Outcome up to one year following different reperfusion strategies in acute ST-segment elevation myocardial infarction: The Helsinki-Uusimaa Hospital District registry of ST-Elevation Acute Myocardial Infarction (HUS-STEMI)

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Abstract

Aims: Current guidelines prefer primary percutaneous coronary intervention (pPCI) over fibrinolysis in the treatment of acute ST-elevation myocardial infarction (STEMI). Pre-hospital fibrinolysis followed by early invasive evaluation is an alternative that we have used in patients presenting within three hours of symptom onset. We made a survey of patients suffering an acute STEMI over one year to assess mortality and adverse events following either pPCI or fibrinolysis.

Methods and results: Of the 448 consecutive STEMI patients, 194 were treated with pPCI and 176 underwent fibrinolysis; 78 patients received no reperfusion treatment within 12 hours (NRT group). The median TIMI risk scores were 4.0, 3.0 and 4.0 in the pPCI, fibrinolysis and NRT groups, respectively ($p < 0.001$). Mortality at one year was 14.4% following pPCI, 5.1% following fibrinolysis and 12.8% in the NRT group ($p = 0.011$ across all groups and $p = 0.003$ between pPCI and fibrinolysis, adjusted for differences in risk factors). The one-year composite of cardiovascular death, stroke, reinfarction and new revascularization was 20.1%, 18.2% and 26.9% for the pPCI, fibrinolysis and NRT groups, respectively ($p = \text{NS}$). In patients presenting within three hours of symptom onset, one-year mortality was 3.7% in the fibrinolysis group ($n = 163$) and 15.3% in the pPCI group ($n = 118$) (adjusted $p = 0.001$), while the composite of adverse events was 16.6% in the former group and 19.5% in the latter ($p = \text{NS}$).

Conclusion: Pre-hospital fibrinolysis followed by routine early invasive evaluation provides an excellent reperfusion strategy for low-risk STEMI patients presenting early after symptom onset.

Keywords

Myocardial infarction, primary angioplasty, fibrinolysis

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Introduction

Current guidelines recommend primary percutaneous coronary intervention (pPCI) for the treatment of an acute ST elevation myocardial infarction (STEMI) if performed within 2 h from diagnosis in all patients and in less than 90 min in patients presenting within 2 h of symptom onset.¹ Fibrinolysis (FL) is recommended in the absence of contraindications if pPCI cannot be completed within these time limits. These guidelines are based on randomized

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trials showing that pPCI is superior to in-hospital FL in reducing mortality, re-infarction and stroke in acute STEMI.² The superiority of pPCI has been shown even in patients transferred to a pPCI-centre from a non-invasive hospital with treatment delays of up to 2 h.³ These trials were, however, done before the implementation of routine early invasive evaluation after FL.

The CAPTIM trial compared pre-hospital FL with pPCI and found no overall advantage from pPCI when FL was followed by frequent invasive treatment during the same hospitalization.⁴ In patients presenting within 2 h of symptom onset, the CAPTIM data even suggested a mortality benefit from pre-hospital FL.⁵ Recently, a French STEMI registry reported equal results from pPCI and FL with frequent use of pre-hospital FL for early presenters and with routine invasive evaluation following FL.⁶

We report here the results of a comprehensive one-year STEMI registry in our area where pre-hospital FL followed by routine early invasive evaluation has been an accepted treatment strategy in low risk early presenters for several years. Our findings, too, support the utility of FL in this subgroup of STEMI.

Methods

Infrastructure and local guidelines

The Hospital District of Helsinki and Uusimaa (HUS) covers a population of 1.49 million in southern Finland around the city of Helsinki. Only Meilahti hospital in the city of Helsinki provides a 24/7 PCI-service and is responsible for all PCIs for STEMI. The area is covered by an emergency medical service (EMS) with ambulance personnel and physicians using telefax-ECG to consult the PCI centre regarding diagnosis and treatment and trained to give FL by the cardiologist's decision. Each pPCI-operator participating in the study performed at least 100 procedures annually.

According to local guidelines, patients with a haemodynamically stable acute STEMI presenting within 3 h from chest pain onset could be treated with FL if this was not contraindicated. The remaining patients were recommended pPCI if it could be performed within 90 min from presentation. At presentation, all FL patients were to receive aspirin (250mg intravenously (i.v.)), and patients under 75 years of age were also to be given enoxaparine 30mg i.v. and 300 mg of clopidogrel orally. The criteria for a successful FL were relief of pain with decrease of ST-segment elevation by 50% within 60 min or by 70% within 90 min. If FL was not successful, immediate rescue PCI was recommended. After a successful FL, coronary angiography was to be done within 1–2 days. At presentation, all pPCI patients were to receive aspirin (250mg i.v.), enoxaparine 30mg i.v., a 0.25mg/kg bolus of abciximab i.v. (eptifibatide or tirofiban could be used alternatively) and 600mg clopidogrel orally.

Study patients and data collection

We enrolled consecutive STEMI patients in our area from 13 June 2007 to 12 June 2008. The criteria for STEMI-diagnosis were acute chest pain with either 1) ST-elevations of ≥ 2 mm in at least two of the leads V1–3 or 2) ST-elevations of ≥ 1 mm in at least two other leads (V4–6, V8, V4R, I, aVL, II, III, avF) or 3) new left bundle branch block. The patients had to meet these criteria, give a written informed consent and live permanently in the HUS-district. To ensure complete coverage, we also searched in retrospect the hospital files for patients admitted for STEMI but having escaped our prospective recruitment. They were contacted later by letter and phone regarding consent and information about later events. The follow-up time after the index hospitalization was at least one year.

The study was approved by the ethical board of the HUS district and was performed according to the criteria of the Helsinki declaration.

Definitions of study endpoints and patient groups

The primary endpoints were all-cause mortality at 30 days and one year following the index STEMI. The secondary endpoints were: 1) cardiovascular mortality, 2) a composite of major adverse cardiovascular events (MACEs) consisting of cardiovascular death, non-fatal myocardial infarction, non-fatal stroke and a new revascularization procedure, as well as 3) in-hospital severe or life-threatening bleeding. Myocardial infarction was defined according to current international guidelines.⁷ Stroke was defined as any focal neurological deficit of ischaemic or haemorrhagic origin lasting for longer than 24 h. Bleedings were classified and reported according to Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries (GUSTO) criteria.⁸

The predefined time points for the assessment of treatment delays were the onset of pain, the first diagnostic ECG (considered as the time of presentation), the start of FL, the arrival at the referring hospital, the start of transportation and arrival at the PCI centre, the start of angiography and the start of PCI.

Statistical analysis

For analysis purposes the patients were divided into three predefined groups of reperfusion therapy: 1) urgent coronary angiography with an intention to perform pPCI, 2) immediate FL supported by rescue PCI if needed and followed by early invasive evaluation and 3) the no reperfusion group (NRT), defined as no attempt at reperfusion or invasive evaluation within 12 h of pain onset. Continuous variables are described using medians or means. For age, interquartile (25th and 75th percentiles) ranges (IQRs) are

Table 1. Baseline characteristics, cardiovascular risk factors, prior cardiovascular diseases, revascularizations and medications at presentation.

	pPCI	FL	NRT	p-value	
	n=194	n=176	n=78	Overall	pPCI vs. FL
Mean age, years (IQR)	65 (56–75)	64 (56–72)	65 (55–77)	0.65	0.39
Age>75	46 (24)	31 (18)	23 (30)	0.09	0.15
Male sex	126 (65)	126 (72)	47 (60)	0.16	0.17
Diabetes	30 (15)	31 (18)	21 (27)	0.08	0.58
Current smoker	67 (36)	74 (43)	27 (36)	0.70	0.18
Hypertension	123 (63)	103 (59)	48 (62)	0.63	0.34
Dyslipidaemia	87 (45)	95 (54)	35 (45)	0.08	0.08
Renal dysfunction ^a	26 (13)	9 (11)	16 (21)	0.11	0.44
CHF	9 (4.6)	9 (5.1)	4 (5.1)	0.97	0.83
STEMI	24 (12)	24 (14)	7 (9.0)	0.10	0.72
Stroke	17 (8.8)	3 (1.7)	8 (10)	0.02	0.003
CABG	8 (4.1)	4 (2.3)	2 (2.6)	0.57	0.32
PCI	19 (9.8)	17 (9.7)	3 (3.8)	0.25	0.97
ASA	45 (23)	44 (25)	23 (29)	0.56	0.66
Clopidogrel	4 (2.1)	4 (2.3)	2 (2.6)	0.97	0.89
Warfarin	18 (9.3)	4 (2.3)	5 (6.4)	0.02	0.004
Beta blocker	60 (31)	49 (28)	20 (26)	0.69	0.56
ACEi/ARB	57 (29)	49 (28)	25 (32)	0.81	0.77
Statin	36 (19)	47 (27)	14 (18)	0.18	0.06
Ca-blocker	24 (12)	24 (14)	13 (17)	0.21	0.08

The data are numbers (percentages) of patients unless indicated otherwise.

pPCI: primary percutaneous coronary intervention; FL: fibrinolysis; NRT: no reperfusion group; IQR: interquartile range; CHF: congestive heart failure; STEMI: ST-elevation myocardial infarction; CABG: coronary artery bypass intervention; ASA: acetylsalicylic acid; beta blocker: beta receptor blocking agent; ACEi: angiotensin converting enzyme inhibitor; ARB: angiotensin II receptor blocker; Ca-blocker: calcium blocking agent; TIMI: thrombolysis in myocardial infarction.

^aEstimated glomerular filtration rate <60 ml/min per 1.73 m².

shown. For continuous endpoint variables 95% confidence intervals (CIs) are shown. Categorical variables are described with absolute (number) and relative (percentage) frequency distribution. Statistical analyses across the groups were done with the chi square test for categorical variables, ANOVA for continuous variables and Kaplan–Meier and Cox regression analyses for mortality, cardiovascular mortality and MACE adjusting for differences in age, sex, diabetes, previous acute coronary syndrome, previous congestive heart failure, renal function at presentation, Killip class and presentation delay. The proportional hazards assumption was examined graphically by inspecting the log–log plots and no violations were found. For one-year mortality a propensity score matching was performed using covariates mentioned above. One-year mortality was also analysed in individual age tertiles. For all tests $p < 0.05$ was considered significant. IBM SPSS Statistics version 19.0 was used for analyses.

Results

In total, 329 patients were enrolled during the prospective recruitment period from 13 June 2007 to 12 June 2008. Of

them, six patients were excluded later; four lived permanently outside the study district and two did not fulfil the predefined ECG criteria for STEMI. Additionally, 136 patients were recognized afterwards from the hospital files. Of them, 11 patients were excluded; seven were not able to conduct independent life due to comorbidities, three did not fulfil the ECG-criteria for STEMI and one patient had STEMI secondary to severe gastrointestinal (GI)-bleeding. Thus, altogether 448 STEMI patients were included in the present analyses. Their baseline characteristics and treatments during hospitalization are shown in Tables 1 and 2.

Age, gender, cardiovascular risk factors or prior coronary artery disease did not vary statistically significantly across the groups but the prevalence of prior stroke was lower in the FL group than in the pPCI and NRT groups. The TIMI risk score was lowest in the FL group. Most patients in all three groups received aspirin, clopidogrel and low molecular weight heparin. Glycoprotein IIb/IIIa inhibitors were administered less often in the FL group than in the other two groups (Table 2).

All patients in the pPCI group underwent coronary angiography and 87% underwent PCI. As expected, these figures were statistically significantly higher than the rates of

Table 2. Clinical characteristics and acute treatment.

	pPCI	FL	NRT	p-value	
	n=194	n=176	n=78	Overall	pPCI vs. FL
Anterior STEMI	88 (47)	8 (46)	37 (48)	0.91	0.63
TIMI score (mean/median)	3.9/4.0	3.2/3.0	4.5/4.0	<0.001	0.003
Killip class >I	25 (13)	12 (6.8)	8 (10)	0.18	0.05
Killip class IV	11 (5.7)	6 (3.4)	3 (3.8)	0.54	0.30
Angiography	194 (100)	164 (93)	64 (82)	<0.001	<0.001
3VD	30 (15)	27 (16)	13 (20)	0.66	0.80
LMD	12 (6.2)	7 (4.3)	3 (4.7)	0.70	0.42
PCI	168 (87)	122 (69)	52 (67)	<0.001	<0.001
LAD-PCI (of all PCI)	81 (48)	59 (48)	26 (50)	0.97	0.98
Use of stents (of all PCI)	146 (87)	112 (92)	50 (96)	0.11	0.19
Use of DES (of stents)	25 (17)	17 (15)	8 (16)	0.92	0.68
CABG	10 (5.2)	12 (6.8)	4 (5.1)	0.76	0.50
Clopidogrel loading dose	134 (70)	131 (75)	50 (66)	0.31	0.32
Clopidogrel during hospitalization	178 (92)	162 (92)	67 (86)	0.25	0.92
ASA during hospitalization	189 (97)	173 (98)	78 (100)	0.35	0.56
GP-blocker during hospitalization	171 (88)	69 (39)	53 (68)	<0.001	<0.001
LMWH during hospitalization	188 (97)	176 (100)	77 (99)	0.06	0.02
Inotropic agents during hospitalization	40 (21)	27 (15)	15 (20)	0.41	0.19

pPCI: primary percutaneous coronary intervention; FL: fibrinolysis; NRT: no reperfusion group; 3VD: three vessel disease; LMD: left main coronary artery disease; LAD-PCI: percutaneous intervention to left anterior descending artery; DES: drug-eluting stent; CABG: coronary artery bypass intervention; ASA: acetylsalicylic acid; GP-blocker: glycoprotein IIb/IIIa inhibitor; LMWH: Low Molecular Weight Heparin.

Table 3. Mortality, adverse cardiac events and bleeding complications.

	pPCI	FL	NRT	pPCI vs. FL	
	n=194	n=176	n=78	p-value	Hazard ratio (95% CI)
30-day mortality	18 (9.3, 5.2–13)	8 (4.6, 1.4–7.7)	7 (9.0, 2.5–16)	0.08 (0.08)	2.7 (0.9–7.5)
One-year mortality	28 (14, 9.4–19)	9 (5.1, 1.8–8.4)	10 (13, 5.2–20)	0.003 (0.003)	4.1 (1.6–10)
One-year CV death	21 (11, 6.4–15)	9 (5.1, 1.8–8.4)	7 (9.0, 2.5–16)	0.04 (0.06)	2.8 (1.0–7.5)
One-year MACE	39 (20, 14–26)	32 (18, 12–24)	21 (27, 17–37)	0.64 (0.80)	1.1 (0.6–1.9)
In-hospital bleeding	5 (2.6, 0.3–4.8)	6 (3.4, 0.7–6.1)	1 (1.3, 0.0–3.8)	0.64	0.8 (0.2–2.4)

The data are numbers of patients (with percentages and their 95% confidence intervals (CIs)) unless indicated otherwise. The p-values in parentheses are adjusted for age, sex, diabetes, renal function, previous acute coronary syndrome, previous congestive heart failure, Killip class and presentation delay. Hazard ratio is for the comparison of pPCI category with FL category. For in-hospital bleeding odds ratio is given.

pPCI: primary percutaneous coronary intervention; FL: fibrinolysis; NRT: no reperfusion group; CI: confidence interval; CV: cardiovascular; MACE: major cardiac event; In-hospital bleeding: GUSTO severe or life-threatening bleeding during primary hospitalization; GUSTO: Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries.

invasive procedures in the FL and NRT groups (see Table 2). In the FL group, rescue PCI was done in 31% of the patients and in total 69% underwent PCI during the index hospitalization (Table 2).

All delays associated with diagnosis and treatment were shortest in the FL group and longest in the NRT group. The median time from symptom onset to diagnostic ECG was 115 min in the pPCI group, 53 min in the FL group and 591 min in the NRT group ($p<0.001$ both across all groups and between pPCI and FL). The median time from symptom onset to start of reperfusion treatment was 240 min in the pPCI and 90 min in the FL group ($p<0.001$). Sixty-five

patients (33.5%) in the pPCI group were transferred from a local hospital to the PCI centre. The median time from diagnostic ECG to angiography was 146 min in them versus 97 min in the non-transferred pPCI group ($p<0.001$).

The fibrinolytic agent was reteplase in 76% of the patients; other fibrin-specific agents were used in the remaining cases. FL was given pre-hospitally in 80% of the patients. The median delay from ECG to thrombolysis was 27 min. The median time from FL to angiography was 17 h in the whole FL group and 123 min if the indication was rescue PCI following an unsuccessful FL. At discharge, statins were used in 95%, 98% and 95% of the patients in

Figure 1. Kaplan–Meier curves for one-year mortality. Dashed line is primary PCI (pPCI), solid line is fibrinolysis (FL). The difference is statistically significant ($p=0.03$, log rank test).

pPCI, FL and NRT groups respectively ($p=0.192$ between the groups), beta blockers in 89%, 93% and 97% of the patients ($p=0.086$) and angiotensin-converting enzyme inhibitors or angiotensin receptor blockers in 86%, 87% and 83% of the patients ($p=0.763$). The median duration of primary hospitalization was six, seven and eight days for pPCI, FL and NRT groups, respectively ($p=0.03$).

The figures for mortality and adverse cardiac events are summarized in Table 3. Survival curves for pPCI and FL groups are shown in Figure 1. The data show statistically significant differences in one-year all-cause and cardiovascular mortalities across the groups even after adjustment for differences in baseline characteristics and risk factors. When treatment groups were divided into age tertiles, the difference between the treatments was not statistically significant but still apparent, favouring thrombolysis in all age tertiles; p -values were 0.36, 0.84, 0.05 and 0.15 respectively in the first, second, third and fourth tertiles. Similarly the mortality difference remained unchanged, favouring FL over pPCI in different risk quartiles according to propensity score matching, albeit not statistically significant in individual quartiles. The differences in one-year MACE or bleeding complications were not statistically significant. There were four, three and two cases of non-fatal stroke, four, seven and two cases of non-fatal myocardial infarction and 11, 17 and 10 cases of new revascularizations in pPCI, FL and NRT groups, respectively, with no statistically significant differences between the groups. There was one fatal and one non-fatal intracranial bleeding, both in the FL group. In the pPCI group, mortality did not differ between transferred and non-transferred patients.

In total, 304 patients presented within 3 h from the onset of symptoms, 118 in the pPCI group, 163 in the FL group and 23 in the NRT group. Comparing the pPCI and FL groups, we found that the pPCI group had a higher thrombolysis in myocardial infarction (TIMI) risk score (medians, 4.0 vs. 3.0, $p=0.037$) and a higher prevalence of previous stroke (8.5% vs. 1.9%, $p=0.009$) but no other statistically significant differences in baseline characteristics (Table 4). The median delay from symptom onset to ECG was 59 min in the pPCI group versus 52 min in the FL group ($p=0.026$), and the median time from onset of pain to the start of reperfusion treatment, 178 min in the former group versus 90 min in the latter ($p<0.01$). Percutaneous angioplasty was performed within 90 min from the diagnostic ECG in 23% of the patients in the pPCI group. One year mortality among these patients was 3% compared with 13% in the pPCI patients with longer delay. However, the difference was not statistically significant ($p=0.10$). The use of glycoprotein IIb/IIIa inhibitors was more frequent among pPCI patients (89%) than FL patients (38%, $p<0.01$). PCI was done in 87% vs. 68% of patients in the pPCI and FL groups, respectively ($p<0.001$). Table 5 summarizes the figures for mortality and adverse cardiac events during follow-up. The data show that mortality at one year was statistically significantly lower in the FL group even after adjustment for differences in clinical characteristics and the TIMI risk score.

Discussion

In this paper we report results of a comprehensive one-year survey of consecutive acute STEMI patients in an area of

Table 4. Baseline characteristics and treatments among patients presenting within three hours from symptom onset in the pPCI and FL groups.

	pPCI n=118	FL n=163	p-value
Mean age, years (IQR)	65 (55–74)	63 (55–71)	0.29
Age>75	28 (24)	25 (15)	0.08
Male sex	75 (64)	117 (72)	0.15
Diabetes	17 (15)	28 (17)	0.54
Current smoker	39 (35)	70 (43)	0.35
Hypertension	68 (58)	91 (56)	0.75
Dyslipidaemia	51 (44)	86 (53)	0.13
Prior CHF	7 (5.9)	7 (4.3)	0.53
Prior STEMI	14 (12)	21 (13)	0.12
Prior PCI	8 (6.8)	12 (7.4)	0.20
Prior CABG	5 (4.3)	1 (0.6)	0.20
Prior stroke	10 (8.5)	3 (1.9)	0.01
Renal dysfunction	17 (14)	14 (8.6)	0.12
TIMI risk score at presentation (mean/median)	3.7/4.0	3.1/3.0	0.04
Killip class >I	13 (11)	10 (6.2)	0.13
Killip class IV	6 (5.2)	6 (3.7)	0.54
Angiography	117 (100)	152 (93)	0.006
3VD	16 (14)	25 (16)	0.53
LMD	9 (7.7)	7 (4.6)	0.29
PCI	102 (87)	110 (68)	<0.001
LAD-PCI (of all PCI)	57 (56)	55 (50)	0.34
Stent (of all PCI)	85.4 (88)	91.0 (101)	0.21
DES (of all stents)	14 (16)	17 (17)	0.86
CABG	6 (5.1)	12 (7.4)	0.27

The data are numbers (percentages) of patients unless indicated otherwise.

pPCI: primary percutaneous coronary intervention; FL: fibrinolysis; IQR: interquartile range; CHF: congestive heart failure; STEMI: ST-elevation myocardial infarction; CABG: coronary artery bypass intervention; TIMI: thrombolysis in myocardial infarction; 3VD: three vessel disease; LMD: left main coronary artery disease; LAD-PCI: percutaneous intervention to left anterior descending artery; DES: drug-eluting stent; CABG: coronary artery bypass intervention

southern Finland. We found that FL was used nearly as frequently as pPCI and resulted in a low one-year mortality rate (5.1%) without an excess risk of strokes or severe bleeding complications. The relatively high one-year mortality rate among patients undergoing pPCI (14.4%) was most likely due to their being later presenters and having a higher acute STEMI risk profile. Our findings support the idea that, in an era of generally preferred pPCI, FL followed by routine early invasive evaluation remains a useful STEMI treatment strategy in low risk patients presenting early after symptom onset.

The low mortality in our FL group is in line with results of the much larger FAST-MI registry's reporting of a 5.3% mortality rate at one year among patients treated with

pre-hospital FL and frequent early coronary angiography and PCI.⁶ Earlier USIC 2000 registry showed similar mortality rates for pre-hospital FL-treated patients.⁹ Likewise, in an analysis combining data from the CAPTIM and WEST studies, one-year mortality following FL was 4.6%.¹⁰ In contrast, a nationwide Swedish registry found one-year mortality rates of 10.3% for pre-hospital FL,¹¹ but the rate of early angiography and PCI following FL was clearly lower in the Swedish centres than in the French one⁶ or ours. However, another study from the same Swedish group reported a 7.2% one-year mortality rate in ambulance-transported pre-hospital FL patients under 80 years of age.¹² The combined CAPTIM and WEST data showed a post hoc mortality benefit of FL over pPCI when the presentation delay was less than 2 h.¹⁰ On the other hand, studies done without routine invasive evaluation after FL have shown pPCI to be superior to FL also in the early presenters.¹³ The recently published STREAM-trial is the only randomized study comparing pPCI and FL in an early phase of acute STEMI.¹⁴ The prognosis of FL-treated patients was comparable to pPCI-treated patients with a slight increase in intracranial bleeding in FL-treated patients. The results in FL-treated patients are in concordance with our findings, the 30-day mortality being 4.6% in the STREAM-trial as well as in our study. In our study delays to pPCI were significantly longer than in the STREAM trial, affecting adversely the outcome of pPCI-treated patients.

The usefulness of rescue PCI after failed FL has been shown in a randomized setting¹⁵ and such a procedure was done in almost one-third of our FL recipients. The median time from onset of FL to the rescue procedure was only 123 min. Overall, more than 90% of our FL recipients underwent angiography and nearly 70% underwent PCI with most of the procedures being done within 24 h of admission. We suppose – and our thoughts are supported by the CAPTIM and FAST-MI data^{4–6} – that our high early interventional activity and the rarity of severe bleeding complications were crucial in the favourable outcome of our FL recipients. Of note, the median TIMI score was 3.0 in our FL group versus 4.0 in the pPCI group, representing a 4.4% and 7.3% predicted 30-day mortality, respectively.¹⁶ Recent reports suggest a mortality benefit for pPCI over FL only in high-risk STEMI patients.^{17,18}

Our findings are in line with reports showing good clinical results from FL in the treatment of STEMI if it is started pre-hospitally and followed by early invasive evaluation.^{4–6} These experiences have important clinical consequences for regions with limited urgent access to PCI. Despite the increasing use of pPCI there are still many regions even in Europe where the penetration of pPCI is less than 50%.¹⁹ Development of STEMI treatment strategies based on pre-hospital FL and transfer to a centre where an emergent or early invasive evaluation is possible offer a practical and efficient option in these areas.

Table 5. Mortality, adverse cardiac events and bleedings among patients presenting within three hours from the symptom onset.

	pPCI n=118	FL n=163	p-value	Hazard ratio (95% CI)
30-day mortality	11 (9.3, 4.0–14.7)	6 (3.7, 0.8–6.6)	0.05 (0.045)	3.1 (1.0–9.3)
One-year mortality	18 (15.3) (15, 8.7–22)	6 (3.7) (3.7, 0.8–6.6)	0.001 (0.001)	5.3 (1.9–15)
One-year CV death	12 (10, 4.6–16)	6 (3.7, 0.8–6.6)	0.028 (0.037)	3.4 (1.1–10)
One-year MACE	23 (20, 12–27)	27 (17, 11–22)	0.53 (0.48)	1.2 (0.7–2.2)
In-hospital bleeding	3 (2.5, 0–5.4)	4 (2.5, 0–4.9)	0.96	1.0 (0.2–4.5)

The data are numbers of patients (with percentages and their 95% confidence intervals (CIs)) unless indicated otherwise. The *p*-values in parentheses are adjusted for age, sex, diabetes, renal function, previous acute coronary syndrome, previous congestive heart failure, Killip class and presentation delay. For in-hospital bleeding the odds ratio is given.

pPCI: primary percutaneous coronary intervention; FL: fibrinolysis; CV: cardiovascular; MACE: MACE: major cardiac event; In-hospital bleeding: GUSTO severe or life-threatening bleeding during primary hospitalization

The strength of our survey is that we were able to generate a comprehensive and detailed picture of patients, treatments and outcomes of acute STEMI over a one-year period in our region. This was possible by combining prospective patient enrolment with retrospective scrutiny of admissions in the nine hospitals providing emergency care in our area. Our survey has several limitations, though. First and foremost, our local STEMI treatment guidelines resulted in an imbalance in delays and acute risk between the reperfusion groups. Therefore, the comparisons between the treatment strategies are likely to be biased and cannot be interpreted as showing superiority of FL over pPCI. Yet, we believe our survey reliably reflects real-life results from modern FL strategy in low-risk early presenters of STEMI. The one-year sample size was relatively small and does not allow analysis of clinical outcomes in important subgroups. A limitation is also the lack of reliable data on left ventricular function during the index hospitalization. Nearly one-fifth of STEMI patients did not get any reperfusion therapy within 12 h of symptom onset. This group was heterogeneous, but the main reason for not receiving reperfusion was patient-dependent delay in diagnosis; the median time from symptom onset to ECG was almost 10 h. The follow-up of patients ended four years ago. Since then, antithrombotic treatment of pPCI patients has developed significantly while fibrinolytic treatment has remained unaltered. Taking this development into account it is likely that the prognosis of pPCI patients would be better than during our study period.

To conclude, we observed a favourable clinical outcome from reperfusion with FL in early-diagnosed acute STEMI. Patients presenting within 3 h of symptom onset and receiving immediate FL had an all-cause on-year mortality of only 5.1%. Importantly, FL was followed by coronary angiography, and with PCI if needed, either as a rescue procedure or within 24 h of admission in most patients. Our results support the idea that FL followed by early invasive evaluation represents an effective treatment strategy for a considerable proportion of STEMI patients.

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Conflict of interest

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