Conoscere e Curare il Cuore 2019

SABATO 2 MARZO

ANGINA (EPICARDICA E MICROVASCOLARE) O PRECORDIALGIE ATIPICHE. DIAGNOSI DIFFERENZIALE CON LA RISONANZA MAGNETICA.

Gianluca Pontone

Department of Cardiovascular Imaging
Centro Cardiologico Monzino - IRCCS, Milano

Outline

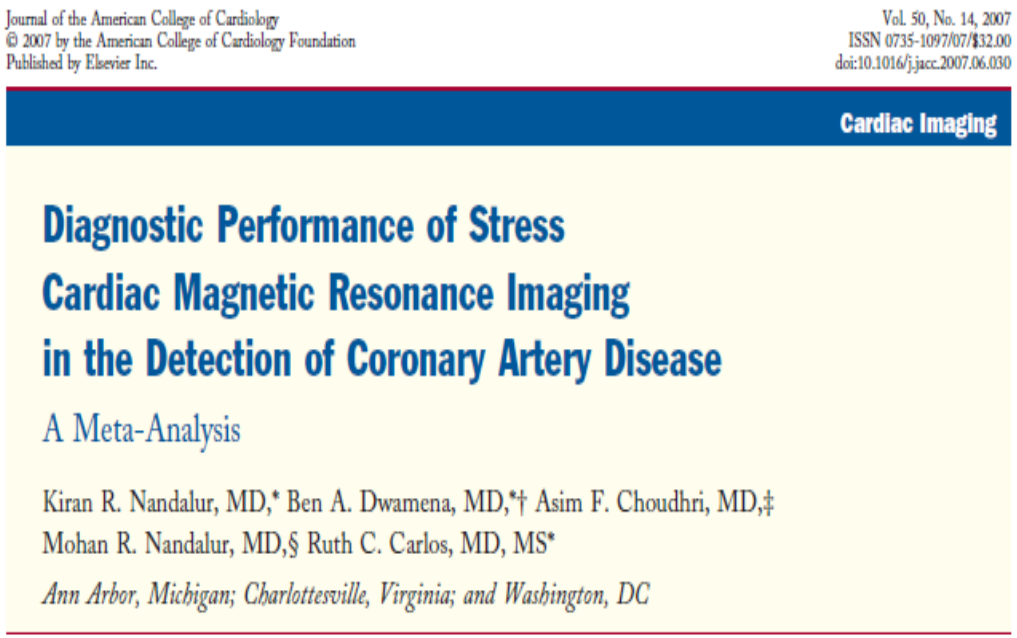
- **Stress MRI: diagnostic performance**
- **Stress MRI and Prognostication**
- **Stress MRI management and prognosis**
- **Future : Fully quantitative analysis, T1 mapping and strain**

STRESS MRI: DIAGNOSTIC PERFORMANCE

STRESS CMR:

- Perfusion Defects
- Wall motion
- Function, valvulopathies and shunts
- Tissue Characterization

STRESS CMR: DIAGNOSTIC PERFORMANCE: OBSTRUCTIVE CAD



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Cardiac Imaging

Diagnostic Performance of Stress Cardiac Magnetic Resonance Imaging in the Detection of Coronary Artery Disease

A Meta-Analysis

Kiran R. Nandalur, MD,* Ben A. Dwamena, MD,*† Asim F. Choudhri, MD,‡
Mohan R. Nandalur, MD,§ Ruth C. Carlos, MD, MS*

Ann Arbor, Michigan; Charlottesville, Virginia; and Washington, DC

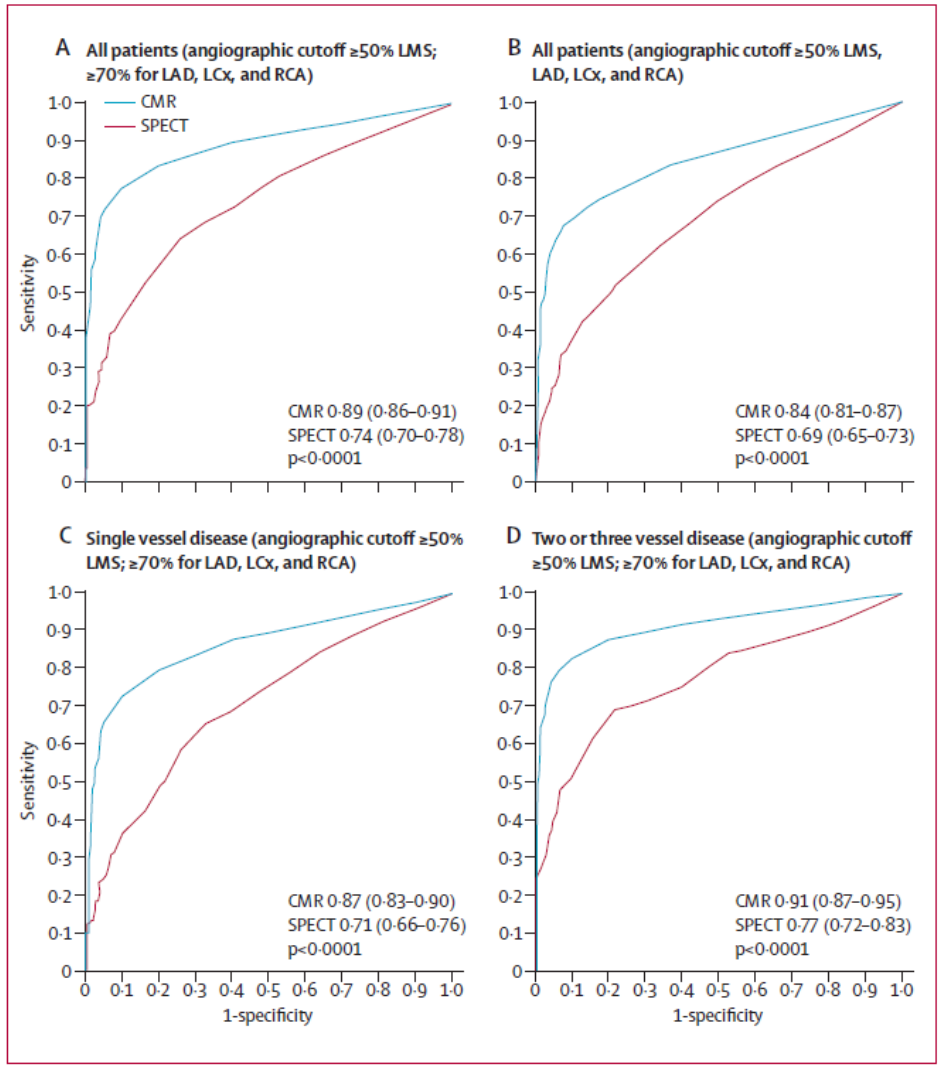
Thirty-seven studies (2,191 patients)

Stress-induced wall motion abnormalities imaging demonstrated a sensitivity of **0.83** (95% confidence interval [CI] 0.79 to 0.88) and specificity of **0.86** (95% CI 0.81 to 0.91) on a patient level (disease prevalence = 70.5%).

Perfusion imaging demonstrated a sensitivity of **0.91** (95% CI 0.88 to 0.94) and specificity of **0.81** (95% CI 0.77 to 0.85) on a patient level (disease prevalence = 57.4%).

Nandalur, JACC 2007

STRESS CMR vs SPECT: DIAGNOSTIC PERFORMANCE: OBSTRUCTIVE CAD



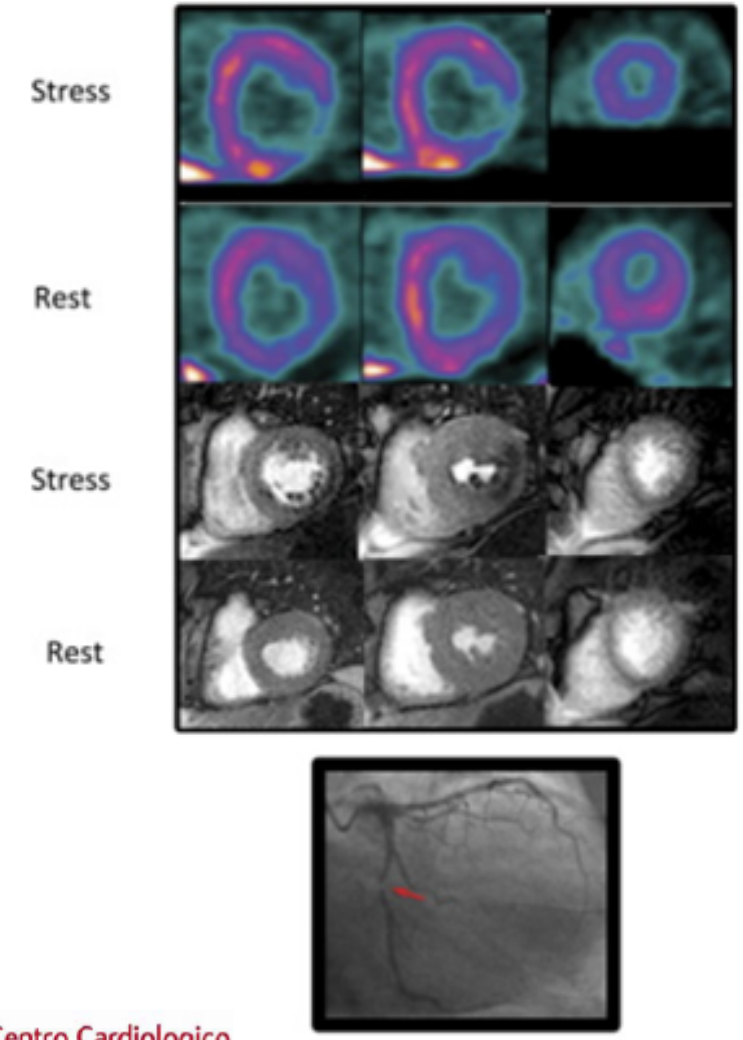
N. 752 pts

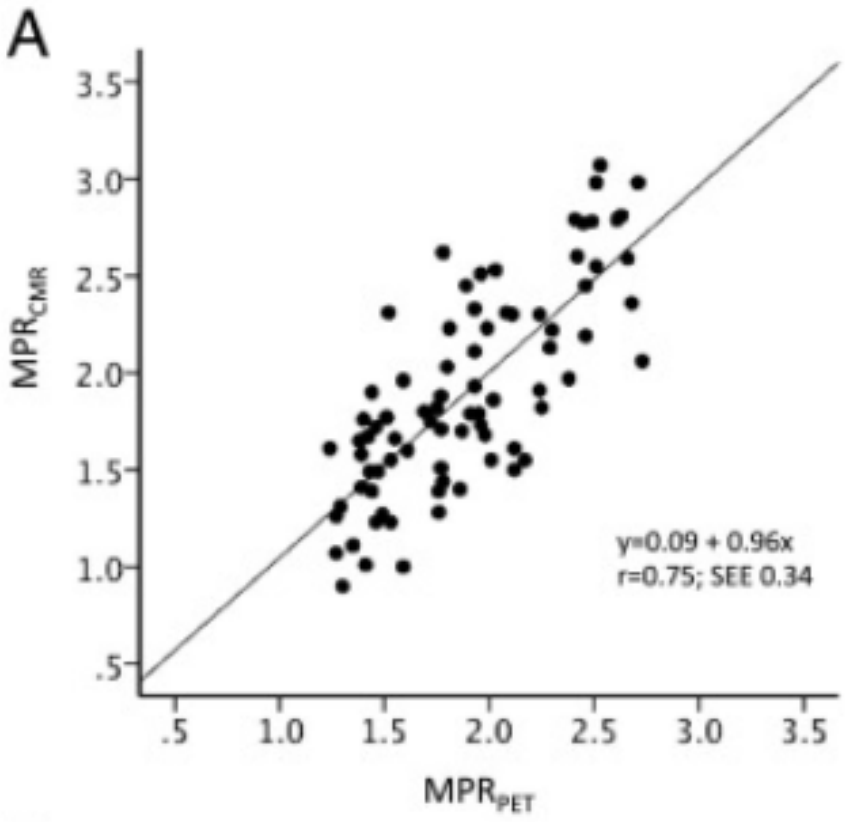
CMR: Sensitivity 86.5%, Specificity 83.4%, PPV 77.2%, NPV 90.5%

SPECT: Sensitivity: 66,5%, Specificity 82.6%, PPV 71.4%, PPV 71.4%

Greenwood, Lancet 2012

STRESS CMR vs SPECT: DIAGNOSTIC PERFORMANCE: OBSTRUCTIVE CAD





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Morton JACC 2012

STRESS CMR: DIAGNOSTIC PERFORMANCE: iFFR

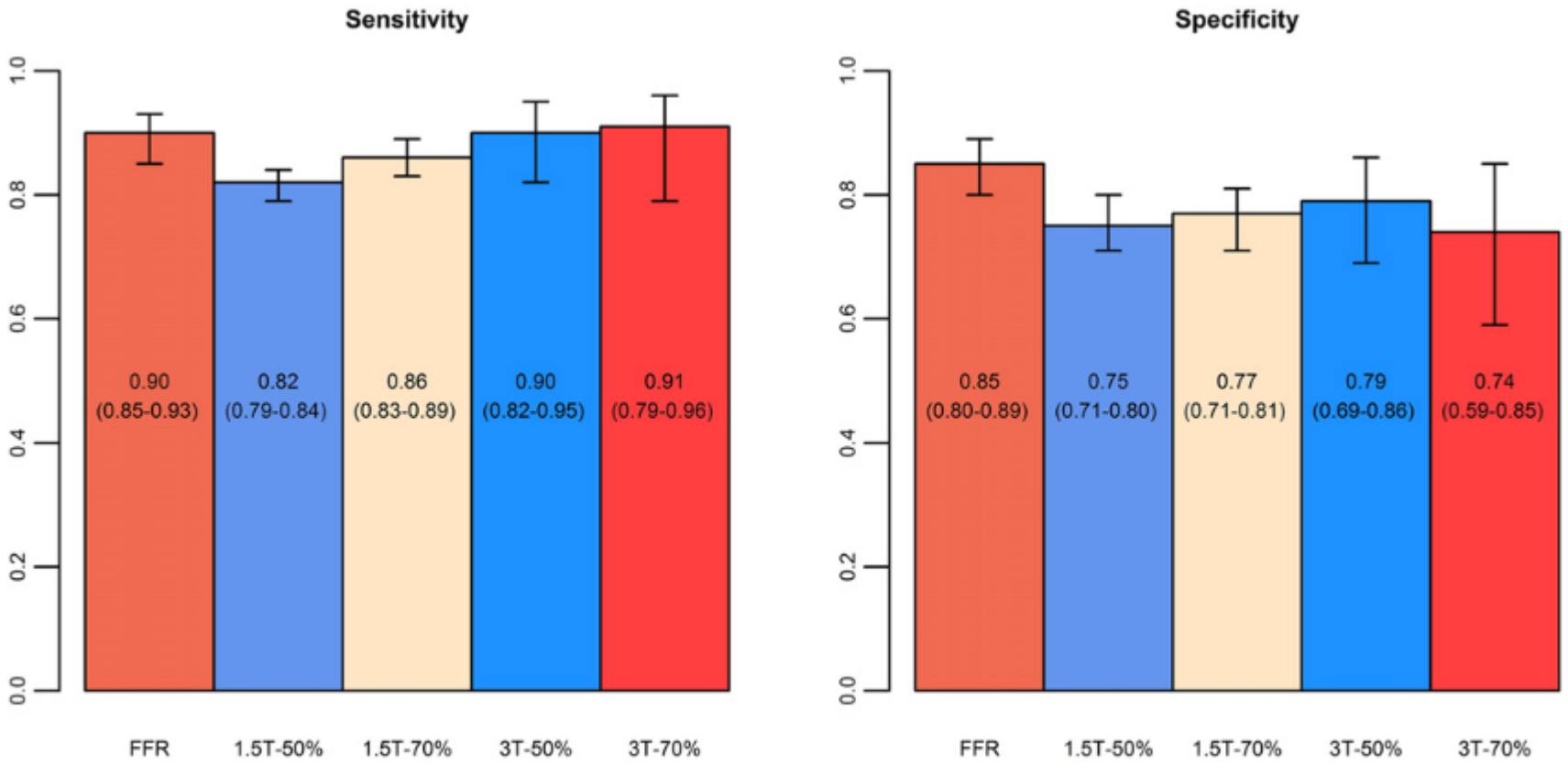

Fig. 1. Summary measures of sensitivity and specificity and their 95% confidence intervals for qualitative stress perfusion cardiac magnetic resonance at the patient level compared with FFR, at 1.5-T for detecting coronary stenosis ≥50%, at 1.5-T for detecting coronary stenosis ≥70%, at 3-T for detecting coronary stenosis ≥50% and at 3-T for detecting coronary stenosis ≥70%. FFR, fractional flow reserve; T, Tesla

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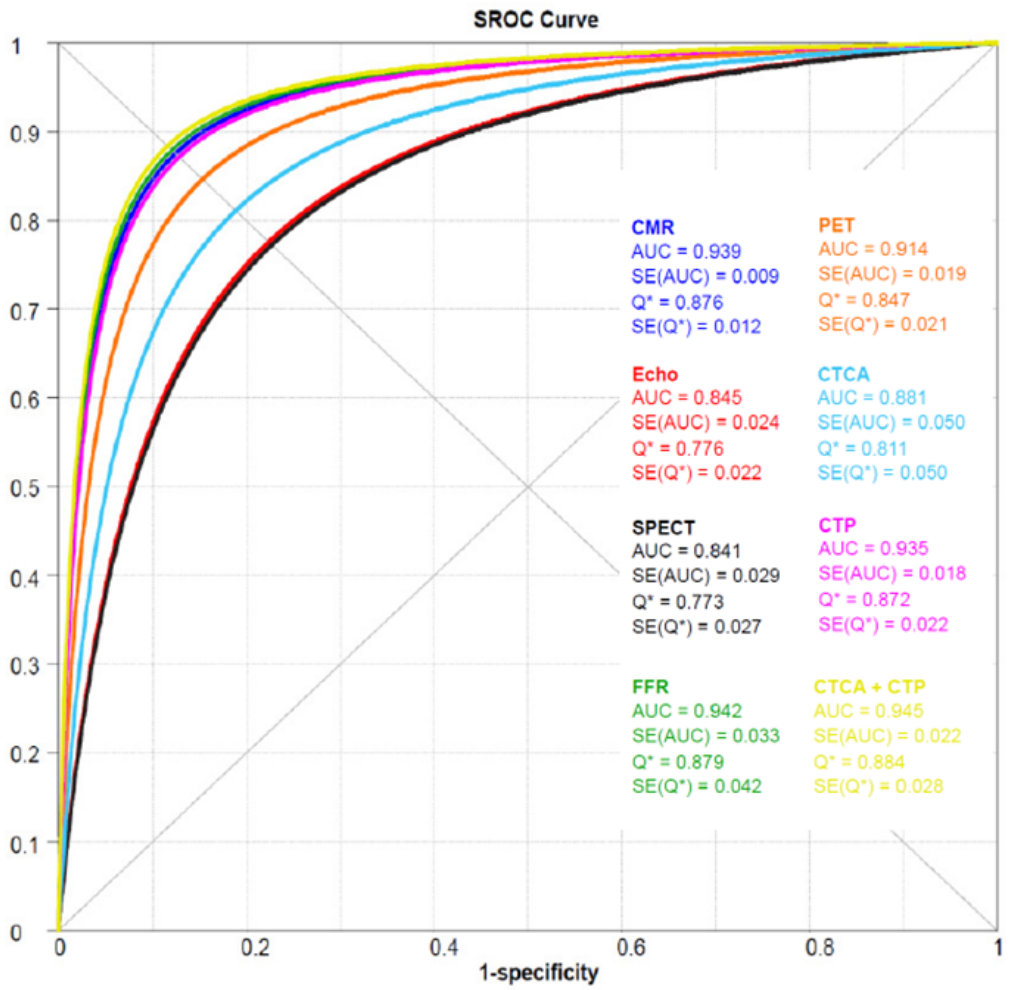
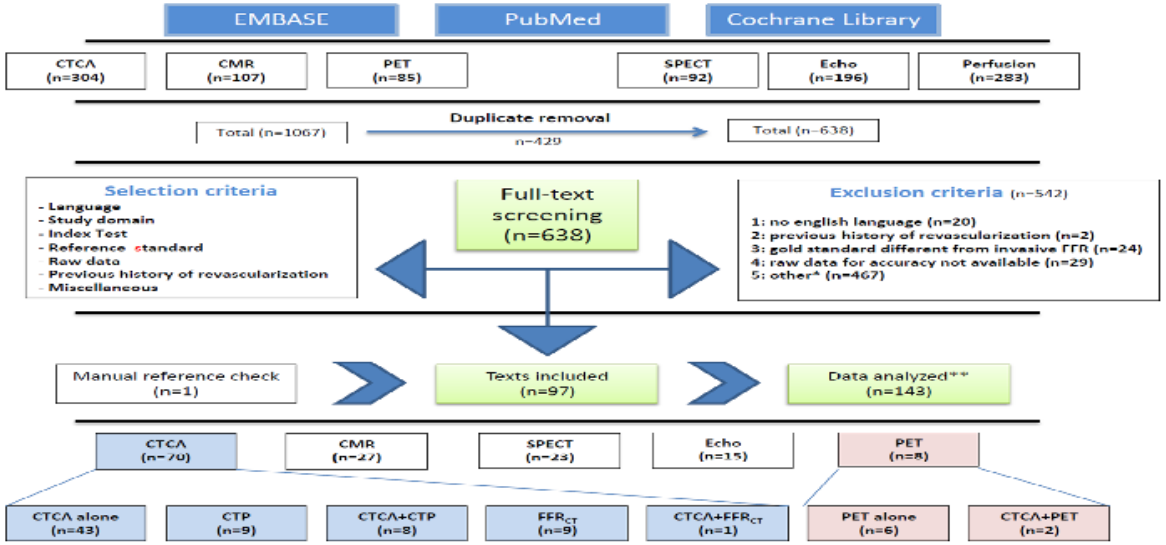
Kiaos A, Int J Cardiol 2018

STRESS CMR: DIAGNOSTIC PERFORMANCE: iFFR



Diagnostic PERFORMANCE of stress echocardiography (Echo), stress single-photon-emission computed tomography (SPECT), positron emission tomography (PET), stress cardiac magnetic resonance (CMR), computed tomography coronary angiography (CTCA), stress computed tomography (CTP) and computed tomography fractional flow reserve (FFR_{CT}) for the assessment of Coronary Artery Disease (CAD) versus invasive FFR (FFR_i): a meta-analysis



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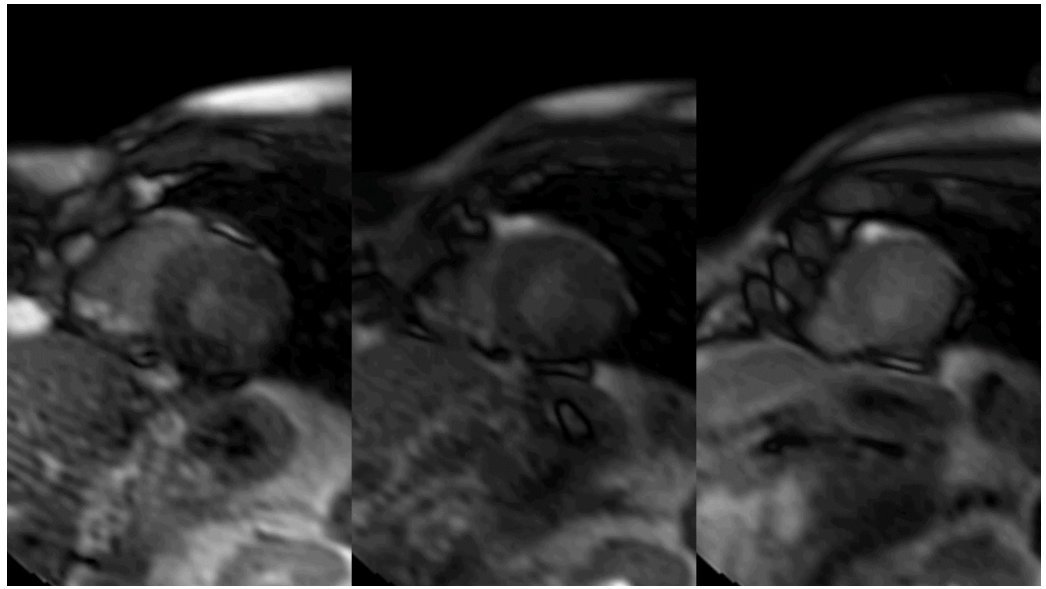
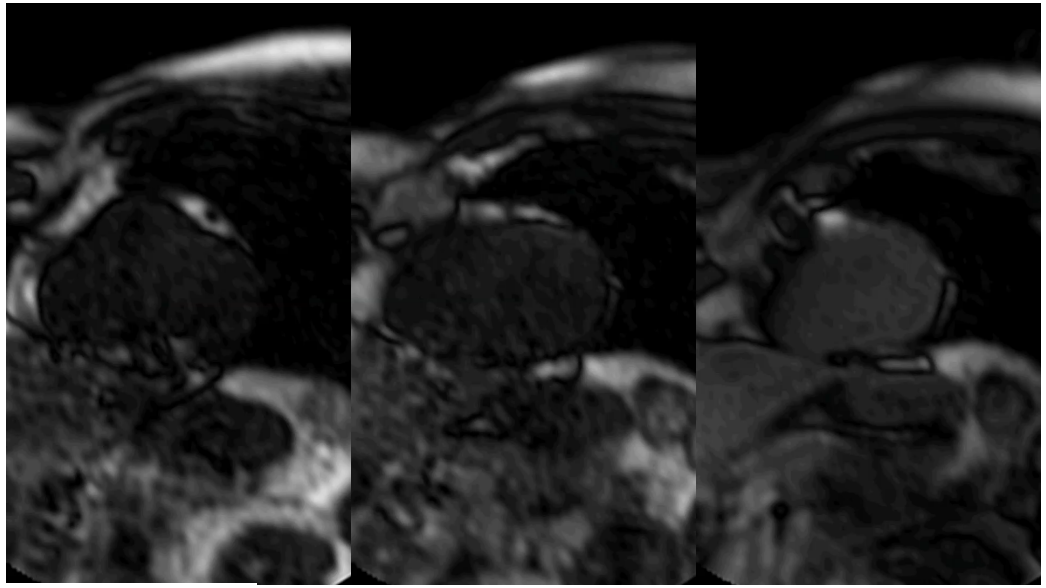
Pontone et al., submitted

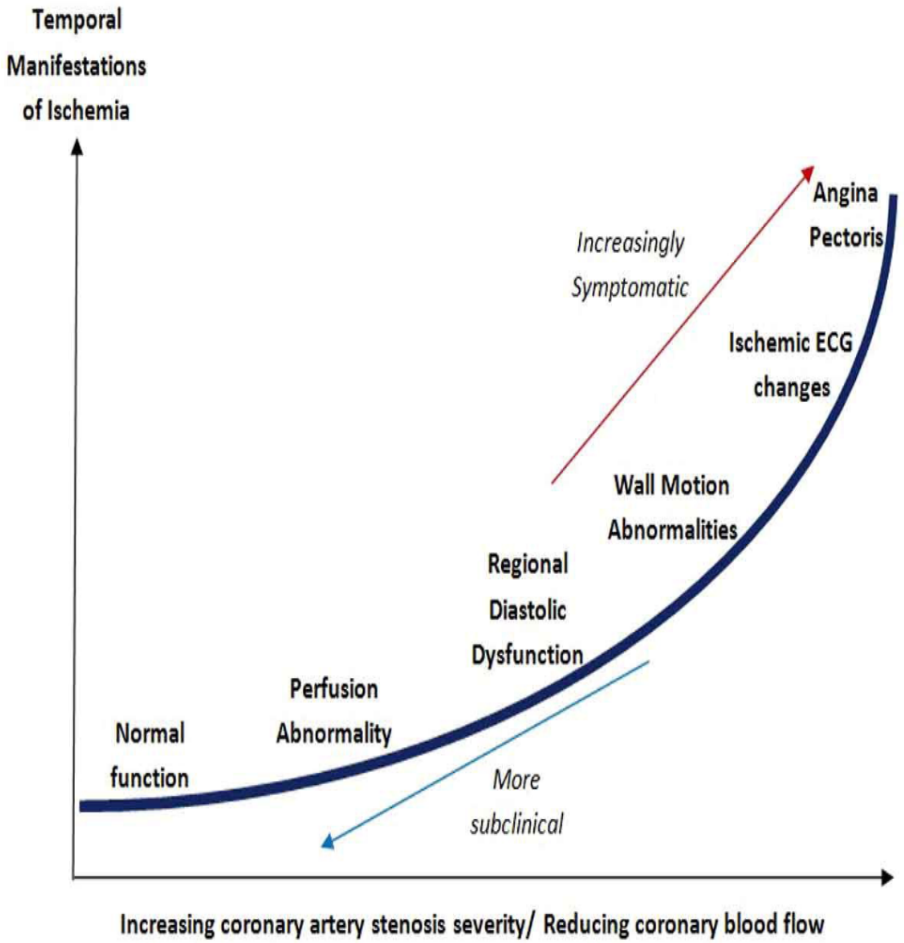
STRESS MRI PROGNOSTICATION



REST Phase



STRESS Phase



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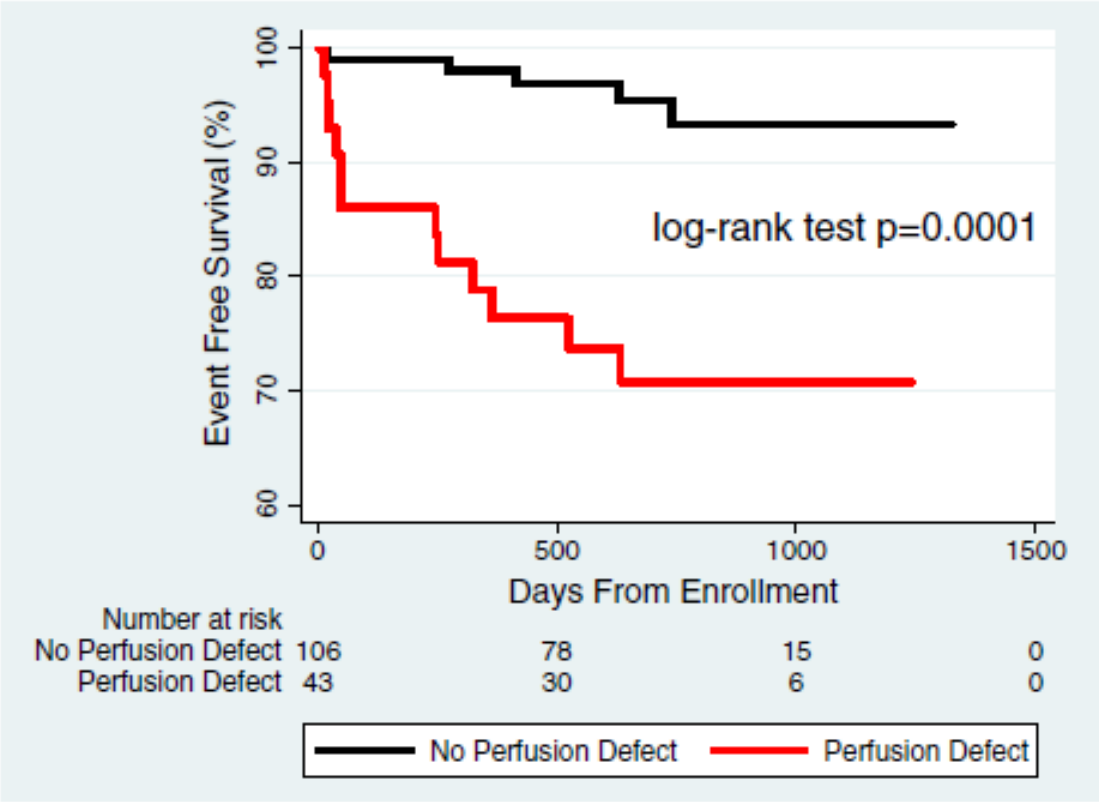
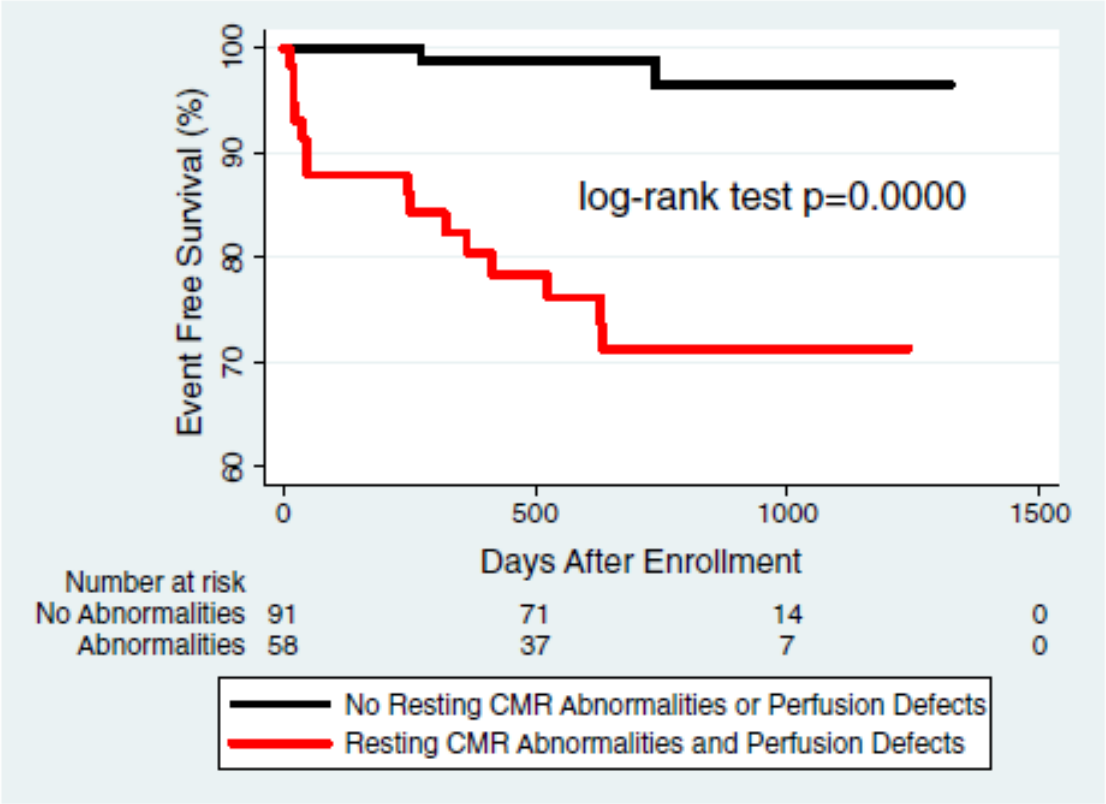
#REGADENOSON STRESS PERFUSION AND PROGNOSIS





When the absence of perfusion defects was added to the absence of other resting CMR abnormalities, the negative predictive value improved from 96% to 99%. Regadenoson perfusion CMR provides high confidence for excellent prognosis in patients with normal perfusion.

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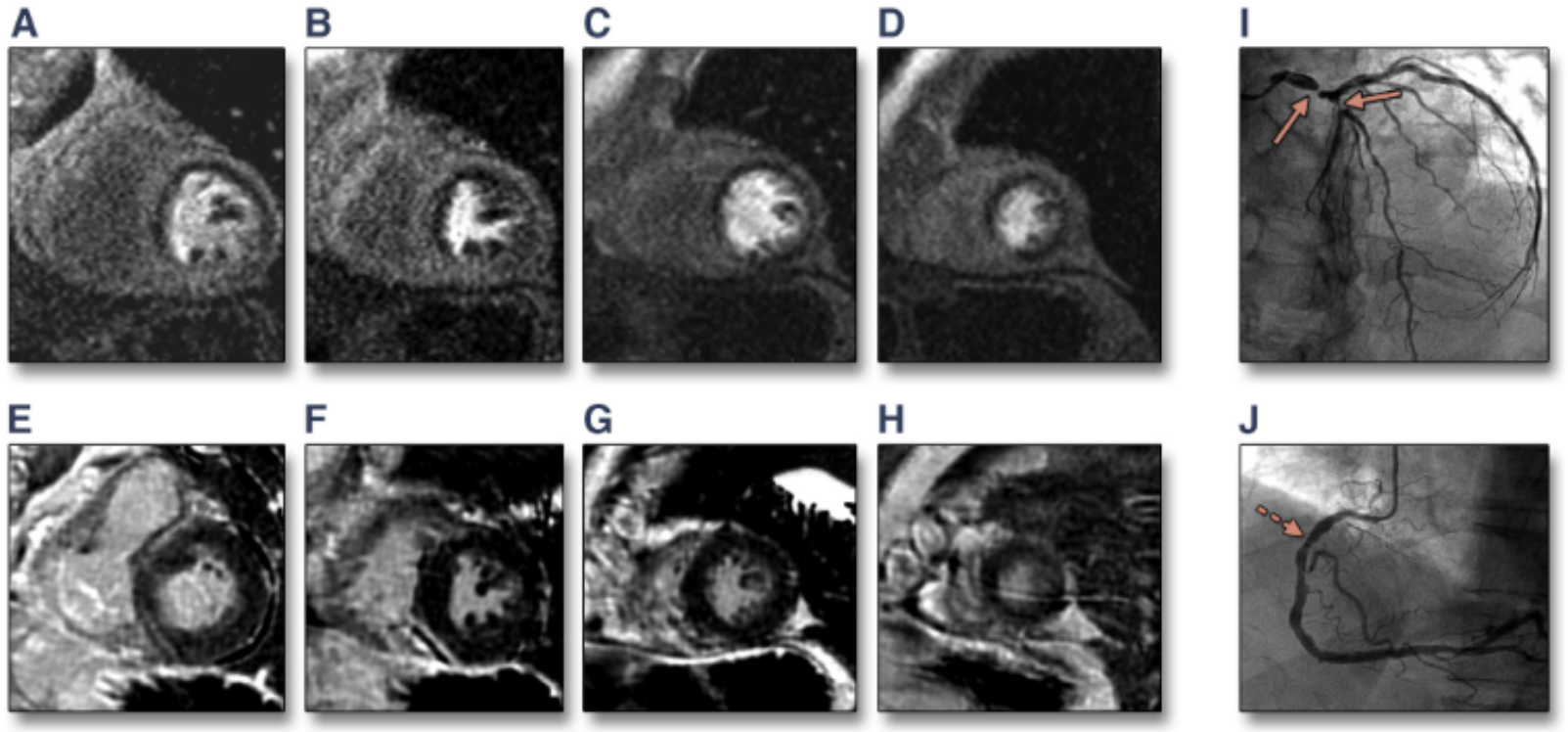
Benjamin H Freed1 JCMR 2013

ISCHEMIA BURDEN AND PROGNOSIS

FIGURE 2 Example of Large Perfusion Deficit



A 65-year-old patient with a large perfusion deficit (14 segments) in the **(A to D)** territory of the left main artery **(E to H)** without scar on late gadolinium enhancement imaging. Coronary angiography shows a severe stenosis of the left main artery (90% to 99%) and the proximal circumflex artery **(I, pink arrows)**; mild nonsignificant right coronary wall irregularities (<50%) **(J, pink dotted arrow)**.

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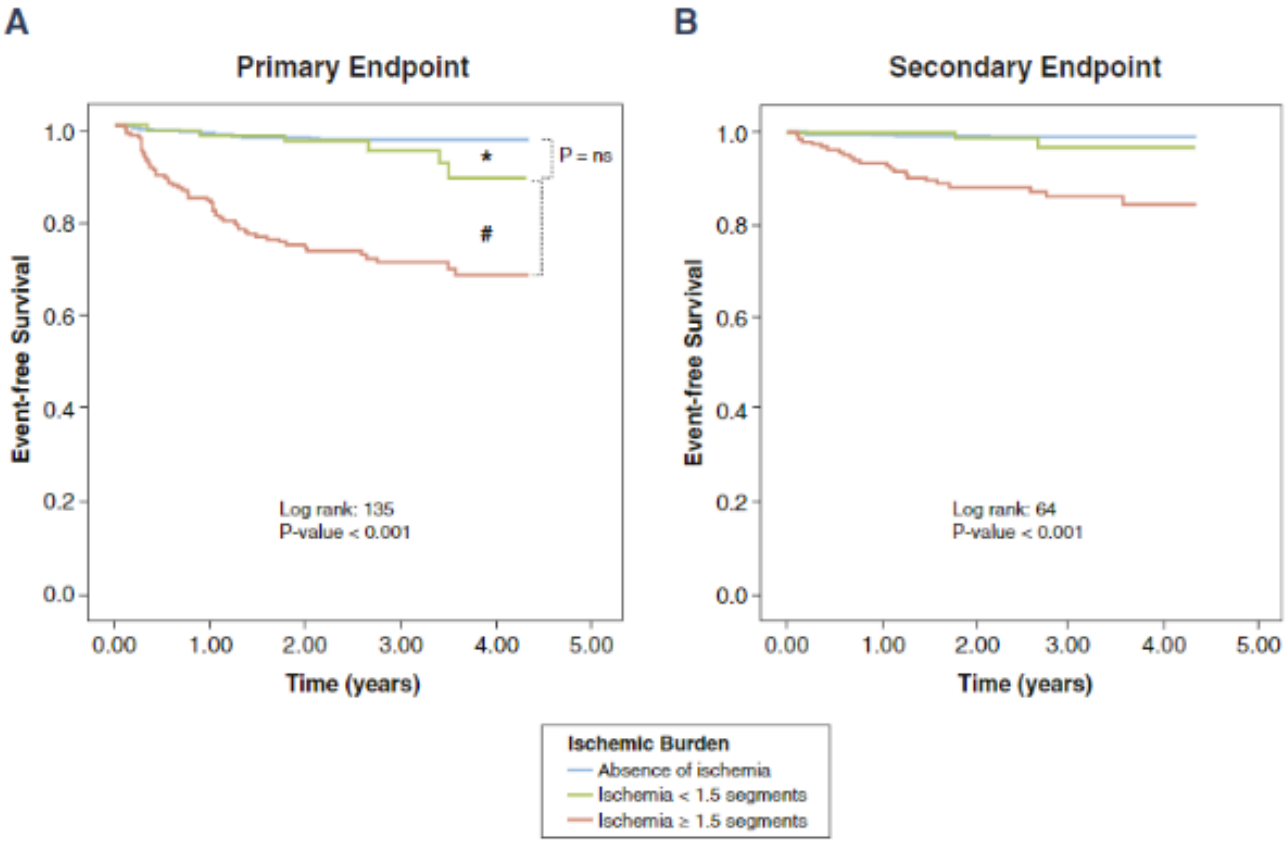
Vincenti G. JACC Cardiovasc Imaging 2017

#ISCHEMIA BURDEN AND PROGNOSIS

FIGURE 4 Event-Free Survival Curves for the Primary and the Secondary Endpoints



Kaplan-Meier event-free survival curves for the **(A)** primary and **(B)** secondary endpoints. *p = 0.121 **(blue and green);** #p < 0.001 **(green and pink).**

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Vincenti G. JACC Cardiovasc Imaging 2017

PROGNOSTIC ROLE OF DYPIRIDAMOLE STRESS CMR

Eur Radiol
DOI 10.1007/s00330-015-4064-x

CARDIAC

Prognostic value of dipyridamole stress cardiac magnetic resonance in patients with known or suspected coronary artery disease: a mid-term follow-up study

Gianluca Pontone[1] · Daniele Andreini[1,2] · Erika Bertella[1] · Monica Loguercio[1] · Marco Guglielmo[1] · Andrea Baggiano[1] · Giovanni Donato Aquaro[3] · Saima Mushtaq[1] · Sara Salerni[4] · Paola Gripari[1] · Carmen Rossi[4] · Chiara Segurini[1] · Edoardo Conte[1] · Virginia Beltrama[1] · Marta Giovannardi[1] · Fabrizio Veglia[1] · Andrea Igoren Guaricci[5] · Antonio L. Bartorelli[1,2] · Piergiuseppe Agostoni[1,2] · Mauro Pepi[1] · Pier Giorgio Masci[3]

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Pontone G Eur Radiol 2015

PROGNOSTIC ROLE OF DYPIRIDAMOLE STRESS CMR

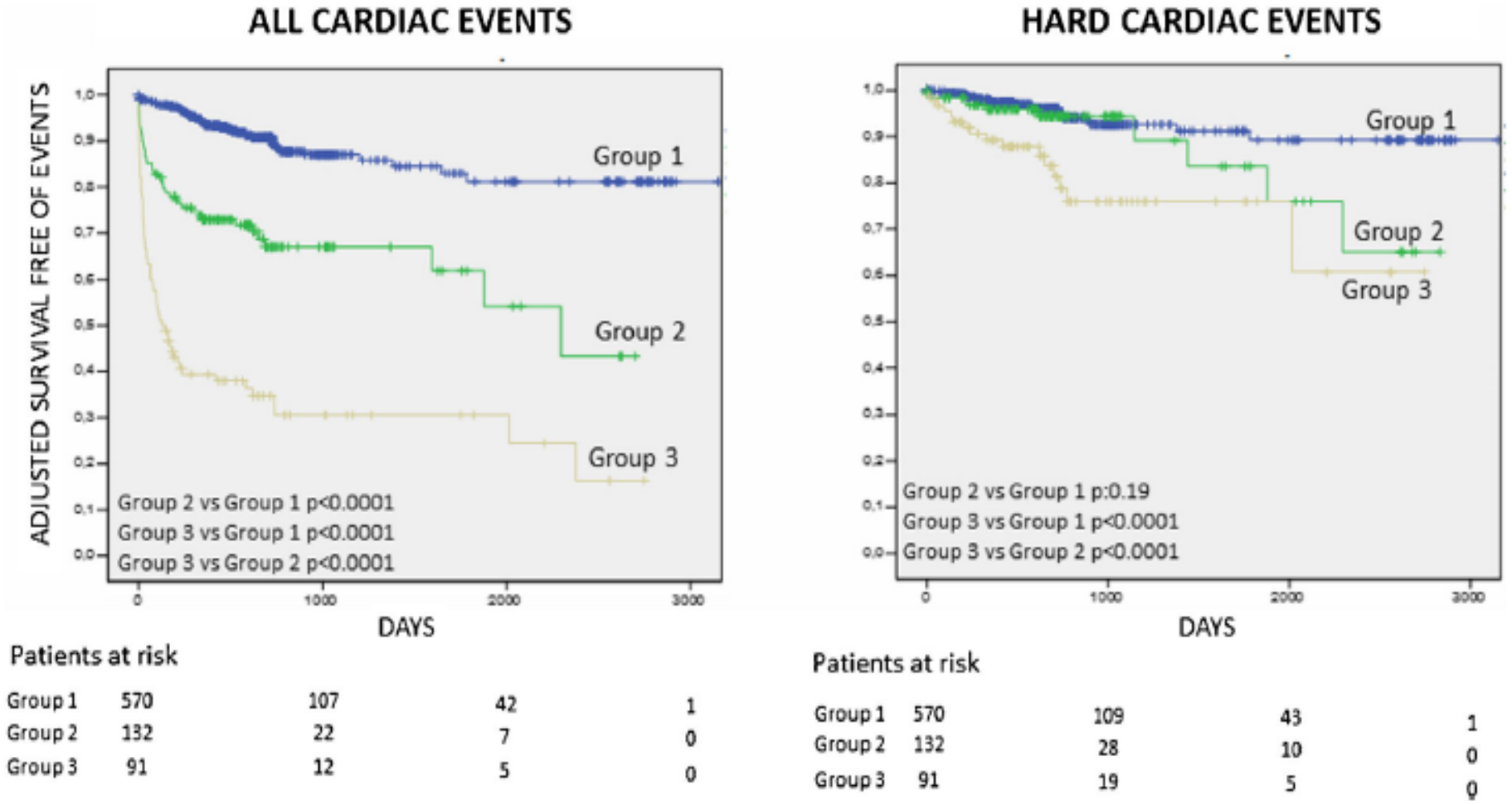

Fig. 3 Adjusted survival curves for all cardiac events (left panel) and hard cardiac events (right panel) in patients with normal stress CMR (Group 1), patients with perfusion defect alone (Group 2) and patients with perfusion defect+AWM (Group 3). *AWM: abnormal wall motion*

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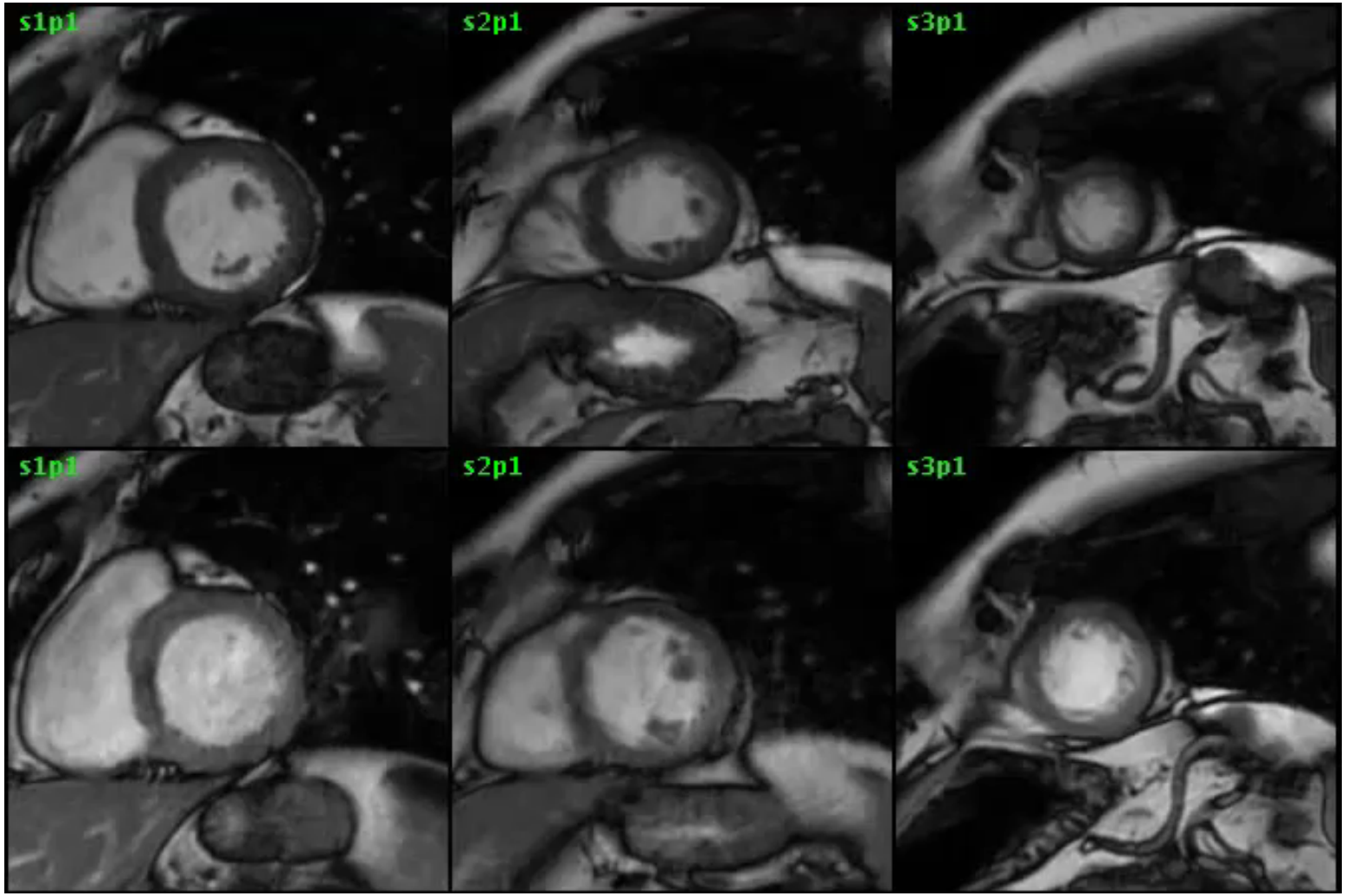
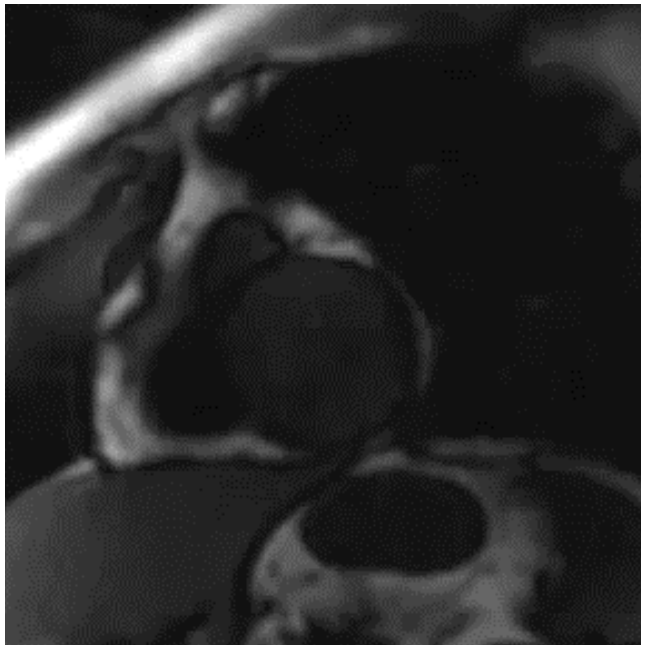
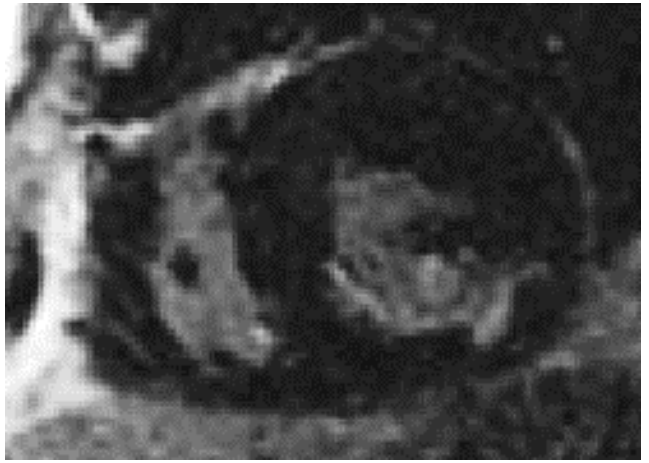
Pontone G Eur Radiol 2015

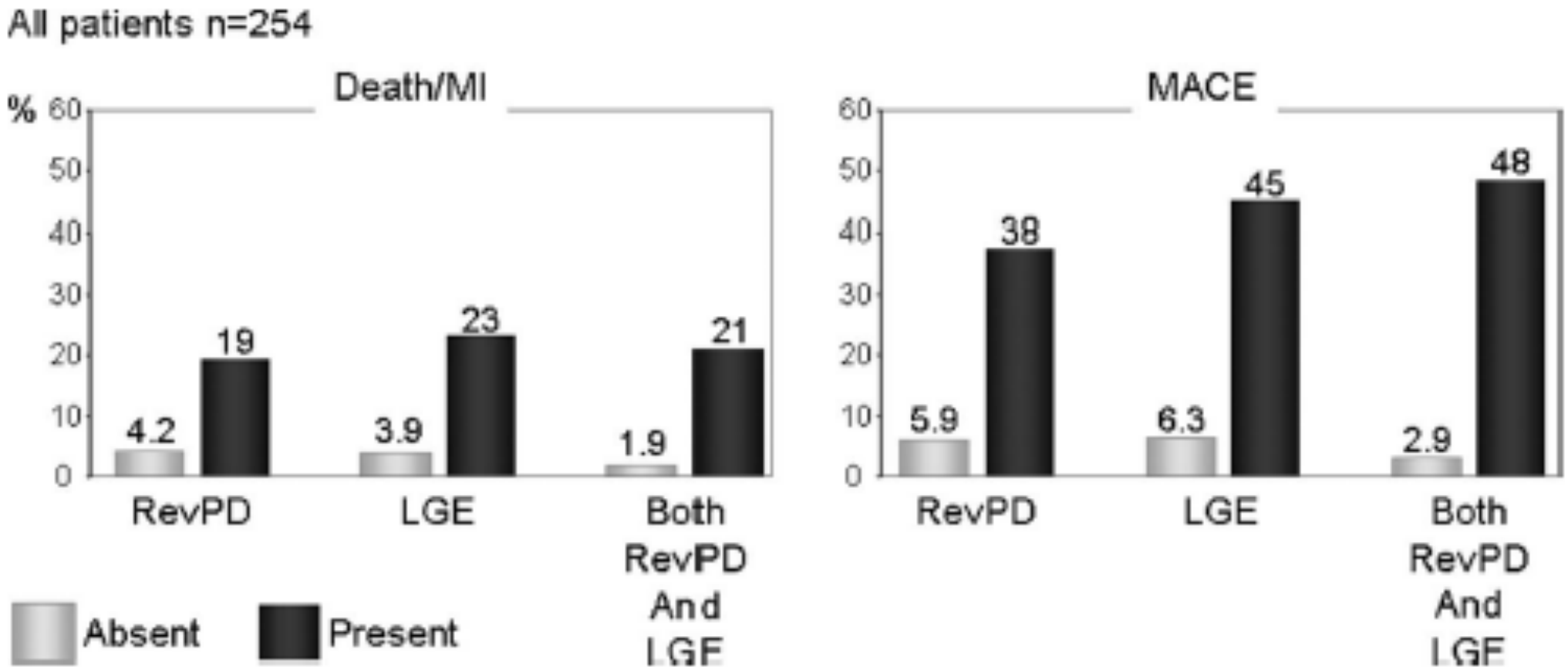
PROGNOSTIC ROLE OF DYPIRIDAMOLE STRESS CMR







COMPLEMENTARY ROLE OF LGE + PERFUSION DEFECTS



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Steel, Circulation 2009

INCREMENTAL PROGNOSTIC VALUE OF COMBINED CMR IMAGING

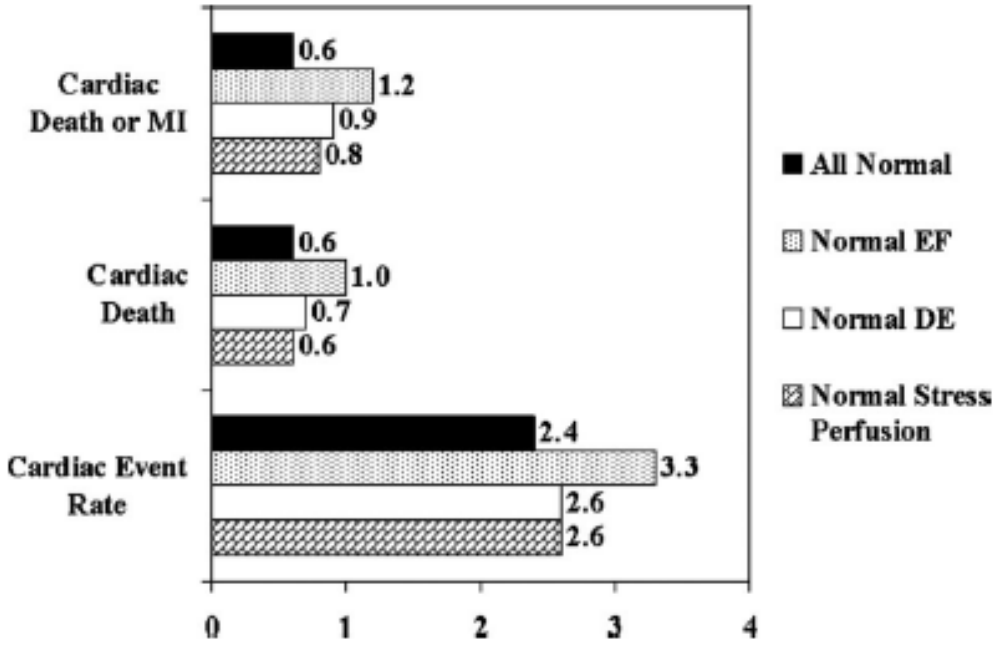


Figure 3. Frequency per year of cardiac death or myocardial infarction (MI), cardiac death, and cardiac event rate after normal stress perfusion (n=610), normal delayed enhancement (DE) (n=567), normal ejection fraction (EF) (n=770), or all 3 normal (n=488).

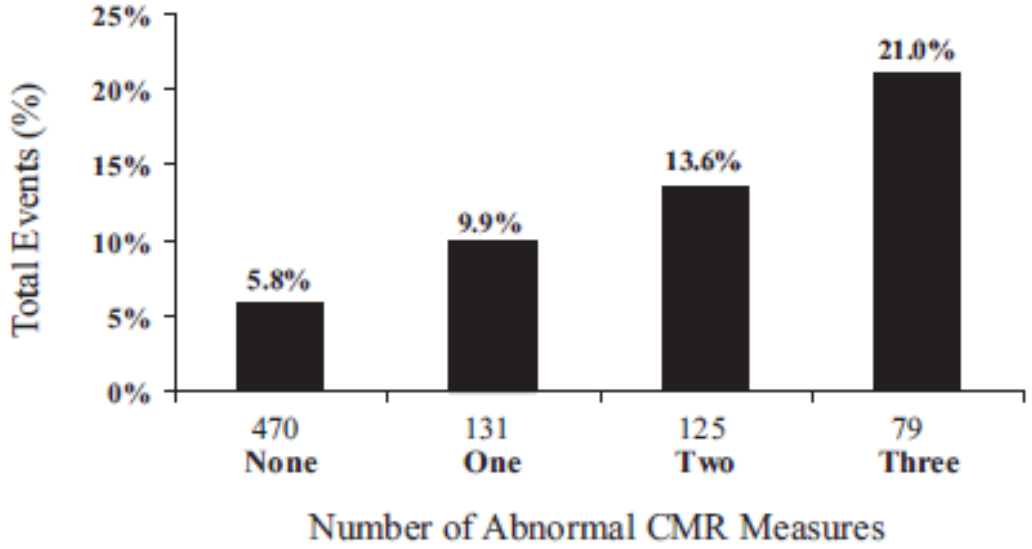
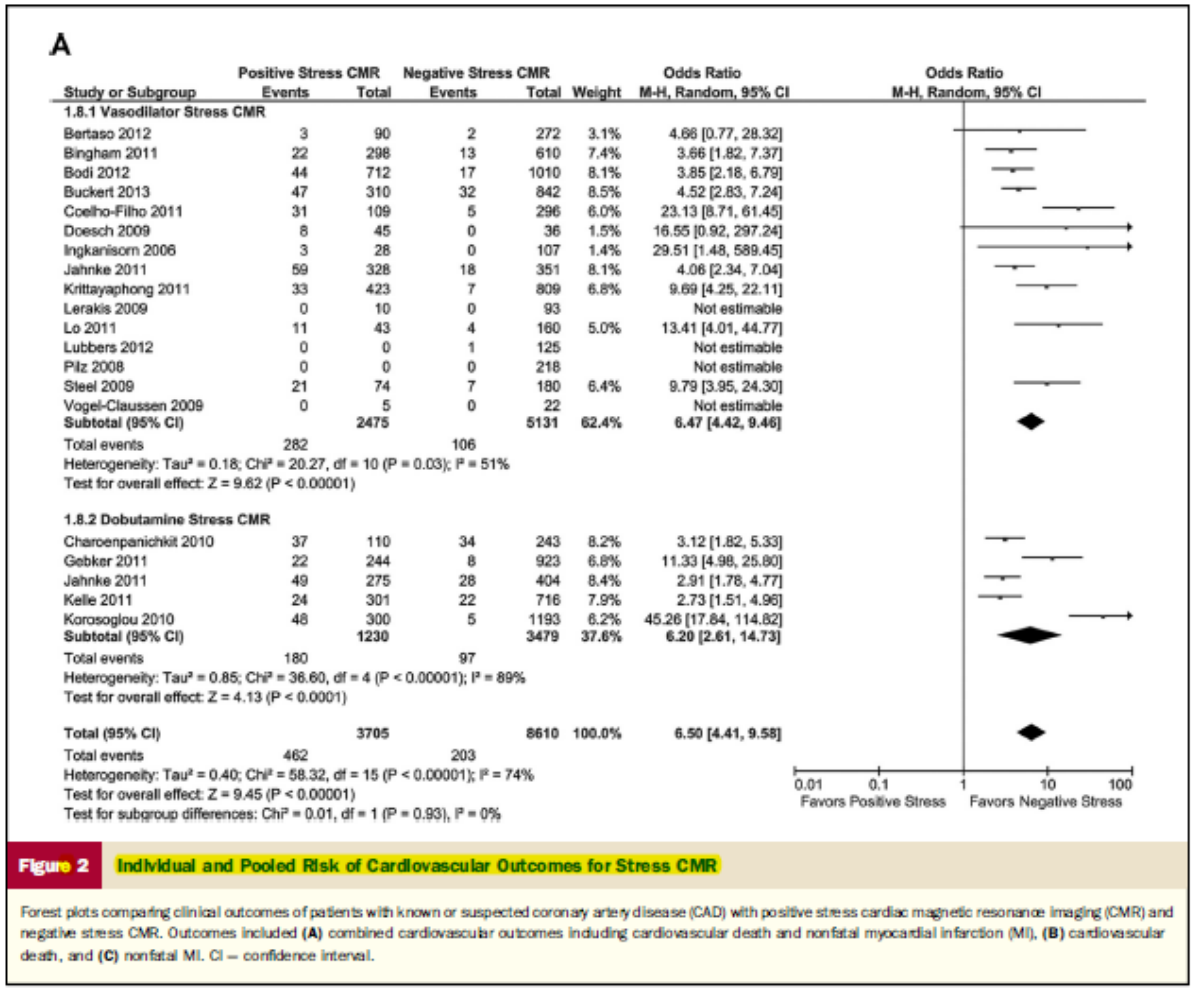


Figure 4. Frequency of total events as a function of the number of cardiac magnetic resonance imaging (CMR) test components abnormal (of stress perfusion, delayed enhancement [DE], and left ventricular ejection fraction [LVEF]). $P<0.001$ across categories. N for each subgroup is underneath the bar.

Bingham Circulation 2011

#STRESS CMR AND PROGNOSIS: METANALYSIS



A

Study or Subgroup	Positive Stress CMR Events	Total	Negative Stress CMR Events	Total	Weight	Odds Ratio M-H, Random, 95% CI
1.8.1 Vasodilator Stress CMR						
Bertaso 2012	3	90	2	272	3.1%	4.66 [0.77, 28.32]
Bingham 2011	22	298	13	610	7.4%	3.66 [1.82, 7.37]
Bodi 2012	44	712	17	1010	8.1%	3.85 [2.18, 6.79]
Buckert 2013	47	310	32	842	8.5%	4.52 [2.83, 7.24]
Coelho-Filho 2011	31	109	5	296	6.0%	23.13 [8.71, 61.45]
Doesch 2009	8	45	0	36	1.5%	16.55 [0.92, 297.24]
Ingkanisorn 2006	3	28	0	107	1.4%	29.51 [1.48, 589.45]
Jahnke 2011	59	328	18	351	8.1%	4.06 [2.34, 7.04]
Krittayaphong 2011	33	423	7	809	6.8%	9.69 [4.25, 22.11]
Lerakis 2009	0	10	0	93		Not estimable
Lo 2011	11	43	4	160	5.0%	13.41 [4.01, 44.77]
Lubbers 2012	0	0	1	125		Not estimable
Pilz 2008	0	0	0	218		Not estimable
Steel 2009	21	74	7	180	6.4%	9.79 [3.95, 24.30]
Vogel-Claussen 2009	0	5	0	22		Not estimable
Subtotal (95% CI)		**2475**		**5131**	**62.4%**	**6.47 [4.42, 9.46]**
Total events	282		106			
Heterogeneity: Tau² = 0.18; Chi² = 20.27, df = 10 (P = 0.03); I² = 51%						
Test for overall effect: Z = 9.62 (P < 0.00001)						
1.8.2 Dobutamine Stress CMR						
Charoenpanichkit 2010	37	110	34	243	8.2%	3.12 [1.82, 5.33]
Gebker 2011	22	244	8	923	6.8%	11.33 [4.98, 25.80]
Jahnke 2011	49	275	28	404	8.4%	2.91 [1.78, 4.77]
Kelle 2011	24	301	22	716	7.9%	2.73 [1.51, 4.96]
Korosoglou 2010	48	300	5	1193	6.2%	45.26 [17.84, 114.82]
Subtotal (95% CI)		**1230**		**3479**	**37.6%**	**6.20 [2.61, 14.73]**
Total events	180		97			
Heterogeneity: Tau² = 0.85; Chi² = 36.60, df = 4 (P < 0.00001); I² = 89%						
Test for overall effect: Z = 4.13 (P < 0.0001)						
Total (95% CI)		**3705**		**8610**	**100.0%**	**6.50 [4.41, 9.58]**
Total events	462		203			
Heterogeneity: Tau² = 0.40; Chi² = 58.32, df = 15 (P < 0.00001); I² = 74%						
Test for overall effect: Z = 9.45 (P < 0.00001)						
Test for subgroup differences: Chi² = 0.01, df = 1 (P = 0.93), I² = 0%						

Odds Ratio M-H, Random, 95% CI

0.01 0.1 1 10 100

Favors Positive Stress Favors Negative Stress

Figure 2 Individual and Pooled Risk of Cardiovascular Outcomes for Stress CMR

Forest plots comparing clinical outcomes of patients with known or suspected coronary artery disease (CAD) with positive stress cardiac magnetic resonance imaging (CMR) and negative stress CMR. Outcomes included **(A)** combined cardiovascular outcomes including cardiovascular death and nonfatal myocardial infarction (MI), **(B)** cardiovascular death, and **(C)** nonfatal MI. CI = confidence interval.

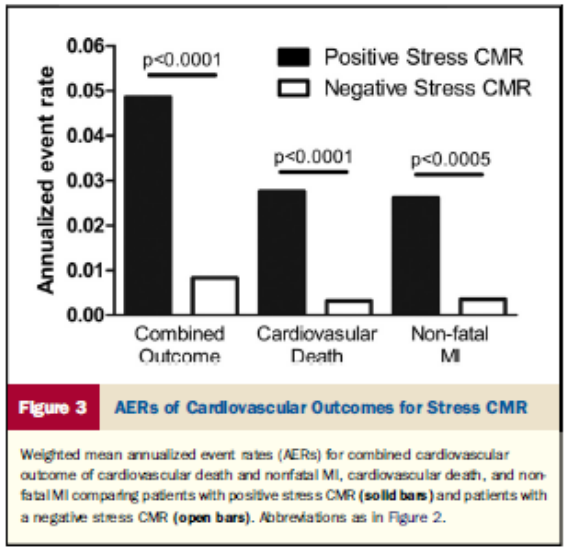


Figure 3 AERs of Cardiovascular Outcomes for Stress CMR

Weighted mean annualized event rates (AERs) for combined cardiovascular outcome of cardiovascular death and nonfatal MI, cardiovascular death, and nonfatal MI comparing patients with positive stress CMR **(solid bars)** and patients with a negative stress CMR **(open bars)**. Abbreviations as in Figure 2.

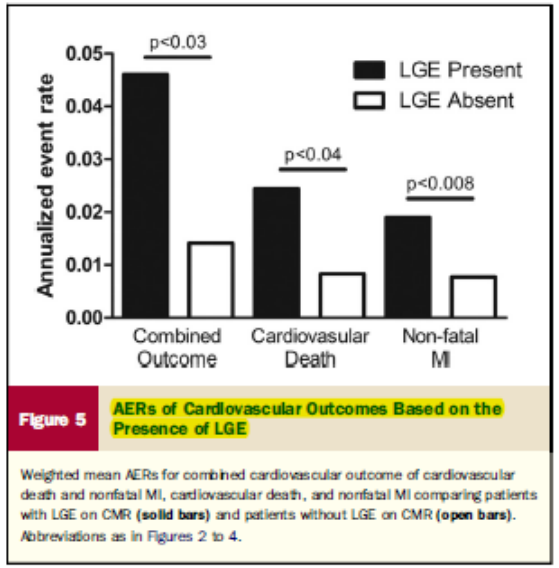


Figure 5 AERs of Cardiovascular Outcomes Based on the Presence of LGE

Weighted mean AERs for combined cardiovascular outcome of cardiovascular death and nonfatal MI, cardiovascular death, and nonfatal MI comparing patients with LGE on CMR **(solid bars)** and patients without LGE on CMR **(open bars)**. Abbreviations as in Figures 2 to 4.

N= 19 FU 32 months
11.636 pts

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Lipinski JACC 2013

#STRESS CMR AND PROGNOSIS IN WOMEN

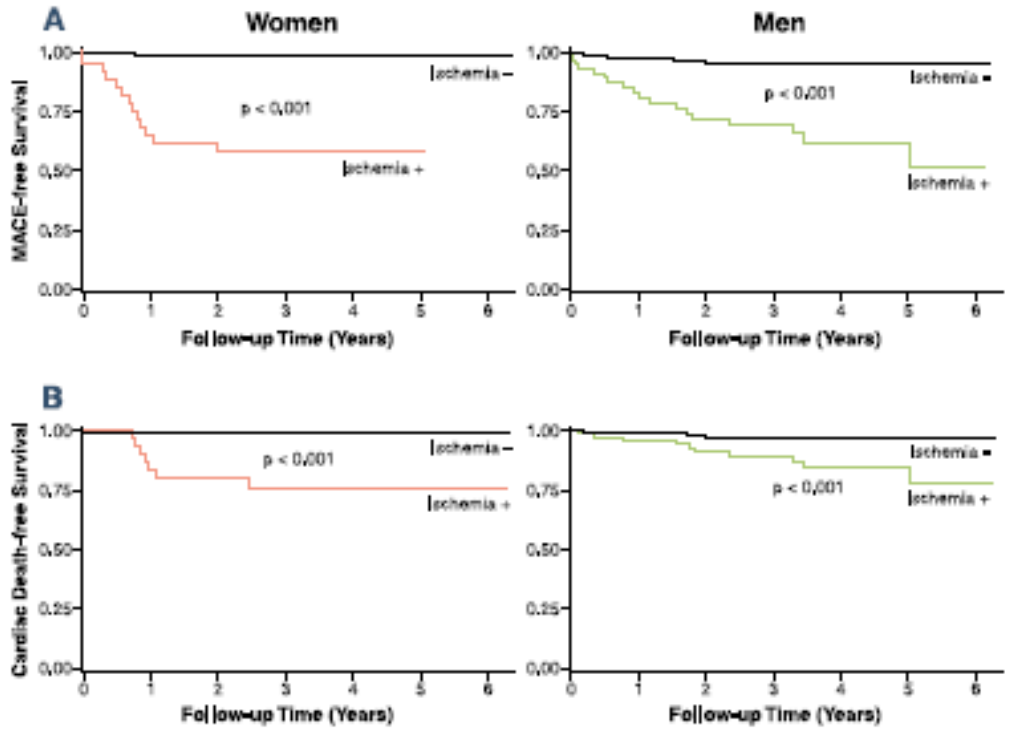

Figure 1. Kaplan-Meier Curves for MACE and Cardiac Death

Kaplan-Meier curves for major adverse cardiac events (MACE) (A) and cardiac death (B) stratified by evidence of ischemia in each sex.

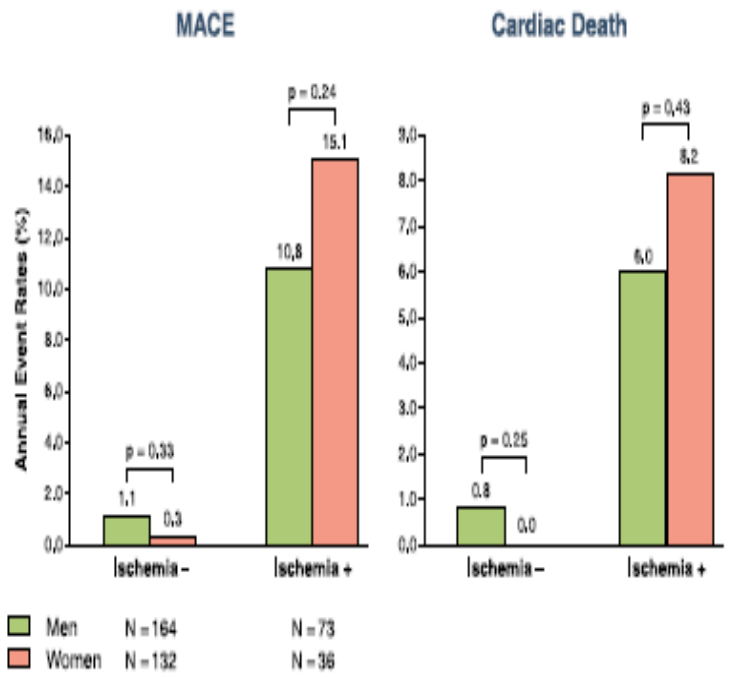

Figure 2. Patient Annual Event Rates of MACE and of Cardiac Death

Patient annual event rates of major adverse cardiac events (MACE) and cardiac death, stratified by sex and evidence of ischemia. Ischemia – = evidence of ischemia absent; ischemia + = evidence of ischemia present.

Otavio R. Coelho-Filho, JACC Card Imaging 2011

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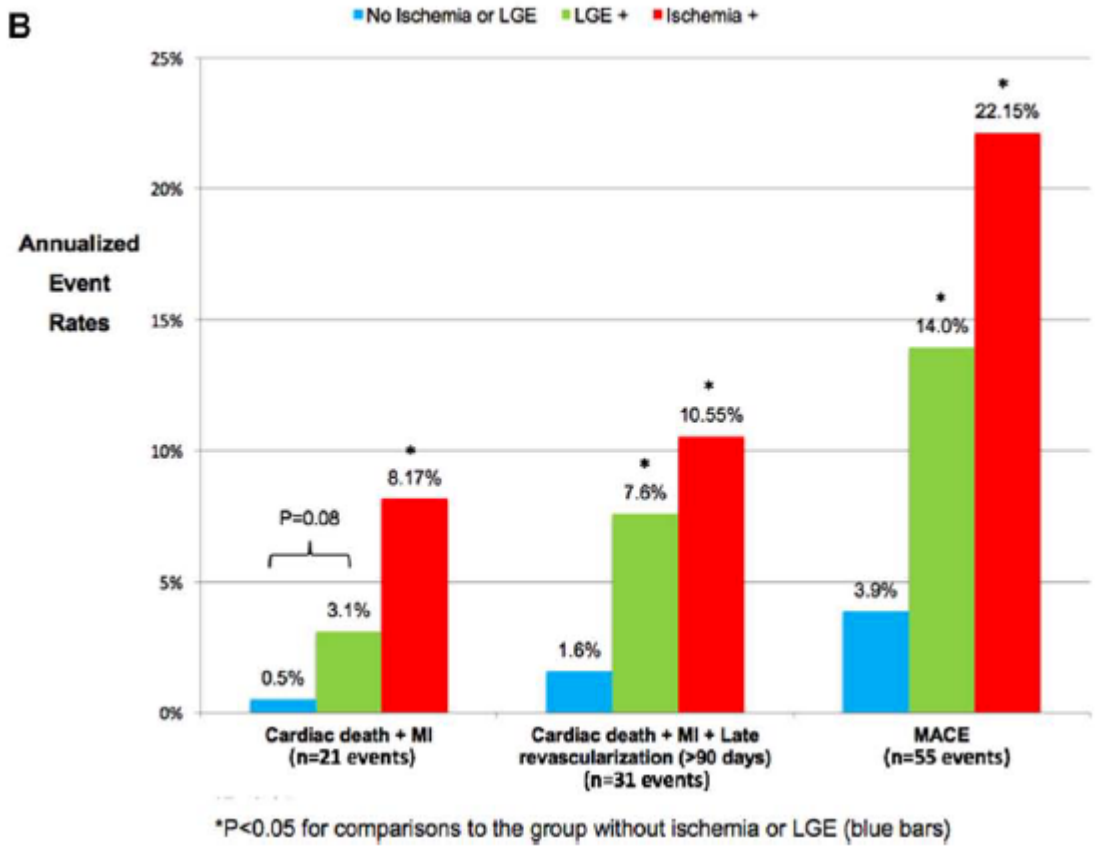
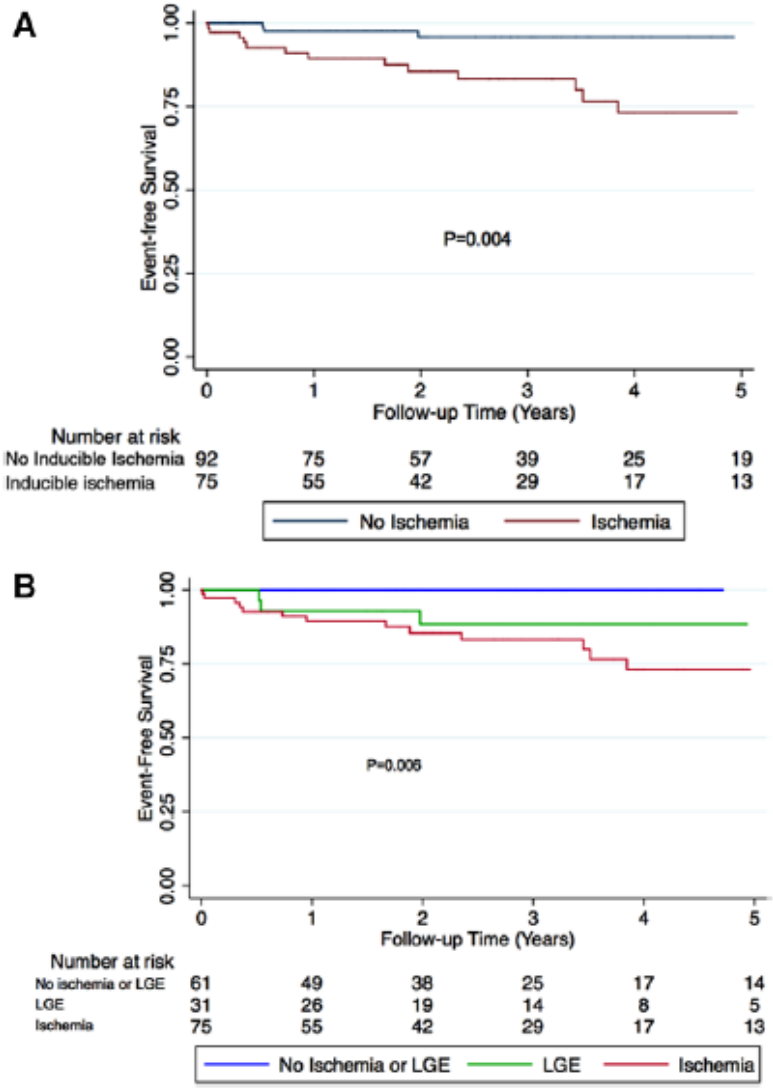
#STRESS CMR AND PROGNOSIS IN DIABETICS





Estimated annualized event rates in diabetics stratified by the presence or absence of inducible ischemia and LGE by stress CMR

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Heydary Circ CI 2016

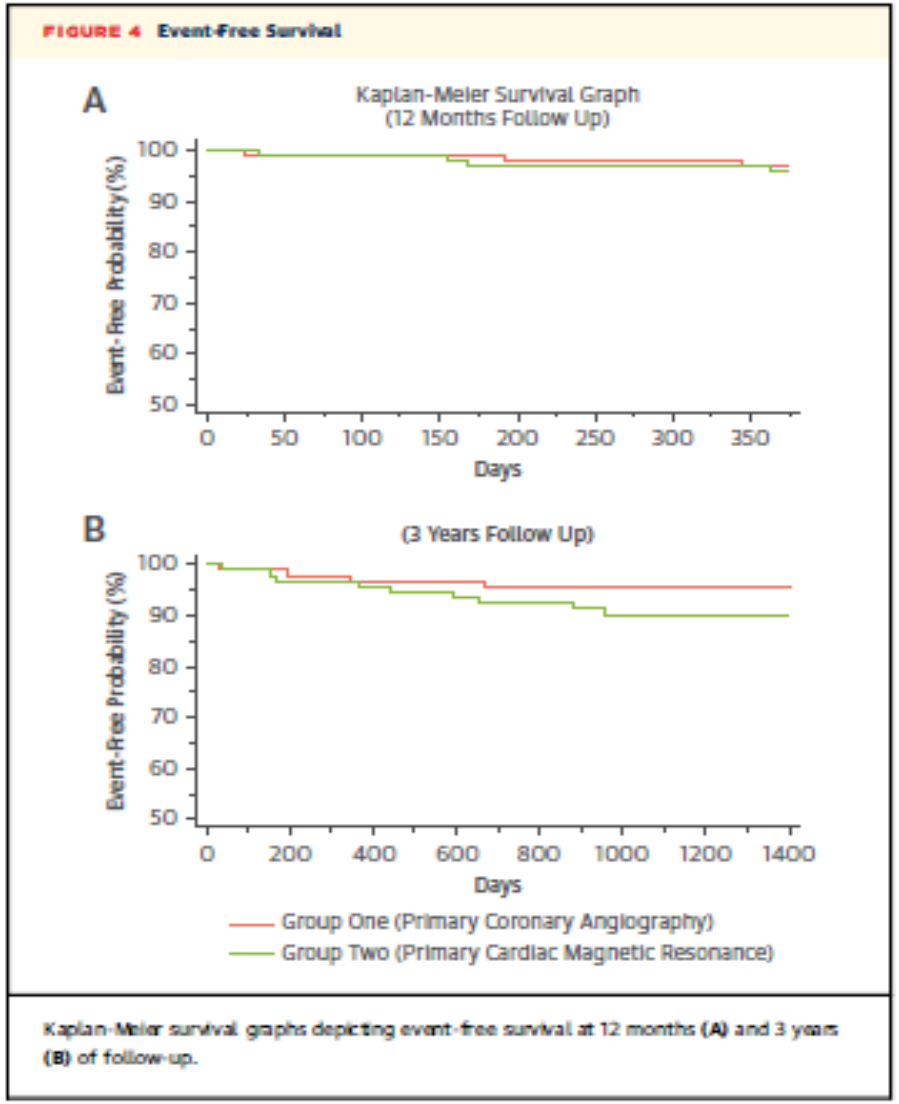
STRESS CMR MANAGEMENT STRATEGY AND PROGNOSIS

#STRESS CMR BASED MANAGEMENT STRATEGY

Comparing Cardiac Magnetic Resonance–Guided Versus Angiography-Guided Treatment of Patients With Stable Coronary Artery Disease

Results From a Prospective Randomized Controlled Trial

Dominik Buckert, MD,[a] Simon Witzel, MD,[a] Jürgen M. Steinacker, MD,[a] Wolfgang Rottbauer, MD,[a] Peter Bernhardt, MD[b]



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Buckert, JACC CI 2018

#STRESS CMR BASED MANAGEMENT STRATEGY

ACC.17

Randomization (1:1)

FFR INFORMED

- Invasive angiography in all patients
- FFR in all arteries >2.5 mm with a stenosis of 40-95%
- If FFR <0.8 revascularization (PCI or CABG) recommended
- CTO regarded as positive

MR INFORMED

- 1.5T multivendor
- Cine imaging
- Adenosine stress/rest first pass perfusion imaging using 0.075 mmol Gadovist / kg body weight for first pass
- Late gadolinium enhancement after top-up to 0.2 mmol/kg body weight
- If transmural defect or subendocardial defect >2 segments or in 2 adjacent slices was found, angiography with aim of revascularization recommended

MR-INFORM

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#STRESS CMR BASED MANAGEMENT STRATEGY

ACC.17

Discussion / Summary

- Guiding the initial management of patients with stable angina and an intermediate to high risk for coronary artery disease with non-invasive MR-perfusion imaging is non-inferior to a strategy with invasive angiography supported by FFR during a follow-up of one year.
- Both strategies are safe and result in a low total event rate.
- The number of revascularization procedures is significantly lower when guided by MR perfusion imaging in comparison to invasive angiography supported by FFR.

MR-INFORM

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#STRESS CMR BASED MANAGEMENT STRATEGY

Ischemic Heart Disease

The STRATEGY Study (Stress Cardiac Magnetic Resonance Versus Computed Tomography Coronary Angiography for the Management of Symptomatic Revascularized Patients)

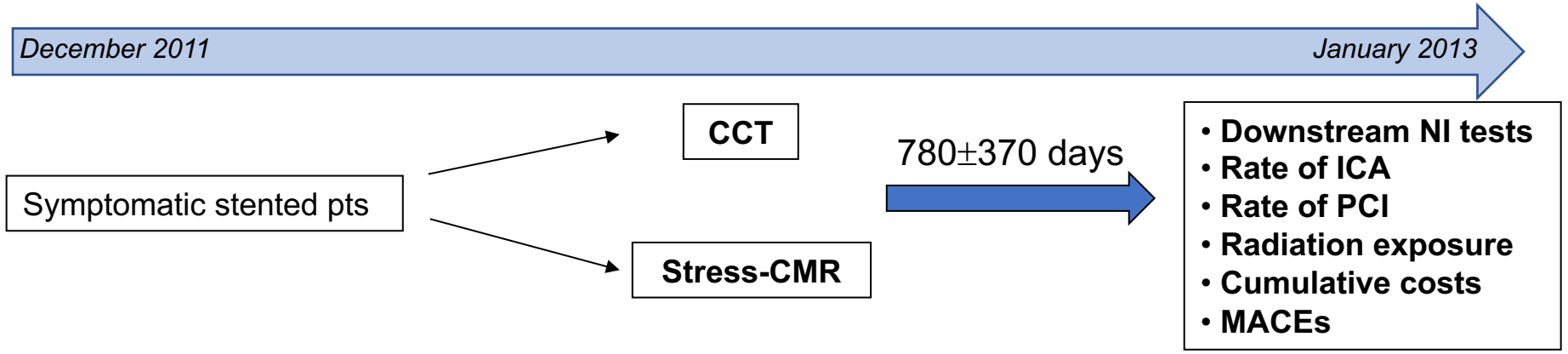
Resources and Outcomes Impact

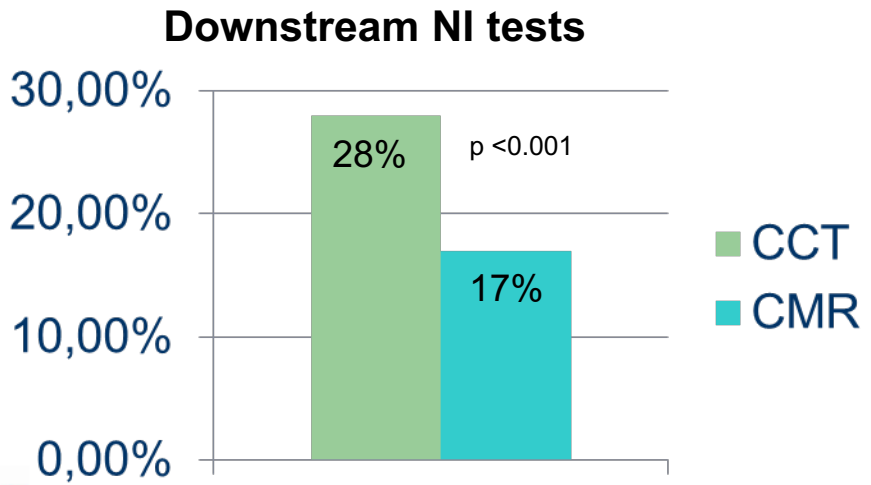
Gianluca Pontone, MD, PhD, FESC, FSCCT; Daniele Andreini, MD, PhD, FESC, FSCCT; Andrea I. Guaricci, MD, FESC; Cristina Rota, MD; Marco Guglielmo, MD; Saima Mushtaq, MD; Andrea Baggiano, MD; Virginia Beltrama, MD; Laura Fusini, MSc; Anna Solbiati, MD; Chiara Segurini, MD; Edoardo Conte, MD; Paola Gripari, MD, PhD; Andrea Annoni, MD; Alberto Formenti, MD; Maria Petulla', MD; Federico Lombardi, MD; Giuseppe Muscogiuri, MD; Antonio L. Bartorelli, MD, FESC, FACC; Mauro Pepi, MD, FESC

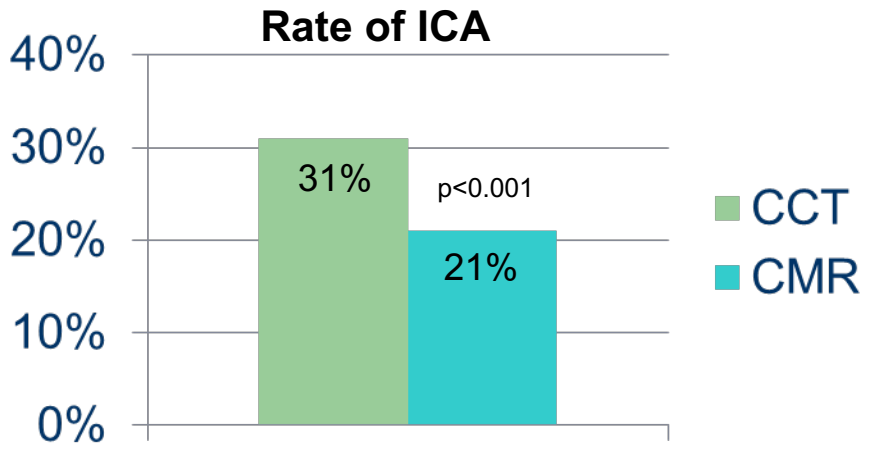
Pontone G et al, Circulation CI 2016

#STRESS CMR BASED MANAGEMENT STRATEGY

Computed tomography coronary angiography verSus sTRess cArdiac magneTic rEsonance for the manaGement of sYmptomatic revascularized patients: a cost effectiveness study (STRATEGY study)







Centro Cardiologico Monzino

Pontone G et al, Circulation CI 2016

#STRESS CMR BASED MANAGEMENT STRATEGY

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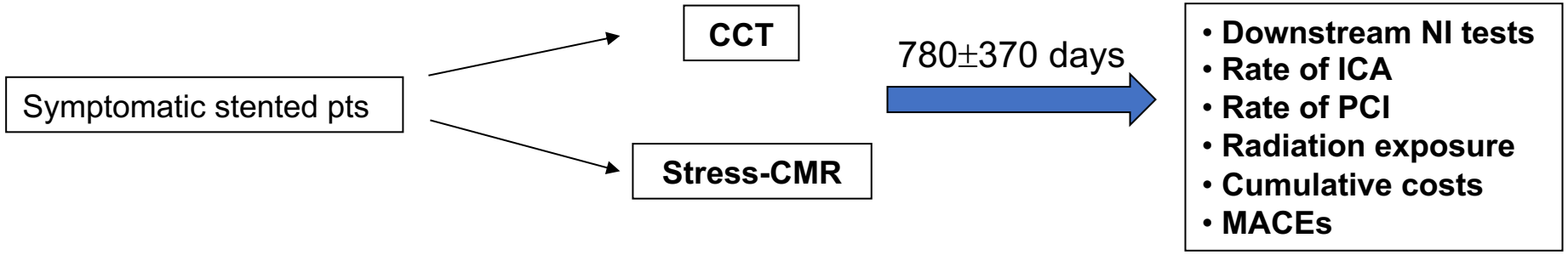

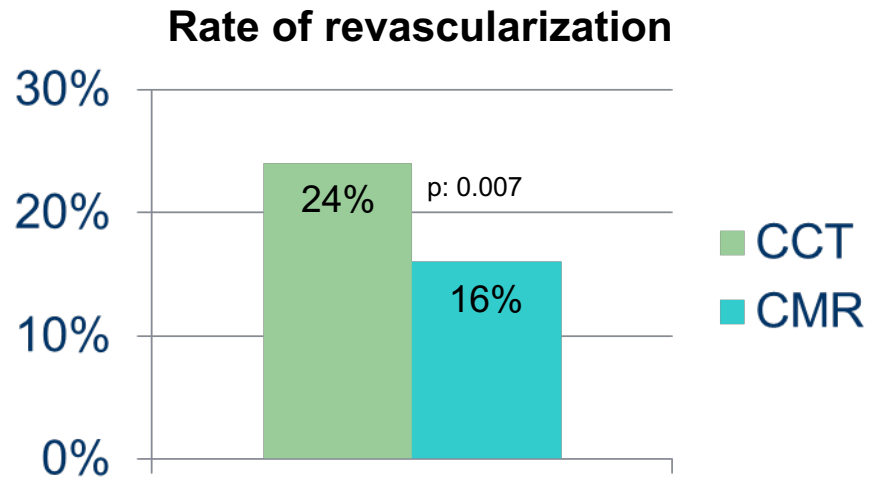

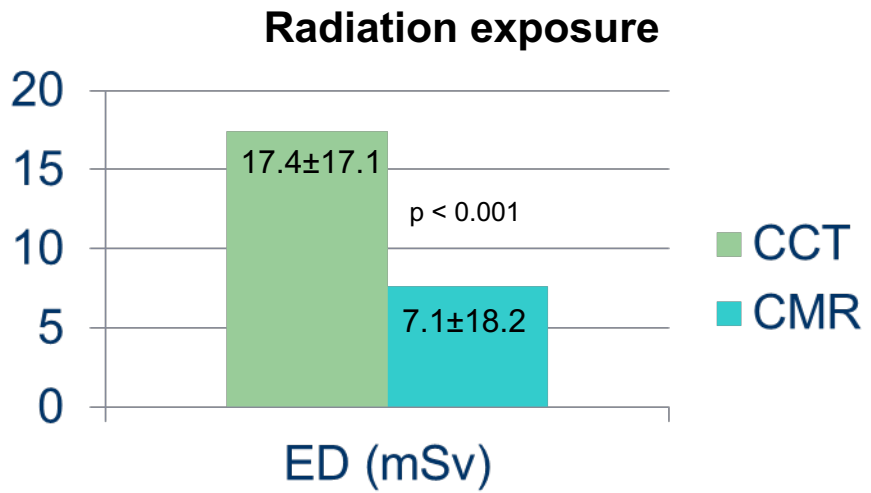

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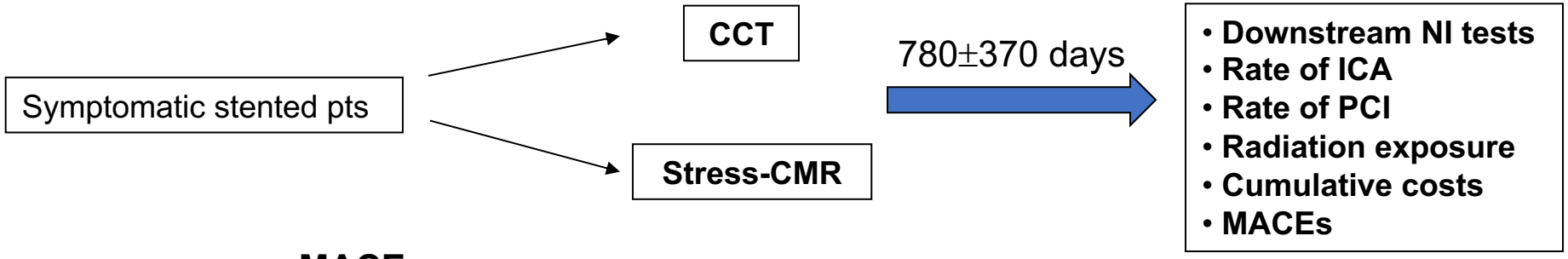

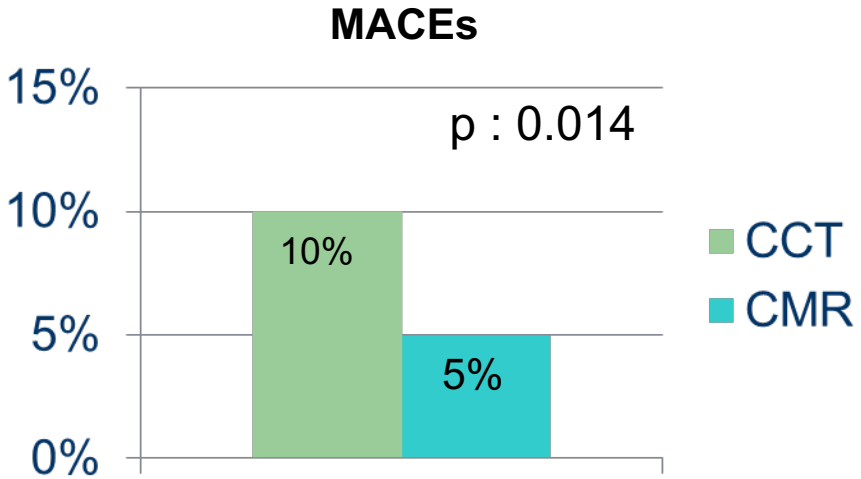

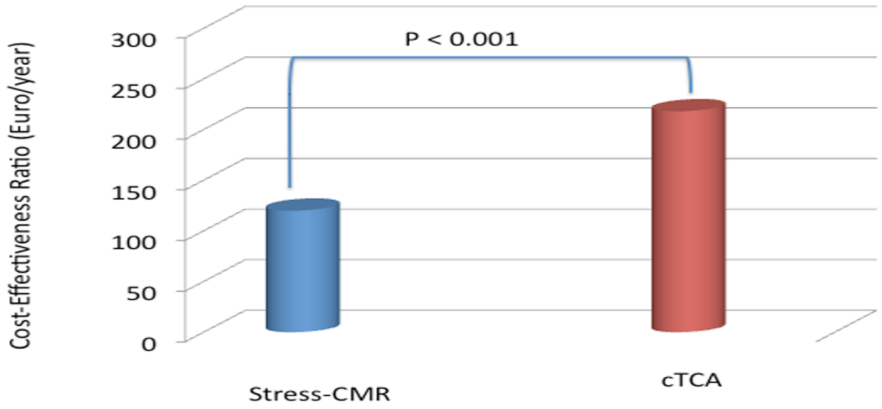

In revascularized patients the functional strategy seems to be superior as compared to anatomical strategy in terms of cost-effectiveness

Pontone G et al, Circulation CI 2016

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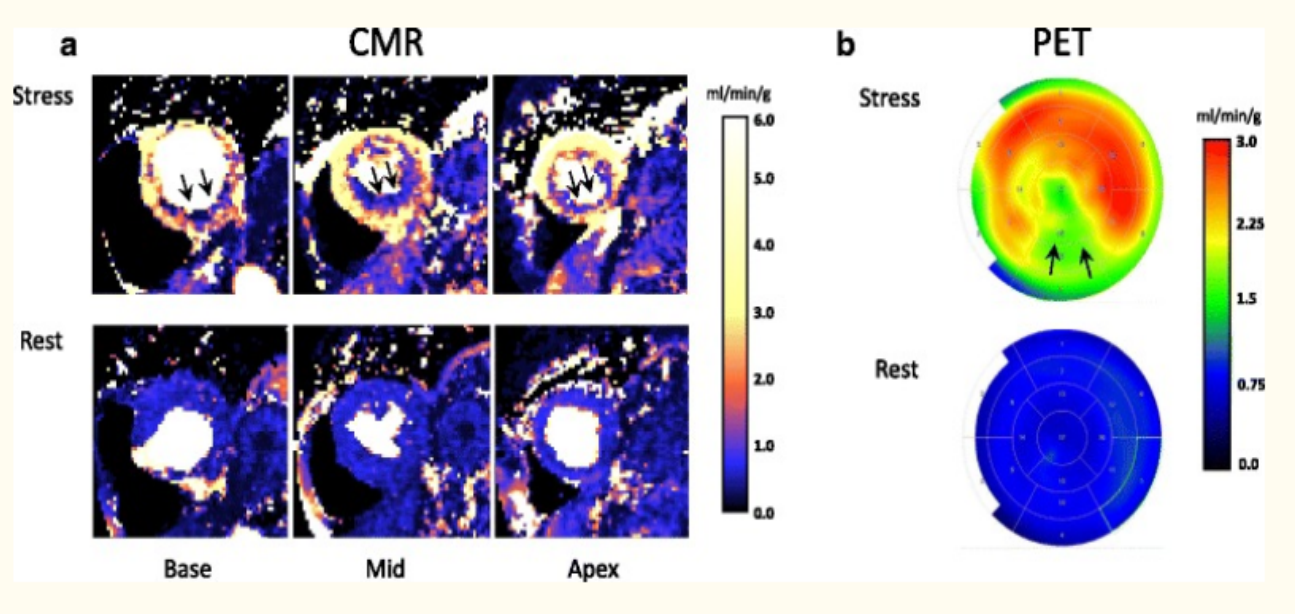
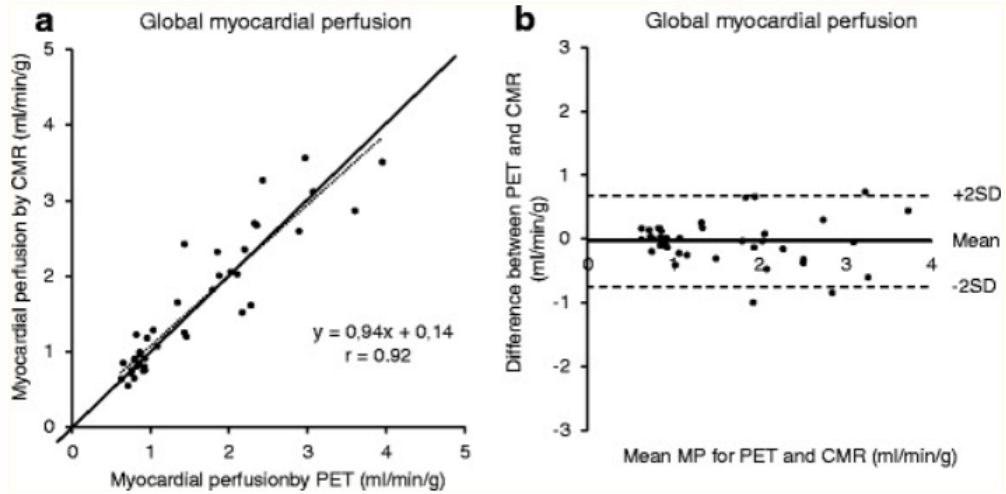
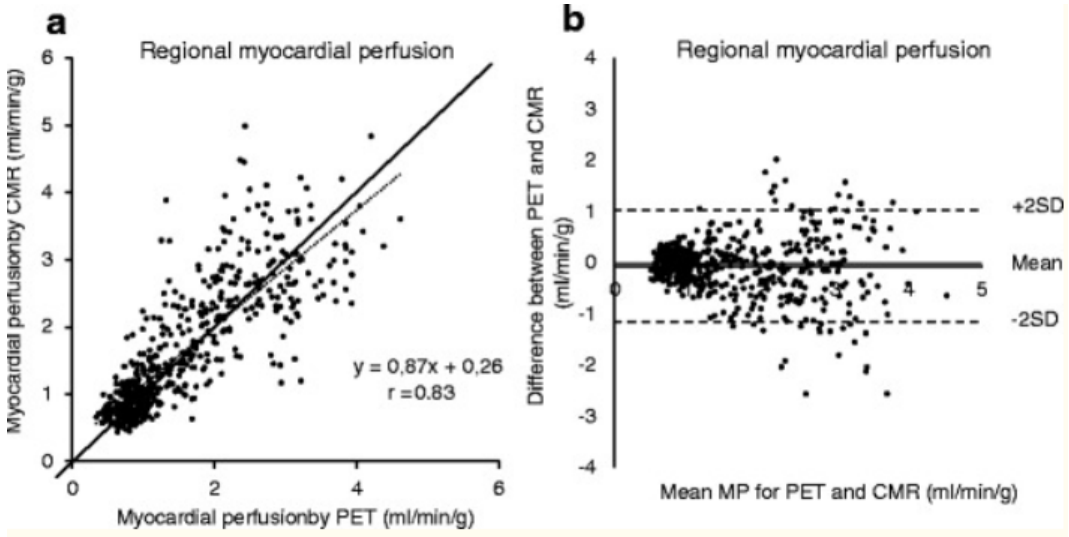
STRESS CMR: FUTURE PERSPECTIVES

#STRESS CMR: FULLY QUANTITATIVE CMR PERFUSION







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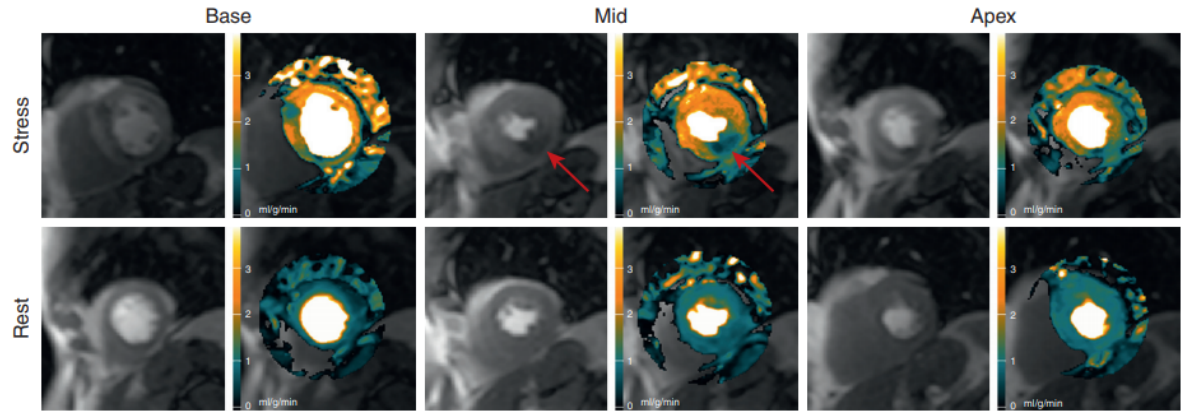
Engblom JCMR 2017

#STRESS CMR: FULLY QUANTITATIVE CMR PERFUSION

FIGURE 3 Automated MBF Pixel Maps in Patient With Single-Vessel Disease



Automated MBF pixel maps in a patient with 89% right coronary artery stenosis by QCA show an inferior perfusion defect **(red arrows)** on the stress perfusion image and MBF map (Online Video 2). The possible perfusion defect in the basal anteroseptal wall did not reach abnormal thresholds. It was associated with a severe narrowing of a septal perforator artery that was too small for QCA. MBF = myocardial blood flow; QCA = quantitative coronary angiography.

TABLE 3 Diagnostic Performance Comparisons of CMR Perfusion Quantification by MBF, MPR, rMBF, and rMPR From Automated Perfusion Maps

	AUC	95% CI	Threshold	Sensitivity (%)	Specificity (%)	Accuracy (%)
Per-patient diagnostic performance						
MBF	0.901	0.837-0.964	1.290	82.9	80.0	81.3
MPR	0.864	0.785-0.942	1.475	82.9	75.6	78.8
rMBF	0.925	0.863-0.988	0.570	85.7	84.4	85.0
rMPR	0.926	0.856-0.997	0.770	91.4	91.1	91.3
Per-vessel diagnostic performance						
MBF	0.841	0.784-0.898	1.350	75.0	71.8	72.5
MPR	0.837	0.773-0.902	1.435	80.8	74.5	75.8
rMBF	0.864	0.809-0.919	0.605	78.8	75.5	76.3
rMPR	0.844	0.778-0.909	0.775	82.7	80.9	81.3

Diagnostic performance comparisons of CMR perfusion quantification by myocardial blood flow (MBF), myocardial perfusion reserve (MPR), relative MBF (rMBF), and relative MPR (rMPR) from automated perfusion maps (see Figure 7 for receiver-operating curves).

AUC = area under the curve; CI = confidence interval.

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Li-Yueh Hsu, JACC CI 2018

#STRESS CMR: THE ROLE OF T1 MAPPING

JOURNAL OF THE AMERICAN COLLEGE OF CARDIOLOGY VOL. 71, NO. 9, 2018

PUBLISHED BY ELSEVIER

EDITORIAL COMMENT

Mapping the Future of Myocardial Ischemia Testing With Cardiac Magnetic Resonance*

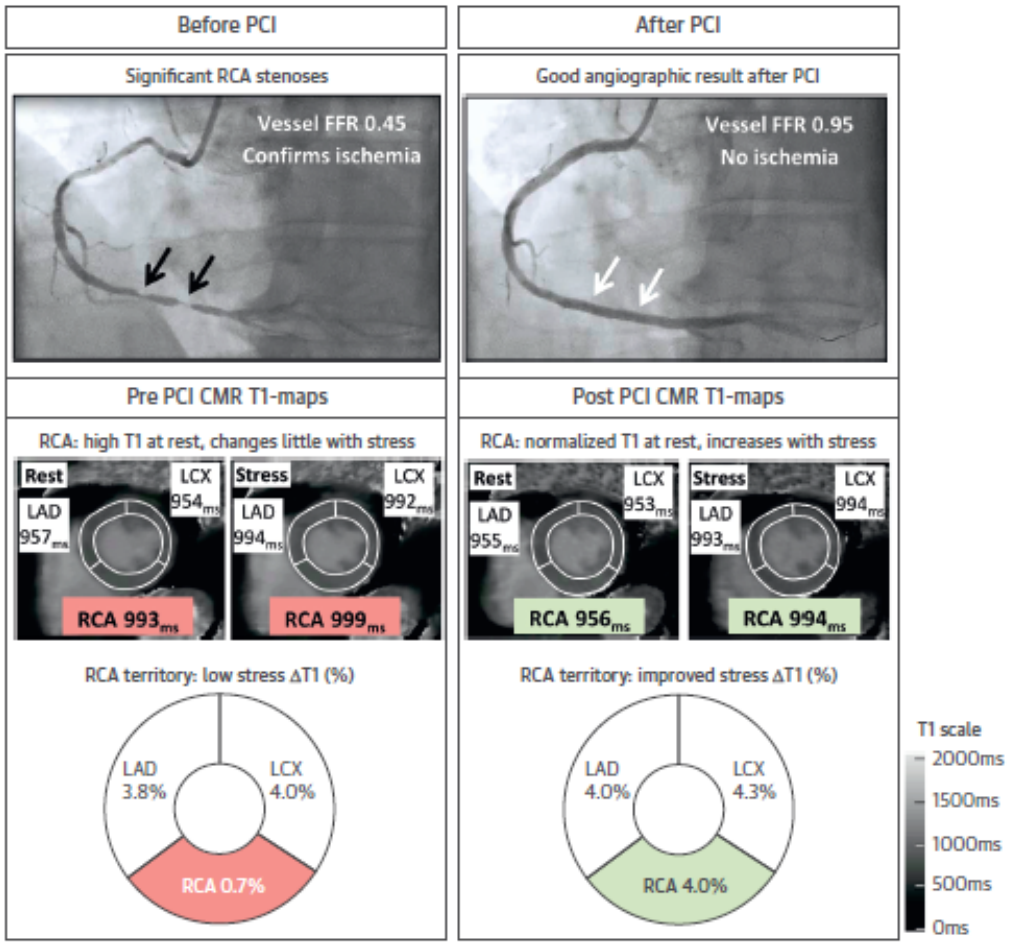
Theodoros D. Karamitsos, MD, PhD

There is no doubt that these novel, noncontrast CMR techniques offer important pathophysiological insights in myocardial ischemia and have a significant diagnostic potential that justifies the conduction of a large-scale study.

Karamitsos JACC 2018

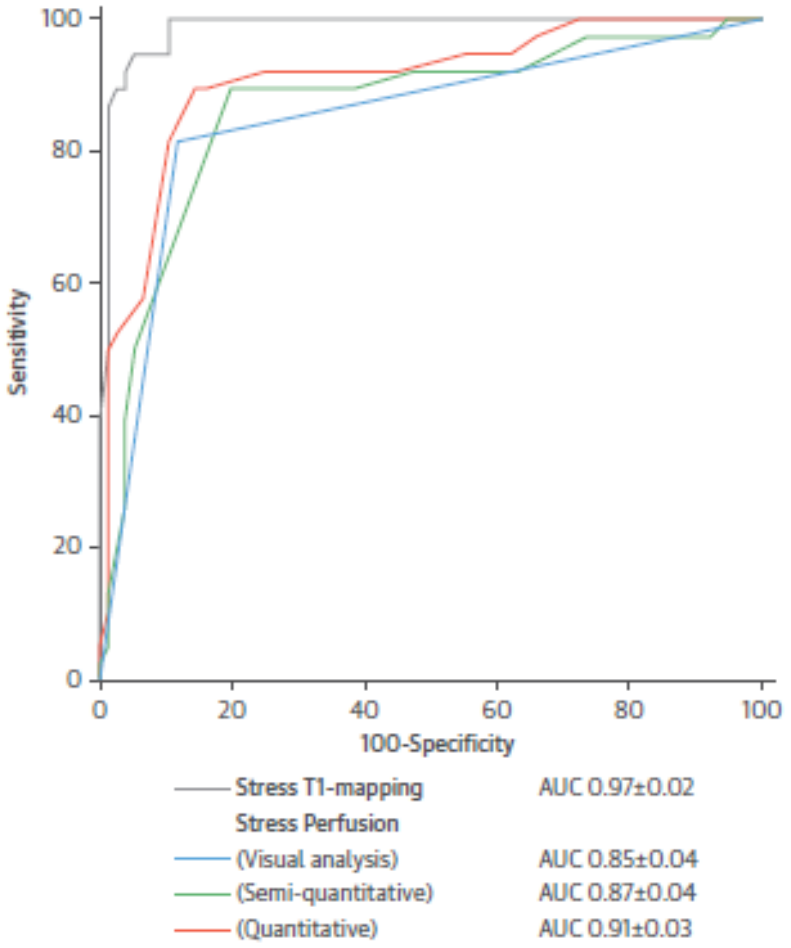
#STRESS CMR: THE ROLE OF T1 MAPPING

FIGURE 2 Noninvasive Assessment of Myocardial Ischemia Using Gadolinium-Free CMR Stress T1 Mapping



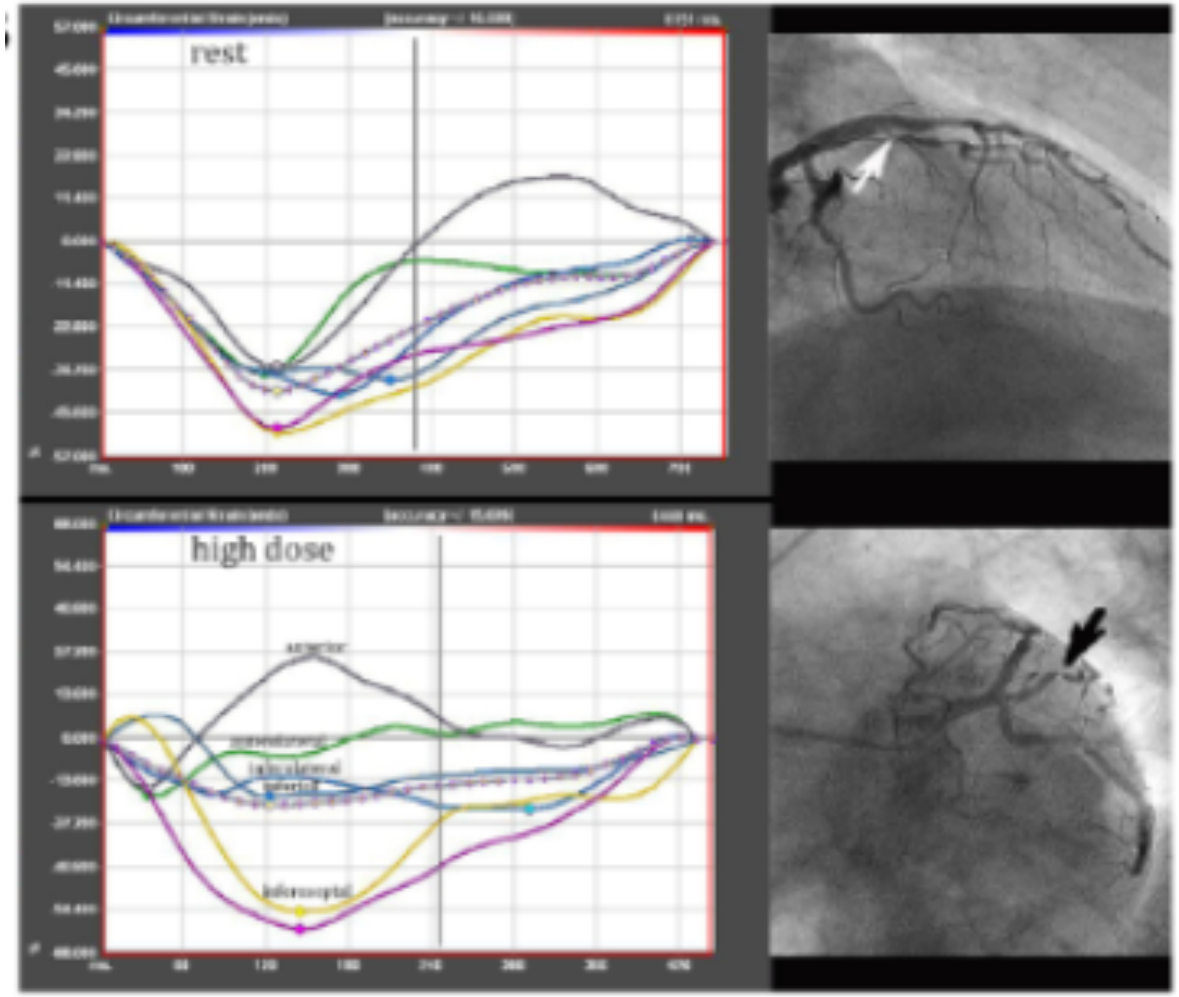
A 69-year-old male patient presented with angina for 3 months. On angiography, he had 2 significant right coronary artery (RCA) stenoses **(black arrows)**, with a combined vessel fractional flow reserve (FFR) of 0.45, indicating coronary ischemia. The 1.5-T cardiac magnetic resonance (CMR) before coronary angiography showed an elevated resting T1 and reduced stress T1 response in the RCA territory ($T1_{rest}$ 993 ms to $T1_{stress}$ 999 ms: ΔT1 − 0.7%). Percutaneous coronary intervention (PCI) relieved the stenoses with good angiographic result **(white arrows)** and normalization of vessel FFR to 0.95. This finding was accompanied by significant improvements in the rest and stress T1 responses ($T1_{rest}$ 956 ms to $T1_{stress}$ 994 ms: ΔT1 − 4.0%).

FIGURE 4 Diagnostic Performance of CMR Stress T1 Mapping (ΔT1) and Gadolinium Contrast-Enhanced Stress Perfusion for Detecting Obstructive CAD



Alexander Liu JACC 2018

#STRESS CMR: THE ROLE OF STRAIN



FT based analysis of Ecc during intermediate- and high-dose DS-CMR was feasible and differentiated
between stenotic, remote and normal segments. Quantitative assessment of Ecc with FT may improve the diagnostic accuracy of DS-CMR for detection of ischemia.

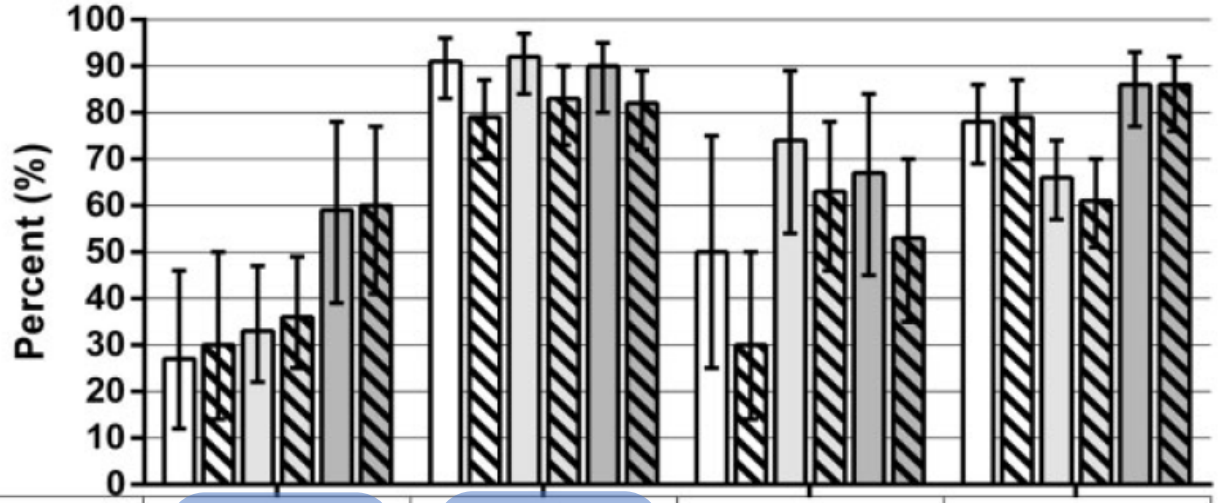
Schneeweism JCMR 2014

#STRESS CMR: THE COMPETITION WITH DYNAMIC STRESS CTP

ESC European Society of Cardiology
European Heart Journal - Cardiovascular Imaging (2018) 0, 1–9
doi:10.1093/ehjci/jex342

Diagnosing coronary artery disease after a positive coronary computed tomography angiography: the Dan-NICAD open label, parallel, head to head, randomized controlled diagnostic accuracy trial of cardiovascular magnetic resonance and myocardial perfusion scintigraphy

L. Nissen[1]*, S. Winther[2], J. Westra[2], J. A. Ejlersen[3], C. Isaksen[4], A. Rossi[5], N. R. Holm[2], G. Urbonaviciene[6], L. C. Gormsen[7], L. H. Madsen[1], E. H. Christiansen[2], M. Maeng[2], L. L. Knudsen[1], L. Frost[6], L. Brix[4], H. E. Bøtker[2], S. E. Petersen[5], and M. Bøttcher[1]



	Sensitivity	Specificity	PPV	NPV
MPS - FFR 0.80	27% (12-46)	91% (83-96)	50% (25-75)	78% (69-86)
CMR - FFR 0.80	30% (14-50)	79% (70-87)	30% (14-50)	79% (70-87)
MPS - QCA 50% stenosis	33% (22-47)	92% (84-97)	74% (54-89)	66% (57-74)
CMR – QCA 50% stenosis	36% (25-49)	83% (73-90)	63% (46-78)	61% (51-70)
MPS – Visual 90 % stenosis	59% (39-78)	90% (80-95)	67% (45-84)	86% (77-93)
CMR – Visual 90 % stenosis	60% (41-77)	82% (72-89)	53% (35-70)	86% (76-92)

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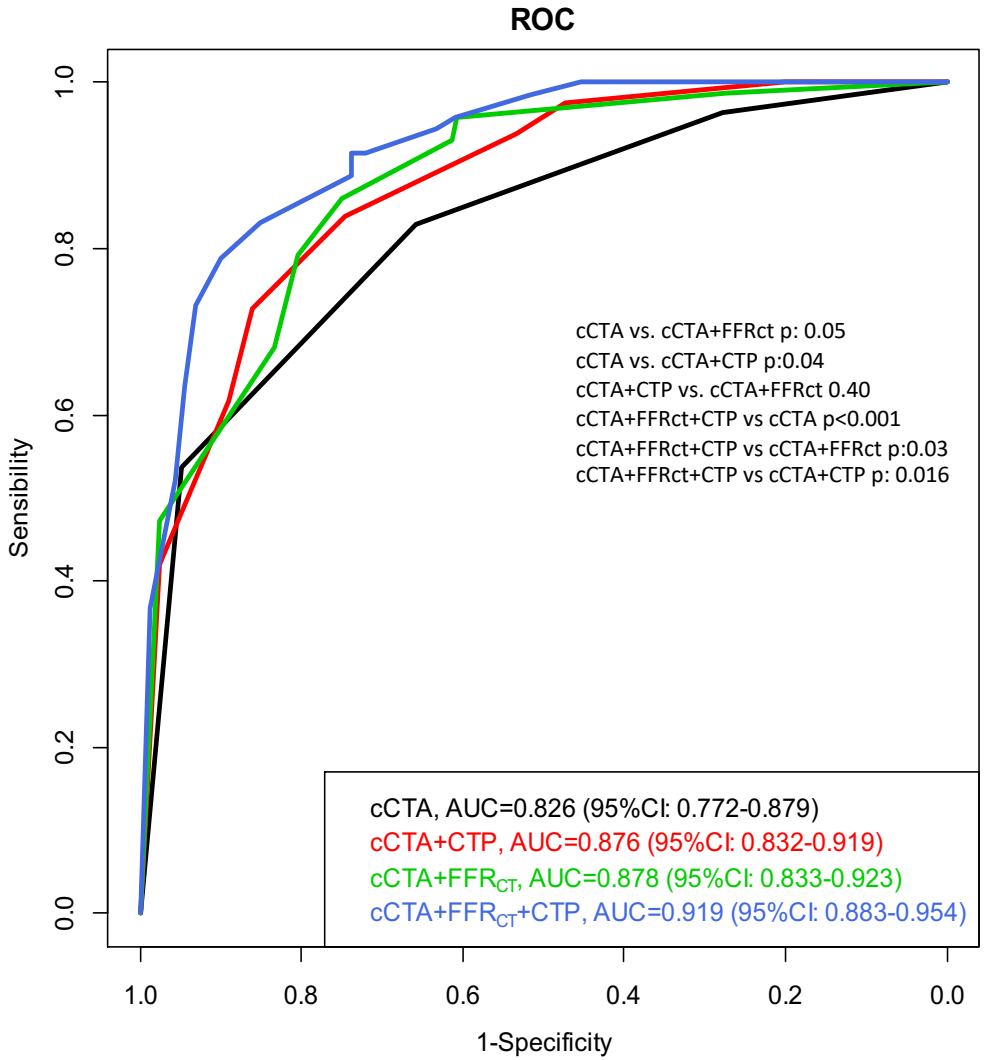
#STRESS CMR: THE COMPETITION WITH DYNAMIC STRESS CTP

Dynamic stress CTP with a whole-heart coverage scanner in addition to cCTA and FFR_{CT}

Dynamic CTP diagnostic accuracy

[1]Gianluca Pontone, MD, PhD, FESC, FSCCT, [1]Andrea Baggiano, MD, [1,2]Daniele Andreini, MD, PhD, FESC, FSCCT, [3]Andrea I. Guaricci, MD, FESC, [1]Marco Guglielmo, MD, [1]Giuseppe Muscogiuri, MD, [1]Laura Fusini, MD, [2]Margherita Soldi, MD, [2]Alberico Del Torto, MD, [1]Saima Mushtaq, MD, [1]Edoardo Conte, MD, [1]Giuseppe Calligaris, MD, [1]Stefano De Martini, MD, [1]Cristina Ferrari, MD, [1]Stefano Galli, MD, [1]Luca Grancini, MD, [1]Paolo Olivares, MD, [1]Paolo Ravagnani, MD, [1]Giovanni Teruzzi, MD, [1]Daniela Trabattoni, MD, [1]Franco Fabbiocchi, MD, [1,2]Piero Montorsi, MD, [4,5]Mark G. Rabbat, MD, FSCCT, FACC, FAHA [1,6]Antonio L. Bartorelli, MD, [1]Mauro Pepi, MD, FESC

	cCTA	cCTA+FFR_{CT}	cCTA+CTP	cCTA+FFR_{CT}+CTP
VESSEL-BASED ANALYSIS				
True positive, n	68	62	59	56
True negative, n	114	126	142	145
False positive, n	59	42	23	16
False negative, n	14	10	22	15
Sensitivity, % (95% CI)	83 (75-91)	86 (78-94)	73 (63-83)	79 (69-88)
Specificity, % (95% CI)	66 (59-73)	75 (68-82)	86 (81-91)	90 (85-95)
Negative predictive value, % (95% CI)	89 (84-94)	93 (88-97)	87 (81-92)	91 (86-95)
Positive predictive value, % (95% CI)	54 (45-62)	60 (50-69)	72 (62-82)	78 (68-87)
Accuracy, % (95% CI)	71 (66-77)	78 (68-82)	82 (77-87)	87 (82-91)



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Pontone G et al JACC CI 2019 in press

#STRESS CMR: THE COMPETITION WITH DYNAMIC STRESS CTP

Clinical Case: 72 y/o patient, risk factors: former smoker, hypertension, diabetes, dyslipidemia. No angina. Dispnea. SPECT positive in inferolateral wall

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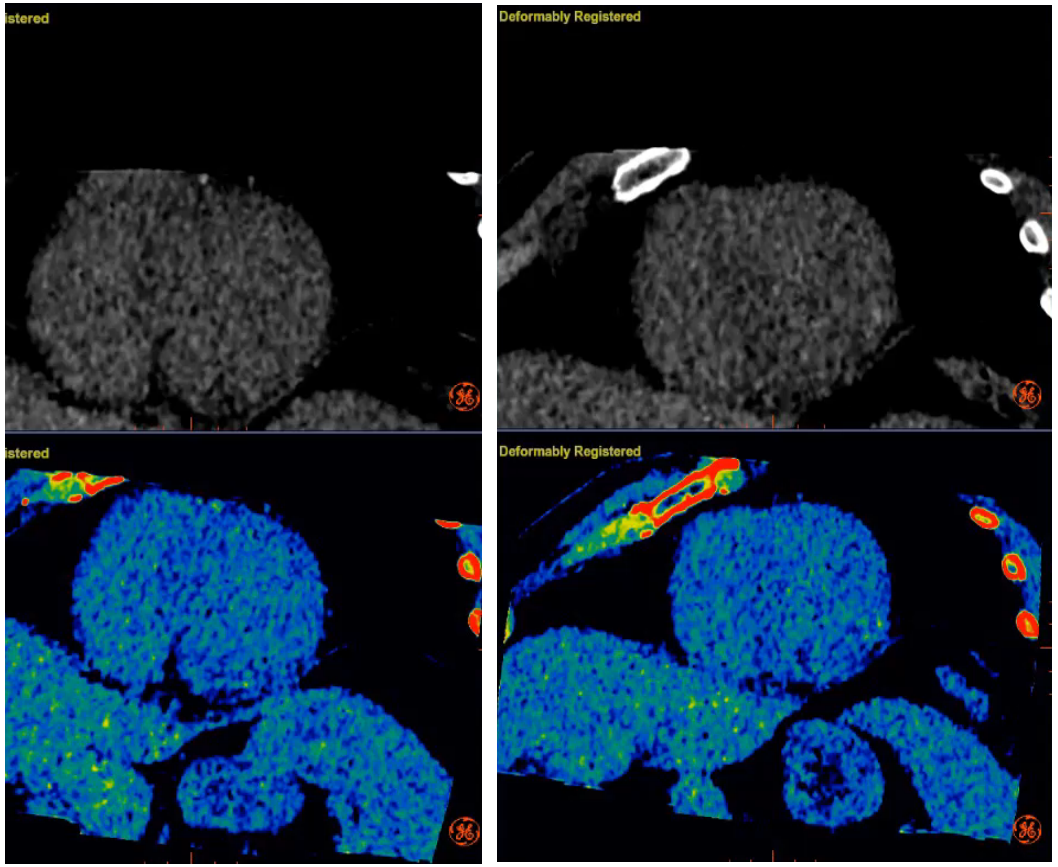

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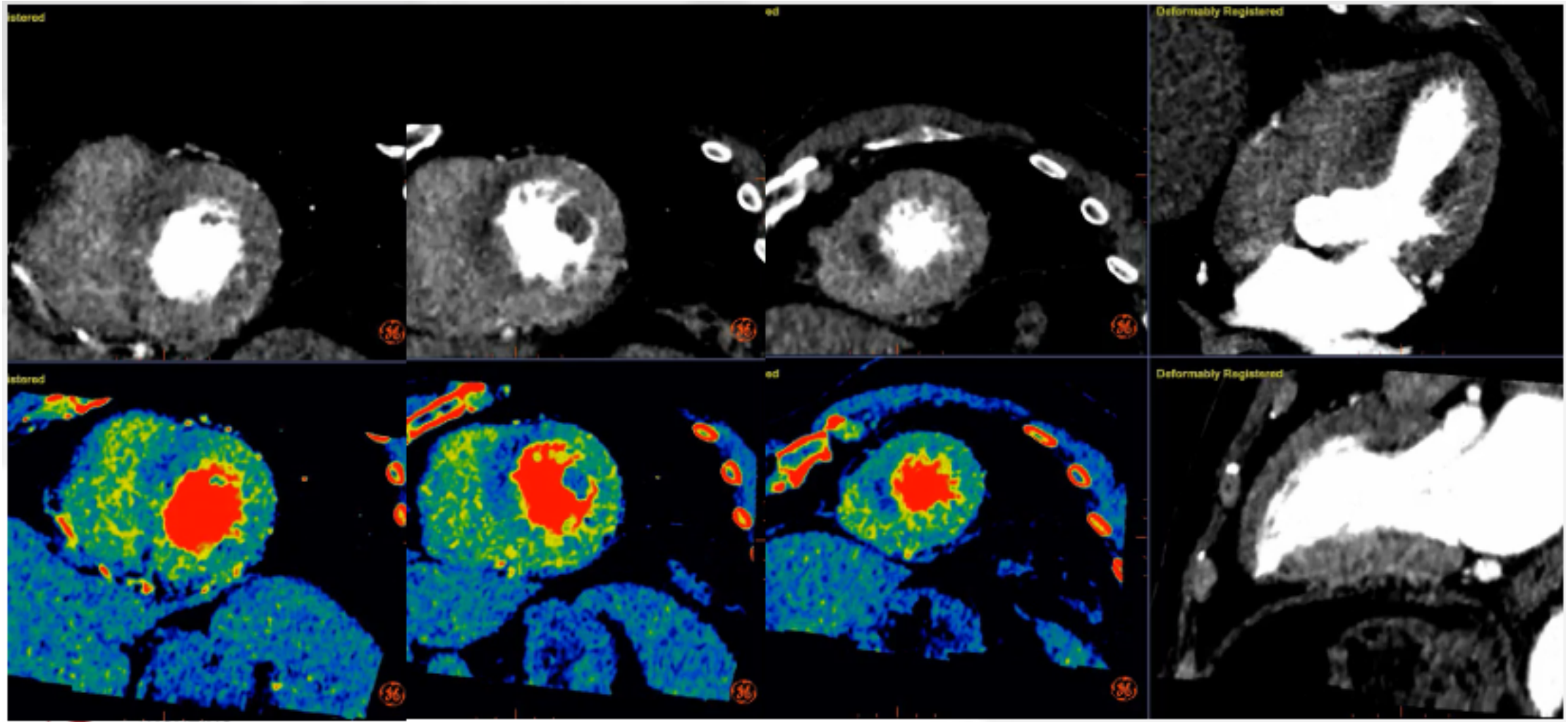

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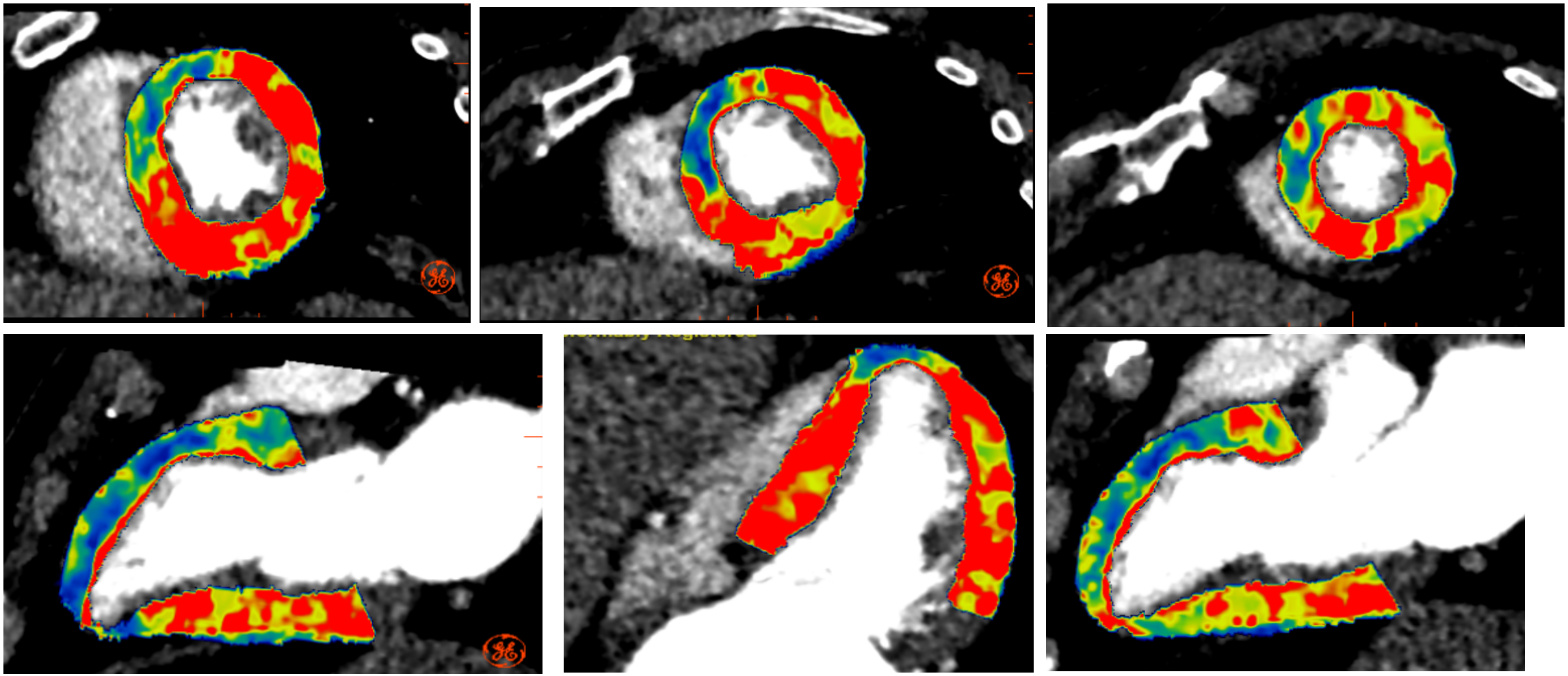

MBF: 45 ml/100 ml/min in LAD segments
ED: 5.1 mSv

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Pontone G et al JACC CI 2019 in press

TAKE HOME MESSAGE

- Meta-analyses of studies comparing stress perfusion CMR with coronary angiography or fractional flow reserve (FFR) as a reference standard have reported **high pooled sensitivity and specificity** with **overall performance** significantly higher than SPECT MPI and similar to PET

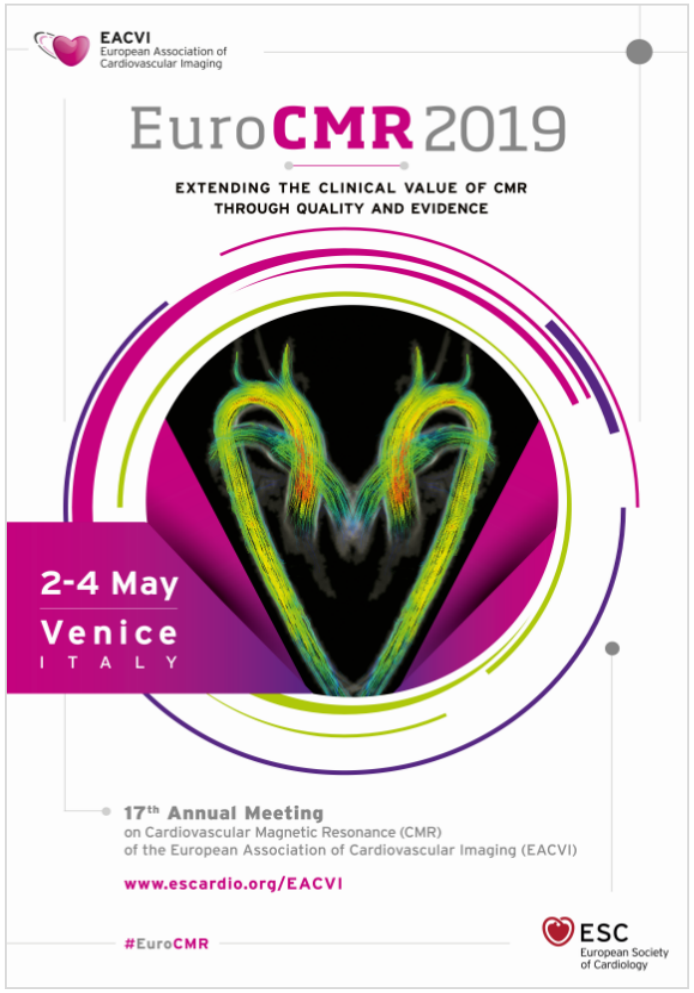
- Stress perfusion CMR provides **prognostic information** for the risk of developing major adverse cardiovascular events (**MACE**)

- **A CMR-based management strategy** for patients with stable coronary artery disease is safe, reduces revascularization procedures and costs

- **Fully Quantitative Perfusion, Stress T1 Mapping and Strain CMR** probably will improve further the diagnostic accuracy in the near future

NEXT MEETING

EACVI
European Association of
Cardiovascular Imaging



2nd – 4th May (Venice)

12th – 14th May (Lisbon)

ESC

ESC European Society of Cardiology

European Heart Journal - Cardiovascular Imaging (2018) **19**, 123–126
doi:10.1093/ehjci/jex310

EACVI DOCUMENT

Training in cardiac computed tomography: EACVI certification process

Gianluca Pontone[1]*, Sarah Moharem-Elgamal[2], Pal Maurovich-Horvat[3], Oliver Gaemperli[4], and Francesca Pugliese[5]

Document reviewers: Mark Westwood[6], Alexandros Stefanidis[7], Kevin F. Fox[8], and Bogdan A. Popescu[9]

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Online publish-ahead-of-print 11 December 2017

Centro Cardiologico Monzino

ESC European Society of Cardiology
European Heart Journal - Cardiovascular Imaging (2019) 0, 1–2
doi:10.1093/ehjci/jey289

EACVI COMMUNICATION

Cardiac Computed Tomography Certification at Euroecho Imaging 2018

Gianluca Pontone[1]*, Alessia Gimelli[2], Pàl Maurovich-Horvat[3], Marc R. Dweck[4], Oliver Gaemperli[5], and Mark Westwood[6]

[1]Centro Cardiologico Monzino, IRCCS, Department of Cardiovascular Imaging, Via Carlo Parea 4, 20138 Milan, Italy; [2]Fondazione Toscana/CNR Gabriele Monasterio, Via Moruzzi, 1, 56100 Pisa, Italy; [3]Cardiovascular Imaging Research Group, Heart and Vascular Center, Semmelweis University, 68 Varosmajor u, 1122 Budapest, Hungary; [4]BHF Centre for Cardiovascular Science, University of Edinburgh, Little France Crescent, Edinburgh EH16 4SB, UK; [5]HeartClinic Hirslanden, Witellikerstrasse 40, 8032 Zürich, Switzerland; and [6]Barts Heart Centre St Bartholomew's Hospital, West Smithfield, London EC1A 7BE, UK

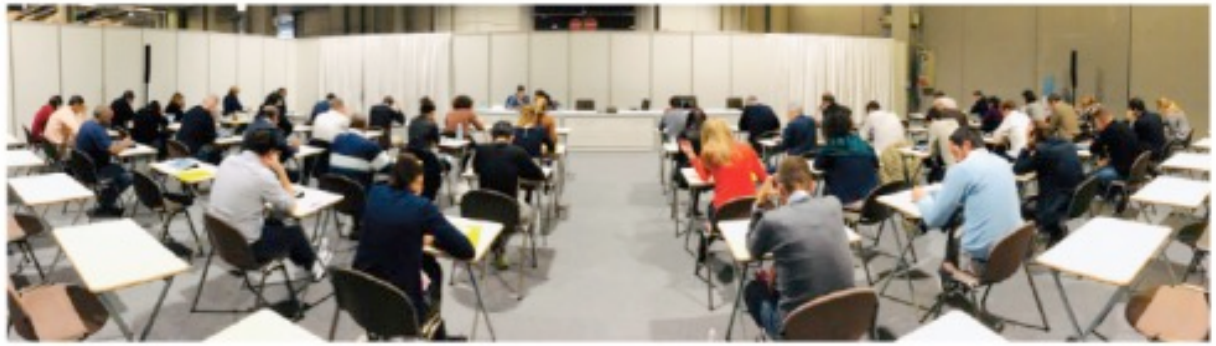

Figure 1 Cardiac computed tomography certification session during Euroecho Imaging Congress 2018 in Milan.

Next exam at ESC 2019 (Paris)

Centro Cardiologico Monzino

THANKS

Director of Cardiology
Prof. Cesare Fiorentini, MD

Area of Cardiovascular Imaging
Dr. Mauro Pepi, MD, FE$C

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Elisabetta Mancini, MD
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