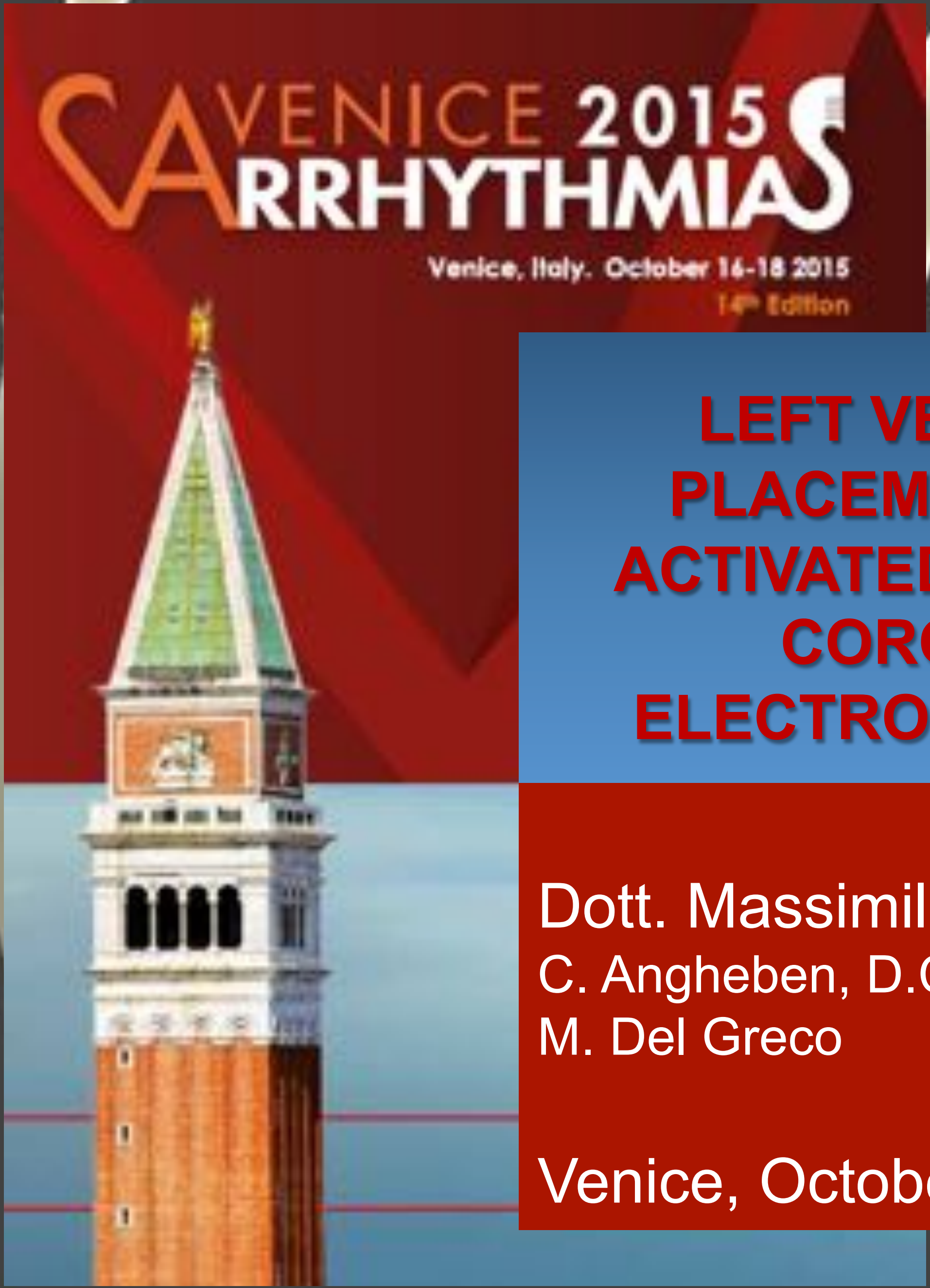
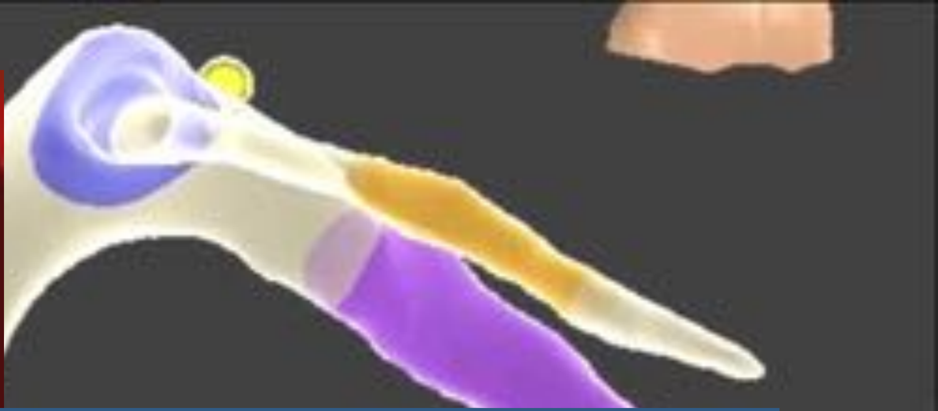




LEFT VENTRICULAR LEAD PLACEMENT IN THE LATEST ACTIVATED REGION GUIDED BY CORONARY VENOUS ELECTROANATOMIC MAPPING

Dott. Massimiliano Maines
C. Angheben, D.Catanzariti, I.DiMatteo, A.Cima, M. Del Greco

Venice, October 17 2015

Division of Cardiology, S. Maria del Carmine Hospital – Rovereto (Italy)

Main limitations of the "angiographic" CRT device implantation

1. The need of prolonged radiation exposure (dangerous both for patients and physicians).
2. The need of CS angiography (with contrast liquid infusion), dangerous for patients (one-third of patients with HF have concomitant stage 3 or greater chronic kidney disease).
3. The lack of clear indications (only anatomical !) for LV lead placement >> decreasing number of CRT responder.

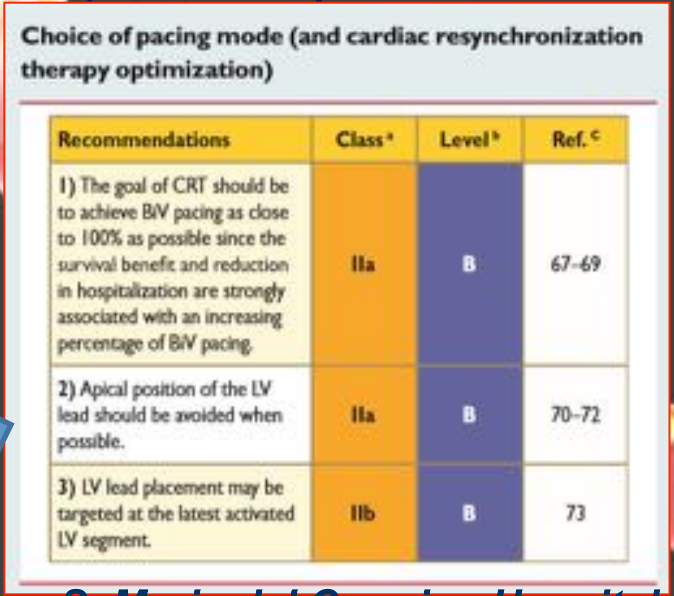
European Heart Journal (2013) **34**, 2281–2329

ESC GUIDELINES

2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy

The Task Force on cardiac pacing and resynchronization therapy of the European Society of Cardiology (ESC). Developed in collaboration with the European Heart Rhythm Association (EHRA).

Authors/Task Force Members: Michele Brignole (Chairperson) (Italy)*, Angelo Auricchio (Switzerland), Gonzalo Baron-Esquivias (Spain), Pierre Bordachar (France), Giuseppe Boriani (Italy), Ole-A Breithardt (Germany), John Cleland (UK), Jean-Claude Deharo (France), Victoria Delgado (Netherlands), Perry M. Elliott (UK), Bulent Gorenek (Turkey), Carsten W. Israel (Germany), Christophe Leclercq (France), Cecilia Linde (Sweden), Lluis Mont (Spain), Luigi Padeletti (Italy), Richard Sutton (UK), Panos E. Vardas (Greece)



Choice of pacing mode (and cardiac resynchronization therapy optimization)

Recommendations	Class[a]	Level[b]	Ref.[c]
1) The goal of CRT should be to achieve BiV pacing as close to 100% as possible since the survival benefit and reduction in hospitalization are strongly associated with an increasing percentage of BiV pacing.	IIa	B	67–69
2) Apical position of the LV lead should be avoided when possible.	IIa	B	70–72
3) LV lead placement may be targeted at the latest activated LV segment.	IIb	B	73

Europace
doi:10.1093/europace/eur250

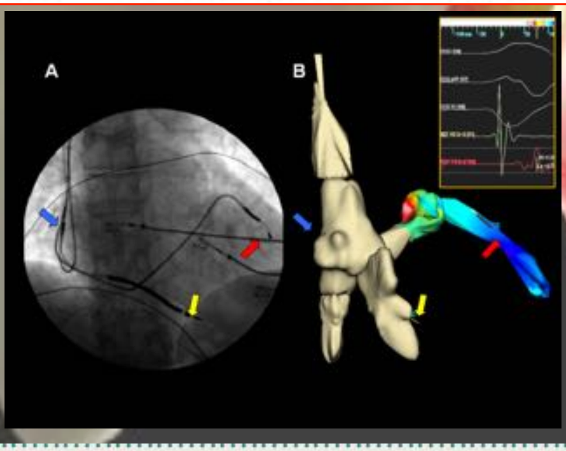
CLINICAL RESEARCH

Implantation of a biventricular implantable cardioverter-defibrillator guided by an electroanatomic mapping system

Maurizio Del Greco, Massimiliano Marini*, and Roberto Bonmassari

Department of Cardiology, S. Chiara Hospital, Trento, Italy

Received 9 March 2011; accepted after revision 6 July 2011



EP

Europace

European Pacing, Arrhythmias
and Cardiac Electrophysiology

Journal of the European Heart Rhythm Association,
a Registered Branch of the ESC and the ESC Working
Group on Cardiac Cellular Electrophysiology

Risk reduction in patients with AF: a report from the 3rd AFNET/EHRA consensus conference

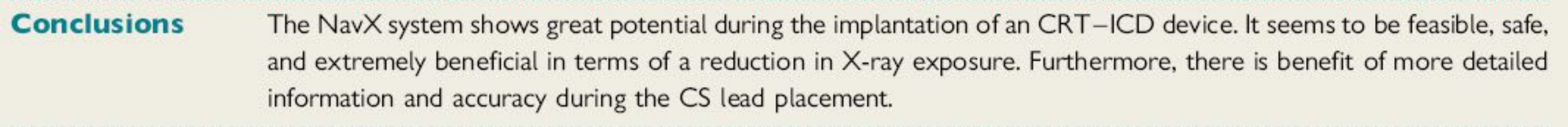
Echocardiography-based refinement of risk stratification for stroke in AF

Age-related pulmonary vein remodelling

Pacing in the RVOT septum: a review

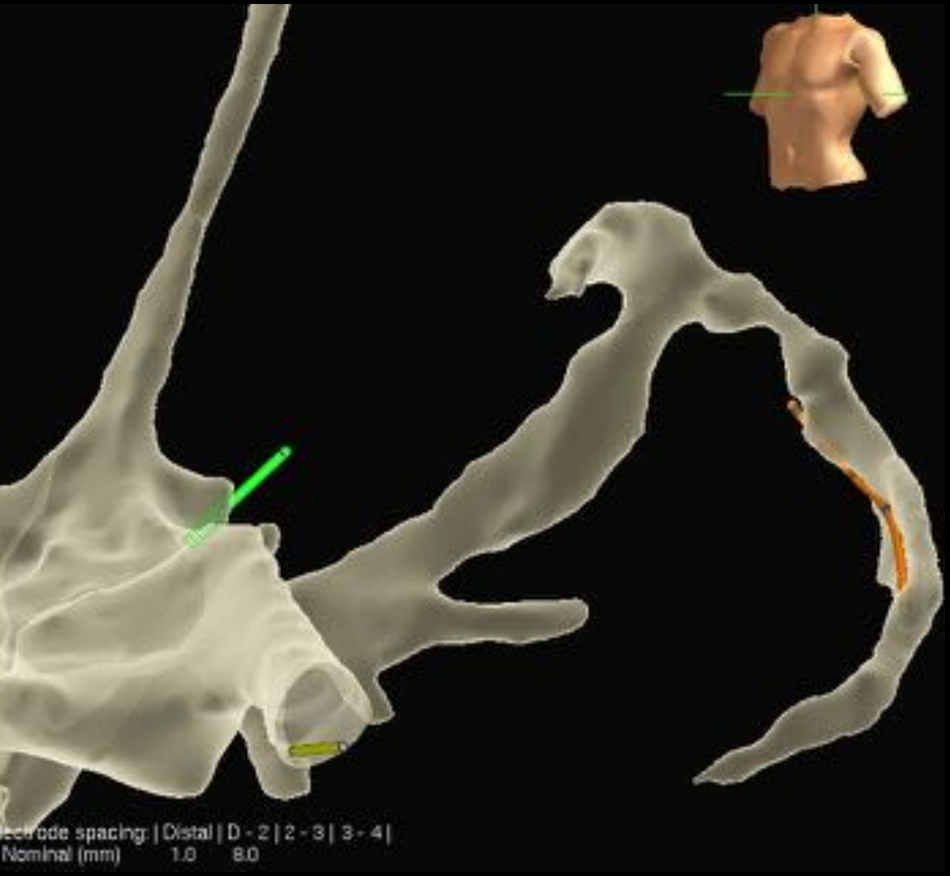
Right ventricular non-apical vs apical pacing: a systematic review and meta-analysis

EHRA position paper: pathways for training and accreditation for transvenous lead extraction



Conclusions The NavX system shows great potential during the implantation of an CRT–ICD device. It seems to be feasible, safe, and extremely beneficial in terms of a reduction in X-ray exposure. Furthermore, there is benefit of more detailed information and accuracy during the CS lead placement.

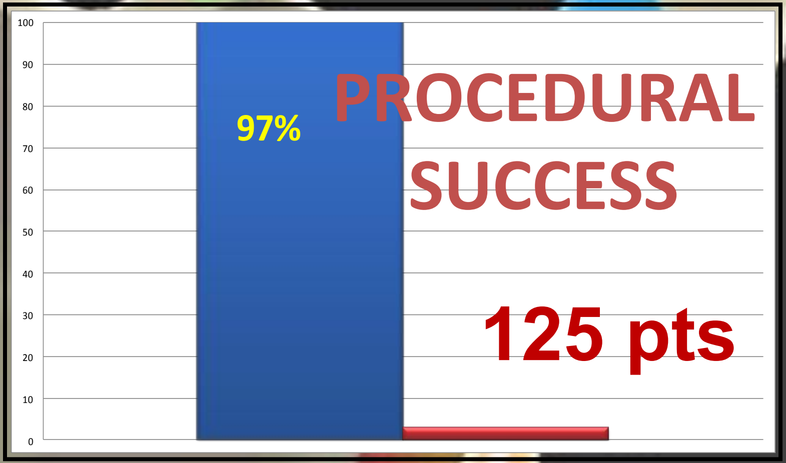
NavX 3.0 vs Angio

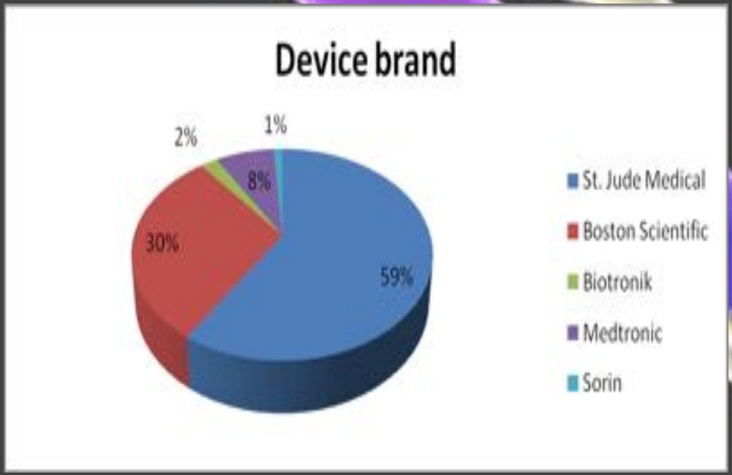


Endoscopic view

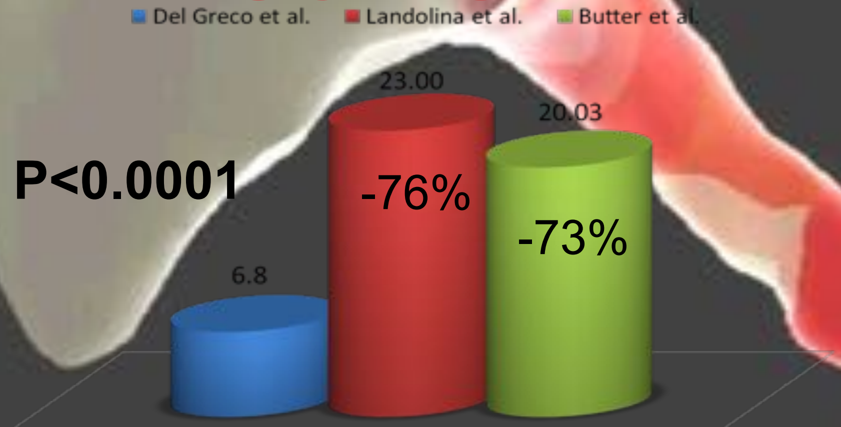
CRT DEVICES IMPLANT USING NON-FLUOROSCOPIC NAVIGATION SYSTEM.

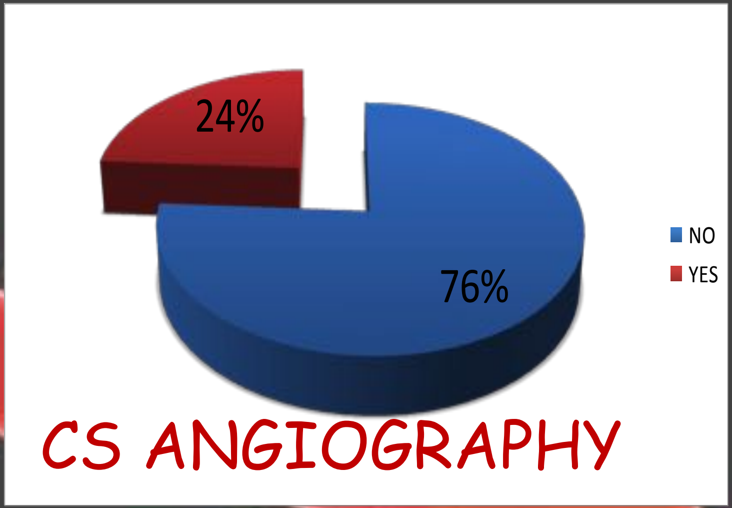
Del Greco M , Maines M, Colella A, Marini M, Zecchin M, Mureddu R, Allocca G,
Marenna B, Rossi P, Vaccari D, Angheben C, Di Matteo I, Indiani S.





PROCEDURAL DATA





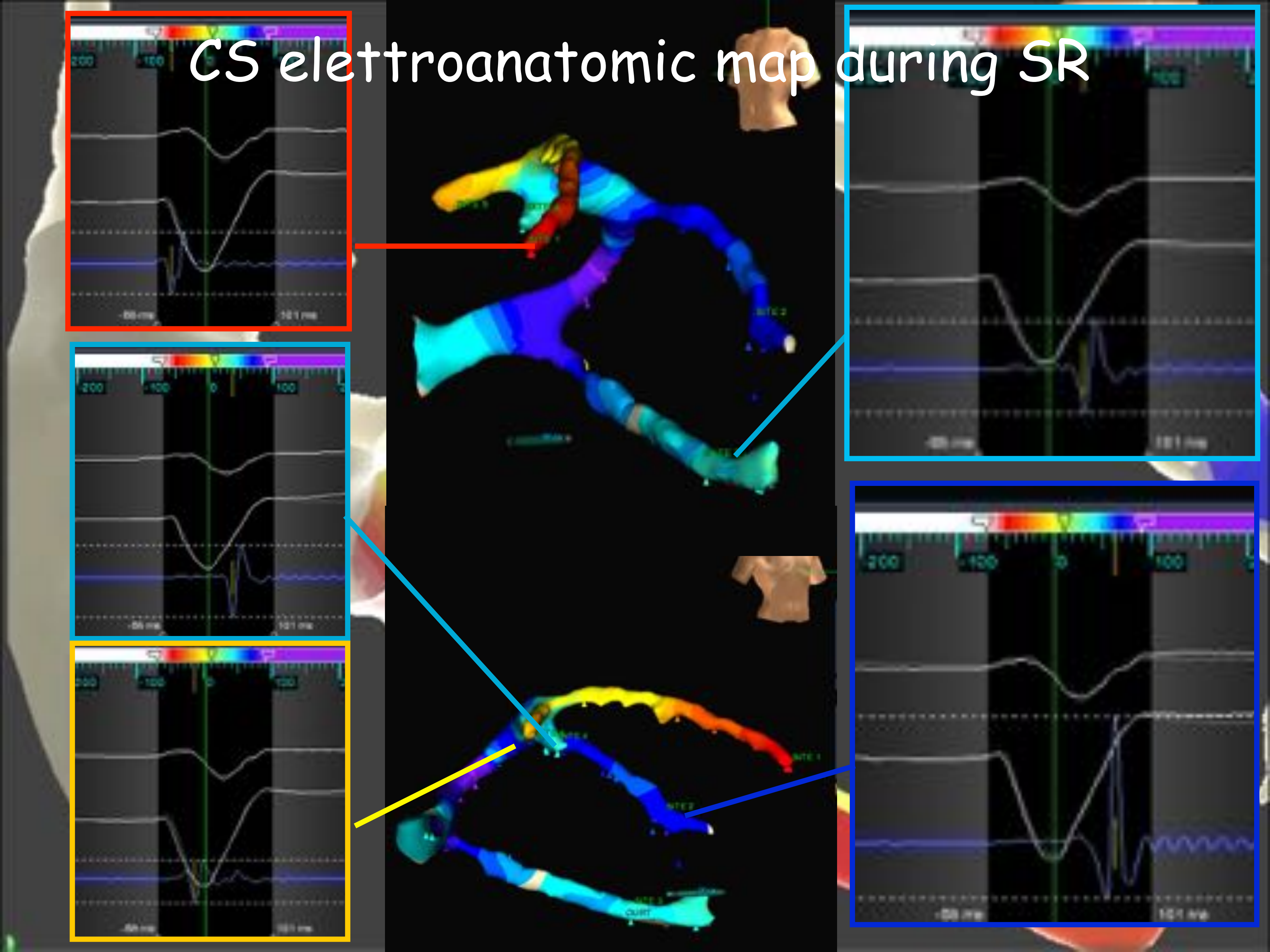
CS ANGIOGRAPHY

LANDOLINA ET AL. *Circulation. 2011;123:2526-2535*

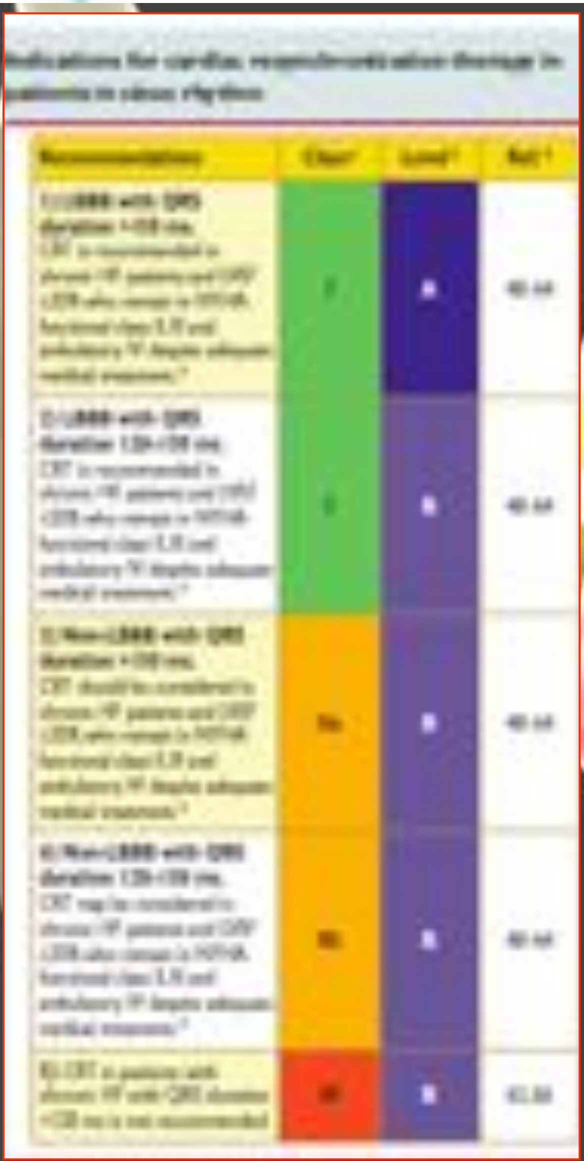
BUTTER ET AL. *PACE 2010: 33:1003–1012*

Division of Cardiology, S. Maria del Carmine Hospital – Rovereto (Italy)

CS elettroanatomic map during SR



2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy

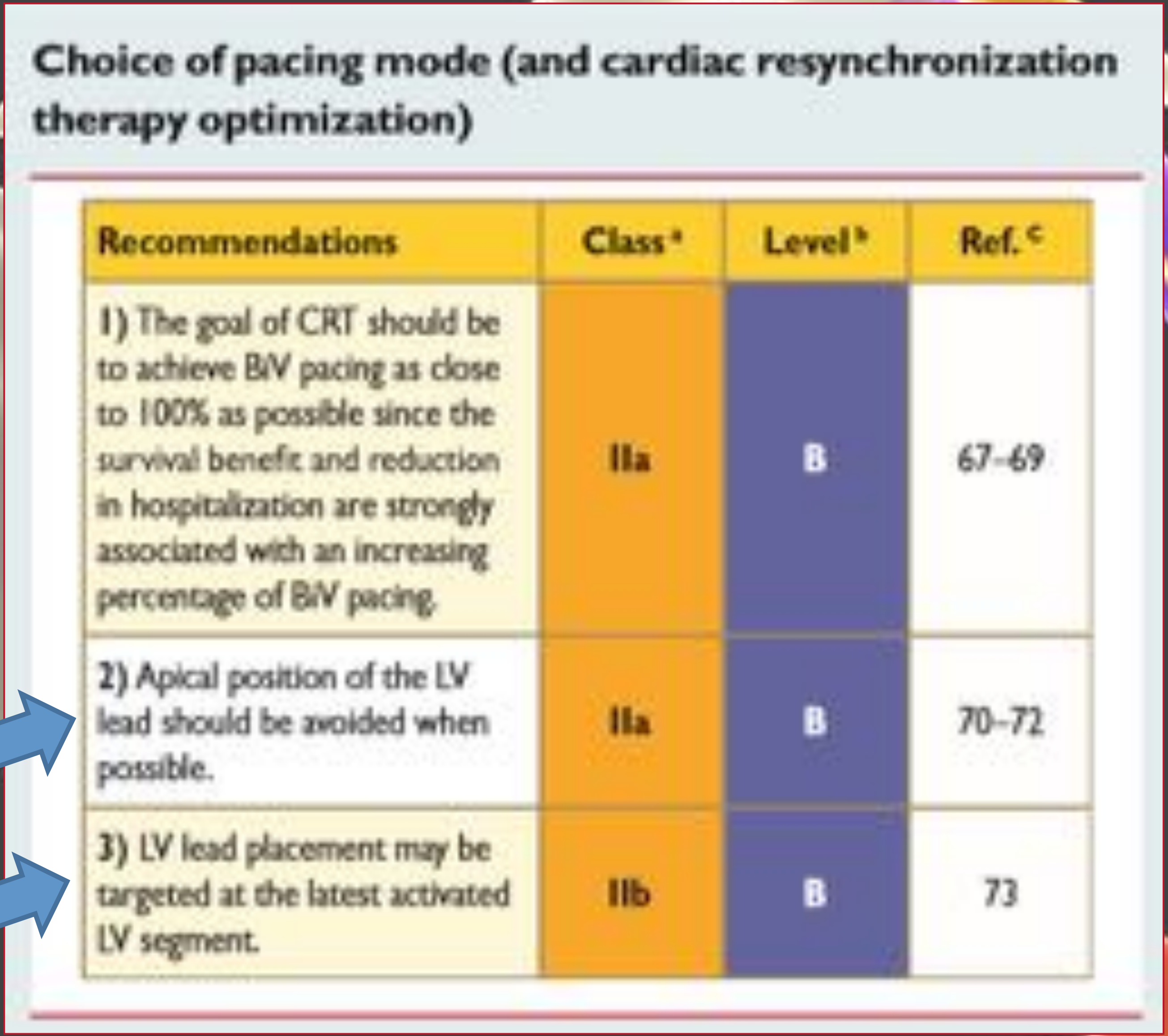


>30% non responder!

Part of this for a suboptimal LV lead position

Daubert JC, Saxon L, Adamson PB, Auricchio A, Berger RD, Beshai JF et al. 2012 EHRA/HRS expert consensus statement on cardiac resynchronization therapy in heart failure: implant and follow-up recommendations and management. Europace 2012;14:1236–86.

2013 ESC Guidelines on cardiac pacing and cardiac resynchronization therapy



Choice of pacing mode (and cardiac resynchronization therapy optimization)

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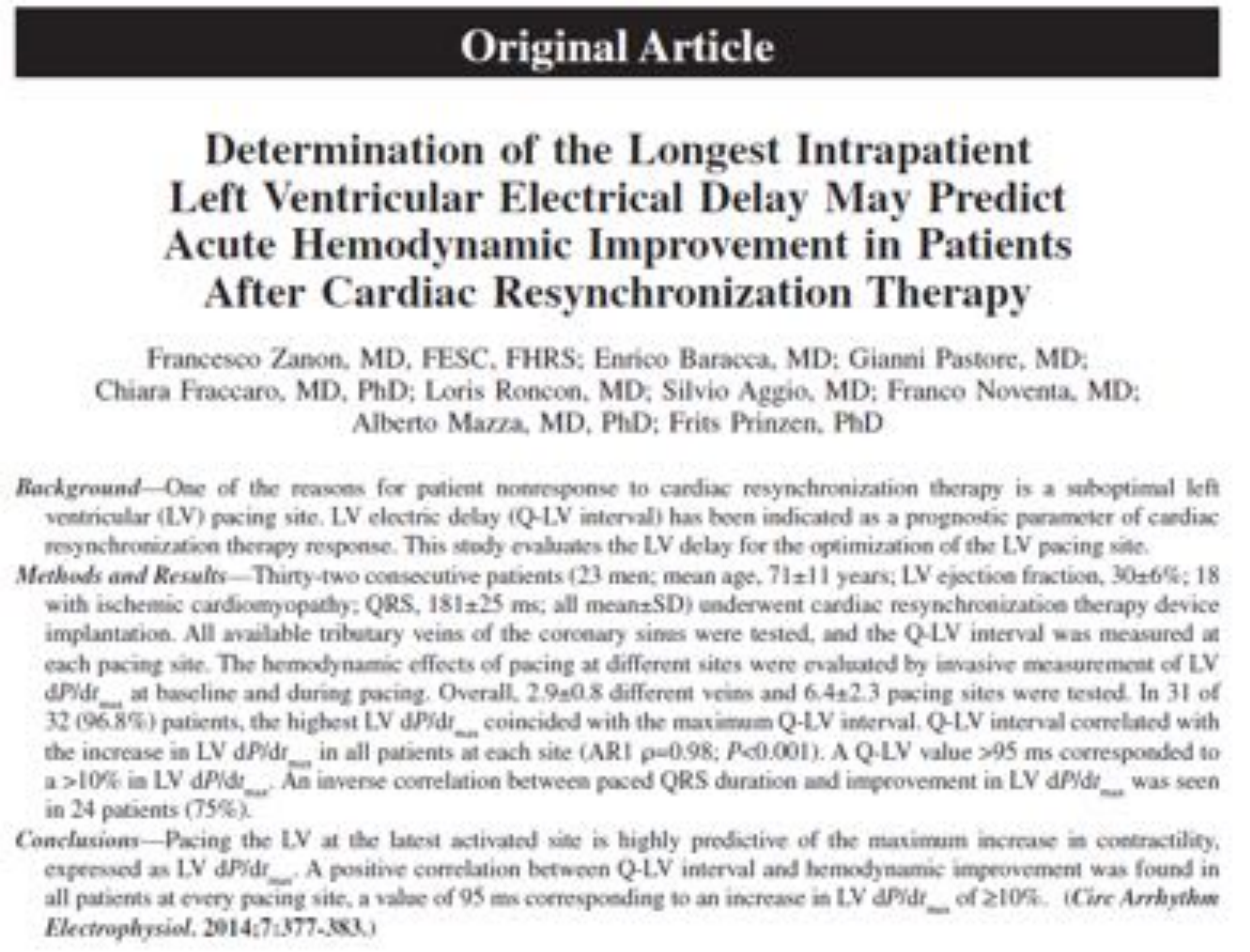
Influence of Left Ventricular Lead Location on Outcomes



Original Article

Determination of the Longest Intrapatient Left Ventricular Electrical Delay May Predict Acute Hemodynamic Improvement in Patients After Cardiac Resynchronization Therapy

Francesco Zanon, MD, FESC, FHRS; Enrico Baracca, MD; Gianni Pastore, MD;
Chiara Fraccaro, MD, PhD; Loris Roncon, MD; Silvio Aggio, MD; Franco Noventa, MD;
Alberto Mazza, MD, PhD; Frits Prinzen, PhD

Background—One of the reasons for patient nonresponse to cardiac resynchronization therapy is a suboptimal left ventricular (LV) pacing site. LV electric delay (Q-LV interval) has been indicated as a prognostic parameter of cardiac resynchronization therapy response. This study evaluates the LV delay for the optimization of the LV pacing site.

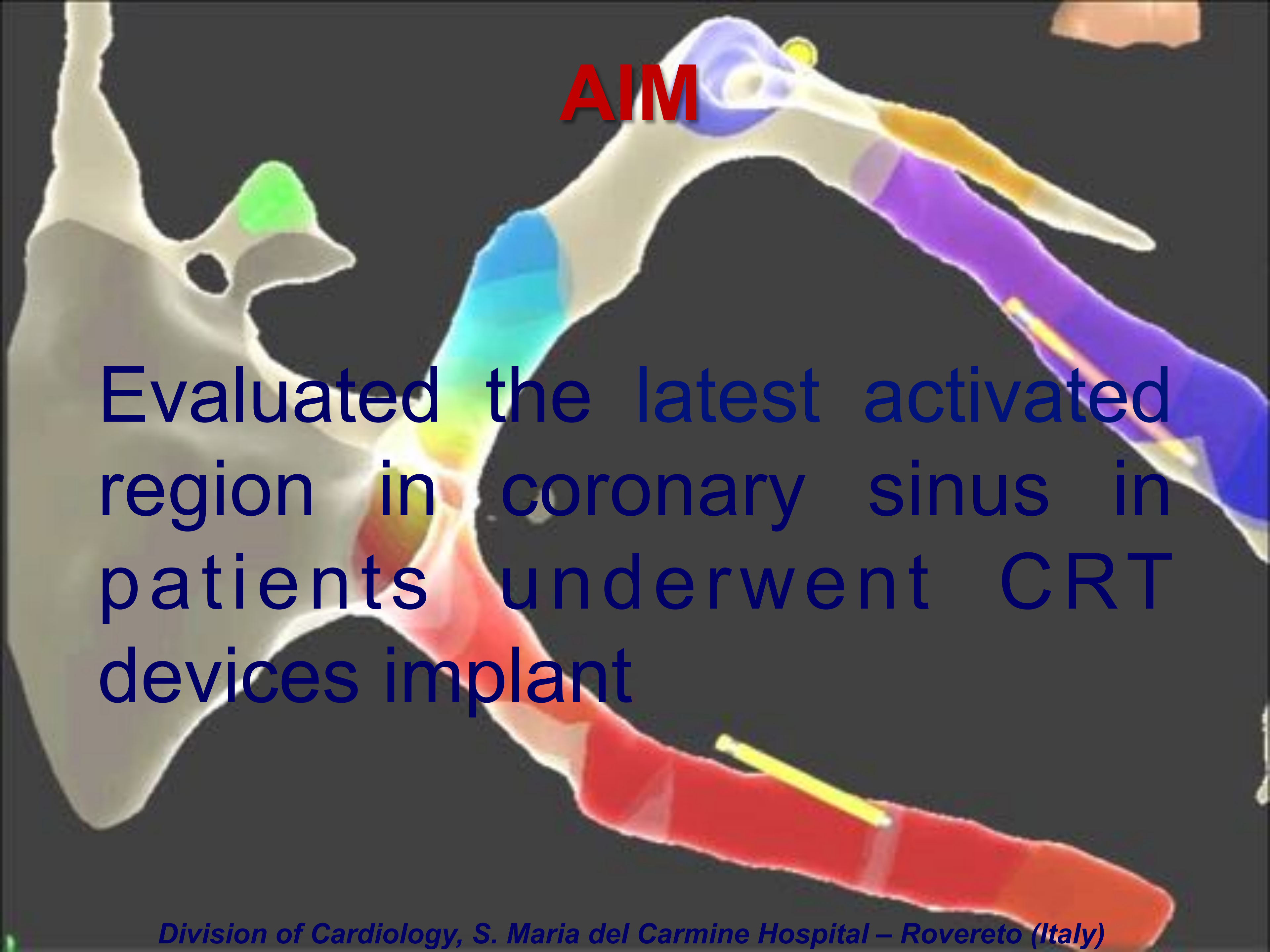
Methods and Results—Thirty-two consecutive patients (23 men; mean age, 71±11 years; LV ejection fraction, 30±6%; 18 with ischemic cardiomyopathy; QRS, 181±25 ms; all mean±SD) underwent cardiac resynchronization therapy device implantation. All available tributary veins of the coronary sinus were tested, and the Q-LV interval was measured at each pacing site. The hemodynamic effects of pacing at different sites were evaluated by invasive measurement of LV dP/dt_{max} at baseline and during pacing. Overall, 2.9±0.8 different veins and 6.4±2.3 pacing sites were tested. In 31 of 32 (96.8%) patients, the highest LV dP/dt_{max} coincided with the maximum Q-LV interval. Q-LV interval correlated with the increase in LV dP/dt_{max} in all patients at each site (AR1 $\rho=0.98$; $P<0.001$). A Q-LV value >95 ms corresponded to a >10% in LV dP/dt_{max}. An inverse correlation between paced QRS duration and improvement in LV dP/dt_{max} was seen in 24 patients (75%).

Conclusions—Pacing the LV at the latest activated site is highly predictive of the maximum increase in contractility, expressed as LV dP/dt_{max}. A positive correlation between Q-LV interval and hemodynamic improvement was found in all patients at every pacing site, a value of 95 ms corresponding to an increase in LV dP/dt_{max} of ≥10%. (*Circ Arrhythm Electrophysiol*. 2014;7:377-383.)

Division of Cardio

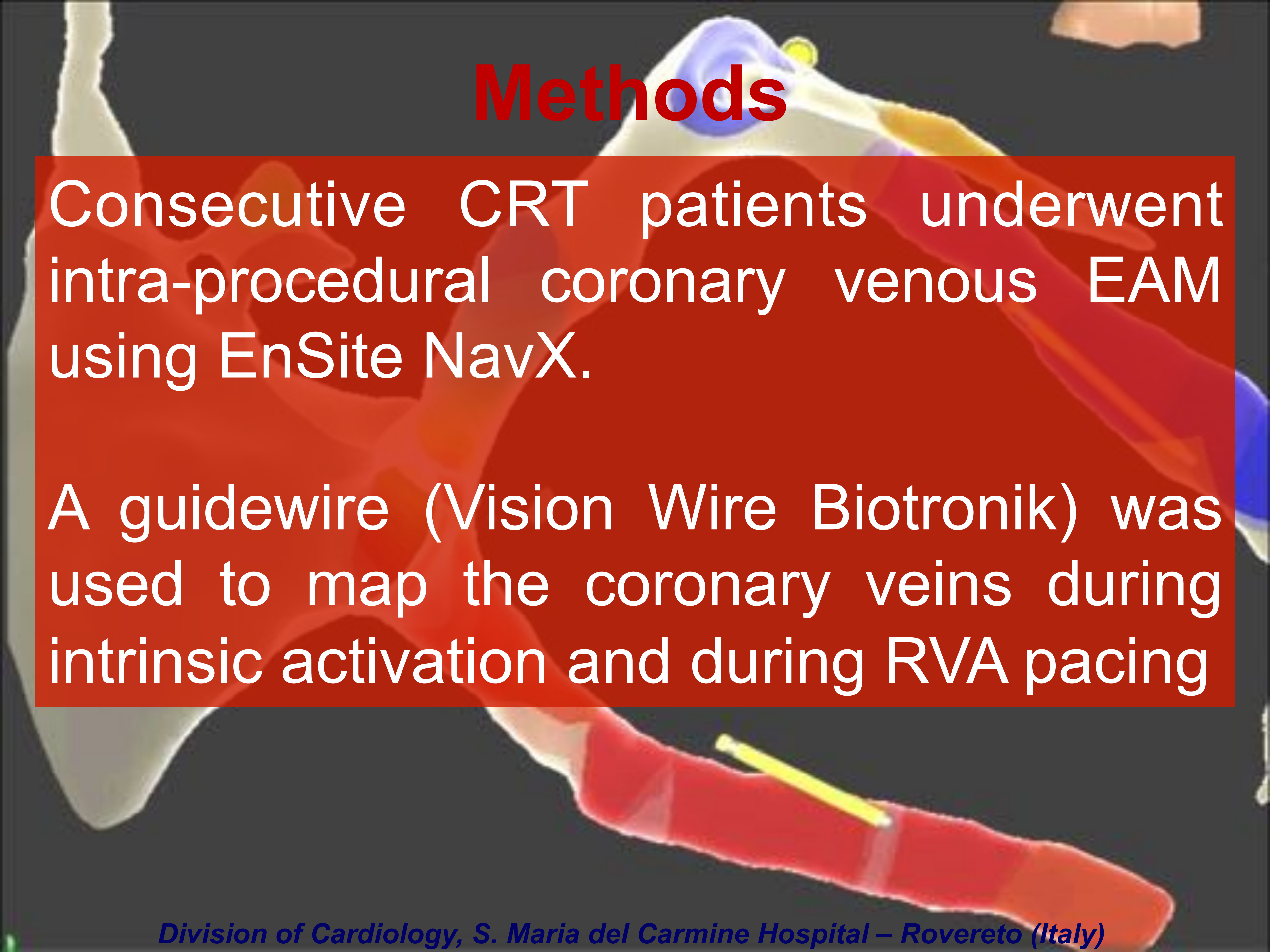
Juan Zhang, MD, Zuoying Hu, PhD', Shaoliang Chen, PhD'

AIM



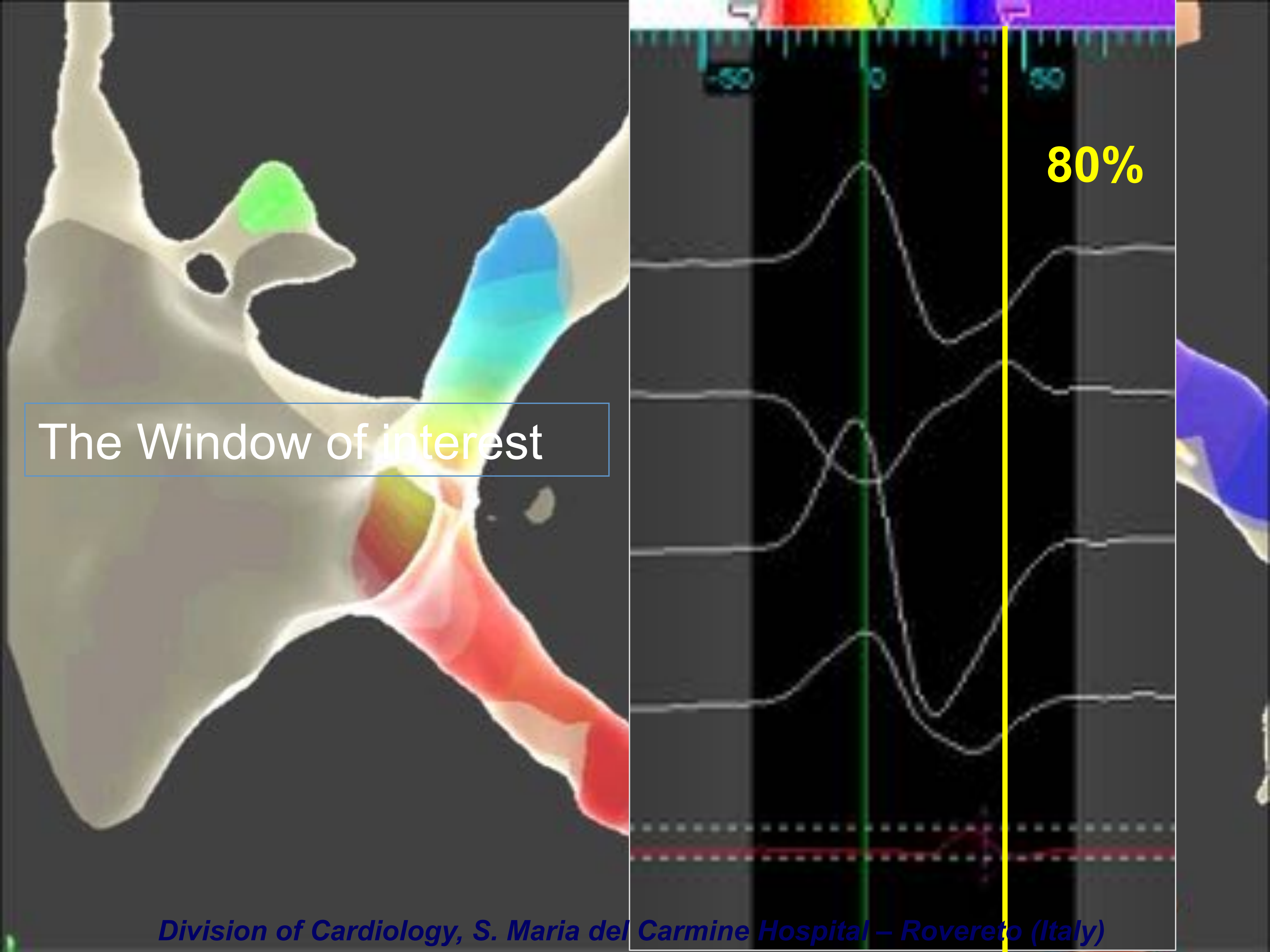
Evaluated the latest activated region in coronary sinus in patients underwent CRT devices implant

Methods



Consecutive CRT patients underwent intra-procedural coronary venous EAM using EnSite NavX.

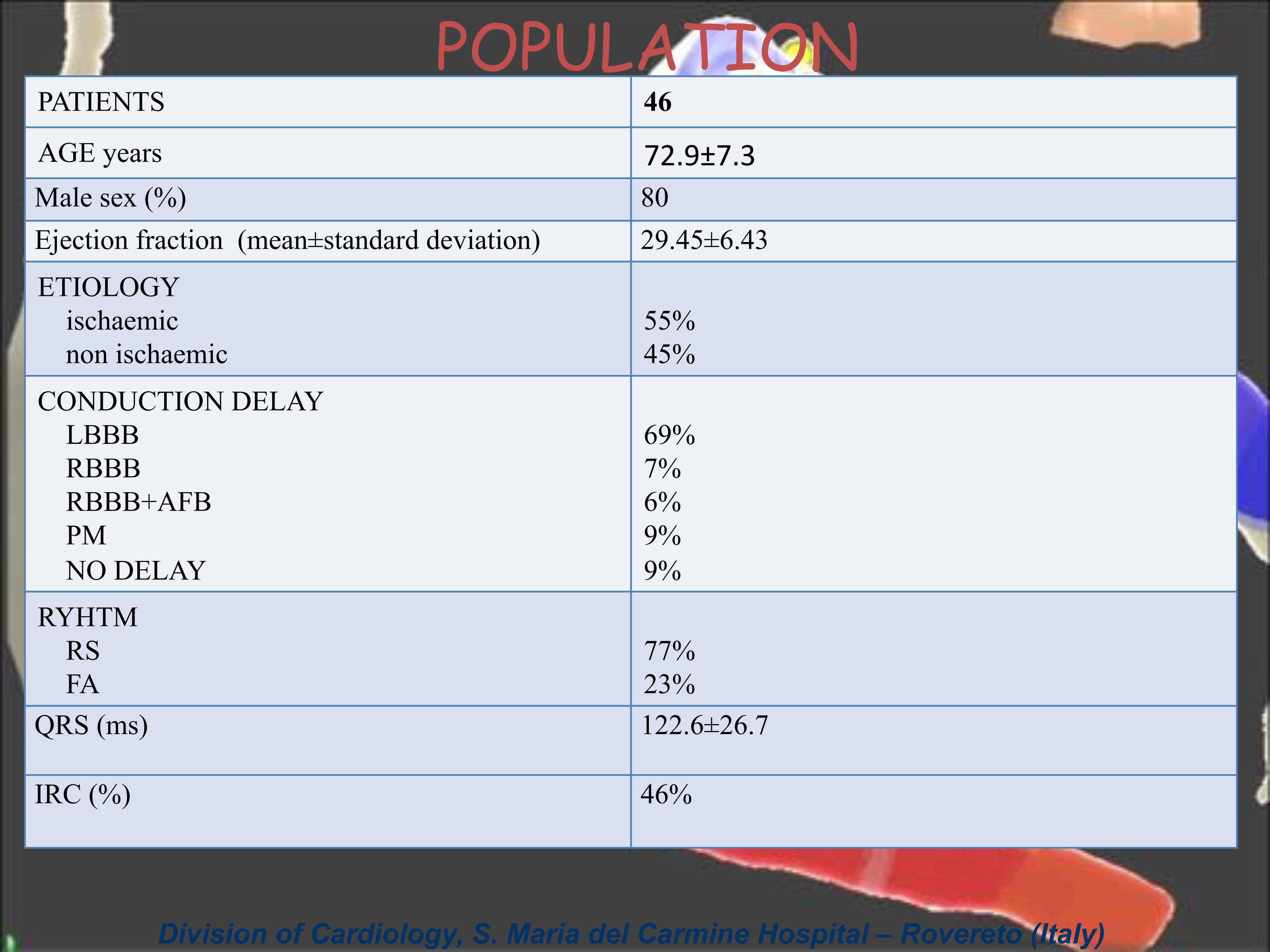
A guidewire (Vision Wire Biotronik) was used to map the coronary veins during intrinsic activation and during RVA pacing



The Window of interest

80%

POPULATION

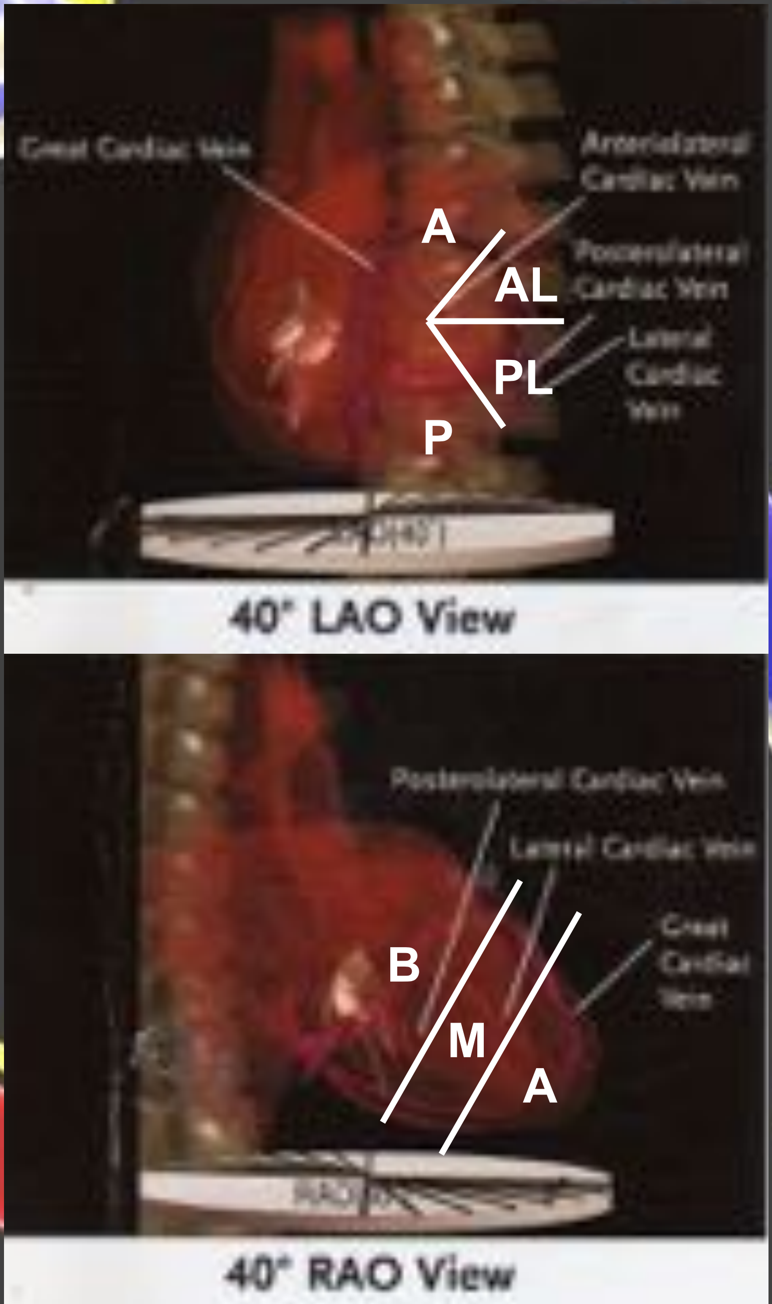


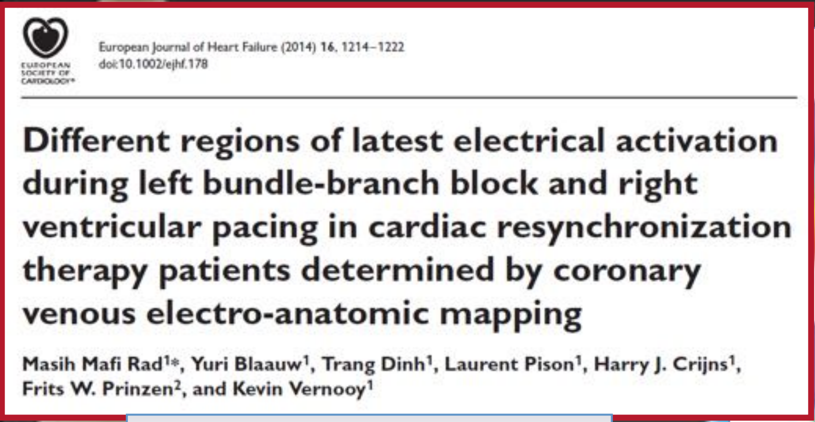
PATIENTS	**46**
AGE years	72.9±7.3
Male sex (%)	80
Ejection fraction (mean±standard deviation)	29.45±6.43
ETIOLOGY	
ischaemic	55%
non ischaemic	45%
CONDUCTION DELAY	
LBBB	69%
RBBB	7%
RBBB+AFB	6%
PM	9%
NO DELAY	9%
RYHTM	
RS	77%
FA	23%
QRS (ms)	122.6±26.7
IRC (%)	46%

More delayed activation

LAO	Latest activation during sinus rhythm - patients	Latest activation during RV pacing* - patients
Anterior	6	11
Antero-lateral	15	15
Postero-Lateral	25	19
Posterior	0	1
RAO		
Basal	20	30
Medium	23	13
Apical	3	3

* Position of the catheter in right ventricle was septal in 74% and apical in 26 % of the patients

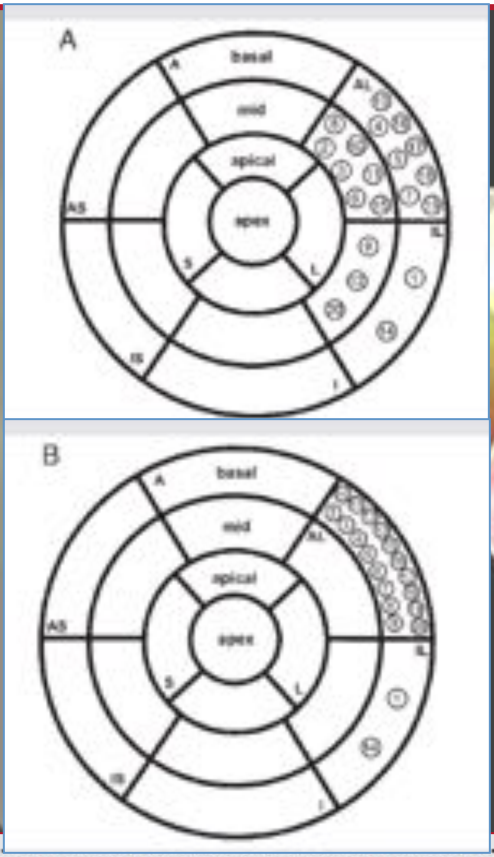


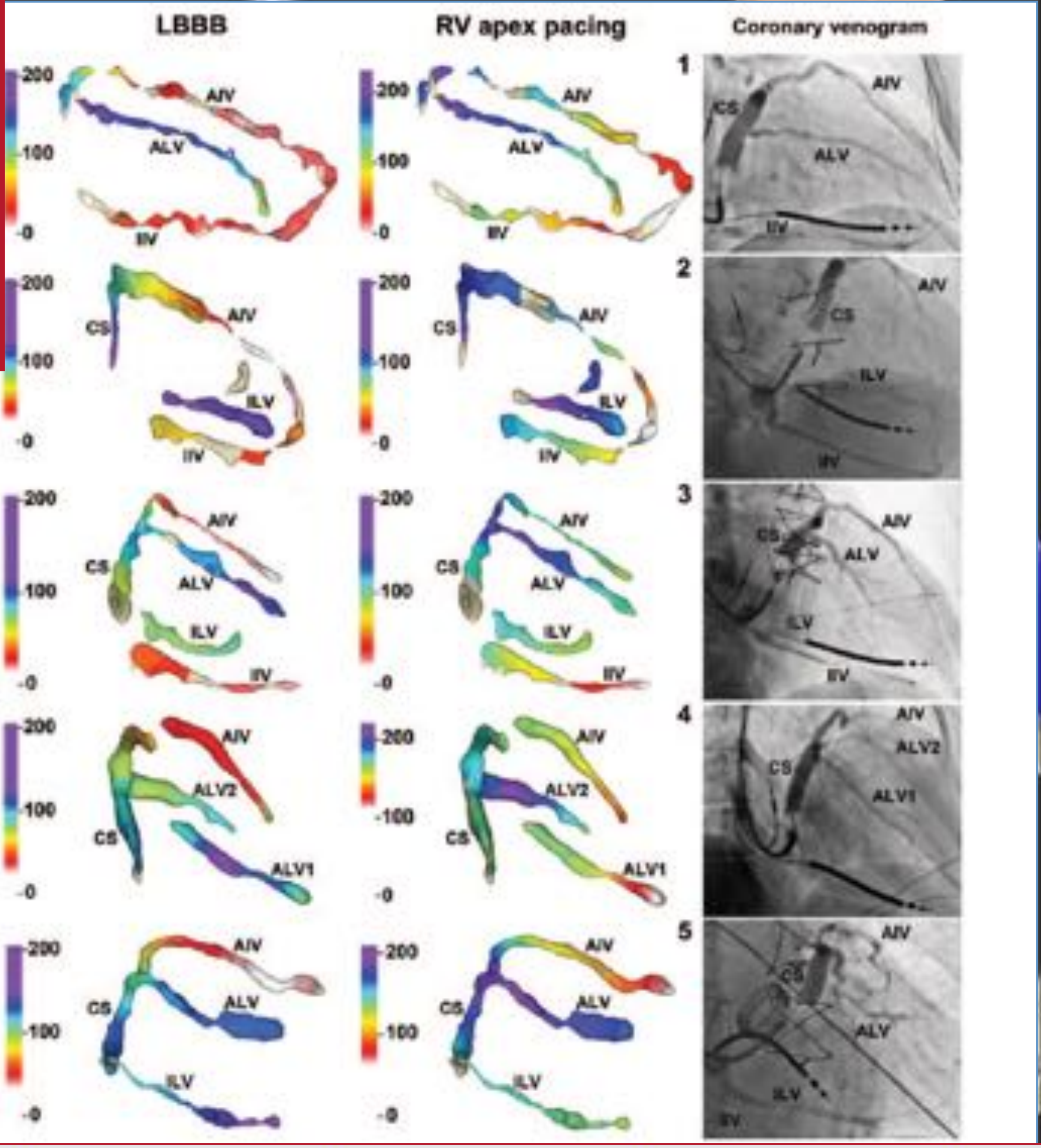


European Journal of Heart Failure (2014) 16, 1214–1222
doi:10.1002/ejhf.178

Different regions of latest electrical activation during left bundle-branch block and right ventricular pacing in cardiac resynchronization therapy patients determined by coronary venous electro-anatomic mapping

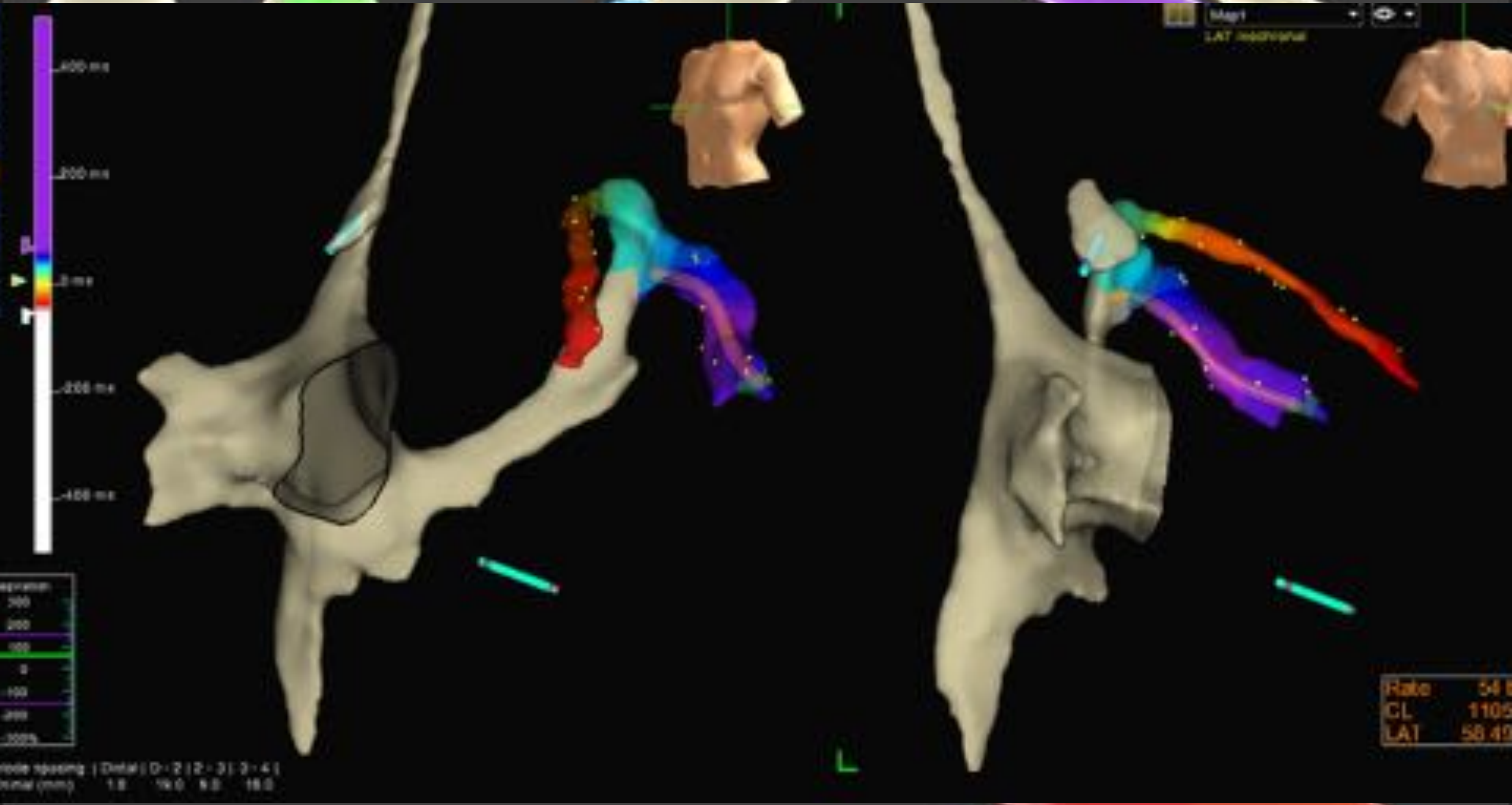
Masih Mafi Rad[1]*, Yuri Blaauw[1], Trang Dinh[1], Laurent Pison[1], Harry J. Crijns[1], Frits W. Prinzen[2], and Kevin Vernooy[1]



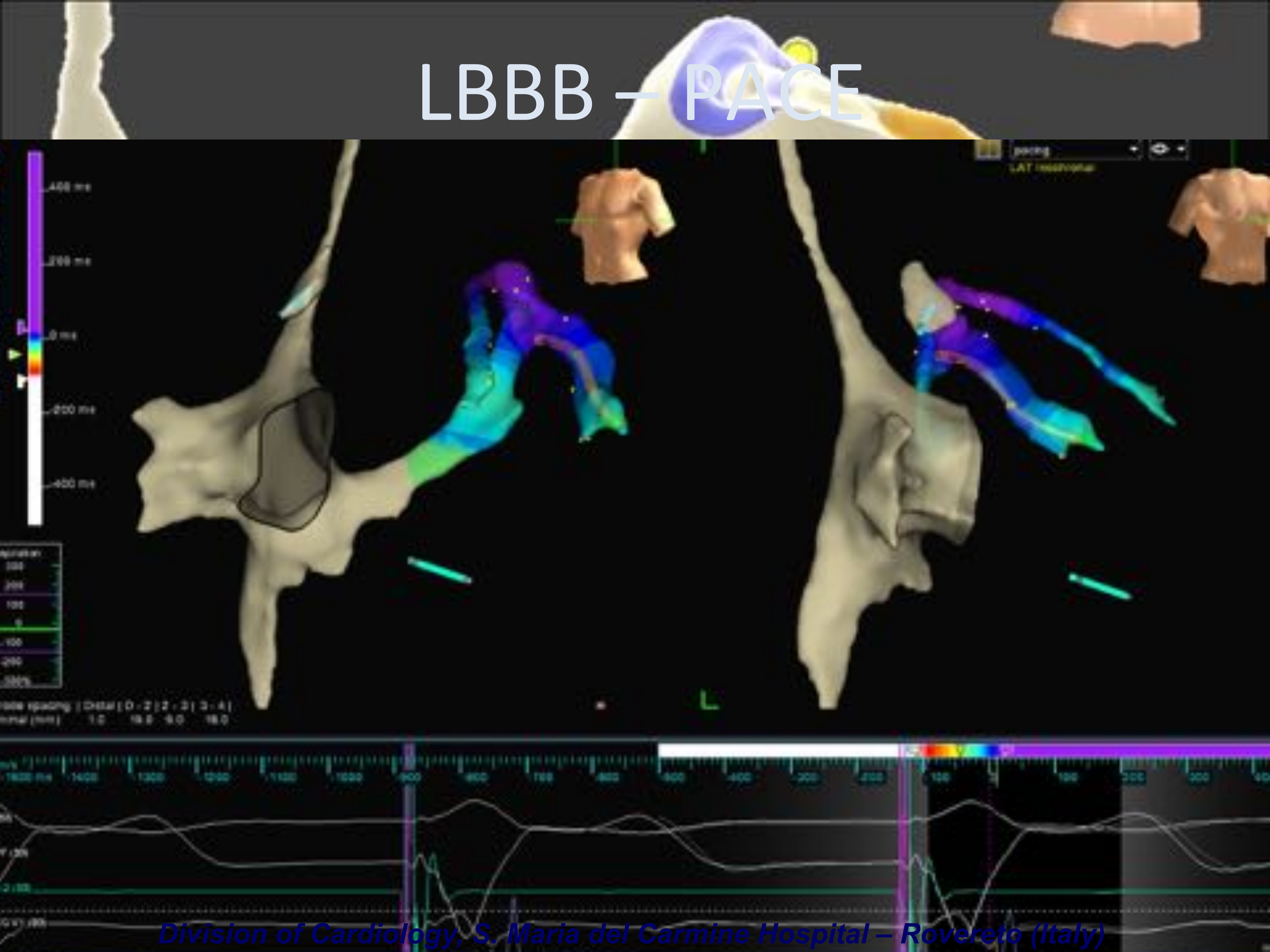


Conclusion Right ventricular apex pacing alters LV electrical activation pattern in CRT patients with LBBB, and shifts the latest activated region in a significant proportion of these patients. These findings warrant reconsideration of the current practice of LV lead targeting for CRT.

LBBB – SR

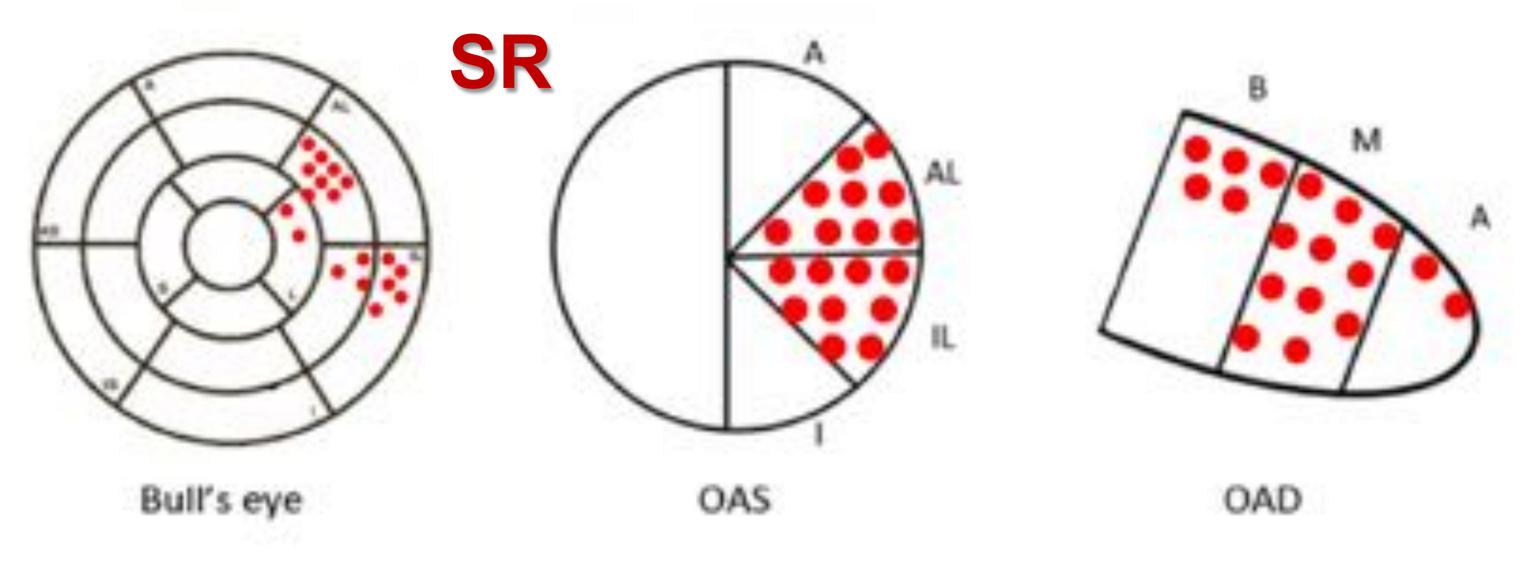


LBBB – PACE

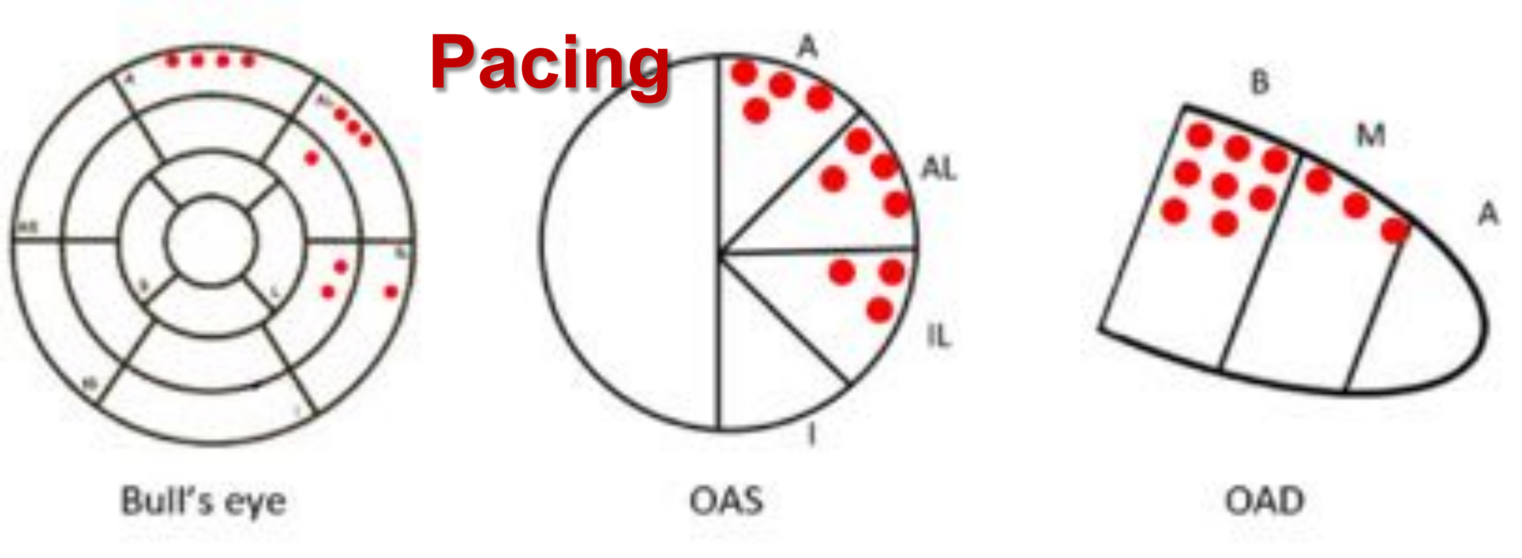


True LBB

SR



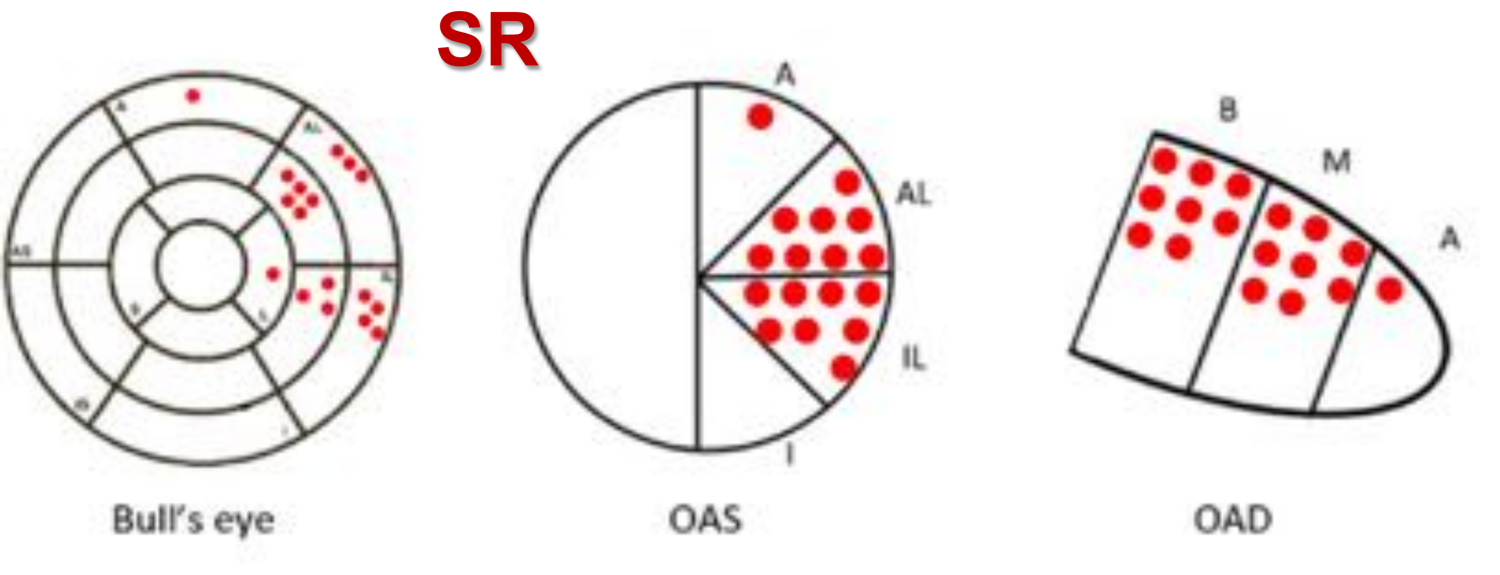
Pacing



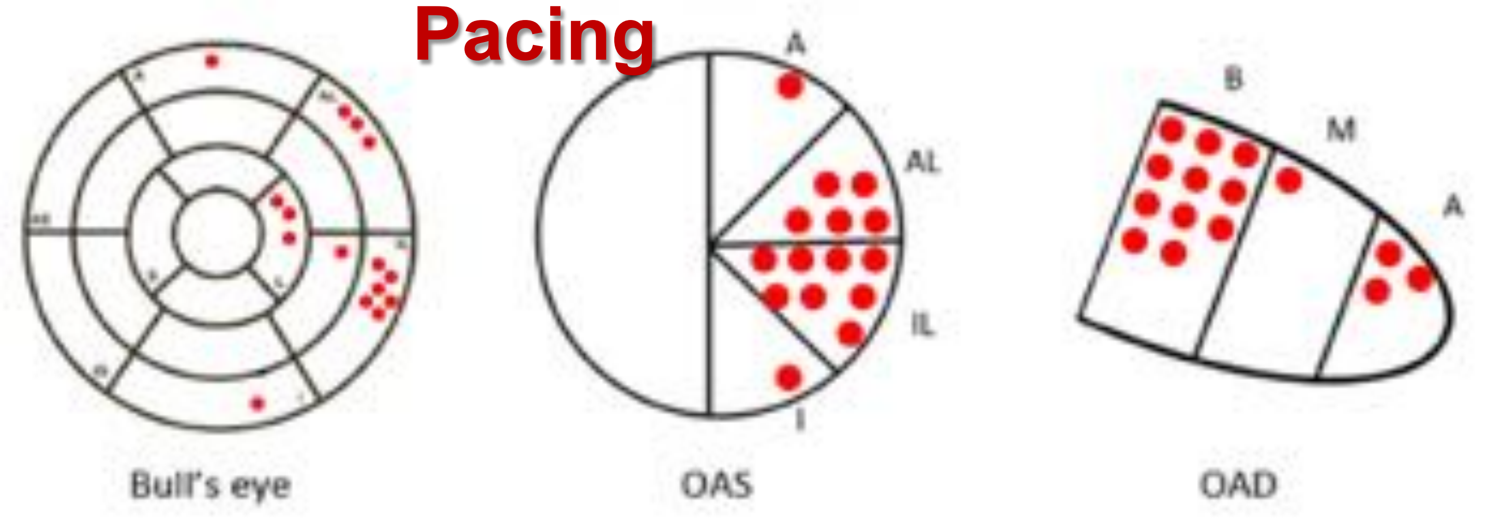
PSEUDO LBBB – SR

Pseudo LBB

SR

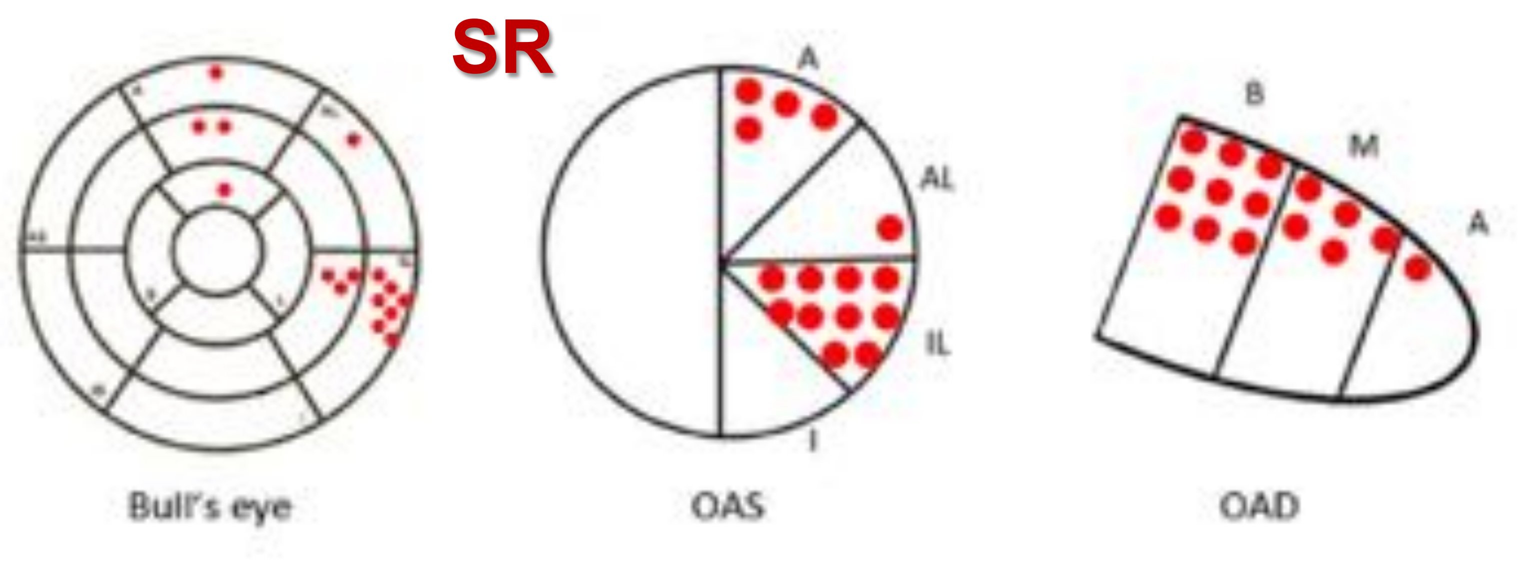


Pacing

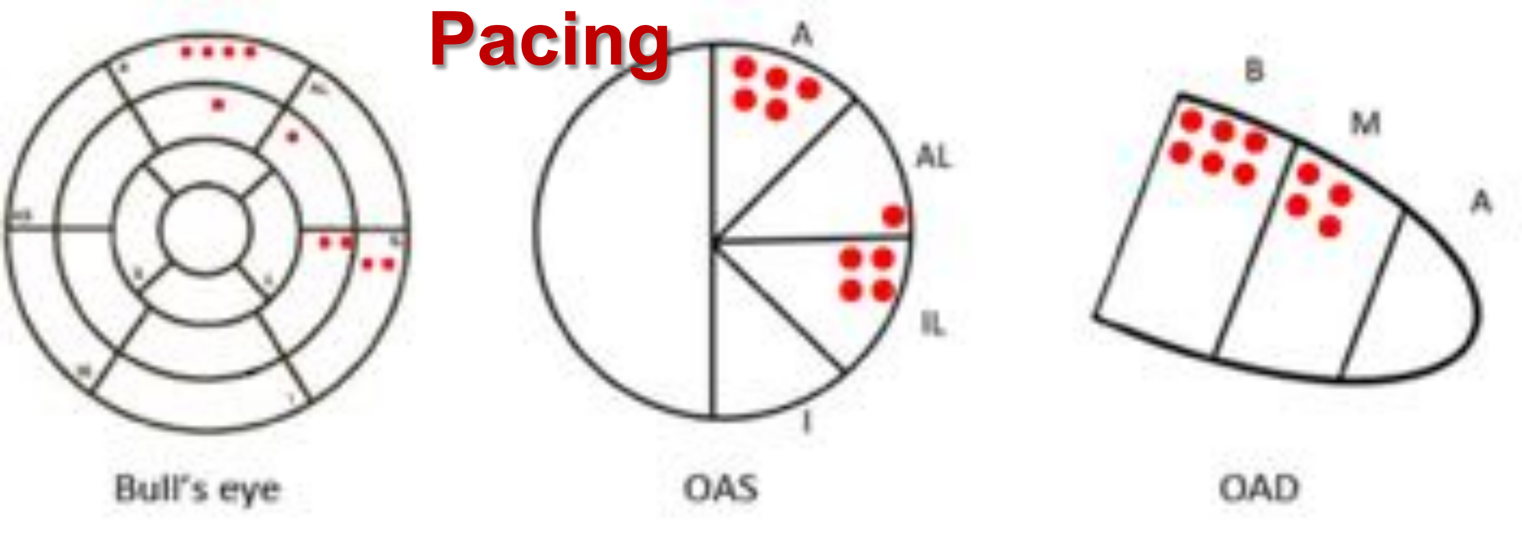


No LBB

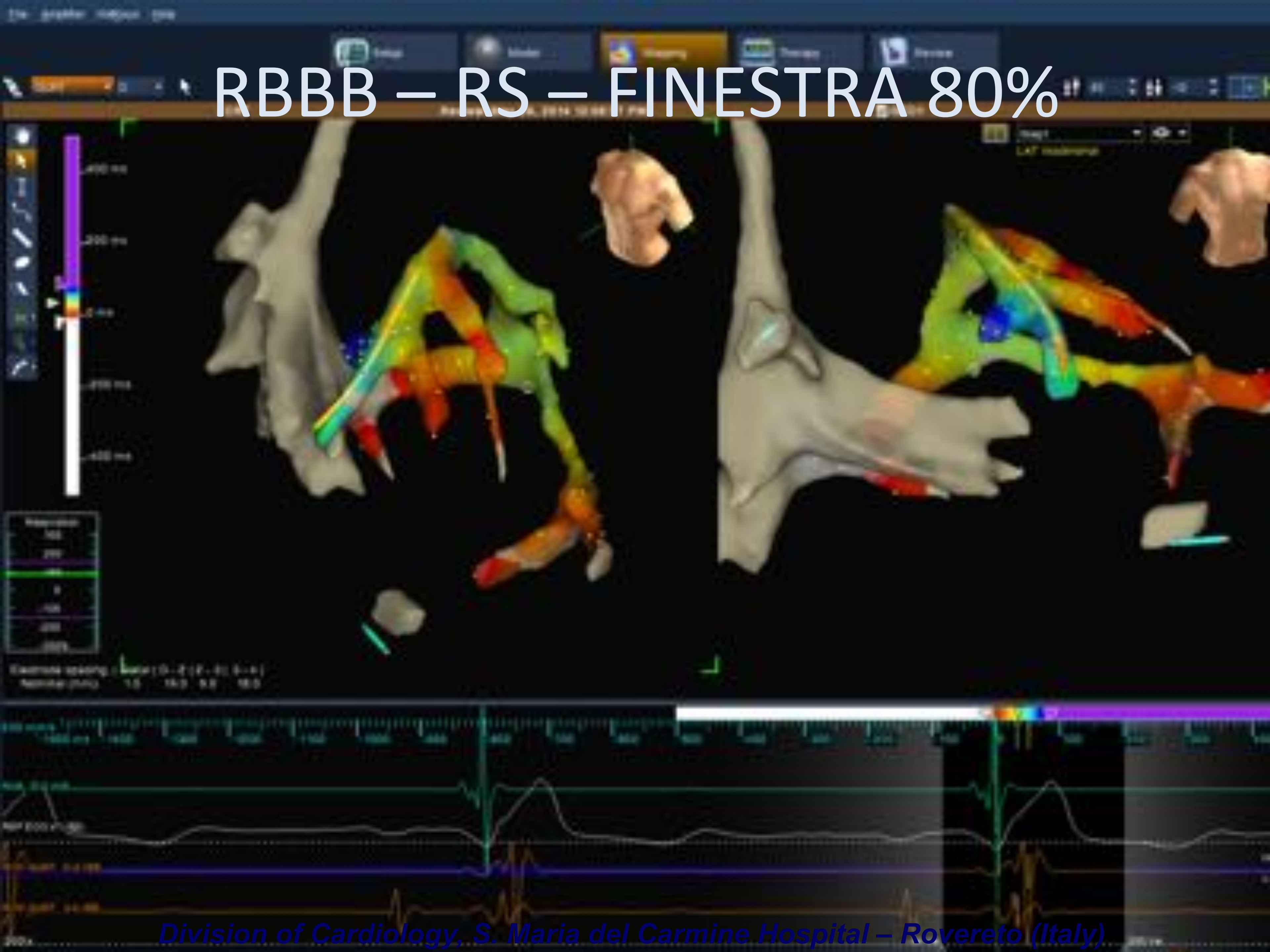
SR



Pacing

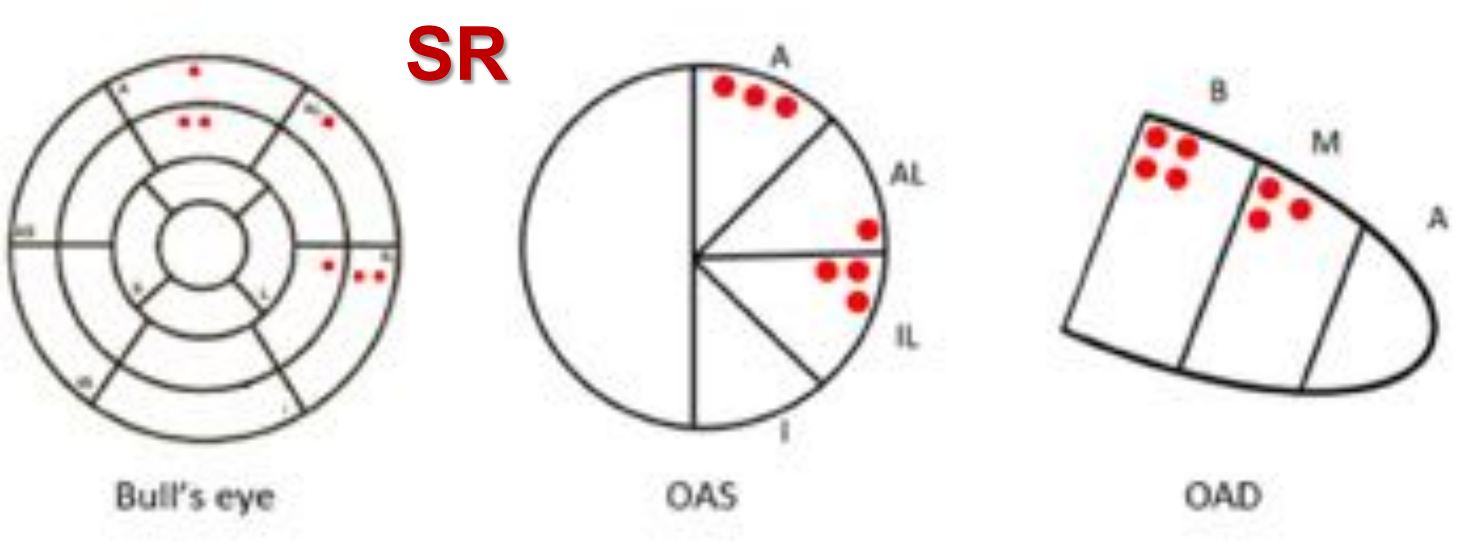


RBBB – RS – FINESTRA 80%

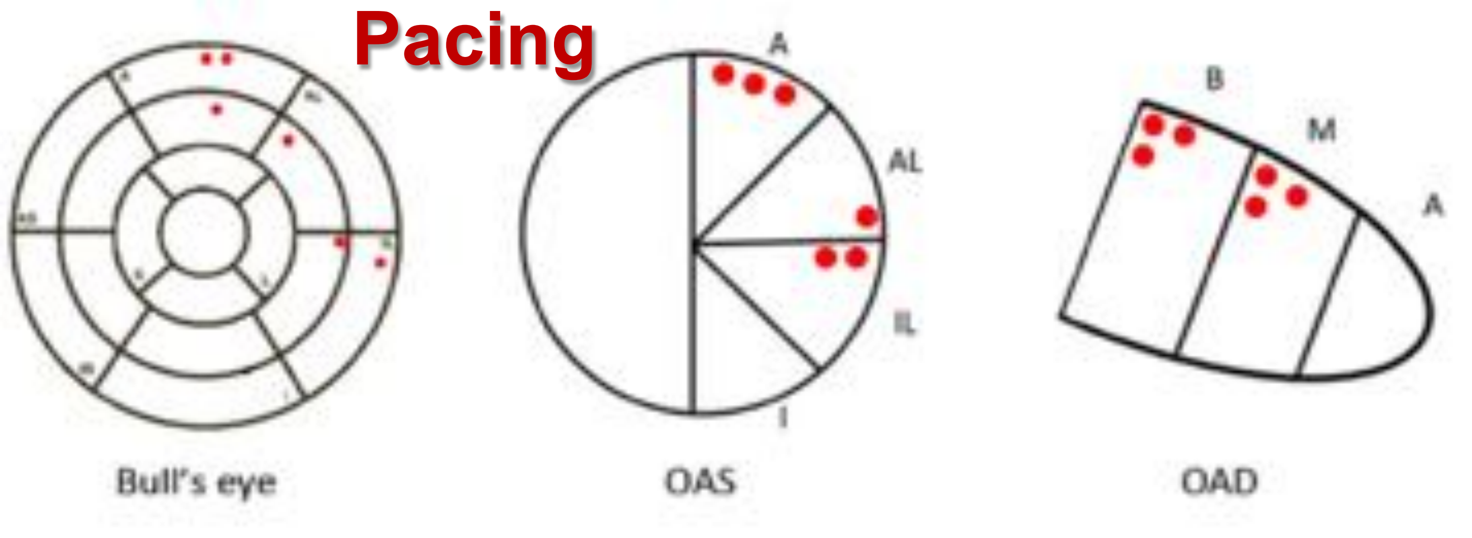


RBB

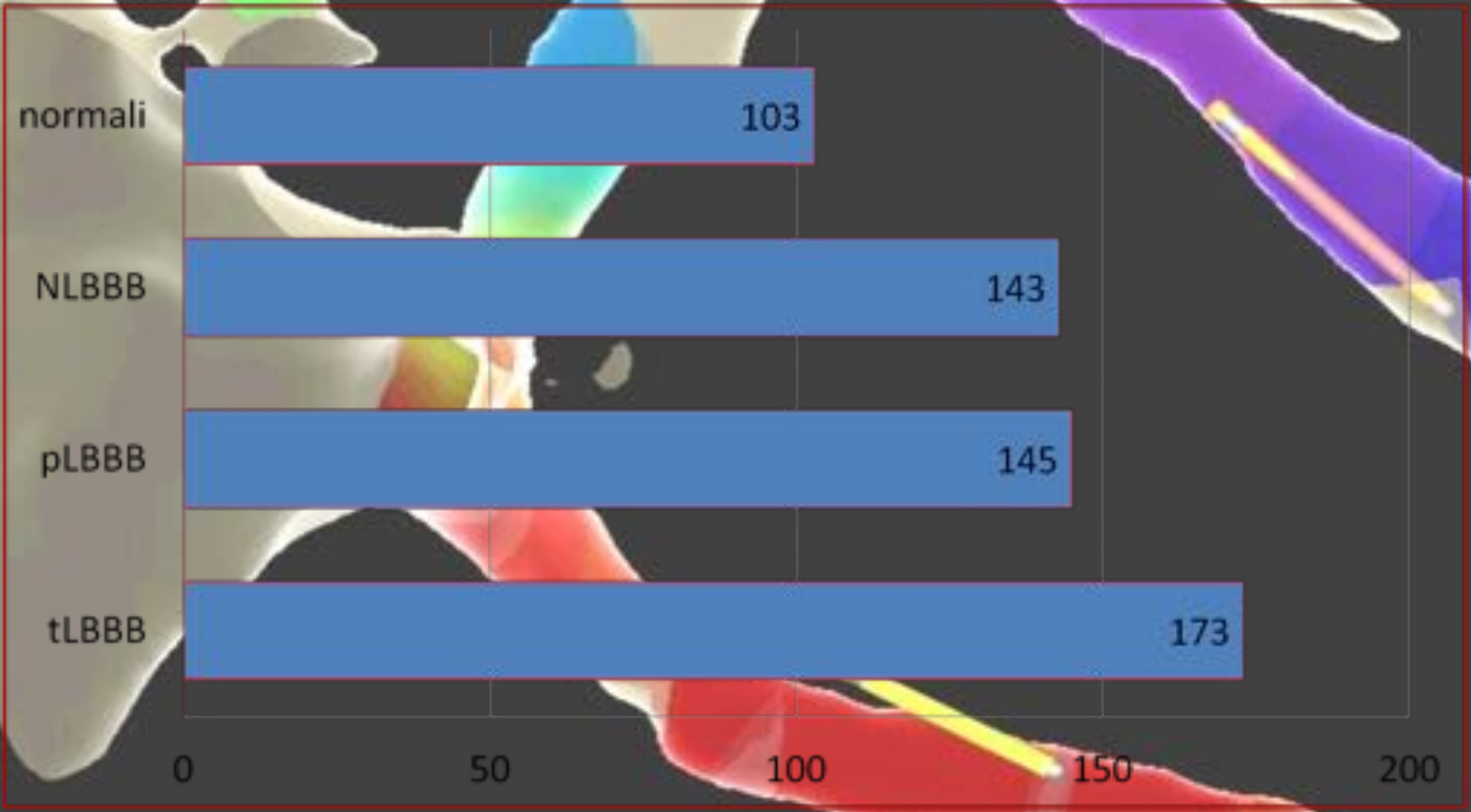
SR



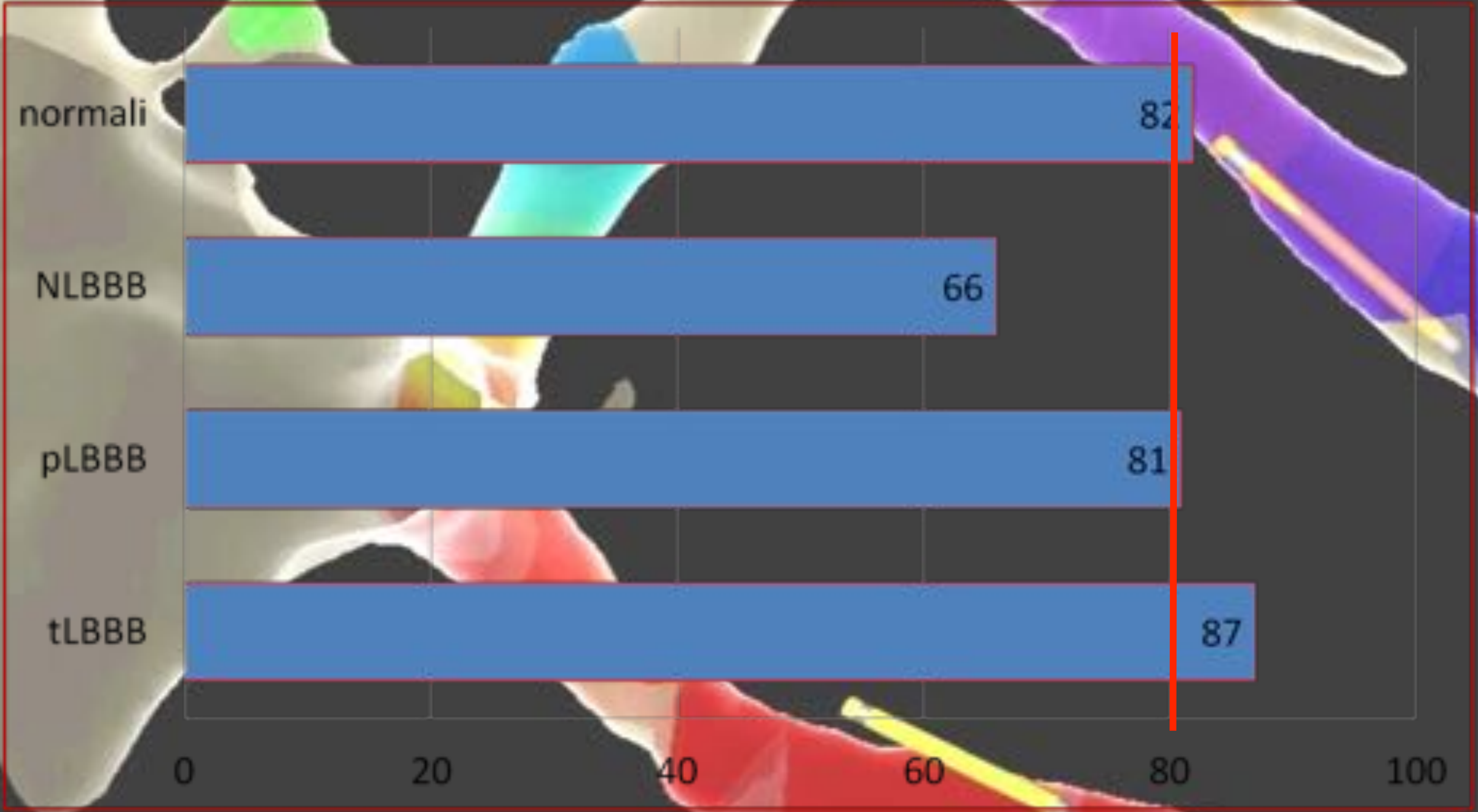
Pacing



Durata media del QRSD: 122.6 ms



Average LVLED: **80.2 %**



Number of mapped branches: 2.6 +/- 0,7

Division of Cardiology, S. Maria del Carmine Hospital – Rovereto (Italy)

European Heart Journal (2013) **34**, 2252–2262
doi:10.1093/eurheartj/eht123

CLINICAL RESEARCH
Heart failure/cardiomyopathy

QRS morphology, left ventricular lead location, and clinical outcome in patients receiving cardiac resynchronization therapy

Jagdesh Kandala[1], Gaurav A. Upadhyay[1], Robert K. Altman[1], Kimberly A. Parks[2], Mary Orencole[1], Theofanie Mela, E. Kevin Heist[1], and Jagmeet P. Singh[1]*

[1]Cardiac Arrhythmia Service, Cardiology Division, Massachusetts General Hospital Heart Center, Harvard Medical School, Boston, MA 02114, USA; and [2]Heart Failure Service, Cardiology Division, Massachusetts General Hospital Heart Center, Harvard Medical School, Boston, MA, USA

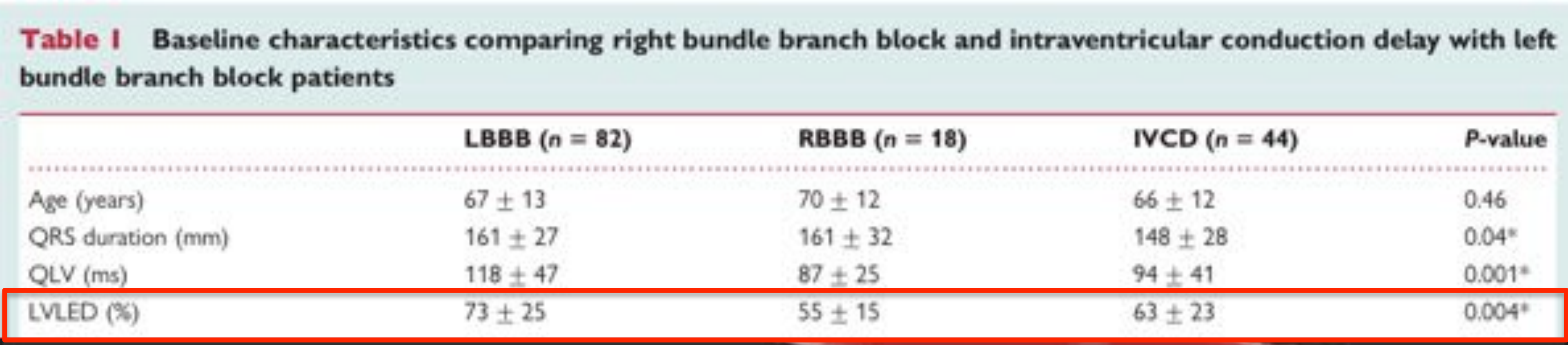
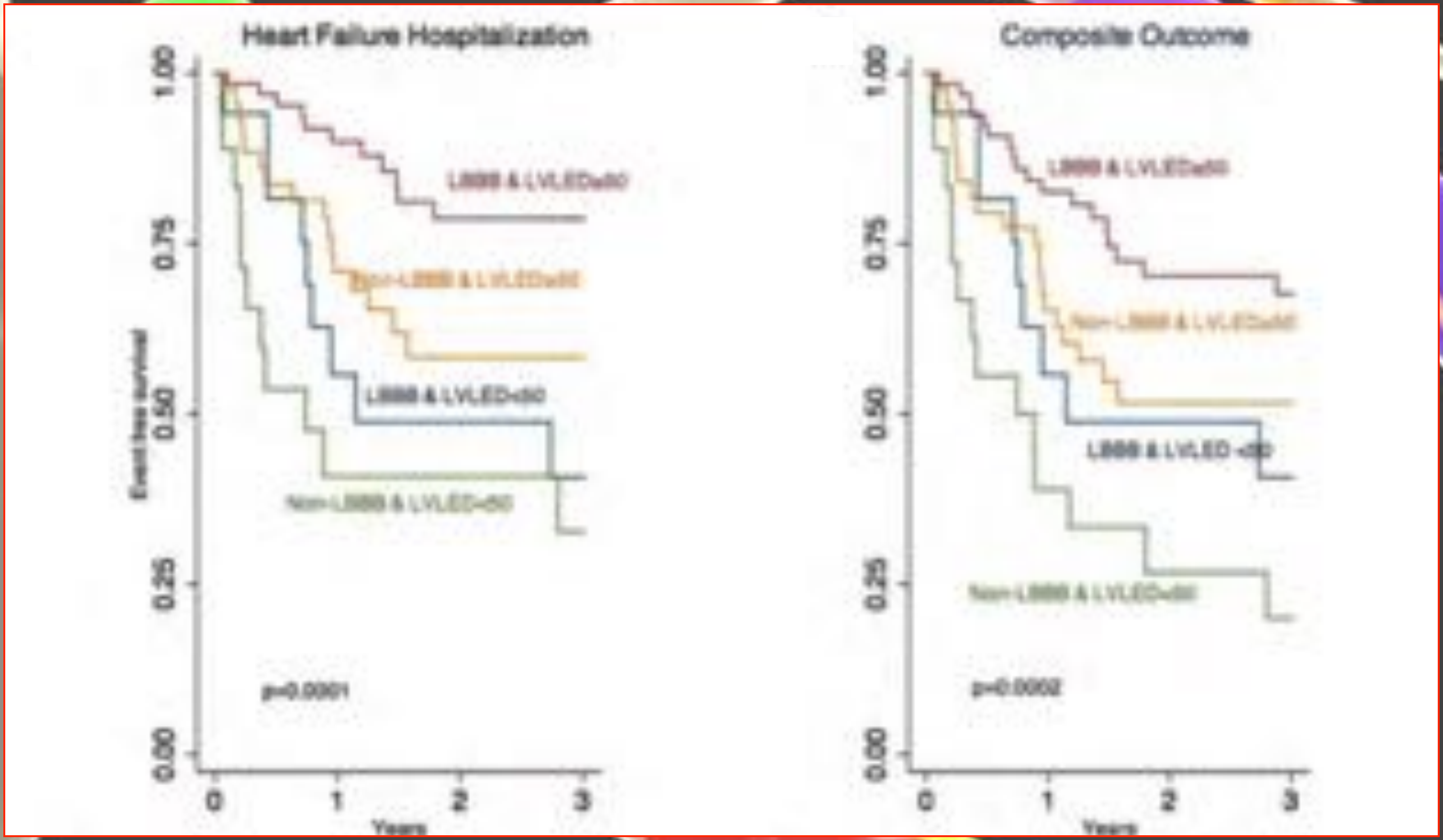


Table I **Baseline characteristics comparing right bundle branch block and intraventricular conduction delay with left bundle branch block patients**

	LBBB (*n* = 82)	RBBB (*n* = 18)	IVCD (*n* = 44)	*P*-value
Age (years)	67 ± 13	70 ± 12	66 ± 12	0.46
QRS duration (mm)	161 ± 27	161 ± 32	148 ± 28	0.04*
QLV (ms)	118 ± 47	87 ± 25	94 ± 41	0.001*
LVLED (%)	73 ± 25	55 ± 15	63 ± 23	0.004*

MORE LATE IT IS BETTER



EUROPEAN SOCIETY OF CARDIOLOGY

European Heart Journal (2013) **34**, 2252–2262
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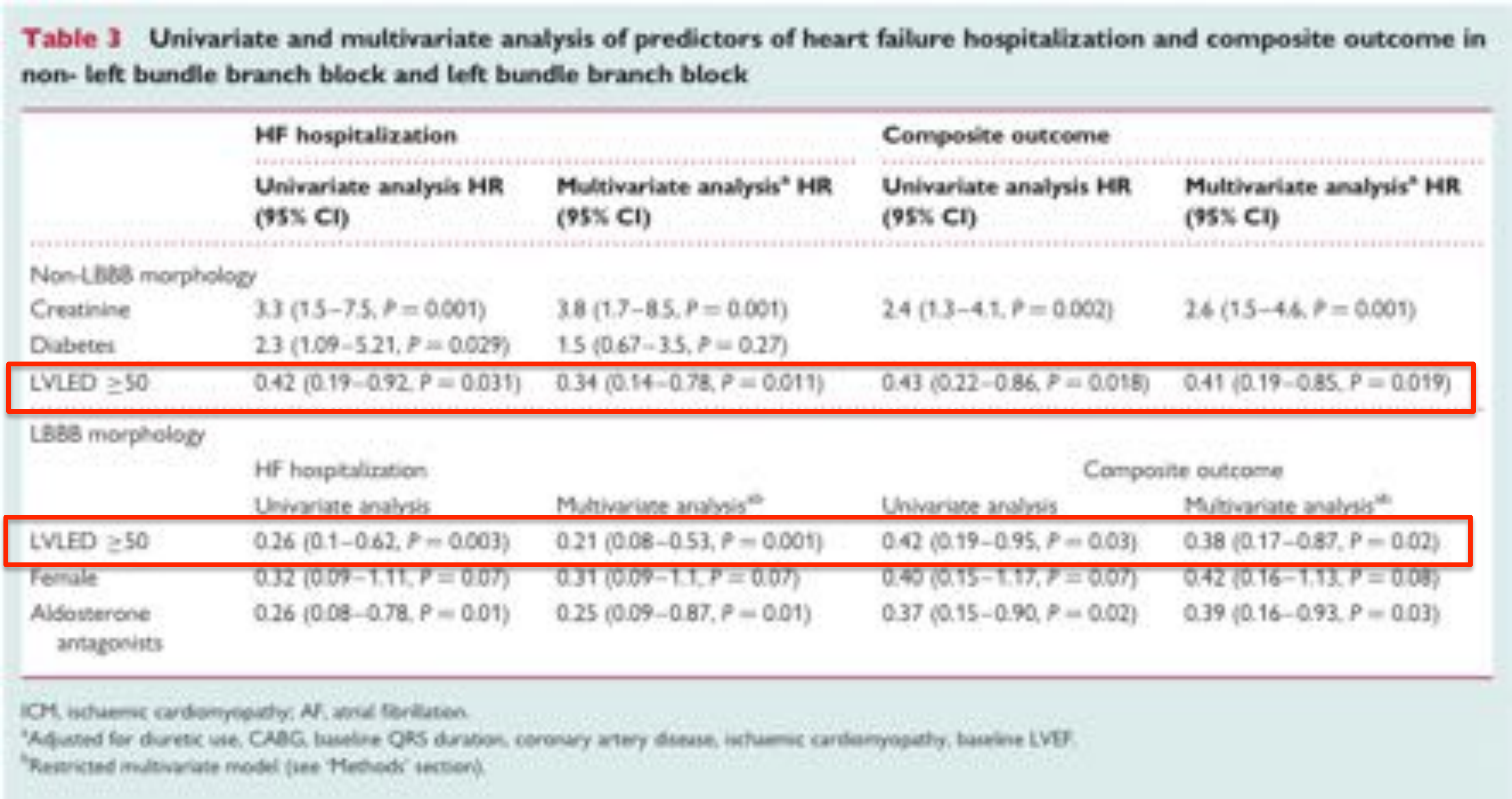


Table 3 Univariate and multivariate analysis of predictors of heart failure hospitalization and composite outcome in non- left bundle branch block and left bundle branch block

	HF hospitalization		Composite outcome	
	Univariate analysis HR (95% CI)	Multivariate analysis[a] HR (95% CI)	Univariate analysis HR (95% CI)	Multivariate analysis[a] HR (95% CI)
Non-LBBB morphology				
Creatinine	3.3 (1.5–7.5, $P = 0.001$)	3.8 (1.7–8.5, $P = 0.001$)	2.4 (1.3–4.1, $P = 0.002$)	2.6 (1.5–4.6, $P = 0.001$)
Diabetes	2.3 (1.09–5.21, $P = 0.029$)	1.5 (0.67–3.5, $P = 0.27$)		
LVLED ≥50	0.42 (0.19–0.92, $P = 0.031$)	0.34 (0.14–0.78, $P = 0.011$)	0.43 (0.22–0.86, $P = 0.018$)	0.41 (0.19–0.85, $P = 0.019$)
LBBB morphology				
	HF hospitalization		Composite outcome	
	Univariate analysis	Multivariate analysis[a,b]	Univariate analysis	Multivariate analysis[a,b]
LVLED ≥50	0.26 (0.1–0.62, $P = 0.003$)	0.21 (0.08–0.53, $P = 0.001$)	0.42 (0.19–0.95, $P = 0.03$)	0.38 (0.17–0.87, $P = 0.02$)
Female	0.32 (0.09–1.11, $P = 0.07$)	0.31 (0.09–1.1, $P = 0.07$)	0.40 (0.15–1.17, $P = 0.07$)	0.42 (0.16–1.13, $P = 0.08$)
Aldosterone antagonists	0.26 (0.08–0.78, $P = 0.01$)	0.25 (0.09–0.87, $P = 0.01$)	0.37 (0.15–0.90, $P = 0.02$)	0.39 (0.16–0.93, $P = 0.03$)

ICM, ischaemic cardiomyopathy; AF, atrial fibrillation.

[a] Adjusted for diuretic use, CABG, baseline QRS duration, coronary artery disease, ischaemic cardiomyopathy, baseline LVEF.

[b] Restricted multivariate model (see 'Methods' section).

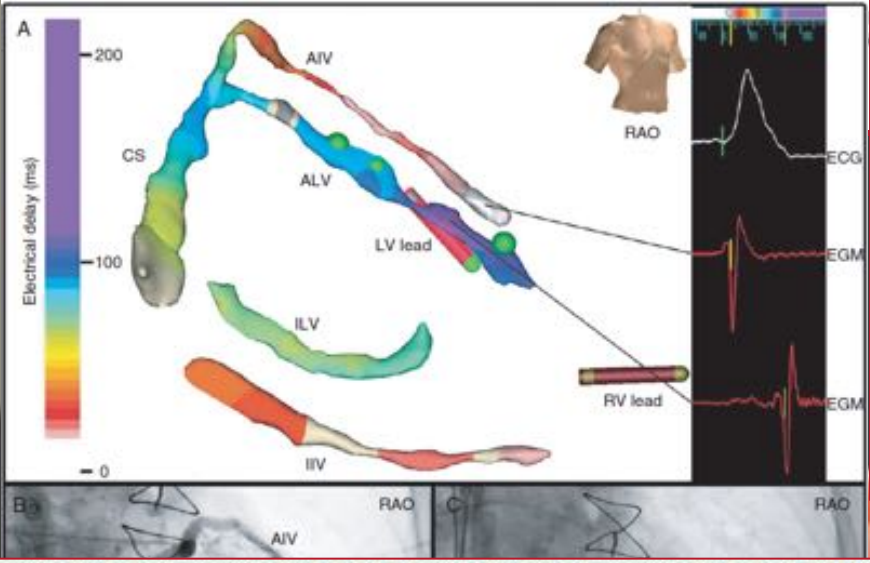
Europace Advance Access published September 3, 2014

Europace
doi:10.1093/europace/euu221

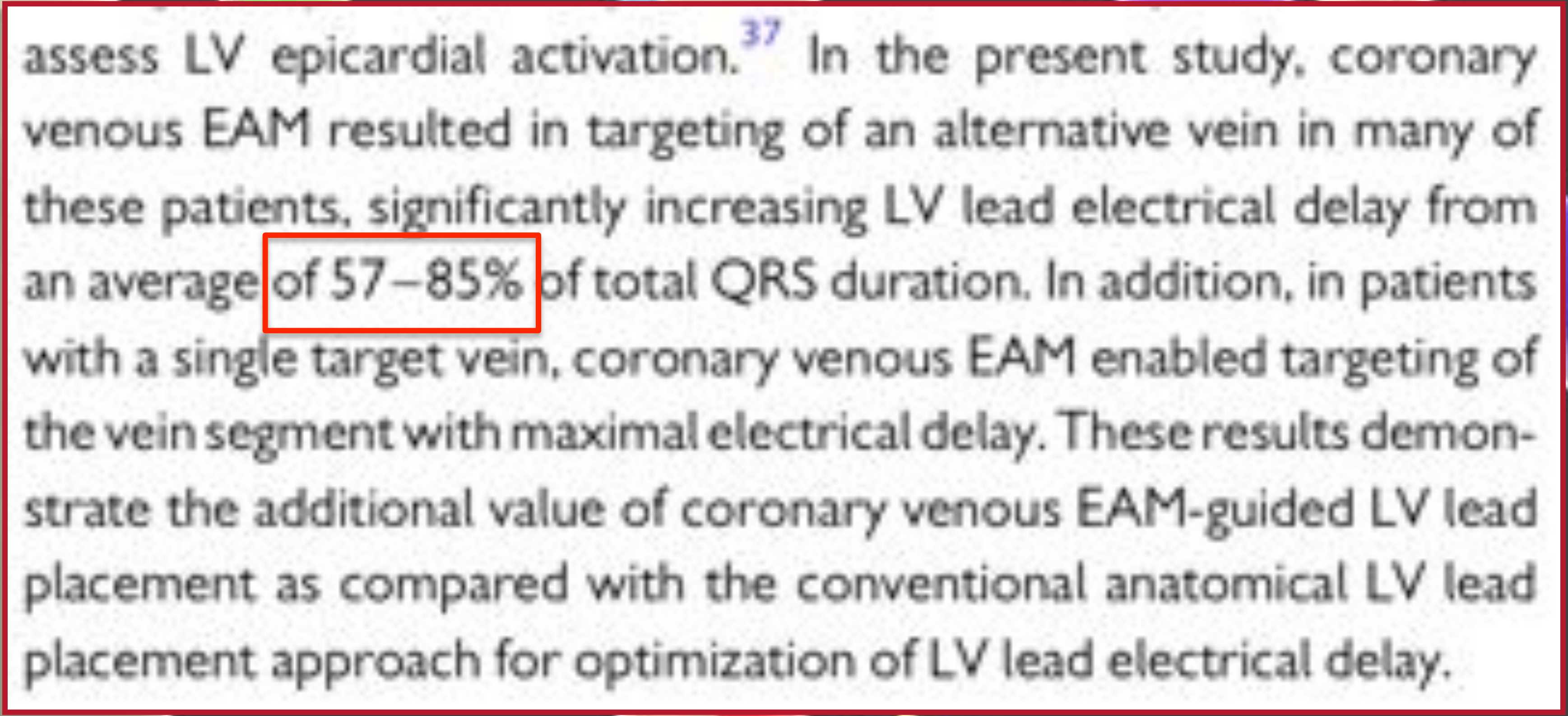
CLINICAL RESEARCH

Left ventricular lead placement in the latest activated region guided by coronary venous electroanatomic mapping

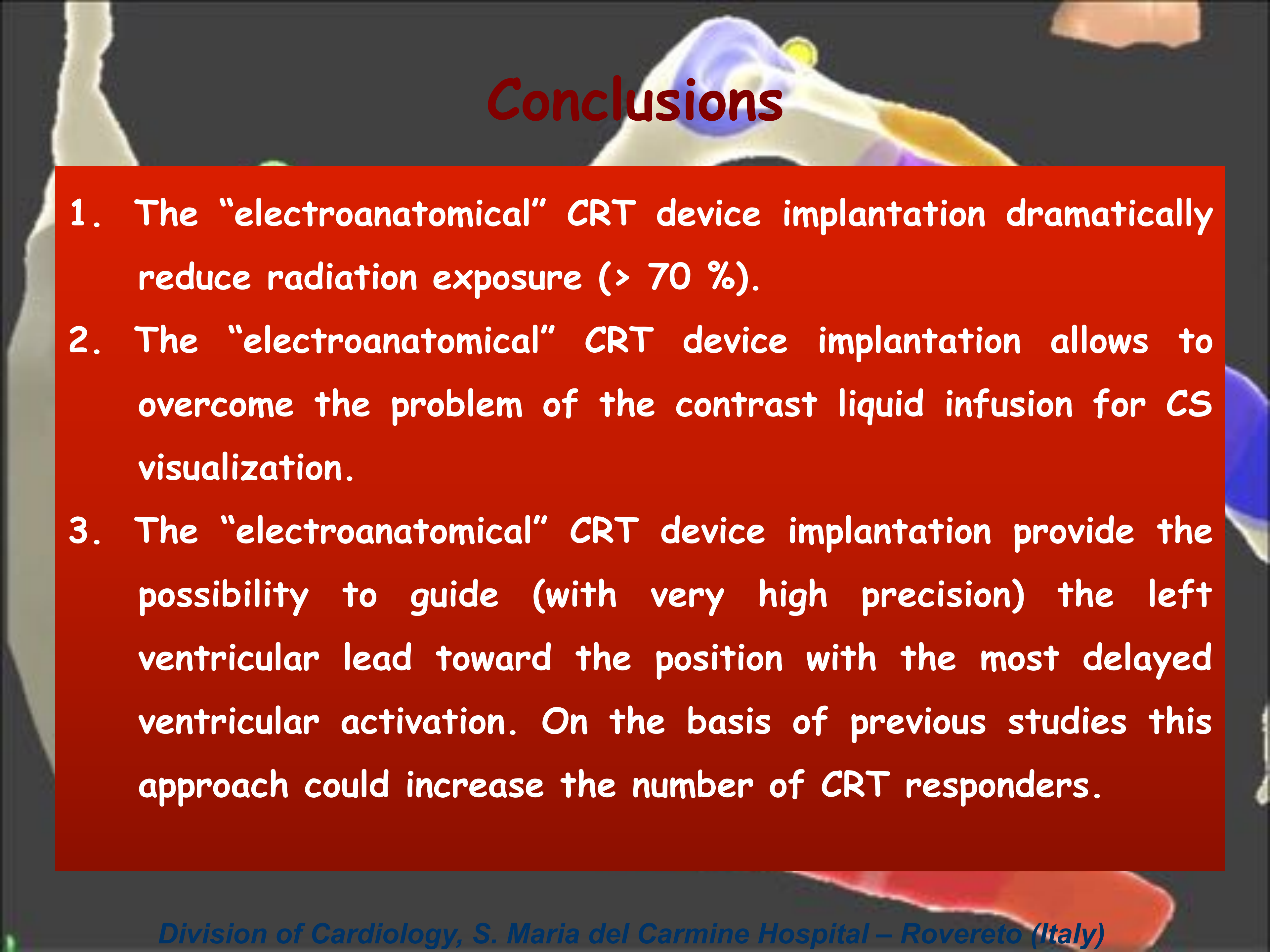
Masih Mafi Rad[1]*, Yuri Blaauw[1], Trang Dinh[1], Laurent Pison[1], Harry J. Crijns[1],
Frits W. Prinzen[2], and Kevin Vernooy[1]



Coronary venous EAM can be used intraprocedurally to guide LV lead placement to the latest activated region free of PNS. This approach especially contributes to optimization of LV lead electrical delay in patients with multiple target veins. Conventional anatomical LV lead placement strategy does not target the vein with maximal electrical delay in many of these patients.

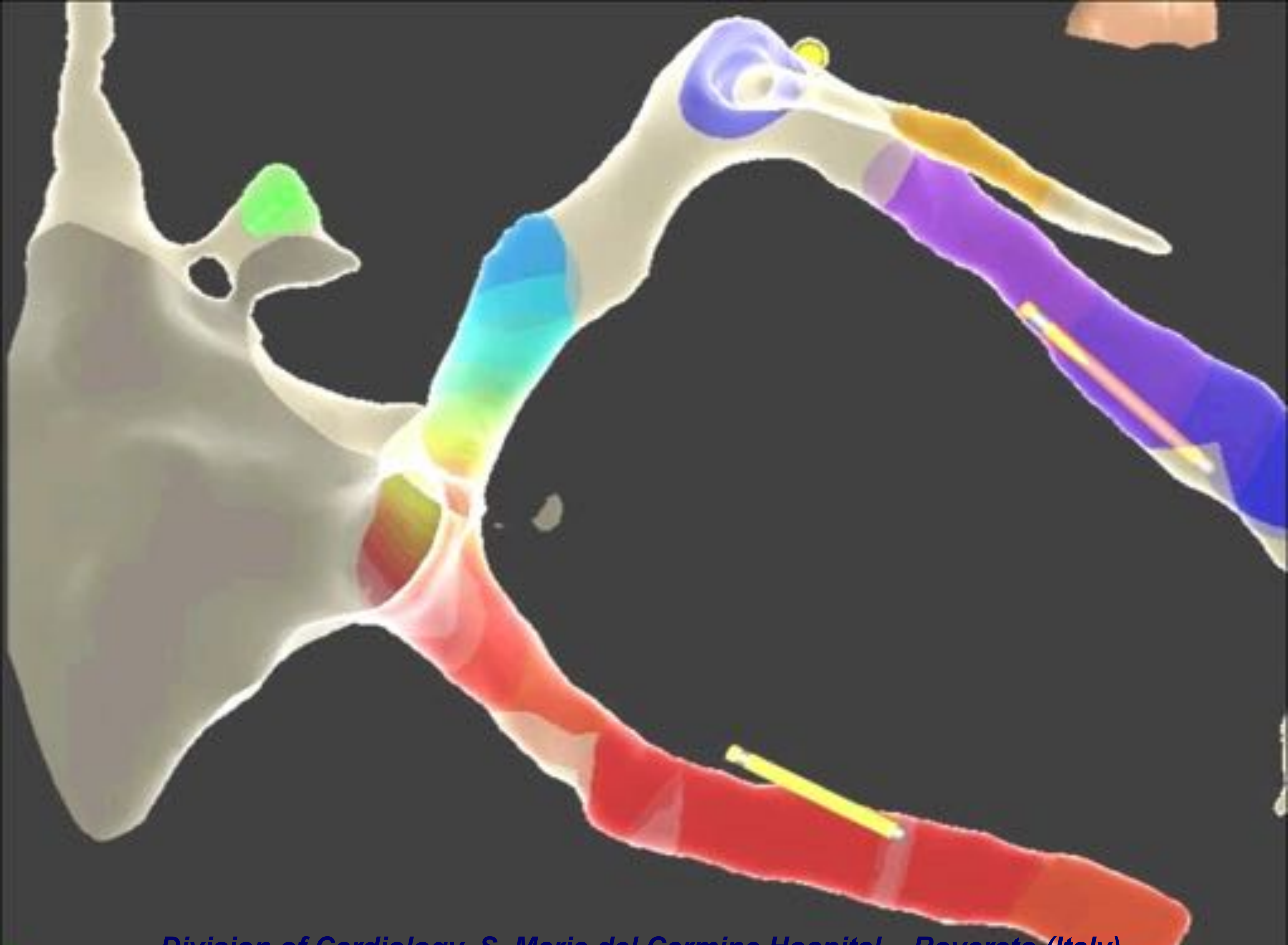


assess LV epicardial activation.[37] In the present study, coronary venous EAM resulted in targeting of an alternative vein in many of these patients, significantly increasing LV lead electrical delay from an average of 57–85% of total QRS duration. In addition, in patients with a single target vein, coronary venous EAM enabled targeting of the vein segment with maximal electrical delay. These results demonstrate the additional value of coronary venous EAM-guided LV lead placement as compared with the conventional anatomical LV lead placement approach for optimization of LV lead electrical delay.



Conclusions

1. The “electroanatomical” CRT device implantation dramatically reduce radiation exposure (> 70 %).
2. The “electroanatomical” CRT device implantation allows to overcome the problem of the contrast liquid infusion for CS visualization.
3. The “electroanatomical” CRT device implantation provide the possibility to guide (with very high precision) the left ventricular lead toward the position with the most delayed ventricular activation. On the basis of previous studies this approach could increase the number of CRT responders.



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MAPS OF POTENTIAL