BEYOND THE SLIDES 2015

1st UDINE ECMO WORKSHOP

DECEMBER 18-19, 2015

ECMO and post-acute myocardial infarction mechanical complications

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Mechanical complications post acute myocardial infarction

- Left Ventricular Free Wall Rupture (LVFWR)
- Papillary Muscle Rupture
- Ventricular Septal Rupture

European Heart Journal (2010) 31, 1449–1456
doi:10.1093/eurheartj/ehq061

CLINICAL RESEARCH
Coronary heart disease

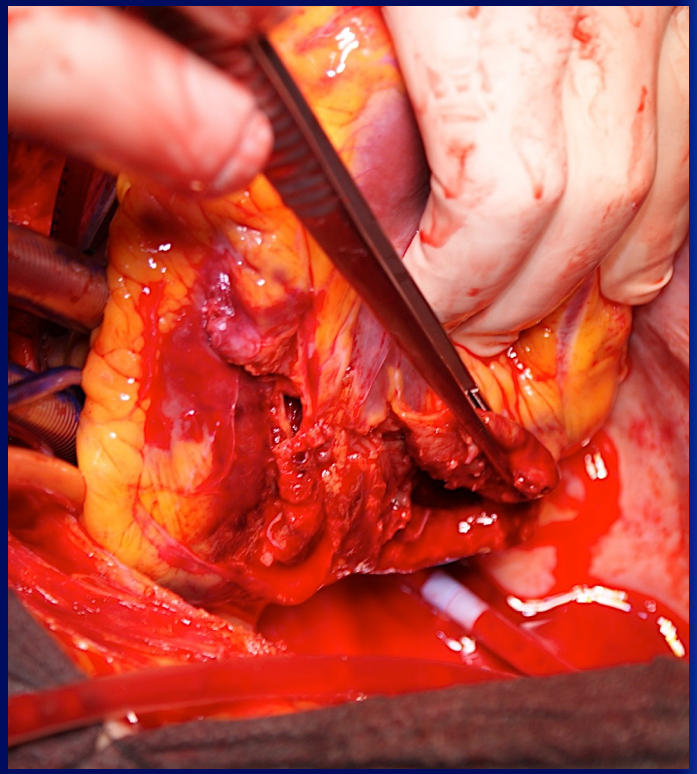
Factors related to heart rupture in acute coronary syndromes in the Global Registry of Acute Coronary Events

José López-Sendón[1]*, Enrique P. Gurfinkel[2], Esteban Lopez de Sa[1], Giancarlo Agnelli[3], Joel M. Gore[4], Phillippe Gabriel Steg[5], Kim A. Eagle[6], Jose Ruiz Cantador[1], Gordon Fitzgerald[4], and Christopher B. Granger[7] for the Global Registry of Acute Coronary Events (GRACE) Investigators

Left Ventricular Free Wall Rupture

60.198 pts affected by ACS:
273 with heart rupture (0.45%)

- 118 (LVFWR)
- 155 (VS Rupture)



Mortality

Hospital mortality rate was 58% in HR patients vs. 4.5% in those without ($P < 0.001$), representing 5.6% of all hospital deaths. Mortality was higher in patients with free wall ventricular rupture (80%) than in patients with ventricular septal rupture (41%). In septal rupture, mortality was higher in patients with cardiogenic shock than in patients without (100 vs. 38%, respectively), whereas in patients with free wall rupture, mortality was similar in patients with and without shock (85 vs. 79%, respectively).

Surgical Treatment for Postinfarction Left Ventricular Free Wall Rupture

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Nobushige Tamura, MD, PhD, and Taira Kobayashi, MD

Department of Cardiovascular Surgery, Kurashiki Central Hospital, Kurashiki City, Okayama, Japan

Background. Left ventricular (LV) free wall rupture is a catastrophic complication after acute myocardial infarction. The optimal therapeutic strategy is controversial and the midterm results are unknown.

Methods. Between June 1993 and May 2006, 32 patients with an average age of 73 years (range, from 55 to 96 years) were surgically treated for LV free wall rupture. Sutureless technique (gluing autologous patch to the tear) was applied in all patients.

Results. The interval between acute myocardial infarction and the rupture was 33 ± 42 hours and the interval between the rupture and the operation was 3.6 ± 2.6 hours. Preoperatively, cardiopulmonary resuscitation was performed in eight cases. Percutaneous cardiopulmonary support was placed in six cases and intraaortic balloon pumping in 20 cases preoperatively. The in-hospital mortality was 15.6%. Two patients died of rerupture within ten days. While there was no rerupture during the follow-up period, five patients developed dyskinetic LV aneurysm and one patient developed LV pseudoaneurysm.

Conclusions. The sutureless technique is a simple and effective option for the surgical treatment for LV free wall rupture. The preoperative moribund condition was highly associated with the operative mortality.

(Ann Thorac Surg 2008;85:1344–7)

6 patients with preoperative ECMO

Ventricular Septal Rupture

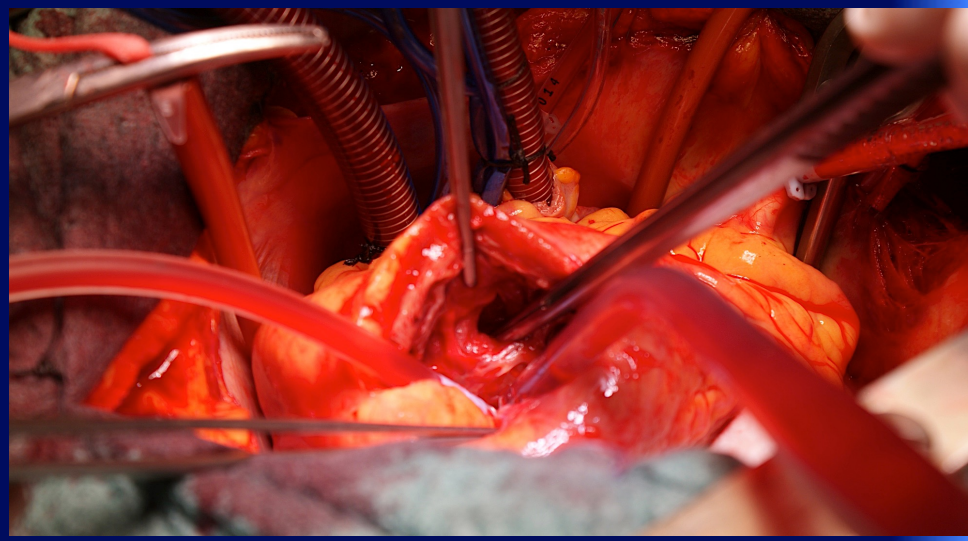
RICHARD E. CLARK AWARD

(Ann Thorac Surg 2012;94:436–44)

Surgical Repair of Ventricular Septal Defect After Myocardial Infarction: Outcomes From The Society of Thoracic Surgeons National Database

George J. Arnaoutakis, MD, Yue Zhao, PhD, Timothy J. George, MD, Christopher M. Sciortino, MD, PhD, Patrick M. McCarthy, MD, and John V. Conte, MD

STS National database:
2876 pts.
In-hospital mortality for VS rupture after surgical repair = 42.9% (n = 1235)



Papillary Muscle Rupture

Clinical Outcome After Mitral Valve Surgery Due to Ischemic Papillary Muscle Rupture

Thomas Schroeter, MD, Sven Lehmann, MD, Martin Misfeld, MD, PhD, Michael Borger, MD, PhD, Sreekumar Subramanian, MD, Friedrich W. Mohr, MD, PhD, and Farhad Bakthiary, MD, PhD

Department of Cardiac Surgery, Heart Center Leipzig, University of Leipzig, Leipzig, Germany

(Ann Thorac Surg 2013;95:820–4)

Table 5. Postoperative Course[a]

Variable	Overall (n = 28)	Survivor (n = 17)	Nonsurvivor (n = 11)	p Value
Rethoracotomy (without ECMO implantation); n (%)	6 (21.4)	3 (17.6)	3 (27.7)	0.576
Low cardiac output; n (%)	16 (57.1)	7 (41.2)	9 (81.8)	0.057
Intraaortic balloon pump; n (%)	20 (71.4)	10 (58.8)	10 (90.9)	0.076
Extracorporeal membrane oxygenation; n (%)	9 (32.1)	2 (11.8)	7 (63.6)	0.005
Episodes of atrial fibrillation; n (%)	11 (39.3)	7 (41.2)	4 (36.5)	0.824
Renal failure with hemodialysis; n (%)	16 (57.1)	6 (35.3)	10 (90.9)	0.005
Lung failure with nitrite oxide ventilation; n (%)	4 (14.3)	3 (17.6)	1 (10.0)	0.561

[a] Values of $p < 0.05$ were considered significant.

ECMO = extracorporeal membrane oxygenation.

Table 4. Comparision of Mortality Between Patients With and Without Additionally Coronary Bypass Operation[a]

	Overall (n = 28)	With CABG (n = 19)	Without CABG (n = 9)	p Value
30-day mortality; n (%)	11 (39.3)	6 (31.6)	5 (55.6)	0.606
Time of death in-hospital, days postoperative; mean ± SD	8.3 ± 5.1	9.6 ± 7.4	7.8 ± 3.1	0.606

[a] Values of $p < 0.05$ were considered significant.

Bouma *et al. Journal of Cardiothoracic Surgery* 2014, **19**:171
http://www.cardiothoracicsurgery.org/content/19/1/171

JCTS JOURNAL OF CARDIOTHORACIC SURGERY

RESEARCH ARTICLE Open Access

Predictors of in-hospital mortality after mitral valve surgery for post-myocardial infarction papillary muscle rupture

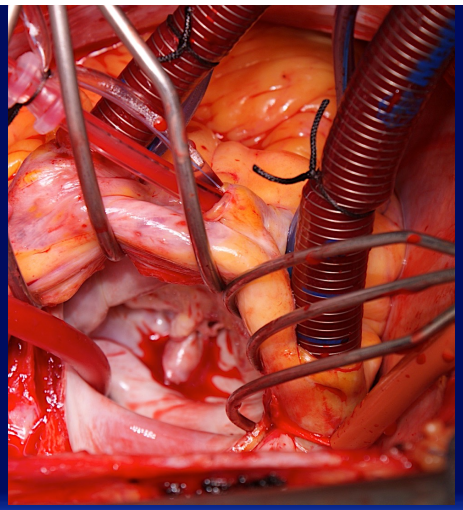
Wobbe Bouma[1,3*], Inez J Wijdh-den Hamer[1], Bart M Koene[1], Michiel Kuijpers[1], Ehsan Natour[1], Michiel E Erasmus[1], Iwan CC van der Horst[2], Joseph H Gorman III[3], Robert C Gorman[3] and Massimo A Mariani[1]

Results: Intraoperative mortality was 4.2% and in-hospital mortality was 25.0%.

Table 4 Predictors of in-hospital mortality by univariate analysis and multivariate logistic regression analysis

	Univariate analysis			Multivariate analysis		
Variable	OR	95% CI	*P* value	OR	95% CI	*P* value
Logistic EuroSCORE, %	1.08	(1.03-1.12)	<0.001	1.07	(1.03-1.12)	0.002[a]
EuroSCORE II, %	1.12	(1.04-1.21)	0.001	1.12	(1.04-1.21)	0.003[b]
Preoperative LVEF <30%	11.67	(1.08-125.90)	0.043	–	–	–
Mechanical ventilation	4.71	(1.09-20.47)	0.030	–	–	–
Preoperative inotropic drug support	7.00	(1.34-36.69)	0.012	–	–	–
Acute renal failure	4.43	(1.00-19.58)	0.094	–	–	–
Cardiogenic shock	8.80	(1.03-75.55)	0.035	–	–	–
Salvage or emergent mitral valve surgery	8.80	(1.03-75.55)	0.035	–	–	–
Complete AL or PM PMR	4.55	(1.13-18.32)	0.041	6.51	(1.18-35.78)	0.031[c]
Mitral valve replacement	9.91	(0.54-182.88)	0.048	–	–	–
MVR without preservation of thesubvalvular apparatus	5.80	(1.41-23.84)	0.024	–	–	–
Cardiopulmonary bypass time, min	1.01	(1.00-1.02)	0.036	–	–	–
Intraoperative IABP requirement	19.46	(2.25-168.27)	0.001	18.70	(1.96-178.79)	0.011[c]

[a]Model 1; [b]Model 2; [c]Model 3.
AL: anterolateral; CI: confidence interval; IABP: intra-aortic balloon pump; LVEF: left ventricular ejection fraction; MVR: mitral valve replacement; OR: odds ratio; PM: posteromedian; PMR: papillary muscle rupture.



Bouma et al. Journal of Cardiothoracic Surgery 2014, 19:171
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JOURNAL OF CARDIOTHORACIC SURGERY

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Predictors of in-hospital mortality after mitral valve surgery for post-myocardial infarction papillary muscle rupture

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Abstract

Background: Papillary muscle rupture (PMR) is a rare, but often life-threatening mechanical complication of myocardial infarction (MI). Immediate surgical intervention is considered the optimal and most rational treatment for acute PMR, but carries high risks. At this point it is not entirely clear which patients are at highest risk. In this study we sought to determine in-hospital mortality and its predictors for patients who underwent mitral valve surgery for post-MI PMR.

Methods: Between January 1990 and December 2012, 48 consecutive patients (mean age 64.9 ± 10.8 years) underwent mitral valve repair (n = 10) or replacement (n = 38) for post-MI PMR. Clinical data, echocardiographic data, catheterization data, and surgical reports were reviewed. Univariate and multivariate logistic regression analyses were performed to identify predictors of in-hospital mortality.

Results: Intraoperative mortality was 4.2% and in-hospital mortality was 25.0%. Univariate and multivariate logistic regression analyses revealed the logistic EuroSCORE and EuroSCORE II as independent predictors of in-hospital mortality. Receiver operating characteristics curves showed an optimal cutoff value of 40% for the logistic EuroSCORE (area under the curve 0.85, 95% CI 0.71-1.00, $P < 0.001$) and of 2.5% for the EuroSCORE II (area under the curve 0.83, 95% CI 0.68-0.99, $P = 0.001$). After removal of the EuroSCOREs from the model, complete PMR and intraoperative intra-aortic balloon pump (IABP) requirement were independent predictors of in-hospital mortality.

Conclusions: The logistic EuroSCORE (optimal cutoff ≥40%), EuroSCORE II (optimal cutoff ≥2.5%), complete PMR, and intraoperative IABP requirement are strong independent predictors of in-hospital mortality in patients undergoing mitral valve surgery for post-MI PMR. These predictors may aid in surgical decision making and they may help improve the quality of informed consent.

Keywords: Myocardial infarction, Papillary muscle (rupture), Mitral regurgitation, Mitral valve repair, Mitral valve replacement, Outcome

Predictors of in-hospital mortality after mitral valve surgery for post-myocardial infarction papillary muscle rupture

Table 4 Predictors of in-hospital mortality by univariate analysis and multivariate logistic regression analysis

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EuroSCORE II, %	1.12	(1.04-1.21)	0.001	1.12	(1.04-1.21)	0.003[b]
Preoperative LVEF <30%	11.67	(1.08-125.90)	0.043	–	–	–
Mechanical ventilation	4.71	(1.09-20.47)	0.030	–	–	–
Preoperative inotropic drug support	7.00	(1.34-36.69)	0.012	–	–	–
Acute renal failure	4.43	(1.00-19.58)	0.094	–	–	–
Cardiogenic shock	8.80	(1.03-75.55)	0.035	–	–	–
Salvage or emergent mitral valve surgery	8.80	(1.03-75.55)	0.035	–	–	–
Complete AL or PM PMR	4.55	(1.13-18.32)	0.041	6.51	(1.18-35.78)	0.031[c]
Mitral valve replacement	9.91	(0.54-182.88)	0.048	–	–	–
MVR without preservation of thesubvalvular apparatus	5.80	(1.41-23.84)	0.024	–	–	–
Cardiopulmonary bypass time, min	1.01	(1.00-1.02)	0.036	–	–	–
Intraoperative IABP requirement	19.46	(2.25-168.27)	0.001	18.70	(1.96-178.79)	0.011[c]

[a]Model 1; [b]Model 2; [c]Model 3.

AL: anterolateral; CI: confidence interval; IABP: intra-aortic balloon pump; LVEF: left ventricular ejection fraction; MVR: mitral valve replacement; OR: odds ratio; PM: posteromedian; PMR: papillary muscle rupture.

TABLE 2
Literature on Mechanical Circulatory Support for Post-Myocardial Infarction Ventricular Septal Rupture

Author	Year	Patient	Device	Infarction Site	Surgical Repair	30-Day Survival	Cause of Death
Meyns et al.	1994	1	Hemopump	NR Failed BTT	No	Pump blockage (necrotic tissue)	
		2	Hemopump	NR	Failed BTT	No	Pump blockage (necrotic tissue)
Waldenberger et al.	1994	1	Hemopump	NR	Failed BTT	No	
Samuels et al.	2003	1	Abiomed BiVAD	Inferior	VAD Placement, OHT	Yes	
Pitsis et al.	2008	1	Centrimag	Anterior	PC, LVAD explant	Yes	
Rohn et al.	2008	1	ECMO	Inferior	PC, MA	Yes	
Gregoric et al.	2008	1	Tandem Heart®	Inferior	Failed PCC, PC, TVR	Yes	
Conradi et al.	2009	1	Abiomed BiVAD	Inferior	VAD placement and explent, PC	Yes	
La Torre et al.	2011	1	Impella Recover® LP 5.0	Inferior	PC	No	RV failure
		2	Impella Recover® LP 5.0	Inferior	PC, CABG	No	Tracheal laceration
		3	Impella Recover® LP 5.0	Inferior	PC	No	
		4	Impella Recover® LP 5.0	Inferior	Transplant	Yes	
		5	Impella Recover® LP 5.0	Inferior	PC, MA, CABG	Yes	Femoral artery bleeding on POD 42
Tsai et al.	2012	1	ECMO	Anterior	Redo-VSD*	Yes	
Loyalka et al.	2012	1	Tandem Heart®	Anterior	PVSDC	No	Pancreatitis
Ashfaq et al.	2013	1	Cardiowest	Inferior	VAD Placement	No	MSOF
Neragi-Miandoab et al.	2013	1	ECMO	Inferior	PC	Yes	
				Total 17			Survival 47%

Early and late outcomes of 517 consecutive adult patients treated with extracorporeal membrane oxygenation for refractory postcardiotomy cardiogenic shock

. (J Thorac Cardiovasc Surg 2010;139:302-311)

Ardawan Julian Rastan, MD, PhD, Andreas Dege, MD, Matthias Mohr, MD, Nicolas Doll, MD, PhD, Volkmar Falk, MD, PhD, Thomas Walther, MD, PhD, and Friedrich Wilhelm Mohr, MD, PhD

TABLE 3. Cardiac procedures

Characteristic	All (n = 517)	Hospital survivors (n = 128)	Nonsurvivors (n = 389)	Hospital survival (%)	In-hospital mortality OR	95% CI	*P* value
All CABG (%)	61.8%	70.4%	58.9%	28.3%	0.60	0.38–0.95	.028
Left internal thoracic artery (%)	69.4%	82.0%	64.5%		0.40	0.22–0.73	.003
Bilateral internal thoracic artery (%)	5.0%	10.1%	3.0%		0.28	0.10–0.77	.014
Complete revascularization (%)	82.2%	84.0%	78.0%		0.68	0.35–1.30	.237
Distal anastomoses (no., mean ± SD)	2.16 ± 1.27	2.30 ± 1.24	2.10 ± 1.27				.202
Isolated CABG (%)	37.4%	52.2%	32.5%	34.7%	0.44	0.29–0.68	<.001
Distal anastomoses (no., mean ± SD)	2.49 ± 0.99	2.56 ± 1.00	2.46 ± 0.98				.482
AV surgery (%)	32.0%	26.1%	33.9%	20.3%	1.45	0.91–2.33	.120
Isolated AV surgery (%)	7.6%	7.8%	7.5%	25.7%	0.95	0.43–2.09	.901
CABG and AV surgery (%)	5.4%	2.6%	6.3%	12.0%	2.52	0.74–8.58	.139
MV surgery (%)	24.8%	15.7%	27.9%	15.7%	2.08	1.20–3.63	.010
Isolated MV surgery (%)	3.9%	1.7%	4.6%	11.1%	2.72	0.62–12.0	.186
CABG and MV surgery (%)	5.8%	5.2%	6.0%	22.2%	1.17	0.46–2.97	.746
Isolated AV and MV surgery (%)	2.8%	0.9%	3.4%	7.7%	4.07	0.52–31.7	.180
CABG, AV, and MV surgery (%)	2.8%	1.7%	3.2%	15.4%	1.84	0.40–8.45	.430
TV repair (%)	4.3%	2.6%	4.9%	15.0%	1.92	0.55–6.67	.306
Ascending aorta surgery (%)	13.2%	11.3%	13.9%	21.3%	1.26	0.65–2.41	.495
Aortic arch repair (%)	3.7%	0.9%	4.6%	5.9%	5.49	0.72–41.9	.100
Surgical ventricular restoration (%)	1.7%	1.7%	1.7%	25.0%	0.99	0.20–4.98	.991
Ischemic VSD closure (%)	1.1%	0.9%	1.1%	20.0%	1.33	0.15–12.0	.802

doi:10.1510/icvts.2004.096883

Azienda Ospedaliera San Gerardo

INTERACTIVE CARDIOVASCULAR AND THORACIC SURGERY

Interactive CardioVascular and Thoracic Surgery 4 (2005) 30-32

www.icvts.org

Case report - Assisted circulation

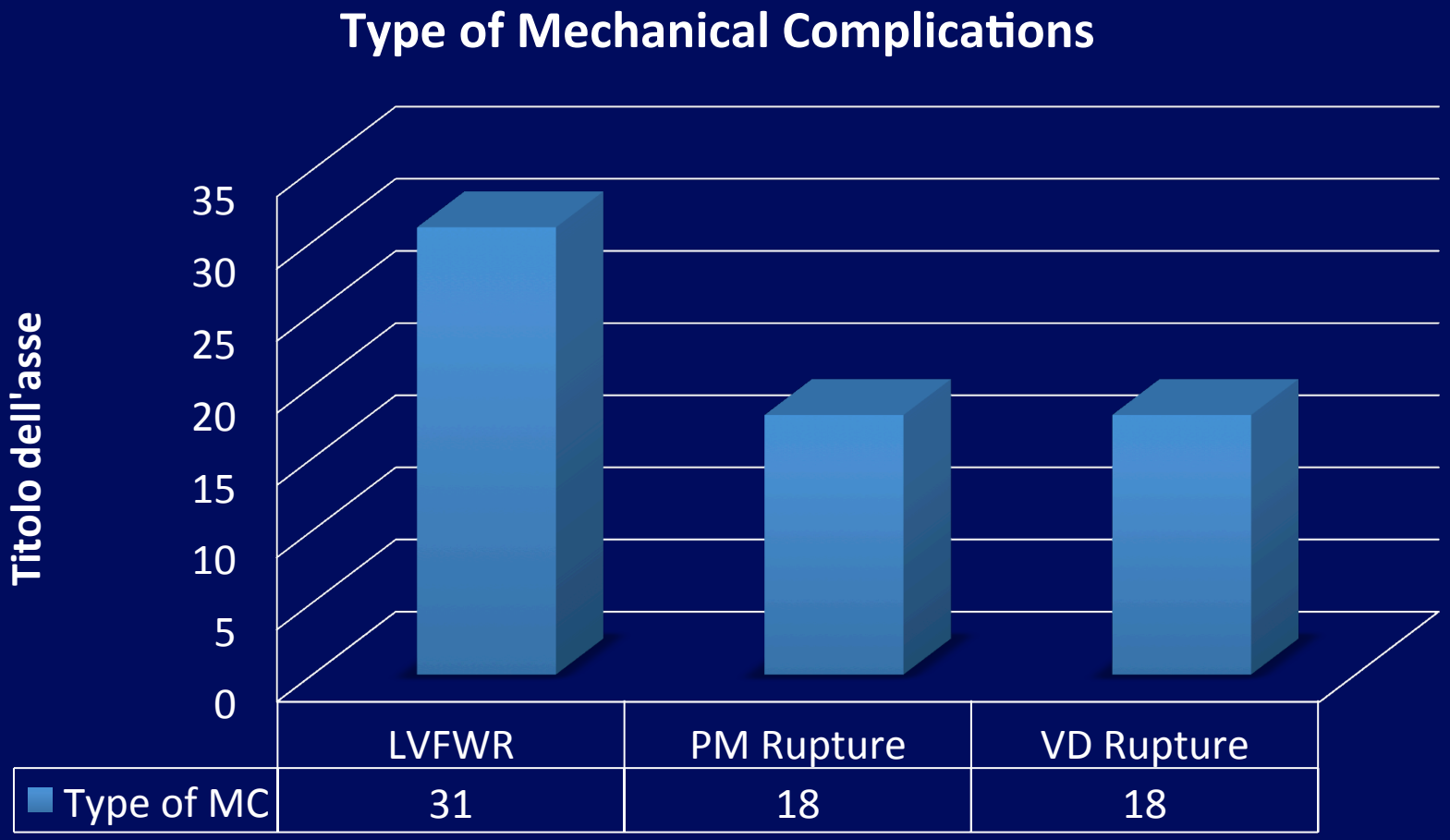
ECMO support for the treatment of cardiogenic shock due to left ventricular free wall rupture☆

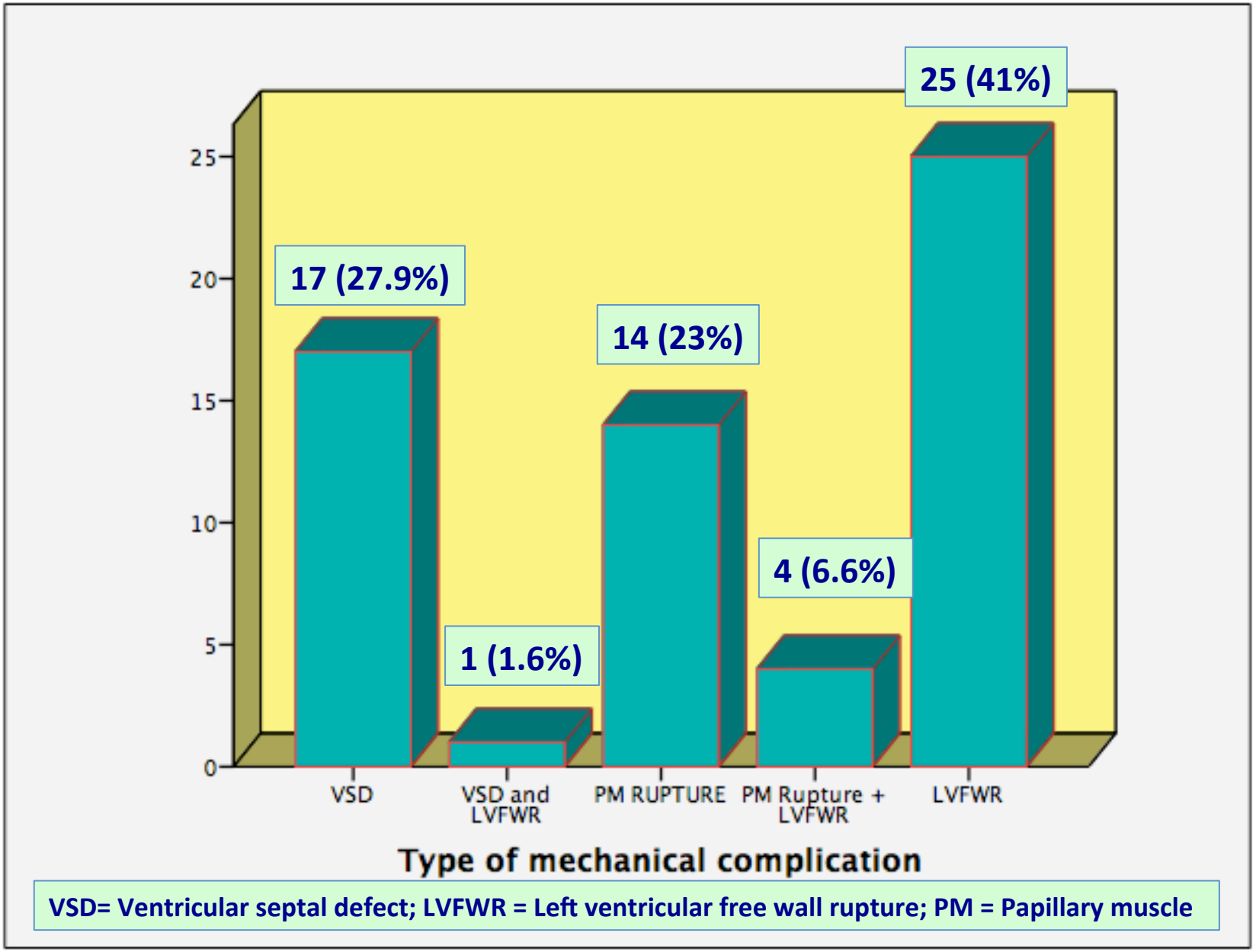
Francesco Formica[a,*], Fabrizio Corti[a], Leonello Avalli[b], Giovanni Paolini[a]

- San Gerardo V-A ECMO program started in 2000
- > 300 V-A ECMO cases until now
- First case of ECMO in mechanical complication of AMI reported in 2004
- 19 patients V-A ECMO for mechanical complication after acute myocardial infarction:

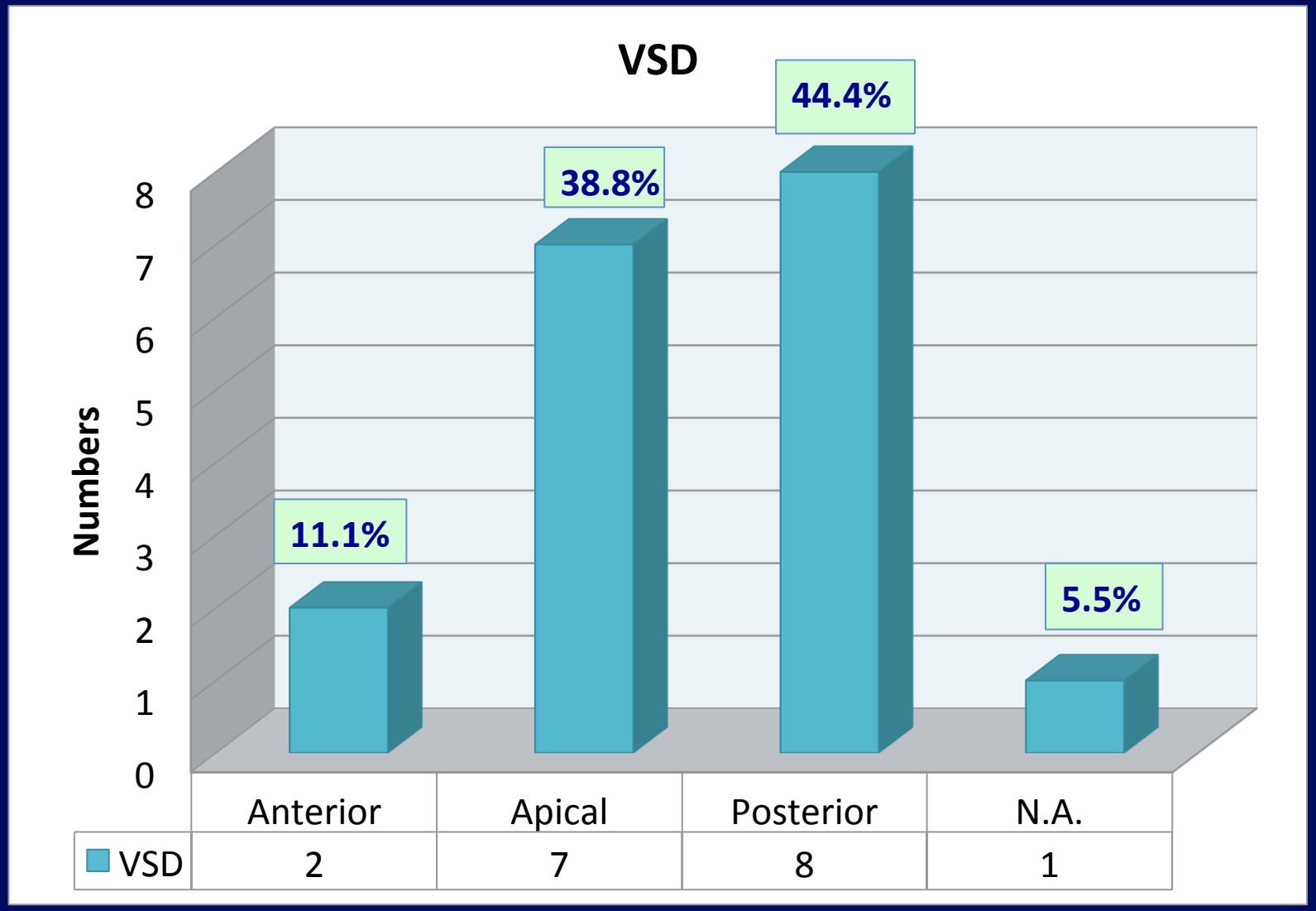
UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

San Gerardo Activity
June 1999- November 2015

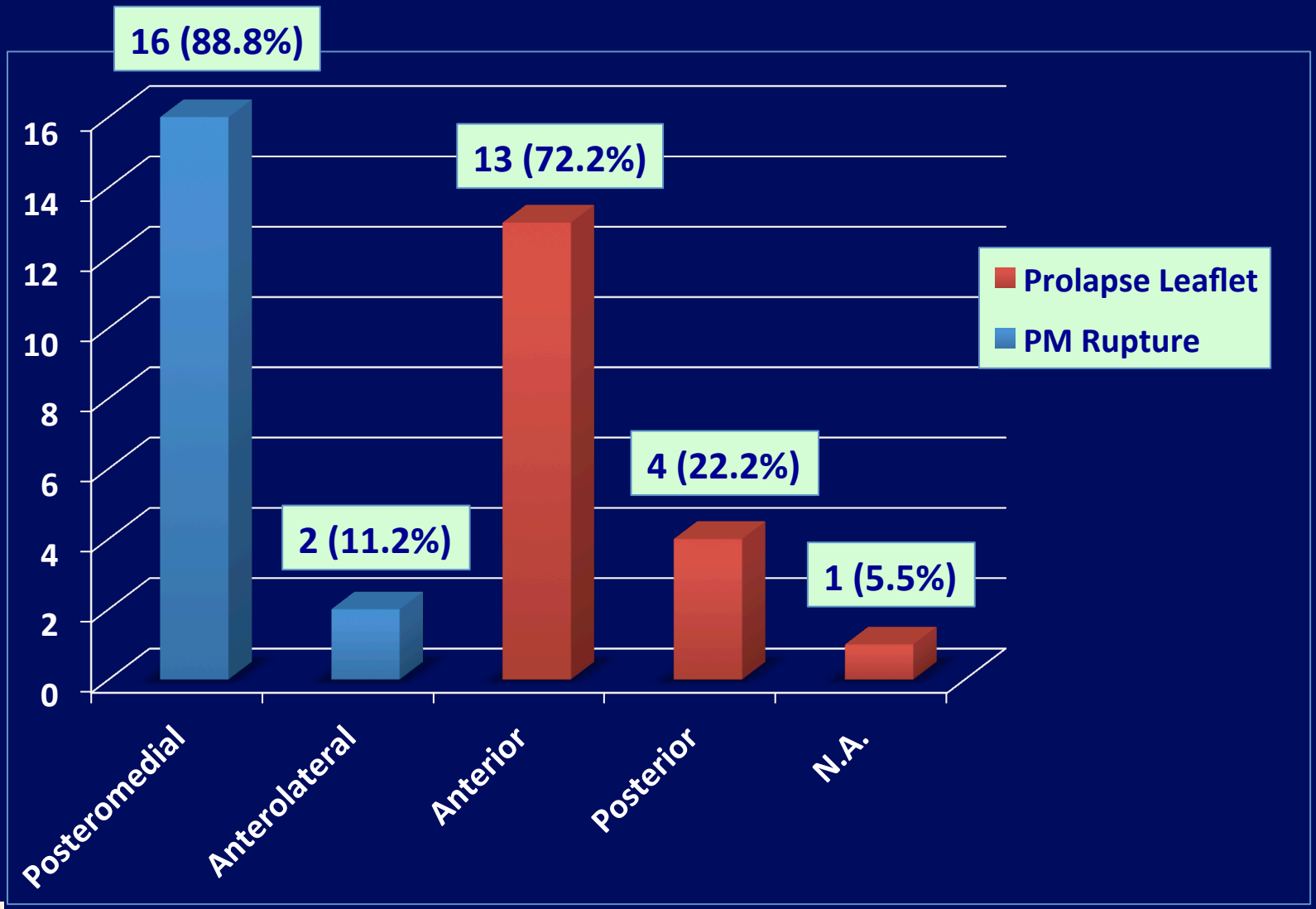




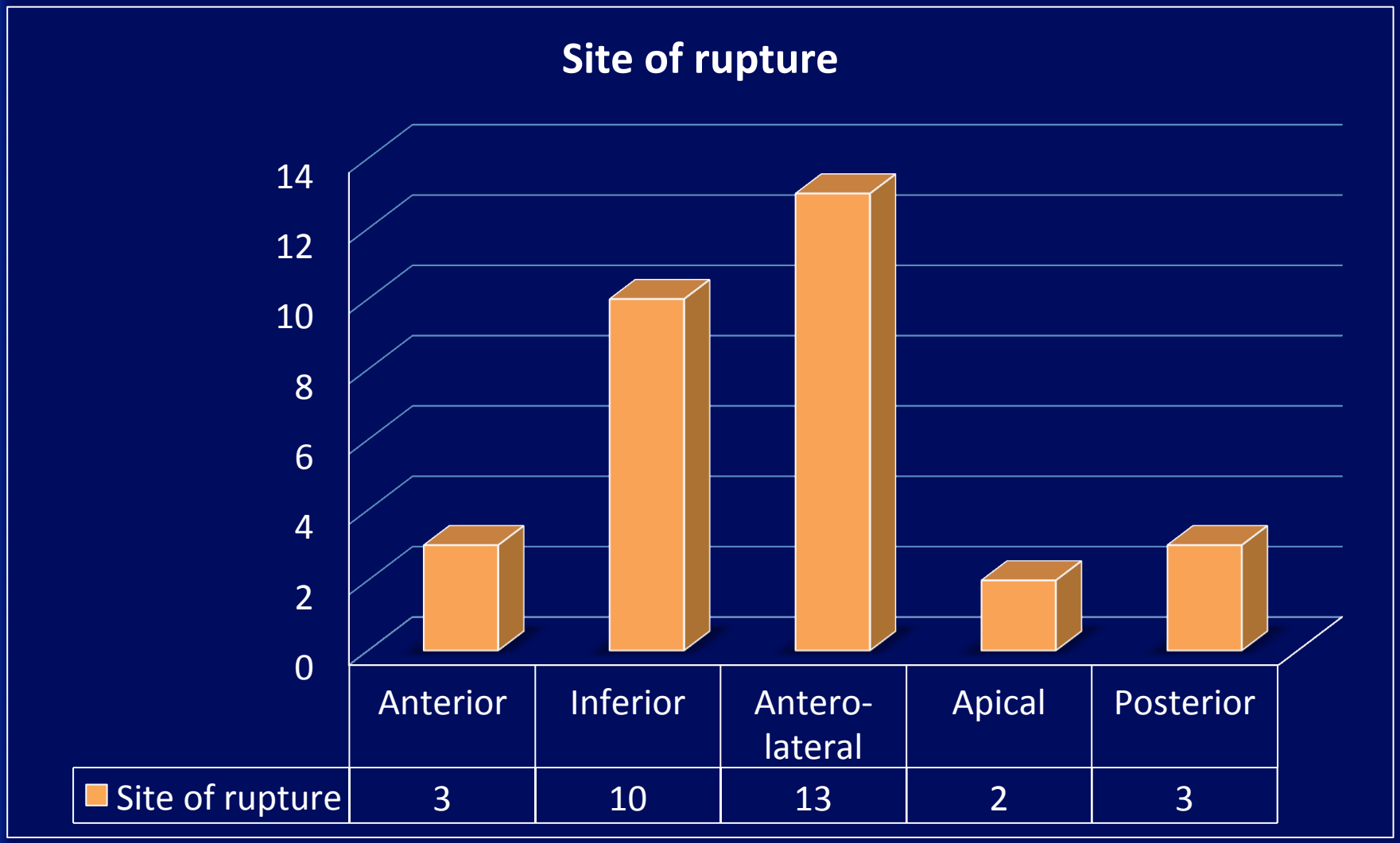
VSD= Ventricular septal defect; LVFWR = Left ventricular free wall rupture; PM = Papillary muscle


VSD
Numbers
0
1
2
3
4
5
6
7
8
11.1%
38.8%
44.4%
5.5%
Anterior
Apical
Posterior
N.A.
VSD
2
7
8
1

VSD = 18



Mitral regurgitation – papillary muscle rupture (N = 18)



Left Ventricular Free Wall Rupture = 31

Preoperative Characteristics

Variables	All (n=67)	ECMO (n=19)	No ECMO (n=48)	p
Age	70.3 ± 8.5	71.2 ± 8.5	66.8 ± 87.8	0.057
Gender (m)	45 (67.2%)	12 (63.2%)	33 (68.8%)	0.66
Height (cm)	167.3 ± 7.4	167 ± 7.7	168 ± 6.8	0.20
Weight (Kg)	70.2 ± 11	69.5 ± 10.6	72.2 ± 12.15	0.43
Ejection Fraction (%)	46.7 ± 10.2	47.3 ± 9.8	45.2 ± 11.1	0.82
Ejection Fraction < 40%	18 (28.6%)	5 (27.6%)	13 (28.9%)	0.83
Hypertension	40 (59.7%)	13 (72.2%)	27 (60%)	0.89
COPD	5 (7.9%)	0 (0%)	5 (11.1%)	0.14
Diabetes Mellitus	9 (13.4%)	2(11.1%)	9 (15.6%)	0.65
Smoke	25 (37.3%)	7 (38.9%)	18 (40%)	0.93
Dyslipidaemia	14 (22.2%)	5 (35.7%)	9 (64.3%)	0.50
Carotid Disease	3 (4.5%)	2 (11,1%)	1 (4.2%)	0.14
Peripheral artery disease	5 (7.5%)	2 (11.1%)	3 (6.5%)	0.53

Preoperative Characteristics

Variables	All (n=67)	ECMO (n=19)	No ECMO (n=48)	OR (C.I.)	p
Type of Mechanical Complications					0.20
• LVFWR	31 (46.3%)	12 (63.2%)	19 (39.6%)		
• MR-PM Rupture	18 (26.9%)	3 (15.8%)	15 (31.3%)		
• VS Rupture	18 (26.9%)	4 (21.1%)	14 (29.2%)		
Cardiopulmonary resuscitation	16 (24%)	10 (67.5%)	6 (32.5%)	3.3 (1.1-10)	0.001
Pericardial tamponade	25 (37.3%)	11 (57.9%)	14 (19.2%)	7.7 (2.2-27)	0.028
IABP	35 (52.2%)	8 (42%)	27 (56.3%)	0.56 (0.19-1.26)	0.29
V-A ECMO	13 (19.4%)	13 (68.4%)	0 (0%)	9.9 (2.5-38.7	< 0.0001
Haemodynamic				18.1 (4.3-75.7)	0.001
• Stable	5 (7.5%)	1 (5.3%)	4 (8.3%)		0.71
• Inotropes	12 (17.9%)	0 (0%)	12 (25%)		0.001
• Cardiogenic shock	35 (52.2%)	8 (42.1%)	27 (56.3%)		0.45
• Cardiac arrest	15 (22.4%)	10 (52.6%)	5 (10.4%)		0.002
Time from onset symptoms to surgery (hours)	24 ± 52 (0-307)	22.4 ± 25.6	25.6 ± 60		0.82

Azienda Ospedaliera San Gerardo

Interhospital stabilization of adult patients with refractory cardiogenic shock by veno-arterial extracorporeal membrane oxygenation

Francesco Formica [a,*], Leonello Avalli [b], Gianluigi Redaelli [a,b], Giovanni Paolini [a]

[a] Cardiac Surgery Unit, San Gerardo Hospital Monza, Department of Surgical Science, University of Milano-Bicocca, Italy
[b] Cardiac Surgery Intensive Care Unit, San Gerardo Hospital, Monza, Italy

Table 1
Patients' haemodynamics, diagnosis, treatment, operations and outcome.

Patient, gender, age (years)	Haemodynamics	Diagnosis	Treatment/operation	Outcome
RA, m, 77	Cardiogenic shock	LVFWR, pericardial tamponade, CPR 35 min, LCO,	Coronary angiogram, IABP insertion before VA-ECMO, CABG plus LVFWR closure	Died on VA-ECMO few hours after operation because of intestinal ischemia
FL, m, 60	Cardiogenic shock	AMI, closure of left main trunk, LCO, IABP	Coronary angiogram, stenting of left main trunk, insertion of IABP before VA-ECMO; no surgery	Weaned and survived; Heart transplant after 8 months
SC, m, 58	Cardiogenic shock	AMI during PTCA, LCO,	Coronary angiogram, failed PTCA, stent entrapment in left main trunk, IABP insertion before VA-ECMO; CABG	Weaned and survived; fully recovery
BD, f, 60	Cardiogenic shock	AMI, closure of left main, LCO, IABP	Coronary angiogram, closure of left main trunk, PTCA on left main, IABP insertion before VA-ECMO; No surgery	Weaned and survived; fully recovery

M, male; f, female; LVFWR, left ventricular free wall rupture; IABP, intra-aortic balloon pump; LCO, low cardiac output; VA-ECMO, extracorporeal membrane oxygenation; AMI, acute myocardial infarction; PTCA, percutaneus transluminal coronary angioplasty; CABG, coronary artery bypass graft.

Interhospital stabilization in 3 patients

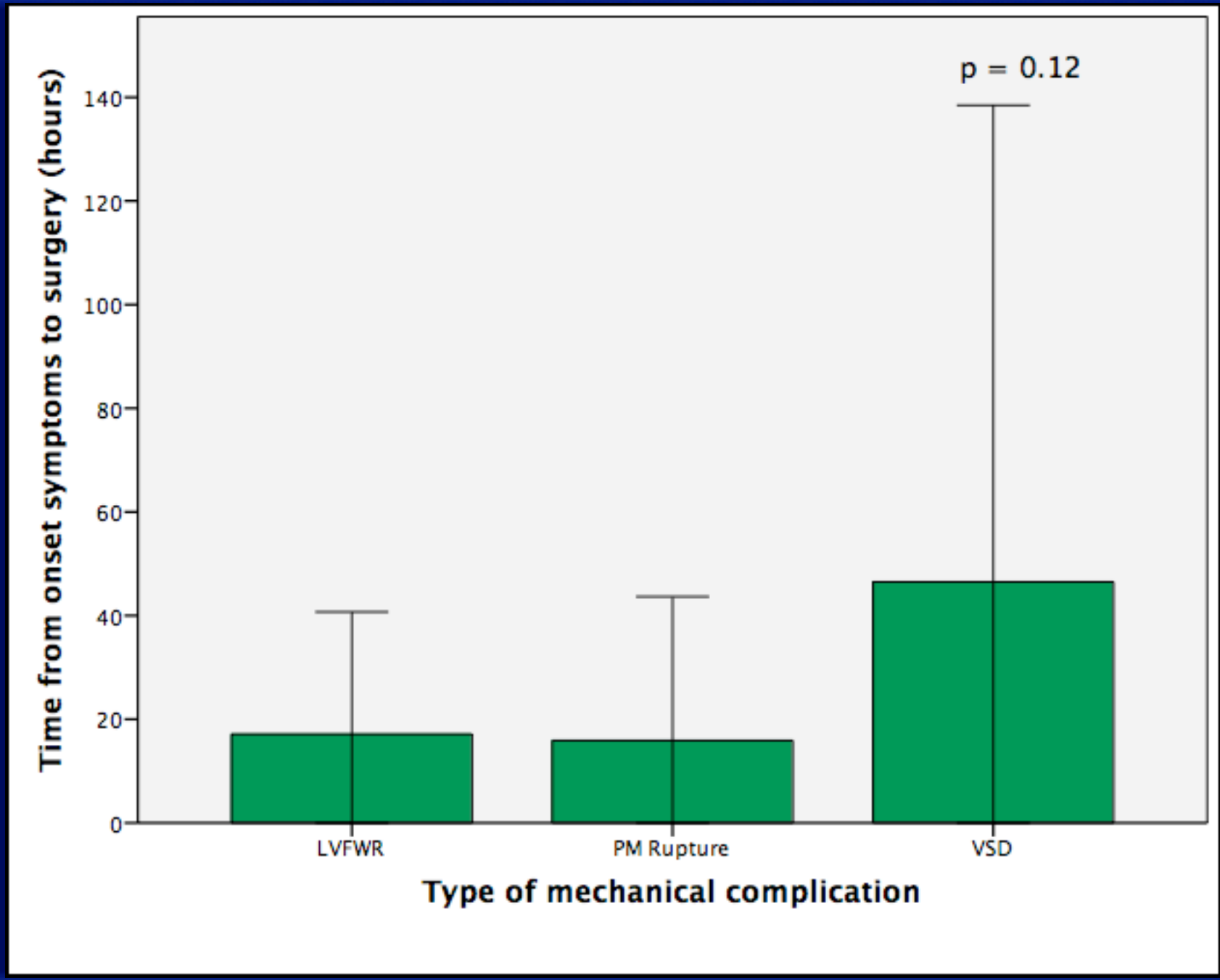
- 2 with LVFWR
- 1 with MP Rupture

UNIVERSITÀ DEGLI STUDI DI MILANO BICOCCA

Formica F, Avalli L, Redaelli G, Paolini G. Interhospital stabilization of adult patients with refractory cardiogenic shock by veno-arterial extracorporeal membrane oxygenation. Int J Cardiol. 2011 Feb 17;147(1):164-5.

Variables	All (n=67)	LVFWR (n=31)	MR-PMR (n=18)	VSR (n=18)	p
Age	70.3 ± 8.5	69.2 ± 9	69.3 ± 8	72 ± 8.5	0.51
Gender (m)	45 (67.2%)	22 (71%)	13 (72.2%)	10 (55.6%)	0.47
Height (cm)	167.3 ± 7.4	163.4 ± 7	169.1 ± 7.2	164.8 ± 9.2	0.20
Weight (Kg)	70.2 ± 11	71.1 ± 9.5	73.2 ± 11.1	66.9 ± 12.4	0.25
Ejection Fraction (%)	46.7 ± 10.2	47.4 ± 9.3	47.9 ± 11.8	44.4 ± 10	0.57
Ejection Fraction ≤ 30%	18 (26.9%)	8 (27.6%)	4 (23.5%)	6 (35.3%)	0.71
Hypertension	40 (59.7%)	19 (6.5%)	10 (58.8%)	11 (64.7%)	0.89
COPD	5 (7.9%)	2 (6.9%)	1 (5.9%)	2 (11.8%)	0.78
Diabetes Mellitus	9 (13.4%)	3 (10.3%9	1 (5.9%)	5 (29.4%)	0.10
Smoke	25 (37.3%)	12 (41.1%)	8 (47.1%)	5 (29.4%)	0.55
Dyslipidaemia	14 (22.2%)	8 (27.6%)	5 (29.4%)	1 (5.9%)	0.16
Carotid Disease	3 (4.5%)	2 (6.9%)	0 (0%)	1 (5.9%)	0.55
Peripheral artery disease	5 (7.5%)	2 (6.9%)	1 (5.9%)	2 (11.8%)	0.76

Variables	All (n=67)	LVFWR (n=31)	MR-PMR (n=18)	VSR (n=18)	p
Haemodynamic					0.11
• Stable	5 (7.5%)	4 (12.9%)	0 (0%)	1 (5.6%)	
• Inotropes	12 (17.9%)	7 (22.6%)	4 (22.2%)	1 (5.6%)	
• Cardiogenic shock	35 (52.2%)	9 (58.3%)	11 (61.1%)	15 (83.3%)	
• Cardiac arrest	15 (22.4%)	11 (10.4%)	3 (16.7%)	1 (5.6%)	
Cardiopulmonary resuscitation	16 (24%)	11 (35.5%)	4 (22.2%)	1 (5.6%)	0.06
Pericardial tamponade	25 (37.3%)	25 (80.6%)	0 (0%)	0 (0%)	< 0.0001
IABP	35 (52.2%)	7 (22.6%)	13 (72.2%)	15 (83.3%)	< 0.0001
V-A ECMO	13 (19.4%)	11 (35.5%)	2 (11.1%)	0 (0%)	0.006


p = 0.12
Time from onset symptoms to surgery (hours)
140
120
100
80
60
40
20
0
LVFWR
PM Rupture
VSD
Type of mechanical complication

Variables	All (n=67)	LVFWR (n=31)	MR-PMR (n=18)	VSR (n=18)	p
IABP	40 (59.7%)	11 (35.5%)	16 (88.9%)	13 (72.2%)	0.001
IABP time (hours)	78.7 ± 77 (4-408)	104 ± 107 (24-408)	69.7 ± 49.3 (24-168)	67 ± 65 (4-240)	0.43
V-A ECMO	19 (28.4%)	12 (38.7%)	3 (16.7%)	4 (22.2%)	0.21
V-A ECMO time (days)	6 ± 5 (1-19)	5.2 ± 4.3 (1-15)	2.3 ± 2.3 (1-5)	11.5 ± 5.2 (7-19)	0.02
Ventilation time (hours) (4-1128)	147 ± 190	125 ± 152 (6-576)	101± 89 (24-288)	232± 288 (4-1128)	0.08
Revision for bleeding/ tamponade	15 (22.4%)	8 (26.7%)	4 (22.2%)	3 (16.7%)	0.32
Blood transfusion	55 (72.6%)	21 (70%)	15 (83.3%)	16 (89%)	0.25
ICU stay (days) (0-150)	12 ± 22	10 ± 18 (1-95)	7.5 ± 7.3 (1-32)	20 ± 35 (0-150)	0.20
CABG	40 (66.7%)	15 (49%)	14 (77.8%)	11 (61.1%)	0.12
MV Replacement • *Biological* • *Mechanical*	19 (28.4%) *13 (19.4%)* *6 (9%)*	3 (10%) *2* *1*	16 (88.9%) *10* *5*	0 (0%) *1* *0*	<0.0001
MV Repair	5 (7.5%)	2 (6.7%)	2 (11.1%)	1 (5.9%)	0.81
Prosthesis size	28.6 ± 1.2		104 ± 107	104 ± 107	
ECC time (min) (63-267)	133 ± 50	118 ± 65 (63-267)	151 ± 46 (99-240)	132 ± 40 (65-203)	0.44
AXC time (min) (32-192)	85.3 ± 38.3	73.8 ± 50.5 (32-190)	86 ± 25 (54-132)	92 ± 37 (48-192)	0.57
Hospital stay (days) (0-146)	18.3 ± 28.7	15.5 ± 18 (0-95)	15 ± 11 (1-43)	26.3 ± 33.8 (0-146)	0.21
Mortality 30 days	19 (28.4%)	11 (35.5%)	3 (16.7%)	5 (27.8%)	0.37

Postoperative Characteristics

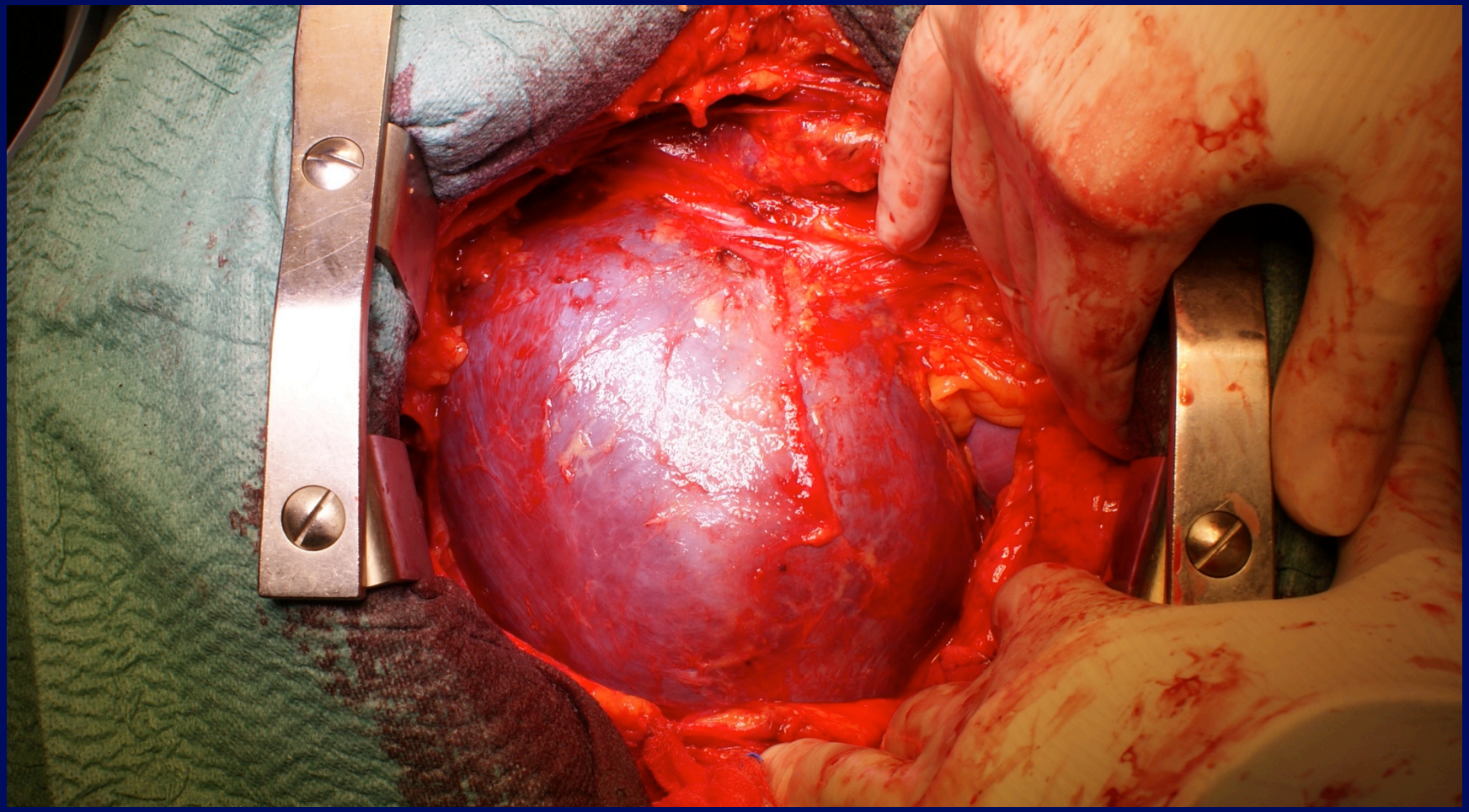
Variables	All (n=67)	ECMO (n=19)	No ECMO (n=48)	OR (CI)	p
IABP	40 (59.7%)	10 (52.6%)	30 (62.5%)	0.66 (0.2-1.9)	0.29
IABP time (hours)	78.7 ± 77	106 ± 130	69 ± 46		0.18
V-A ECMO time (days)	6 ± 5 (1-19)	6.08 ± 5.09	-		-
Ventilation time (hours)	147 ± 190	274 ± 278	92.2 ± 98.6		<0.0001
Revision for bleeding/tamponade	15 (22.4%)	12 (63.2 %)	3 (6.4%)	25 (5.6-112)	<0.0001
Blood transfusion	55 (72.6%)	18 (94.7%)	34 (72.3%)	6.8 (0.8-56.9)	0.04
ICU stay (days)	12 ± 22 (1-95)	18.2 ± 24.5	9.7 ± 22.1		0.52
CABG	40 (66.7%)	11 (57.9%)	29 (61.7%)		0.77
MV Replacement • *Biological* • *Mechanical*	19 (28.4%) *13 (19.4%)* *6 (9%)*	4 (21.1%) *4* *1*	15 (32.6%) *9* *5*		0.35
MV Repair	5 (7.5%)	2 (10.5%)	3 (6.5%)		0.58
Prosthesis size	28.6 ± 1.2	28.5 ± 1	28.7 ± 1.3		0.7
ECC time (min)	133 ± 50	125 ± 67	136 ± 45		0.61
AXC time (min)	85.3 ± 38.3	79 ± 50	88 ± 35		0.57
Hospital stay (days)	18.3 ± 28.7	21.1 ± 25.5	17.2 ± 21.6		0.52
In- hospital mortality (days)	19 (28.4%)	12 (63.2%)	7 (14.6%)	10 (2.9-34.3)	<0.0001

Predictors of in-hospital mortality by univariate analysis and multivariate logistic regression analysis

Variable	Univariate analysis				Multivariate analysis			
	OR	95% CI	p		OR	95% CI	p	Wald χ^2
Cardiopulmonary Resuscitation	3.3	1.1-10	0.001		-	-	-	
Cardiac Tamponade	7.7	2.2-27	0.028		-	-	-	
VA ECMO at presentation	9.9	2.5-38.7	0.001		-	-	-	
Haemodynamic at presentation *	18.1	4.3-75.7	0.001		16.8	4-70	<0.0001	14.9
Reoperation for bleeding	25	5.6-112	<0.0001		-	-	-	
Blood transfusion	6.8	0.8-56.9	0.044		-	-	-	

*** Stable, inotropes, cardiogenic shock, cardiac arrest**

Hosmer-Lemeshow goodness-of-fit test was non-significant (Wald χ^2= 0.2; df = 2; p= 0.90)

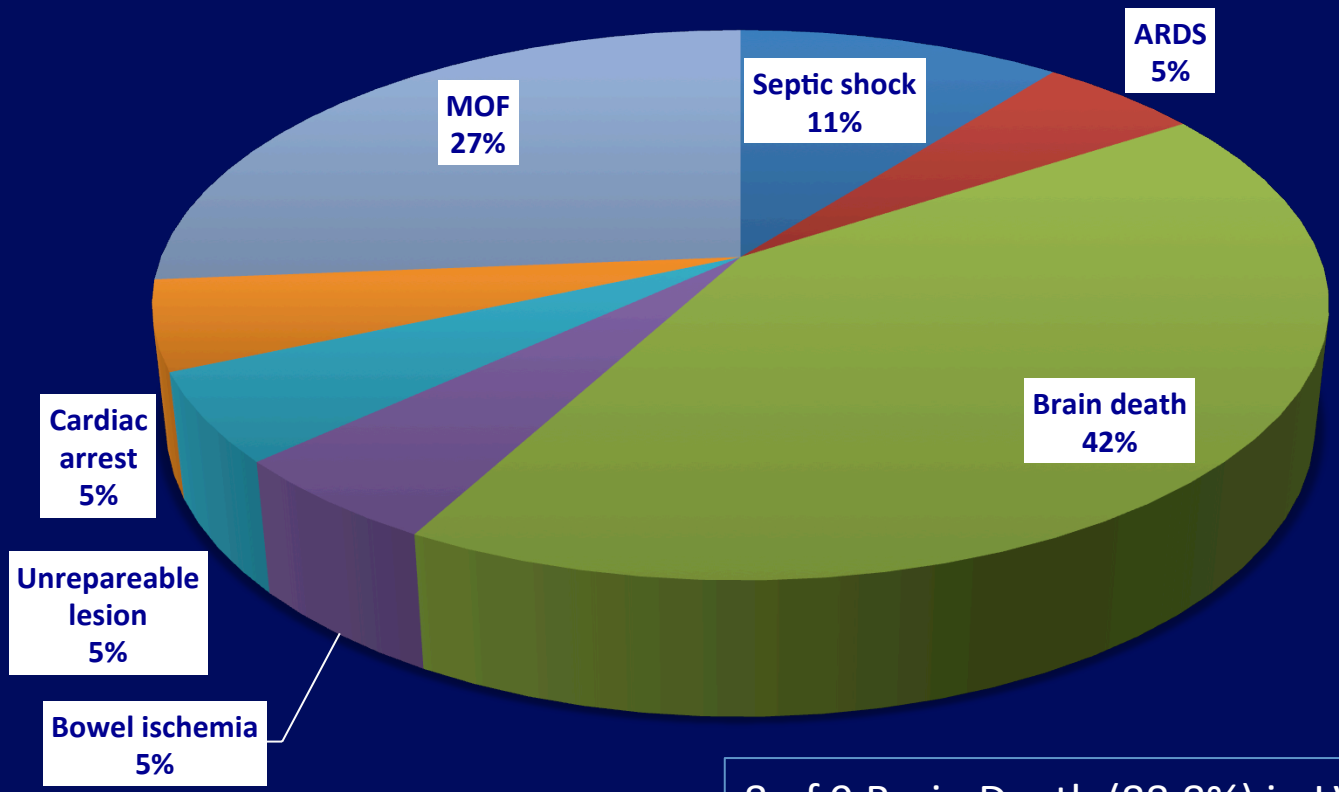


Type of MC	Cardiac Arrest	P = 0.001
LVFWR (31)	11 (35.5%)	
PM Rupture (18)	3 (16.7%)	
VSD Rupture (18)	1 (5.6%)	

	ECMO at presentation (n=13)	No-ECMO (n=54)	p
In-hospital mortality	9 (69%)	10 (54.5%	0.001

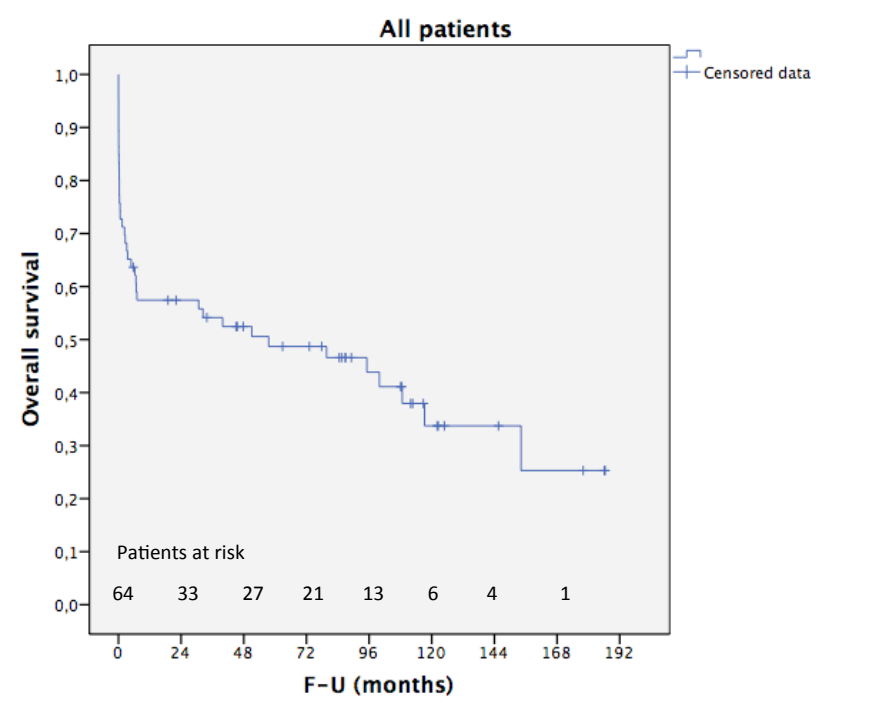
Patients ID	Age	Type of MC	Cardiac arrest at presentation	Time from surgery to death (DAys	Cause of death
1	70,0	LVFWR	Yes	9	Septic shock
2	75,2	PM Rupture	Yes	4	ARDS
3	74,9	VS Rupture	No	1	MOF
4	69,6	VS Rupture	No	146	Brain Ddeath
5	56,0	LVFWR	No	7	Brain death
6	70,3	LVFWR	Yes	1	Bowel iscaemia
7	57,0	VS Rupture	No	18	MOF- Mediastinitis
8	69,4	VS Rupture	No	13	Septic shock
9	75,2	LVFWR	Yes	2	Brain death
10	66,0	LVFWR	Yes	2	Brain death
11	74,2	LVFWR	No	0	Unreparable heart lesion
12	72,0	LVFWR	Yes	8	Cardiac arrest
13	68,6	LVFWR	Yes	5	Brain death
14	64,0	PM Rupture	No	1	MOF
15	81,8	LVFWR	Yes	9	Brain death
16	69,8	LVFWR	Yes	0	Brain death
17	67,0	PM Rupture	Yes	1	MOF
18	78,0	LVFWR	Yes	19	MOF
19	76,9	VS Rupture	Yes	0	Brain death – heart failure

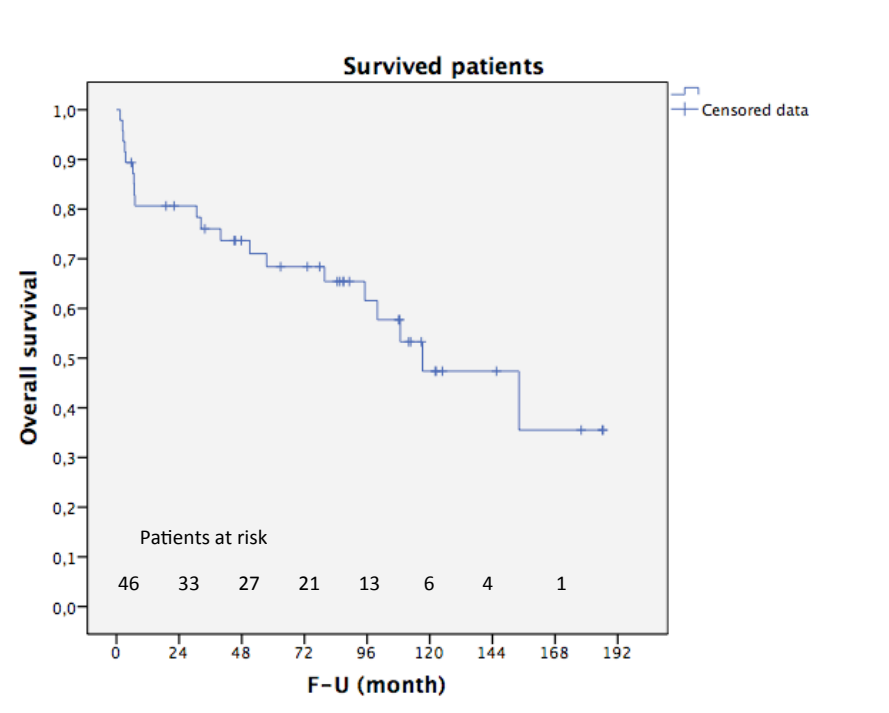
Causes of in-hospital mortality



8 of 9 Brain Death (88.8%) in LVFWR patients

Survival





Mean F-U = 80 ± 10 CI 95% = 59.5 – 100.5

24 = 57.4% ± 6.1%

48 = 52.5% ± 6.2%

72 = 48.7% ± 6.3%

96 = 52.5% ± 6.2%

Mean F-U = 112 ± 11.8 (CI 95% = 89 – 135.5)

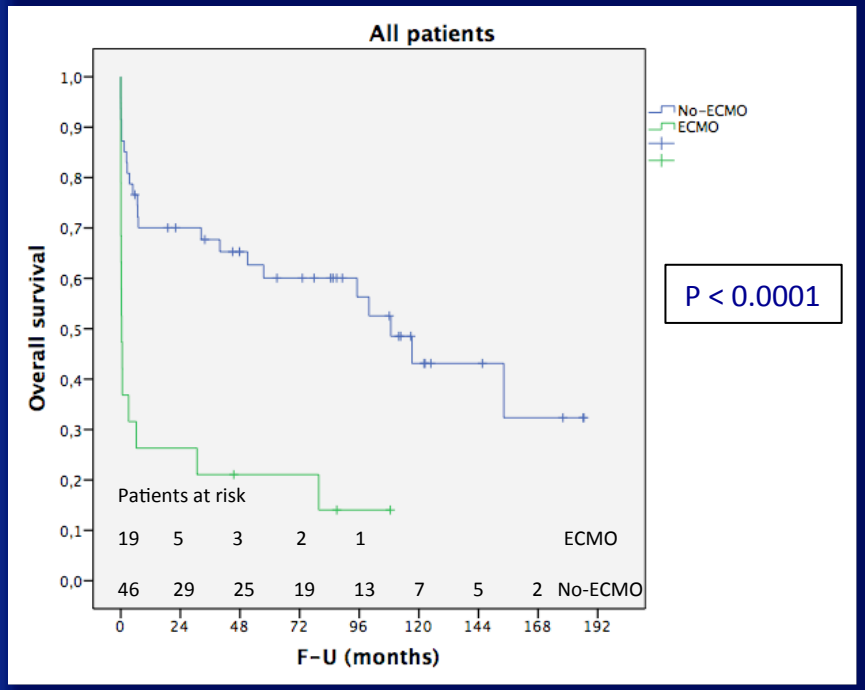
24 = 80% ± 5.8%

48 = 73% ± 6.6%

72 = 68% ± 7.1%

96 = 61.6% ± 7.9%

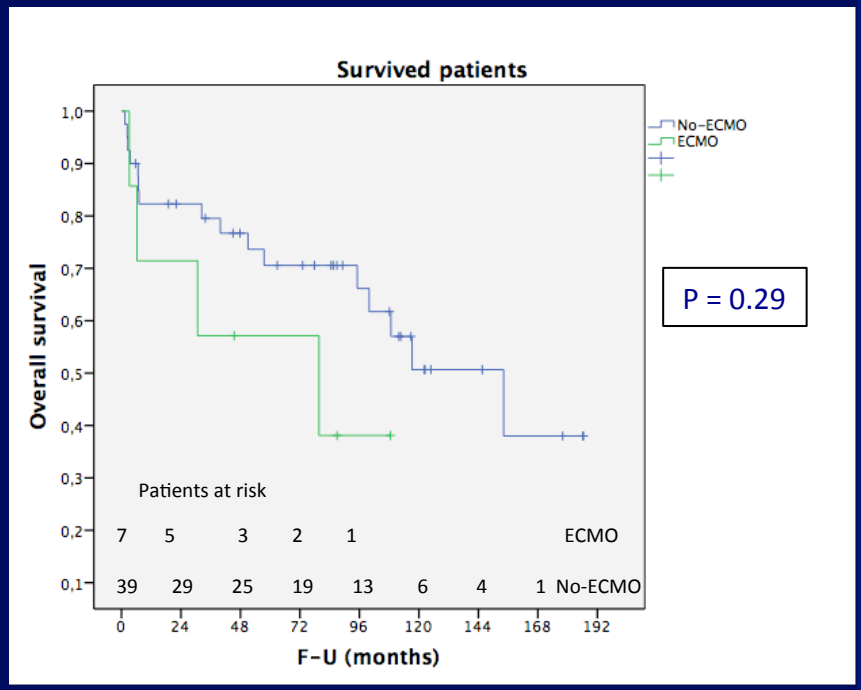
Mean F-U (Months)
No-ECMO = 100 ± 12.3 (CI 95% = 76 – 124)
ECMO = 23 ± 9.2 (CI 95% = 4.9-41.2)



P < 0.0001

No - ECMO	ECMO
24 = 70 % ± 6.7%	24 = 26.3% ± 1%
48 = 65% ± 7%	48 = 21.1% ± 9.8%
72 = 60% ± 7.5%	72 = 14% ± 8.5%
96 = 56.3% ± 7.8%	96 = -

Mean F-U (Months)
No-ECMO = 117 ± 12.3 (CI 95% = 93 – 142)
ECMO = 62.2± 16.8 (CI 95% = 29-95



P = 0.29

No - ECMO	ECMO
24 = 82.3% ± 6.1%	24 = 71.4% ± 17.1%
48 = 76.7% ± 6.8%	48 = 57.1% ± 18.7%
72 = 70.6% ± 7.5%	72 = 38.1% ± 19.9%
96 = 66.2% ± 7.8%	96 = -

Conclusions

- Left ventricular ruptures remain a devastating complication after myocardial infarctions.
- The use of V-A ECMO is not a standardized technique in this critical clinical scenario (literature is missing)
- In our sample, cardiac arrest at presentation increases dramatically the rate of early mortality.
- Early mortality is higher in patients supported by V-A ECMO (consider the high mortality before operation).
- Survived ECMO patients seems to have a favourable midterm survival.

Thanks to all cardiac surgeons, cardio-anesthesiologist doctors, resident doctors, perfusionist and nursing staff