

Factors influencing patency of coronary bypass grafts

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The immediate relief of angina pectoris was striking in the earliest patients treated with bypass graft surgery in the late 1960s. Early optimism was tempered, however, by the uncertainties of long-term graft patency, particularly in view of the experiences reported with autogenous venous femoropopliteal bypass grafts with which patency ranged from 20% to 90%, depending upon the site of the distal anastomosis, adequacy of runoff, and time. Early postoperative arteriograms of coronary bypass grafts in 48 patients operated upon from May 1967 through September 1968 demonstrated patency in 87.5% of grafts. Encouraged by these results, the indications for surgical treatment were cautiously expanded to include larger numbers of patients.

Patients are selected for bypass graft surgery on the basis of angiographic assessment of their coronary arteries and left ventricle. In many instances, the arteriographic assessment of an artery is supplanted by that of the surgeon at the time of operation, and the various factors influencing graft patency are preempted by these preselection criteria. It is recognized that the greater likelihood of symptomatic patients with graft failure to return for postoperative

study introduces a negative bias into postoperative arteriographic results. This can be overcome only by 100% arteriographic follow-up of survivors or by strict randomization of patients for postoperative arteriography, neither of which has been achieved. Although a large number of patients have returned for routine postoperative studies 1 year or more after surgery, an increasing caseload in the Cardiac Catheterization Laboratory

has precluded the routine 1 year postoperative study, and currently these studies are carried out only when specifically indicated.

In our computerized Cardiovascular Information Registry, the results of 4590 postoperative arteriographic studies are available for analysis and a number of parameters of possible importance in graft patency have been studied:

Patency of IMA vs. vein grafts to anterior descending artery*

| | IMA | Vein | Total |
|----------------|------|------|-------|
| No. grafts | 845 | 1268 | 2113 |
| No. occluded | 19 | 171 | 190 |
| No. patent | 826 | 1097 | 1923 |
| Percent patent | 97.8 | 86.5 | 91.0 |

* Postoperative angiograms 1974 through 1976.

Patency vs. postoperative interval

| Postoperative interval | IMA | | Vein | | Both | |
|------------------------|------|-------|------|------|------|------|
| | No. | % | No. | % | No. | % |
| <7 months | 153 | 94.1 | 706 | 76.6 | 859 | 79.7 |
| 7-12 months | 454 | 96.9 | 1956 | 84.4 | 2410 | 86.8 |
| 13-24 months | 492 | 95.1 | 2510 | 84.7 | 3002 | 86.4 |
| 25-36 months | 51 | 94.1 | 350 | 89.4 | 401 | 90.0 |
| 37-48 months | 28 | 92.9 | 171 | 78.9 | 199 | 80.9 |
| >48 months | 9 | 100.0 | 192 | 81.8 | 201 | 82.6 |
| Total | 1187 | 95.6 | 5885 | 83.7 | 7072 | 85.7 |

Patency vs. sex

| | IMA | | Vein | | Both | |
|---------|------|--------|------|--------|------|--------|
| | Male | Female | Male | Female | Male | Female |
| Number | 1088 | 99 | 5355 | 530 | 6443 | 629 |
| Percent | 95.9 | 92.9 | 84.4 | 76.6 | 86.3 | 79.2 |

Patency vs. other risk factors (vein and IMA grafts)

| | Hypertension | | Diabetes | | Smoking | |
|---------|--------------|---------|----------|------|---------|------|
| | ≥150/100 | <150/90 | + | - | + | - |
| Number | 1786 | 5227 | 681 | 4960 | 3203 | 2728 |
| Percent | 87.0 | 85.2 | 84.4 | 86.8 | 84.5 | 87.9 |

Patency vs. hyperlipidemia (vein and IMA grafts)

| | Cholesterol | | Triglycerides | |
|---------|-------------|------------|---------------|------------|
| | ≥260 mg/dl | <260 mg/dl | ≥160 mg/dl | <160 mg/dl |
| Number | 2164 | 4682 | 3599 | 2390 |
| Percent | 85.9 | 85.8 | 85.4 | 86.5 |

Patency vs. severity of preoperative lesion (vein and IMA grafts)

| | <50% | 50%-75% | 76%-99% | 100% |
|---------|------|---------|---------|------|
| Number | 454 | 876 | 4060 | 1682 |
| Percent | 86.8 | 84.1 | 86.1 | 85.0 |

Patency vs. preoperative LV function

| | Focal akinesia | Generalized hypokinesia |
|---------|----------------|-------------------------|
| Number | 1865 | 205 |
| Percent | 88.2 | 87.8 |

Patency vs. emergency or repeat operation

| | Emergency operation | | +1 | Repeat operation | |
|---------|---------------------|------|------|------------------|------|
| | + | - | | +2 | - |
| Number | 43 | 7029 | 30 | 77 | 7042 |
| Percent | 93.0 | 85.6 | 70.0 | 84.0 | 85.7 |

+1 Reoperation for same artery (CVIR)

+2 Reoperation for any artery (Irrarrazaval)

Patency vs. perioperative MI in area of grafted artery

| | IMA | | Vein | | Both | |
|-------|------|------|------|------|------|------|
| | No. | % | No. | % | No. | % |
| MI | 35 | 94.3 | 82 | 65.9 | 117 | 74.4 |
| No MI | 1152 | 95.7 | 5803 | 83.9 | 6955 | 85.9 |

Intraoperative electromagnetic flow measurements were of little value in predicting the late patency of grafts except at flow rates of 20 cc per minute or less. Histologic abnormalities identified in vein graft samples at the time of surgery (phlebosclerosis) did not predict graft occlusion.

Insufficient material for late histologic analyses of graft (from reoperations or autopsy) precludes any conclusion regarding the incidence of intimal fibroplasia or atherosclerotic

involvement. Both have rarely been observed.

Despite an initial attrition of grafts, which is probably related to factors of selection as well as to surgical technique, long-term graft patency, up to 106 months postoperatively, has been demonstrated. For the anterior descending artery, patency is better for the IMA graft than for the venous graft. Explanation for reduced graft patency in women remains to be determined.