Results of Elective Aortocoronary Saphenous Vein Graft Surgery in a Community Hospital

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SUMMARY

In a community hospital setting, without academic affiliation or house staff coverage, 145 patients had elective saphenous vein graft surgery between January 1970 and January 1973. Patients with good left ventricular function, with or without associated procedures, had an operative mortality of 2.4%. The surgical mortality of patients who had associated procedures was 9.5%. The overall operative mortality was 6.2% with an immediate postoperative myocardial infarction rate of 17%. Results in 38 patients with pre-infarction angina were no different from the group as a whole. The risk of surgery is best categorized by a combination of angiographic severity of coronary artery disease plus severity of left ventricular dysfunction estimated by left ventriculogram.

Additional Indexing Words:
Angina pectoris  Myocardial infarction  Left ventriculogram  Bypass surgery

MULTIPLE ARTICLES have now been published regarding experience with saphenous vein graft surgery, and were recently reviewed by Wilson. The information is primarily derived from university medical centers, with no significant input from non-university associated community hospitals, where a large amount of revascularization surgery is being performed. Therefore, we thought it would be of interest to present our experience with saphenous vein graft surgery for several reasons: 1) The procedures were accomplished in a community hospital of 330 beds; 2) The open heart team, comprised of three cardiologists and three cardiac surgeons, are all in fulltime private practice; 3) No fulltime medical or surgical residents were available for postoperative care; and 4) A significant amount of responsibility in routine postoperative care was given to critical care nurses in combination with a standard written protocol.

Methods

From January 1970 to January 1973, 145 patients had elective saphenous vein graft surgery at Bryan Memorial Hospital. The initial 80 patients’ hospital charts were reviewed retrospectively. Then a protocol was established for prospective data collection. Because of the nature of our referral private practice, many patients are lost in follow-up. Therefore, most of the data is related to the immediate postoperative period.

Angina pectoris classification was based on the New York Heart Association functional classes I-IV. Thirty-eight patients were categorized in a subgroup of pre-infarction angina, which was defined as follows: 1) Crescendo angina pectoris from a previously stable state, or new onset of angina with rapid progression; 2) No electrocardiographic or serum enzyme evidence of acute myocardial infarction; and 3) Demonstration by selective coronary arteriography of 70% or greater narrowing of one or more of the three major coronary arteries. New myocardial infarction was defined as new development of a significant Q wave (0.04 sec in duration) in two or more leads. Operative mortality is defined as death occurring after surgery but prior to discharge from hospital.

In over 90% of the cases, selective coronary arteriography was performed by the transfemoral percutaneous technique. Systemic heparinization during the catheterization procedure was not utilized. Grading of coronary artery anatomy was based on the Johns Hopkins system of scoring the three major coronary arteries (right, left circumflex, and left anterior descending), with a maximum score for each artery of five: 0 = no lesion; 1 = 1-49% stenosis; 2 = 50-89% stenosis; 3 = several lesions in the same artery, with at least one lesion greater than 50% stenosis; 4 = 90% or greater stenosis; and 5 = total obstruction. Therefore, maximal coronary artery disease of three vessels would be a score of 15. Left ventriculogram grading was as follows: class I—normal; class II—one wall (anterior or
involving; class III—two walls involved with either akinesis, hypokinesis, or dyskinesis present. In the first 46 patients described, left ventricular angiography was performed at the end of the catheterization procedure. In the last 109 patients it was the first angiographic procedure, and the left ventricular end diastolic pressure measurements were taken before the routine use of sublingual nitroglycerin.

**Operative Technique**

All operations were performed with cardiopulmonary bypass, hemodilution, and a bubble oxygenator. An occasional right coronary artery vein graft did not require institution of cardiopulmonary bypass. Along with moderate hypothermia, the heart was electrically fibrillated, then vented through the left ventricle or left atrium. Coronary arteriography was performed in the appropriate area. A dry field for the distal anastomosis was obtained early in the experience with encircling suture, and later with finger pressure, or aortic cross clamping. After the distal anastomoses were performed, patients were gradually weaned from cardiopulmonary bypass while the proximal anastomosis was accomplished. Direct blood flow measurements of the individual grafts were obtained in the last 55 patients. A radial artery cannula and central venous pressure line were routinely left in place, although the latter was changed to a left atrial catheter later in the series. Ventilatory assist with an endotracheal tube was used for the first 12-24 hr after surgery.

Using the above methods, 223 vein bypass grafts were constructed. This included 106 grafts to the left anterior descending coronary artery system, 82 grafts to the right coronary artery system, and only 35 grafts to the left circumflex coronary artery system. This averaged 1.54 grafts per patient, and varied from 1 to 4. A Y graft was seldom used; each vein graft was constructed with an individual proximal anastomosis. A direct internal mammary artery artery anastomosis to a coronary artery was constructed for seven vessels. The indication for internal mammary artery anastomosis was younger patients with a bypassable coronary artery of small diameter.

**Clinical Data**

The clinical data are summarized in table 1. Six patients were age 66 years or older. The two oldest patients were age 73: both had pre-infarction angina. Fifty percent of the patients had a history of prior myocardial infarction, 9% had a history or findings for congestive heart failure, and 30% had normal resting electrocardiograms. Sixty-seven patients or 46% had elevated left ventricular end-diastolic pressures greater than 13 mm Hg.

Ninety-six patients (67%) had class III-IV angina prior to surgery. Forty-nine patients (33%) had class I-II angina prior to surgery. The primary indication for surgery in this latter group of patients was associated procedures (8), significant stenosis of the left main stem coronary artery (4), and significant stenosis of the left anterior descending coronary artery at or prior to the first spetal perforator (32). Five patients with mild stable angina who underwent surgery early in the series would not meet the present criteria for surgical intervention.

**Operative Results**

The operative mortality experienced is summarized in table 2. The immediate operative mortality was 9 of 145 patients or 6.2%. For the group with class I and II ventriculograms, the operative risk was only 2.4%, vs 27% for patients with class III left ventriculograms. Analyzing the data by coronary artery classification alone, class 0-12 disease had an operative risk of 3/99 or 2.9%; class 13-15 disease had a mortality rate of 6/44 or 13.6%. Four of 13 patients or 30% died when they had the combination of a class III left ventriculogram with class 13-15 coronary artery disease.

### Table 1

**Clinical Data in 145 Patients**

<table>
<thead>
<tr>
<th>Measure</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average age (yrs)</td>
<td>53</td>
</tr>
<tr>
<td>Range (yrs)</td>
<td>36-73</td>
</tr>
<tr>
<td>Sex</td>
<td>125 M, 20 F</td>
</tr>
<tr>
<td>Angina class:</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>11 (7%)</td>
</tr>
<tr>
<td>II</td>
<td>38 (26%)</td>
</tr>
<tr>
<td>III</td>
<td>40 (28%)</td>
</tr>
<tr>
<td>IV</td>
<td>56 (39%)</td>
</tr>
<tr>
<td>History prior myocardial infarction</td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>2</td>
</tr>
<tr>
<td>None</td>
<td>70</td>
</tr>
<tr>
<td>One</td>
<td>56</td>
</tr>
<tr>
<td>Two or more</td>
<td>73 (50%)</td>
</tr>
<tr>
<td>Normal resting ECG</td>
<td>44 (30%)</td>
</tr>
<tr>
<td>Left ventricular end-diastolic pressure (mm Hg)</td>
<td></td>
</tr>
<tr>
<td>&lt;12</td>
<td>78</td>
</tr>
<tr>
<td>13-20</td>
<td>37</td>
</tr>
<tr>
<td>21-30</td>
<td>22</td>
</tr>
<tr>
<td>&gt;30</td>
<td>8</td>
</tr>
</tbody>
</table>

### Table 2

**Operative Mortality**

<table>
<thead>
<tr>
<th>Coronary artery class</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-8</td>
<td>0/22</td>
<td>0/14</td>
<td>1/2</td>
<td>1/38 (2.6%)</td>
</tr>
<tr>
<td>9-10</td>
<td>0/21</td>
<td>0/6</td>
<td>0/2</td>
<td>0/29 (0)</td>
</tr>
<tr>
<td>11-12</td>
<td>1/17</td>
<td>0/10</td>
<td>1/5</td>
<td>2/32 (6.2%)</td>
</tr>
<tr>
<td>13-15</td>
<td>2/13</td>
<td>0/18</td>
<td>4/13</td>
<td>6/44 (13.6%)</td>
</tr>
<tr>
<td>Total</td>
<td>3/73</td>
<td>0/48</td>
<td>6/22</td>
<td>(4.0%)</td>
</tr>
</tbody>
</table>

*Two patients who did not have preoperative left ventriculogram are excluded from this table.
The operative mortality in the pre-infarction angina subgroup was 3 of 38 patients or 8%. Seven of 38 patients or 18% had a postoperative myocardial infarction. Both of these results are similar to the overall operative results. Thirty-three of 38 patients had 90% or greater stenosis of the proximal left anterior descending coronary artery.

The overall immediate postoperative myocardial infarction incidence was 25 of 145 patients or 17%. Five of these 25 patients died. When the data were analyzed by either increasing severity of coronary disease or left ventricular dysfunction, there were no differences in the infarction rate between the different classes, except that only one of 49 patients with a class II left ventriculogram developed an infarction.

Twenty-one patients (14%) had associated procedures: Ventricular aneurysmectomy (13), prosthetic aortic valve replacement (3), prosthetic mitral valve replacement (1), mitral annuloplasty (1), repair of atrial septal defect (1), ligation of coronary arteriovenous fistula (1), and internal mammary implant (2). The operative mortality for revascularization and associated procedure was two deaths of 21 patients (9.5%). One patient died following an aneurysmectomy and the other following an atrial septal defect repair. Both patients had class III left ventriculograms.

The total risk to the patient with coronary artery surgery is not complete without consideration of the preoperative evaluation. In the last 544 patients consecutively studied by selective coronary arteriography, our mortality has been 0.7%, with a myocardial infarction rate of 0.55%. In the last 176 patients we have had no infarcts.

Discussion

Our operative results are comparable with university centers across the country. In more than 25 surgical series of 40 or more cases, the total operative mortality has ranged from 2.5-18%.1 The operative mortality figures in patients with good left ventricular function in four university centers in Milwaukee,3 St. Louis,4 Chicago,5 and Dallas,6 was 4.0%, 3.1%, 4.0% and 3.9% respectively. Information regarding ventricular function and operative mortality is not specifically available in many reports.7-12 The incidence of immediate postoperative myocardial infarction has been as low as 0.7%13 to a high of 58%14 with the most recent reports ranging from 6-30%.1,15-18

Because of the unknown long term patency of saphenous vein grafts, the significant incidence of postoperative myocardial infarction, and the detrimental changes in the intrinsic coronary circulation,18 we have revised our operative indications in patients with angina pectoris to a more conservative position. A myocardial revascularization procedure is recommended to a patient who continues to be significantly disabled (class III-IV) from angina pectoris after a medical trial, has significant disease in one or more of the three major coronary arteries, and has good left ventricular function. Surgery is also considered for any patient, with or without symptoms, who has either significant left main stem stenosis or left anterior descending coronary artery stenosis, at or proximal to the first septal perforator, unless severe depression of left ventricular function is already present. If there is isolated disease of the right and/or left circumflex coronary arteries, we recommend a medical trial before considering surgery. We still occasionally operate on a symptomatic patient with a class III left ventriculogram, if the patient is severely disabled and fully realizes the risks involved and the uncertainty of outcome.

We study all patients who are considered preinfarctional because: 1) Our surgical mortality and postoperative infarction rates in patients with preinfarction angina are not dissimilar from the group as a whole; 2) Our coronary arteriography complication rate in 38 patients with preinfarction angina has been low, i.e., one infarction and no deaths; and 3) In the past two years we have demonstrated normal coronary arteries in six patients with preinfarction angina. Other centers have also demonstrated normal coronary arteries in this group of patients.20,21

Recently, the Committee on Coronary Artery Surgery of the American Heart Association recommended that a cardiac center should perform a minimum of four open heart procedures weekly to stay competent.22 Although our open heart team averages only three cases per week, we feel our operative results in aortocoronary saphenous vein graft surgery indicate these procedures can be performed in a nonacademic setting with reasonable results. We would encourage other community hospital based cardiologists and cardiac surgeons to report their data for further comparison.

References


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