

PLATFORM OF LABORATORIES FOR ADVANCES IN CARDIAC EXPERIENCE

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**Auditorium
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TOPICS IN CARDIOCHIRURGIA E DINTORNI

RIMODELLAMENTO CHIRURGICO DEL VENTRICOLO SINISTRO

Lorenzo A. Menicanti
IRCCS Policlinico San Donato





No Conflict of interest

Lorenzo A. Menicanti MD

IRCCS Policlinico San Donato

San Donato Milanese – Milano Italy

Left Ventricular Aneurysm: A New Surgical Approach

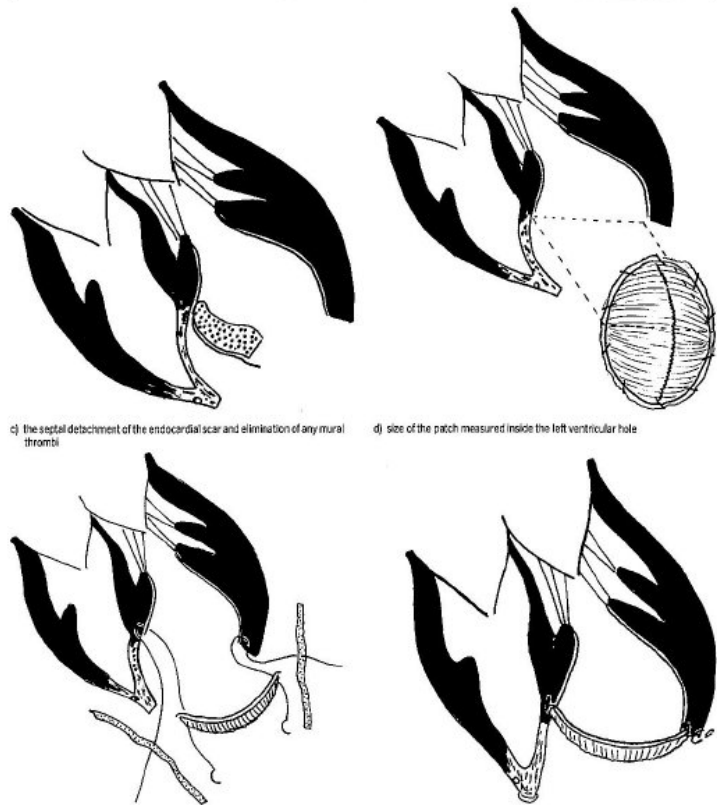
V. Dor, M. Saab, P. Coste, M. Kornaszewska, and F. Montiglio*

Centre Cardiothoracique de Monaco, Monaco

* Service de chirurgie cardiaque, Hopital Pasteur, CHU, Nice, France

Left Ventricular Aneurysm: A New Surgical Approach

Thorac. cardiovasc. Surgon 37 (1989)



The technique involves the following steps:

- Resection of dyskinetic or akinetic LV free wall and thrombectomy when indicated.
- A dacron patch lined with pericardium is secured at the junction of the endocardial muscle and scarred tissue, thereby excluding non contractile portions of the LV and septum.
- Myocardial revascularization is performed as indicated with particular attention paid to revascularizing the proximal left anterior descending segment.

Presented in part at the 17th Annual Meeting of the German Society for Thoracic and Cardiovascular Surgery, Bad Nauheim, 1988

2016 ESC Guidelines for the diagnosis and treatment of acute and chronic heart failure

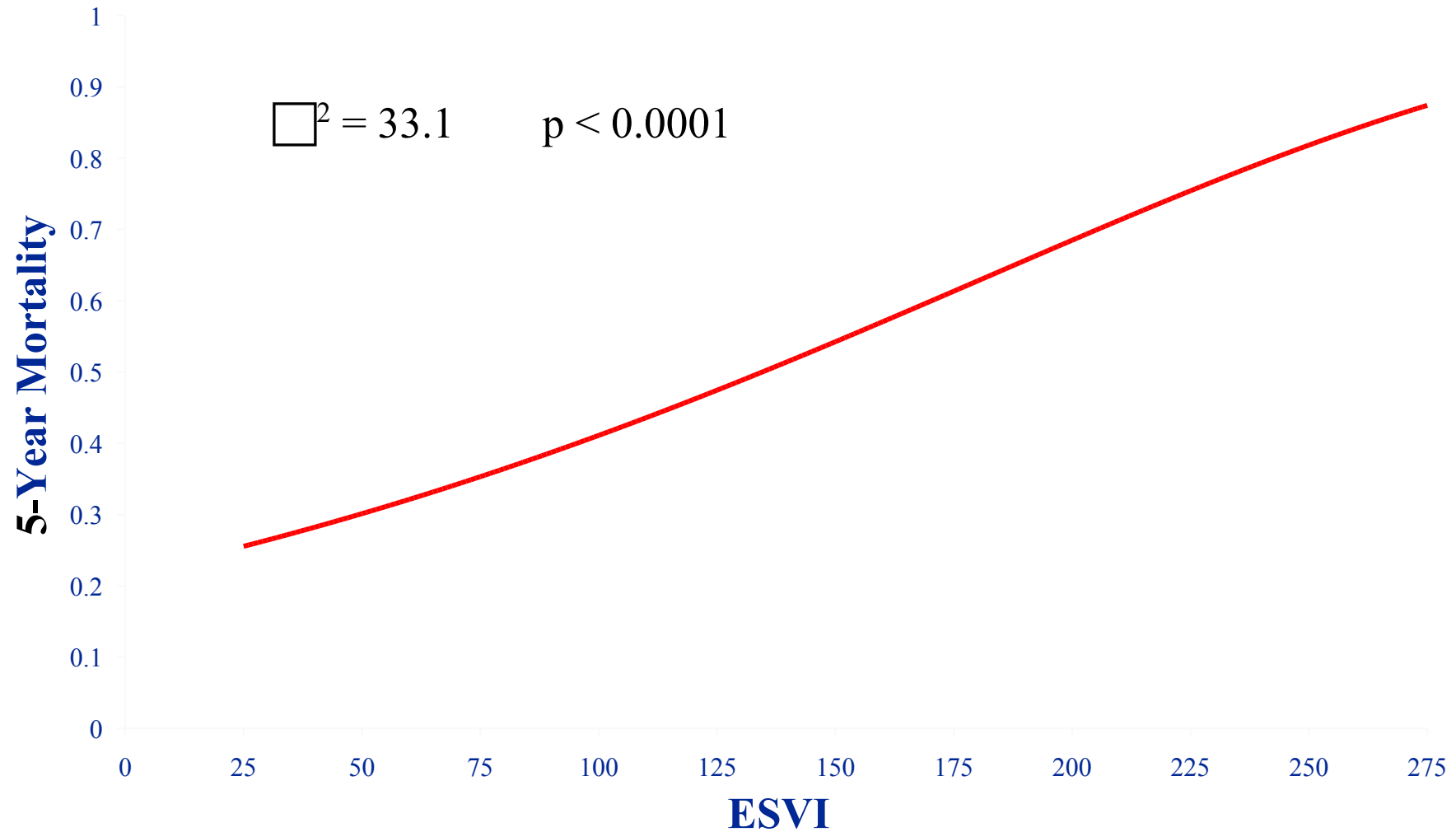
The Task Force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC)

Developed with the special contribution of the Heart Failure Association (HFA) of the ESC

Table 3.4 Aetiologies of heart failure

DISEASED MYOCARDIUM		
Ischaemic heart disease	Myocardial scar	←
	Myocardial stunning/hibernation	←
	Epicardial coronary artery disease	←
	Abnormal coronary microcirculation	
	Endothelial dysfunction	
Toxic damage	Recreational substance abuse	Alcohol, cocaine, amphetamine, anabolic steroids.
	Heavy metals	Copper, iron, lead, cobalt.
	Medications	Cytostatic drugs (e.g. anthracyclines), immunomodulating drugs (e.g. interferons monoclonal antibodies such as trastuzumab, cetuximab), antidepressant drugs, antiarrhythmics, non-steroidal anti-inflammatory drugs, anaesthetics.
	Radiation	
Immune-mediated and inflammatory damage	Related to infection	Bacteria, spirochaetes, fungi, protozoa, parasites (Chagas disease), rickettsiae, viruses (HIV/AIDS).
	Not related to infection	Lymphocytic/giant cell myocarditis, autoimmune diseases (e.g. Graves' disease, rheumatoid arthritis, connective tissue disorders, mainly systemic lupus erythematosus), hypersensitivity and eosinophilic myocarditis (Churg-Strauss).
Infiltration	Related to malignancy	Direct infiltrations and metastases.
	Not related to malignancy	Amyloidosis, sarcoidosis, haemochromatosis (iron), glycogen storage diseases (e.g. Pompe disease), lysosomal storage diseases (e.g. Fabry disease).
Metabolic derangements	Hormonal	Thyroid diseases, parathyroid diseases, acromegaly, GH deficiency, hypercortisolaemia, Conn's disease, Addison disease, diabetes, metabolic syndrome, pheochromocytoma, pathologies related to pregnancy and peripartum.
	Nutritional	Deficiencies in thiamine, L-carnitine, selenium, iron, phosphates, calcium, complex malnutrition (e.g. malignancy, AIDS, anorexia nervosa), obesity.
Genetic abnormalities	Diverse forms	HCM, DCM, LV non-compaction, ARVC, restrictive cardiomyopathy (for details see respective expert documents), muscular dystrophies and laminopathies.

5-Year Mortality vs. ESVI



Courtesy of Kerry Lee



2014 ESC/EACTS Guidelines on myocardial revascularization

The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

Developed with the special contribution of the European Association of Percutaneous Cardiovascular Interventions (EAPCI)



Recommendations on revascularizations in patients with chronic heart failure and systolic LV dysfunction (ejection fraction $\leq 35\%$)

Recommendations	Class ^a	Level ^b	Ref ^c
CABG is recommended for patients with significant LM stenosis and LM equivalent with proximal stenosis of both LAD and LCx arteries.	I	C	-
CABG is recommended for patients with significant LAD artery stenosis and multivessel disease to reduce death and hospitalization for cardiovascular causes.	I	B	112,288
LV aneurysmectomy during CABG should be considered in patients with a large LV aneurysm, if there is a risk of rupture, large thrombus formation or the aneurysm is the origin of arrhythmias.	IIa	C	
Myocardial revascularization should be considered in the presence of viable myocardium.	IIa	B	55
CABG with surgical ventricular restoration may be considered in patients with scarred LAD territory, especially if a post-operative LVESV Index $< 70 \text{ mL/m}^2$ can be predictably achieved.	IIb	B	291–295
PCI may be considered if anatomy is suitable, in the presence of viable myocardium, and surgery is not indicated.	IIb	C	

^aClass of recommendation.

^bLevel of evidence.

^cReferences.

CABG = coronary artery bypass grafting; LAD = left anterior descending; LCx = left circumflex; LM = left main; LVESV = left ventricular end-systolic volume; PCI = percutaneous coronary intervention; SVR = surgical ventricular reconstruction.

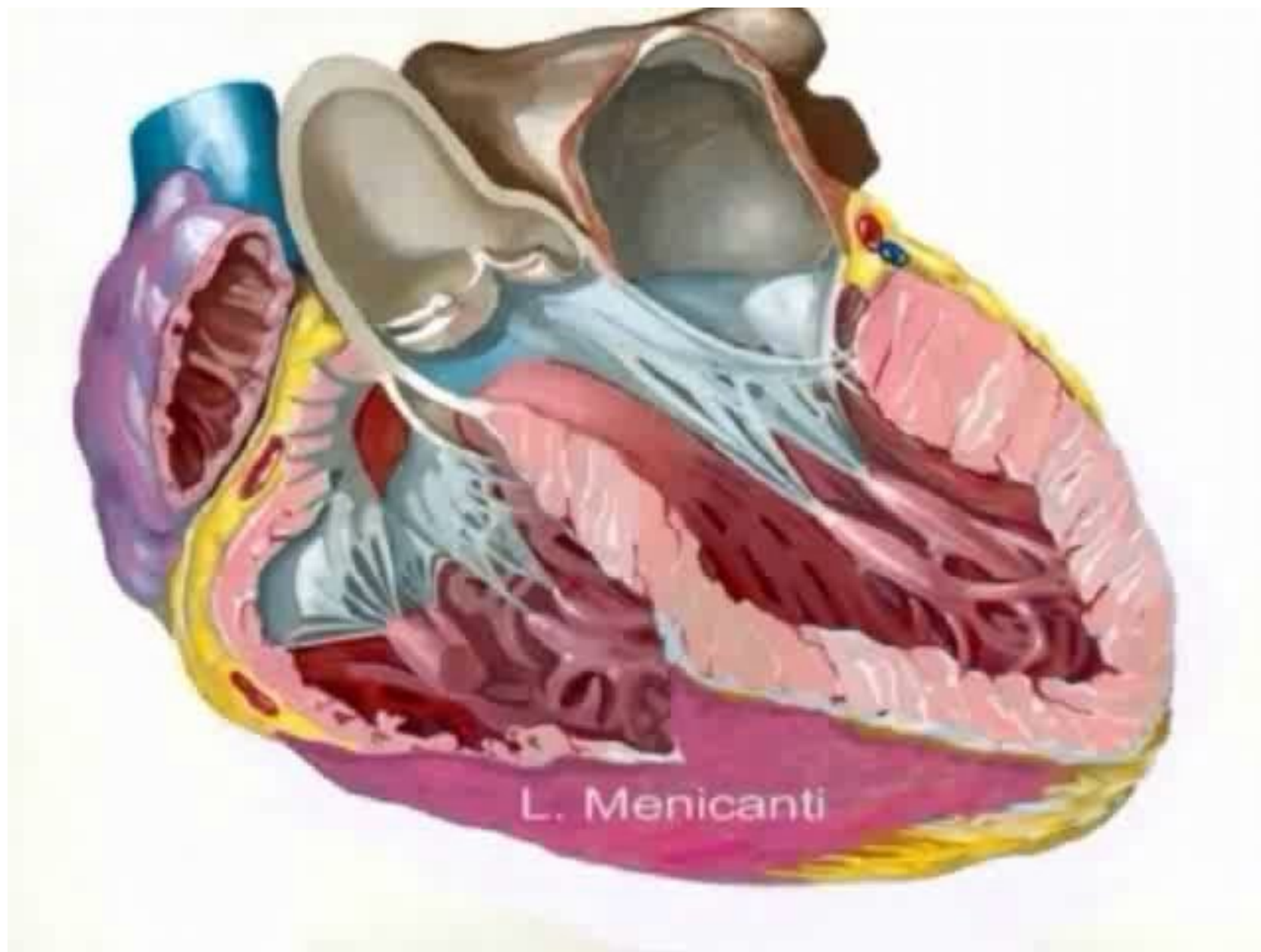
8 Myocardial revascularization in patients with heart failure

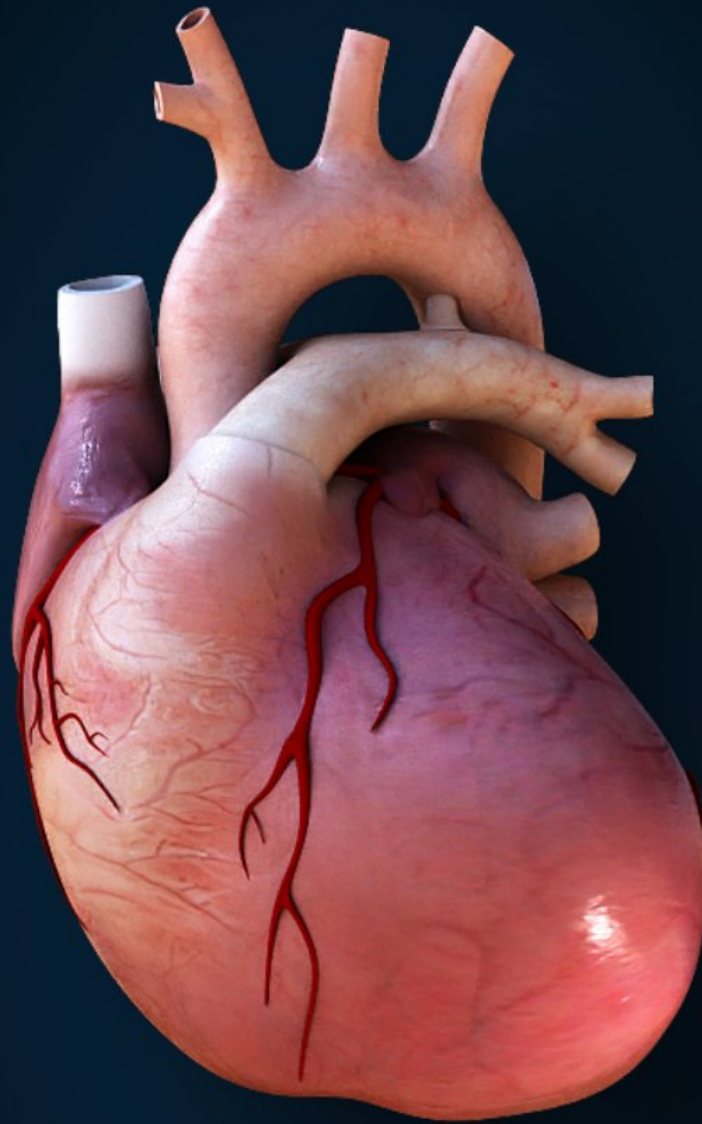
8.1.2 Ventricular reconstruction and aneurysm resection

The aim of surgical ventricular reconstruction (SVR) is to restore physiological volume, and achieve an elliptical shape of the LV, by scar resection and LV wall reconstruction on a mannequin of predefined size. The aim of ventricular aneurysmectomy is to remove fibrous scars in cases of severe dilatation, thrombus formation, or as a source of life-threatening ventricular arrhythmias.

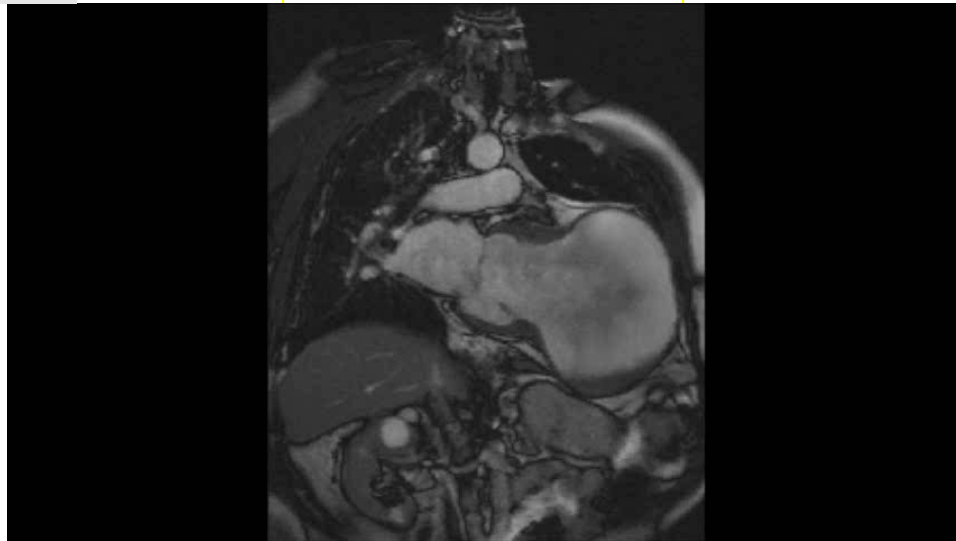
Recommendations on revascularizations in patients with chronic heart failure and systolic left ventricular dysfunction (ejection fraction $\leq 35\%$)

Recommendations	Class ^a	Level ^b
In patients with severe LV systolic dysfunction and coronary artery disease suitable for intervention, myocardial revascularization is recommended. ^{81,250}	I	B
CABG is recommended as the first revascularization strategy choice in patients with multivessel disease and acceptable surgical risk. ^{68,81,248,255}	I	B
In patients with one- or two-vessel disease, PCI should be considered as an alternative to CABG when complete revascularization can be achieved.	IIa	C
In patients with three-vessel disease, PCI should be considered based on the evaluation by the Heart Team of the patient's coronary anatomy, the expected completeness of revascularization, diabetes status, and comorbidities.	IIa	C
LV aneurysmectomy during CABG should be considered in patients with NYHA class III/IV, large LV aneurysm, large thrombus formation, or if the aneurysm is the origin of arrhythmias.	IIa	C
Surgical ventricular restoration during CABG may be considered in selected patients treated in centres with expertise. ^{252–254,256,257}	IIb	B

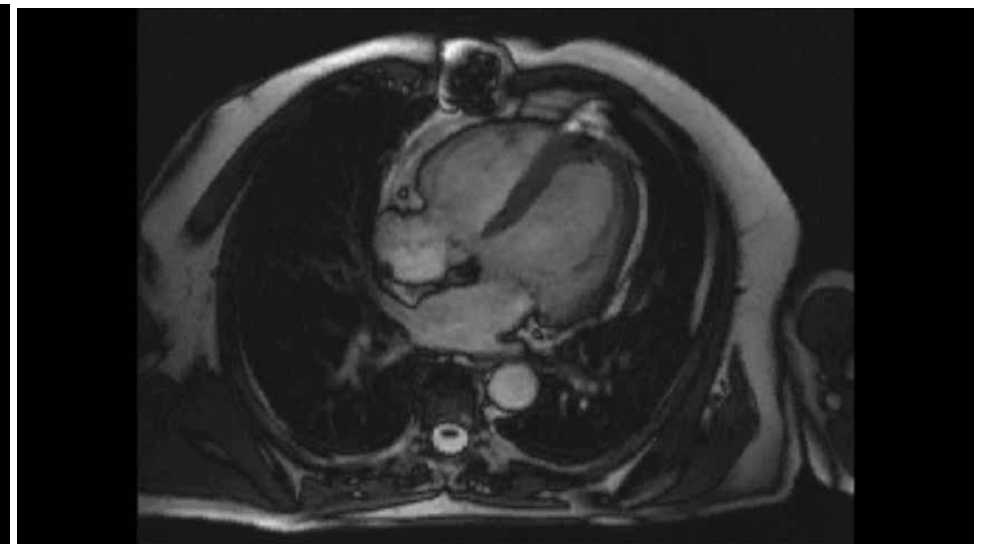
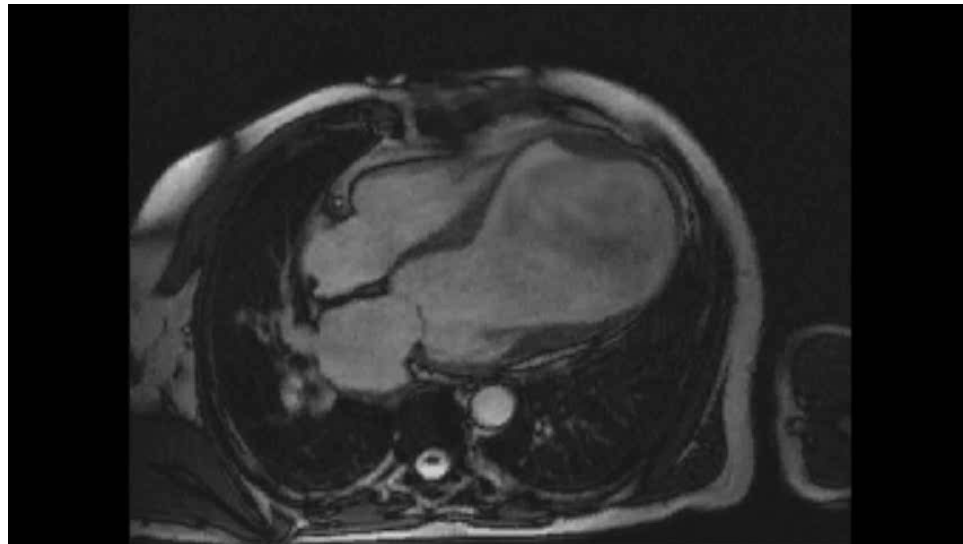
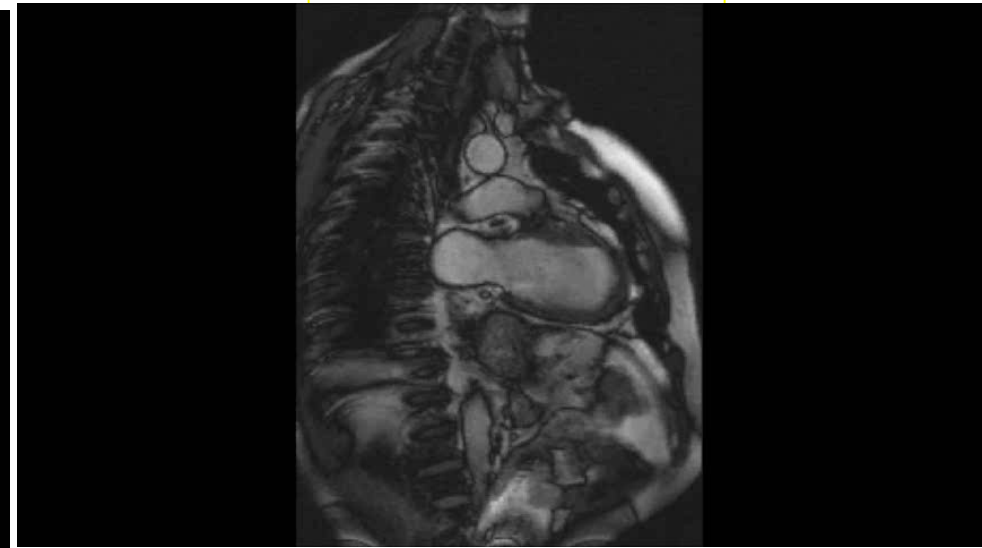




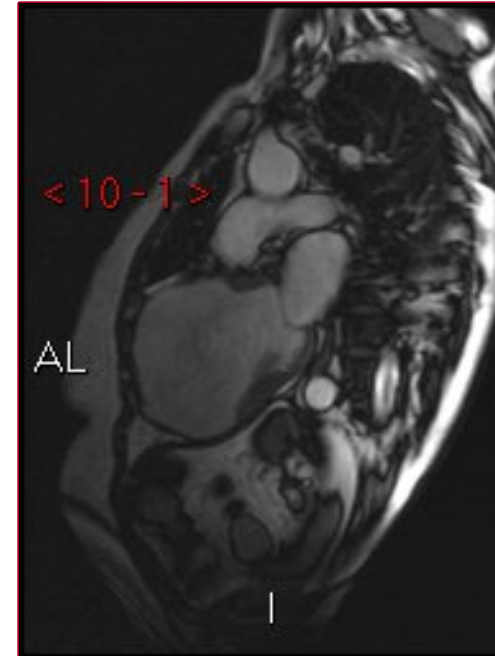
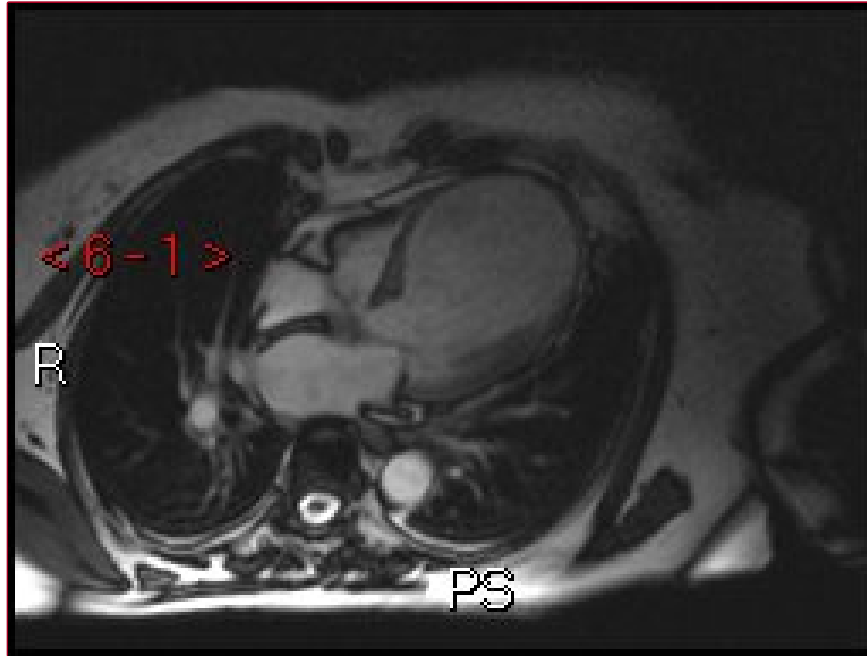
EDVI 485 ml/m²
ESVI 435 ml/m²
EF 10%
SVI=50ml/m²



EDVI 57ml/m²
ESVI 26 ml/m²
EF 54%
SVI=31ml/m²

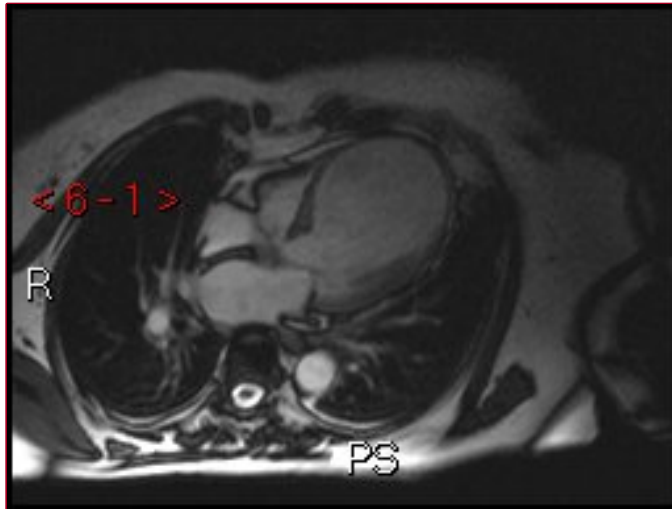


R.M. ♀ 70 years old
NYHA IV transplant candidate
Magnetic Risonance Imaging – LGE MRI



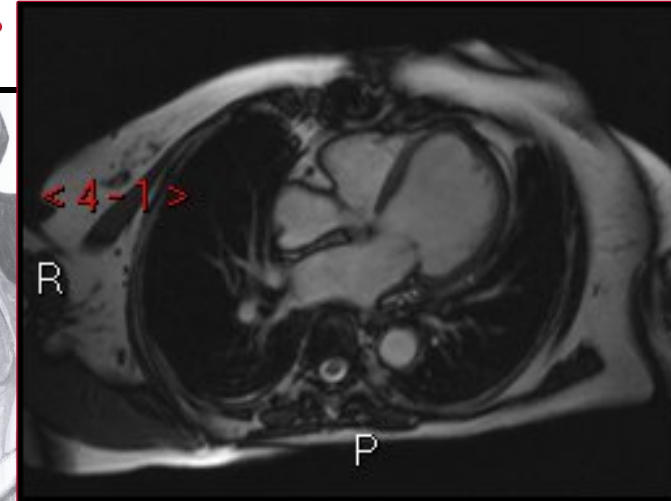
Surgical LV Remodeling for Ischemic HF

Pre-op

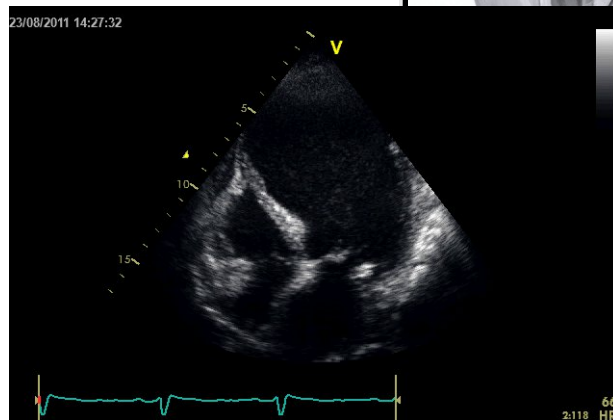


I.R.C.C.S. POLICLINICO SAN DONATO

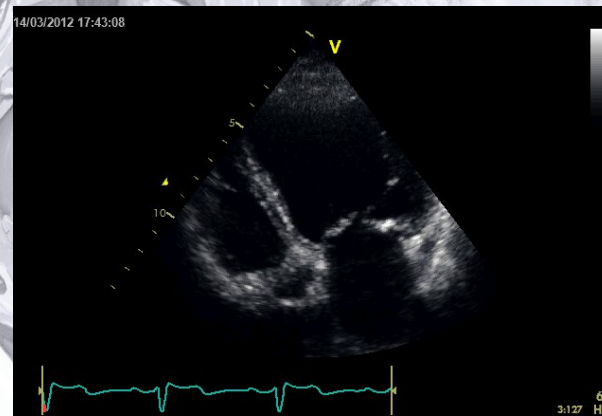
6 - Months



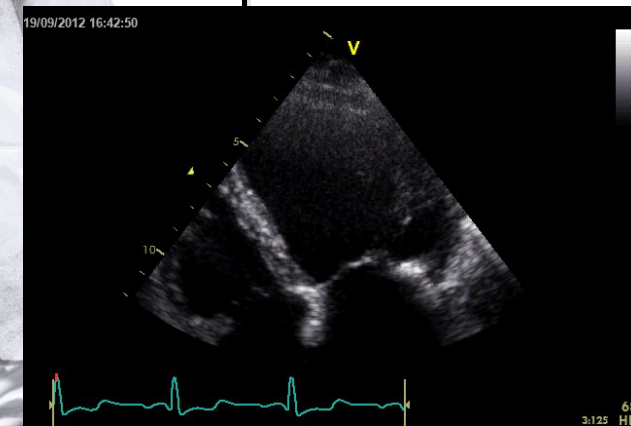
Pre-op



6 - Months



12 - Months



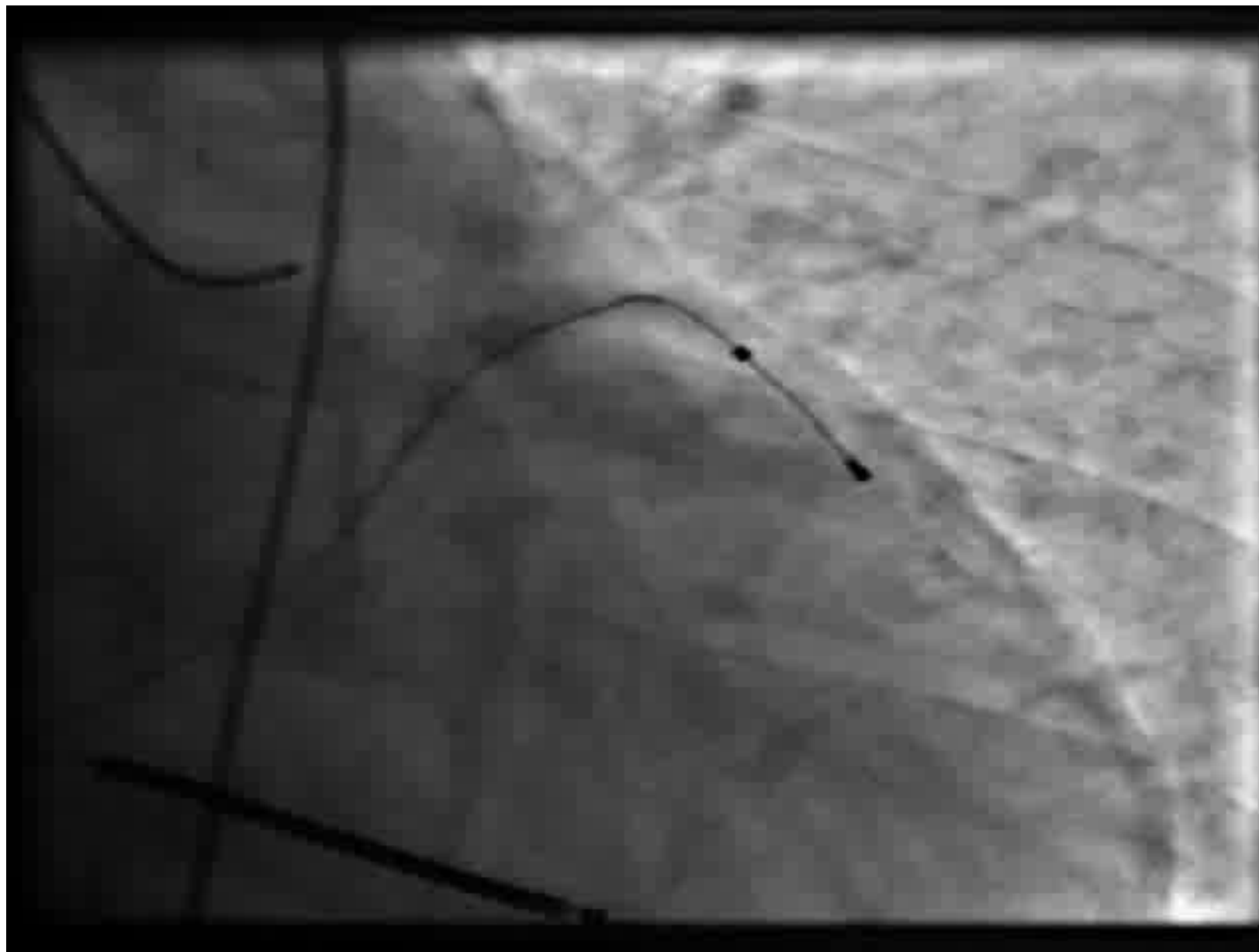
EF= 25%, NT-proBNP= 7.885

EF= 34%, NT-proBNP= 1.722

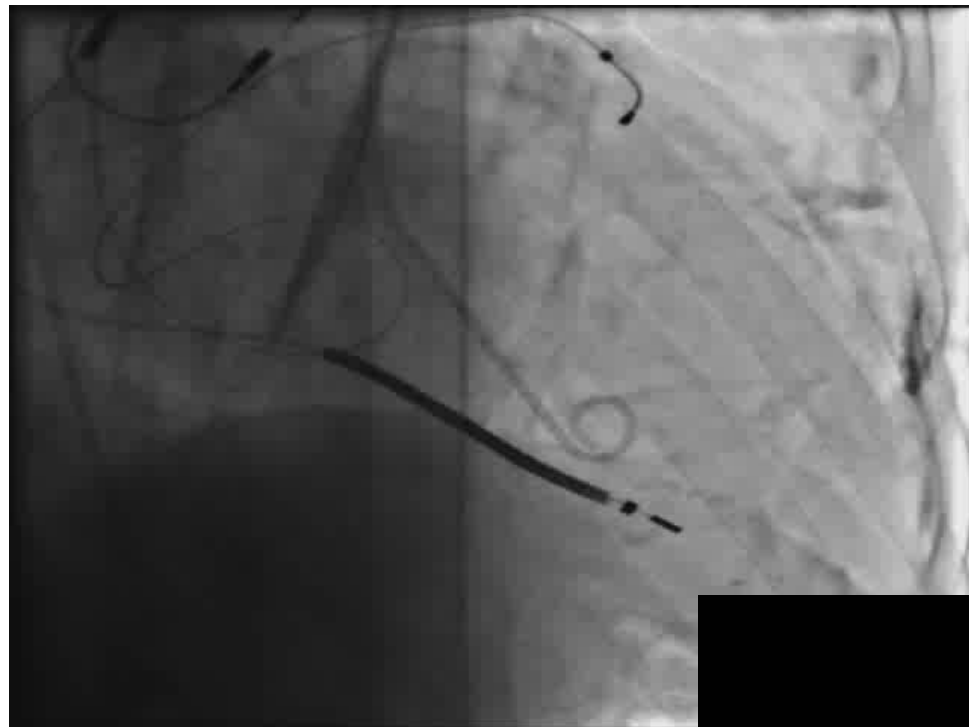
EF= 35%, NT-proBNP= 822



I.R.C.C.S.
POLICLINICO
SAN DONATO

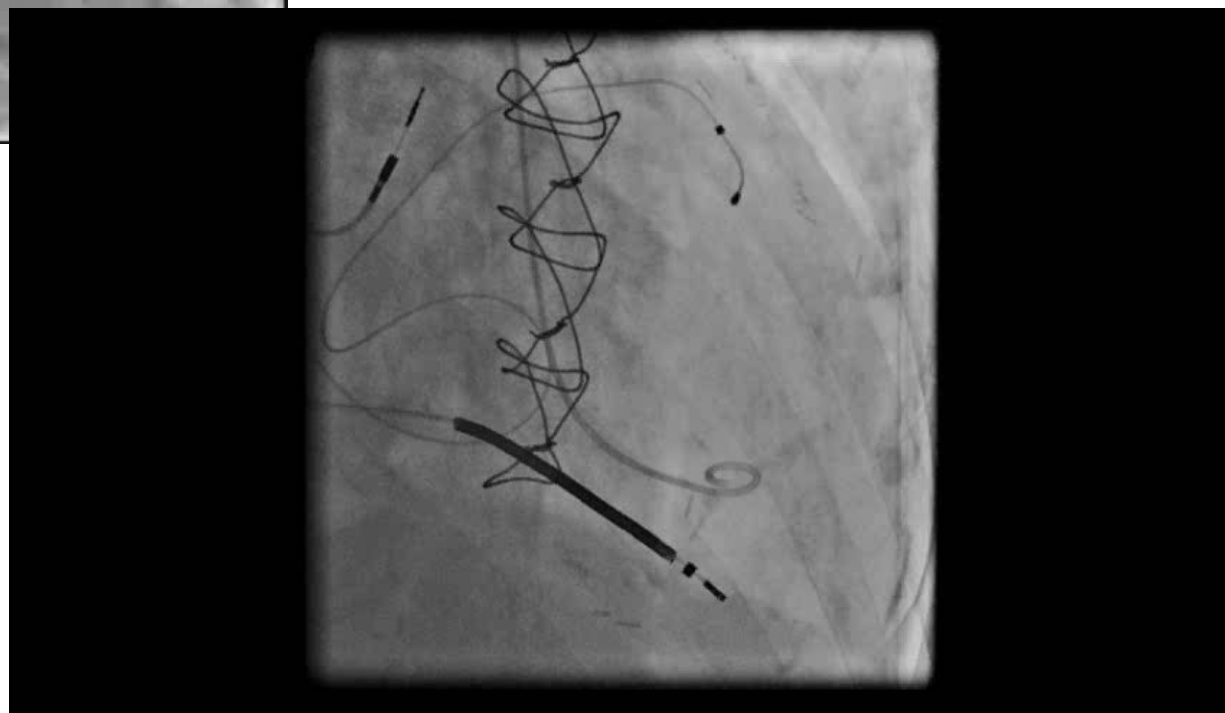


P.I. MALE 67 YEARS TRANSPLANT CANDIDATE

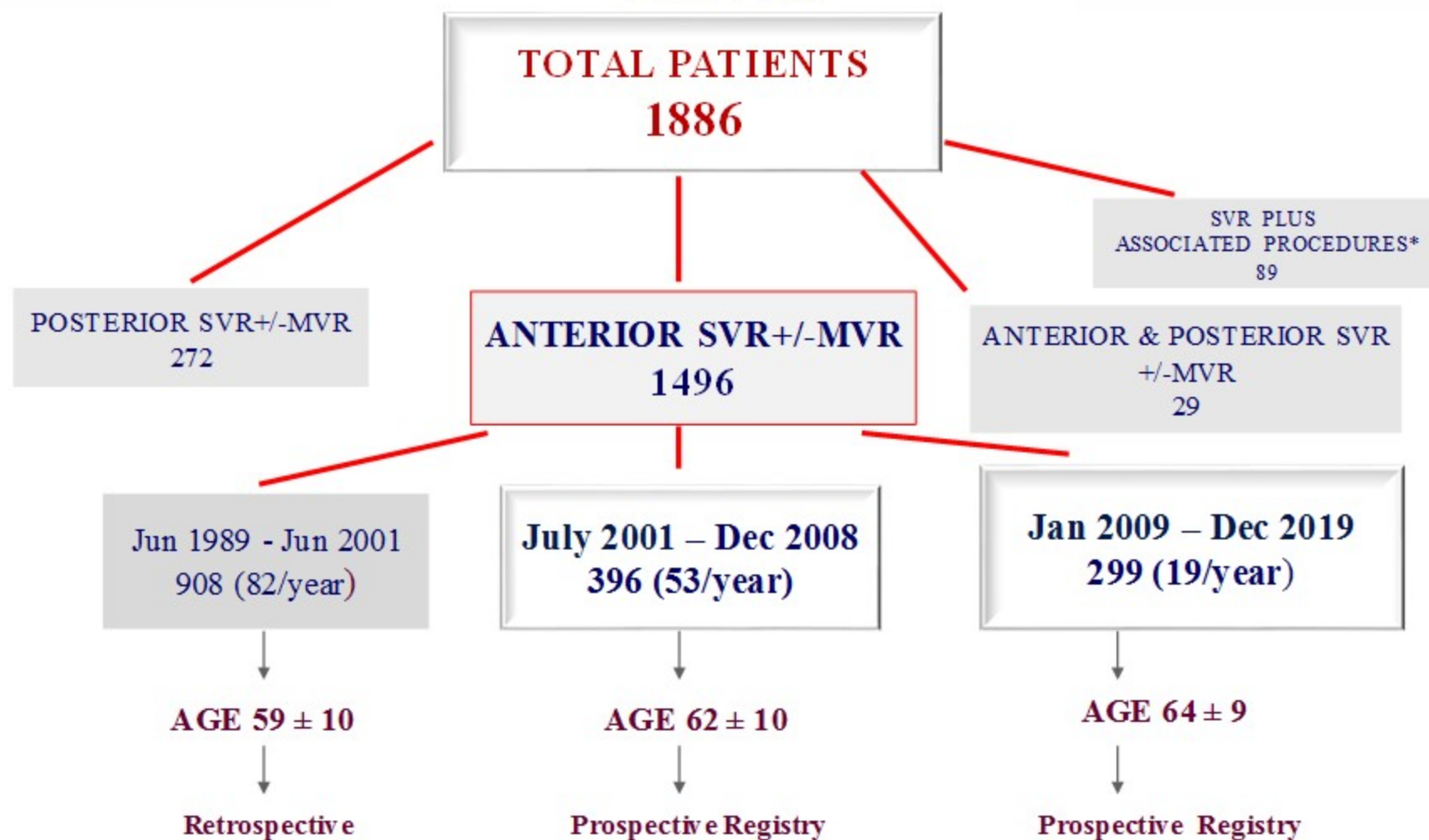


13-11-2011

26-11-2011



THE OVERALL EXPERIENCE 1989 -2019



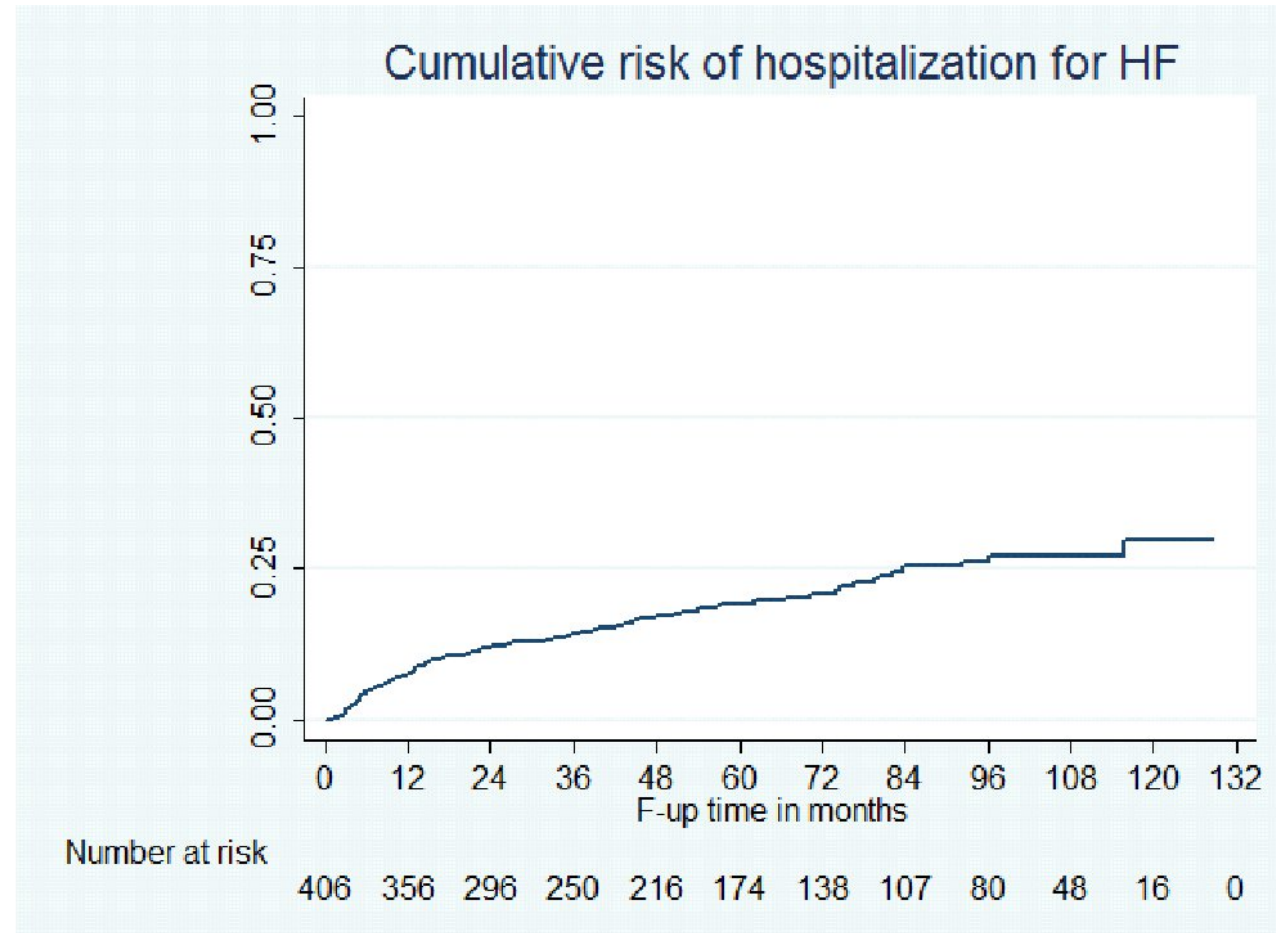
* MV/AV Replacement (17/26), Tricuspid Valve Repair (35), Bentall Op (1), VSD Closure (10)

SURGICAL VENTRICULAR RECONSTRUCTION AND LONG-TERM OUTCOME: RESULTS FROM 10-YEAR-SINGLE CENTER EXPERIENCE

Table 2. Preoperative and postoperative echocardiographic variables

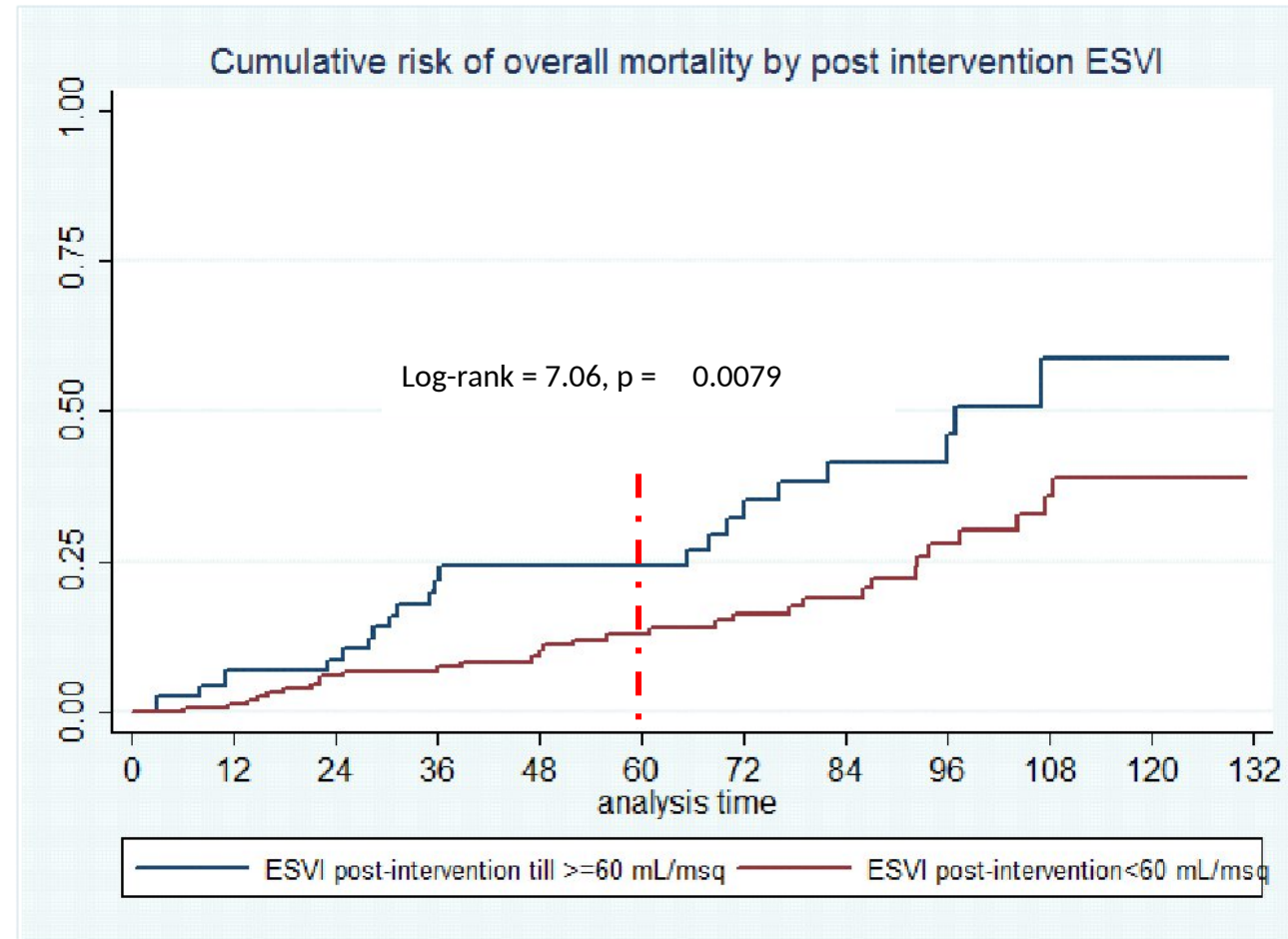
Variable	Pre	Post	p-value*
Diastolic Diameter (mm)	63.8 (9.0)	61.3 (8.4)	<0.0001
Systolic Diameter (mm)	50.8 (10.2)	48.0 (10.3)	<0.0001
EDVI (mL/m ²)	116.0 (41.3)	89.1 (24.4)	<0.0001
ESVI (mL/m ²)	80.8 (37.5)	54.2 (20.8)	<0.0001
EF (%)	32.3 (8.3)	40.2 (9.5)	<0.0001
SV (mL)	35.2 (9.4)	33.9 (9.8)	<0.08
TAPSE (mm)	19.9 (4.4)	16.2 (3.4)	<0.0001
PAPs (mmHg)	40.3 (14.7)	36.3 (11.8)	0.02
LVMI (g/m ²)	166.4 (41.6)	150.3 (38.9)	<0.0001
Sphericity Index, diastole	0.57 (0.1)	0.67 (0.1)	<0.0001
Sphericity Index, systole	0.49 (0.1)	0.58 (0.1)	<0.0001
Conicity Index, diastole	0.86 (0.17)	0.78 (0.12)	<0.0001
Conicity Index, systole	0.99 (0.30)	0.93 (0.16)	<0.0001

SURGICAL VENTRICULAR RECONSTRUCTION AND LONG-TERM OUTCOME: RESULTS FROM 10-YEAR-SINGLE CENTER EXPERIENCE



SURGICAL VENTRICULAR RECONSTRUCTION AND LONG-TERM OUTCOME: RESULTS FROM 10-YEAR-SINGLE CENTER EXPERIENCE

Cumulative risk of all-causes mortality by post-operative ESVI classes (<60 mL/m² and ≥60 mL/m²)



ESVI <60 vs ESVI ≥60

Gender (F vs.M)

Age

HR	95% CI		P
0.50	0.29	0.88	0.015
0.71	0.36	1.41	0.330
1.41	1.07	1.86	0.016

Elucidating the mechanisms underlying left ventricular function recovery in patients with ischemic heart failure undergoing surgical remodeling: A 3-dimensional ultrasound analysis

Serenella Castelvecchio, MD, FESC,^a Matteo Frigelli, MSc,^{b,c} Francesco Sturla, PhD,^{b,c} Valentina Milani, PhD,^d Omar A. Pappalardo, PhD,^b Michele Citarella, CVt,^a Lorenzo Menicanti, MD,^a and Emiliano Votta, PhD^{b,c}

Surgical ventricle reconstruction (SVR) improves LV endocardial strain mostly in the remote myocardium

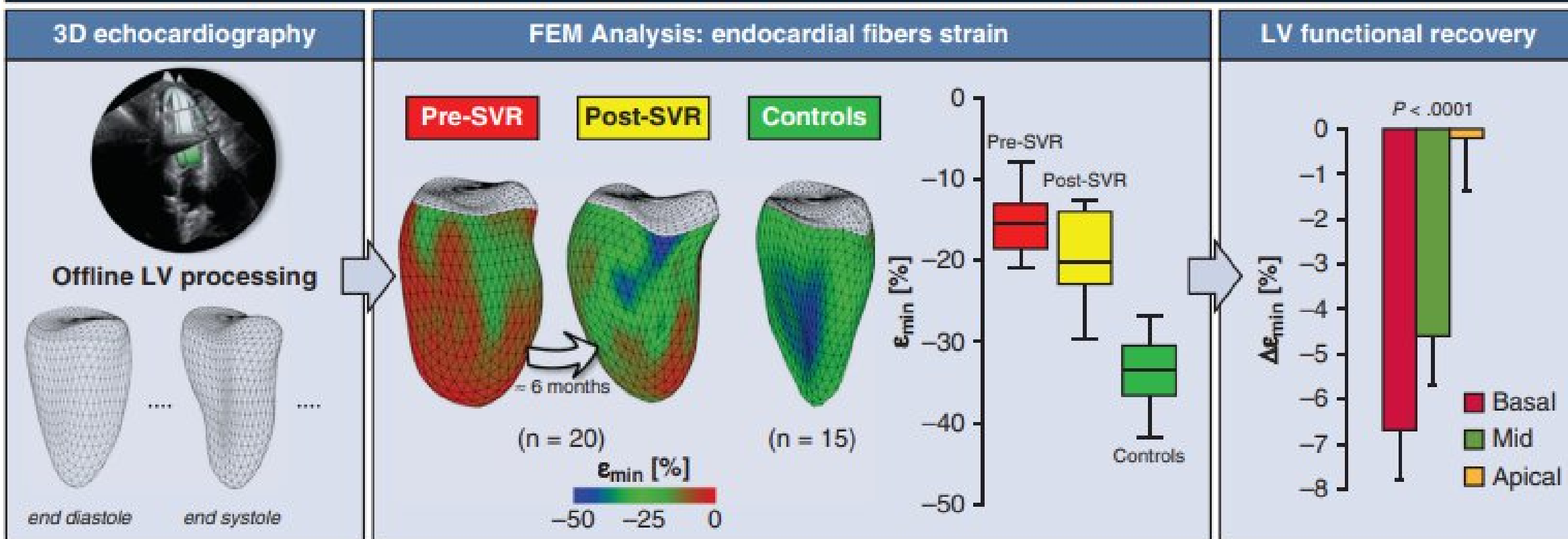
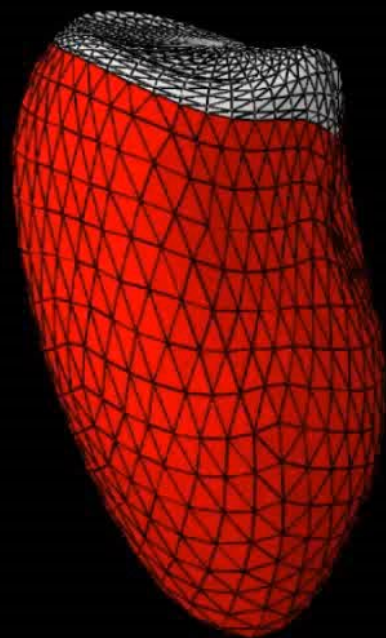


TABLE 2. Results of global and segmental ultrasound-based analysis within each group (controls, pre-SVR, and post-SVR)

		Controls (n = 15)	Pre-SVR (n = 20)	Post-SVR (n = 20)	<i>P</i> value		
					Pre-SVR vs controls	Pre-SVR vs post-SVR	Post-SVR vs controls
EDVi [mL/m ²]		63.1 (58.7, 70.3)	121.4 (99.2, 152.9)	79.3 (64.6, 104.5)	<.0001	<.0001	.0085
ESVi [mL/m ²]		25.0 (20.9, 27.0)	90.8 (67.6, 126.7)	51.6 (34.9, 64.6)	<.0001	.0002	<.0001
EF [%]		60.0 (59.1, 65.8)	27.1 (21.4, 33.3)	42.3 (28.5, 44.1)	<.0001	.0009	<.0001
GLS [%]		−19.6 (−20.8, −17.4)	−6.7 (−9.5, −5.3)	−11.3 (−12.3, −9.6)	<.0001	<.0001	<.0001
ϵ_{min} [%]		−33.6 (−36.6, −30.5)	−15.4 (−18.6, −13.1)	−20.3 (−23.0, −14.0)	<.0001	.0032	<.0001
	Basal	−30.6 (−31.5, −29.0)	−16.6 (−21.4, −13.3)	−22.3 (−26.4, −17.4)	<.0001	.0027	<.0001
	Mid	−35.3 (−41.7, −31.6)	−15.8 (−18.8, −13.6)	−21.5 (−23.2, −13.5)	<.0001	.0064	<.0001
	Apical	−31.4 (−37.5, −28.9)	−12.9 (−14.9, −8.9)	−14.9 (−17.0, −9.9)	<.0001	.0696	<.0001
MD [% cycle]		5.8 (4.7, 6.3)	11.7 (8.9, 14.0)	8.2 (7.6, 9.2)	<.0001	.0007	<.0001
	Basal	6.2 (5.0, 7.5)	9.8 (7.7, 12.9)	7.8 (6.3, 9.0)	<.0001	.0049	.0463
	Mid	5.6 (4.9, 6.5)	10.2 (8.3, 13.4)	8.2 (7.2, 9.4)	<.0001	.0172	<.0001
	Apical	3.9 (3.0, 4.9)	12.1 (9.6, 15.5)	7.8 (6.7, 9.8)	<.0001	.0004	<.0001
MD [ms]		48 (42, 63)	106 (69, 137)	79 (70, 86)	<.0001	.0017	<.0001
	Basal	51 (42, 68)	94 (58, 117)	75 (48, 91)	.0014	.0094	.0230
	Mid	46 (41, 59)	88 (66, 125)	77 (69, 88)	<.0001	.0266	<.0001
	Apical	32 (26, 40)	101 (72, 162)	71 (60, 87)	<.0001	.0004	<.0001

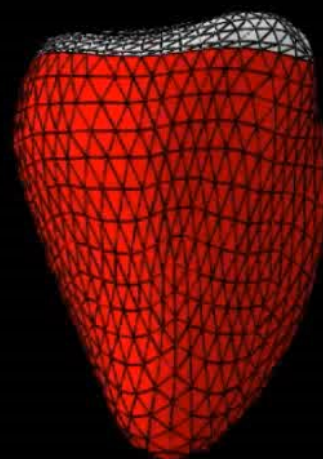
Pre-SVR

Time: 0.000000



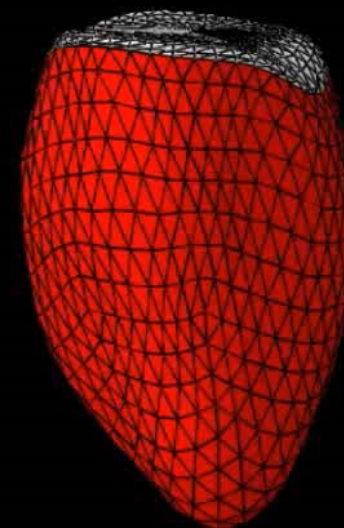
Post-SVR

Time: 0.000000

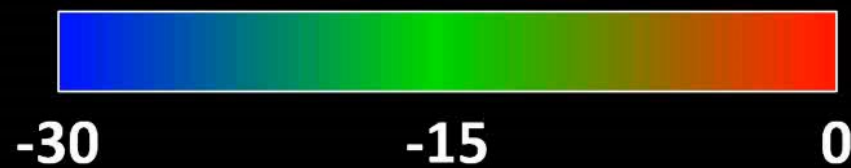


Control

Time: 0.000000



ϵ_{\min} [%]



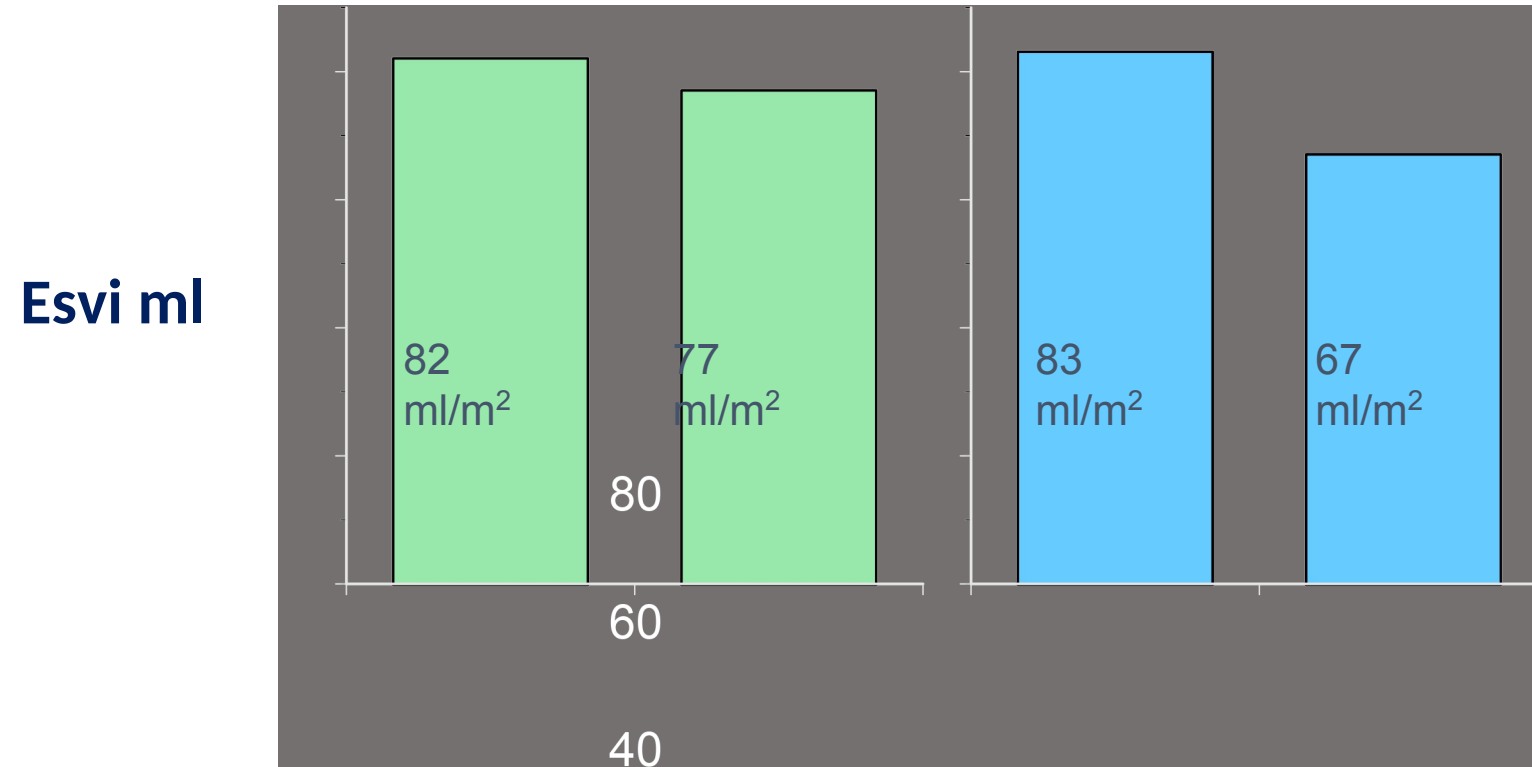
Coronary Bypass Surgery with or without Surgical Ventricular Reconstruction

Robert H. Jones, M.D., Eric J. Velazquez, M.D., Robert E. Michler, M.D., George Sopko, M.D., Jae K. Oh, M.D.,
Christopher M. O'Connor, M.D., James A. Hill, M.D., Lorenzo Menicanti, M.D., Zygmunt Sadowski, M.D.,
Patrice Desvigne-Nickens, M.D., Jean-Lucien Rouleau, M.D., and Kerry L. Lee, Ph.D.,
for the STICH Hypothesis 2 Investigators*

CONCLUSIONS

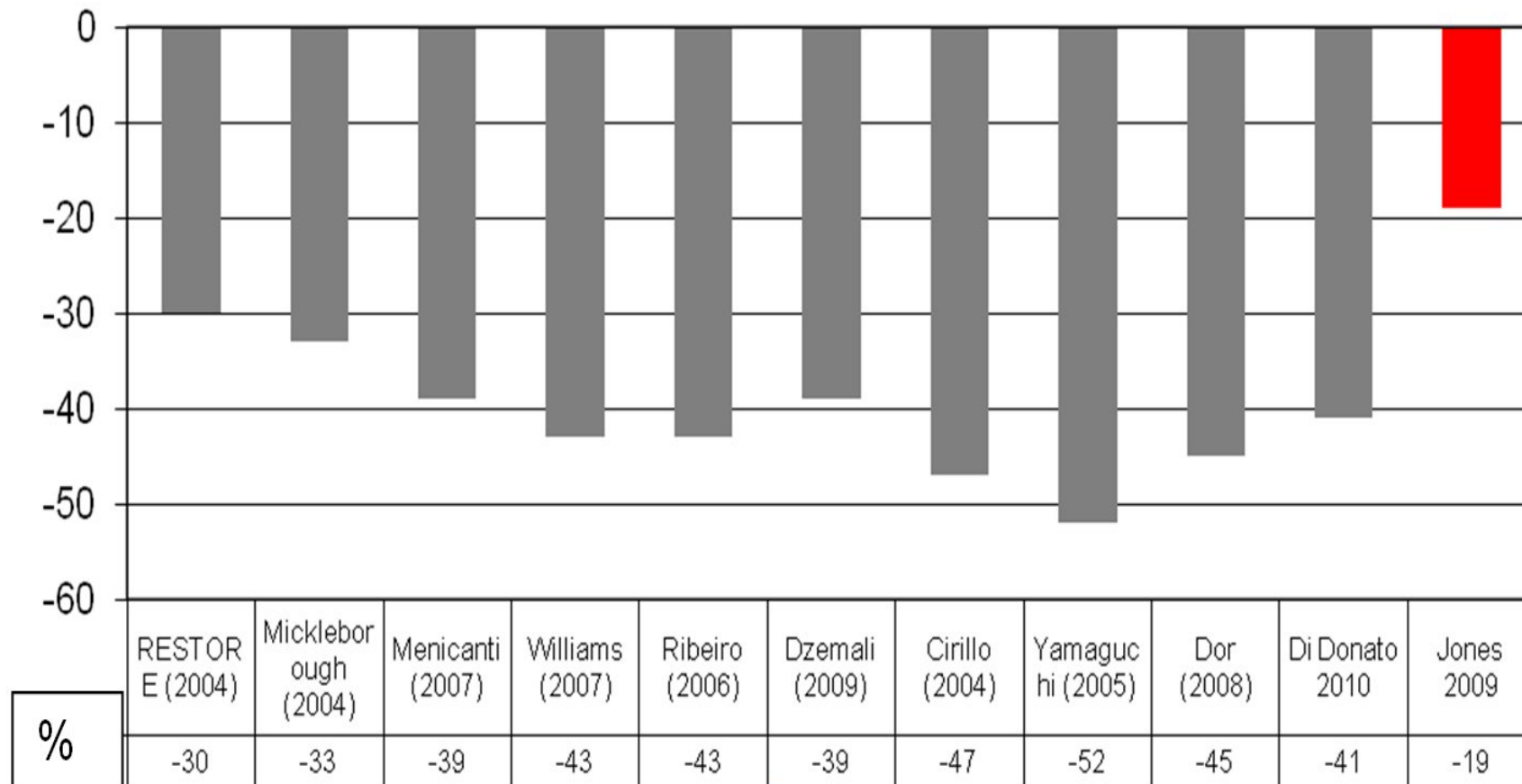
Adding surgical ventricular reconstruction to CABG reduced the left ventricular volume, as compared with CABG alone. However, this anatomical change was not associated with a greater improvement in symptoms or exercise tolerance or with a reduction in the rate of death or hospitalization for cardiac causes. (ClinicalTrials.gov number, NCT00023595.)

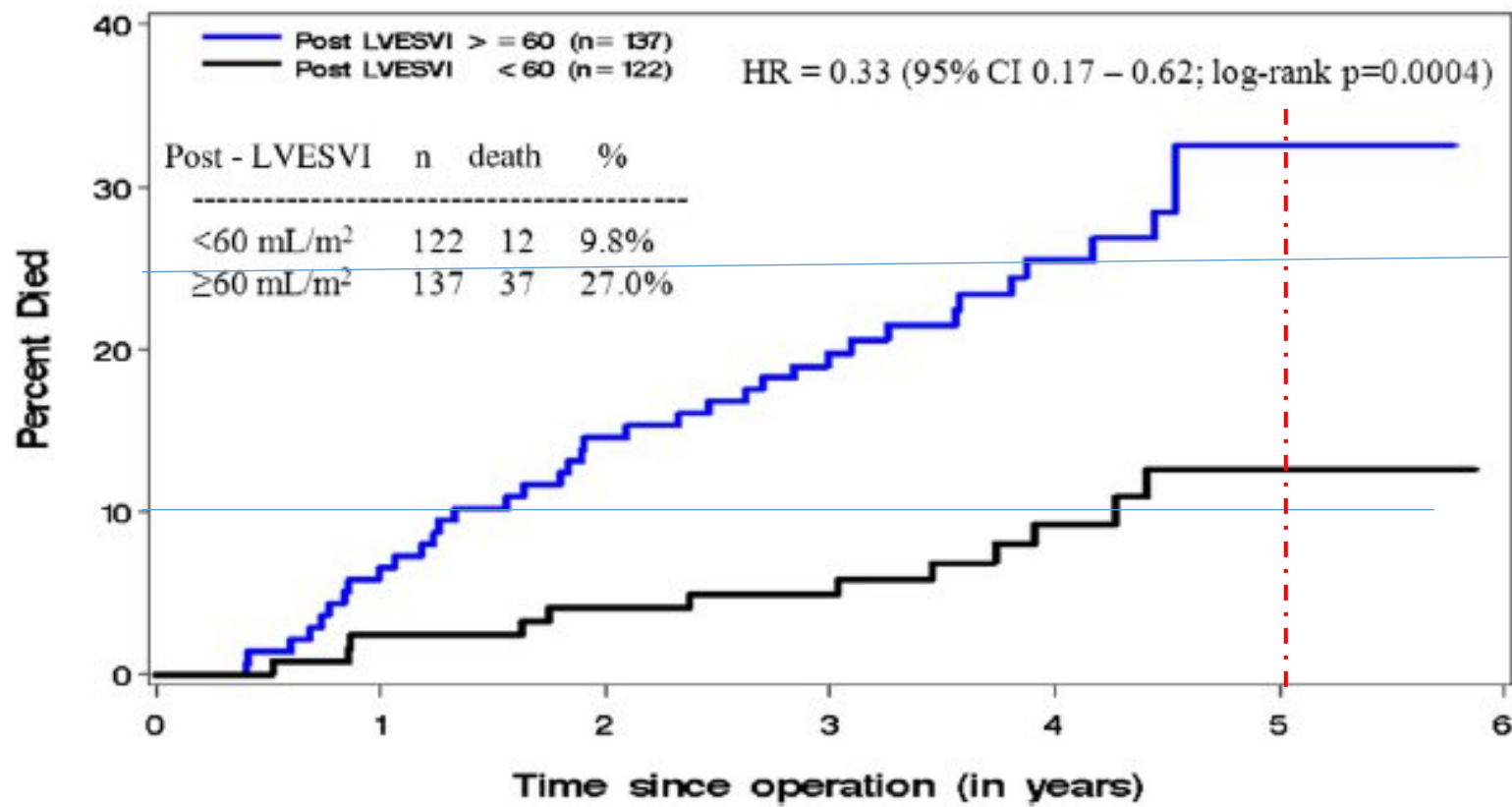
Baseline and Four Month End-Systolic Volume Index (ESVI) in 373 Hypothesis 2 Patients With Quantitative Echocardiogram at Both Intervals



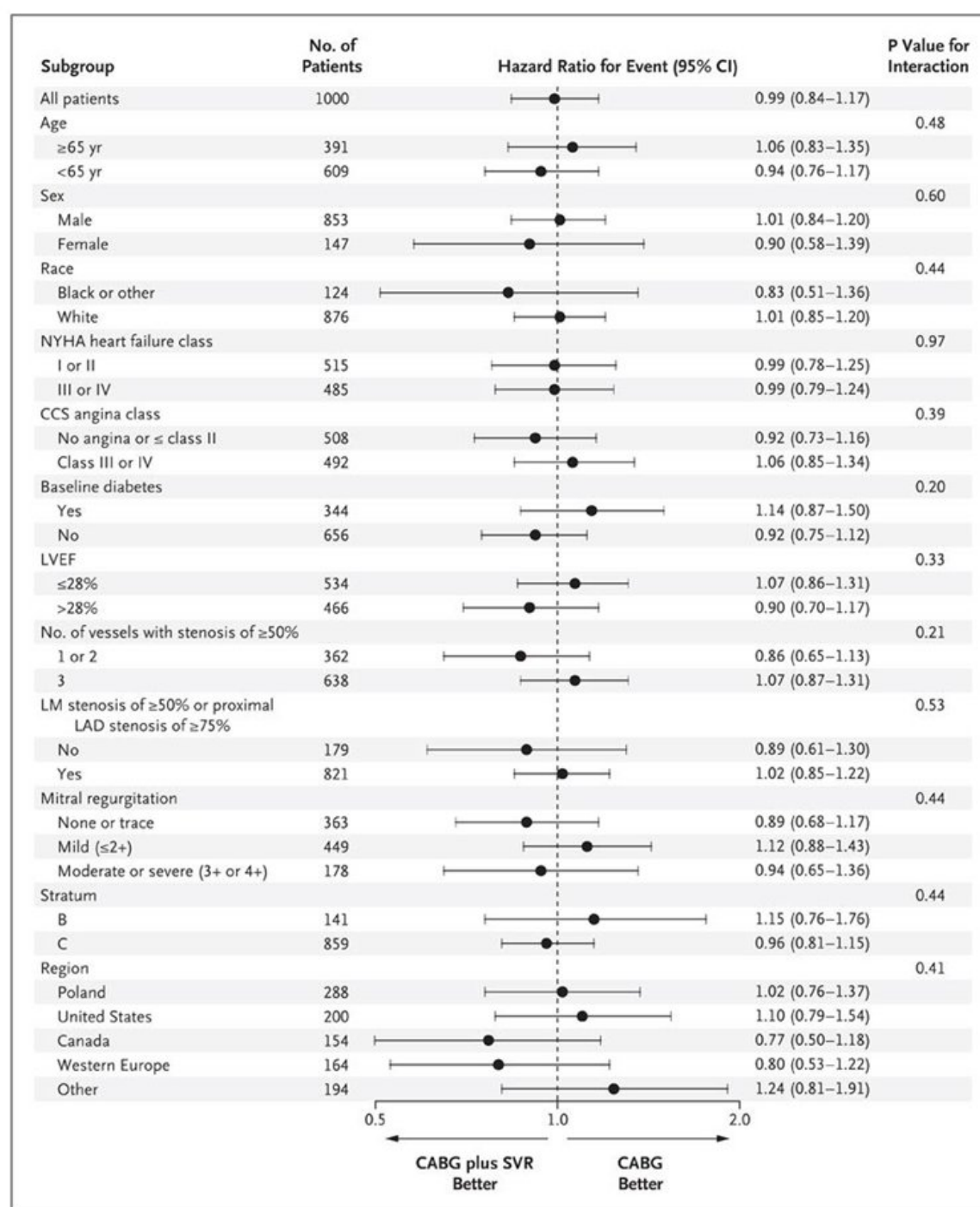
$P < 0.001$

Percentage (%) of LVESV Reduction following SVR





(J Thorac Cardiovasc Surg 2013;146:1139-45)



Jones R et al. N Engl J Med
2009;10.1056/NEJMoa0900559

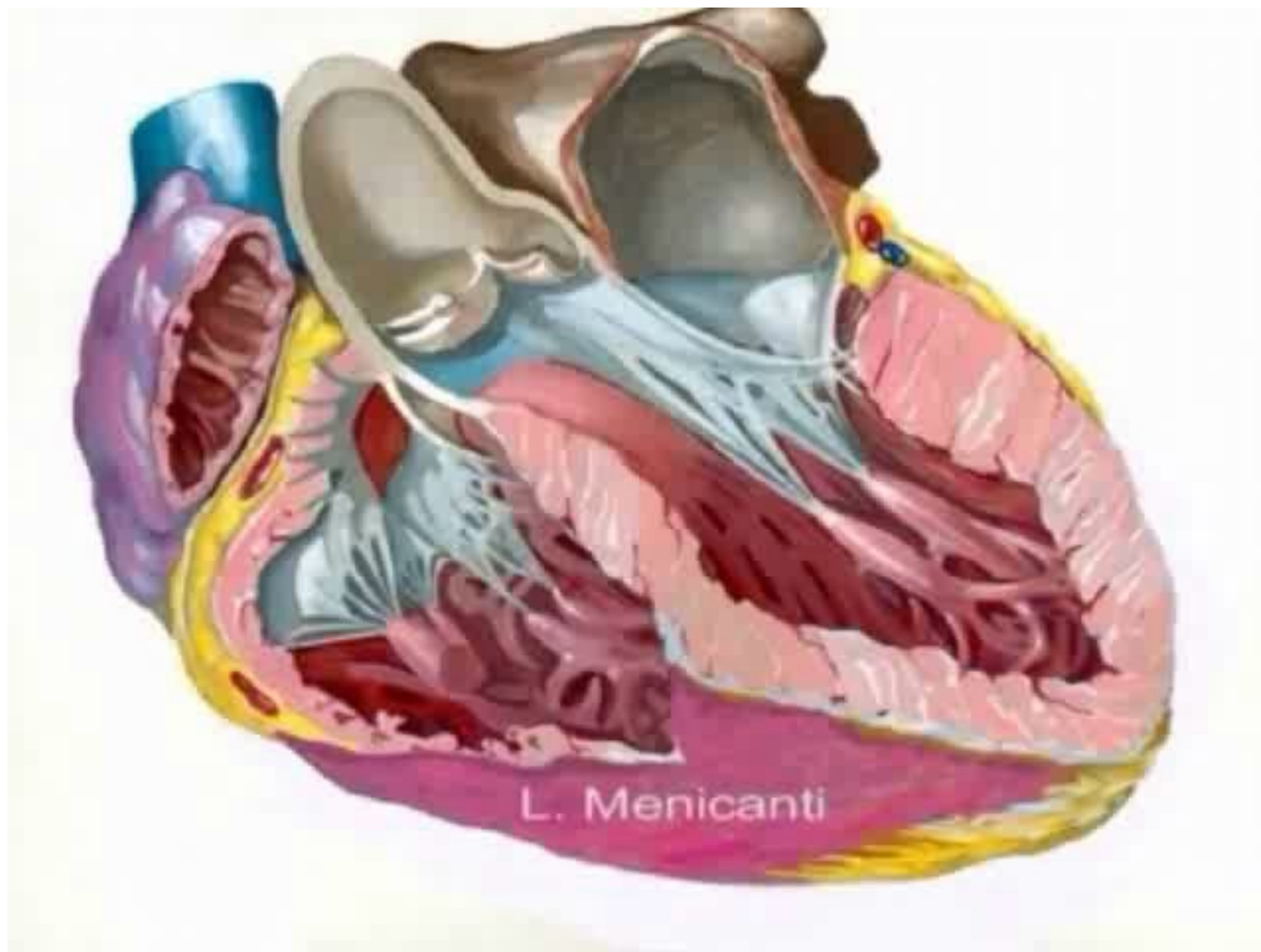
STICH (Surgical Treatment for Ischemic Heart Failure) Trial Enrollment

Robert H. Jones, MD,* Harvey White, MB, ChB, DSc,|| Eric J. Velazquez, MD,† Linda K. Shaw, MHS,§
Ricardo Pietrobon, MD, PhD,‡¶|| Julio A. Panza, MD,# Robert O. Bonow, MD,** George Sopko, MD,††
Christopher M. O'Connor, MD,† Jean-Lucien Rouleau, MD‡‡

*Durham, North Carolina; Auckland, New Zealand; Singapore; Washington, DC; Chicago, Illinois;
Bethesda, Maryland; and Montreal, Quebec, Canada*



- The clinical judgment of physicians and surgeons responsible for care of STICH-eligible patients determined the enrolment stratum offered for patient consent under the oversight of the ethics committee at each site. The primary **ethical concern** guiding equipoise for randomization was to offer patients treatment combination **judged** to have **similar long term mortality**



Long-term results of surgical ventricular reconstruction and comparison with the Surgical Treatment for Ischemic Heart Failure trial

Mario Gaudino, MD, PhD,^a Serenella Castelveccchio, MD,^b Mohamed Rahouma, MD,^a N. Bryce Robinson, MD,^a Katia Audisio, MD,^a Giovanni J. Soletti, MD,^a Gianmarco Cancelli, MD,^a Derrick Y. Tam, MD,^c Andrea Garatti, MD,^b Umberto Benedetto, MD, PhD,^d Torsten Doenst, MD, PhD,^e Leonard N. Girardi, MD,^a Robert E. Michler, MD,^f Stephen E. Fries, MD,^c Eric J. Velazquez, MD,^g and Lorenzo Menicanti, MD^b

Comparison Between the San Donato and STICH Cohorts

The San Donato cohort was compared with the SVR group of the hypothesis 2 of STICH and with the medical therapy group and the CABG group of STICHES in 3 separate pairwise comparisons. To reduce confounders, propensity scores (PS) for each of the compared techniques was developed using a generalized boosted regression model.

Exploratory Analysis on the Association Between Postoperative LVESVI and Mortality

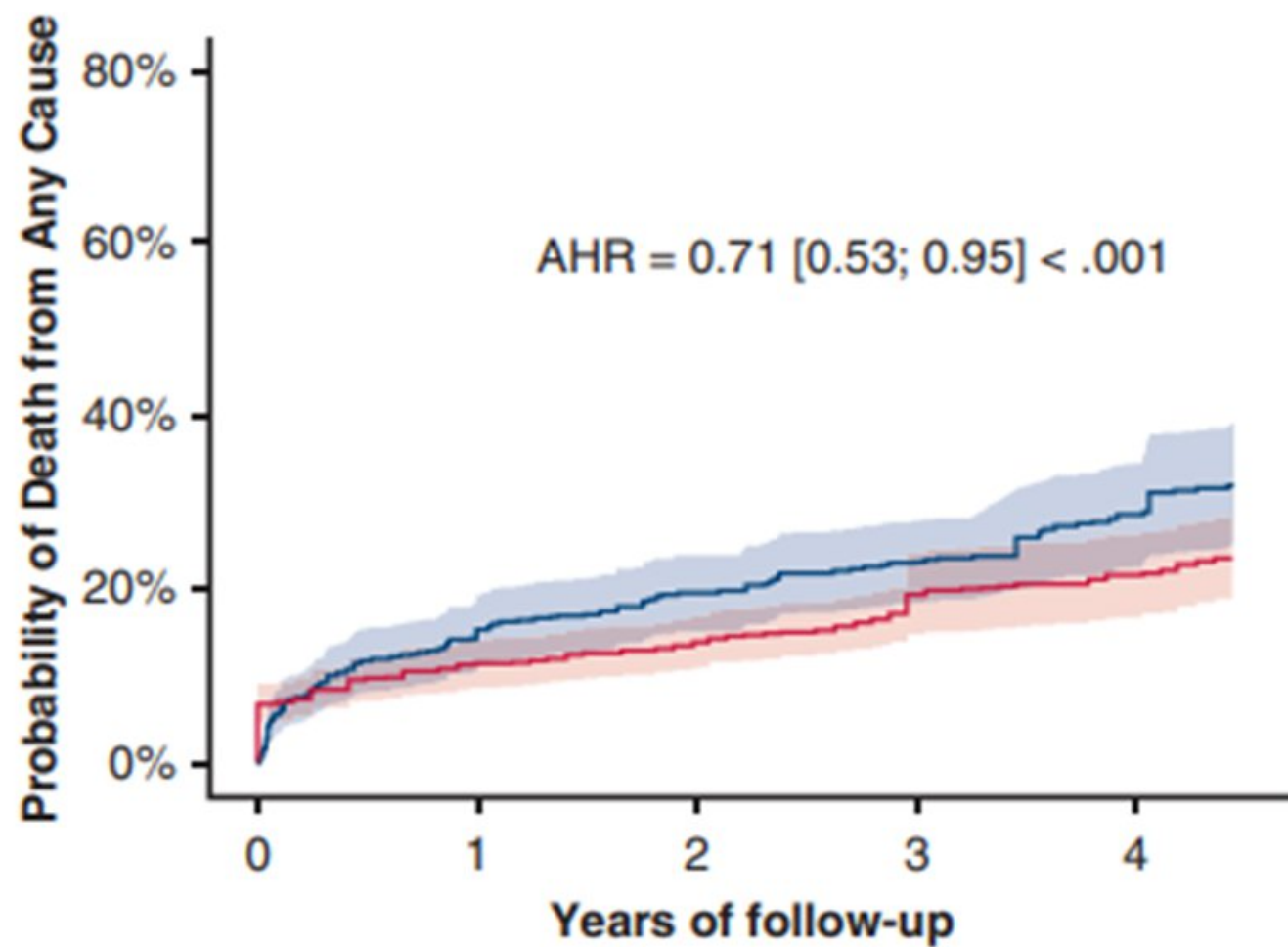
Based on data from both the San Donato and STICH groups on the prognostic role of postoperative LVESVI, we investigated the association between postoperative LVESVI and mortality in both groups of patients who underwent SVR. For this purpose, we included all patients from the San Donato cohort with available paired echocardiographic data at baseline and at 6-month follow-up (n = 506/725, 69.8% of the San Donato population) and all patients from the STICH-SVR cohort with available paired imaging studies at baseline and at 4-month follow-up (n = 259/501, 51.7% of the STICH-SVR cohort)

TABLE 3. Comparison of baseline characteristics between the San Donato, STICH-SVR, and STICHES cohorts

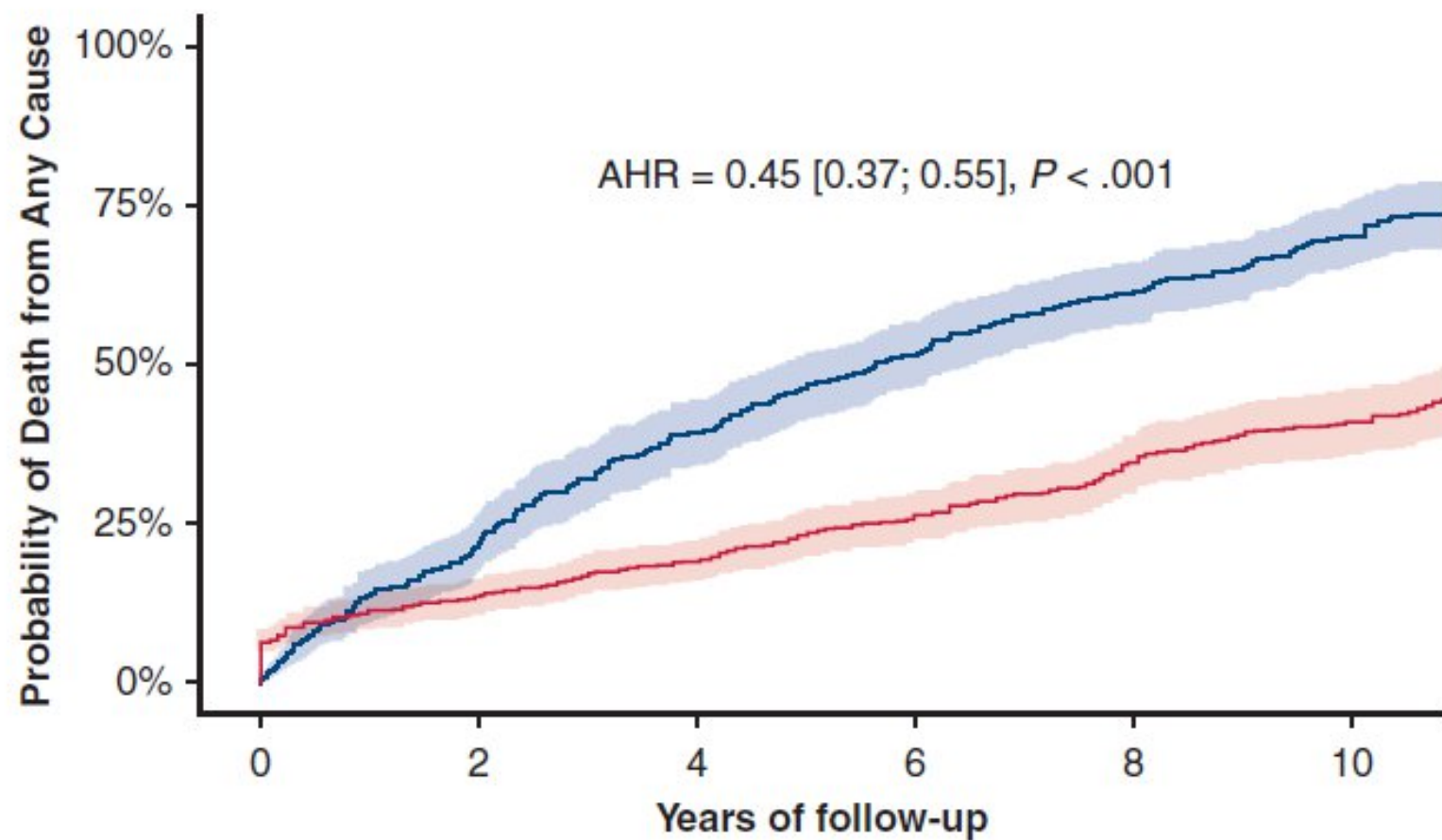
	San Donato	STICH-SVR	SMD	STICHES-medical therapy	SMD	STICHES-CABG	SMD
No. of patients (as-treated)	725	481		591		621	
Age, y, median [Q1, Q3]	66.0 [58.0, 72.0]	61.5 [54.5, 68.4]	0.32	59.2 [53.7, 67.1]	0.43	59.9 [53.4, 67.3]	0.45
Female sex	128 (17.7)	67 (13.9)	0.10	70 (11.8)	0.16	78 (12.6)	0.14
BSA, m ² , median [Q1, Q3]	1.8 [1.7, 2.0]	1.94 [1.8, 2.1]	0.54	1.9 [1.8, 2.1]	0.43	1.9 [1.8, 2.1]	0.38
Hypertension	425 (58.6)	285 (59.3)	0.01	363 (61.4)	0.06	365 (58.8)	<0.01
Hyperlipidemia	418 (57.7)	343 (71.5)	0.29	356 (60.2)	0.05	374 (60.4)	0.06
Diabetes	192 (26.5)	164 (34.1)	0.17	241 (40.8)	0.31	237 (38.2)	0.25
Current smoker	138 (19.0)	93 (19.3)	0.01	118 (20.0)	0.02	134 (21.6)	0.06
Renal failure	56 (7.7)	43 (8.9)	0.04	50 (8.5)	0.03	44 (7.1)	0.02
Previous stroke	58 (8.0)	29 (6.0)	0.08	39 (6.6)	0.25	53 (8.5)	0.32
NYHA			0.20		0.37		0.31
I	31 (4.3)	42 (8.7)		75 (12.7)		64 (10.3)	
II	336 (46.4)	196 (40.7)		303 (51.3)		323 (52.0)	
III	315 (43.5)	215 (44.7)		196 (33.2)		216 (34.8)	
IV	42 (5.8)	28 (5.8)		17 (2.9)		18 (2.9)	

TABLE 4. LVESVI and LVEF at baseline and follow-up in the different groups

	San Donato (n = 506)	STICH-SVR (n = 259)	STICH-CABG (n = 296)
Baseline LVESVI, mL/m ² , mean ± standard deviation	82.0 ± 34.9	83.8 ± 41.6	76.9 ± 31.1
Follow-up* LVESVI, mL/m ² , mean ± standard deviation	49.4 ± 25.2	74.8 ± 38.4	72.1 ± 31.7
Baseline LVEF, %, median [Q1, Q3]	32.0 [26.0, 37.0]	27.0 [21.1, 33.0]	27.0 [22.0, 32.8]
Follow-up LVEF,* %, median [Q1, Q3]	41.0 [35.0, 46.0]	32.9 [25.4, 40.6]	27.5 [21.2, 33.6]

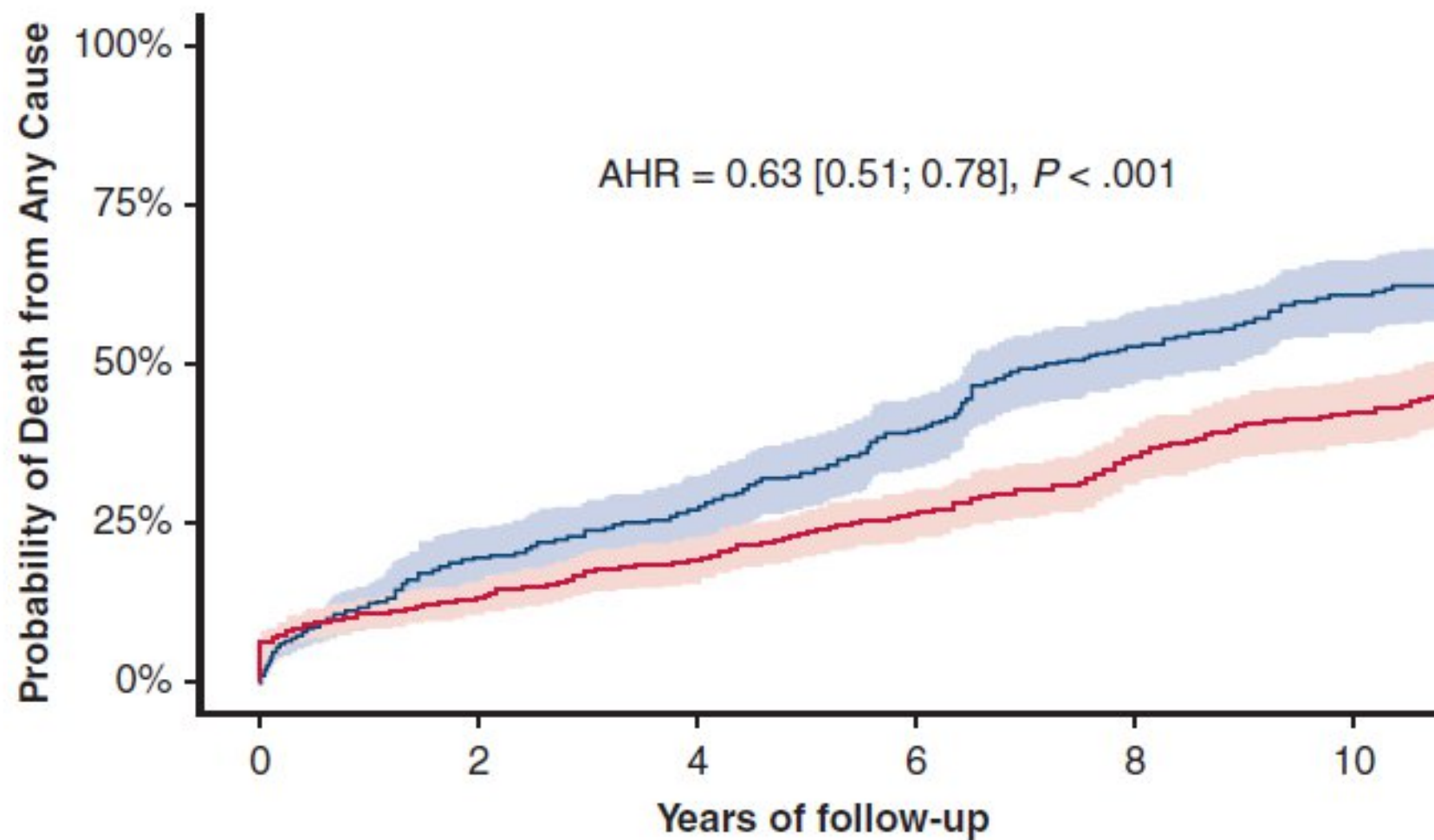


STICH-SVR	481	410	387	335	185
San Donato	725	625	557	518	473



A

STICHES Medical therapy	591	464	380	300	235	77
San Donato	725	557	473	363	271	195



STICHES-CABG	621	511	456	374	299	110
San Donato	725	557	473	363	271	195

B

In conclusion, in an experienced center the long-term results of SVR in patients with depressed ventricular function and postinfarction LV remodeling were favorable and significantly better than those reported in the STICH trial. Our data suggest that a new trial testing the SVR hypothesis with clearly defined and standardized criteria for patient enrollment and intervention delivery may be warranted

PERSCHIEDs ABGRÜNDE



KUNSTFEHLER

Choosing to add SVR to CABG should be based on a careful evaluation of patients, including symptoms (HF symptoms should be predominant over angina), measurements of LV volumes, assessment of the transmural extent of myocardial scar tissue, and should be performed only in centres with a high level of surgical expertise



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ESC/EACTS GUIDELINES



Guidelines on myocardial revascularization

The Task Force on Myocardial Revascularization of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS)

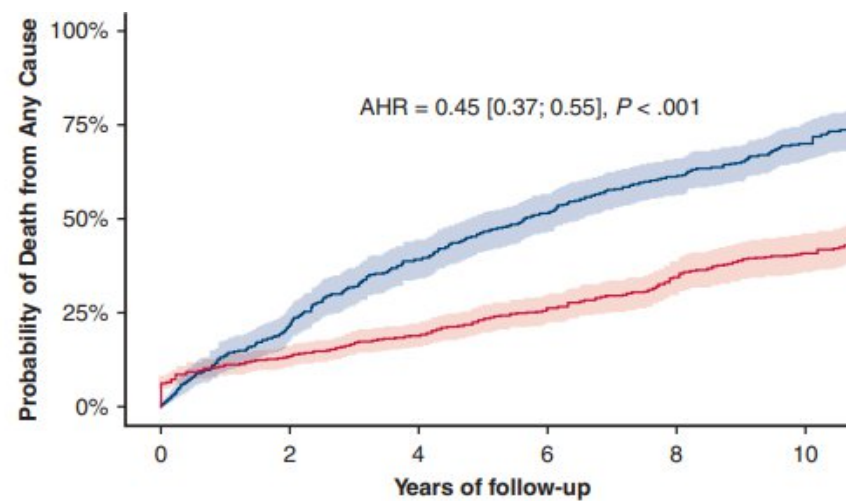
Developed with the special contribution of the European Association for Percutaneous Cardiovascular Interventions (EAPCI)¹

Authors/Task Force Members: William Wijns (Chairperson) (Belgium)^{*}, Philippe Kolh (Chairperson) (Belgium)^{*}, Nicolas Danchin (France), Carlo Di Mario (UK), Volkmar Falk (Switzerland), Thierry Folliguet (France), Scot Garg (The Netherlands), Kurt Huber (Austria), Stefan James (Sweden), Juhani Knuuti (Finland), Jose Lopez-Sendon (Spain), Jean Marco (France), Lorenzo Menicanti (Italy), Miodrag Ostojic (Serbia), Massimo F. Piepoli (Italy), Charles Pirlet (Belgium), Jose L. Pomar (Spain), Nicolaus Reiffart (Germany), Flavio L. Ribichini (Italy), Martin J. Schalij (The Netherlands), Paul Sergeant (Belgium), Patrick W. Serruys (The Netherlands), Sigmund Silber (Germany), Miguel Sousa Uva (Portugal), David Taggart (UK)

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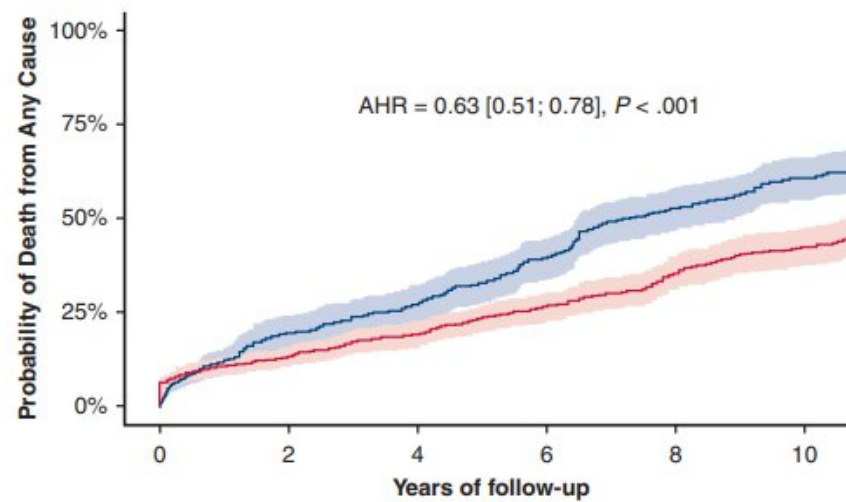
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Document Reviewers: Peter Kearney (ESC CPG Review Coordinator) (Ireland), Ludwig von Segesser (EACTS Review Coordinator) (Switzerland), Stefan Agewall (Norway), Alexander Aladashvili (Georgia), Dimitrios Alexopoulos (Greece), Manuel J. Antunes (Portugal), Enver Altınar (Turkey), Aart Bruijntje de la Riviere



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