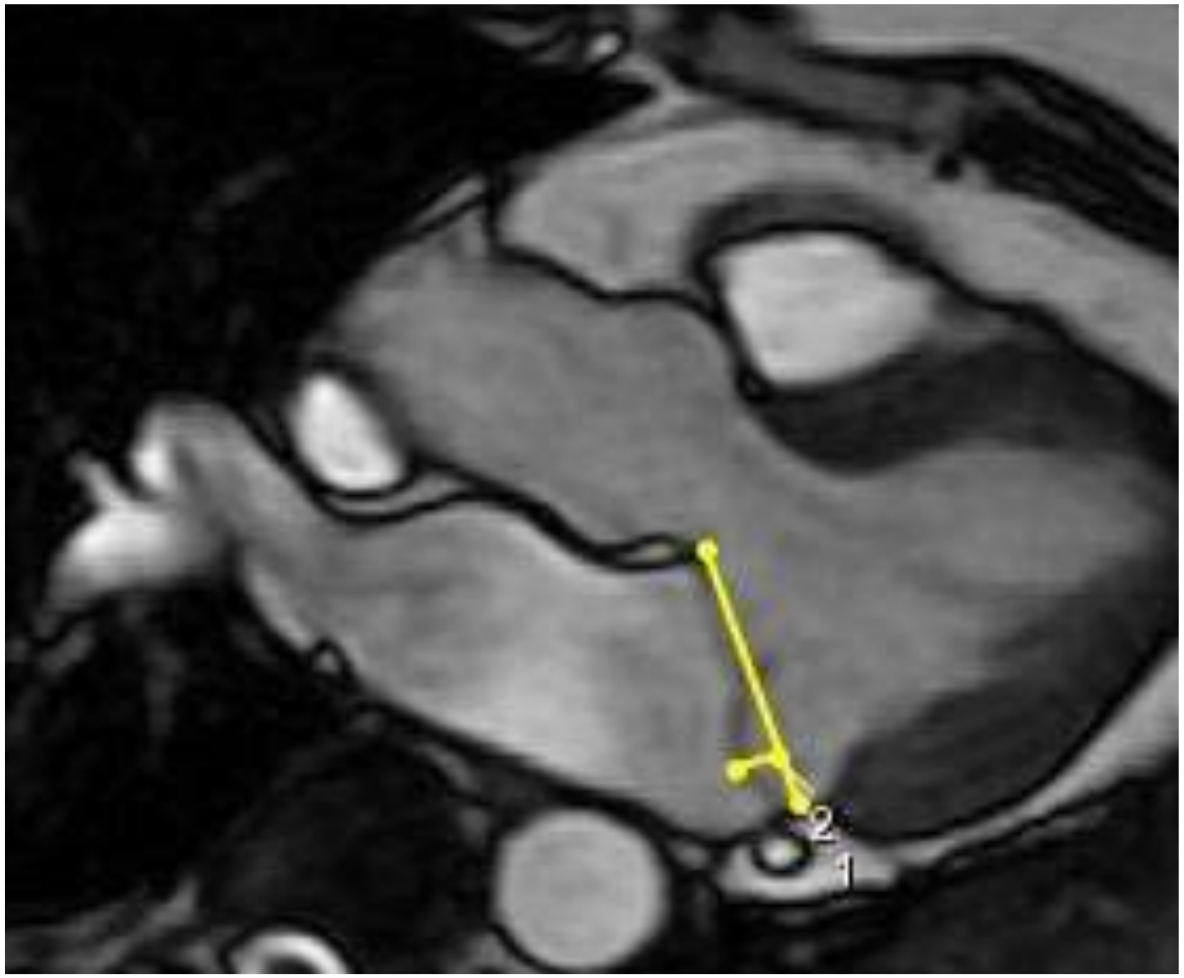
	Vol. Telediastólico		Vol. Telesistólico		Vol. sistólico		FE	Masa	
	[ml]	[ml/m^2]	[ml]	[ml/m^2]	[ml]	[ml/m^2]	[%]	[g]	[g/m^2]
VI (valores normales)	**111** (86-178)	**61** (56-96)	**38** (22-66)	**21** (14-34)	**73**	**40**	**65** (57-77)	**81** (56-140)	**45** (41-81)
VD (valores normales)	**99** (77-201)	**54** (48-112)	**34** (24-84)	**19** (12-52)	**65**	**36**	**66** (51-71)	**----**	**----**

Tabla 1. Volúmenes, FE, GC y masa miocárdica (rangos de normalidad en mujeres entre paréntesis)[1]

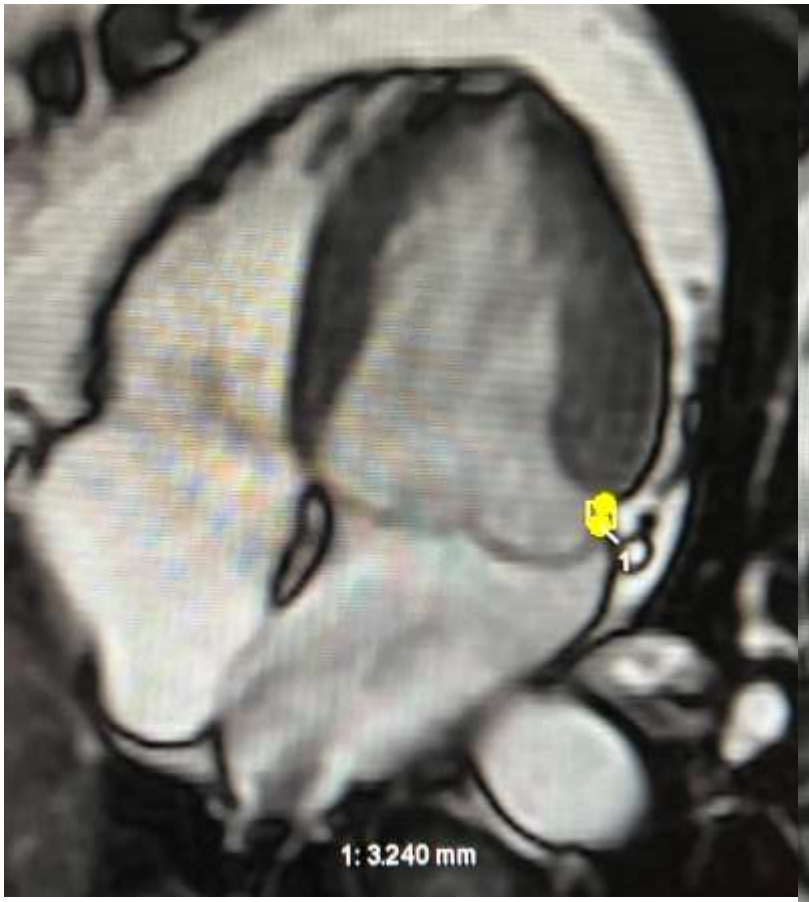
*Músculos papilares incluidos en la masa y excluidos del volumen. ASC: área superficie corporal; FE: fracción de eyección; VD: ventrículo derecho; VI: Ventrículo izquierdo.

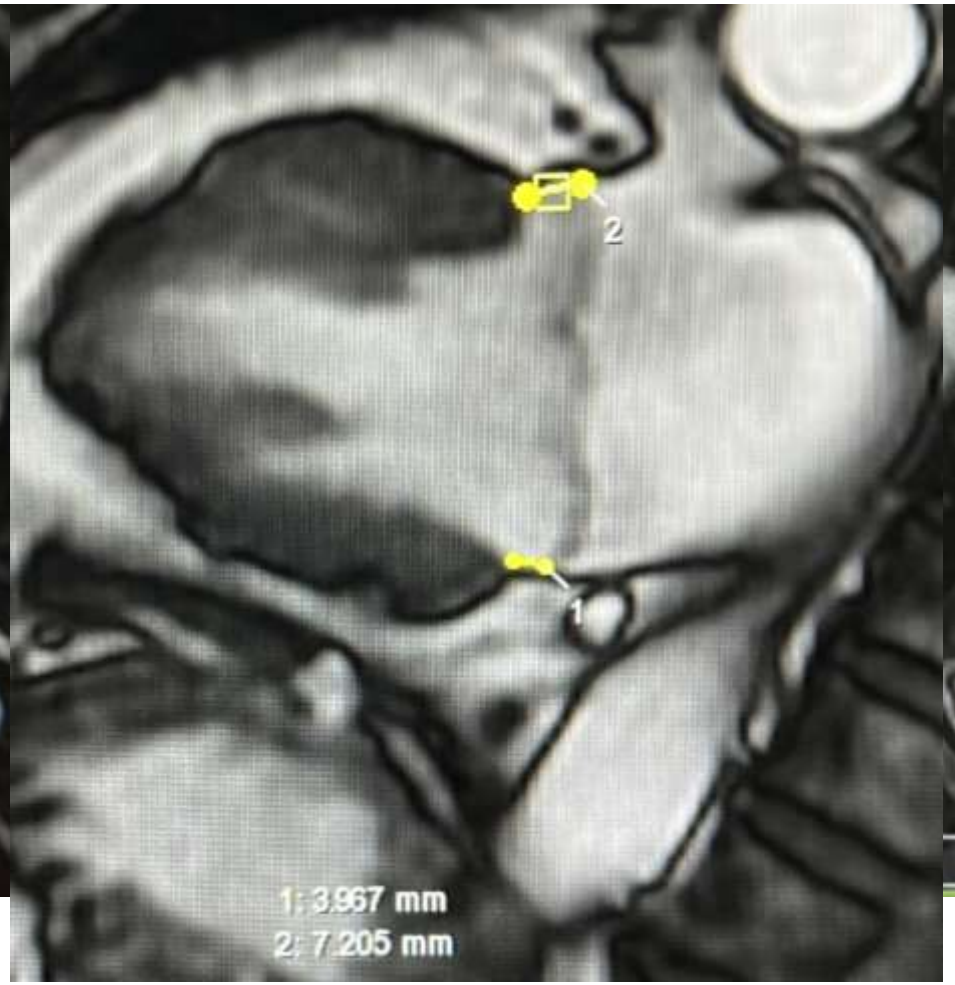
Prolapso Válvula Mitral

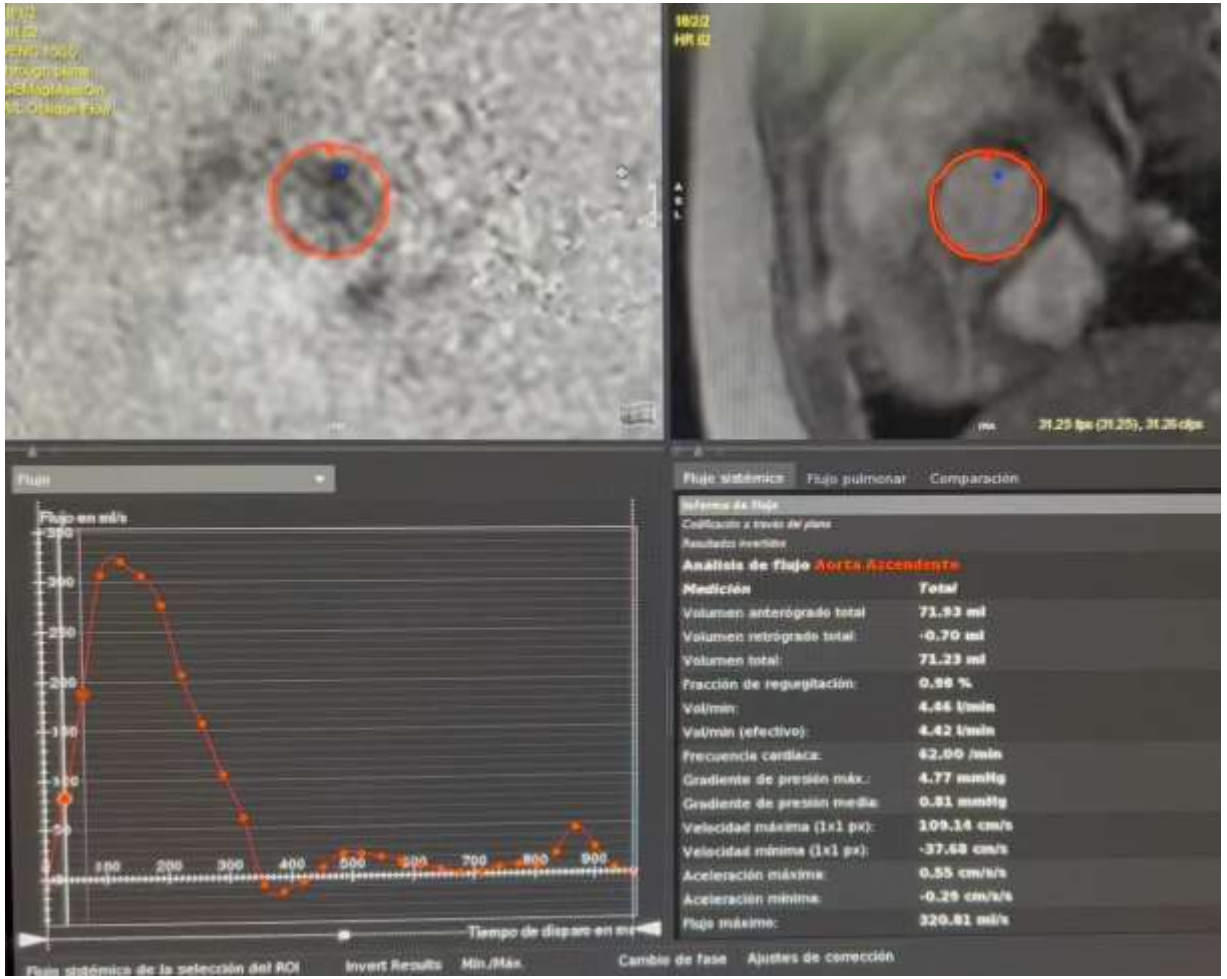


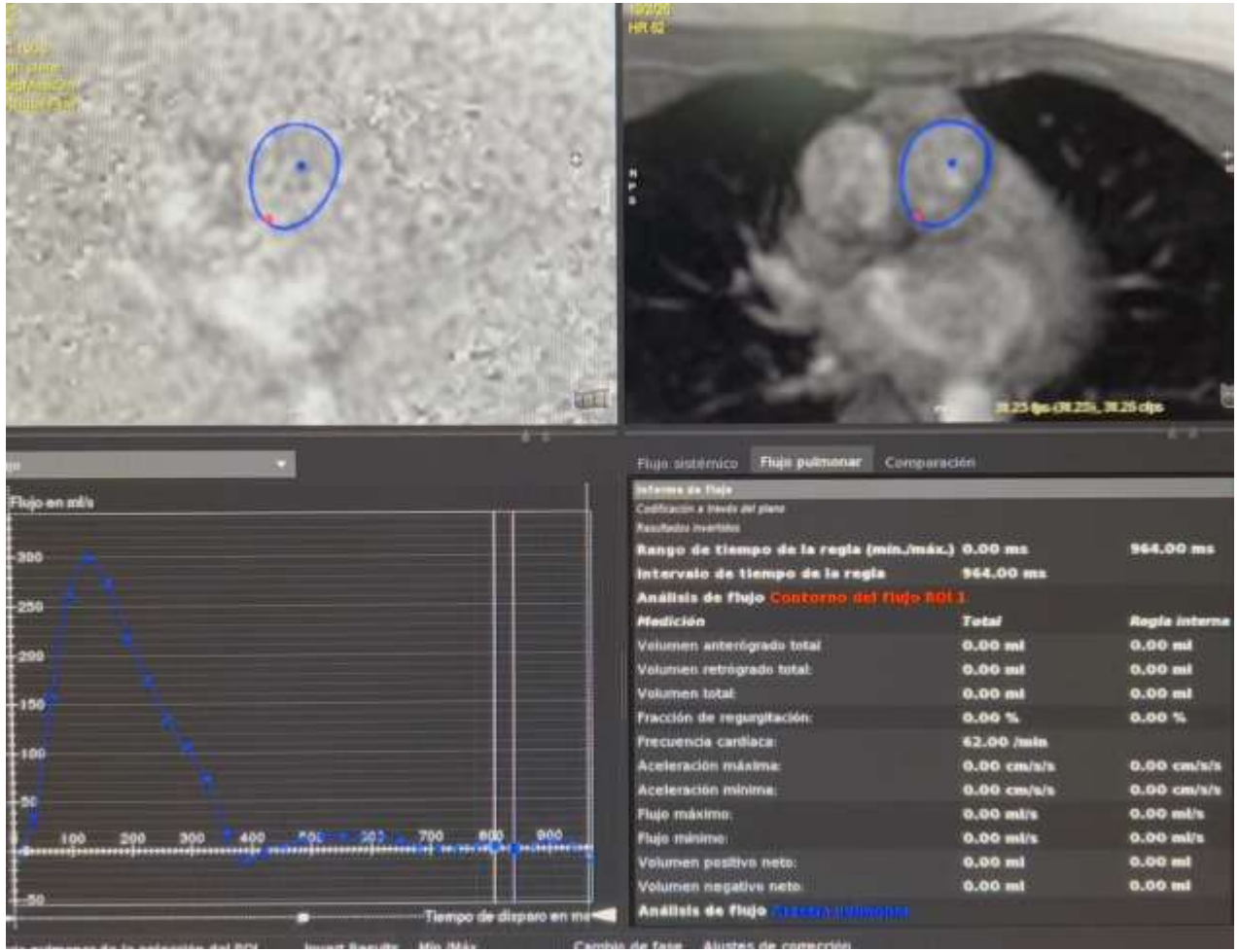


Disyunción anillo mitral





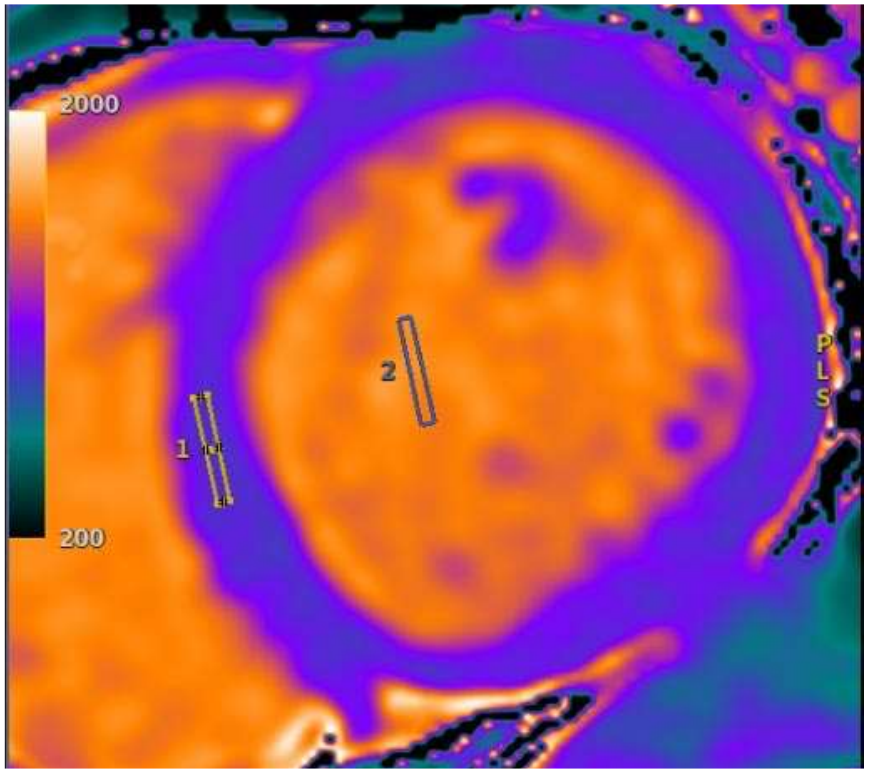




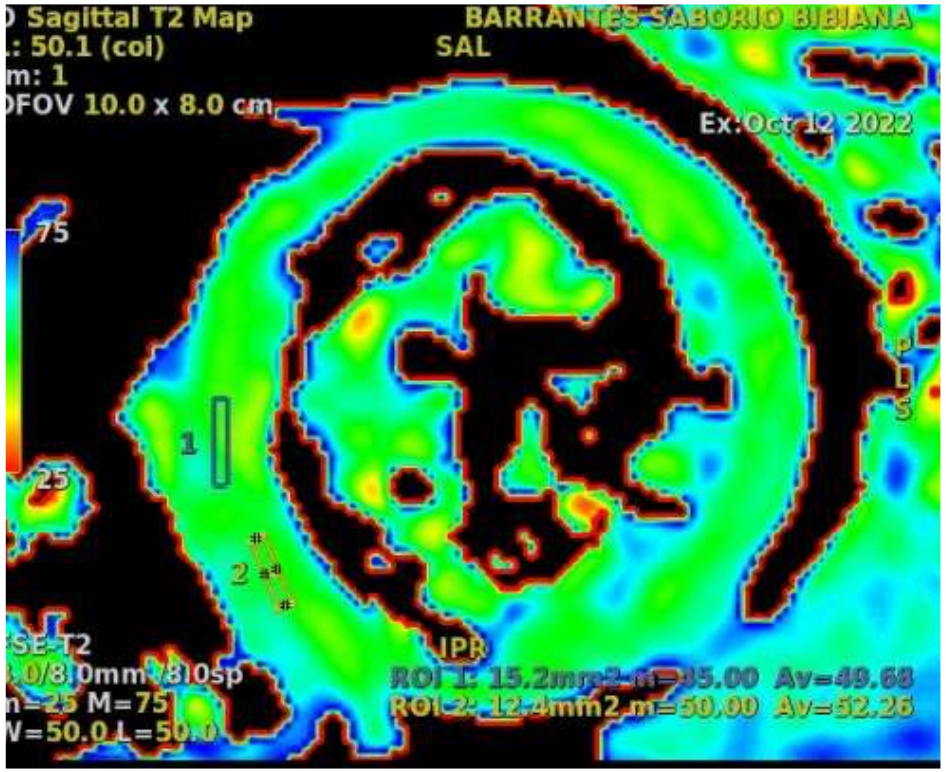
Insuficiencia mitral leve,
RF 11%

Qp:Qs= 0.9 (normal)

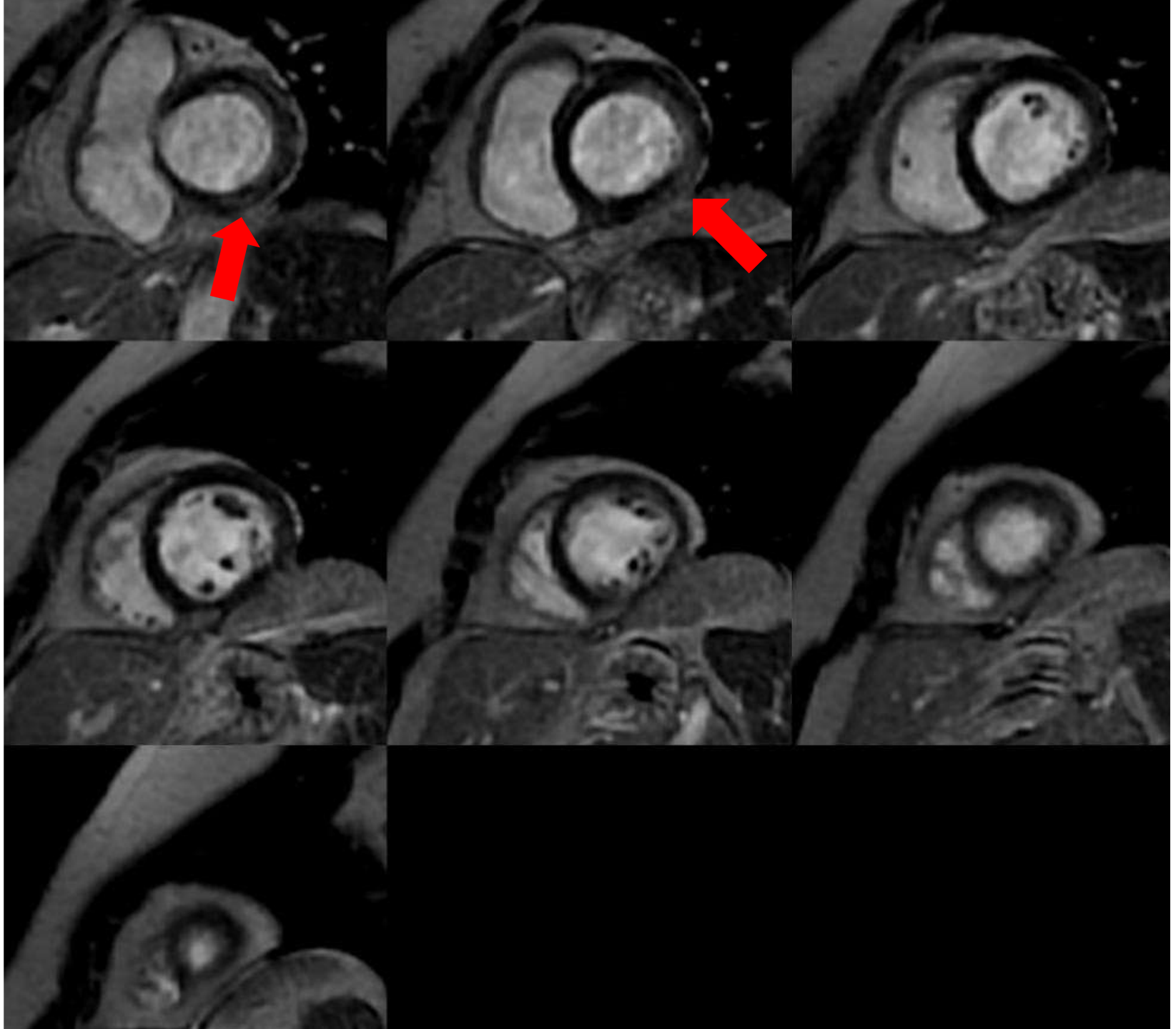
T1 mapping
957 ms
(normal)



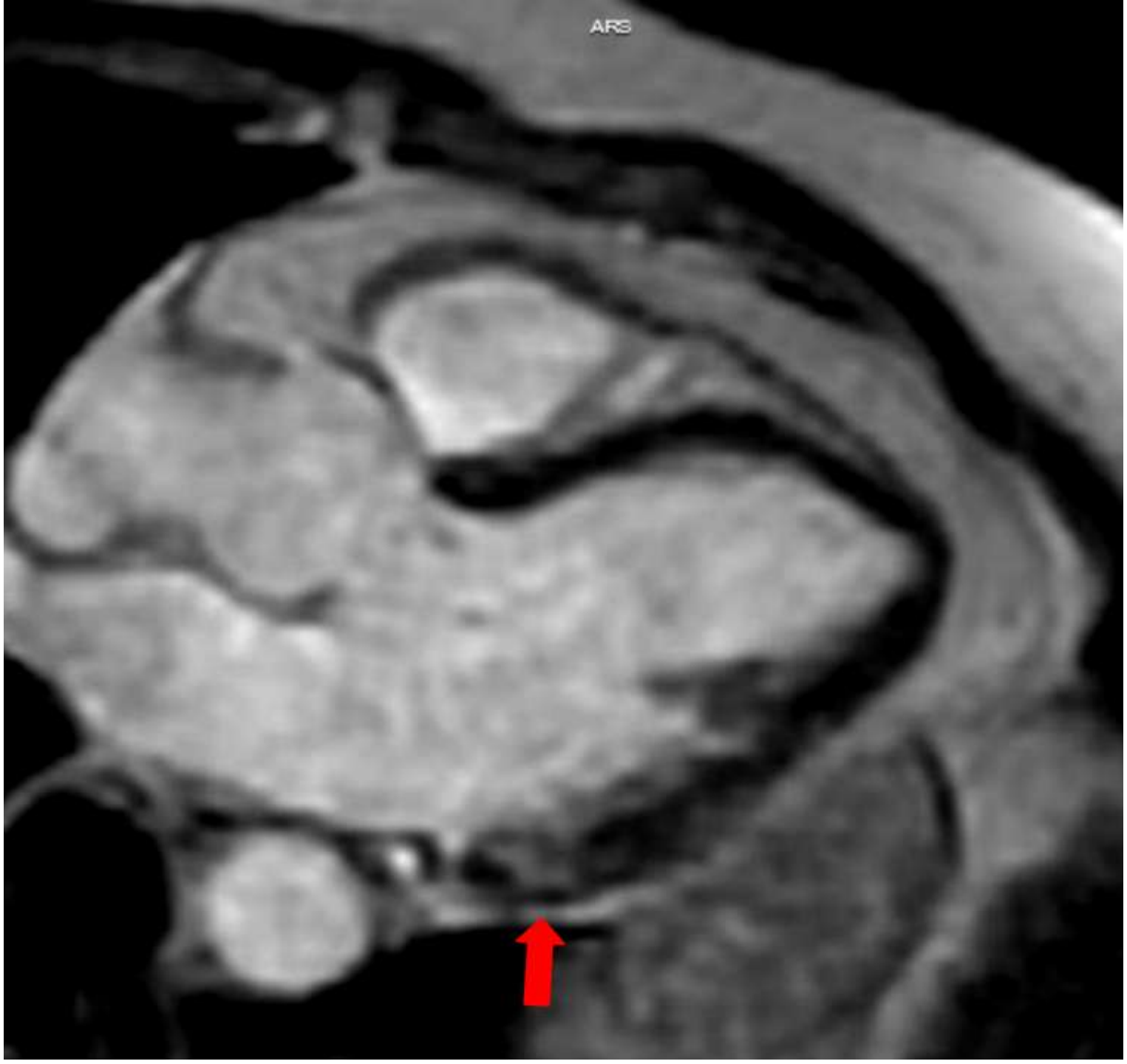
T2 mapping
50 ms
(normal)



CMR
LGE



CMR
LGE



1. MVP es común pero no todas son lo mismo

- MVP prevalencia 1-2%.
- SCD 0.2-0.4%/año (causa arritmias ventriculares)
- MVP es diferente de MR.
- Sospecha de “malignant MVP” cuando: síntomas, ECG anormal, arritmias ventriculares.

2. Existe el MVP arrítmico (MVP cardiomyopathy)

Arrhythmia/Electrophysiology

Arrhythmic Mitral Valve Prolapse and Sudden Cardiac Death

Cristina Basso, MD, PhD*; Martina Perazzolo Marra, MD, PhD*; Stefania Rizzo, MD, PhD; Manuel De Lazzari, MD; Benedetta Giorgi, MD; Alberto Cipriani, MD; Anna Chiara Frigo, MSc; Ilaria Rigato, MD, PhD; Federico Migliore, MD, PhD; Kalliopi Pilichou, PhD; Emanuele Bertaglia, MD; Luisa Caccia villani, MD, PhD; Barbara Bauce, MD, PhD; Domenico Corrado, MD, PhD; Gaetano Thiene, MD; Sabino Iliceto, MD

Estudio de 43ptes SCD con único hallazgo de MVP

83% inversión onda T derivaciones inferiores.

100% arritmias ventriculares con morfología BRDHH.

LV fibrosis detectada en histología en la pared inferolateral en 88% pacientes.

LGE in 93% pacientes vs 14% sanos.

Circulation, 2015.

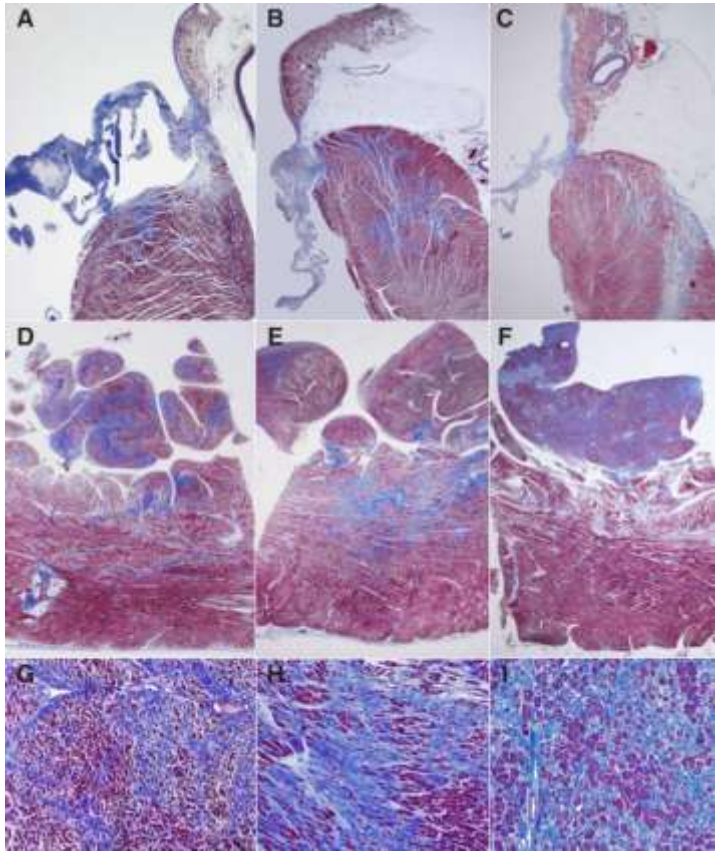
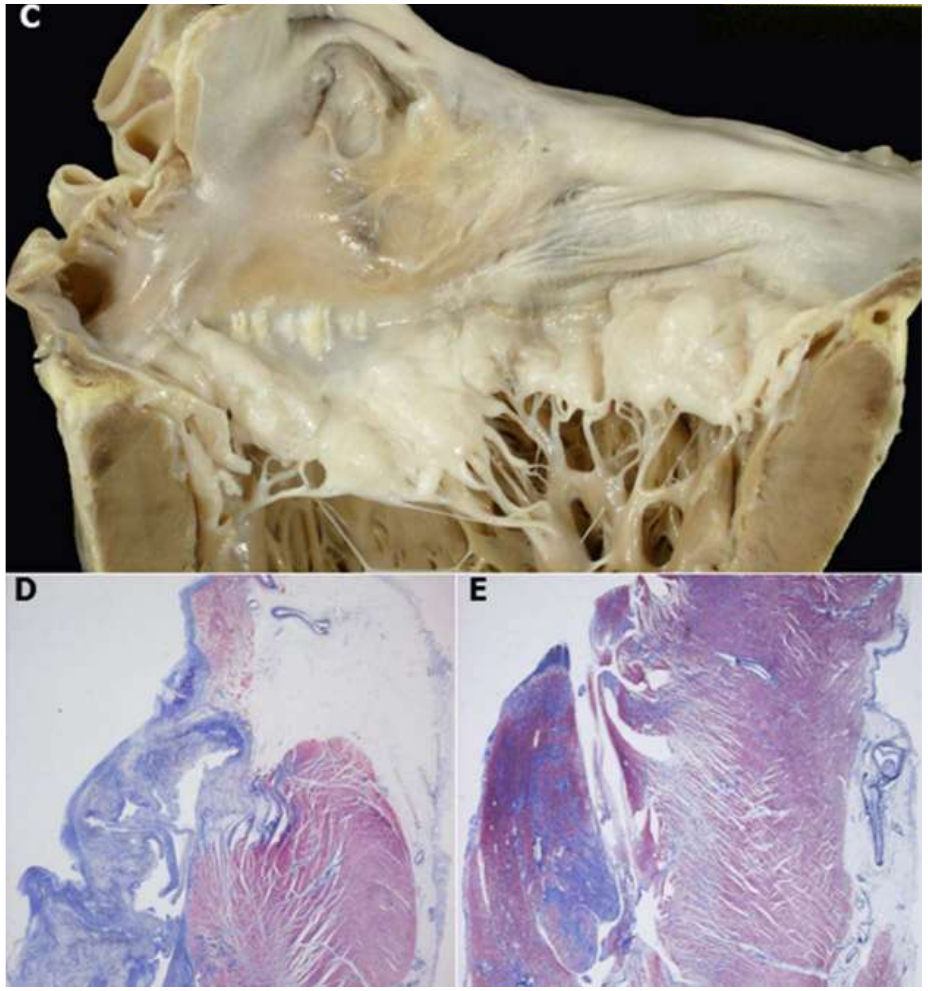
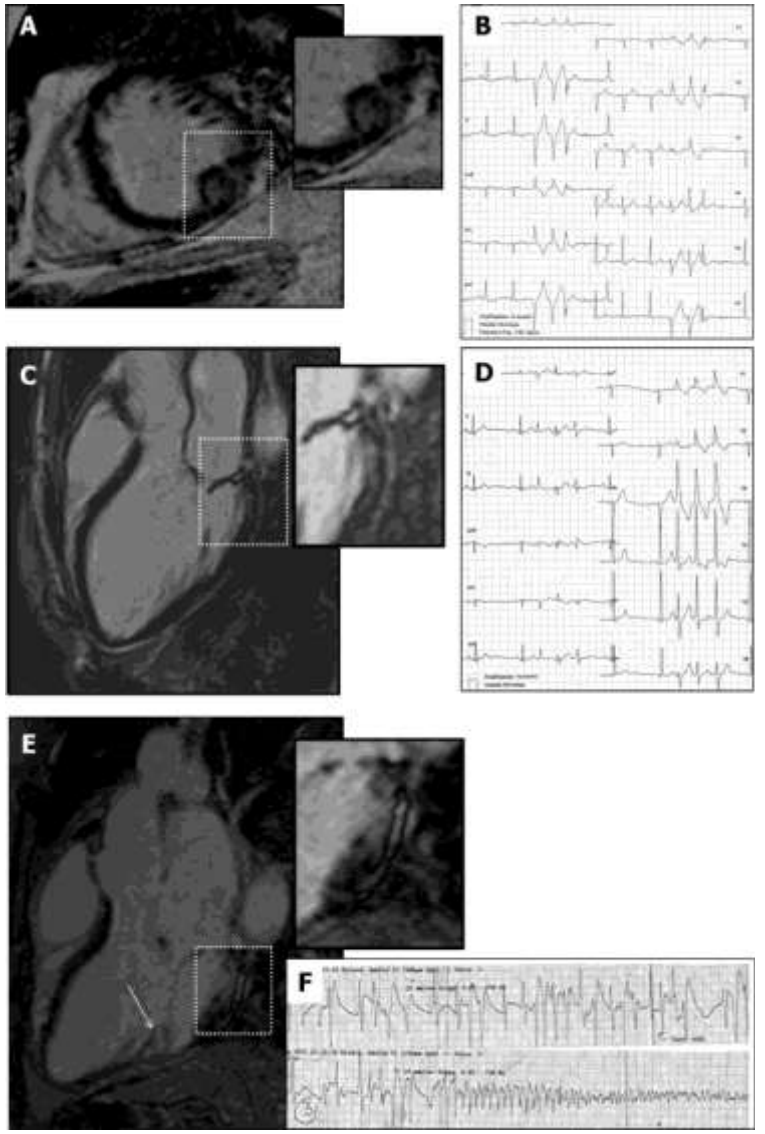


Figure 2. Histology of 3 representative sudden cardiac death cases with mitral valve prolapse. Myocardial scarring is visible at the level of the inferobasal left ventricular free wall under the posterior mitral valve leaflet (**A–C**) and of the papillary muscles plus adjacent free wall (**D–F**). Close-up of the scarring areas showing endoperimysial and patchy replacement-type fibrosis with interspersed cardiomyocytes (**G–I**).

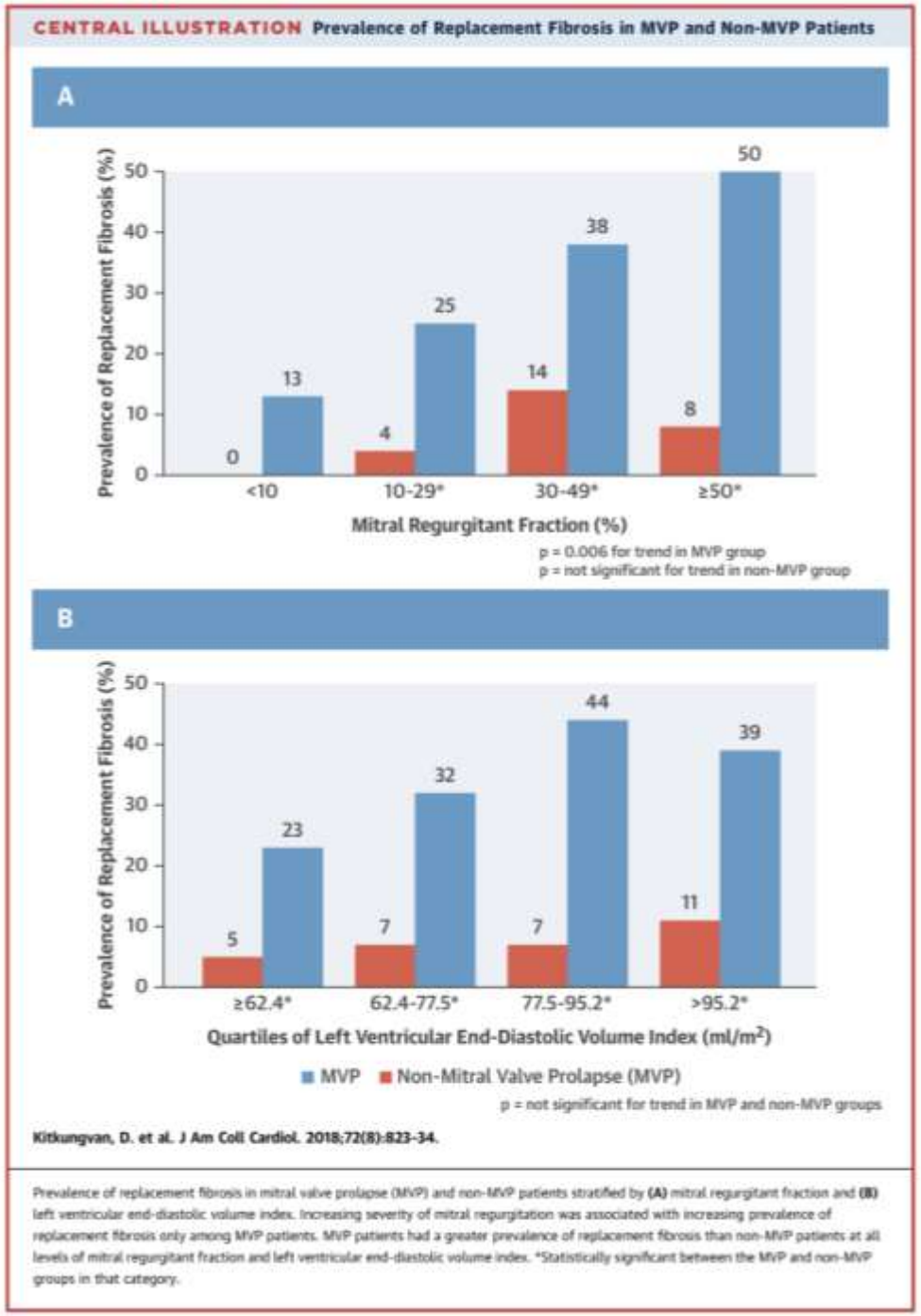
Hystopathologic correlation with cardiac MRI (LGE images)





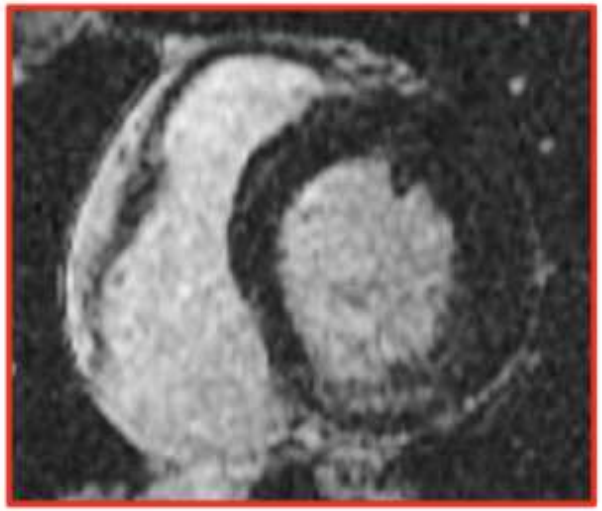
Circulation, 2015.

3. LGE puede ocurrir incluso con MR leve y es más frecuente que en otras causas de MR primaria

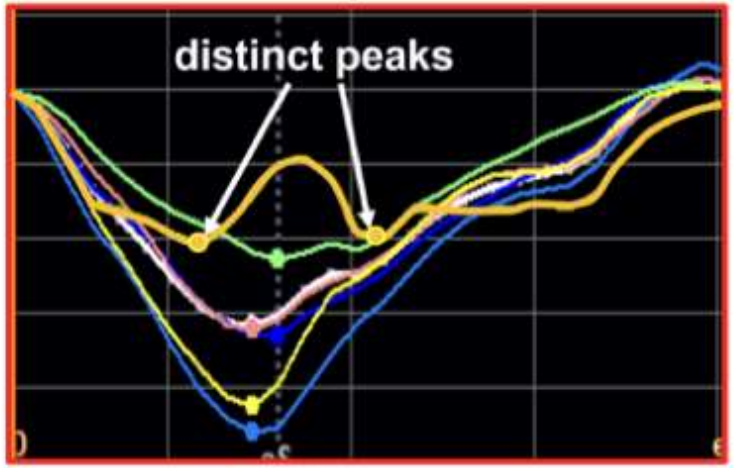


MVP potentially provoques mechanical stress on basal wall adjacent to papillary muscle, wich relates to fibrosis and abnormal myocardial deformation.

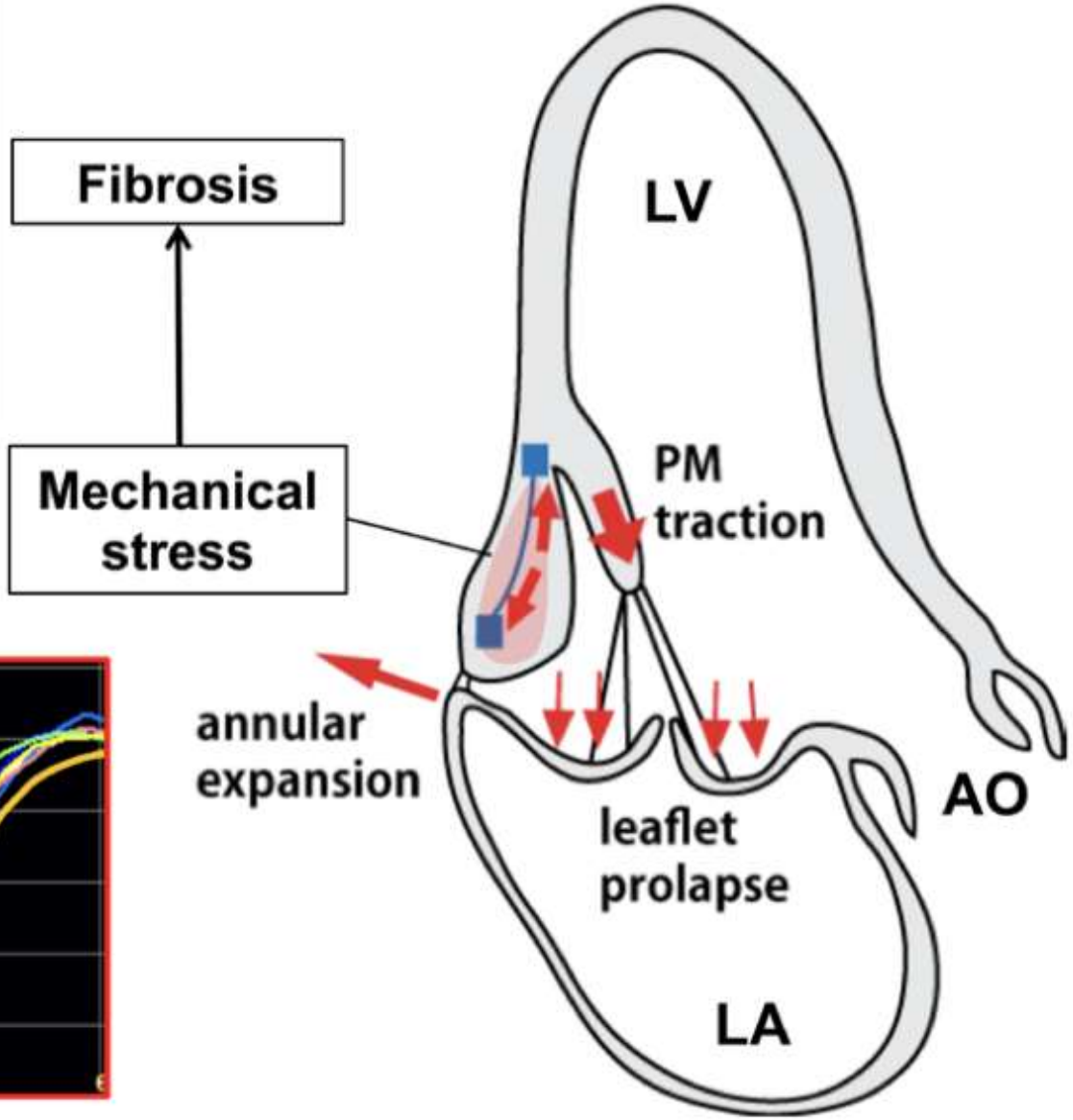
LGE



Double-peak strain pattern



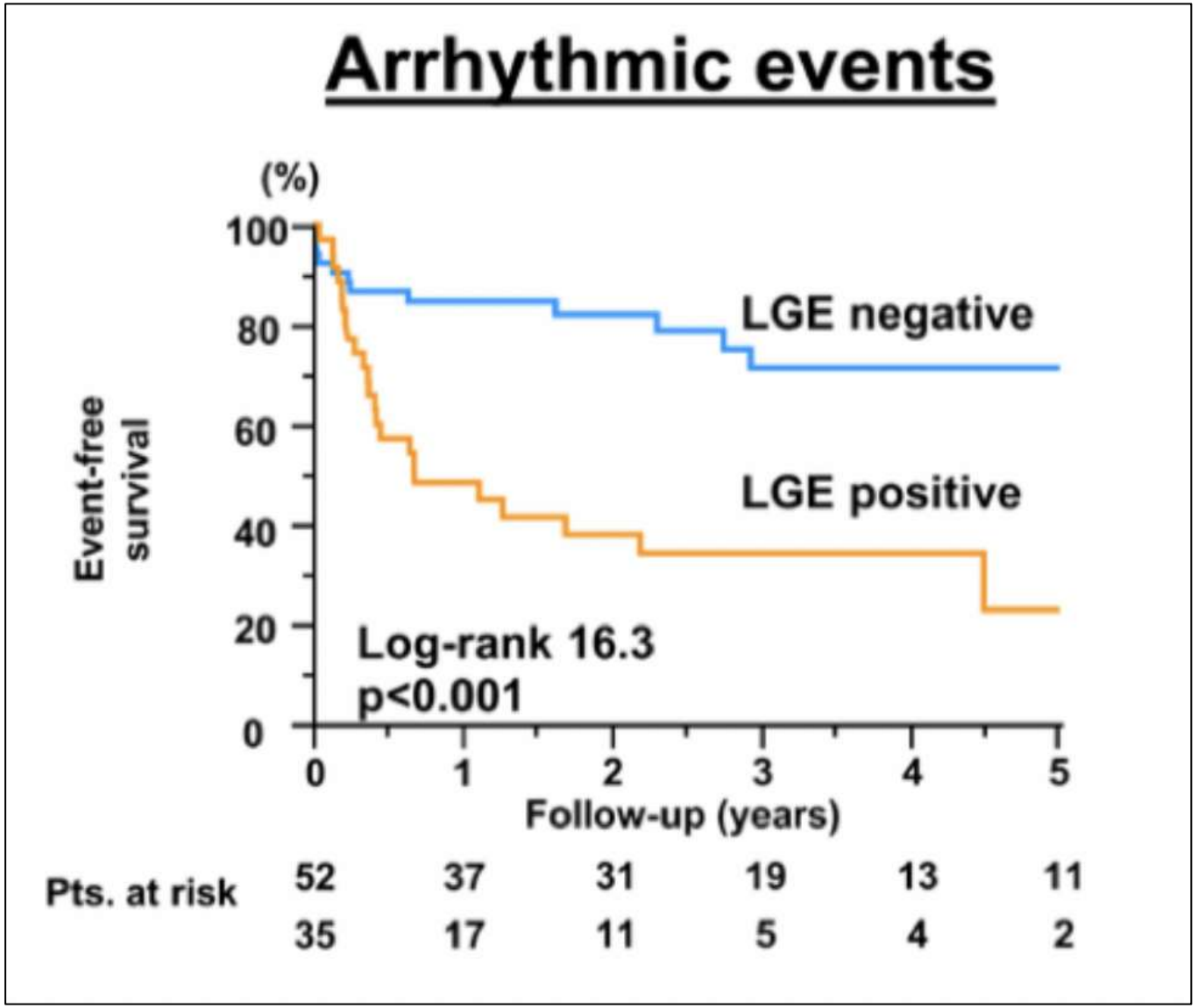
Potential mechanism of mechanical stress



4. LGE en MVP está asociado a peor pronóstico (eventos arrítmicos)

LGE + was associated with worse 4-year cardiovascular event-free survival (49% in LGE + vs 73% in LGE negative)

Primary end-point: cardiac death, heart failure, new onset of AF, arterial embolism, and life-threatening ventricular arrhthmia



Circ Cardiovasc Imaging, 2023

Circulation

ORIGINAL RESEARCH ARTICLE

Replacement Myocardial Fibrosis in Patients With Mitral Valve Prolapse

Relation to Mitral Regurgitation, Ventricular Remodeling, and Arrhythmia

Study of 400 patients with MVP (trace to severe MR).

In trace-mild MR, despite the absence of significant volumen overload, abnormal LV dilatation was observed in 16% of patients and ventricular arrhytmia in 25%.

Circulation, 2021

Table 4. Association of Replacement Myocardial Fibrosis With Cardiovascular Events in Univariable and Multivariable Stepwise Analyses With Either Dichotomous Variables (Model 1) or Continuous Variables (Model 2) Apart From LGE+ Expressed as a Binary Variable

Parameters	Chi²	Hazard ratio (95% CI)	*P* value
Univariable analysis			
LGE+	15	3.3 (1.7–5.5)	<0.0001
MR grade	46		
Trace-mild MR (reference)		–	<0.0001
Moderate MR		3.7 (1.3–10.3)	0.014
Severe MR		15.9 (5.8–43.7)	<0.0001
Regurgitant volume, per mL	41	1.03 (1.02–1.04)	<0.0001
Left atrium volume index, per mL/m²	42	1.03 (1.02–1.04)	<0.0001
Multivariable model 1*	56		
Trace-mild MR (reference)		–	<0.0001
Moderate MR		3.5 (1.3–10.0)	0.017
Severe MR		14.1 (5.1–39.2)	<0.0001
LGE+		2.6 (1.3–4.9)	0.004
Multivariable model 2†	51		
Regurgitant volume, per mL		1.03 (1.02–1.04)	<0.0001
LGE+		2.6 (1.4–4.9)	0.002

5. Disyunción anillo mitral (MAD)

- Distancia que se mide de la unión de la valva mitral a la pared auricular izquierda al borde superior del VI en final de sístole.
- Puede asociarse o no a MR.
- Se ha asociado con MVP y arritmias ventriculares.
- CMR es superior al ECHO en detección (especialmente si MAD <3mm).

5. Disyunción anillo mitral (MAD)

Prevalencia de MAD
16-71% (variante normal?)

<u>Factor independiente de SCD y arritmias ventriculares, especialmente si:</u>

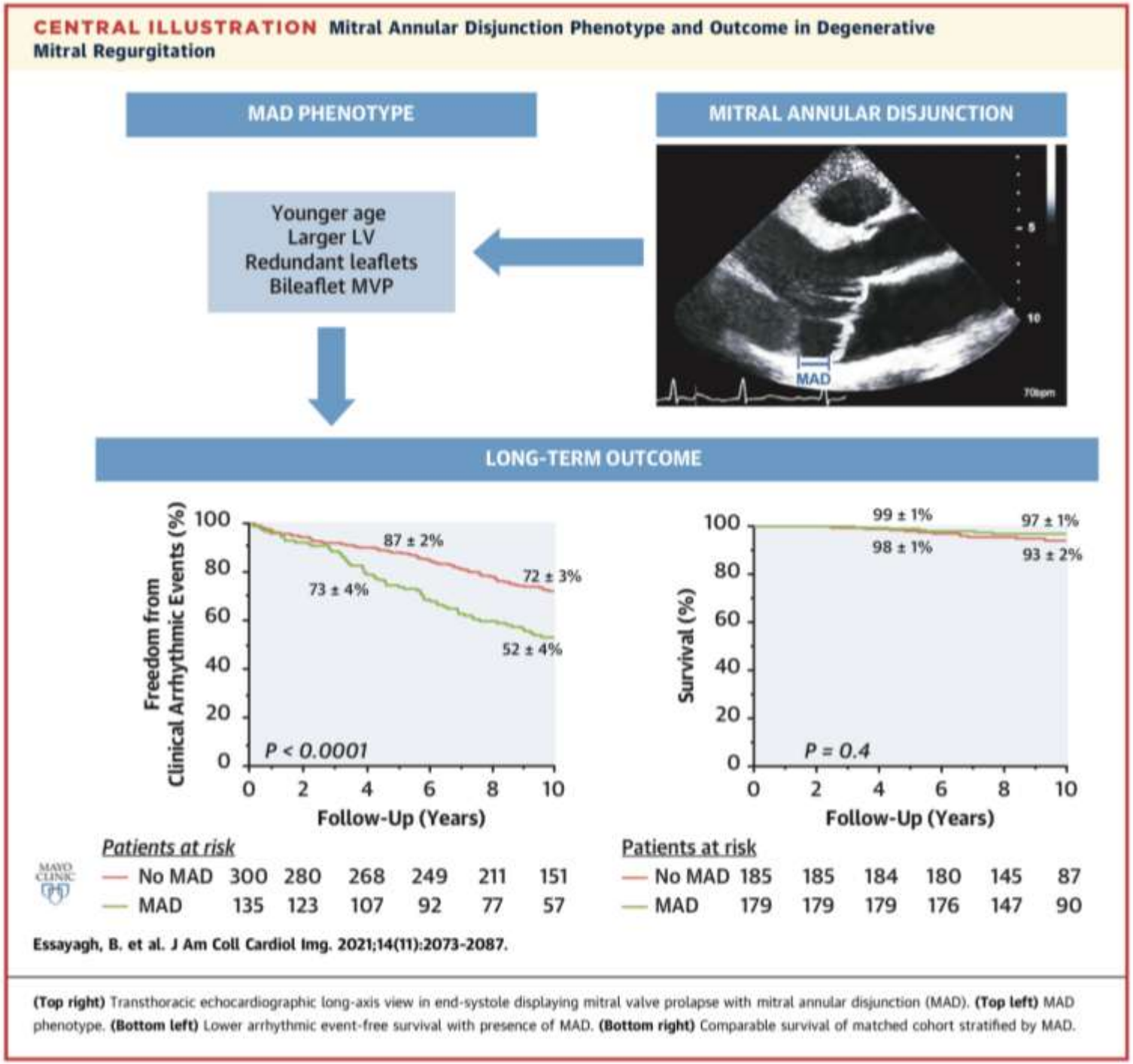
-MAD >8.5mm

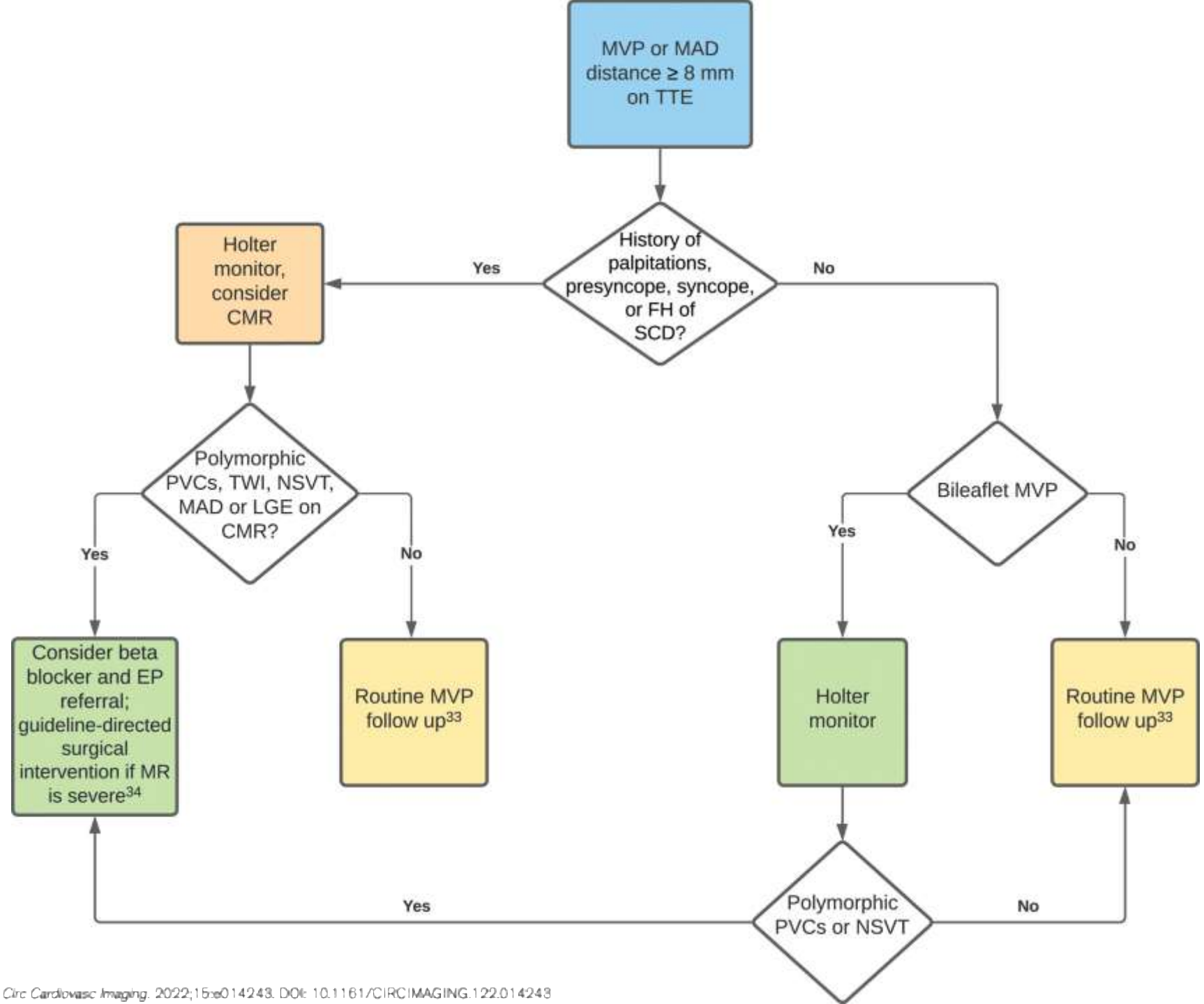
-MAD en pared inferolateral.

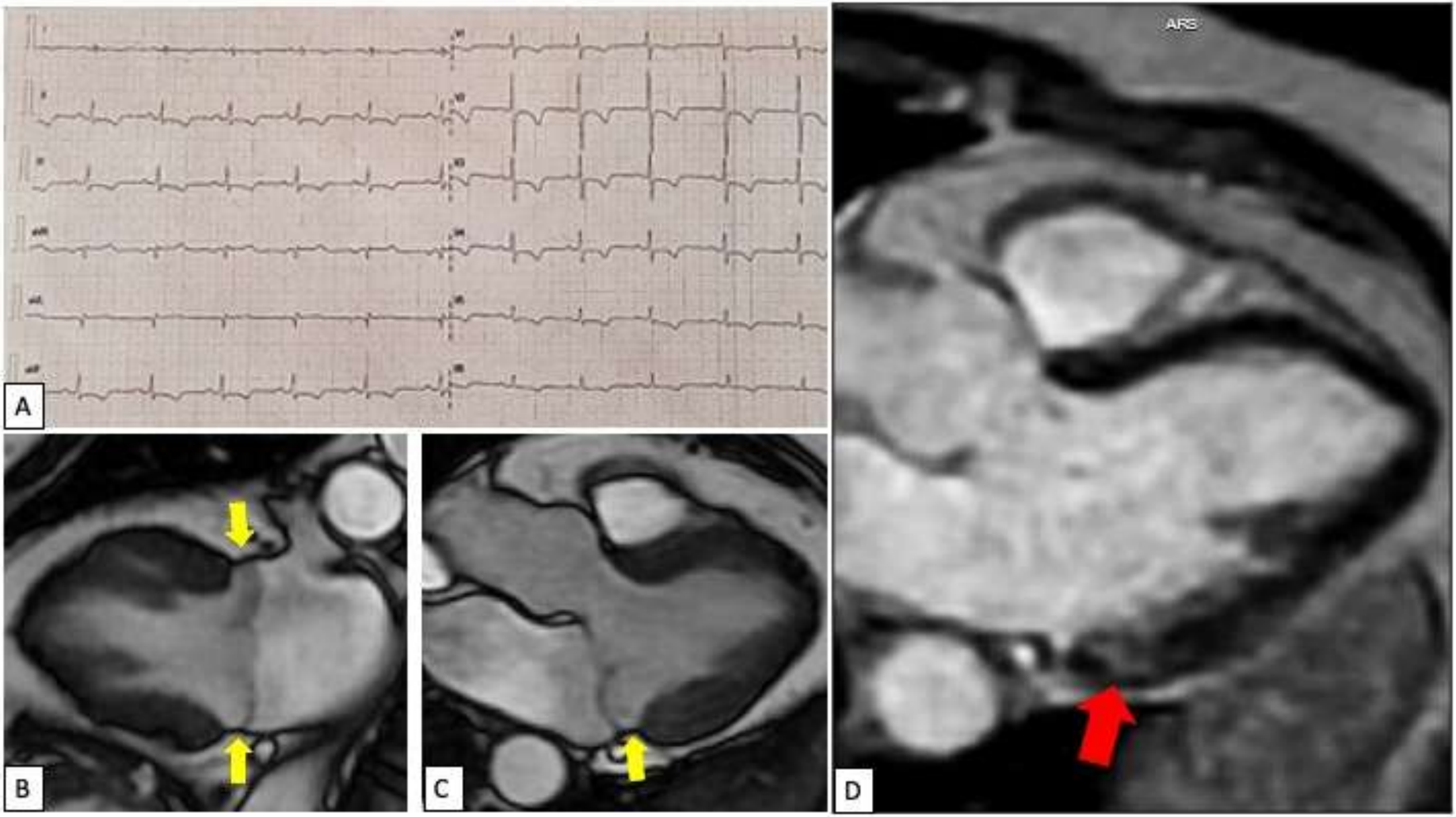
-Asociada con MVP de ambas valvas.

5. Mitral Annulus Disjunction (MAD) + Mitral Valve Prolapse (not a good association)

Presence of MAD in MVP: 31%




MVP or MAD distance ≥ 8 mm on TTE
History of palpitations, presyncope, syncope, or FH of SCD?
Yes
No
Holter monitor, consider CMR
Polymorphic PVCs, TWI, NSVT, MAD or LGE on CMR?
Yes
No
Consider beta blocker and EP referral; guideline-directed surgical intervention if MR is severe[34]
Routine MVP follow up[33]
Bileaflet MVP
Yes
No
Holter monitor
Routine MVP follow up[33]
Polymorphic PVCs or NSVT
Yes
No


A
B
C
D

XIII CONGRESO INTERNACIONAL DE CARDIOLOGIA

CARDIOLOGIA INTERVENCIONISTA - LII JORNADA ACCI-SOLACI

DE LA PREVENCIÓN A LA INTERVENCIÓN

ASOCAR
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ASOCAR
Capítulo de Enfermería

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JORNADAS SOLACI