Timing of Revascularization after Acute Myocardial Infarction

Mohammed M Abd-Alaal, MD, Mostafa A Alsabban, MD, Osama A Abbas*, MD, Ahmad A Alshaer, MD, Ahmed Al-Saddique, FACS, Mohammed Fouda, FRCS

Heart Sciences Department
King Fahad Cardiac Center, King Saud University
Riyadh, Saudi Arabia, Cardio-Thoracic Surgery Department, Ain Shams University

ABSTRACT
The optimal timing of surgical revascularization after acute myocardial infarction remains controversial. Higher mortality after emergency coronary artery bypass has been documented. We retrospectively reviewed 278 patients who underwent coronary artery bypass between 2005 and 2007. The time from onset of myocardial infarction to surgical revascularization was the basis for dividing patients into 3 groups: surgery was performed within 24 h in group 1, at 24–72 h in group 2, and after 1-4 days in group 3. There was a definite relationship between the timing of revascularization and the outcome of surgery. Group 1 had a mortality rate of 11.7%, group 2 had 7% mortality, and group 3 had 2.5% mortality. Group 1 had the highest incidence of postoperative complications. Surgical revascularization within 24 h of acute myocardial infarction was associated with significantly higher risks of mortality and morbidity than procedures performed after 72 h.

(int Asian Cardiovasc Thorac Ann 2010;18:118–21)

KEYWORDS: Coronary Artery Bypass, Myocardial Infarction

INTRODUCTION
The optimal timing of reperfusion after acute myocardial infarction (MI) is a matter of controversy and the subject of ongoing studies. Evolving ischemia, cardiogenic shock, failure of a percutaneous intervention, and structural complications such as papillary muscle rupture, ventricular septal defect, or severe left ventricular dysfunction are indications for an emergency operation to maximize myocardial salvage and reduce the impact of severe hemodynamic compromise on other organs. Mortality associated with emergency coronary artery bypass grafting (CABG) after acute MI ranges from 5% to 30%, and interestingly, it has remained unchanged since the early 1970s. Temporizing measures such as preoperative intraaortic balloon counterpulsation play a role, but better selection of patients and timely surgical intervention are the most important factors. The objective of this study was to determine the relationship between the timing of CABG after MI and mortality and short-term postoperative outcomes.

PATIENTS AND METHODS
The records of 278 patients who underwent isolated conventional CABG between January 2005 and December 2007 were reviewed retrospectively. Medical histories including cardiac risk factors and any previous MI were entered prospectively in our database. Operative details including urgency of the procedure, cardiopulmonary bypass (CPB) time, aortic crossclamp time, number of distal anastomoses, and use of an intraaortic balloon pump were also recorded. Postoperative courses were analyzed for incidences of cerebrovascular accident or atrial fibrillation, durations of intensive care unit and hospital stay, and mortality.
The diagnosis of MI was made by conventional electrocardiographic and enzyme criteria. It was confirmed by coronary angiography showing occluded vessels with a regional wall-motion abnormality on the left ventriculogram. Patients who underwent redo-CABG, concomitant valve replacement, or other combined operative procedures were excluded. The patients were divided into 3 groups: group 1 comprised 77 patients who underwent emergency CABG for evolving MI within the first 24 h after onset of pain, with cardiogenic shock, hemodynamic instability, complications arising from cardiac catheterization, failure of a percutaneous intervention, or dissection of a coronary artery; group 2 included 85 hemodynamically stable patients who underwent CABG 24–72 h after MI; and group 3 was 116 patients who had CABG >2 weeks after MI. There were 210 (75.5%) men and 68 (24.5%) women; the mean age was 59.2 ± 12.4 years (range, 42–92 years). The mean left ventricular ejection fraction was 40.9% ± 14.5%. The preoperative characteristics of each group are given in Table 1.

The timing of surgery was based on the stability of the patient, ongoing ischemia despite optimal medical management, and mechanical complications of infarction, according to standardized guidelines. The indications for urgent surgery in group 1 were unstable hemodynamics refractory to maximum medical therapy. Patients in group 2 received aggressive medical treatment to optimize their condition and allow recovery of potentially stunned myocardium. Patients in group 3 were responding to management with no electrocardiographic evidence of ongoing ischemia and without chest pain but still at high risk, or those with an uncomplicated hospital course who were operated up on electively. The most commonly used myocardial protection technique was antegrade intermittent cold blood cardioplegia, according to the preference of the surgeon. A dose of warm blood cardioplegia was given at the end of the operation, according to standardized guidelines. The incidence of ongoing ischemia and without chest pain. In our study, hospital mortality decreased with increasing time between the MI and surgery. Our results are in agreement with those of Lee and colleagues. In a short-term risk analysis, Hirose and colleagues documented high hospital mortality in patients with preoperative cardiogenic shock (15.8%) and no deaths among those without cardiogenic shock. In our study, 15 (19.48%) comparisons between continuous variables were made using Student’s t test. Multiple group means were compared using analysis of variance. Differences were considered significant when the p value was 0.05 or less.

RESULTS

Overall hospital mortality (within 30 days postoperatively) was 6.47% (18 patients). The mortality rate was 11.7% in group 1, 7% in group 2, and 2.5% in group 3. The mean number of vessels bypassed was 3.2 ± 0.9. Mean aortic crossclamp time was 59.2 ± 28.5 min, and mean CPB time was 95.3 ± 39.8 min. There were no significant differences in the number of distal anastomoses, CPB time, or crossclamp time among groups. There were higher incidences of cerebrovascular accident and atrial fibrillation in group 1 (Table 2). The postoperative intensive care unit stay was longer in group 1, but there were no differences in the length of hospital stay among groups.

DISCUSSION

Although the optimal method and timing for reperfusion after acute MI are still debated, hemodynamic compromise in terms of ongoing ischemia, cardiogenic shock, structural complications, and failed percutaneous procedures are indications for prompt surgical intervention. Some reports advocate emergency revascularization in the acute setting, whereas others recommend variable periods of waiting before surgical intervention. Revascularization within the first 6 h after acute MI was found to result in a greater degree of reperfusion injury and increased mortality. Increased morbidity and mortality has also been noted after CABG in the first 12–24 h after acute MI.

In our study, hospital mortality decreased with increasing time between the MI and surgery. Our results are in agreement with those of Lee and colleagues, who reported hospital mortality of 11.8%, 9.5% 4.3%, 2.4%, and 2.6% after CABG at <6 h, 6–23 h, 1–7 days, 8–14 days, and 15 days, respectively. Mortality in patients with transmural MI remained high during the first 24 h before declining. A prospective randomized study of 302 patients by Hochman and colleagues showed improved survival in patients undergoing early revascularization after MI complicated by cardiogenic shock; however, methods of revascularization included either CABG or percutaneous transluminal angioplasty. In a short-term risk analysis, Hirose and colleagues documented high hospital mortality in patients with preoperative cardiogenic shock (15.8%) and no deaths among those without cardiogenic shock. In our study, 15 (19.48%)
patients in group 1 were in cardiogenic shock. Cardiogenic shock impairs coronary blood flow, which may result in extension of myocardial necrosis. Early surgical intervention might limit infarct expansion and ventricular remodeling. However, there is a potential risk of reperfusion injury that might lead to hemorrhagic infarct extension, resulting in additional myocardial damage. Surgical revascularization with or without CPB within 3 days of MI might also add to the systemic inflammatory response.

Sintek and colleagues argued that CABG can provide a better outcome than medical treatment in patients with acute MI. They had no hospital mortality among patients who underwent emergency CABG within 24 h after the onset of MI, despite the fact that 43.8% had triple-vessel disease and 34.4% were in cardiogenic shock. An ejection fraction < 50% is considered a risk factor for death after MI. In our study, patients in group 1 with the highest mortality rate had the lowest ejection fractions. In the absence of clear indications for emergency surgical intervention, a 3-day waiting period should be considered. Important questions regarding the management of acute MI still need to be answered, such as the roles of thrombolytic therapy, percutaneous angioplasty, and controlled surgical reperfusion. These questions require the cooperation of our cardiology colleagues in multi-institutional prospective randomized clinical trials.

Table 1. Preoperative risk factors in patients undergoing coronary artery bypass at various times after myocardial infarction

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1 (&lt; 24 h)</th>
<th>Group 2 (24–72 h)</th>
<th>Group 3 (&gt;14 days)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of patients</td>
<td>77</td>
<td>85</td>
<td>116</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>62.3 ± 12.0</td>
<td>65.0 ± 11.3</td>
<td>65.1 ± 10.5</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Smoking</td>
<td>63 (81.8%)</td>
<td>57 (67.1%)</td>
<td>77 (66.4%)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>23 (29.9%)</td>
<td>25 (29.4%)</td>
<td>35 (30.2%)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Hypertension</td>
<td>42 (54.5%)</td>
<td>50 (58.8%)</td>
<td>70 (60.3%)</td>
<td>&gt;0.05</td>
</tr>
<tr>
<td>Renal insufficiency</td>
<td>14 (18.2%)</td>
<td>6 (7.1%)</td>
<td>12 (10.3%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Ejection fraction &lt; 30%</td>
<td>20 (26.0%)</td>
<td>13 (15%)</td>
<td>6 (5.2%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Intraaortic balloon pump</td>
<td>33 (42.9%)</td>
<td>23 (27.1%)</td>
<td>24 (20.7%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Congestive heart failure</td>
<td>15 (19.5%)</td>
<td>4 (4.7%)</td>
<td>3 (2.6%)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>

Table 2. Short-term outcomes of coronary artery bypass at various times after myocardial infarction

<table>
<thead>
<tr>
<th>Variable</th>
<th>Group 1 (&lt; 24 h)</th>
<th>Group 2 (24–72 h)</th>
<th>Group 3 (&lt;2 weeks)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebrovascular accident</td>
<td>7 (9.1%)</td>
<td>3 (3.5%)</td>
<td>3 (2.6%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>34 (44.2%)</td>
<td>35 (41.2%)</td>
<td>26 (22.5%)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Intensive care (days)</td>
<td>8.1 ± 4.4</td>
<td>4.4 ± 1.4</td>
<td>2.8 ± 1.9</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Hospital stay (days)</td>
<td>9.8 ± 10.6</td>
<td>9.5 ± 10.0</td>
<td>8.1 ± 6.6</td>
<td>&gt;0.05</td>
</tr>
</tbody>
</table>

REFERENCES


