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Primary versus facilitated percutaneous coronary intervention in acute myocardial infarction complicated by cardiogenic shock

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Abstract

Background: *Mortality in patients with cardiogenic shock (CS) due to acute myocardial infarction (MI) may be decreased by fibrynolytic therapy combined with intraaortic balloon counterpulsation or by invasive treatment, either with percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). The aim of the study was to compare in-hospital and long-term outcomes in patients with acute MI complicated by CS who were treated with primary or facilitated PCI.*

Methods: *Among 98 consecutive patients with acute MI complicated by CS, 93 patients were treated with PCI and 5 patients underwent CABG. Patients treated with PCI were divided into two groups: group I included 59 patients treated with facilitated PCI and group II included 34 patients treated with primary PCI. Patients in group II were older, had higher systolic and diastolic blood pressure, and more often presented with 1-vessel disease and previous MI, while 3-vessel disease was more common in group I (all $p < 0.05$).*

Results: *Immediate PCI success rate was similar in both groups (83% in group I vs. 74% in group II, p = NS), as was in-hospital mortality (41% vs. 36%, respectively, p = NS) and mortality rate in the cardiac catheterization laboratory (20% vs. 15%, respectively, p = NS). The need for repeated PCI was significantly more common in group I (22% vs. 3%, $p = 0.02$). The two groups did not differ with respect to the need for CABG or the rate of hemorrhagic complications. During one year follow-up, three deaths occurred in every group, including two patients in each group who died suddenly.*

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Conclusions: *Comparable immediate PCI success rate, in-hospital mortality, and long-term mortality were seen in patients with acute MI complicated by CS treated with primary or facilitated PCI. More coronary reinterventions were needed in patients treated with facilitated PCI compared to those treated with primary PCI.* (Folia Cardiol. 2006; 13: 384–389)

Key words: acute myocardial infarction, cardiogenic shock, primary percutaneous coronary intervention, facilitated percutaneous coronary intervention

Introduction

Cardiogenic shock (CS) is currently the major cause of death of patients with acute myocardial infarction (AMI) [1]. Some reports suggest that fibrinolytic therapy (FT) in patients with AMI might be associated with decreased incidence of CS [2, 3]. On the other hand, FT does not affect mortality in patients with AMI and established CS [4]. Mortality in patients with AMI complicated by CS may be decreased by FT combined with intraaortic balloon counterpulsation (IABP) or by invasive treatment, either with percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG) [5–9]. The role of FT in patients with AMI complicated by CS undergoing coronary angioplasty has not been defined. In particular, it is unclear whether FT should be administered in patients with established CS referred for PCI.

The aim of the study was: to compare immediate success rate and complications of primary versus facilitated PCI in patients with AMI complicated by CS, and to evaluate in-hospital and long-term mortality in these patients depending on whether they were revascularized with primary or facilitated PCI.

Methods

We studied 98 patients hospitalized in our center between January 1991 and October 1999 due to AMI within 6 hours from the onset of chest pain. Ninety-three patients were treated with PCI and 5 patients with left main coronary artery disease underwent CABG. Inclusion criteria, patient management on admission and in the cardiac catheterization laboratory, and details of long-term follow-up were presented previously [10]. Only patients undergoing PCI were included in the present analysis. Patients were divided into two groups: group I included patients treated with PCI following FT with streptokinase, i.e. fulfilling the current criteria of facilitated PCI, and group II included patients treated with primary PCI. The administration of FT in the referring hospital was left at the discretion of the treating physician, taking into account contraindications to FT and expected patient transfer time. The decision to administer FT was often made after a telephone consultation with a physician in our center. FT was initiated in the referring hospital and continued until angioplasty. Immediate PCI success was defined as TIMI 2–3 flow with < 50% residual stenosis [9].

Statistical analysis

Results are expressed as mean values ± standard deviation (SD) for continuous variables and numbers and percentages for categorical variables. Distribution of continuous variables was evaluated using Shapiro-Wilk test. Statistical significance of the differences in normally distributed continuous variables between the two groups was evaluated using Student t test. Categorical variables were compared using χ^2 test. Long-term survival in the two groups was evaluated using Kaplan-Meyer curves. Statistical significance of the differences in survival between the two groups was tested using Cox proportional hazards model. $P<0.05$ was considered statistically significant.

Results

Group I consisted of 59 patients (63%) including 43 men (73%), and group II consisted of 34 patients (37%) including 22 men (65%). Mean age was 53.2 years in group I compared to 61.7 years in group II ($p < 0.004$). Similarly, there were significantly more patients aged > 70 years in group II. Demographic and clinical characteristics of the two groups is shown in Table 1. The two groups differed significantly in systolic and diastolic blood pressure on admission (78/54 mm Hg in group I vs. 70/46 mm Hg in group II). Three-vessel disease was significantly more common in group I (34% vs. 12% in group II), while 1-vessel disease was significantly more common in group II (53% vs. 29% in group I). All patients in group I received streptokinase. Immediate PCI success rata was higher in group I (83%) than

Table 1. Demographic, clinical and angiographic characteristics of patients.

Variable	Overall (n = 93)	Facilitated PCI (n = 59)	Primary PCI (n = 34)	p
Age (years)	56.0 ±11.2	53.2 ± 10.0	61.7 ± 11.5	< 0.004
Age > 70 years	9 (10%)	1 (2%)	8 (24%)	< 0.002
Female	28 (30%)	16 (27%)	12 (35%)	NS
Male	65 (70%)	43 (73%)	22 (65%)	NS
Hypertension	42 (45%)	28 (47%)	14 (41%)	NS
Diabetes	18 (19%)	10 (17%)	8 (24%)	NS
Smoking	59 (63%)	41 (69%)	18 (53%)	NS
Hypercholesterolemia	28 (30%)	17 (28%)	11 (32%)	NS
Previous myocardial infarction	19 (20%)	8 (13%)	11 (32%)	0.03
Time from onset of chest pain [h]	3.9 ±1.6	4.0 ± 1.6	3.6 ± 1.7	NS
Site of myocardial infarction:				
anterior wall	55 (59%)	32 (54%)	23 (68%)	NS
inferior wall	38 (41%)	27 (46%)	11 (32%)	NS
Pulmonary edema on admission	19 (20%)	14 (24%)	5 (15%)	NS
Inotropic support on admission	61 (66%)	39 (66%)	22 (64%)	NS
Systolic blood pressure on admission	75.2 ±12.6	77.9 ± 11.0	70.4 ± 13.2	< 0.005
Diastolic blood pressure on admission	51.2 ±13.0	54.4 ± 13.3	46.0 ± 16.7	< 0.006
Need for temporary pacing	28 (33%)	14 (24%)	14 (41%)	NS
Need for defibrillation in cath lab	18 (21%)	10 (17%)	8 (24%)	NS
Need for external chest massage in cath lab	24 (26%)	13 (22%)	11 (32%)	NS
Need of ventilatory support in cath lab	28 (33%)	16 (27%)	12 (35%)	NS
Intraaortic balloon counterpulsation	33 (35%)	22 (37%)	11 (32%)	NS
Extent of coronary artery disease:				
1-vessel	35 (38%)	17 (29%)	18 (53%)	0.02
2-vessel	34 (36%)	22 (37%)	12 (35%)	NS
3-vessel	24 (26%)	20 (34%)	4 (12%)	0.02
Culprit vessel:				
left main	6 (6%)	4 (7%)	2 (6%)	NS
left anterior descendings	45 (49%)	25 (42%)	20 (59%)	NS
left circumflex	9 (10%)	8 (14%)	1 (3%)	NS
right coronary artery	33 (35%)	22 (37%)	11 (32%)	NS
TIMI flow before percutaneous coronary intervention				
TIMI 0	72 (77%)	44 (75%)	28 (82%)	NS
TIMI 1	6 (7%)	3 (5%)	3 (9%)	NS
TIMI 2	10 (11%)	8 (13%)	2 (6%)	NS
TIMI 3	5 (5%)	4 (7%)	1 (3%)	NS
TIMI flow after percutaneous coronary intervention				
TIMI 0	14 (15%)	7 (12%)	7 (20%)	NS
TIMI 1	2 (2%)	1 (2%)	1 (3%)	NS
TIMI 2	7 (8%)	4 (7%)	3 (9%)	NS
TIMI 3	70 (75%)	47 (79%)	23 (68%)	NS
Use of balloon perfusion cathethers	11 (12%)	7 (12%)	4 (12%)	NS
Use of stents	14 (15%)	11 (19%)	3 (9%)	NS

in group II (74%) but the difference was not significant (Table 2). In-hospital mortality was higher in group II (41% vs. 36% in group I), and mortality rate in the cardiac catheterization laboratory was higher in group I (20% vs. 15% in group II) but these differences were not significant. The need for repeated PCI during in-hospital follow-up was significantly more common in group I (22% vs. 3%, p = 0.02).

Table 2. Selected outcomes in patients treated with primary and facilitated percutaneous coronary intervention.

Outcome	Facilitated PCI (n = 59)	Primary PCI (n = 34)	p
Immediate angioplasty success (effective reperfusion)	49 (83%)	25 (74%)	NS
In-hospital deaths	21 (36%)	14 (41%)	NS
Deaths in the cath lab	12 (20%)	5 (15%)	NS
Need for repeated angioplasty	13 (22%)	1 (3%)	0.02
Hemorrhagic complications requiring transfusion	5 (9%)	3 (9%)	NS
Need for coronary artery bypass grafting	4 (7%)	3 (9%)	NS

PCI was repeated due to symptomatic restenosis in 3 patients in group I, and due to symptomatic reocclusion in the remaining 11 patients (including 10 patients in group I and 1 patient in group II). Five patients underwent repeat PCI during the first day, and the remaining patients in the subsequent days of hospitalization. The two groups did not differ with respect to the need for CABG required or the rate of hemorrhagic complications requiring transfusion. During one year follow-up, three deaths occurred in every group, including two patients in each group who died suddenly from cardiac causes. Figure 1 shows Kaplan-Meier survival curves.

Discussion

The use of FT is associated with the decreased incidence of CS [2, 3]. Primary PCI may also reduce the incidence of CS but no randomized studies comparing primary PCI with medical management in patients with AMI are available [11]. Some reports suggest decreased mortality in patients with AMI complicated by CS treated with FT and IABP [5–8]. Available data from the literature do not clarify the role of FT in patients undergoing revascularization. In a study by Berger et al. [12], who analyzed patients with CS in the GUSTO I trial, early coronary angiography and invasive treatment (PCI/CABG), if needed, were shown to decrease mortality compared to late or no coronary angiography. Sanborn et al. analyzed data from the SHOCK registry and suggested that the use of FT, IABP, and PCI/CABG in CS is associated with decreased mortality compared to medical management. With FT, mortality was decreased (54% vs. 64%, p = 0.005) regardless of the use of IABP. Significant differences in mortality were found between all four groups of patients (FT + IABP: 47%; IABP only: 52%; FT only: 63%; no FT and IABP: 77%), and invasive strategies were associated with improved survival in each groups [13]. The authors noted that these results may have been influenced by patient selection. In addition, they concluded that the best strategy to treat patients with AMI complicated by CS in a hospital without interventional facilities is probably to initiate FT, start IABP, and transfer the patient to a hospital with a cardiac catheterization laboratory [13]. Our findings show comparable immediate PCI success rate, in-hospital mortality, and long-term mortality in patients with AMI complicated by CS treated with primary or facilitated PCI. Similar findings were shown in the SHOCK trial that showed no additional benefit from FT in patients undergoing invasive treatment (PCI/CABG). In this randomized study, patients were randomly assigned to initially conservative or initially invasive treatment but not to FT or no FT. This study also showed the improved survival with FT in patients initially treated conservatively (with most patients also treated with IABP) [14].

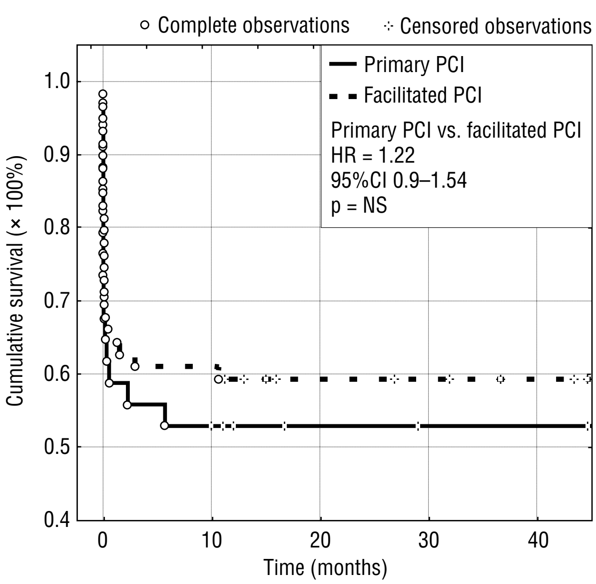

Figure 1. Kaplan-Meier cumulative survival curves in groups treated with primary and facilitated percutaneous coronary intervention.

In our study, the two groups of patients differed significantly in age and blood pressure on admission. Similar differences were seen by French et al. [14] who showed that patients treated with FT were younger and had higher blood pressure but that study compared patients treated invasively or conservatively, and in our study all patients underwent angioplasty. Our findings also show no significant difference in the rate of hemorrhagic complications requiring transfusion. Similarly, no difference in the rate of hemorrhagic complications was seen between patients receiving FT or no FT in the invasive group (PCI/CABG) in the study by French et al. [14] (36% vs. 36%). The rates of hemorrhagic complications in the latter trial were higher than in our study, most likely due to differences in the use of IABP. In our study, the use of IABP was less frequent, while nearly all patients in the SHOCK trial received IABP [14]. The study by French et al. [14] also suggests that the use of IABP in the invasive group significantly increases the rate of hemorrhagic complications — from 11% to 33% in patients not receiving FT and from 18% to 40% in patients receiving FT. Our findings, similarly to the study by French et al. [14], do not suggest that patients with AMI complicated by CS who are referred for invasive treatment, should additionally receive FT, as the latter seems to be associated with no additional benefits. Until now, no randomized studies have evaluated FT in patients with AMI complicated by CS who are treated invasively. Both in the study by French et al. [14] and in our study some patients received FT prior to the occurrence of CS but precise data regarding the percentage of such patients in our study is missing. In summary, our study shows that in patients with AMI complicated by CS who are treated invasively, FT does not improve survival but it is also not associated with increased risk of hemorrhagic complications.

Despite the use of FT in some patients we saw no difference in the rate of TIMI 2–3 flow in the initial angiogram. The rates of TIMI 2–3 flow before PCI in patients treated with facilitated or primary PCI in our study (20% vs. 9%, p = NS) were lower than in the study by French et al. [14] (58% vs. 43%, respectively, p = 0.03) [14]. Although no significant differences were shown in our analysis, lower percentage of patients with TIMI 2–3 flow in our study may be explained by shorter time from the onset of AMI to admission and coronary angiography compared to the SHOCK trial.

Main limitations of our study included lack of randomization to the evaluated strategies, single center nature of the study, and low numbers of patients in the study groups. In addition, low use of stents, in contrast to the current clinical practice, might have affected the rate of repeated PCI.

Conclusions

1. Comparable immediate PCI success rate, in-hospital mortality, and long-term mortality were seen in patients with AMI complicated by CS treated with primary or facilitated PCI.
2. More coronary reinterventions were needed in patients treated with facilitated PCI compared to those treated with primary PCI, while the rate of hemorrhagic complications requiring transfusion was similar in the two groups.

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