Stratificazione del rischio nelle cardiomiopatie (dilatativa, ipertrofica e displasia aritmogena) mediante RMN

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Stratificazione del rischio nelle cardiomiopatie

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OUTLINE

1) Sudden cardiac death epidemiology
2) When CMR is indicated in pts with arrhythmic disorder
3) … in the setting of dilated cardiomyopathy
4) … in the setting of hypertrophic cardiomyopathy
5) … in the setting of ACM

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… in the setting of dilated cardiomyopathy

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PRACTICE GUIDELINE

2012 ACCF/AHA/HRS Focused Update Incorporated Into the ACCF/AHA/HRS 2008 Guidelines for Device-Based Therapy of Cardiac Rhythm Abnormalities

CLASS I

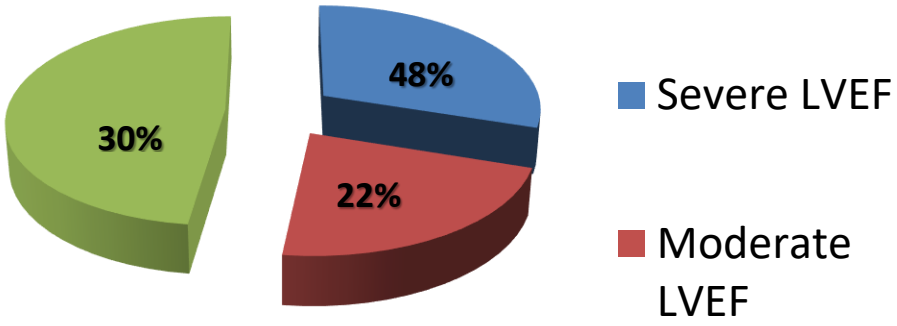
4. ICD therapy is indicated in patients with LVEF less than or equal to 35% due to prior MI who are at least 40 days post-MI and are in NYHA functional Class II or III. (*Level of Evidence: A*) (16,333)
5. ICD therapy is indicated in patients with nonischemic DCM who have an LVEF less than or equal to 35% and who are in NYHA functional Class II or III. (*Level of Evidence: B*) (16,333,369,379)
6. ICD therapy is indicated in patients with LV dysfunction due to prior MI who are at least 40 days post-MI, have an LVEF less than or equal to 30%, and are in NYHA functional Class I. (*Level of Evidence: A*) (16,332)
7. ICD therapy is indicated in patients with nonsustained VT due to prior MI, LVEF less than or equal to 40%, and inducible VF or sustained VT at electrophysiological study. (*Level of Evidence: B*) (16,327,329)

CLASS IIb

1. ICD therapy may be considered in patients with nonischemic heart disease who have an LVEF of less than or equal to 35% and who are in NYHA functional Class I. (*Level of Evidence: C*)

… in the setting of dilated cardiomyopathy

Distribution of SCD based on LVEF in in Multnomah County, Oregon (population 660,486; 2002 to 2004) prospectively ascertained in the ongoing Oregon Sudden Unexpected Death Study



KEY POINT: *"On the other hand, several patients who had aborted SCD did not meet LVEF cut-off values for ICD implantation eligibility*

Table 2. Clinical Characteristics of SCD Cases That Underwent Evaluation of LV Function

	Reduced EF			
	Severe (n = 36)	Mild/Moderate (n = 27)	Normal EF (n = 58)	p Value*
Age (yrs)	74 ± 11	73 ± 9.1	66 ± 15	<0.01
Female	9 (25%)	8 (30%)	27 (47%)	0.03
Attempted resuscitation	23 (64%)	19 (70%)	38 (66%)	1
CAD	27 (75%)	24 (89%)	29 (50%)	<0.01
Prior SCD	2 (6%)	1 (4%)	3 (5%)	1
DM	11 (31%)	9 (33%)	19 (33%)	1
Hypertension	25 (69%)	19 (70%)	35 (60%)	0.27
Hyperlipidemia	21 (58%)	15 (56%)	23 (40%)	0.06
Seizure disorder	0	0	8 (14%)	<0.01
Prior CVA	4 (11%)	5 (19%)	9 (16%)	0.85
Sleep apnea	4 (11%)	3 (11%)	6 (10%)	0.89

*p value for difference between any reduction in EF and normal EF.

CAD = obstructive coronary artery disease; CVA = cerebrovascular accident; DM = diabetes mellitus; EF = ejection fraction; LV = left ventricular; SCD = sudden cardiac death.

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… in the setting of non ischemic cardiomyopathy

… in the setting of non ischemic cardiomyopathy

Table 2 Eligibility for cardiac device therapy according to imaging modality

	CMR EF>35 %	CMR EF≤35 %	Total
Echo EF>35 %	14 (9 %)	33 (22 %)	47 (31 %)
Echo EF≤35 %	9 (6 %)	96 (63 %)	105 (69 %)
Total	23 (15 %)	129 (85 %)	152 (100 %)

EF ejection fraction, *CMR* cardiac magnetic resonance imaging

KEY POINT : *"Up to 1/5 of patients with 2D TTE LVEF could be reclassified by CMR as having lower LVEF*

… in the setting of non ischemic cardiomyopathy

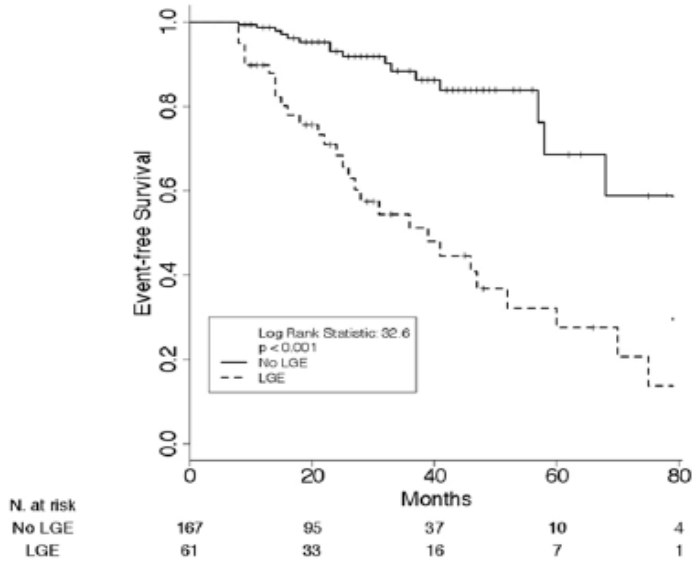


Figure 2. Kaplan–Meier curves for composite end point. LGE indicates late gadolinium enhancement.

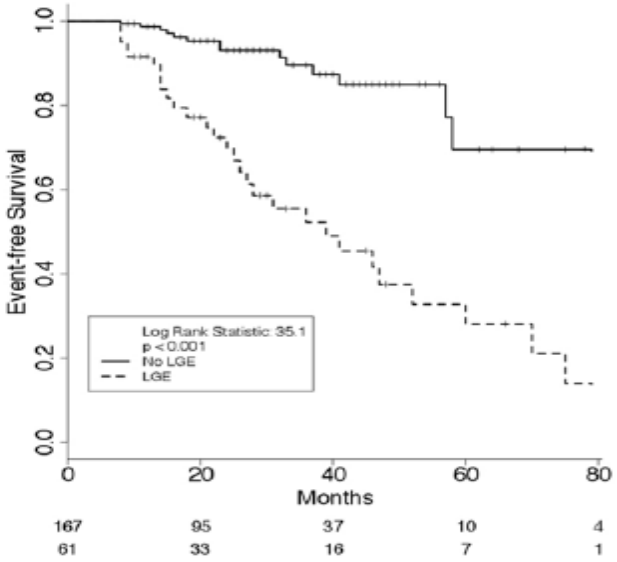


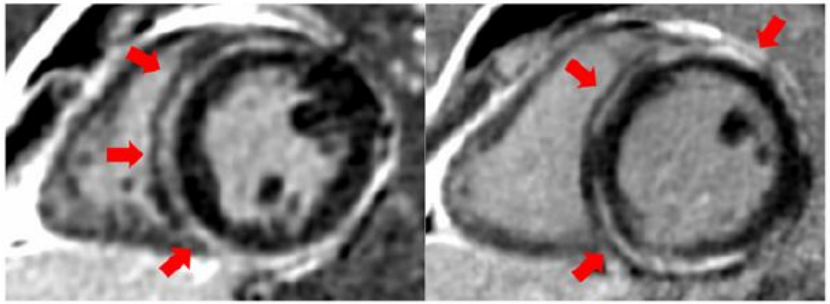
Figure 3. Kaplan–Meier curves for the development of congestive heart failure. LGE indicates late gadolinium enhancement.

KEY POINT: *"LGE is an independent predictor of sudden cardiac death and congestive heart failure in DCM beyond the LVEF"*

Masci PG, Pontone G Circulation CVI 2015

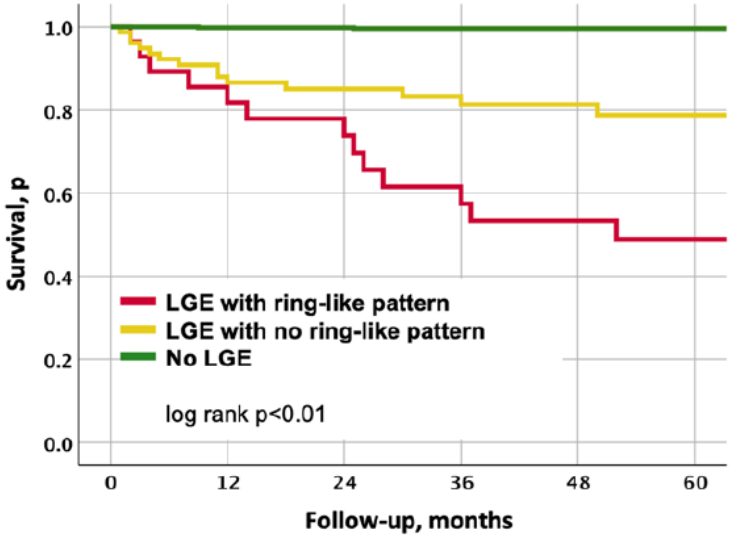
… in the setting of non ischemic cardiomyopathy

A **Example of 2 patients with ring-like scar pattern**



A ringlike pattern of LV scar was defined as LV subepicardial/ midmyocardial LGE involving at least 3 contiguous segments in the same short-axis slice.

Survival free from the composite endpoint according to presence and phenotype of LGE



Number at risk

	28	22	18	14	12	10
	78	61	54	42	32	28
	580	542	506	430	368	307

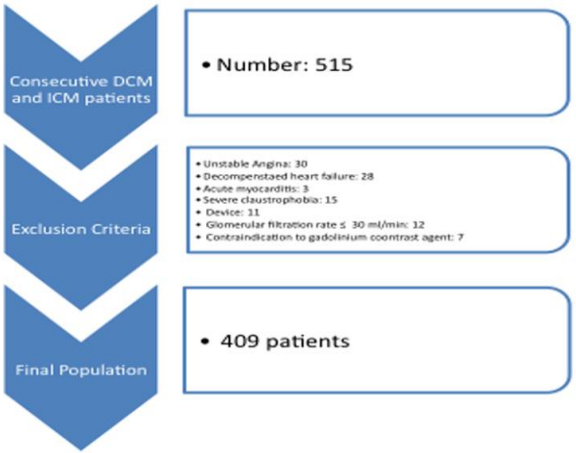
Muser D Circulation 2021

… in the setting of non ischemic cardiomyopathy

Cardiomyopathies

Prognostic Benefit of Cardiac Magnetic Resonance Over Transthoracic Echocardiography for the Assessment of Ischemic and Nonischemic Dilated Cardiomyopathy Patients Referred for the Evaluation of Primary Prevention Implantable Cardioverter–Defibrillator Therapy

Gianluca Pontone, MD, PhD, FESC, FSCCT*; Andrea I. Guaricci, MD, FESC*; Daniele Andreini, MD, PhD, FSCCT, FESC; Anna Solbiati, MD; Marco Guglielmo, MD; Saima Mushtaq, MD; Andrea Baggiano, MD; Virginia Beltrama, MD; Laura Fusini, MSc; Cristina Rota, MD; Chiara Segurini, MD; Edoardo Conte, MD; Paola Gripari, MD; Antonio Dello Russo, MD; Massimo Moltrasio, MD; Fabrizio Tundo, MD; Federico Lombardi, MD; Giuseppe Muscogiuri, MD; Valentina Lorenzoni, MSc; Claudio Tondo, MD, PhD, FESC; Piergiuseppe Agostoni, MD, FESC; Antonio L. Bartorelli, MD, FACC, FESC; Mauro Pepi, MD, FESC



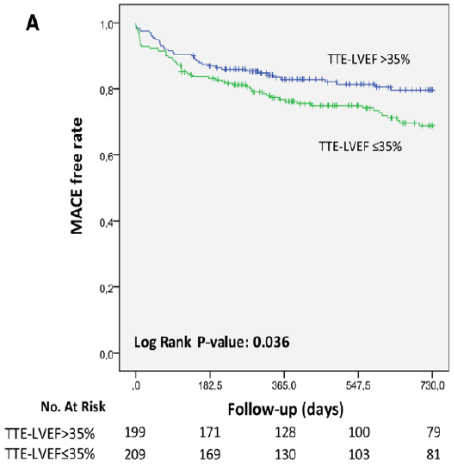
Pontone G CMR for ICD Study Circulation CVI 2016

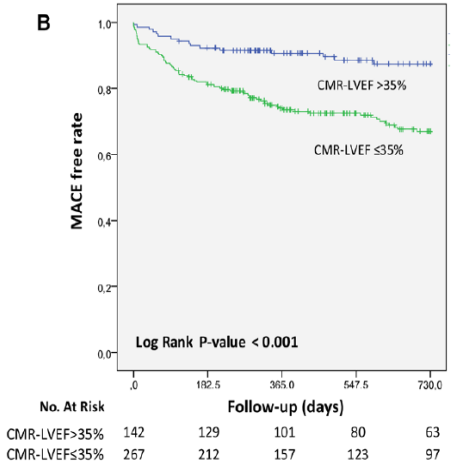
… in the setting of non ischemic cardiomyopathy

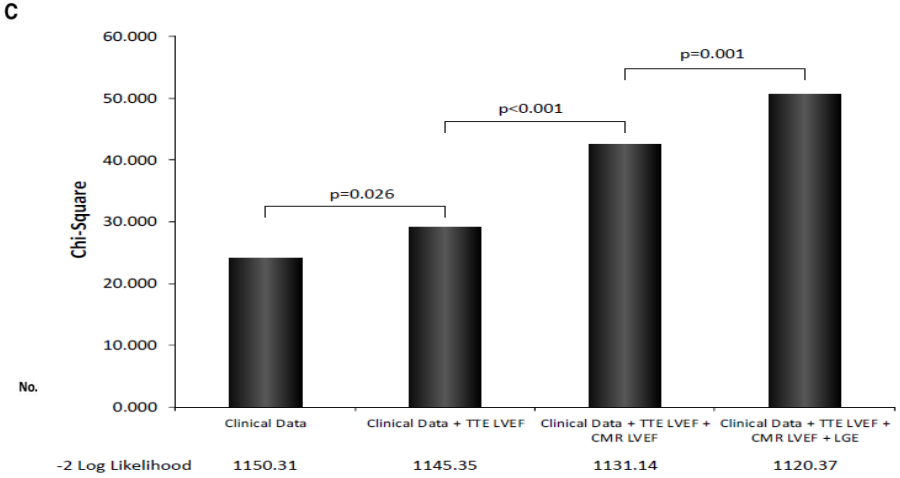
	Univariable Analysis		Multivariable Analysis, Including TTE-LVEF		Multivariable Analysis, Including CMR-LVEF and LGE	
	HR (95% CI)	*P* Value	HR (95% CI)	*P* Value	HR (95% CI)	*P* Value
Demographic characteristics						
TTE						
LVEDVi	1.012 (1.006–1.018)	<0.001	…	…	…	…
LVESVi	1.016 (1.009–1.023)	<0.001	…	…	…	…
LVEF≤35%	1.491 (1.005–2.212)	0.047	1.225 (0.797–1.882)	0.355	…	…
TAPSE	0.952 (0.913–0.993)	0.022	…	…	…	…
PAP	1.023 (1.006–1.041)	0.009	…	…	…	…
CMR						
LVEDVi	1.008 (1.004–1.012)	<0.001	…	…	…	…
LVESVi	1.010 (1.005–1.014)	<0.001	…	…	…	…
LVEF≤35%	2.803 (1.686–4.662)	<0.001	…	…	2.176 (1.250–3.790)	0.006
RVEF	0.981 (0.966–0.995)	0.009	…	…	…	…
LGE, presence	2.250 (1.433–3.534)	<0.001	…	…	2.201 (1.356–3.571)	0.001
LGE, no. of segments	1.086 (1.034–1.140)	0.001	…	…	…	…

Pontone G CMR for ICD Study Circulation CVI 2016

… in the setting of non ischemic cardiomyopathy







Pontone G CMR for ICD Study Circulation CVI 2016

… in the setting of non ischemic cardiomyopathy

ESC European Society of Cardiology
Europace (2020) 00, 1–12 doi:10.1093/europace/euaa401

CLINICAL RESEARCH

CarDiac magnEtic Resonance for prophylactic Implantable-cardioVerter defibrillAtor ThErapy in Non-Ischaemic dilated CardioMyopathy: an international Registry

Table 4 Multivariable predictors of primary and secondary endpoint in the derivation cohort

	Primary endpoint		Secondary endpoint	
	HR (95%CI)	*P*-value	HR (95%CI)	*P*-value
Demographic characteristics				
Age (years) (per 1 year)	1.036 (1.017–1.056)	<0.001	–	–
Male		–	2.131 (1.231–3.690)	0.007
TTE				
LVEF <35%		–	1.336 (0.806–2.215)	0.261
CMR functional evaluation				
LVEDVi > 120.5 mL/m^2		–	3.161 (1.750–5.709)	<0.001
CMR LGE evaluation				
Prevalence of midwall LGE in >3 segments	2.077 (1.211–3.562)	0.008	1.693 (1.084–2.644)	0.021

Derivate Score
2 points
3 points
2 points

CMR, cardiac magnetic resonance; LGE, late gadolinium enhancement; LVEF, left ventricle ejection fraction; LVESVi, left ventricle end-systolic volume index; TTE, transthoracic echocardiography.

Guaricci AI, Pontone G Europace 2021

… in the setting of non ischemic cardiomyopathy

Derivation Cohort

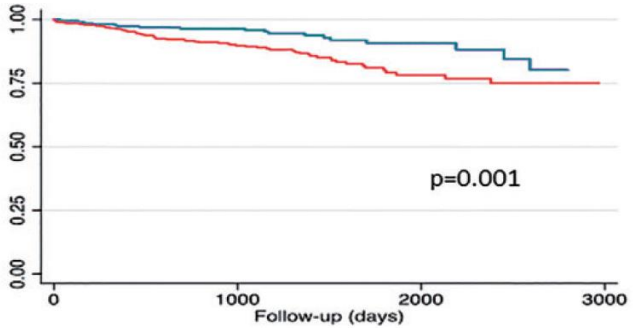
Model-based Composite Risk Score

Model based on TTE LVEF	Low risk	Intermediate risk	High risk
No MAACE			
Low risk	404	54	4
Intermediate risk	94	50	36
High risk	25	56	184
MAACE			
Low risk	22	7	0
Intermediate risk	5	7	10
High risk	1	3	38

Categorical NRI: 17.5% (6.2-28.7%), p=0.002
Continuous NRI: 63.7% (44.7%-82.8%), p<0.001
IDI 4.4% (2.5%-6.3%), p<0.001

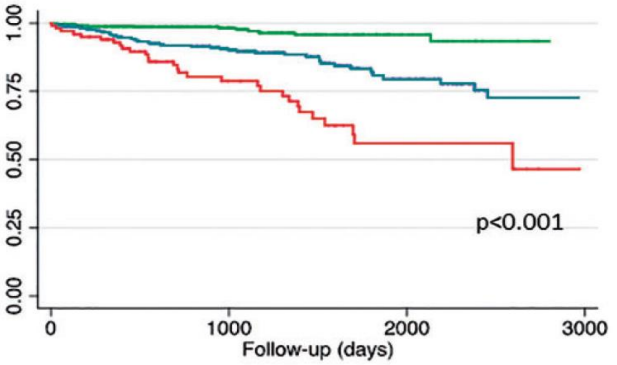
Low risk <0.05; 0.05 ≤ Intermediate risk < 0.1; High risk ≥ 0.1

B



TTE LVEF≥35%	457	185	48	10
TTE LVEF<35%	543	260	66	16

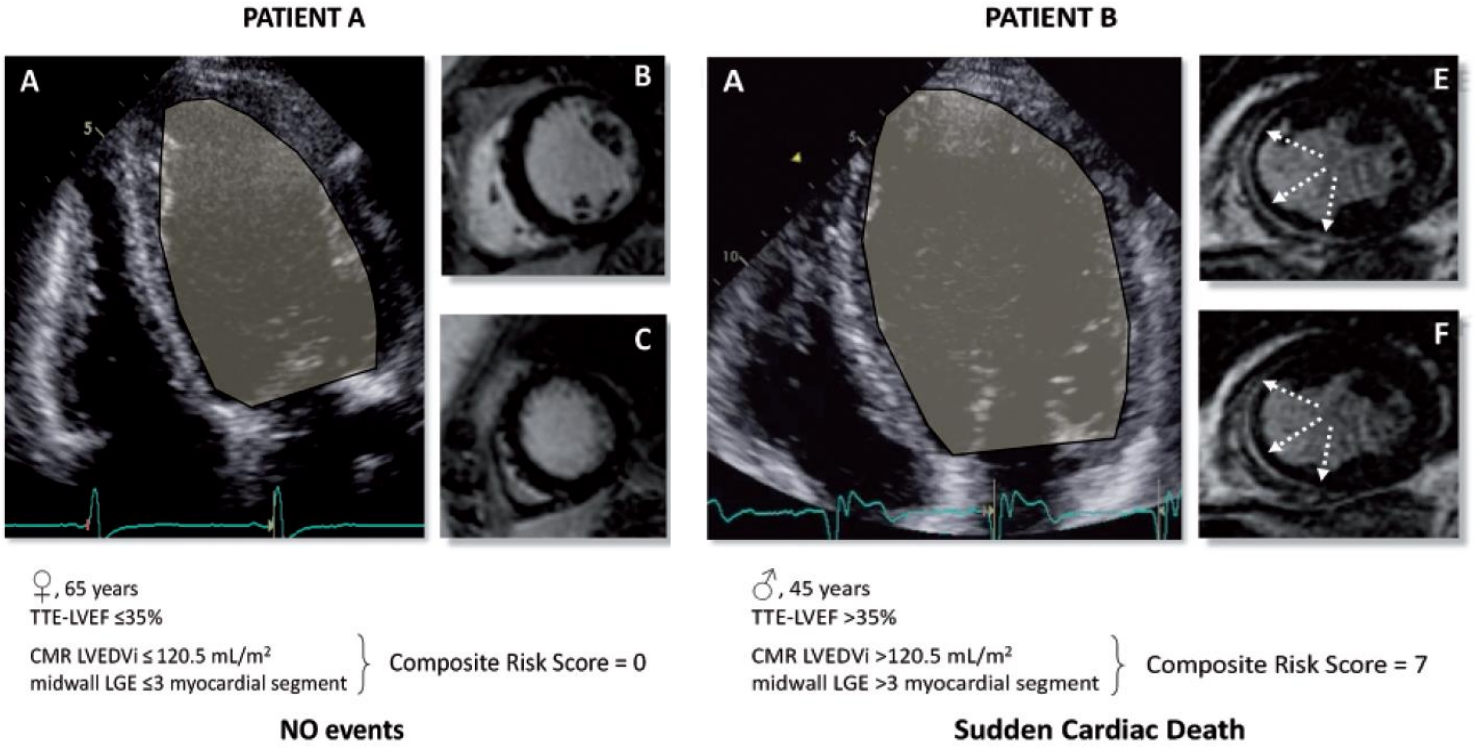
C



Composite Risk Score ≤2	451	205	50	12
2< Composite Risk Score ≤5	447	196	53	14
Composite Risk Score >5	102	46	11	0

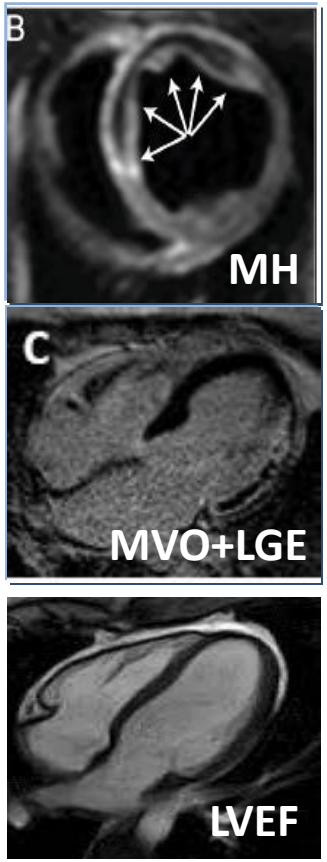
Guaricci AI, Pontone G Europace 2021

… in the setting of non ischemic cardiomyopathy



Guaricci AI, Pontone G Europace 2021 in press

… in the setting of ischemic cardiomyopathy



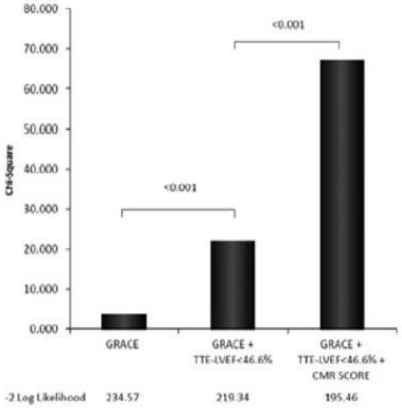
Prognostic Stratification of Patients With ST-Segment–Elevation Myocardial Infarction (PROSPECT)

A Cardiac Magnetic Resonance Study

Gianluca Pontone, MD, PhD;* Andrea I. Guaricci, MD;* Daniele Andreini, MD, PhD; Giovanni Ferro, MD; Marco Guglielmo, MD; Andrea Baggiano, MD; Laura Fusini, MSc; Giuseppe Muscogiuri, MD; ntina Lorenzoni, MSc; Saima Mushtaq, MD; Edoardo Conte, MD; Andrea Annoni, MD; Alberto Formenti, MD; Maria Elisabetta Mancini, MD; Patrizia Carità, MD; assimo Verdecchia, MD; Silvia Pica, MD; Fabio Fazzari, MD; Nicola Cosentino, MD; Giancarlo Marenzi, MD; Mark G. Rabbat, MD; Piergiuseppe Agostoni, MD; Antonio L. Bartorelli, MD; Mauro Pepi, MD; Pier Giorgio Masci, MD

Table 5. Multivariable Predictors of Major Adverse Cardiac Events

	HR (95% CI)	*P* Value
GRACE score*	1.047 (0.988–1.09)	0.119
TTE-LVEF<46.6%	2.247 (0.807–6.258)	0.121
CMR Score*†	1.867 (1.311–2.658)	0.001



Predicted Risk with GRACE and TTE-LVEF<46.6%, %	Predicted Risk with GRACE, TTE-LVEF<46.6% and CMR SCORE, %			
	<10	≥10	Total	Reclassified
Outcome Absent				
<10	131	9	140	6
≥10	24	20	44	55
Outcome Present				
<10	5	4	9	44
≥10	1	14	15	7

	Incidence
Low risk not-reclassified	3.6%
Low risk reclassified-up	31%
High risk reclassifed down	4%
High risk not reclassified	41%

Categorical NRI: 0.206 (0.021, 0.392; p=0.029)
Continuous NRI: 0.931 (0.525, 1.337; p<0.001)
IDI: 0.067 (0.086, 0.274; p<0.001)

Pontone G Circulation CI 2017

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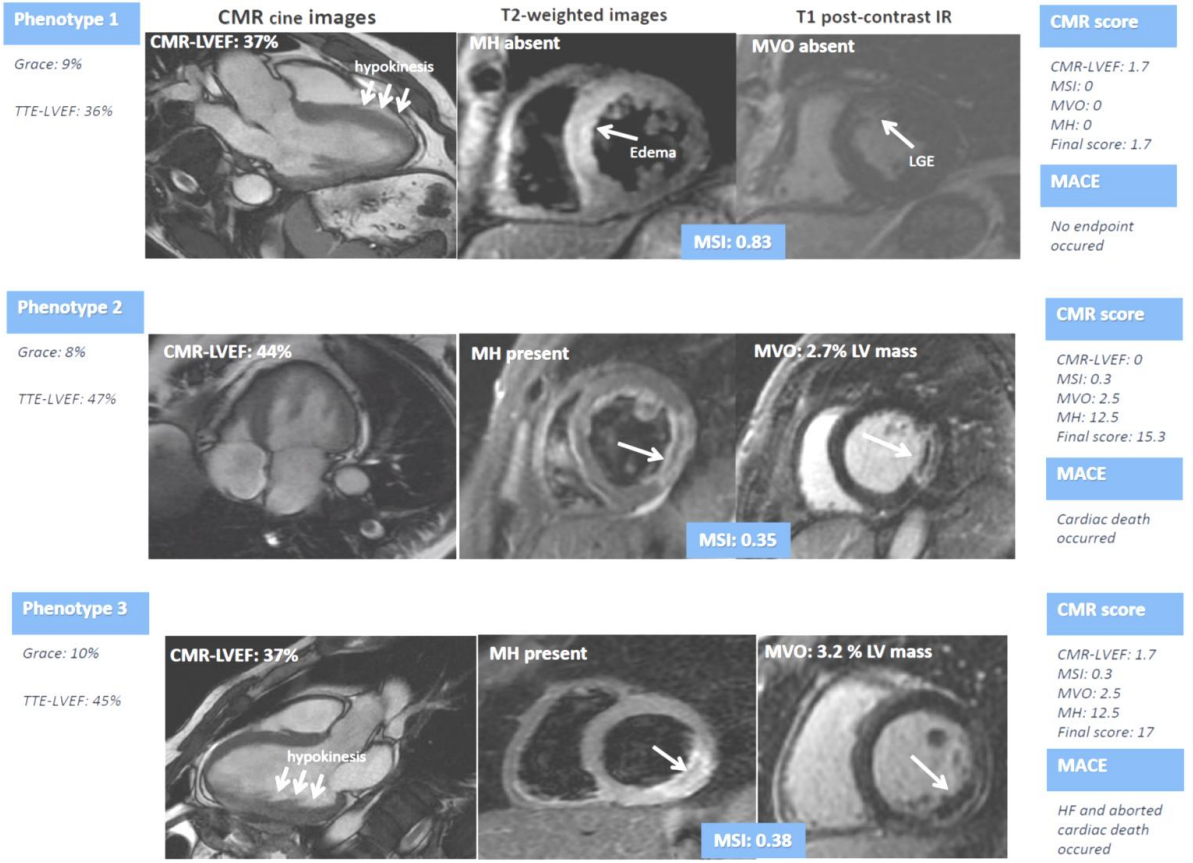
… in the setting of ischemic cardiomyopathy



Incremental value of cardiac magnetic resonance (CMR) score in predicting major adverse cardiac events when compared with models including global registry of acute coronary events (GRACE) score in combination with transthoracic echocardiography (TTE)–left ventricular ejection fraction (LVEF). IDI indicates integrated discrimination improvement; and NRI, net reclassification improvement

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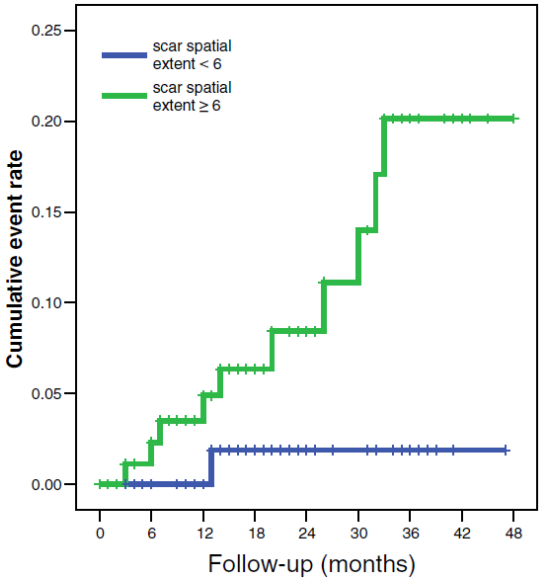
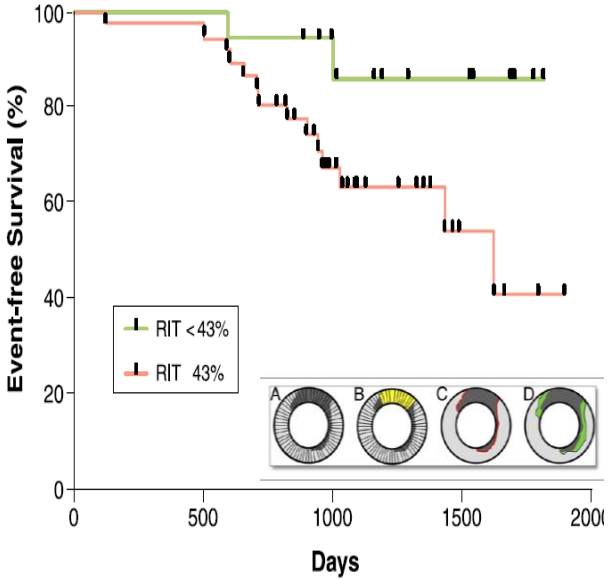
LGE extent



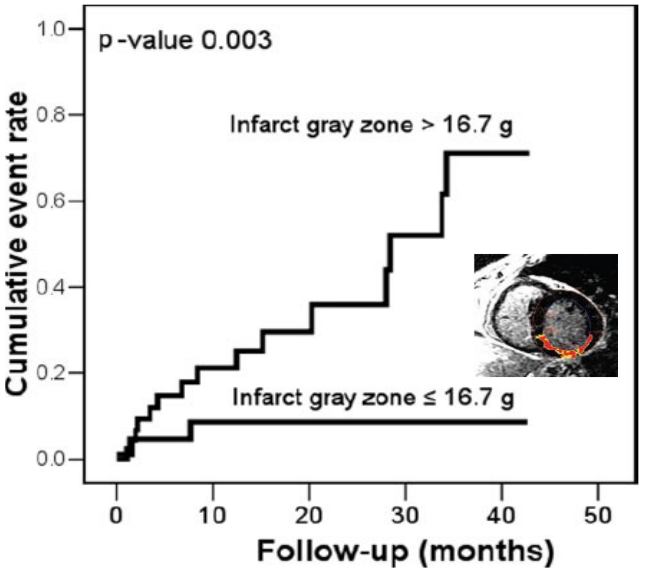
Kelle S JACC 2009

LGE transmurality



Bojè P JACC 2011

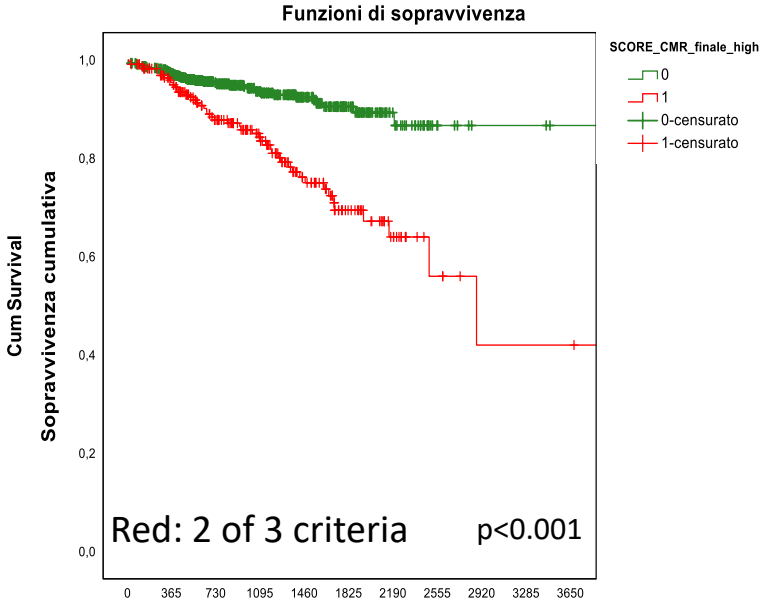
LGE heterogeneity



Roes S Circulation 2009

… in the setting of ischemic cardiomyopathy

CarDiac MagnEtic Resonance for Prophylactic Implantable-CardioVerter DefibrillAtor ThErapy International Study in Ischemic Cardiomyopathy
Short Title: DERIVATE-ICM Study



	Univariate Analysis		Multivariate Analysis	
	HR (95% CI)	p value	HR (95% CI)	p value
LVEDVi > 140 mL/m^2	2.370(1.559-3.603)	<0.001	1.841(1.140-2.974)	0.013
LVEF<21%	2.334(1.535-3.551)	<0.001	1.814(1.151-2.858)	0.010
LV mass/BSA >72 g/m^2	1.558(1.006-2.411)	0.047		0.661
LGE from 75% to 100%	2.930(1.173-7.318)	0.021		0.159
LGE segments > 8	1.759(1.150-2.689)	0.009	1.562(1.012-2.410)	0.044

Model based on Composite CMR Risk Score

Model based on TTE LVEF	Low risk	High risk	% Reclassified
No MAACE			
Low risk	263	23	8
High risk	252	143	64
MAACE			
Low risk	17	4	19
High risk	18	39	32

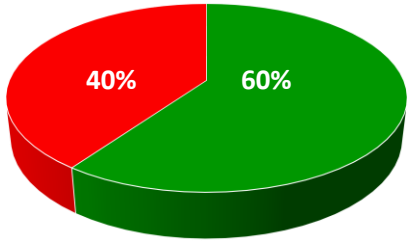
Categorical NRI: 15.7% (3.9-27.5%), p=0.009
Continuous NRI: 44.3% (21.6%-67.0%)

Pontone G, Fusini L … Guaricci AI et al DERIVATE-ICM submitted

… in the setting of ischemic cardiomyopathy

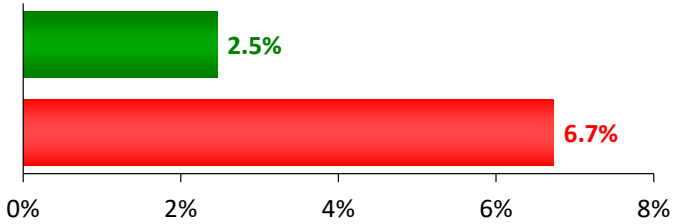
CarDiac MagnEtic Resonance for Prophylactic Implantable-CardioVerter DefibrillAtor ThErapy International Study in Ischemic Cardiomyopathy
Short Title: DERIVATE-ICM Study

TTE-LVEF<35%

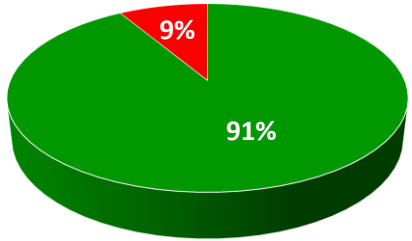


■ CMR Composite Risk Score ≤1 ■ CMR Composite Risk Score ≥ 2

MAACE: event rate per 100 person-year

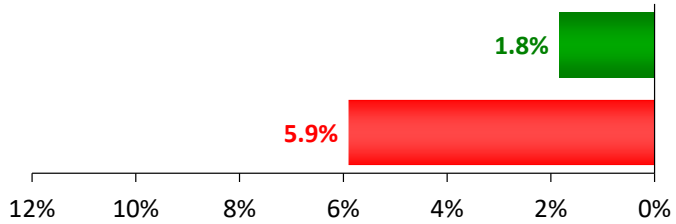


TTE-LVEF≥35%



■ CMR Composite Risk Score ≤1 ■ CMR Composite Risk Score ≥ 2

MAACE: event rate per 100 person-year

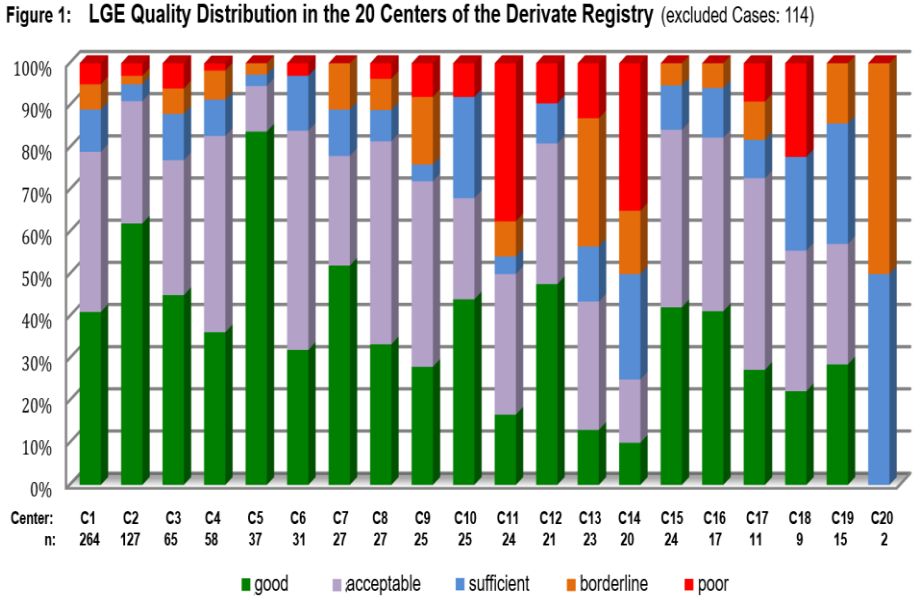


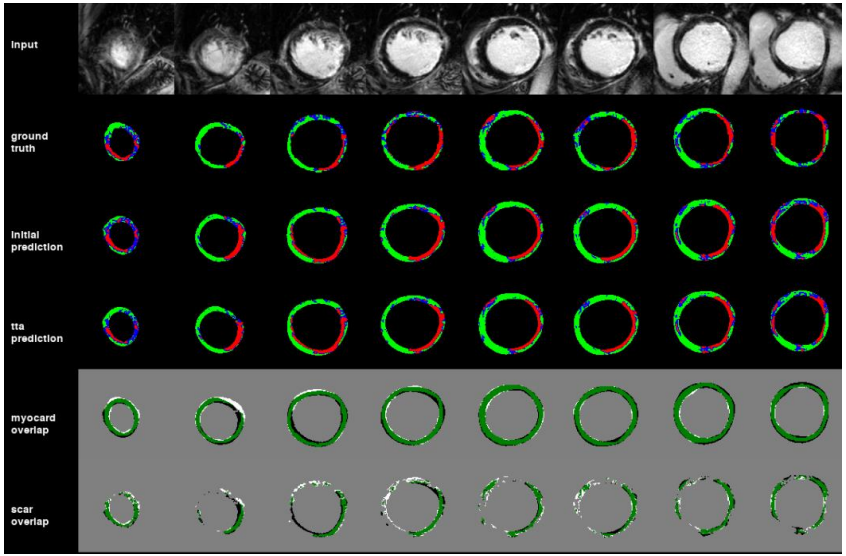
Pontone G, Fusini L … Guaricci AI et al DERIVATE-ICM submitted

… in the setting of ischemic cardiomyopathy

Using machine-learning for fully automatic LGE scar quantification in the large multi-national Derivate Registry

F. Ghanbari, T. Joice, S. Kozerke, ... P-G. Masci, G. Crelier, GL Pontone, J. Schwitter

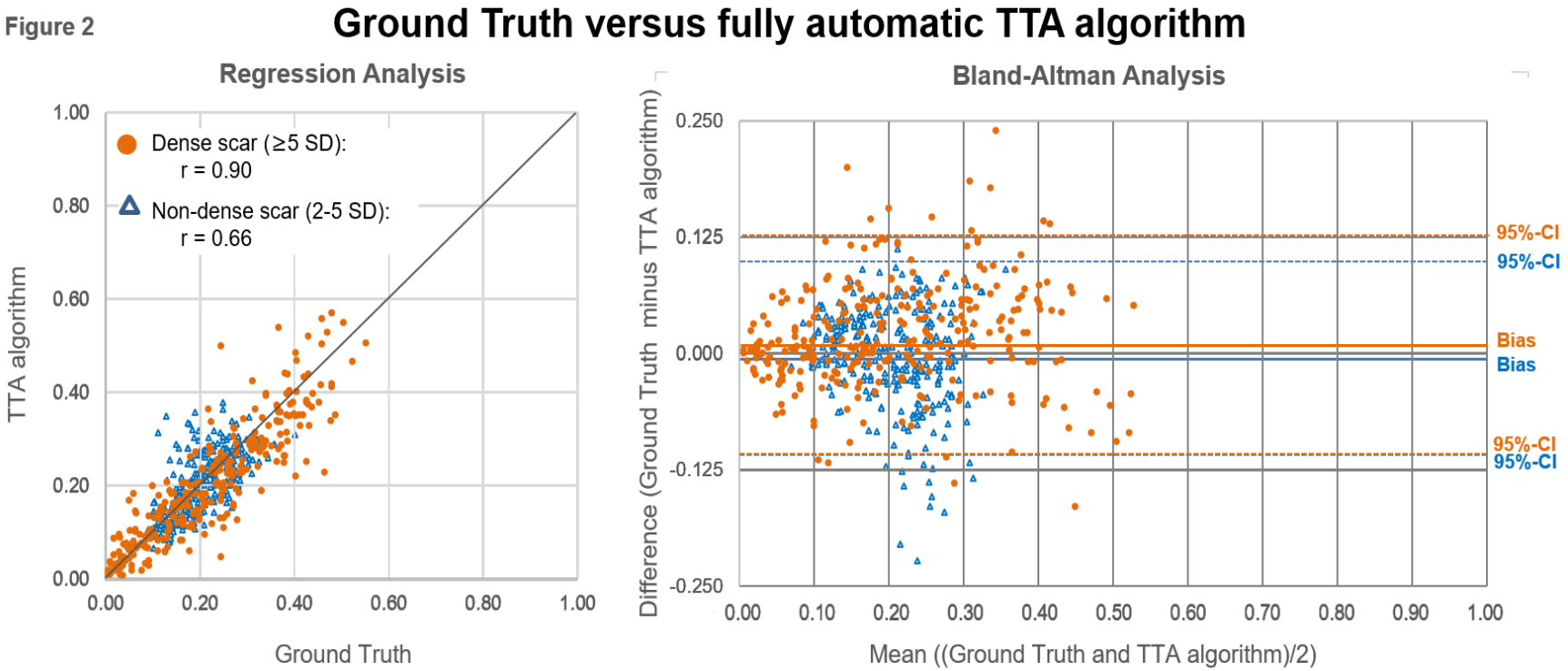




Ghanbari F, … Pontone G, Schwitter J SCMR 2020

… in the setting of ischemic cardiomyopathy

Figure 2



The presented ML-based algorithm can analyse multicenter CMR scar data fully automatically yielding scar mass that correlate with human-generated GT. Such a tool could facilitate the quantification of CMR scar imaging in clinical routine cardiology as it eliminates human observer variability and can handle large data sets.

Ghanbari F, … Pontone G, Schwitter J SCMR 2020

… in the setting of cardiomyopathy

doi:10.1093/eurheartj/ehaa645

The PROFID project

A large European effort towards personalized prediction and prevention of sudden cardiac death after myocardial infarction funded by the European Union

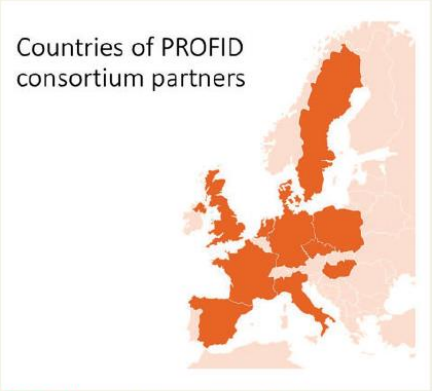


Figure 1 Geographic location of the PROFID consortium partners. The countries where the consortium partners are located are depicted in darker colour.

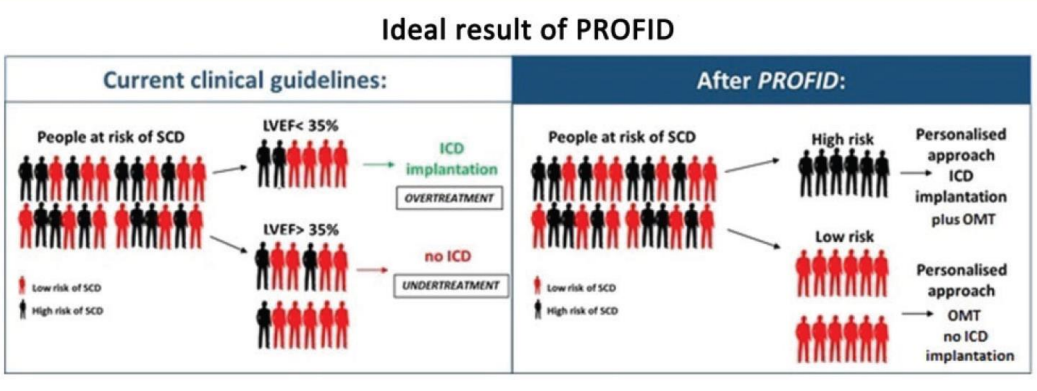


Figure 2 Ideal result of PROFID. On the left, the unsatisfactory current situation of imprecise identification of patients that should receive an implantable cardioverter-defibrillator based solely on the ejection fraction. On the right, the ideal result of the PROFID project: an optimal identification of high-risk patients that can be successfully protected from sudden cardiac death by implantable cardioverter-defibrillator implantation. OMT, optimal medical therapy.

… in the setting of HCM

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… in the setting of HCM

EUROPEAN SOCIETY OF CARDIOLOGY®

HCM Risk-SCD Calculator

Age	50	**Years**	*Age at evaluation*
Maximum LV wall thickness	32	**mm**	*Transthoracic Echocardiographic measurement*
Left atrial size	42	**mm**	*Left atrial diameter determined by M-Mode or 2D echocardiography in the parasternal long axis plane at time of evaluation*
Max LVOT gradient	6	**mmHg**	*The maximum LV outflow gradient determined at rest and with Valsalva provocation (irrespective of concurrent medical treatment) using pulsed and continuous wave Doppler from the apical three and five chamber views. Peak outflow tract gradients should be determined using the modified Bernouilli equation: Gradient= $4V^2$, where V is the peak aortic outflow velocity*
Family History of SCD	◉ No ○ Yes		*History of sudden cardiac death in 1 or more first degree relatives under 40 years of age or SCD in a first degree relative with confirmed HCM at any age (post or ante-mortem diagnosis).*
Non-sustained VT	◉ No ○ Yes		*3 consecutive ventricular beats at a rate of 120 beats per minute and <30s in duration on Holter monitoring (minimum duration 24 hours) at or prior to evaluation.*
Unexplained syncope	○ No ◉ Yes		*History of unexplained syncope at or prior to evaluation.*

Risk of SCD at 5 years (%): 4.01

ESC recommendation: ICD may be considered

Reset

2014 ESC Guidelines on Diagnosis and Management of Hypertrophic Cardiomyopathy (Eur Heart J 2014 – doi:10.1093/eurheartj/ehu284)

O'Mahony C et al Eur Heart J (2014) 35 (30): 2010-2020

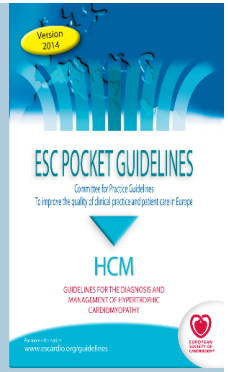
HCM Risk-SCD should not be used in:

- *Paediatric patients (<16 years)*
- *Elite/competitive athletes*
- *HCM associated with metabolic diseases (e.g. Anderson-Fabry disease), and syndromes (e.g. Noonan syndrome).*
- *Patients with a previous history of aborted SCD or sustained ventricular arrhythmia who should be treated with an ICD for secondary prevention.*

Caution should be exercised when assessing the SCD in patients following invasive reduction in left ventricular outflow tract obstruction with myectomy or alcohol septal ablation.

Pending further studies, HCM-RISK should be used cautiously in patients with a maximum left ventricular wall thickness ≥35 mm.

HCM = hypertrophic cardiomyopathy; LV = left ventricular; LVOT = left ventricular outflow tract; NSVT = non-sustained ventricular tachycardia; SCD = sudden cardiac death; VT = ventricular tachycardia



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… in the setting of HCM

The New England Journal of Medicine

MAGNITUDE OF LEFT VENTRICULAR HYPERTROPHY AND RISK OF SUDDEN DEATH IN HYPERTROPHIC CARDIOMYOPATHY

PAOLO SPIRITO, M.D., PIETRO BELLONE, M.D., KEVIN M. HARRIS, M.D., PAOLA BERNABÒ, M.D., PAOLO BRUZZI, M.D., PH.D., AND BARRY J. MARON, M.D.

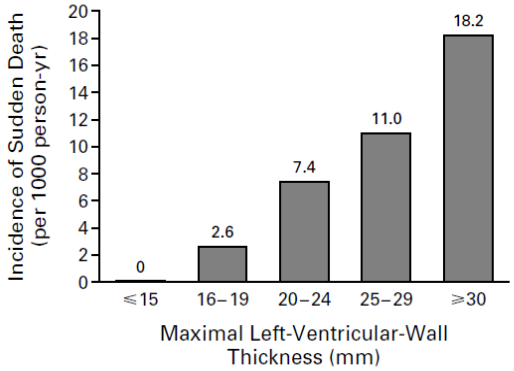


Figure 1. Relation between Maximal Left-Ventricular-Wall Thickness and the Risk of Sudden Death in 480 Patients with Hypertrophic Cardiomyopathy.

The incidence of sudden death increased progressively and in direct relation to maximal wall thickness (P=0.001 by the chi-square test for trend).

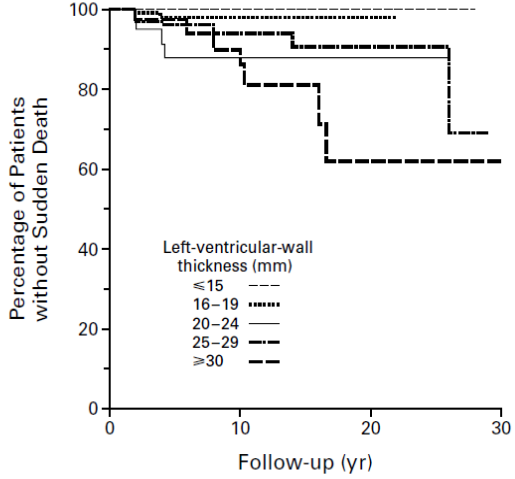
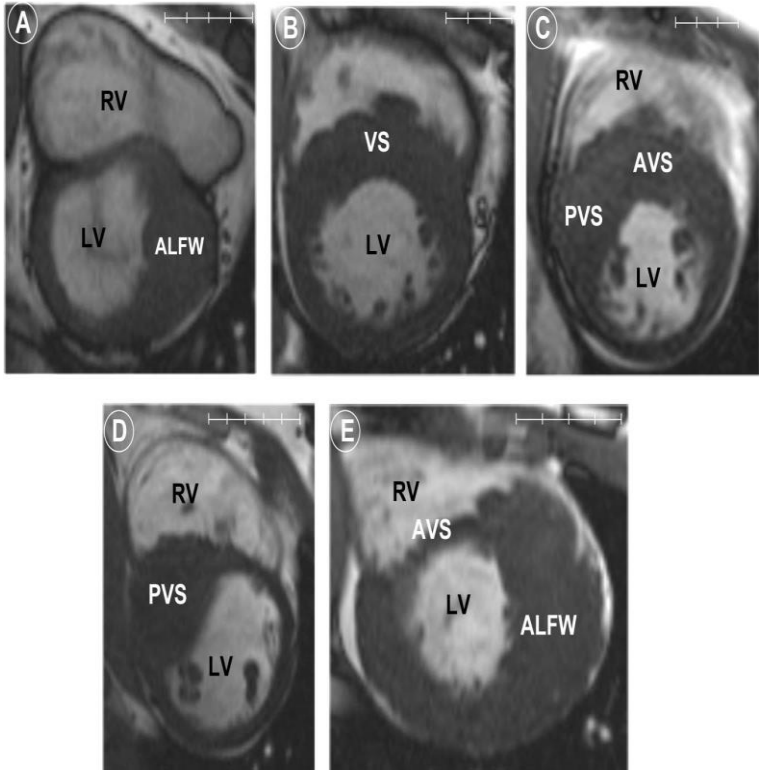
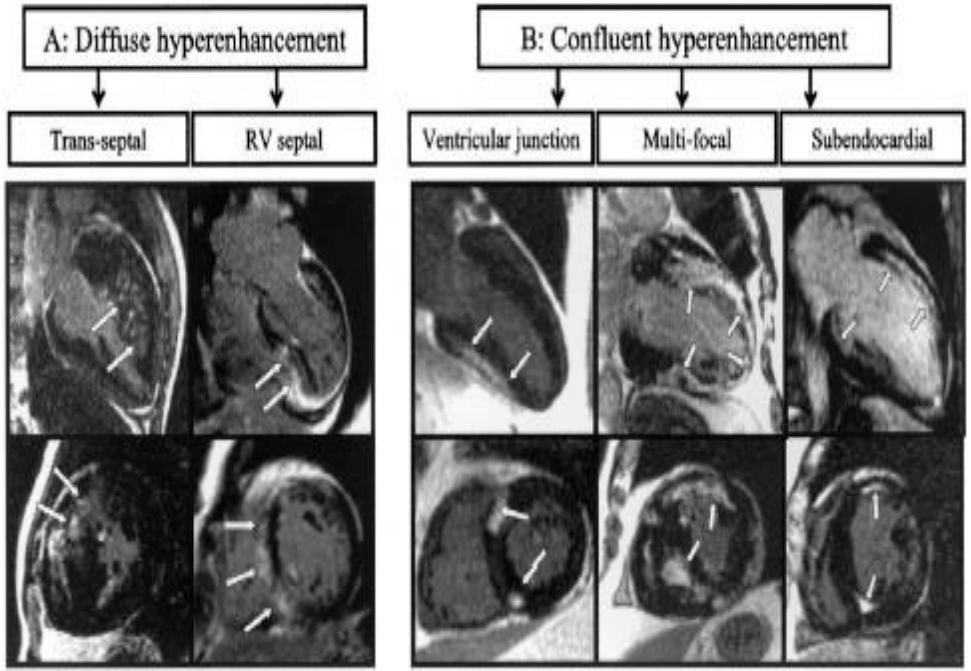


Figure 2. Kaplan–Meier Estimates of the Proportions of Patients without Sudden Death among the 480 Patients with Hypertrophic Cardiomyopathy, According to the Magnitude of Left Ventricular Hypertrophy.



… in the setting of HCM

DE è stato evidenziato nel 79% dei pazienti affetti da HCM



Moon J, JACC 2003

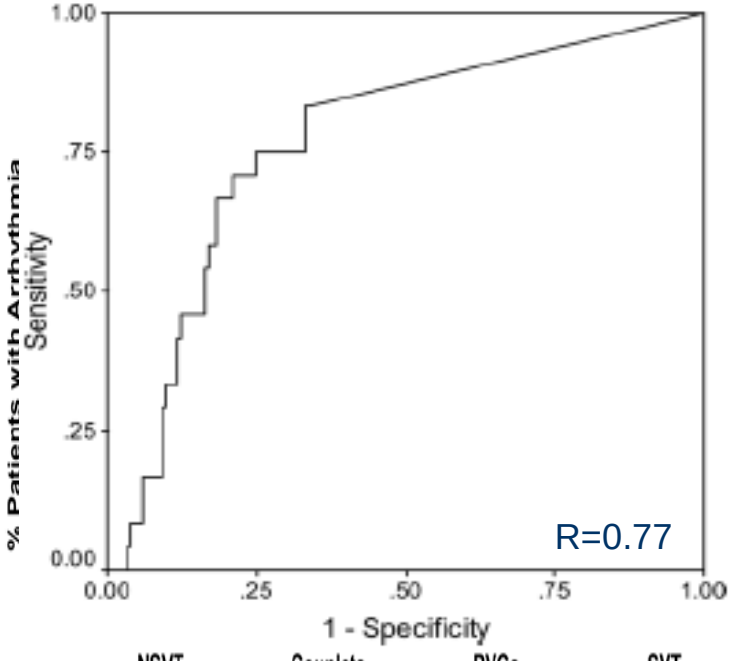
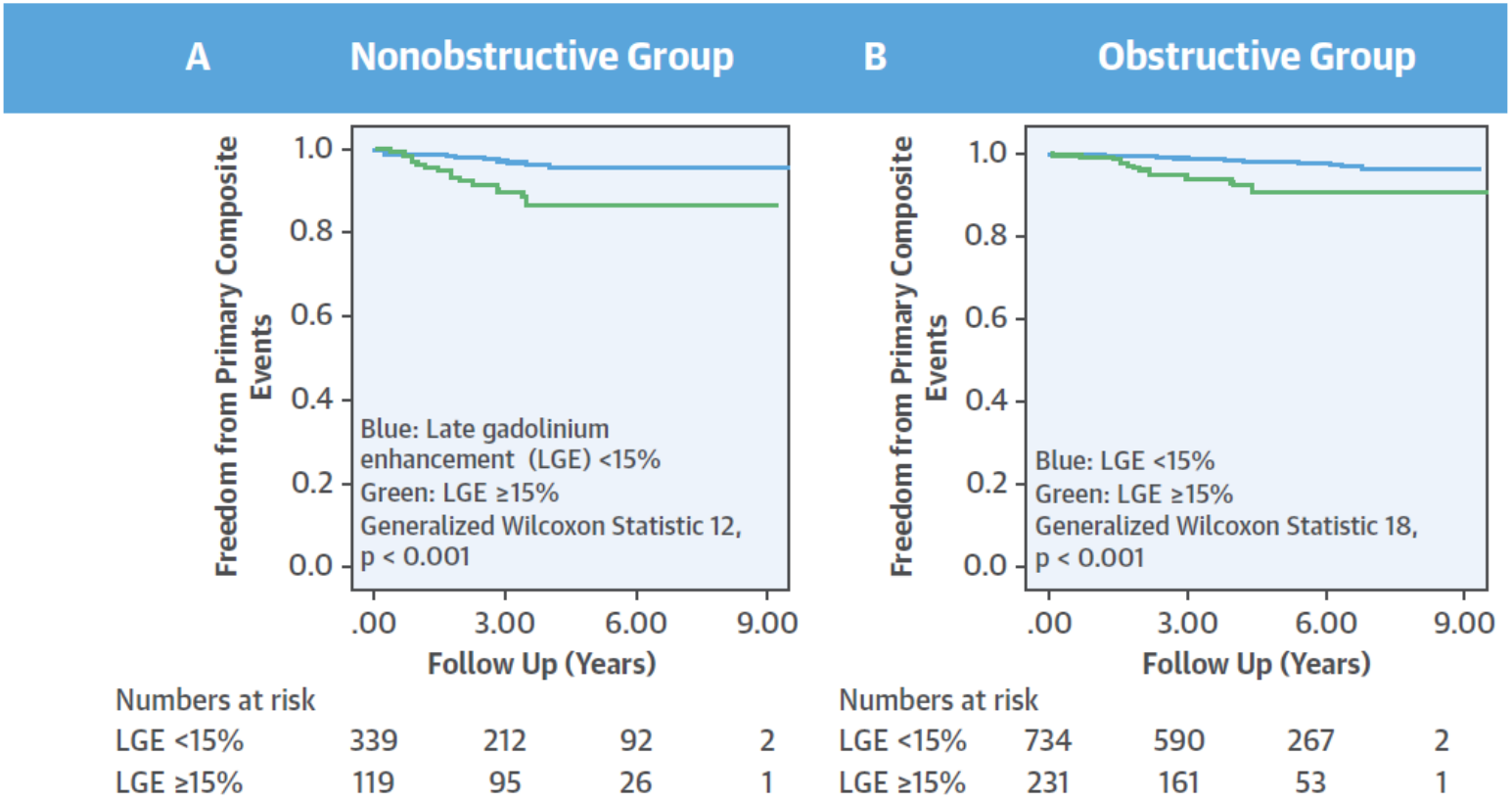


Figure 2 ROC Curve to Assess Ability of DE to Discriminate Patients With and Without NSVT on Holter ECG

Adabag A, JACC 2008

… in the setting of HCM



Mentias, A. et al. J Am Coll Cardiol. 2018;72(8):857–70.

… in the setting of HCM

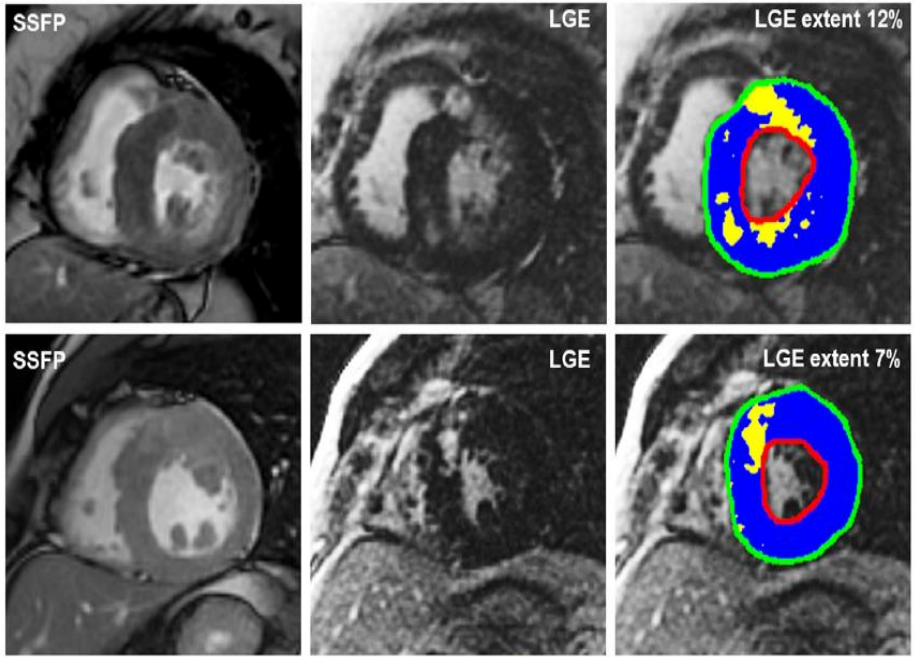


Figure 1. Examples of 2 patients with hypertrophic cardiomyopathy with LGE extent ≥10% and <10% (respectively in *upper* and *lower panels*). Patient of *upper panels* had a HC-risk score of 2.7% but presented an episode of sustained ventricular tachycardia. Patient of *lower panel* had a risk score of 4.8% but without cardiac events during the follow-up.

Prognostic Role of Late Gadolinium Enhancement in Patients With Hypertrophic Cardiomyopathy and Low-to-Intermediate Sudden Cardiac Death Risk Score

Giancarlo Todiere, MD, PhD[a], Cinzia Nugara, MD[b,c], Giovanni Gentile, MD[d], Francesco Negri, MD[e], Francesco Bianco, MD, MD[b,f], Calogero Falletta, MD[d], Giuseppina Novo, MD, PhD[b], Gianluca Di Bella, MD, PhD[g], Raffaele De Caterina, MD, PhD[f], Elisabetta Zachara, MD[h], Federica Re, MD[h], Francesco Clemenza, MD[d], Gianfranco Sinagra, MD, PhD[e], Michele Emdin, MD, PhD[a,i], and Giovanni Donato Aquaro, MD[a,*]

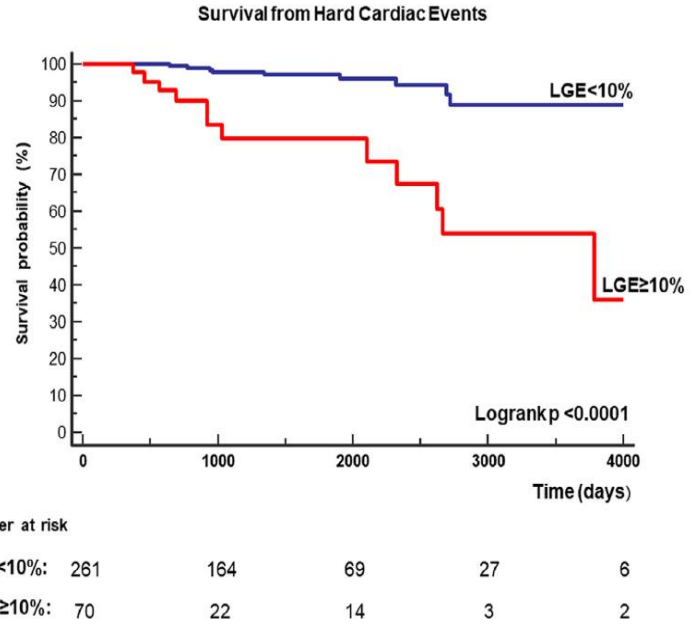
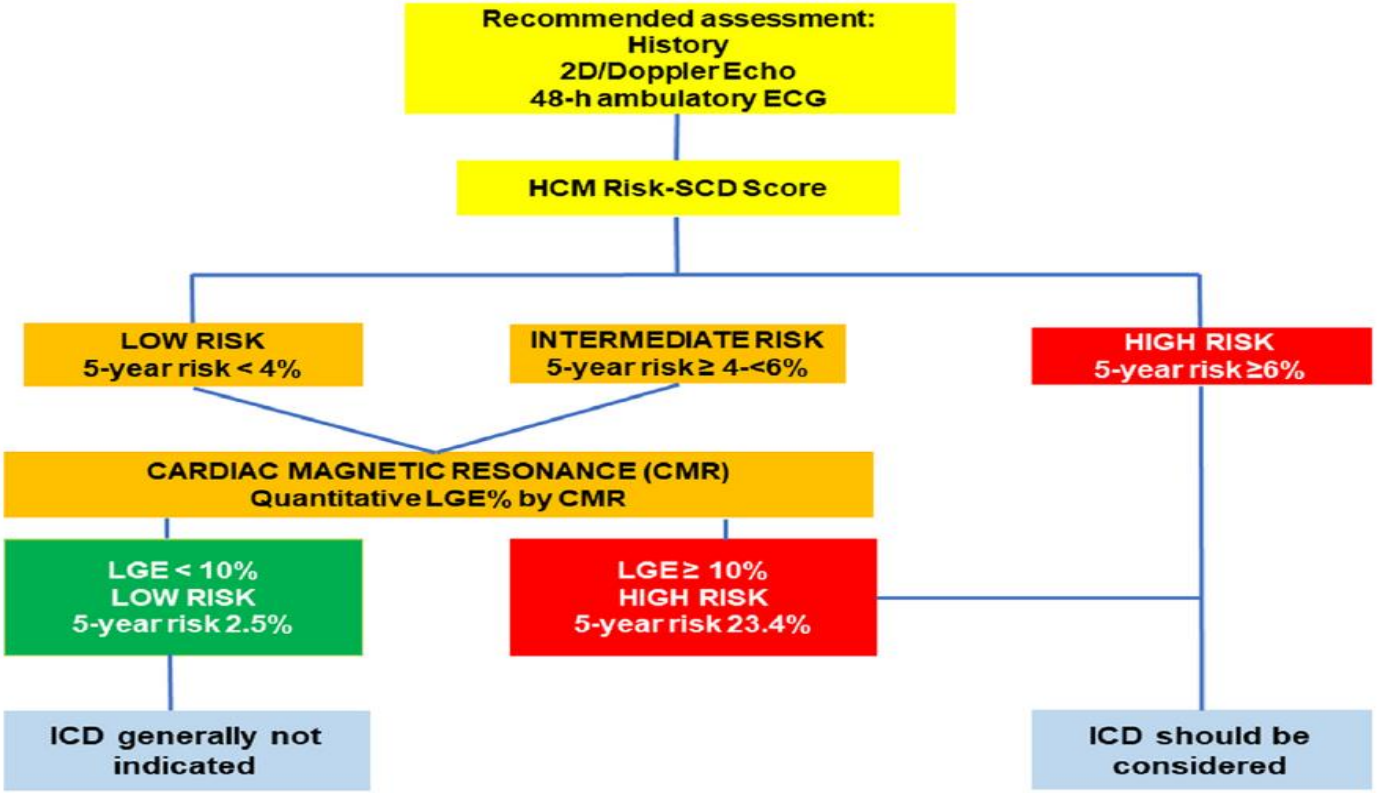


Figure 2. Kaplan-Meier survival curve demonstrated that patients with LGE extent ≥10% had worse prognosis than others.

Todiere J AJC 2019

… in the setting of HCM

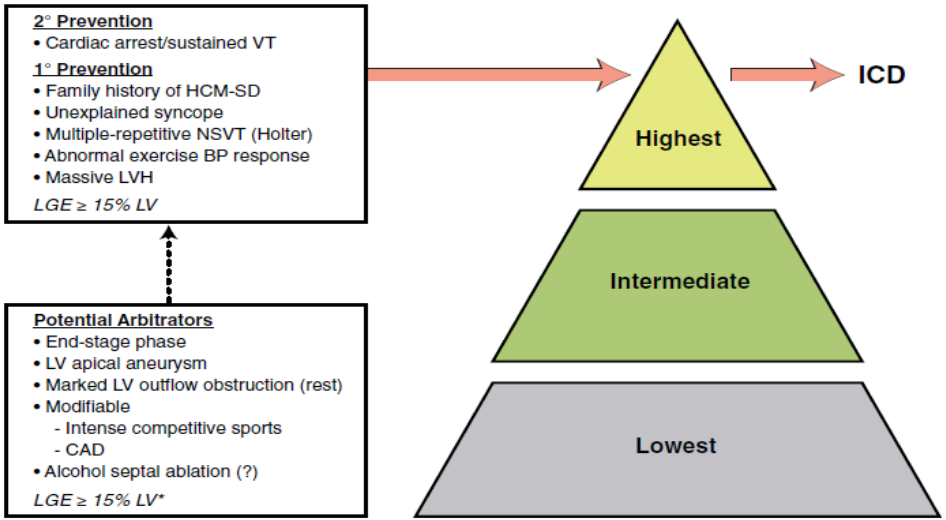


igure 3. Modified algorithm for selection of patients for ICD implantation based on current ESC guidelines combined with the results of the present study.

Todiere J AJC 2019

… in the setting of HCM

FIGURE 1 Updated Risk Stratification Model to Identify HCM Patients at Highest Risk Who May Be Candidates for ICDs and Sudden Death Prevention



Primary risk markers and potential arbitrators appear in **boxes** at the left. *Extensive LGE, a primary risk marker, can also be used as an arbitrator when conventional risk assessment is ambiguous. BP = blood pressure; CAD = coronary artery disease; HCM = hypertrophic cardiomyopathy; ICD = implantable cardioverter-defibrillator; LGE = late gadolinium enhancement; LV = left ventricular; LVH = left ventricular hypertrophy; NSVT = nonsustained ventricular tachycardia; SD = sudden death; VT = ventricular tachycardia. Reprinted with permission from Maron et al. (4).

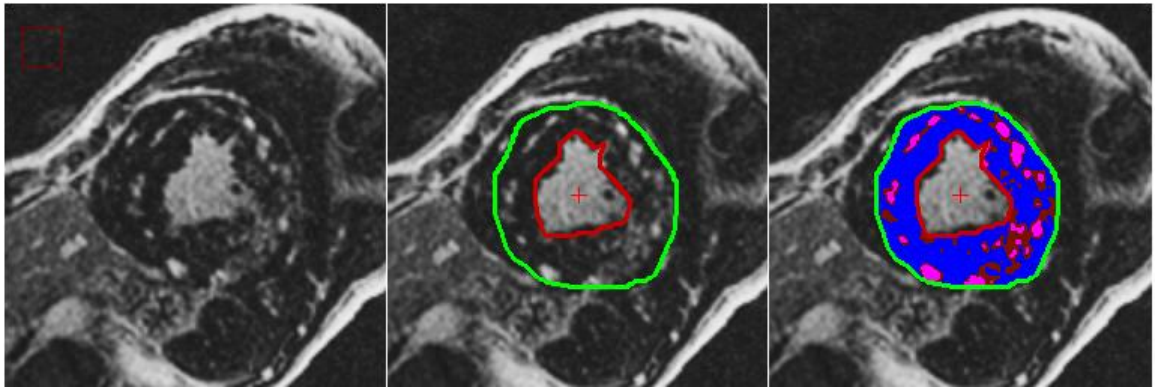
Maron B JACC CI 2016

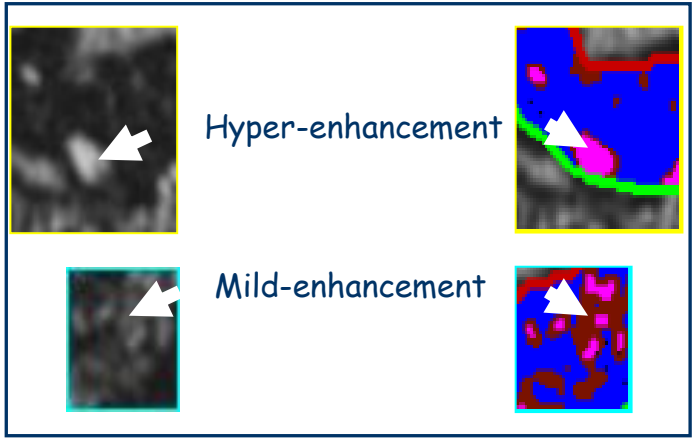
… in the setting of HCM

Usefulness of Delayed Enhancement by Magnetic Resonance Imaging in Hypertrophic Cardiomyopathy as a Marker of Disease and Its Severity

Giovanni Donato Aquaro, MD[a,*], Piergiorgio Masci, MD[a], Francesco Formisano, MD[b], Andrea Barison, MD[c], Elisabetta Strata, MD[a], Alessandro Pingitore, PhD[d], Vincenzo Positano, MSC[a], Paolo Spirito, MD[b], and Massimo Lombardi, MD[a]

Original Image | Countours | Parametric Map

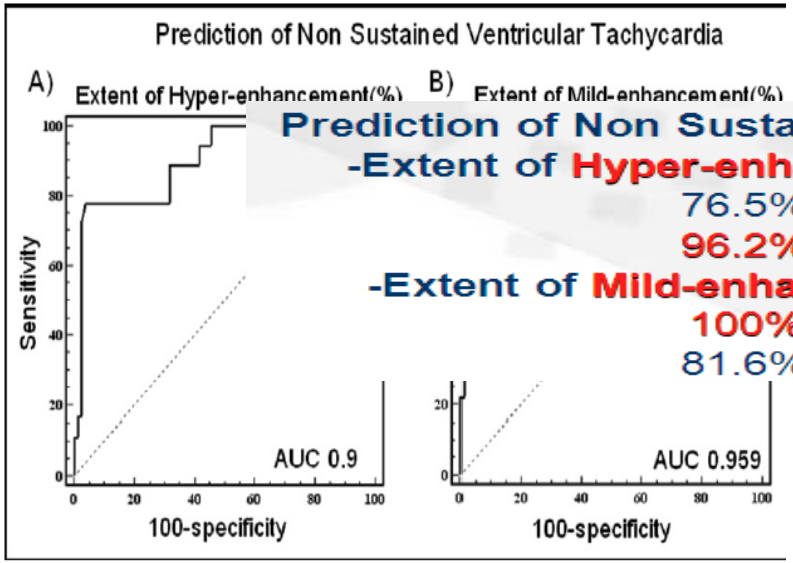




… in the setting of HCM

Usefulness of Delayed Enhancement by Magnetic Resonance Imaging in Hypertrophic Cardiomyopathy as a Marker of Disease and Its Severity

Giovanni Donato Aquaro, MD[a,*], Piergiorgio Masci, MD[a], Francesco Formisano, MD[b], Andrea Barison, MD[c], Elisabetta Strata, MD[a], Alessandro Pingitore, PhD[d], Vincenzo Positano, MSC[a], Paolo Spirito, MD[b], and Massimo Lombardi, MD[a]



Prediction of Non Sustained Ventricular Tachycardia
-Extent of Hyper-enhancement(%); Cut off >2.4
76.5% sensitivity
96.2% specificity
-Extent of Mild-enhancement(%); Cut off >4.9
100% sensitivity
81.6% specificity

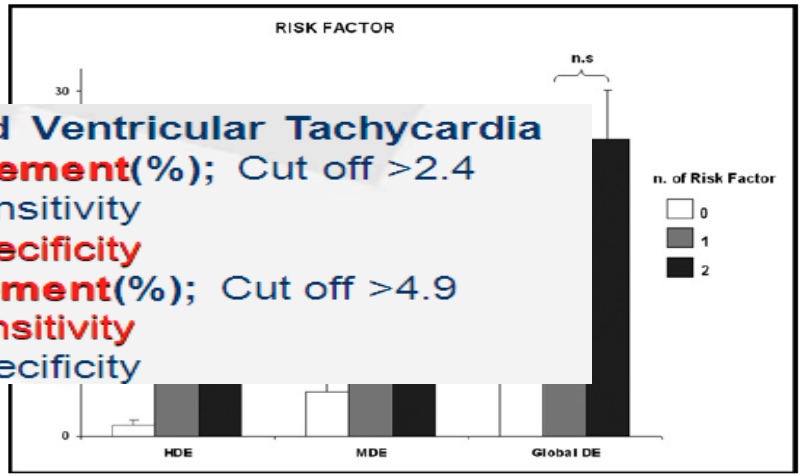


Figure 3. Histograms representing extent of higher enhancement, mild enhancement, and global enhancement in patients with 0, 1, or 2 risk factors.

… in the setting of ARVD

Centro Cardiologico Monzino

… in the setting of ARVD

Table 2. Sensitivity and Specificity of Proposed RV Imaging Criteria*

	Value	Sensitivity, %	Specificity, %
Echocardiogram			
Major			
PLAX RVOT (diastole)	≥32 mm	75	95
Corrected for body size (PLAX/BSA)	≥19 mm/m²		
PSAX RVOT (diastole)	≥36 mm	62	95
Corrected for body size (PSAX/BSA)	≥21 mm/m²		
Fractional area change	≤33%	55	95
Minor			
PLAX RVOT (diastole)	≥29 mm	87	87
Corrected for body size (PLAX/BSA)	≥16 to ≤18 mm/m²‖		
PSAX RVOT (diastole)	≥32 mm	80	80
Corrected for body size (PSAX/BSA)	≥18 to ≤20 mm/m²		
Fractional area change	≤40%	76	76
MRI†			
Major			
Ratio of RV end-diastolic volume to BSA			
Males	≥110 mL/m²		
Females	≥100 mL/m²	76	90♂
or		68	98♀
RV ejection fraction	≤40%		
Minor			
Ratio of RV end-diastolic volume to BSA			
Males	≥100 mL/m²		
Females	≥90 mL/m²	79	85♂
or		89	97♀
RV ejection fraction	≤45%		

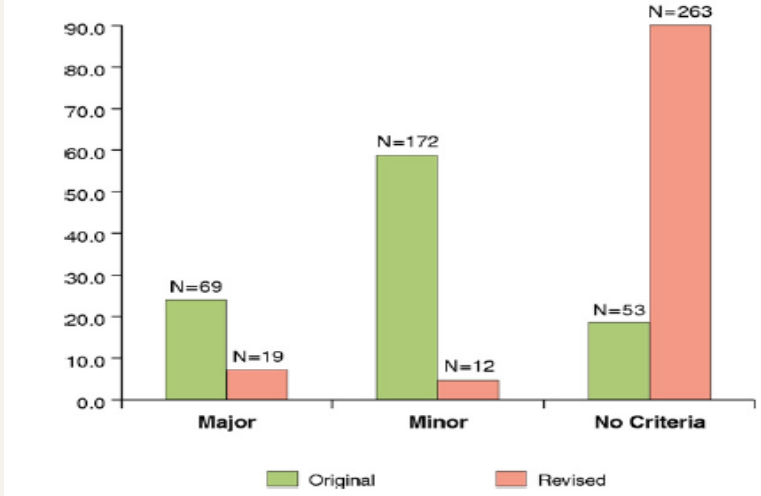


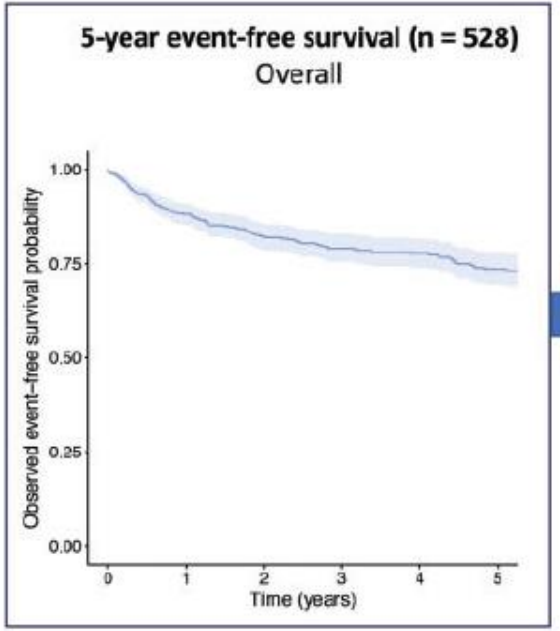
Figure 2. Proportional Incidence of Original and Revised ARVC Criteria

The graph shows the different incidence of patients with major criteria, minor criteria, or without criteria according to the original cardiac magnetic resonance criteria **(green bars)** and the revised criteria **(orange bars)**.

Vermes E JACC CI 2011

… in the setting of ARVD

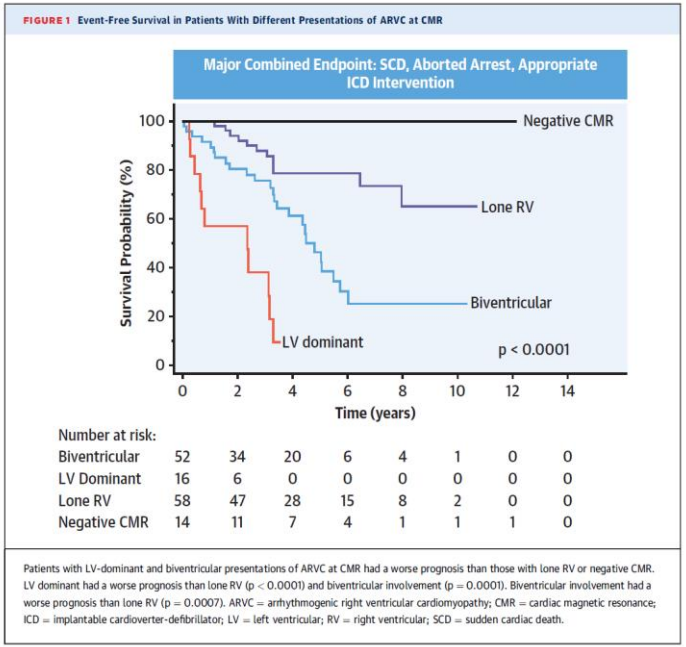
Prediction of sustained ventricular arrhythmia in ARVC



Model for 5-year risk prediction

Sex	x	0.49
Age	x	-0.022
Recent syncope	x	0.66
Non-sustained VT	x	0.81
Ln(24h PVC count)	x	0.17
Leads with T-wave inv.	x	0.11
RVEF	x	-0.025

$$1 - 0.802^{\exp(\quad)} = 5 \text{ year risk}$$

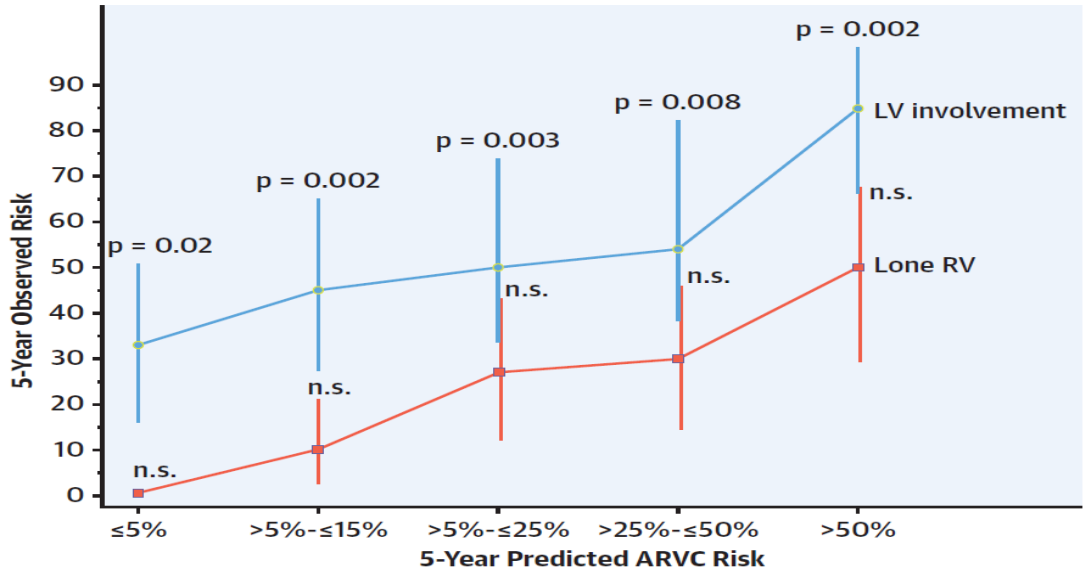


Julia Cadrin-Tourigny EHJ 2019

Aquaro G JACC 2020

… in the setting of ARVD

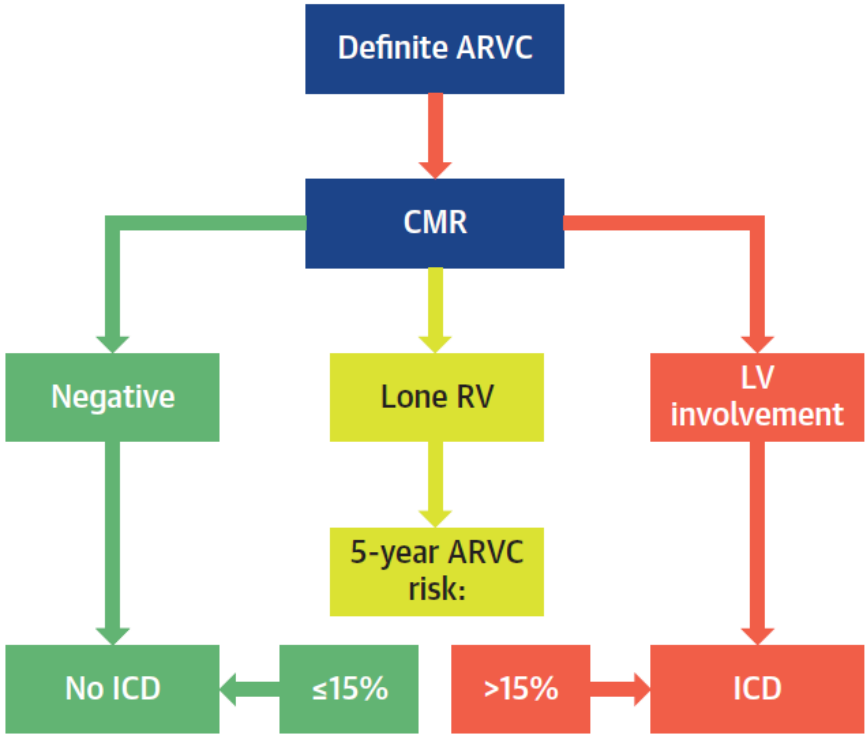
FIGURE 3 Predicted Versus Observed 5-Year Risk of Major Cardiac Events in Patients With LV Involvement or Lone RV



The 5-year predicted risk using the ARVC risk score divided into 5 classes (≤5%, >5% to ≤15%, >15% to ≤25%, >25% to ≤50%, >50%) was compared with the observed risk in patients with LV involvement **(blue)** and in those with lone RV **(red)**. As is evident, in patients with lone-RV presentation, the predicted 5-year risk matched well with the observed risk. By contrast, the predicted risk significantly underestimated the observed risk in LV involvement for every class of risk. n.s. = nonsignificant; other abbreviations as in Figure 1.

Aquaro G JACC 2020

… in the setting of ARVD



Results of this study showed a different prognosis for different CMR presentations of ARVC. In patients with negative CMR, the prognosis was good, and ICD could be not recommended. In patients with lone RV, the 5-year ARVC risk score is valid, and the cutoff of >15% was the most accurate to predict events. In the case of LV involvement, the observed 5-year risk was always >15% and so ICD is recommended. ARVC: arrhythmogenic right ventricular cardiomyopathy; CMR: cardiac magnetic resonance; ICD: implantable cardioverter-defibrillator; LV: left ventricular; RV ¼ right ventricular.

Aquaro G JACC 2020


L'orizzonte
è negli occhi
e non nella realtà.
Ángel Ganivet
Aforismario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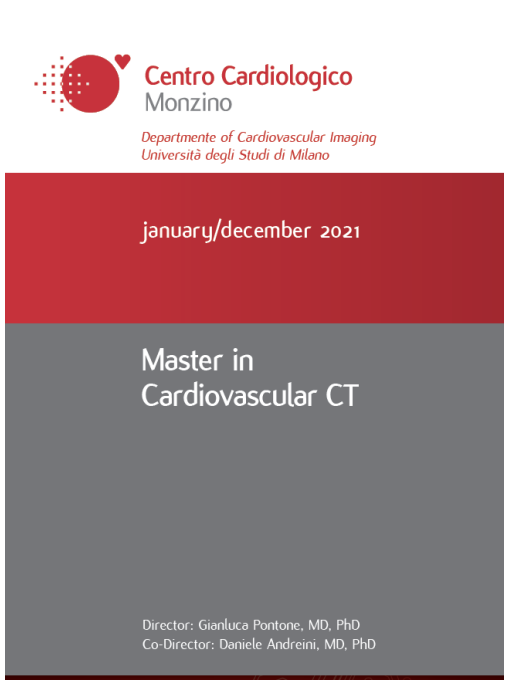
Monzino
U.O. di Ecocardiografia
ECM
Corso di
Ecocardiografia 2020
3-5 marzo 2020
23-25 giugno 2020
8-10 settembre 2020
Sede corso
Centro Cardiologico Monzino IRCCS, Milano
Direttore Corso
Gloria Tamborini
Responsabile U.O. Ecocardiografia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CARDIOVASCULAR IMAGING DEPARTMENT

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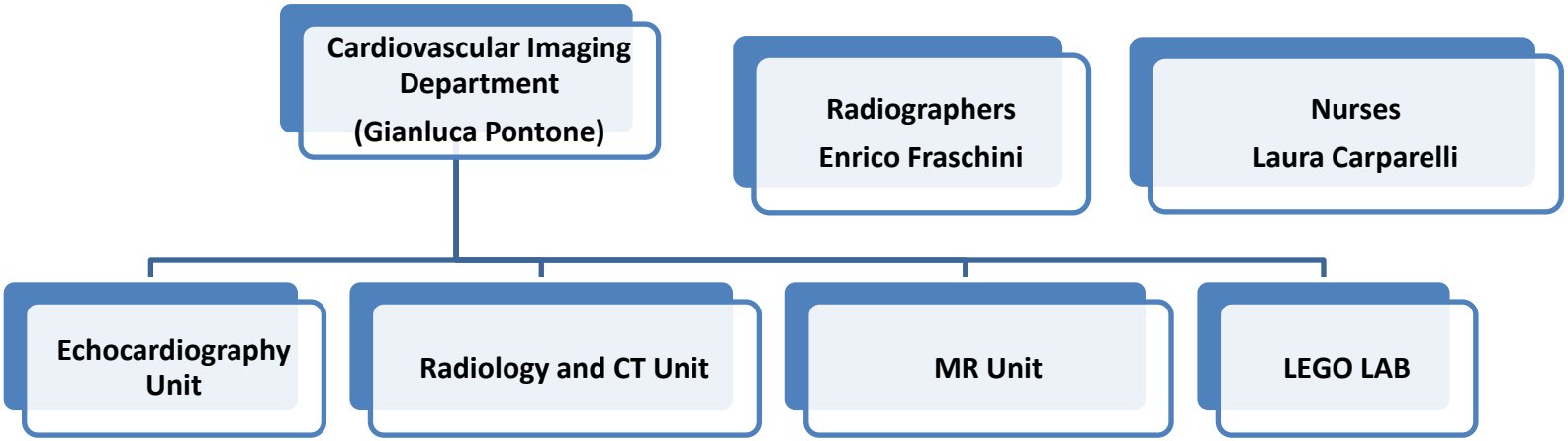

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