Low Recurrence of Angina Pectoris After Coronary Artery Bypass Graft Surgery With Bilateral Internal Thoracic and Right Gastroepiploic Arteries

T. Margot Bergsma, MD; Jan G. Grandjean, MD, PhD; Adriaan A. Voors, MD, PhD; Piet W. Boonstra, MD, PhD; Peter den Heyer, MD, PhD; Tjark Ebels, MD, PhD

Background—In the past 10 years, there has been a trend to use more arterial grafts instead of vein grafts for coronary artery bypass graft surgery. Although there are many reports on the short- and mid-term follow-up of patients who underwent arterial revascularization with 1 or 2 arteries, little has been reported on the follow-up of patients with 3-vessel disease who received 3 arteries.

Methods and Results—We reviewed a group of 256 patients with 3-vessel disease who received the right gastroepiploic artery together with both internal thoracic arteries (ITAs). Vein grafts were not used in these patients. The patients were monitored for up to 7 years (mean, 51 ± 15 months). Seven-year actuarial survival was 91.1%. The cumulative probability of event-free survival for myocardial infarction, reintervention, and angina pectoris at 7 years was 97.3%, 95.4%, and 85.4%, respectively.

Conclusions—we conclude that concomitant use of the gastroepiploic artery with both ITAs results in low mortality and a low incidence of myocardial infarction and reintervention at follow-up. Most interestingly, we found 85.4% freedom from angina pectoris after 7 years, which is considerably lower than the results of studies in which vein grafts, single ITA grafts, or double ITA grafts are used. These results strongly support the use of both ITAs and the right gastroepiploic artery for bypass grafting in patients with 3-vessel disease. (Circulation. 1998;97:2402-2405.)

Key Words: angina □ arteries □ bypass □ follow-up studies □ revascularization

The use of single as well as double ITA grafts instead of vein grafts in CABG has been demonstrated through the years to improve survival and to reduce the recurrence of myocardial ischemia and the occurrence of late myocardial infarction without a significant increase in perioperative morbidity or mortality.1-4 Therefore, the current trend in CABG is toward completely arterial revascularization, even in patients with 3-vessel disease. However, in most patients with 3-vessel disease, the two ITAs do not provide enough graft material to revascularize the entire myocardium. This encouraged the use of the right GEA as a pedicled arterial graft for myocardial revascularization. At present, only short-term results of use of the GEA for bypass grafting are well documented.5-8 Recently, we described perioperative morbidity and mortality of a group of 256 patients with 3-vessel disease who underwent myocardial revascularization with exclusive use of both ITAs and the GEA. Venous grafts were not used.5 These results have now been updated. Therefore, the aim of the present study is to describe the 7-year clinical follow-up of this group of patients.

See p 2384

Methods

Between September 1989 and September 1994, 3720 patients were operated on for coronary artery disease in our institution. Revascularization of all 3 vessels was performed in 1495 patients. In this group of patients, the GEA in combination with 2 ITAs was used in 256 patients (17%), who then composed the study population. Baseline characteristics of these patients are shown in Table 1. All data were updated in the beginning of 1997, and the common closing date was April 30, 1997. Clinical information about survival and subsequent cardiac events was obtained through interviews by medically trained personnel and examination by the patient’s own cardiologist. In the case of cardiac events, the patient’s own physicians were asked for more detailed information.

The following clinical events were analyzed: mortality (from any cause, including in-hospital mortality), myocardial infarction (including perioperative infarction), cardiac reoperations (CABG and PTCA), and the recurrence of angina pectoris (graded according to the New York Heart Association scale). The actuarial survival was calculated according to the Kaplan-Meier method.

Results

No patient was lost during follow-up. Mean postoperative follow-up was 51 ± 15 months (up to 84 months).

Mortality

During follow-up, a total of 12 patients died (4.7%). Four patients died in the hospital of in-hospital complications as described in our previous report.7 One patient died of brain infarction, 1 of a myocardial infarction caused by embolization of atheromatous material from the aorta, 1 of an anterior
infarction after the left anterior descending branch was not found, and 1 of cardiac failure. The other 8 patients died 25, 26, 28, 38, 44, 52, 63, and 68 months, respectively, after the operation. Four patients died of noncardiovascular causes (2 of lung carcinoma, 1 of colon carcinoma, 1 of a temporal subdural hematoma). Four patients died of a cardiovascular cause (2 of cardiac failure, 1 of ventricular fibrillation, 1 of endocarditis). Seven-year actuarial survival (including in-hospital death and death from a noncardiovascular cause) for this group of patients was 91.1% (Figure, panel A).

**Morbidity**

In-hospital infarction occurred in 5 patients. After discharge from hospital, 2 patients suffered a myocardial infarction (1 anteroseptal and 1 inferior), at 8 and 20 months, respectively, after the operation. Seven-year infarct-free cardiac survival for this group of patients (including 5 in-hospital infarctions) was 97.3% (Figure, panel B).

Eleven patients underwent a reintervention procedure. Two patients had to undergo a repeat CABG (a few hours after their operation), and 9 had to undergo PTCA. The actuarial freedom from reintervention at 7 years after the operation was 95.4% (Figure, panel C).

After leaving the hospital, 28 patients experienced a return of angina pectoris. Eighteen were in NYHA class II, and 10 in NYHA class III. Seven-year angina-free cardiac survival was 85.4% (Figure, panel D).

**Discussion**

Arterial grafts are preferred to venous grafts for CABG, because long-term patency of venous grafts is poor, with consequent recurrent angina pectoris and subsequent cardiac events. In contrast, excellent long-term patency and better patient outcomes have been demonstrated for ITA grafts in several series. The improved survival with ITA grafts is due to improved patency rates of these grafts, which, if they are patent immediately after surgery, usually remain patent, whereas vein grafts exhibit progressive atherosclerosis.

However, venous grafts (in combination with 1 or 2 ITA grafts) are still used in the majority of patients. A reasonable alternative for the saphenous vein graft in conjunction with both ITAs is the right GEA. With the GEA, myocardial revascularization can be achieved with the use of arterial grafts only, even in patients with 3-vessel disease.

We restudied a group of 256 patients suffering 3-vessel disease who underwent CABG with arterial grafts only (both ITAs and the GEA). Mean postoperative follow-up was 51 ± 15 months (up to 84 months), which at present is the longest follow-up of the use of the GEA graft in combination with 2 ITA grafts as yet reported. We compared our results with those of clinical studies in which patients were operated on with vein grafts and/or ITA grafts and in which the actuarial survival was calculated.

**Mortality**

Actuarial 7-year survival in our study group was 91.1%. This is a satisfactory outcome compared with studies in which vein

### TABLE 1. Baseline Patient Characteristics

<table>
<thead>
<tr>
<th>Condition</th>
<th>No.</th>
<th>% of 256</th>
</tr>
</thead>
<tbody>
<tr>
<td>NYHA class</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II–III</td>
<td>173</td>
<td>67</td>
</tr>
<tr>
<td>IV</td>
<td>83</td>
<td>33</td>
</tr>
<tr>
<td>Myocardial infarction, n</td>
<td>140</td>
<td>54.7</td>
</tr>
<tr>
<td>1</td>
<td>120</td>
<td>46.9</td>
</tr>
<tr>
<td>2</td>
<td>19</td>
<td>7.4</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>0.4</td>
</tr>
<tr>
<td>Hypercholesterolemia</td>
<td>133</td>
<td>52</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>13</td>
<td>5.0</td>
</tr>
<tr>
<td>PTCA</td>
<td>26</td>
<td>10</td>
</tr>
<tr>
<td>Reoperation</td>
<td>28</td>
<td>11</td>
</tr>
<tr>
<td>Prior laparotomy</td>
<td>9</td>
<td>3.6</td>
</tr>
</tbody>
</table>
grafts, single ITA grafts, or double ITA grafts are used, especially considering that we studied only patients with 3-vessel disease and we included in-hospital mortality in the calculation of the actuarial 7-year survival (Table 2).

Morbidity

Myocardial Infarction

Seven-year actuarial freedom from myocardial infarction in our study group was 97.3%. Despite the inclusion of 5 in-hospital infarctions in our calculation of the actuarial freedom from myocardial infarction, the percentage of patients in our study group remaining free from myocardial infarction during follow-up is higher than in the comparable studies (Table 2).

Reintervention

The 7-year actuarial probability of remaining free from reintervention after coronary bypass in our study (95.4%) is comparable to that in other studies (Table 2). However, again it should be noted that, in contrast to the other studies, we included 2 in-hospital reoperations.

Angina Pectoris

Actuarial freedom from angina pectoris after 7 years was 85.4%, which is considerably lower than in the studies in which vein grafts, single ITA grafts, and double ITA grafts were used (Table 2). Because all patients in our study group were explicitly asked about anginal complaints, we firmly believe that we have not underreported the incidence of angina.

Data published on results in patients with coronary revascularization with vein grafts, single ITA grafts, and double ITA grafts are in most instances difficult to compare because of differences in inclusion and exclusion criteria. A limitation of the study is that we compared our group of patients with historical control subjects. Furthermore, follow-up is still too short to draw definitive conclusions. Nevertheless, if we allow comparisons in this early stage, we demonstrated that mortality, myocardial infarction, and reintervention rates in our patients with 3-vessel disease were at least comparable to the results of other studies. Moreover, our results indicate a lower recurrence of angina pectoris after 7 years of follow-up.

Acknowledgments

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References


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