African Journal of Biotechnology Vol. 10(70), pp. 15801-15804, 9 November, 2011
Available online at http://www.academicjournals.org/AJB
DOI: 10.5897/AJB11.975
ISSN 1684–5315 © 2011 Academic Journals

Full Length Research Paper

Effects of early angioplasty after fibrinolysis on prognosis of patients with ST-segment elevation acute myocardial infarction

Li Dong-Bao[1], Hua Qi[2]*, Li Hong-Wei[1], Chen Hui[1] and Zhao Shu-Mei

[1]Department of Cardiology, Beijing Friendship Hospital, Capital Medical University, Beijing, 100050, China.
[2]Department of Cardiology, Xuanwu Hospital, Capital Medical University; Changchun Ave 45, Xuanwu district, Beijing,100053, China.

Accepted 2 August, 2011

Patients having myocardial infarction with ST-segment elevation often cannot undergo timely primary percutaneous coronary intervention (PCI) and therefore receive fibrinolysis. The role and optimal timing of routine PCI after fibrinolysis have not been established. 368 high-risk patients who had myocardial infarction with ST-segment elevation and fibrinolytic therapy were divided into early PCI group (n = 162), PCI within 6 h after fibrinolysis and standard treatment group (n = 206), and single drug therapy or PCI after one day of fibrinolysis. All patients received aspirin, tenecteplase, urokinase, pro-urokinase, streptokinase, rt-pa, Tnk and heparin, while enoxaparin or clopidogrel was recommended. The MACE was the composite of death, reinfarction, recurrent ischemia, new or worsening congestive heart failure, or cardiogenic shock during the in-hospital periods. Cardiac catheterization and PCI was performed for 34% of the patients in the standard-treatment group and 100% of the patients in the early-PCI group. A follow-up evaluation at in-hospital days was completed for all patients. The major adverse cardiac event occurred in 3.1% of the patients in the early-PCI group and in 17.0% of the patients in the standard-treatment group. There were no significant differences between the groups in the incidence of major bleeding. Among high-risk patients who had myocardial infarction with ST-segment elevation and who were treated with fibrinolysis, early PCI within 6 h after fibrinolysis decreased mortality in hospitals than standard treatment.

Key words: Acute myocardial infarction, early angioplasty, fibrinolysis.

INTRODUCTION

Primary percutaneous coronary intervention (PCI) is an effective treatment for myocardial infarction with ST-segment elevation when performed rapidly (Boura and Grines, 2003). However, primary PCI is performed in less than 25% of acute care hospitals in the United States (Bates and Nallamothu, 2008). Many patients having myocardial infarction with ST-segment elevation were presented to hospitals that do not have the capability of performing PCI and therefore could not undergo PCI within the timelines recommended in the guidelines (Antman et al., 2008); as such, they received fibrinolysis as the initial reperfusion therapy.

Initial studies of this issue did not show a clinical benefit of routine early PCI after fibrinolysis (The TIMI Study Group, 1998). More recent studies, performed in the era of coronary stenting and contemporary pharmacotherapy, have been more encouraging but have not been adequately powered to definitively establish the safety and efficacy of this approach (Armstrong, 2007). We therefore performed a large, randomized trial to compare a strategy of routine transfer and PCI within 6 hours after fibrinolysis with a standard strategy of transfer and PCI only in cases where fibrinolytic therapy has failed.

*Corresponding author. E-mail: huaqi5371@medmail.com.cn.

MATERIALS AND METHODS

Study population

Between January 2000 and May 2005, 368 consecutive AMI patients, who were admitted within 12 h after the onset of symptoms, underwent thrombolysis at the Department of Cardiology, Xuanwu Hospital, Capital Medical University, Beijing, China. Acute myocardial infarctions were defined by the following characteristics: chest pain consistent with any ongoing myocardial ischemia persisting longer than 30 min, ischemic electrocardiographic changes, and an increase in serum creatine kinase levels greater than 3-fold.

This study excluded patients with a history of recent surgery or trauma within the preceding 2 months, renal insufficiency (creatinine >106 mmol/L), malignancy or liver cirrhosis, febrile disorders, acute or chronic inflammatory disease on the study's entry or history of recent infection, previous myocardial infarction cardiogenic shock before randomization, PCI within the previous month, and previous coronary-artery bypass surgery. However, all participants provided a written informed consent.

Study protocol

All patients received tenecteplase, urokinase, pro-urokinase, streptokinase, rt-pa, Tnk and aspirin, and unfractionated heparin in the Coronary Care Unit. Patients were divided into two prespecified groups: early-PCI group and standard treatment group. Coronary angiography and PCI of the infarct-related artery within 6 h after fibrinolysis were performed for patients who were assigned to the early-PCI group, while patients assigned to the standard-treatment group were treated with the second preventive drugs of CHD, and PCI after about 7 days was performed for some of the patients.

We performed coronary angiography using the right brachial or femoral approach to determine the culprit lesion. Reperfusion was considered successful if balloon angioplasty and/or stent deployment was carried out at the desired site yielding residual stenosis of <50% diameter and thrombolysis in myocardial infarction (TIMI) grade 3 flow. Blood samples for measuring white blood cell count, admission glucose, peak of CPK and CK-mb were taken from a peripheral vessel in the cardiac intensive care unit before the administration of any medication, while the left ventricular ejection fraction was measured with Doppler echocardiography during the third day after acute myocardial infarction.

Patients in this study were followed up in hospital intervals about 2 to 4 weeks after the AMI event. The major adverse cardiac event (MACE) of the study was the combined incidence of death, reinfarction, recurrent ischemia, new or worsening heart failure, or cardiogenic shock. The incidence of bleeding complications was classified with the use of the Global Utilization of Streptokinase and Tissue Plasminogen Activator for Occluded Coronary Arteries (GUSTO) severity scales (The GUSTO Investigators, 1994).

Statistical analysis

Data were expressed as mean ± SD or frequency. The comparison of the data between the two groups was performed by an unpaired t-test for continuous variables and by a chi-square test or Fisher's exact test for discrete variables. In order to estimate relative risk of mortality, the odds ratio (OR) was calculated, and the statistical significance was tested by X^2 analysis. Logistic regression was used to determine the predictors of mortality in-hospital complications. All $P<0.05$ were considered as statistically significant. However, analyses were done using the statistical software SPSS 11.5.

RESULTS

In this study, 368 patients were assigned to the standard-treatment group (206 patients) or the early-PCI group (162 patients). Baseline characteristics were well balanced between the two groups except that there was a higher prevalence of smokers and males in the early-PCI group than in the standard-treatment group and a higher prevalence of previous congestive heart failure and aged people in the standard-treatment group than in the early-PCI group (Table 1). Cardiac catheterization and PCI were performed for 34 and 100% of the patients in the standard-treatment group and the early-PCI group, respectively.

A follow-up evaluation at in-hospital days was completed for all patients. The MACE occurred in 3.1% of the patients in the early-PCI group and in 17.0% of the patients in the standard-treatment group. Consequently, there were no significant differences in the rates of major, moderate or severe bleeding.

DISCUSSION

In our trial, we compared a strategy of early PCI after fibrinolysis with a standard strategy. The major adverse events occurred significantly less frequently with early PCI than with standard therapy. As such, no significant differences in the rates of major bleeding were seen.

Trials of early PCI that were performed after fibrinolysis in time before stents used did not show a clinical benefit of this strategy, but instead showed higher rates of major bleeding complications (Cantor et al., 2005). In one trial, there was a trend to higher mortality with early PCI (Simoons et al., 1988). One explanation that was proposed for the lack of benefit was that there is a risk of reocclusion after standard balloon angioplasty (Arnold et al., 1991). It is also possible that higher rates of bleeding episodes with early PCI may have offset any benefit achieved with this intervention. Bleeding rates after PCI have been reduced with the use of smaller sheaths, earlier removal of sheaths, radial access, the administration of lower doses of anticoagulants, and the elimination of postprocedural heparin infusions (Cantor et al., 2007). The trials performed after the widespread use of stents that became routine have shown encouraging results for the PCI that was performed early after fibrinolysis (Di Mario et al., 2008). The results of this study are consistent with those of smaller trials and meta-analyses of trials, in which contemporary PCI techniques and pharmacotherapy were used (Wijeysundera et al., 2008).

The strategy of PCI performed a few hours after fibrinolysis - which was evaluated in our trial - should be distinguished from the strategy of PCI performed immediately after fibrinolysis, an approach that has been termed facilitated PCI (Keeley et al., 2006). Clinical trials of facilitated PCI have shown increased rates of bleeding

Table 1. Baseline characteristics and clinical end points in two groups.

Parameter	Early PCI group (N = 162)	Standard treatment group (N = 206)	P value
Age (year)	57.7±12.20	63.1±12.10	0.000
Male number (%)	133 (82.1%)	146 (70.9%)	0.013
Hypertension, no. (%)	73 (45.1%)	103 (50%)	0.346
Diabetes, no. (%)	35 (21.6%)	51 (24.8%)	0.478
History of smoking, no. (%)	107 (66%)	113 (54.9%)	0.03
Systolic blood pressure (mmHg)	133.22±27.28	135.44±28.72	0.454
Diastolic blood pressure (mmHg)	81.39±17.77	81.78±17.20	0.832
Heart rate (beats/min)	76.5±16.39	80.60±19.26	0.033
Peak of CK(U/L)	2234.75±1383.77	1966.11±1446.60	0.077
Peak of CK-MB(U/L)	170.85±108.99	207.38±169.60	0.02
EF	59.07±9.97	55.40±11.89	0.006
Killip grade			0.001
I	111(68.9%)	106 (51.7%)	
II	42(26.1%)	67 (32.7%)	
III	4(2.5%)	20 (9.8%)	
IV	4(2.5%)	12 (5.9%)	
PCI	100%	34%	＜0.001
MACE	5 (3.1%)	35(17.0)	0.000
Bleeding			0.344
Mild, no. (%)	9 (5.6%)	21 (10.2%)	
Moderate, no. (%)	3 (1.9%)	6 (2.9%)	
Severe, no. (%)	1 (0.6%)	2 (1%)	

and no clinical benefit with the strategy of primary PCI alone (Ellis et al., 2008). Although, the reasons for these disappointing findings remain speculative, it is possible that the time between fibrinolysis and PCI (median, 90 to 104 min) was too short for these trials, with the result that persistent fibrinolytic activity led to increased bleeding complications. The lack of adequate antiplatelet therapy in these trials may have also conferred a predisposition to thrombotic complications. However, if the delay between fibrinolysis and PCI is too long, patients are exposed to the risk of reinfarction and recurrent ischemia while they await PCI, and patients in whom reperfusion after fibrinolysis is not successful may not be able to undergo rescue PCI quickly enough to salvage myocardium. A recent meta-analysis of contemporary trials has shown that there are significantly lower mortality and reinfarction rates with routine early PCI after fibrinolysis than with a more conservative ischemia-guided approach (Wijeysundera et al., 2008).

Several important study limitations should be carefully considered. First, this was a single-centered, non-randomized and retrospective study with a relatively small number of patients. Secondly, we did not observe the long term prognosis after discharge.

In conclusion, patients having myocardial infarction with ST-segment elevation, and who could not undergo timely primary PCI, can benefit from early PCI after fibrinolysis.

REFERENCES

Antman EM, Hand M, Armstrong PW (2008). 2007 focused update of the ACC/AHA 2004 guidelines for the management of patients with ST-elevation myocardial infarction: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J. Am. Coll. Cardiol. 51: 210-247.

Armstrong PW (2007). WEST Steering Committee: A comparison of pharmacologic therapy with/without timely coronary intervention vs. primary percutaneous intervention early after ST-elevation myocardial infarction: the WEST (Which EarlyST-elevation myocardial infarction Therapy) study. Eur. Heart J. 27: 1530-1538.

Arnold AE, Serruys PW, Rutsch W (1991). Reasons for the lack of benefit of immediate angioplasty during recombinant tissue plasminogen activator therapy for acute myocardial infarction: a regional wall motion analysis. J. Am. Coll. Cardiol. 17: 11-21.

Bates ER, Nallamothu BK (2008). Commentary: The role of percutaneous coronary intervention in ST-segment-elevation myocardial infarction. Circulation, 118: 567-573.

Boura JA, Grines CL (2003).Primary angioplasty versus intravenous thrombolytic therapy for acute myocardial infarction: a quantitative review of 23 randomized trials. Lancet, 361: 13-20.

Cantor WJ, Brunet F, Ziegler CP, Kiss A, Morrison LJ (2005). Immediate angioplasty afterthrombolysis: a systematic review. CMAJ, 173: 1473-1481.

Cantor WJ, Mahaffey KW, Huang Z (2007). Bleeding complications in patients with acute coronary syndrome undergoing early invasive management can be reduced with radial access, smaller sheath sizes, and timely sheath removal. Catheter Cardiovasc Interv. 69: 73-

83.
Di Mario C, Dudek D, Piscione F (2008). Immediate angioplasty versus standard therapy with rescue angioplasty after thrombolysis in the Combined Abciximab REteplase Stent Study in Acute Myocardial Infarction (CARESS-in-AMI): an open, prospective, randomised, multicentre trial. Lancet, 371: 559-568.
Ellis SG, Tendera M, de Belder MA (2008). Facilitated PCI in patients with ST-elevation myocardial infarction. N Engl. J. Med. 358: 2205-2017.
Keeley EC, Boura JA, Grines CL (2006). Comparison of primary and facilitated percutaneous coronary interventions for ST-elevation myocardial infarction: quantitative review of randomised trials. Lancet, 367:579-588.
Simoons ML, Arnold AE, Betriu A (1988). Thrombolysis with tissue plasminogenactivator in acute myocardial infarction: no additional benefit from immediate percutaneouscoronary angioplasty. Lancet, 1: 197-203.
The GUSTO Investigators (1994). An international randomized trial comparing four thrombolytic strategies for acute myocardial infarction. N. Engl. J. Med. 329: 673-682.
The TIMI Study Group (1998). Comparison of invasive and conservative strategies after treatment with intravenous tissue plasminogen activator in acute myocardial infarction — results of the Thrombolysis in Myocardial Infarction (TIMI) phase II trial. N. Engl. J. Med. 320: 618-627.
Wijeysundera HC, You JJ, Nallamothu BK, Krumholz HM, Cantor WJ, Ko DT (2008). An early invasive strategy versus ischemiaguided management after fibrinolytic therapy for ST-segment elevation myocardial infarction: a meta-analysis of contemporary randomized controlled trials. Am. Heart J. 156: 564-572.