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Reduced-Dose Fibrinolytic Acceleration of ST-Segment Elevation Myocardial Infarction Treatment Coupled With Urgent Percutaneous Coronary Intervention Compared to Primary Percutaneous Coronary Intervention Alone

Results of the AMICO (Alliance for Myocardial Infarction Care Optimization) Registry

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Objectives We sought to evaluate the impact of a strategy of reduced-dose fibrinolytic acceleration of ST-segment elevation myocardial infarction (STEMI) treatment followed by urgent percutaneous coronary intervention (FAST-PCI) on the mortality, reinfarction, and stroke rates in STEMI patients as compared with a primary percutaneous coronary intervention (PPCI) approach.

Background Time to reperfusion is a major determinant of mortality among STEMI patients. Rapid initiation of fibrinolytic therapy can shorten time to reperfusion, and mechanical therapy of the culprit lesion is known to be beneficial.

Methods Data from 2,869 STEMI patients treated in 5 high-volume percutaneous coronary intervention (PCI) centers were pooled for analysis. Mortality at 30 days was the primary end point. Death, reinfarction, and stroke were secondary end points, as were infarct-related artery TIMI (Thrombolysis In Myocardial Infarction) flow grade before PCI and shock on arrival to the catheterization laboratory.

Results Compared to PPCI, mortality at 30 days was significantly lower with FAST-PCI (3.8% vs. 6.4%, $p = 0.002$). The combined triple end point of death, reinfarction, or stroke was also less frequent (5.1% vs. 8.9%, $p < 0.0001$). The FAST-PCI patients had a lower incidence of Killip class IV (5.6% vs. 10.9%, $p < 0.0001$) and higher infarct-related artery TIMI flow grades (2.1 ± 1.2 vs. 1.1 ± 1.3, $p < 0.0001$) upon arrival in the catheterization laboratory. Stepwise logistic regression analysis demonstrated that FAST-PCI was an independent predictor of 30-day mortality (relative risk = 0.542, $p = 0.0151$).

Conclusions The FAST-PCI strategy reduced the mortality and combined end point of death, reinfarction, and stroke among STEMI patients, without increasing the risk of stroke or bleeding, compared to PPCI. Fibrinolysis before hospital admission also increased the initial infarct-related artery patency and decreased the likelihood of shock at presentation. (J Am Coll Cardiol Intv 2008;1: 504–10) © 2008 by the American College of Cardiology Foundation

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Despite advances in medications and interventional techniques, ST-segment elevation myocardial infarction (STEMI) remains a major cause of mortality in the U.S. Data from 3,377 hospitals nationwide show that the short-term (in-hospital) mortality is 8% among STEMI patients (1). Recent data also show that the mean time to percutaneous coronary intervention (PCI) is 253 min, and the mean time to hospital-administered fibrinolysis is 54 min (1). In a recent assessment of hospitals for adherence to national guideline recommendations, only 35% of hospitals were able to achieve door-to-balloon times within the recommended 90 min, and there has not been any real improvement in the door-to-balloon time in the nation during the last decade (2). Reducing the time from symptom onset to reperfusion (the ischemic time) is the major determinant for reducing 1-year mortality (3). In contemporary registries, mortality doubles as door-to-balloon time exceeds 2 h (4,5).

The current, widely accepted use of primary percutaneous coronary intervention (PPCI) or hospital-administered fibrinolytic therapy will not be sufficient to decrease the total ischemic time to <2 h. The use of a strategy of fibrinolytic acceleration of STEMI treatment coupled with urgent percutaneous coronary intervention (FAST-PCI) in which STEMI patients are identified and treated with reduced-dose fibrinolytic agents in the field or at STEMI referral hospitals, and then transported to the closest STEMI receiving center for urgent PCI, may offer an effective solution to the problem. Previous trials have demonstrated a decrease in mortality with pre-hospital fibrinolysis (6,7). Conversely, in a recent meta-analysis of facilitated PCI versus primary PCI in STEMI, Keeley at al. (8) concluded that facilitated PCI (fibrinolytic agents or glycoprotein IIb/IIIa inhibitors, administered just before or after hospital arrival) increased mortality and nonfatal myocardial infarction as well as risks of bleeding and stroke. This meta-analysis analyzed all the randomized trials regardless of the facilitator drug used, but the analysis was mainly driven by the ASSENT-4 (Assessment of the Safety and Efficacy of a New Treatment Strategy with Percutaneous Coronary Intervention for Acute Myocardial Infarction) trial (9). The ASSENT-4 trial compared PPCI to full-dose tenecteplase therapy before PCI for patients with STEMI. It was not designed to significantly shorten the ischemic time. The trial was stopped early because of increased mortality in the facilitated PCI arm, largely driven by an excess of stroke deaths.

There remains a need to better determine the impact of much shorter ischemic times than are achievable with currently practiced reperfusion strategies. We evaluated the impact of true pre-hospital administration of half-dose fibrinolytic therapy coupled with FAST-PCI on the mortality, reinfarction, and stroke rates among STEMI patients as compared with patients administered PPCI without fibrinolytic acceleration.

Methods

The 5 centers of the AMICO (Alliance for Myocardial Infarction Care Optimization) registry include the Minneapolis Heart Institute at Abbott Northwestern Hospital (T.D.H., D.M.L.) (10,11), Dartmouth Hitchcock Medical Center (M.S., N.W.N.), Leipzig Heart Center (H.T., G.S.) (12), Hartford Hospital (R.G.M.), and the University of Texas at Houston/Memorial Hermann Hospital (R.W.S., H.V.A., S.S., A.E.D.) (13,14). Data from their respective registries were obtained and merged into a master database. Each center received approval from their respective Institutional Review Boards for their protocols.

Study subjects. The definition of an eligible patient for inclusion varied slightly at each center but used conventional criteria of ST-segment elevation of ≥1 mm in 2 contiguous leads, and no obvious contraindications for fibrinolysis. Demographic, clinical, procedural, and outcome data were tabulated. There were 1,200 patients in the FAST-PCI group and 1,669 patients in the PPCI group. The types of fibrinolytic agents used were reteplase (52.8%), tenecteplase (39.4%), tissue-type plasminogen activator (2.5%), or unspecified (5.25%). The fibrinolytic agents were either administered in the field, during transfer, or at the transferring hospital, and not at the PCI center. The selection criteria for PPCI versus FAST-PCI in each center as well as the number of patients from each center are summarized in Table 1.

Abbreviations and Acronyms

FAST-PCI = urgent percutaneous coronary intervention
PCI = percutaneous coronary intervention
PPCI = primary percutaneous coronary intervention
Re-MI = recurrent myocardial infarction
STEMI = ST-segment elevation myocardial infarction
TIMI = Thrombolysis In Myocardial Infarction

Adjunctive agents. Local protocols dictated the use of aspirin, heparin, or low molecular weight heparin and clopidogrel in the field or at the transferring hospital for all patients.

End points. The primary end point for analysis was mortality at 30 days. The major secondary end point (at 30 days, except for Dartmouth Hitchcock Medical Center data, which had only in-hospital data for recurrent myocardial infarction [re-MI] and stroke rates) was the combination of death, re-MI, and stroke. Culprit artery Thrombolysis In Myocardial Infarction (TIMI) flow grade and Killip class IV (shock) on arrival, as well as the peak creatine kinase levels were pre-specified analytic end points.

Data analysis and statistical methods. Categorical variables are expressed as number and percentage of patients, and were tested for differences using the chi-square tests. Continuous variables are expressed as mean and standard deviation, and were tested for differences using Student *t* test.

Table 1. Selection Criteria and Contribution of Patients From Each Center

Center	Selection Criteria (Ref. #)	FAST-PCI (n)	PPCI (n)
DHMC	By geographic location and intended strategy with catheterization laboratory enrollment	250	100
Hartford	By geographical location of the patient	544	1,040
Houston MHH/HVI	Randomized PATCAR study (14)	55	72
Leipzig	Randomized study of FAST-PCI and PPCI patients from same dates not included in the study (11,12)	80	135
Minneapolis	By geographical location of the patient (11)	271	322

DHMC = Dartmouth Hitchcock Medical Center; FAST-PCI = fibrinolytic acceleration of ST-segment elevation myocardial infarction treatment followed by urgent percutaneous coronary intervention; MHH/HVI = Memorial Hermann Hospital Heart and Vascular Institute; PATCAR = Prehospital Administration of Thrombolytic Therapy with Urgent Culprit Artery Revascularization; PPCI = primary percutaneous coronary intervention.

Age, creatinine, hyperlipidemia, diabetes mellitus, gender, hypertension, smoking, and centers were entered as candidate independent variables for stepwise logistic regression analyses. Stepwise logistic regression was used to identify independent prognostic factors for 30-day death, stroke, MI, and the combination of these events. Stepwise logistic regression was done to identify predictors for decreased peak creatine kinase.

Results

There were 2,869 patients registered at the 5 different sites between 2001 and 2006. Of these, 1,200 were treated by FAST-PCI, receiving pre-hospital half-dose fibrinolysis coupled by immediate coronary angiography and PCI if appropriate. The remaining 1,669 were treated with PPCI alone.

Demographics. The demographics of the patient groups were representative of typical STEMI patient populations (Table 2). Importantly, patients with pre-hospital cardiac arrest and shock were not excluded. Patients undergoing fibrinolysis before hospital admission were slightly younger, with less frequent history of coronary artery bypass graft surgery and hypertension, and more of them were current smokers and had a history of hyperlipidemia. The groups were well matched in the number of prior MIs, prior PCIs, and the presence of diabetes mellitus. The baseline creatinine was 0.1 mg/dl higher in the group without pre-hospital fibrinolysis, but both groups had a normal baseline creatinine value.

Time to reperfusion. We were unable to determine the true symptom onset to reperfusion times in all of our patients. The initial medical contact to balloon time was used instead as a surrogate of time to reperfusion. The PPCI group had shorter initial medical contact to balloon times (168 ± 318 min in the PPCI group vs. 196 ± 263 min in the FAST-PCI group, $p = 0.012$). Median times were 110 min for the PPCI and 138 min for the FAST-PCI groups.

Findings on presentation to the STEMI center. The mean TIMI flow grade before the intervention was significantly higher in the FAST-PCI group of patients (2.1 ± 1.2 vs. 1.1 ± 1.3, $p < 0.0001$) compared with the PPCI patients. A significantly lower percentage of patients in the FAST-PCI group were in cardiogenic shock at presentation to the PCI hospital (5.6% vs. 10.9%, $p < 0.0001$) (Table 2). The total number of vessels diseased was 1.66 ± 0.84 in the FAST-PCI group and 1.59 ± 0.80 in the PPCI group ($p = 0.097$). (Data were available for 924 FAST-PCI and 1,336 PPCI patients). The left ventricular ejection fraction of the PPCI patients (n = 1,148) was slightly lower than that of the FAST-PCI patients (n = 754; 45.5 ± 12% vs. 46.5 ± 11%, $p = 0.019$).

Safety. The TIMI major bleeding rates between the two groups were slightly in favor of the FAST-PCI group: the PPCI group with a 6.53% and the FAST-PCI group with

Table 2. Baseline Characteristics of Patients Treated With and Without Pre-Hospital Fibrinolytic Therapy and Hospital Presentation and Course

Variables	FAST-PCI (n = 1,200)	PPCI (n = 1,669)	p Value
Baseline characteristics			
Age (yrs)	61 ± 12	63 ± 14	<0.0001*
Women	323 (27%)	524 (31%)	0.010
Prior PCI	109 (11%)	216 (14%)	0.093
Prior MI	162 (14%)	235 (14%)	0.672
Prior CABG	47 (4%)	113 (7%)	0.001
Hypertension	629 (53%)	963 (58%)	0.010
Smoking	554 (47%)	607 (37%)	<0.0001
Hyperlipidemia	620 (54%)	837 (51%)	0.089
Diabetes mellitus	223 (19%)	352 (21%)	0.108
Creatinine	1.0 ± 0.5	1.1 ± 0.8	0.005*
Cardiovascular disease	33 (4%)	76 (6%)	0.024
Family history	405 (43%)	503 (36%)	0.0004
Hospital presentation and course			
Killip class IV	5.6%	10.9%	<0.0001
TIMI pre-PCI	2.1 ± 1.2	1.1 ± 1.3	<0.0001†
Peak creatine kinase	1,299 ± 1,957	1,667 ± 2,247	<0.0001*
Intra-aortic balloon time	195.8 ± 262.8	168.1 ± 317.6	0.012
Glycoprotein IIb/IIIa use	57.6%	35.8%	<0.0001

Values are mean ± SD or n (%). *p Value based on Student *t* test; all others based on chi-square test. †p Value based on Wilcoxon rank-sum test.

CABG = coronary artery bypass graft surgery; FAST-PCI = fibrinolytic acceleration of ST-segment elevation myocardial infarction treatment followed by urgent percutaneous coronary intervention; MI = myocardial infarction; PCI = percutaneous coronary intervention; TIMI = Thrombolysis In Myocardial Infarction.

a 4.75% major bleeding rate (p = 0.044). There was no increase in the stroke rate (ischemic and hemorrhagic) in the FAST-PCI group compared with the PPCI group (1.4% vs. 1.1%, p = NS). The total number of intracranial hemorrhages was 7 of 1,200 (0.58%) in the FAST-PCI group and 4 of 1,669 (0.24%) in the PPCI group (p = 0.08).

Primary end points. The frequencies of death, re-MI, or new stroke among patients treated with and without reduced-dose pre-hospital fibrinolytic agents are given in Table 3 and Figure 1. There were fewer deaths, less reinfarction, and a lower combined end point with the strategy of using reduced-dose pre-hospital fibrinolysis.

Multivariate analysis. Pre-hospital reduced-dose fibrinolytic use was a significant independent predictor for 30-day survival after controlling the confounding effect of age, creatinine level, hyperlipidemia, and diabetes mellitus, with a 46% lower chance of death at 30 days compared with patients who were treated with PPCI. (Table 4).

Diabetes mellitus (p = 0.008) was the only significant independent prognostic factor for 30-day stroke. Previous cardiovascular disease (p = 0.019) was the only significant independent prognostic factor for 30-day re-MI.

Pre-hospital fibrinolysis was not a significant independent predictor for absence of any event (death, stroke, or re-MI) after controlling the confounding effect of age, creatinine, hyperlipidemia, and diabetes mellitus (Table 4). Pre-hospital fibrinolysis was a significant negative independent predictor for peak creatine kinase after controlling the confounding effects of age, creatinine, prior MI, and family history (Table 4).

Discussion

Current mortality among STEMI patients across the U.S. is approximately 8% or higher (1). Early treatment with either fibrinolysis (15) or primary PCI (3) is associated with a decrease in mortality that is correlated with reduced ischemic time. In an analysis of the National Registry of Myocardial Infarction database from 1992 to 2002, McNamara et al. (2) showed that fewer than one-half of the patients with STEMI receive reperfusion therapy within the published guidelines time frame, and there was no significant improvement in the mean time to reperfusion over the years. Boersma et al. (15) analyzed more than 50,000 patients receiving fibrinolytics for STEMI, in published trials that enrolled more than 100 patients between 1983 and 1993. They examined the proportional gain in mortality reduction with very early treatment (15). Their analysis suggested that with early treatment within 1 h of onset of symptoms, an additional 60 lives might be saved per 1,000 patients treated.

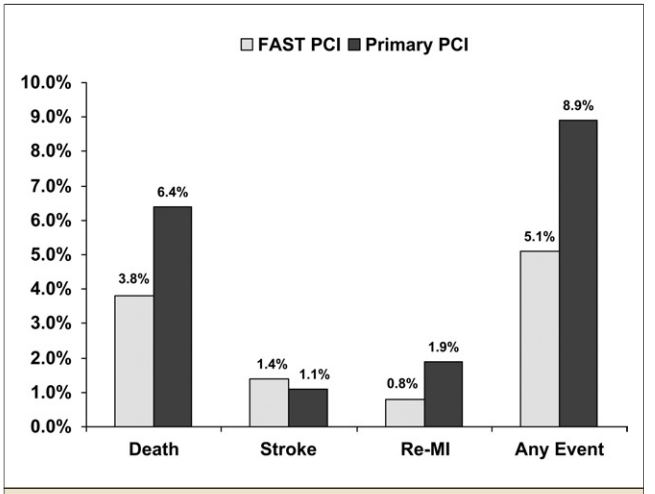

Figure 1. Univariate Analysis of Death, Recurrent Myocardial Infarction, Stroke, and Combined End Points With FAST-PCI Compared to PPCI

FAST-PCI = fibrinolytic acceleration of ST-segment elevation myocardial infarction treatment coupled with urgent percutaneous coronary intervention; PPCI = primary percutaneous coronary intervention; re-MI = recurrent myocardial infarction.

Table 3. 30-Day Outcomes

Variable	FAST-PCI (n = 1,200)	PPCI (n = 1,669)	p Value*	p Value†
Death	3.8%	6.4%	0.002	0.002
Stroke	1.4%	1.1%	0.416	0.808
Recurrent MI	0.8%	1.9%	0.013	0.0005
Any event‡	5.1%	8.9%	0.0001	<0.0001

*p Value based on chi-square test. †p Value based on Mantel-Haenszel test, controlling the effect of institutions. ‡Occurrence of any death, stroke, or MI (Dartmouth Hitchcock Medical Center provided in-hospital stroke and recurrent MI data).

PPCI = primary percutaneous coronary intervention; other abbreviations as in Table 2.

Table 4. Predictors of 30-Day Mortality, 30-Day Major Adverse Events, and Decreased Peak Creatine Kinase

Variable	RR	95% CI	p Value
Predictors of 30-day mortality			
Age	1.054	1.037–1.071	<0.0001
Serum creatinine	1.563	1.349–1.812	<0.0001
Hyperlipidemia	0.398	0.258–0.613	<0.0001
Diabetes mellitus	2.063	1.332–3.196	0.0012
Pre-hospital fibrinolysis	0.542	0.331–0.888	0.0151
Predictors of 30-day major adverse events*			
Age	1.051	1.036–1.066	<0.0001
Serum creatinine	1.481	1.287–1.705	<0.0001
Hyperlipidemia	0.495	0.342–0.717	0.0002
Diabetes mellitus	2.109	1.430–3.109	0.0002
Predictors of decreased peak creatine kinase			
Age	1.054	1.035–1.073	<0.0001
Serum creatinine	1.514	1.286–1.782	<0.0001
Hyperlipidemia	0.402	0.249–0.648	0.0002
Diabetes mellitus	2.341	1.457–3.762	0.0004
Pre-hospital fibrinolysis	0.536	0.315–0.913	0.0217

*Death, recurrent myocardial infarction, and stroke.

CI = confidence interval; RR = relative risk.

Infarct-related artery patency at presentation to the cardiac catheterization laboratory has been associated with better outcomes (16). Among 2,507 patients enrolled in 4 PAMI (Primary Angioplasty in Myocardial Infarction) trials undergoing PPCI for STEMI, patients who had TIMI flow grade 3 at presentation compared with patients who did not have TIMI flow grade 3 had better left ventricular ejection fraction (57 ± 10% vs. 53 ± 11%, p = 0.003) and were less likely to be in heart failure (7.0% vs. 11.6%, p = 0.009). Patients with initial TIMI flow grade 3 had significantly lower in-hospital rates of mortality, new-onset heart failure, and hypotension, and had a shorter hospital stay. Cumulative 6-month mortality was 0.5% in patients with initial TIMI flow grade 3, 2.8% with TIMI flow grade 2, and 4.4% with initial TIMI flow grade 0/1 (p = 0.009). By multivariate analysis, TIMI flow grade 3 before PCI was an independent determinant of survival (odds ratio: 2.1, p = 0.04), even when corrected for by post-procedural TIMI flow grade 3.

The use of fibrinolysis has been associated with a TIMI flow grade 3 rate of 32% to 54% (17) compared to a rate of 80% to 97% with PPCI (18). Fibrinolysis alone has also been associated with reocclusion (19), and this has been a major factor in the better outcomes with PPCI in STEMI trials compared to fibrinolysis.

We have recently demonstrated a reduced incidence of pre-hospital shock, improved infarct-related artery initial patency, and reduced ischemic time with pre-hospital, reduced-dose fibrinolysis coupled with urgent PCI compared with either pre-hospital fibrinolysis alone or PPCI (14). In the present study, with the combination of pre-hospital, reduced-dose fibrinolysis and pre-hospital notification of the cardiac catheterization team, the 30-day mortality of STEMI patients has been reduced by half with no increase in major bleeding complications.

Although the overall results were negative for facilitated PCI with full-dose fibrinolysis in the ASSENT-4 study, patients in that trial who received fibrinolysis in the ambulance had better outcomes (9). In the MITI (Myocardial Infarction Triage and Intervention) trial, the patients treated "very early" (within 70 min of symptom onset) with pre-hospital fibrinolysis had lower mortality (1.2% vs. 8.7%) and smaller infarct size (20). In a meta-analysis of pre-hospital fibrinolysis, it was shown that the time to reperfusion treatment was almost an hour shorter with pre-hospital administration than for the patients with in-hospital treatment, and all-cause mortality was significantly reduced (7). Currently, even in the best centers with the use of standard order sets for fibrinolytic agents or PPCI, a single phone call system, a central communication system for fast transfers and bypassing emergency department evaluation, the in-hospital mortality of patients with STEMI who had PPCI was 5.7% to 6.6% and the 30-day mortality was 7.1% to 7.2% (21).

Although PPCI as reperfusion therapy for STEMI is superior to fibrinolysis alone (18), the more widespread use of this mode of therapy is limited by the unavailability of primary angioplasty centers. With the widespread availability of fibrinolytic agents and the durability of PPCI for STEMI, it has been suggested that perhaps the combination of these two therapies might be the optimal treatment (22). The recently published ASSENT-4 PCI trial tried to address this issue. However, the use of glycoprotein IIb/IIIa inhibitors was not permitted in the facilitated PCI group except for bailout situations, and the use of clopidogrel was limited to the stented patients at the time of cardiac catheterization (9). Nevertheless, this trial showed that full-dose tenecteplase given 1 to 3 h before PCI for STEMI was associated with worse outcomes despite having higher infarct-related artery patency rates at presentation to the cardiac catheterization laboratory. There were 8 deaths from stroke in the fibrinolytic arm (and none in the PCI arm), with a total stroke rate of 1.8%. This is similar to the stroke rate reported in ASSENT-3 with the same fibrinolytic agent *23).

In the ASSENT-4 PCI trial, the patients with TIMI flow grades 0 to 2 before PCI in the facilitated PCI group were less likely to have TIMI flow grade 3 after the PCI. This finding might be attributed to the prothrombotic environment after fibrinolytic therapy as well as to the suboptimal antithrombin therapy in this trial (24). The major differences between the ASSENT-4 PCI trial and our study include the reduced dose of fibrinolytic agent, shorter symptom onset to treatment times, and upstream use of antiplatelet agents. Although this was not a randomized clinical trial, in this multicenter cohort of STEMI patients, we have demonstrated that reduced-dose fibrinolysis followed by urgent routine PCI reduces 30-day mortality, the combined end points of death, re-MI, and stroke, and also reduces peak creatine kinase and the incidence of shock at presentation, compared to a primary PCI strategy. The safety of this approach was also demonstrated by no increase in intracranial or major bleeding despite more frequent use of glycoprotein IIb/IIIa inhibitors in the FAST-PCI group.

Recently, the similarly sized and randomized FINESSE (Facilitated Intervention With Enhanced Reperfusion Speed to Stop Events) study was presented (25,26). In this trial, 2,452 patients with STEMI presenting less than 6 h after symptom onset, with 1 to 4 h estimated time to catheterization, were randomly assigned to in-hospital half-dose reteplase (patients <75 years of age) followed by PCI, or in-hospital abciximab bolus followed by PCI, or in-laboratory abciximab and PCI. When compared to our present study, the FINESSE trial did not use clopidogrel loading preintervention by protocol and used a double bolus (5-U + 5-U) fibrinolytic agent for most of the patients. The use of an abciximab bolus was also mandated by the protocol. Furthermore, the median time to balloon was

2.2 h in all patients, and the symptom onset to first bolus of reteplase was 165 min. Only 60% of the FINESSE patients were treated within 3 h of symptom onset, and of those who were treated within 3 h, there was a trend toward more clinical benefit with reteplase and abciximab combination treatment. None of the patients had pre-hospital administration of half-dose fibrinolysis, whereas all of our FAST-PCI patients did. The FINESSE study showed that the in-hospital administration of half-dose double bolus reteplase with abciximab bolus before urgent PCI in non–low-risk patients (inferior MI and <60 years of age) with STEMI did not have an additional benefit over primary PCI. Furthermore, the risk of nonintracranial TIMI major/minor bleeding was increased with the reteplase and abciximab combination approach, when compared to the primary PCI group (14.5% vs. 6.9%, respectively). Although ischemic stroke occurred in 0.5% of the patients in the facilitated groups of the FINESSE trial and in 0.9% of the patients in the primary PCI group, the intracranial hemorrhage rates were higher in the reteplase and abciximab combination group than in the PPCI group (0.6% vs. 0.1%). It is an intriguing finding in this trial, however, that none of the patients >75 years of age had an intracranial hemorrhage. Those patients received a single bolus of reteplase, which was similar in pattern but half the dose of our regimen.

Study limitations. This study was not randomized between the reduced-dose fibrinolytic acceleration of STEMI treatment coupled with urgent PCI, and primary PCI. Because of the nonrandomized nature of this study, there were some nontrivial differences in the baseline characteristics of the patients. There was no uniform study protocol, which would have provided a uniform definition of ischemic time (time from onset of symptoms to reperfusion) between the centers participating in the analysis. The patients in the 2 groups were treated in the same hospitals by the same physicians and the door-to-balloon times were not different between the groups, but there was a trend toward longer balloon times in the FAST-PCI group.

Conclusions

Our results show that it is feasible, safe, and effective to use a pre-hospital (before transfer), reduced-dose fibrinolytic agent coupled with effective antithrombotic treatment, followed by PCI for STEMI. These results with reduced-dose fibrinolytic acceleration of STEMI treatment coupled with urgent PCI further emphasize the need for an appropriately powered, randomized trial to test the hypothesis that this strategy will be more effective than PPCI alone for STEMI. It is possible that this strategy could further reduce STEMI-associated mortality.

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