

Percutaneous Reperfusion of Left Main Coronary Disease Complicated by Acute Myocardial Infarction

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Previous studies have shown a benefit of a strategy of direct angioplasty and stenting in patients with acute myocardial infarction (AMI) complicated by early cardiogenic shock. However, few data exist for the subset of patients with left main trunk disease complicated by AMI and cardiogenic shock. We performed an analysis of patients with AMI who underwent mechanical intervention between January 1995 and December 2000. Out of 1,433 patients with ST segment elevation AMI treated with primary coronary angioplasty (PTCA), 22 patients (1.5%) had left main disease (LMD) as the culprit lesion. Baseline characteristics were age, 66 ± 11 years; female gender, 9%; diabetes, 14%; previous myocardial infarction, 14%; mean systolic blood pressure, 77 ± 24 mm Hg; time to treatment, 4.8 ± 2.2 hr; TIMI 0–1, 77%; collateral flow (Rentrop grade ≥ 2) 9%. The primary success rate was 91%. Primary stenting was performed in 17 patients (77%). The in-hospital mortality rate was 50%. All deaths were due to refractory shock. The 6-month survival rate was $41\% \pm 1\%$, while the event-free survival rate was $27\% \pm 10\%$. At 6-month follow-up, the mortality rate increased to 59%; the target vessel revascularization rate was 14%. A percutaneous mechanical intervention strategy in patients with left main disease complicated by AMI is feasible and effective, and patients discharged alive have a good mid-term prognosis. *Cathet Cardiovasc Intervent* 2002;56:31–34.

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Key words: acute myocardial infarction; PTCA

INTRODUCTION

Randomized trials and large registries have shown a striking survival benefit of surgical revascularization in comparison with medical therapy in patients with left main coronary artery disease (LMD) [1–5]. Initial studies of percutaneous transluminal coronary angioplasty (PTCA) of unprotected LMD reported varying degrees of procedural success and uniformly poor long-term results due to the high incidence of restenosis [6–9]. However, these studies were performed before the evolution of percutaneous intervention techniques that currently can be considered an effective alternative treatments, especially in high-surgical-risk patients [10]. The introduction of stents has improved acute and long-term results of coronary interventions. The favorable outcomes of elective stenting of unprotected LMD, in low- as well as in high-risk surgical candidates, have been reported [11–13].

However, there are few data on emergency LM percutaneous interventions in the setting of acute myocardial infarction (AMI). This observational study reports the immediate and the 6-month clinical and angiographic outcomes of emergency LM percutaneous intervention in patients with ST segment elevation AMI.

MATERIALS AND METHODS

Patient Population

Between January 1995 and December 2000, 1,433 consecutive unselected patients with ST segment elevation AMI underwent primary percutaneous mechanical intervention. Out of these, 22 (1.5%) were found to have LMD as the culprit lesion.

Treatment Protocol

Patients were pretreated with aspirin, and heparin (10,000 U) was administered immediately after sheath insertion. The decision on whether to use intravenous pressor agents and the intra-aortic balloon pump was made by an experienced interventional cardiologist. The

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Received 9 July 2001; Revision accepted 17 December 2001

DOI 10.1002/ccd.10168

Published online in Wiley InterScience (www.interscience.wiley.com).

intra-aortic balloon was placed in the catheterization laboratory under fluoroscopic control. Direct PTCA was always attempted whatever the coronary anatomy, and the revascularization procedure included provisional as well as elective stenting and abciximab administration depending on operator decision. Direct PTCA and coronary stenting were accomplished with standard techniques. After intervention, patients were treated with aspirin (300 mg/d.i.e. indefinitely), ticlopidine (500 mg/d.i.e. for 2 months), intravenous heparin (adjusted at 1.5–2 times the baseline activated partial thromboplastin time for 48–72 hr), and vasopressor agents as needed. In patients receiving abciximab, the low-dose heparin infusion was stopped after 12 hr.

Angiographic Analysis

Quantitative coronary angiography was performed with an automatic edge detection system (Siemens Ancor, Solna, Sweden). Coronary flow before and after revascularization was graded according to Thrombolysis in Myocardial Infarction (TIMI) study group classification [14]. Collateral flow before direct angioplasty was graded using the classification developed by Rentrop et al. [15]. Significant stenosis of non-infarct-related artery (IRA) vessels was defined as > 50% vessel narrowing. A successful revascularization procedure was defined as a residual stenosis < 50% associated with TIMI grade 2 or 3 flow. An optimal angiographic result was defined as a residual stenosis < 30% associated with TIMI grade 3 flow. Unsuccessful PTCA was defined as TIMI grade flow < 2 at any level of residual stenosis. Binary angiographic restenosis was defined as > 50% stenosis of the target lesion on the scheduled or unscheduled follow-up angiography.

Follow-Up

Follow-up information were collected after hospital discharge. All surviving patients were seen in the outpatient clinic 1, 3, and 6 months after discharge and were scheduled for follow-up angiography catheterization at 6 months.

Statistics

Categorical data are presented as number (%) and continuous data as mean value $\pm$ SD. Survival curves were generated by using the Kaplan-Meier method. Cox regression model was used for univariate and forward stepwise multivariate analysis (SPSS 7.0 package, SPSS, Chicago, IL). The following variables were considered: age (years), female gender, diabetes, preinfarction angina, previous myocardial infarction, cardiogenic shock, three-vessel coronary disease, preprocedural IRA patency (TIMI 2–3), collateral circulation to IRA (Rentrop

TABLE I. Baseline Clinical and Angiographic Characteristics of 22 Patients With Acute Myocardial Infarction Who Underwent Primary Left Main Coronary Angioplasty

Age (years)	66 $\pm$ 11
Range	43–79
> 75 years	4 (18%)
Male	20 (91%)
Hypertension	6 (27%)
Hypercholesterolemia	4 (18%)
Smokers	3 (41%)
Diabetes mellitus	3 (14%)
Systolic blood pressure	77 $\pm$ 24 (mm Hg)
Cardiogenic shock	18 (82%)
Previous myocardial infarction	3 (14%)
Previous bypass surgery	3 (14%)
Previous PTCA	1 (5%)
TIMI 0–1	17 (77%)
TIMI 2–3	5 (23%)
Three-vessel disease	8 (36%)
Chronic occlusion	3 (14%)
Rentrop grade $\geq$ 2	2 (9%)

2–3), time to reperfusion (hr), primary stenting, abciximab therapy, unsuccessful PTCA.

RESULTS

Baseline Characteristics

The baseline characteristics of the study group are listed in Table I. The mean age was 66 $\pm$ 11 years, and 18% of patients were over 75. Most patients (82%) were in cardiogenic shock on admission.

Procedural Characteristics

The procedural characteristics are shown in Table II. Time from AMI onset to reperfusion was 4.8 $\pm$ 2.2 hr. Direct PTCA success rate was achieved in 21 patients (95.5%). An optimal angiographic result was achieved in 20 (91%). Stenting of the left main trunk was performed in 17 patients (77%) and multiple stents were implanted in 7 patients (41%) who had left main bifurcation occlusion involving left anterior descending artery and circumflex artery ostia. Percutaneous revascularization of vessels other than left main trunk was performed in three patients (14%).

Clinical and Angiographic Outcome

Overall, the in-hospital mortality rate was 50% (11/22 patients; Table III). Refractory cardiogenic shock was the cause of death in all patients who underwent a primary successful intervention, and no death was due to target vessel failure. The patient with failed PTCA died after emergency coronary surgery. One patient underwent successful emergency re-PTCA during hospital stay for recurrent ischemia. After discharge, there were two other

TABLE II. Procedural Characteristics (n = 22)

Time to reperfusion (hr)	4.8 ± 2.2
PTCA success	21 (95.5%)
Optimal angiographic result	20 (91%)
Suboptimal angiographic result	1 (4.5%)
Stenting	17 (77%)
Multiple stenting	7 (41%)
Multivessel revascularization	3 (14%)
Intra-aortic balloon pump	18 (81%)
Intubation	5 (23%)
Abciximab treatment	10 (46%)

TABLE III. In-Hospital and Six-Month Outcome

	Number of patients (%)
In-hospital follow-up	
Overall mortality	11 (50%)
PTCA failure	1
PTCA success	10
Nonfatal reinfarction	0
Target vessel revascularization	2 (9%)
PTCA	1
Coronary surgery	1
Cumulate 6-month outcome	
Overall mortality	13 (59%)
Causes of death	
Refractory cardiogenic shock	10
Reinfarction	1
Coronary surgery	2
Nonfatal reinfarction	0
Target vessel revascularization	3 (14%)
PTCA	2
Coronary surgery	1
Angiographic follow up (n = 10)	
Restenosis	4 (40%)

deaths. One patient died for a fatal reinfarction at 30 days, and one patient with recurrent ischemia and angiographic evidence of restenosis died after elective coronary surgery. The 6-month survival rate was $41\% \pm 1\%$ (Fig. 1). The 6-month mortality rate was not related to the extent of coronary artery disease (CAD). Mortality rate was 57% (8/14) in patients with isolated LMD and 63% (5/8) in patients with multivessel disease ($P = 0.806$). No other reinfarctions occurred at 6-month follow-up. Target vessel revascularization was performed in three patients (14%; two re-PTCA and one coronary surgery). The 6-month event-free survival was $27\% \pm 10\%$ (Fig. 1). The multivariate analysis did not show any variable related to mortality. All 10 eligible patients performed the 6-month angiographic follow-up. The restenosis rate was 40%.

DISCUSSION

There is a paucity of data on outcomes of patients undergoing emergency percutaneous or surgical revascularization of left main disease complicated by AMI.

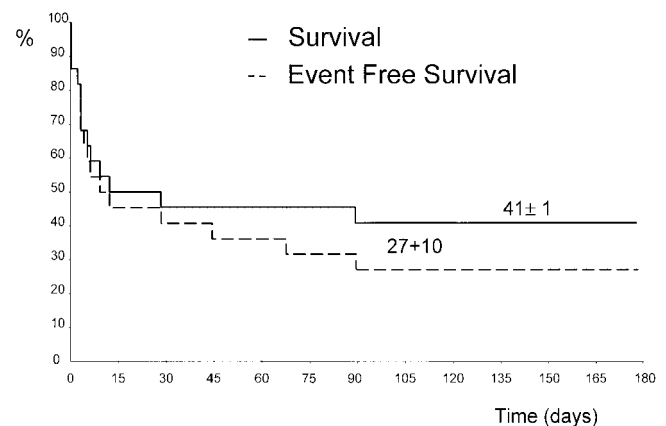


Fig. 1. Kaplan-Meier estimates of survival and event-free survival among 22 patients with acute myocardial infarction who underwent primary left main coronary revascularization.

Initial studies on percutaneous revascularization in patients with AMI and LMD reported very poor in-hospital results. In a case series of six patients with LMD who underwent percutaneous intervention reported by Chauhan et al. [16], the in-hospital mortality rate was 83% (5/6 patients). This result led the authors to conclude that there is a prohibitive risk for percutaneous revascularization in patients with LMD complicated by AMI. Quigley et al. [17] reported the in-hospital outcome of 34 patients with AMI and LMD. Out of these, 16 patients were in cardiogenic shock; 7 patients were treated medically, 4 were managed with PTCA, and 5 with coronary artery surgery. The overall mortality rate was 100% (4/4 patients) in the PTCA group and 100% (7/7 patients) in the medical treatment group; the surgical revascularization group mortality rate was 89% (8/9 patients).

Our data suggest a better outcome in comparison to the previous reports. The attempt to achieve a good angiographic result with the use, in most patients, of stents, antiplatelets therapy, and mechanical support may have contributed to our better results. Our figures are in agreement with those of the ULTIMA (Unprotected Left Main Trunk Intervention Multicenter Assessment) registry [18]. This is a multicenter registry, reporting the outcomes of 40 patients who underwent percutaneous left main interventions for AMI from 13 high-volume clinical sites. In this registry, the in-hospital mortality rate was 55%, and 18% of patients required in-hospital coronary artery surgery. The survival and event-free survival curves were similar to those generated in our study with a marked clustering of deaths and events during the hospital stay, and a nearly flat curve in the mid-term follow-up. With respect to the emergent surgery for LMD complicated by AMI, the only reported data are those of Nakanishi et al. [19] and are based on a series of 13 patients.

The mortality rate was 46% for the entire group, and 53% for the patients presenting with cardiogenic shock. These results are comparable to those observed in our study as well as in the ULTIMA registry experience [18]. However, the paucity of data does not allow any conclusion on whether percutaneous or surgical reperfusion is preferred in patients with LMD complicated by AMI.

The results of our study suggest that emergency percutaneous revascularization in patients with LMD and AMI is technically feasible. The benefit of percutaneous coronary interventions on mortality is likely. However, the small number of patients prevents any definitive conclusion.

Study Limitations

This is a retrospective analysis and the study design prevents any comparison with a surgical strategy in patients with LMD complicated by AMI. However, in our center primary PTCA is the systematic treatment for all patients with AMI, without any restriction based on coronary anatomy or clinical status on presentation [20,21]. Thus, this small series of unselected consecutive patients may be considered representative of the dramatic setting of LMD complicated by AMI.

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