Emergency Coronary Artery Bypass Grafting for Left Main Shock Syndrome

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Objective: Acute myocardial infarction (AMI) complicated by cardiogenic shock and left main coronary artery disease (left main shock syndrome) shows high morbidity, and whether early coronary artery bypass grafting (CABG) improves the clinical outcome remains unclear.

Methods: Six consecutive patients (mean age, 61.6 years) with MI complicated by left main shock syndrome underwent emergency CABG. Patients were divided into 2 groups according to the time from MI to reperfusion; within 8 hours in 3 patients and beyond 8 hours in the remaining. Average postoperative peak creatinine kinase (CK) and creatinine kinasesmyosin band (CK-MB) levels were recorded, and the ejection fraction (EF) was measured with ultrasound cardiography.

Results: Significant differences in postoperative EF and CPK-MB were observed between the 2 groups. The 30-day survival rate was 100%. Five patients left the hospital alive, while 1 died on postoperative day 78.

Conclusions: AMI complicated by cardiogenic shock and left main coronary artery disease can be effectively treated with emergency CABG, with acceptable mortality and morbidity. Emergency CABG for MIs within 8 hours can improve survival in patients with left main shock syndrome.

Keywords: coronary artery bypass grafts surgery, shock (cardiac), myocardial infarction, surgery (emergency)

Introduction

Cardiogenic shock due to acute myocardial infarction (AMI) has a high in-hospital mortality rate. Left main coronary artery (LMCA) disease represents a significant, independent predictor of mortality in patients with MI complicated by cardiogenic shock, and the associated mortality rate is catastrophic. Quigley et al called this phenomenon left main shock syndrome (LMSS) in patients with MI complicated by cardiogenic shock and LMCA disease, and reported a mortality of approximately 80%, regardless of emergency surgical recanalization. Several studies have shown that early revascularization with hemodynamic support improves survival in patients with cardiogenic shock. Therefore, prompt and complete revascularization of the occluded coronary artery is important to improve clinical outcome. The authors of the American College of Cardiology/American Heart Association/Society for Cardiac Angiography and Interventions guidelines recommend coronary artery bypass grafting (CABG, Class I) in such patients. However, percutaneous coronary intervention (PCI) has become the most common strategy of revasculization and is general preferred in multiple comorbidities and/or very...
unstable patients. In contrast, CABG surgery, when possible, are delayed by a few days and selected in stable patients.4–6)

In this article, we present the cases of 6 patients with MI complicated by cardiogenic shock and LMCA disease who underwent emergency CABG within 24 hours. The aim of this study was to evaluate the outcomes of emergency CABG in patients with AMI and LMSS.

Patients and Methods

From 2004 to 2009, 6 patients (5 males, 1 female; mean age, 61.6 years; range, 36–74 years) with AMI complicated by cardiogenic shock and LMCA disease were admitted to either our hospital or a nearby hospital. All patients had chest pain and reported no history of previous MI, PCI, or CABG (Table 1). On presentation, all patients were in cardiogenic shock. After initial assessments, they were taken to the catheterization room with minimum delay and an intra-aortic balloon pump (IABP) was used for coronary angiography. Three patients were transferred from the nearby hospital for emergency CABG. All patients underwent surgery within 4 hours after coronary angiography. CABG was performed under antegrade cardioplegic arrest with cardiopulmonary bypass. We used the left internal thoracic artery (LITA) and saphenous vein as graft materials. Six LITA grafts were used for the left anterior descending artery (LAD). Five saphenous vein grafts (SVGs) were used for the circumflex artery; 2, for the right coronary artery, and 2 were used for the Diagonal branch coronary artery. As soon as distal anastomoses were completed, the aortic cross-clamp was removed, and the heart beat was established with temporal electrical pacing. Top-end anastomoses with SVGs were then carried out on the ascending aorta with aortic partial clamping.

Results

Complete revascularization was achieved in all patients (Table 1). The mean number of grafts per patient was 2.7 ± 0.47 and all patients received a left internal mammary artery conduit to LAD. The average durations of aortic clamping and cardiopulmonary bypass were 32.5 ± 10.6 and 98.2 ± 36.2 min, respectively. The median time from MI to revascularization was 9.7 ± 4.1 hours (interquartile range, 4–17). In the 3 patients with more than 8 hours between AMI and revascularization, 1 patient died on postoperative day 78, and the remaining 2 patients survived, but stayed in the hospital for more than 90 days following surgery. Among the 3 patients with less than 8 hours between AMI and revascularization, all survived, and their hospital stays were less than 72 days.

Postoperative peak CK-MB and CK levels were 511.5 ± 250.4 and 6425.0 ± 1690.0 IU/L, respectively. The mean postoperative ejection fraction (EF) on ultrasound cardiology was 43.6 ± 15.1% average (range, 23.8–61.7%) (Table 1). No patients reported stroke or mediastinitis.

We divided the patients into 2 groups of 3 each: one group consisted of those for whom time from AMI to revascularization was less than 8 hours and the other comprised those for whom the time was more than 8 hours. A significant difference in postoperative EF and postoperative CPK-MB was noted between these 2 groups (Table 2, Figs. 1 and 2).

All patients underwent continuous hemodiafiltration, and 1 patient underwent chronic dialysis. One patient died on the 74th day of hospitalization after CABG due to multiorgan failure and the other 5 were discharged from our hospital. The 30-day survival rate was 100%. The hospital mortality rate was 16.7%. Late deaths occurred in 2 patients due to arrhythmia or cardiac failure. The mean duration of follow-up was 15.5 ± 8.9 months (range, 3–30 months) (Table 1).

Discussion

Our study had 4 major findings described as follows:

First: The most important finding was that patients with LMSS treated with CABG had a high 30-day survival rate and low hospital mortality rate. Our study showed a 100% 30-day survival rate and a hospital mortality rate of 16.7% in patients with LMSS who underwent emergency CABG. This result is comparable to or significantly better than results published by other centers, where treatment of small groups of patients with cardiogenic shock and LMCA disease was managed with angioplasty and stenting.2, 4–6) Some studies have reported that patients with LMSS who underwent emergency CABG had an extremely low survival rate and the condition was associated with catastrophic results.

Lee et al. showed that the 30-day survival rate in CABG for LMSS was 40% and that for PCI was 16%.2, 4–6) CABG for LMSS in our institute appeared to provide a survival advantage compared to PCI in other institutes.

Second: Time from MI to reperfusion was found to influence myocardial damage and myocardial function. It took 4 hours to complete PCI in 1 case and 6–17 hours to
Table 1  Results

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<th>Case1</th>
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<th>Case3</th>
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<td>4603</td>
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<td>Hospital death</td>
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ACC: aortic cross-clamp; CPB: cardiopulmonary bypass; SD: standard deviation; LOS: low output syndrome; MOF: multi organ failure

Fig. 1  Peak CK-MB. There are significant differences between patients who undergo revascularization after AMI within and beyond 8 hours.
AMI: acute myocardial infarction

Fig. 2  Postoperative left ventricular ejection fraction (EF). There are significant differences between patients who undergo revascularization after AMI within and beyond 8 hours.
AMI: acute myocardial infarction
complete CABG in the others. These results indicate a comparable or slightly shorter time taken to perform the mentioned procedures compared with the results published by other centers. Lee et al showed that the median time from MI to revascularization was 24.3 hours (interquartile range, 8.7–82.5 hours) in the CABG group, and Okamoto et al reported that recanalization by CABG required more than 9 hours to complete. There is an obvious, positive correlation between the value of peak CPK-MB and the time taken to complete the recanalization. A prompt revascularization strategy for AMI is known to keep myocardial damage to a minimum. In our study, we divided patients into 2 groups. Patients with a revascularization time greater than 8 hours showed significantly increased, postoperative peak CPK-MB values and decreased postoperative EFs, compared with those with a revascularization time of less than 8 hours. We, thus, believe that a longer time between MI and revascularization produces a lower postoperative EF, and due to this, difficulties are encountered during postoperative care and long-term morbidity. We suggest that patients with LMSS who undergo recanalization after MI within 8 hours suffer minimal myocardial damage and retain myocardial function.

Third: Whether patients with LMSS need to undergo PCI before CABG? In our study, only case 2 was treated with PCI before CABG. As a result, the time from MI to revascularization was 4 hours, which was the lowest in our study; the patient had a postoperative EF of 67%, thus showing competent myocardial function. He had an uncomplicated postoperative course. However, few reports have shown that the outcome of coronary angioplasty for LMT has a continuing high restenosis rate and that periprocedural deaths frequently occur. Failed coronary interventions for LMT obviously contributes to the poor prognosis. The operator’s experience and stenting technique are, therefore, important.

We believe that PCI should be performed in patients with LMSS before CABG if the cardiologist ensures safety, and the time from AMI to reperfusion remains within 8 hours; however, if the above is not possible, CABG should be performed as soon as possible.

Fourth: Patients with LMSS undergoing CABG require longer-term postoperative treatment. In our study, the duration of hospital stay in patients with LMSS who underwent CABG ranged from 37 to 111 days (average, 75.3 ± 22.1 days), which was significantly longer than that in patients who underwent elective, isolated CABG at our hospital (average, 16.4 ± 20.8 days). We suspect two reasons for this discrepancy. First is that AMI complicated by LMT disease produces greater myocardial damage than AMI due to single-vessel disease. The recovery after CABG is long. Most cases were treated for severe cardiac failure in the postoperative period.

The second reason is that cardiogenic shock, ischemic reperfusion after AMI, and cardiopulmonary bypass in an emergency setting induce an extremely high systemic inflammatory response, and several organs, especially the lung, are affected. We used CHDF and sivelestat infusion for all patients to protect them from systemic inflammatory response disease. These therapies can help patients who show general, systemic complications due to the inflammatory response. During the postoperative period, it took longer to recover from the systemic inflammatory response disease.

Limitations
This case study included a small number of patients and had a short follow-up duration. The decision for use of CABG may have been based on acuity, severity, and technical feasibility. Our clinical profile only estimated the time between onset of MI and complete revascularization.

Conclusion
It is difficult to treat patients with LMSS, but CABG
appeared to provide a survival advantage over PCI in our study. Complete revascularization of MI patients within 8 hours appeared to minimize myocardial damage and retain left ventricular function. We suggest that emergency CABG with complete revascularization performed within 8 hours of MI can improve survival in patients with LMSS.

References