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Abstract

Aims: Current guidelines do not advocate implantation of cardioverter-defibrillators (ICD) for survivors of ventricular fibrillation (VF) during the first 48 hours of ST-elevation myocardial infarction (STEMI). However, contemporary studies in a real-life setting with long-term follow-up are lacking. We assessed the prognostic impact of early VF in a non-selected population of STEMI patients treated with primary PCI.

Methods and Results: Consecutive STEMI patients admitted to a Swedish tertiary care hospital during 2007-2009 were identified from the Register of Information and Knowledge about Swedish Heart Intensive Care Admissions (n=1718, age 66±12 years, 70% male). Patients with VF were identified from the Register, and medical records were reviewed to determine the time point of VF. Patients surviving VF in the first 48 hours after symptom onset were compared to patients without VF for 1-year mortality and a combined endpoint of death, resuscitated VF or appropriate ICD therapy. VF within 48 hours occurred in 7% of STEMI patients (n=121). In patients alive at 48 hours (n=1663), VF patients (n=101) had higher in-hospital mortality (12% vs. 2%, $p<0.001$). However, in VF patients discharged alive (n=89), mortality was low (1%) and combined endpoint rate (3%) did not differ compared to patients without VF (n=1538), (4% and 4% respectively).

Conclusion: In a large non-selected population of STEMI patients treated with primary PCI, VF during the first 48 hours after STEMI is associated with increased in-hospital mortality but does not influence the long-term prognosis for those discharged alive.

Key words: Ventricular fibrillation, myocardial infarction, primary PCI, prognosis

Introduction

Ventricular fibrillation is common in the acute phase of ST-elevation myocardial infarction (STEMI) [1, 2] and markedly increases in-hospital mortality [3-6]. However, it is suggested that ventricular tachycardia (VT) and ventricular fibrillation (VF) occurring on the first days of STEMI is a poor predictor of arrhythmia recurrence [4]. Patients who survive to hospital discharge are believed to have a similar long-term prognosis compared to patients who do not experience life-threatening ventricular arrhythmias during the acute phase of STEMI [2-4, 7, 8]. Accordingly, current guidelines from the ESC/ACC/AHA on the management of STEMI do not recommend implantation of cardioverter-defibrillator (ICD) in patients with sustained VT or VF within the first 24-48 hours of STEMI [9-11] and there is no data that would support ICD use in these circumstances.

However, most of the scientific evidence on which current understanding of the prognostic value of early ventricular arrhythmias is based, dates back to either the era before reperfusion therapy became widely adopted or back to the thrombolysis era [3, 12]. It is not fully known whether this strategy is still valid today, when thrombolytic therapy has been replaced with more efficient percutaneous coronary interventions (PCI). Even though several earlier studies assessed the impact of early VF on the short- or long-term outcomes in selected patient groups,[6, 13, 14] a large-scale long-term outcome analysis performed in non-selected STEMI patients, to the best of our knowledge, is lacking. Therefore, our aim was to assess the prognostic value of life-threatening ventricular arrhythmias occurring within the first 48 hours after symptom onset in a large non-selected population of STEMI patients treated by primary PCI.

Methods

Study population

We performed a retrospective, register-based single-site cohort study. The study population and relevant clinical information was identified from the Swedish National Register of Information and Knowledge about Swedish Heart **I**ntensive Care Admissions (RIKS-HIA). Detailed information about the RIKS-HIA registry is available at www.riks-hia.se, and long-term outcome studies using the Register data have been published previously.[15-17]

All patients admitted to the Lund University Hospital with acute STEMI during a three-year period from January 1, 2007 to December 31, 2009, were included in the study. Patients not covered by the Swedish social security system (n=24) were excluded from analysis due to lack of follow-up data. For patients who had multiple admissions for STEMI during the three-year period, only the first admission was considered.

Patients who underwent cardiopulmonary resuscitation (CPR) or defibrillation for VT/VF during the period from symptom onset through discharge from the coronary care unit, or upon in-hospital death were identified from the RIKS-HIA Register. Medical records of these patients were reviewed in order to: verify whether cardiac arrest was caused by haemodynamically unstable VT or VF (VT/VF); estimate the exact timing of arrhythmia in regard to symptom onset and PCI; and reconstruct the sequence of events that lead to VT/VF and defibrillation. Patients in whom VT/VF occurred within the first 48 hours of STEMI were identified as the VF Group. All other patients were identified as the No VF Group. VT/VF episodes after 48 hours from symptom onset were considered as study endpoints. In all patients with VT/VF during the index admission, medical records that include review of ST-segment monitoring and series of

electrocardiograms (ECG) were analyzed to exclude recurrent ischemic events as possible causes of arrhythmia. One patient, who did not have VT/VF initially, developed VF due to reinfarction caused by in-stent thrombosis during the second day of STEMI. Due to uncertainty in regard to group allocation, he was excluded from the analysis.

Patients with VT/VF were divided into three subgroups based on timepoint of arrhythmia in regard to the reperfusion: a first group of VT/VF occurring before intervention on infarct-related artery (IRA), defined as "before PCI" including both pre-hospital and in-hospital VT/VF; a second group of VT/VF during reperfusion defined as VT/VF occurring during the period from restoration of blood flow to the end of the PCI procedure; and a third group of VT/VF occurring after PCI. Patients who had more than one VT/VF episode during the index admission were classified according to the latest episode.

Angiographic characteristics were determined from the Swedish Coronary Angiography and Angioplasty Register (SCAAR). The Register contains information from all centers performing coronary angiography and PCI in Sweden, and has been described previously.[18, 19] Information on implanted cardioverter-defibrillators (ICD) for primary or secondary prevention was obtained from the local hospital register. Medical records were reviewed for occurrence and adequacy of ICD therapy which was defined as ICD shocks and/or antitachycardia pacing due to ventricular arrhythmias.

The study was approved by the Regional Ethics Committee in Lund (# 2010/585, 2010-11-29).

Study endpoints

The primary endpoints were in-hospital death; death from any cause at 1 year (total mortality); and a combined endpoint including death from any cause, VT/VF, or appropriate ICD therapy at 1 year.

Statistical Analysis

The prognostic impact of successful resuscitation for VT/VF during the first 48 hours after onset of the ST-elevation myocardial infarction was evaluated from survival functions calculated using the Kaplan-Meier estimator. Groups were compared using the log rank test.

To identify clinical factors associated with VT/VF, relevant clinical factors were compared across groups using chi-square or Fisher's exact test for categorical variables and Student's t-test for continuous variables with an approximate normal distribution, or non-parametric tests, as appropriate. Significantly associated covariates were further evaluated in univariate logistic regression models with estimation of odds ratios and likelihood-ratio tests. To determine independent factors of risk, clinical factors significantly associated with VT/VF in univariate models were included in a stepwise regression analysis with backwards elimination. All patients were included in analyses of clinical correlates of VT/VF, whereas only patients alive by 48 hours of STEMI were included in prognostic analyses.

P-values <0.05 were considered significant. All analyses were performed using SPSS 19.0 (SPSS Inc., Chicago, Illinois, USA).

Results

Patient characteristics

The study population comprised 1,718 unique STEMI patients admitted to the Lund University Hospital for primary PCI during a three-year period (mean age 66±12 years, 70% males). The population included 61 patients (3.1%) who received pre-hospital CPR, 54 of whom had

ongoing mechanical chest compressions with the LUCAS device (Jolife AB, Lund, Sweden) upon arrival to the catheterization laboratory.

VT/VF during the first 48 hours of STEMI occurred in 121 patients (7.0%). As described in **Figure 1**, VT/VF was registered before intervention in 73 patients ("before PCI" group), between restoration of blood flow in IRA and the end of the PCI procedure in 26 patients ("reperfusion arrhythmia" group), and after PCI procedure in 22 patients, of which 17 occurred within the first 24 hours of STEMI, and 5 occurred during the day after. Thus, in 96% of patients from the VF group, life-threatening arrhythmias occurred within the first 24 hours of STEMI. Reperfusion arrhythmias were registered in patients with acute coronary occlusion.

Patients with VT/VF were more likely to have a history of myocardial infarction and to use B-blockers, aspirin, and statins than those without VT/VF (**Table 1**). The proportion of patients with left ventricular ejection fraction < 30% and Killip class IV was higher in the VF group. Patients with VT/VF more often received an intra-aortic balloon pump and mechanical chest compressions with the LUCAS device. Symptom-to-balloon time was shorter in the VF group than in the No VF group (167 (IQR=130) vs. 215 (IQR=249) minutes, p=0.019).

Coronary angiography findings

Coronary angiography was performed in all patients. Angiographic findings are shown in **Table 2**. Patients with VT/VF were less likely to have single-vessel disease (33.9% vs. 43.9% in the group without VT/VF, p=0,04) and more often had left main disease (14.8% vs. 6.5%, p=0.001). The proportion of patients with two-vessel and three-vessel disease did not differ between the groups.

Left main artery was the IRA more often in the VF group (2,6% vs. 0,3%, p=0,008), (Table 2). No difference was observed between the two groups in regard to LAD, RCA or LCx. The majority of patients in both groups had acute occlusion of IRA defined as occlusion that occurred within 3 months [18] prior to coronary angiography at STEMI admission (70% in No VF group and 78% in VF group, p=0.126).

PCI was not performed in 111 of 1,718 patients (6.4%) due to technical difficulties or uncertain culprit lesion. 41 of these patients (2.5% in the VF group and 2.4% in the No VF group) underwent subsequent CABG. For patients undergoing primary angioplasty, the procedure was successful in 89.6% for VF patients and in 97.6% for the No VF group (p<0.001).

Independent predictors of early VT/VF

In univariate regression analyses, the following factors were associated with increased risk of VT/VF during the first 48 hours of STEMI: current smoking, history of myocardial infarction, aspirin, beta-blockers, digitalis and statin use, plasma creatinine level and left main coronary artery disease (**Table 3**). In a multivariate analysis, current smoking (OR 2.82, p=0.001, 95%CI 1.49-5.32), beta-blocker therapy (OR 2.47, p<0.001, 95%CI 1.54-3.96), digitalis at admission (OR 4.70; p=0.005, 95%CI 1.58-13.94) and left main disease (OR 3.11; p=0.001, 95%CI 1.61-5.98) remained independently associated with VT/VF during the first 48 hrs. Beta-blockers (OR 2.04; p=0.003, 95%CI 1.27-3.27) and digitalis (OR 3.34; p=0.035, 95%CI 1.09-10.22) at admission remained independent predictors of VT/VF before reperfusion.

Prognostic impact of early VT/VF

55 of the 1,718 STEMI patients died within 48 hours of symptom onset (3.2%, age 76±11 vs. 66±12 years in survivors, p<0.001). The remaining 1,663 patients alive at 48 hours of STEMI were studied with survival analysis, and included 101 patients from the VF group (age 66±12 years, 27% female) and 1,562 patients from the No VF group (age 66±12 years, 30% female, n.s.). Of these 1,663 patients, 100 died during 1-year follow-up: 13 (12.9%) from the VF group and 87 (5.6%) from the No VF group, p=0.0001, **Figures 2 and 3A**. The vast majority of deaths occurred during index hospitalization: 12 patients from the VF group (11,9%) and 24 patients from the No VF group (1.5%), p<0.001, **Figures 2 and 3A**). Among patients who were alive at 48 hours but died during hospital stay, 18 died from heart failure or cardiogenic chock (12 of 24 No VF patients and 6 of 12 VF patients), 4 from mechanical complications of myocardial infarction (interventricular septum rupture, free left ventricular vall rupture, acute mitral insufficiency (all from No VF group), 1 from ventricular fibrillation (No VF group), and 13 from other causes.

Among patients from the VF group who were alive at 48 hours, the in-hospital mortality was 11.3% in patients where VT/VF occurred before PCI, 9.1% in patients with reperfusion arrhythmias and 17.6% in patients with VT/VF after PCI (p=0.696).

The length of hospital stay was 6,12±8,14 days in VF group and 5,38±9,9 in No VF group (p=0.421)

Among the 1,627 patients discharged alive, 64 (3.9%) died during follow-up. The mortality rate at 1 year did not differ significantly between groups: 1.1% in the VF group and 4.1% in the No VF group (HR=0.27 95%CI 0.037-1.945, p=0.194, **Figure 3C**).

Among patients discharged alive, 18 received an ICD for primary prevention and 6 for secondary prevention of sudden death (**Figure 2**). 3 of the 6 patients in whom ICD was

implanted for secondary prevention were from the VF group. In 5 of the 6 patients with ICD for secondary prevention, the VT episode which motivated device implantation occurred within the first half-year of STEMI, in 4 patients it occurred during the first two months. 2 patients with ICD implanted for secondary prevention received adequate ICD therapy, both of them twice during 1 year of follow-up. The time from ICD implantation to the first adequate ICD therapy was 1 and 4 months, respectively. None of the patients who received an ICD for primary prevention received adequate ICD therapy by 1 year of follow-up.

In total, 68 individuals experienced the combined endpoint of death, VT/VF or appropriate ICD therapy during follow-up: 5 in the VF group and 63 in No VF group. Two2 patients from the No VF group developed sustained VT on 18 and 39 days following the date of the index admission, respectively. Two additional patients from the VF group received appropriate ICD therapy during follow-up. There were no differences between the two groups in regard to the combined endpoint among those discharged alive (HR=0.85 95%CI 0.225-2.585, p=0.725 for combined endpoint ,**Figure 3D**).

Discussion

Current standards in clinical practice for STEMI patients are based on the premise that VF during the first two days of STEMI is benign in terms of long-term prognosis if the patient survives to discharge from the hospital and the lack of proven ICD efficacy for prevention of sudden death in survivors of VT/VF early during STEMI. However, most data concerning the prognostic significance of early VT/VF for long-term outcome were obtained during or even prior to the thrombolysis era (**Table 4**). Few prior studies have evaluated VT/VF among patients

undergoing primary PCI for acute STEMI, the most important of them were PAMI trial and APEX AMI trial [6, 13, 14, 20].

APEX AMI was the largest one that enrolled 5745 patients, however it did not include patients admitted beyond the first 6 hours of STEMI and those with isolated inferior STEMI. Moreover, the length of follow-up was limited to 90 days[14]. PAMI trial assessed long-term 1-year prognosis and included 3065 patients however those with renal failure, cardiogenic chock and patients with contraindications for antiplatelet therapy were excluded[13].

Our study included all patients admitted for primary PCI during a three-year period. Being a register-based study, our analysis did not exclude the most severe patient categories such as those who underwent pre-hospital resuscitation (3.5%) or arrived to the catheterization laboratory with ongoing mechanical chest compressions with LUCAS (3.1%). More inclusive nature of our study may explain the differences in malignant ventricular arrhythmias occurrence between our study (7,2%), the PAMI trial (4.3%)[13] and the APEX-AMI trial (5.7%).[14] Furthermore, these earlier studies included VF and any sustained VT episode, whereas our study included only VF and VT necessitating defibrillation.

In regard to the type of ventricular arrhythmias reviewed in earlier trials, PAMI trial focused on ventricular arrhythmias in PCI laboratory only and disregarded potential additional events that could have occurred during prehospital stage or after PCI. In our material, 62 of 121 qualifying VT/VF episodes occurred before patient admission to the cath lab and did not recur during PCI. This patient category was not included in PAMI analysis. In the APEX study, pre-catheterisation VT/VF accounted for 7,5% (25 of 329) of all events which is in contrast with our study population.

Through medical histories of patients we were able to verify all VT/VF episodes, to analyze in detail the timing and circumstances of VT/VF in the studied population. In the majority of cases (60%), malignant ventricular arrhythmias occurred before balloon inflation, while 23% of cases accompanied restoration of blood flow in IRA, and only 17% were registered after the end of PCI. In general, 96% of life-threatening arrhythmias occurred within the first 24 hours of PCI treated STEMI. In previous studies, which were conducted before the routine use of reperfusion therapy or during the thrombolysis era, the proportion of patients having VF after the first day of STEMI was generally higher. However, the exact timing of VF within the first 48 hours of STEMI has not been reported in previous studies.[2, 21] In the GUSTO-I study, 86% of VF occurred within the first 48 hours of thrombolysis-treated STEMI, and 15% occurred after the first 48 hours.[5]

In our study, patients from the VF group more often had prior MI, which is in agreement with earlier reports.[5, 20] We did not observe any association between MI localization and occurrence of VT/VF, which is in contrast to previously published data[13, 14] that reported higher risk of malignant ventricular arrhythmias in inferior and RCA-related infarctions. However, thrombosis in the left main coronary artery was observed more often in the VF group. Otherwise, aside from beta-blocker treatment, which is likely to be a more sensitive indicator for underlying cardiovascular disease than anamnaestic data, only current smoking and digoxin use were independently associated with VF occurrence. The association between early VF and smoking has been reported earlier.[13] The association between digoxin use and early VF in our study is especially notable in light of recent publications about this drug. It is well known that digoxin decreases the hospitalization rate but does not decrease mortality due to congestive heart failure (CHF)[22]; at the same time, digoxin was reported to increase the rate of death from "other causes",[23] presumed to be due to arrhythmias. Recently, based on a large data sample

from the RIKS-HIA registry, it was shown that digoxin is an independent risk factor for death among patients with AF without a history of congestive heart failure [24]. The strong association between digoxin use at admission with acute STEMI and early VF is in agreement with the findings of previous trials, thus further supporting the previously suggested potential hazard of digoxin in the settings of acute ischemia. However, interventional studies are needed to establish the causality as our findings can also be explained by a more severe underlying congestive heart failure in patients treated with digoxin.

In our study, in-hospital mortality was higher in the VF patients, which is in agreement with previous studies.[3-6] Moreover, we analyzed the timing of VF according to IRA opening and did not find any significant differences between arrhythmias occurring before, during or after PCI.

Considerable number of patients surviving STEMI fulfills criteria for primary prevention ICD implantation during follow-up. Appropriate ICD therapy can in some cases prevent sudden death, however earlier studies in similar patient populations, such as APEX AMI or PAMI, did not analyze ICD-therapies during follow-up. In our study, we analyzed not only the cases of death but also the combined end-point of death, resuscitated cardiac arrest or appropriate ICD treatment, and found no differences between the two groups for this endpoint either. So, this study performed on a large non-selected population of PCI-treated STEMI confirmed the data from trials conducted before or during the thrombolysis era [2-4, 7, 8] regarding the absence of influence of VT/VF within the first days of STEMI on the long-term prognosis.

Limitations

Our approach of retrospective analysis based on the information on VT/VF available through RIKS-HIA registry is likely to underestimate the true prevalence of clinically relevant VT/VF as

occasions with ventricular arrhythmias during the acute phase of STEMI that lasted longer than 30 seconds and resolved either spontaneousely or converted using pharmacological interventions may not have been documented. Our findings should therefore be considered as referring the most severe arrhythmias as haemodynamically unstable VT or VF.

Information on electrolyte status at admission would potentially further improve our understanding of VF mechanisms during early phase of STEMI, but it was not available for analysis.

Finally, while we intended to include all patients admitted with STEMI to a high-volume tertiary care hospital during three-year period, the study population and the actual number of study endpoints might be considered low in comparison with large-scale trials (see Table 4) and have to be acknowledged. However, we believe that this limitation has been balanced by the high level of details concerning arrhythmic events and study endpoitns available through direct access to medical records and ECG archive.

Conclusion

In a large non-selected population of STEMI patients treated with primary PCI, the predefined incidence of VT/VF within the first 48 h of STEMI is associated with increased in-hospital mortality, but does not influence the long-term prognosis for those discharged alive. Therefore, in line with current sudden death prevention guidelines, our data does not advocate ICD therapy in survivors of VF during the first 48 hours of STEMI. The rate of VF events beyond 24 h of STEMI in PCI-treated patients was low and for these patients the results must be interpreted with caution.

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Disclosures:

None.

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Figure legends

Figure 1.

Timing of VT/VF during acute STEMI

Figure 2.

Patient groups chart. Abbreviations: VF, ventricular fibrillation; VT, ventricular tachycardia

Figure 3.

A. – Kaplan Meier survival analysis in regard to total mortality during follow-up for patients alive at 48 hours of STEMI, B - Kaplan Meier analysis in regard to combined endpoint of total mortality, appropriate ICD discharge or new VT/VF during follow-up for patients alive at 48 hours of STEMI, C - Kaplan Meier survival analysis in regard to total mortality during follow-up for patients discharged alive , D - Kaplan Meier analysis in regard to combined endpoint of total mortality, appropriate ICD discharge or new VT/VF during follow-up for patients discharged alive Abbreviations: STEMI, ST-elevation myocardial infarction; VT, ventricular tachycardia; VF, ventricular fibrillation

Table 1. Clinical characteristics

Characteristic	**No VF group (n=1,597)**	**VF group (n=121)**	**p -value**
Age, years	64.9±11.6	65.1±11.4	0.657
Male sex, n(%)	1,115 (69.8%)	88 (72.7%)	0.501
BMI	27.0±4.5	26.2±4.4	0.616
Medical History:			
Prior MI	**221 (13.8%)**	**31 (25.6%)**	**<0.001**
Prior PCI	154 (9.6%)	16 (13.2%)	0.204
Prior CABG	62 (3.9%)	8 (6.6%)	0.146
Prior CHF	46 (2.9%)	5 (4.1%)	0.436
Prior Stroke	104 (6.5%)	10 (8.3%)	0.460
Hypertension	637 (40.0%)	52 (43.0 %)	0.522
Diabetes mellitus	196 (12.3%)	9 (7.5%)	0.118
Current smoker	526 (34.4%)	42 (43.3%)	0.093
Smoked earlier	511 (33.4%)	33 (34%)	
Medications at admission:			
Beta-blockers	**397 (25.5%)**	**50 (44.2%)**	**<0.001**
ACE or ARB	319 (20.0%)	25 (20.7%)	0.856
Digitalis	**21 (1.3%)**	**5 (4.3%)**	**0.011**
Aspirin	**377 (24.0%)**	**45 (39.1%)**	**<0.001**
Statins	**282 (18.0%)**	**32 (28.1%)**	**0.007**
Nitroglycerin	55 (3.5%)	6 (5.2%)	0.342
Anterior MI	470 (48.8%)	54 (47.0%)	0.708
Symptom-to-balloon time	**215 (249)**	**167 (130)**	**0.019**
AF at admission	97 (6.2%)	11 (10.4%)	0.092

Heart rate at admission	75 (24)	74 (29)	0.551
Systolic blood pressure	**144 (35)**	**120 (40)**	**<0.001**
IABP	**58 (3.6)**	**24 (19.8%)**	**<0.001**
LUCAS	**22 (1.4)**	**32 (26.4%)**	**<0.001**
Killip class IV at admission	**17 (1.3%)**	**9 (10.0%)**	**<0.001**
EF < 30	**110 (8.0%)**	**16 (16.2%)**	**0.005**
Laboratory parameters:			
Creatinine, median (IQ)	**79 (25)**	**81 (28)**	**0.023**
CRP, median (IQ)	5.0 (11)	3.0 (16)	0.936
Glucose, median (IQ)	**7.0 (2.3)**	**7.3 (3.9)**	**0.001**
Hb	139 (22)	139 (23)	0.344

Continuous variables are presented as mean ± standard deviation or as median and interquartile range if asymmetric distribution. Categorical variables are presented as frequencies and percentages. Data are presented in average ± SD, or median (IQ) in case of abnormal distribution.

Abbreviations: BMI, body mass index; CABG, coronary artery bypass graft surgery; CHF, congestive heart failure; CRP, c-reactive protein; EF, ejection fraction; Hb, hemoglobin; IABP, intra-aortic balloon pump; MI, myocardial infarction; PCI, percutaneous coronary intervention;

Table 2. Angiographic characteristic

Characteristic	**No VF group**	**VF group**
IRA:		
LAD	628 (43.4%)	47 (40.9%)
LCX	221 (15.3%)	12 (10.4%)
RCA	570 (39.4%)	52 (45.2%)
LM	**5 (0.3%)**	**3 (2.6%)***
Graft	22 (1.5%)	1 (0.9%)
Characteristic of stenosis:		
Occlusion in IRA < 3 month**	1,036 (70.0%)	91 (77.8%)
Non-occlusive stenosis in IRA	416 (28.4%)	24 (20.5%)
Chronic occlusion***	12 (0.8%)	2 (1.7%)
Number of vessels with stenosis:		
1-vessel disease	**638 (43.9%)**	**39 (33.9%)†**
2-vessel disease	398 (27.4%)	31 (27.0%)
3-vessel disease	285 (19.6%)	24 (20.9%)
LM	**95 (6.5%)**	**17 (14.8%)***
No stenosis	36 (2.5%)	4 (3.5%)

*- $p<0.01$; † - $p<0.05$

Abbreviations: IRA, infarct-related artery; LAD, left anterior descendening coronary artery; LCX, left circumflex artery; LM, left main stenosis; RCA, right coronary artery.

** - acute IRA occlusion : (less than three months prior to admission),

*** - chronic occlusion (more than three months before admission), as defined by SCAAR registry.

Table 3. Clinical factors associated with VF during acute STEMI

Charasteristics at admission	Univariate analysis			Multivariate analysis		
	HR	95% CI	p-value	HR	95% CI	p-value
Current smoking	1.79	1.06-3.05	0.03	2.82	1.50-5.31	0.001
Previous MI	2.14	1.39-3.30	0.001	-	-	-
Medications:						
Aspirin	2.03	1.38-3.01	< 0.001	-	-	-
Statins	1.78	1.16-2.73	0.008	-	-	-
B-blockers	2.32	1.57-3.42	< 0.001	2.54	1.59-4.05	<0.001
Digitalis	3.35	1.24-9.06	0.017	4.57	1.54-13.53	0.006
Left main stenosis	2.52	1.44-4.39	0.001	3.04	1.58-5.85	0.001
Creatinine >80 mmol/L	1.63	1.08-2.39	0.019	-	-	-

Abbreviations: MI, myocardial infarction; Left main stenosis, left main coronary artery stenosis

Table 4. Clinical trials on prognostic impact of VF during acute STEMI

Author	Year of publication	Treatment strategy	Population type	Sample size	Arrhythmia	Time of follow-up
Schwartz P.[12]	1985	No reperfusion therapy	Non-selected	7,486	Primary VF	5 years
Behar S.[3]	1990	No reperfusion therapy	Non-selected	5,839	Primary VF	1 year
Nicod P.[7]	1988	No reperfusion therapy	Non-selected	2,088	Primary VF	1 year
Volpi A.[8]	1989	Thrombolysis	GISSI	6,337	Primary VF	1 year
Newby K.H.[5]	1998	Thrombolysis	GUSTO I	40,895	Sustained VT, VF	1 year
Piccini J.P.[6]	2008	Primary PCI	Non-selected	9,015	Sustained VT, VF	In-hospital
Metha R.H.[14]	2009	Primary PCI	APEX AMI	5,745	Sustained VT, VF	90 days
Metha R.H.[13]	2004	Primary PCI	PAMI	3,065	Sustained VT, VF	1 year

Figure 1.

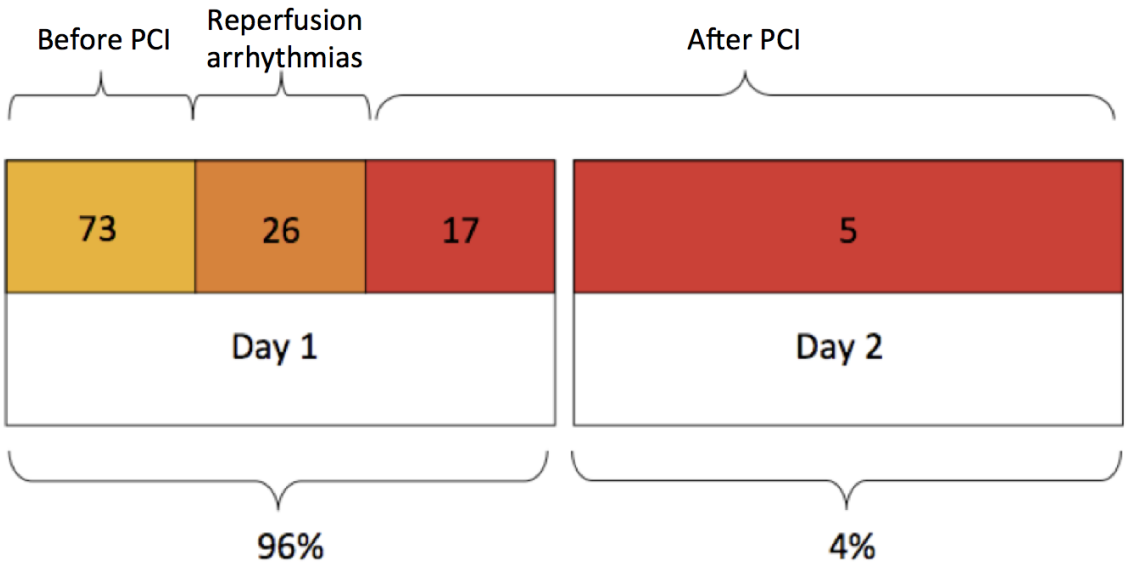

Before PCI
Reperfusion arrhythmias
After PCI
73
26
17
5
Day 1
Day 2
96%
4%

Figure 2.

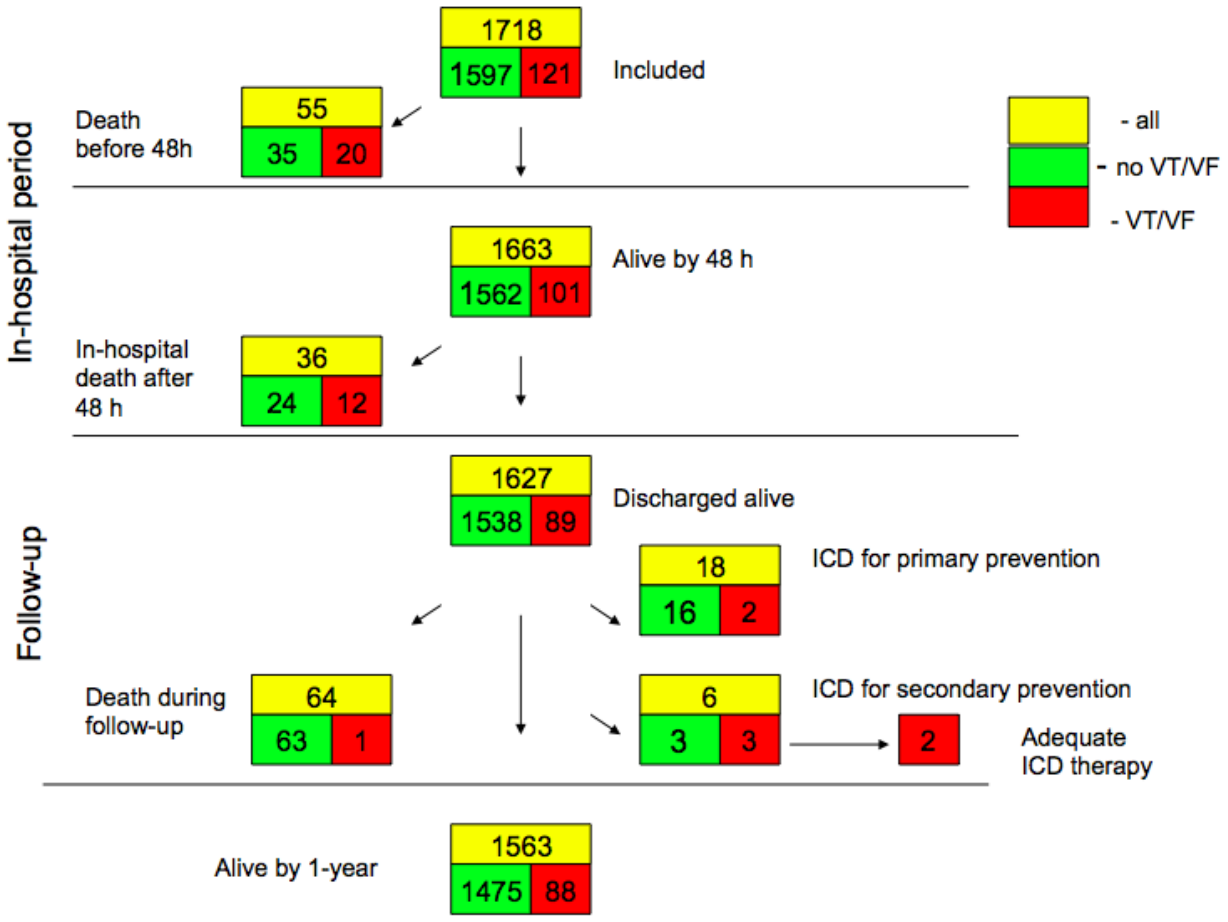
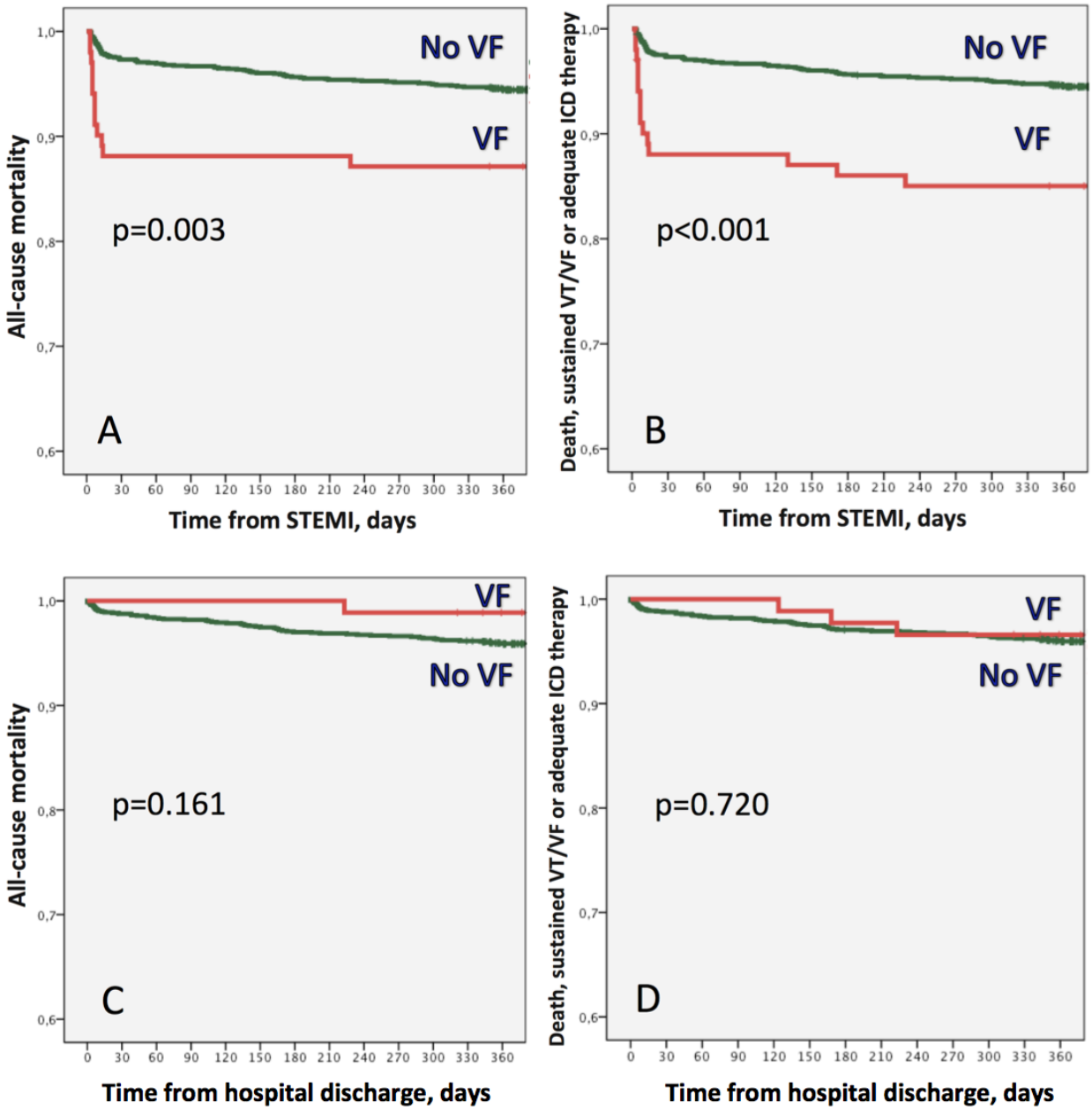

1718
1597
121
Included
55
35
20
Death before 48h
- all
- no VT/VF
- VT/VF
In-hospital period
1663
1562
101
Alive by 48 h
36
24
12
In-hospital death after 48 h
1627
1538
89
Discharged alive
18
16
2
ICD for primary prevention
Follow-up
64
63
1
Death during follow-up
6
3
3
ICD for secondary prevention
2
Adequate ICD therapy
Alive by 1-year
1563
1475
88

Figure 3.


All-cause mortality
No VF
VF
p=0.003
A
Time from STEMI, days
Death, sustained VT/VF or adequate ICD therapy
No VF
VF
p<0.001
B
Time from STEMI, days
All-cause mortality
VF
No VF
p=0.161
C
Time from hospital discharge, days
Death, sustained VT/VF or adequate ICD therapy
VF
No VF
p=0.720
D
Time from hospital discharge, days