Emergency Vein Bypass for the Pre-Infarction Syndrome*


Our results from emergency aorta to coronary artery saphenous vein bypass grafting in five patients with pre-infarction syndrome are presented. The feasibility of such treatment is discussed, and it is suggested that the pre-infarction syndrome may present a major indication for coronary revascularization.

The purpose of this article is to report our experience with emergency aorta to coronary artery vein bypass in five patients with pre-infarction syndrome.

METHODS AND MATERIALS

Four men, ages 51, 54, 63 and 64, and one woman, age 48, underwent emergency saphenous vein bypass surgery. Preoperatively, all patients underwent selective coronary cineangiography and in four patients, left ventricular cineangiograms were performed. Four patients were operated on within 48 hours and one within 72 hours after admission.

PREOPERATIVE STATUS AND PRODOMATA

Four of the five patients were admitted with a tentative diagnosis of acute myocardial infarction based on the presence of severe, crushing retrosternal chest pain requiring narcotics for relief. One patient was admitted because of marked increase in her anginal episodes, which were awakening her every 30 minutes at night and requiring six to seven nitroglycerin tablets per attack. In this patient, and in one other, there was a history of angina for the preceding 14 months. Three patients had no past history of angina pectoris; they presented with a history of increasing chest pain over three-day, seven-day and four-week periods. Frequent PVCs were noted in two patients. Blood pressure was slightly elevated in one and normal in the other four. Heart size was normal in all. A fourth heart sound was heard at some time in all the patients; no murmurs were detected.

The admission electrocardiogram was normal in one patient and abnormal in four, with minimal ST-segment changes noted in three and poor R-wave progression in one. Twenty-four hours after admission, precordial T-wave inversion was noted in three patients. Enzymes on admission were normal in all patients and remained so at 24 hours. In patient 2 a tracing obtained immediately prior to surgery revealed Q waves in the anterior precordial leads and a SGOT of 85. Patient 5—with marked T-wave inversion—had a SGOT of 47 immediately prior to surgery.

Coronary cineangiography revealed single-vessel disease of the left anterior descending in two patients (2, 5), neither of whom had had chronic pain. In case 4, with a four-week history of increasingly severe pain, three-vessel disease was present. This patient had had a negative submaximal exercise treadmill (heart rate increased to 85 percent of predicted maximal) test two weeks previously. In the two patients (1 and 3) with a long history of angina pectoris, three-vessel disease was present. The 48-year-old woman (case 1) with severe nocturnal angina had a critical lesion of the main left coronary artery. No collateral circulation was seen in any patient.

Ventricular function data are shown in Table 1. All procedures were performed with the patients awake, using a percutaneous approach via the femoral artery. Judkins catheters were used in each instance; premedication consisted of .4 to 1.0 mg of atropine, im; in all instances, the patients had received narcotics for chest pain. Except for transient sinus bradycardia during the percutaneous puncture, there were no complications. Using a special grid previously described,1 left ventricular
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Table 1—Hemodynamic Studies

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex</th>
<th>Age</th>
<th>Time</th>
<th>BSA m²</th>
<th>LV Pressure S/ED</th>
<th>Peak LV dp/dt</th>
<th>EDV ml/m²</th>
<th>ESV ml/m²</th>
<th>SI ml/m²</th>
<th>SEF</th>
<th>HR</th>
<th>CI</th>
<th>Short Rate cm</th>
<th>Circum cm/sec</th>
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<tr>
<td>1</td>
<td>F</td>
<td>48</td>
<td>Preop</td>
<td>1.79</td>
<td>12/17</td>
<td>1300</td>
<td>49.8</td>
<td>18.6</td>
<td>31.2</td>
<td>.63</td>
<td>105</td>
<td>3.28</td>
<td>6.1</td>
<td>24.4</td>
<td>41.5</td>
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<tr>
<td>2</td>
<td>M</td>
<td>54</td>
<td>Preop</td>
<td>1.99</td>
<td>164/32</td>
<td>1900</td>
<td>74.8</td>
<td>37.4</td>
<td>37.4</td>
<td>.50</td>
<td>72</td>
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<td>13.4</td>
<td>29</td>
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<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>Postop</td>
<td>1.90</td>
<td>118/14</td>
<td>51.5</td>
<td>26.8</td>
<td>24.7</td>
<td>.48</td>
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<td>Postop</td>
<td>1.76</td>
<td>143/13</td>
<td>63.3</td>
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<td>47.1</td>
<td>.74</td>
<td>70</td>
<td>3.29</td>
<td>7.6</td>
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<td></td>
<td>Postop</td>
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<td>40.4</td>
<td>.72</td>
<td>115</td>
<td>4.65</td>
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</table>

BSA = Body surface area
LV = Left ventricular
S = Systolic
E = End diastolic
ESV = End systolic volume
SEF = Systolic ejection fraction

Operative Procedures

A single graft to the left anterior descending was inserted in two patients with single-vessel disease. Branch grafts were inserted into the right coronary artery and left anterior descending in the three patients with three-vessel disease. The branch graft consisted of a long segment of saphenous vein which was attached at its midpoint to the aorta prior to going on cardiopulmonary bypass. Subsequently, one end of the vein was inserted into the left anterior descending and the other end of the graft into the right coronary artery. Bypass was performed with the Bentley disposable oxygenator primed with either 5 percent D/W or Ringers lactate, and with the patients maintained at normothermia; anesthesia consisted of morphine and/or halothane with oxygen. Pump time ranged from 27 to 95 minutes; all patients came off of the pump without difficulty.

Hospital Course

Two patients (4 and 5) developed atrial fibrillation following surgery and were reverted to a sinus mechanism with digitalization. No patient received digitalis prior to surgery. One patient (3) developed atrial flutter six days postoperatively. Rate was controlled with digitalis and propranolol and he subsequently was converted to normal sinus rhythm with a 50 watt-second shock. One patient (2) had transient hypotension the first postoperative day. Patient 5's electrocardiogram returned to normal following surgery. However, 12 days following surgery, he had an uncomplicated ischemic episode lasting one day, associated with electrocardiographic changes of an anteroseptal wall myocardial infarction and a SGOT of 83. Patient 3, who developed atrial flutter and had a loud friction rub, had persistent ST elevation for several days, followed by T-wave inversion; no enzyme rise was detected; no pain was present. Two patients had no significant electrocardiographic changes postoperatively. Patient 4 developed pericardial tamponade 12 hours postoperatively, although the pericardium was left widely open. However, neither chest cavity had been entered at surgery. There was a markedly paradoxic pulse with a low venous pressure. Hypotension and low urinary output were immediately corrected when the tamponade was relieved at surgery.

Ten days postoperatively, patients 2 and 3 were restudied. The single-vein graft to the LAD was widely patent in patient 2 (Fig 1) and repeat left ventricular angiography revealed improvement in wall motion (Fig 2) and an increase in shortening.

![Figure 1](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21516/) Patient 2: 35 mm cine frame illustrating patency of saphenous vein graft. Also shown is occluded LAD (left anterior descending) which on preoperative study was narrowly patent.
rate to 21.4 cm/sec compared to 13.4 cm/sec preoperatively, and $V_{\text{cr}}$ from .7 to 1.6 lengths/sec postoperatively, and a decrease in LVED pressure from 30 to 14 mm/Hg postoperatively. However, it is of some interest that the ejection fraction remained low and unchanged from the preoperative value. In patient 3, the branch to the right coronary artery was occluded, whereas the branch to the LAD was widely patent. Ventricular cineangiography was similar to the preoperative study, revealing normal ejection fraction, ventricular volumes and shortening rates.

**Follow-up Observations**

The patients have been observed after discharge for intervals varying from two to five and one-half months after surgery. Patients 2 and 5 have been walking between one to three miles daily without pain. Three months after surgery, patient 2 performed a submaximal exercise treadmill test without chest pain, during which the heart rate was increased to 85 percent of predicted maximal, which revealed no ischemic ST changes. Patient 3, who prior to surgery had severe incapacitating chest pain and paroxysmal rapid heart rate, had the onset of PVCs ten weeks after discharge, which were controlled with procaine amide. In a progressive exercise program, he now notes infrequent mild angina pectoris. Patient 4 has progressively increased his daily exercise to several blocks without chest pain. Patient 1 is now performing light housework without chest pain, and a submaximal treadmill test two months postoperation was performed without pain or ischemic ST changes (Fig 3).

**Discussion**

The pre-infarction patient allows a unique opportunity to observe the mechanisms of infarction and sudden death. Vagaries of the pre-infarction syndrome are considerable and more studies are needed to better predict the course of a patient with a given set of presenting complaints. However, the studies of Solomon and associates have shown acute myocardial infarction is preceded by prodromata in 65 percent of patients. In patients with well-established angina, 83 percent had an early recognizable increasing incidence of angina and/or characteristic chest pain. Moreover, it is recognized that single-vessel disease may result in acute myocardial infarction and death, and that single-vessel disease is not limited to the young.

*A summary of individual patient observations is available on request.*

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**Figure 2.** Patient 2: (a) preoperative study RAO view diastole; (b) preoperative study RAO view systole; note absence of anterior wall motion; (c) postoperative study RAO view diastole; (d) postoperative study RAO view systole; note normal movement of anterior wall.
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We have shown in this report of our preliminary experience that it is possible to perform emergency coronary cineangiography as well as successfully perform saphenous vein bypass in the pre-infarction, or early infarction, patient. All five patients undergoing surgery have survived.

The criteria for selection for surgery remains to be established; however, in the patient presenting with pain suggestive of acute myocardial infarction, in whom the enzymes are normal, or near normal, who develops T-wave inversion or ST change; or, in the patient with a marked increase in the severity of his angina and ventricular irritability, we believe selective coronary cineangiography should be considered. We feel that the pre-infarction syndrome, when associated with critical coronary artery lesions, particularly in the absence of collaterals, represents the leading indication for saphenous vein bypass surgery.

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