Myocardial revascularization at The Cleveland Clinic Foundation—1980

Gary L. Saltus, D.O.
Floyd D. Loop, M.D.

Department of Thoracic and Cardiovascular Surgery

Fawzy G. Estafanous, M.D.

Department of Cardiothoracic Anesthesia

William C. Sheldon, M.D.

Department of Cardiology

In this second decade of coronary artery surgery, the number of procedures has increased 15% to 20% each year. Seventy-five percent of these operations are performed in the private sector.[1] Advances in myocardial protection, number of grafts per patient, blood usage, and perioperative management require close surveillance to determine the impact on early and late clinical results.[2]

Results of coronary artery surgery from The Cleveland Clinic Foundation include a 10- to 13-year follow-up of 741 patients in the 1967 to 1970 experience[3] and 5-year survival from 1000 patient cohorts from 1971 to 1974.[4] In 1980 we reviewed the experience of the previous year in coronary artery surgery.[5] Herein we report all cases of isolated bypass grafting during 1980.

Methods

All patients who underwent only myocardial revascularization from January 1, 1980 through December 31, 1980 were entered into a computer base registry. Included were patients who underwent emergency and elective surgery, reoperations, and had normal or abnormal left ventricular function. Patients who underwent coronary artery bypass surgery combined with either peripheral vascular operations, ventricular aneurysmectomy, or valve repair or replacement were excluded.

Clinical characteristics

A total of 2443 patients, 2121 (86.8%) men and 322 (13.2%) women were operated on in the calendar year 1980. The age range was 28 through 80 years. The median age increased from 57 years in 1979 to 58 in 1980, continuing the upward trend of the past 13 years. Preoperatively, 562 (23.0%) had no symptoms or mild symptoms, 1463 (59.9%) had moderate angina, and 418 (17.1%) had severe or unstable angina. These findings are attributed to earlier referral, better medical management, and a trend toward selection based on pathoanatomy. There were little or no changes statistically between 1979 and 1980 patients regarding hypertension, diabetes, or serum cholesterol and triglyceride levels. Angiographic characteristics are shown in *Table 1*.

Perioperative management

With few exceptions management procedures intraoperatively and postoperatively are similar to those reported in the 1979 review.[5] There is a trend toward greater use of a single venous drainage cannula rather than bicaval venous cannulation. Venting techniques are individualized, but an aortic vent is now widely used. It is appreciated, however, that bicaval cannulation with atrioventricular venting techniques gives optimal myocardial protection and is preferred in complicated cases.

Table 1. Angiographic characteristics (narrowing >49%)

	Patients	
	No.	%
One-vessel disease	229	9.4
Two-vessel disease	630	25.8
Three-vessel disease	1274	52.1
Left main coronary artery disease	310	12.7
Normal left ventricle	1122	45.9
Abnormal left ventricle	1321	54.1

Table 2. Myocardial revascularization mortality, 1980

Cause	No. of patients
Ischemia/infarction/low output	14
Cerebrovascular accident	7
Sudden death	3
Mediastinitis	2
Pneumonia	1

The blood conservation protocol established in 1978[6] has been modified slightly in that blood collected in the operating room is processed centrally in the blood bank and returned as packed cells.

Results

From January 1, 1980 to December 31, 1980, seven staff surgeons performed isolated revascularization operations on 2443 patients at the Cleveland Clinic; 2.6 bypass grafts were performed per patient; and the hospital mortality was 1.1% (27 patients). Mortality for men was 0.8% (17 patients) and for women 3.1% (10 patients). Of 818 patients (33.5%) who received internal mammary artery grafts the hospital mortality was 0.1% (one patient). The incidence of reoperation for coronary artery disease was 6.3% (153 patients); the operative mortality was 2.6% (four patients) in this subset.

Of the 27 deaths (*Table 2*), 14 patients died of ischemia, infarction, or low cardiac output; seven died within the first 24 to 48 hours, and two patients died at 8 and 9 days, respectively. Of the two patients who died intraoperatively, one experienced prolonged ischemia during a reoperation. This patient had received mediastinal radiation therapy for Hodgkin's disease. The second patient was a 69-year-old woman with subtotal obstruction of the left main trunk; total obstruction of the left anterior descending and circumflex arteries; subtotal right coronary artery occlusion; and se-

Table 3. Postoperative complications

	Patients	
	No.	%
Reoperation for bleeding	73	3.0
Stroke	37	1.5
Congestive heart failure	29	1.2
Respiratory insufficiency	26	1.1
Myocardial infarction	23	0.9
Renal failure	21	0.9
Wound complication	21	0.9
GI bleeding	6	0.2
Noncerebral embolus	4	0.2

vere, diffuse impairment of left ventricular function. Extracorporeal circulatory bypass could not be discontinued and she died in the operating room.

The second leading cause of death was cerebrovascular accident (seven patients). Three other patients died suddenly on a regular nursing floor, presumably secondary to arrhythmia or myocardial infarction. Two patients died of the effects of mediastinitis and another of Pseudomonas pneumonia.

The intraaortic balloon pump (IABP) was used in 84 patients in 1980 in comparison with 80 patients in 1979. Of the 84 patients, the IABP was placed preoperatively in 13, intraoperatively in 50, and after the first 12 hours in 21. Twenty-three of the 84 patients had percutaneous insertion. Forty-eight of the 84 survived and were discharged.

Twenty-three patients (0.9%) had perioperative or postoperative myocardial infarctions defined as new Q waves during the 1980 period. Seventy-three patients (3.0%) were reoperated on for the control of persistent bleeding postoperatively. Complications are listed in *Table 3*.

Summary

Coronary bypass surgery was performed on 2443 patients in 1980; 2416 (98.9%) survived and were discharged from the hospital. An average of 2.6 grafts per patient was performed. Of the 27 patients (1.1%) who died in the hospital, 14 died of ischemia/infarction or low cardiac output. Revascularization of patients with impaired left ventricles and diffuse atherosclerosis requires close hemodynamic monitoring during induction and cannulation. Uniform myocardial distribution of cold cardioplegia solution and expeditious performance of grafting are crucial in myocardial protection. Intraoperative or early hospital death can usually be attributed to instability at outset of the procedure, diffuse atherosclerosis, or unrecognized infarction, which occurred within a day or two preoperatively. The number of coronary artery reoperations increased to 153 in 1980 accounting for 6.3% of our operative volume. The incidence of IABP use, including preoperative insertion for unstable angina, did not change.

The operative mortality was 1.1% and major morbidity continued to decline.

References

1. Miller DW Jr, Ivey TD, Bailey WW, Johnson DD, Hessel EA. The practice of coronary artery bypass surgery in 1980. J Thorac Cardiovasc Surg 1981; **81:** 423–7.
2. Estafanous FG, ed. Anesthesia and the heart patient; an international symposium. Cleve Clin Q 1981; **48:** 1–236.
3. Sheldon WC, Rincon G, Pichard AD, Razavi M, Cheanvechai C, Loop FD. Surgical treatment of coronary artery disease; pure graft operations, with a study of 741 patients followed 3–7 yr. Prog Cardiovasc Dis 1975; **18:** 237–53.
4. Loop FD, Cosgrove DM, Lytle BW, et al. An 11 year evolution of coronary arterial surgery (1967–1978). Ann Surg 1979; **190:** 444–54.
5. Sandberg GW, Loop FD, Estafanous FG, Sheldon WC. Myocardial revascularization in The Cleveland Clinic Foundation—1979. Cleve Clin Q 1980; **47:** 255–60.
6. Cosgrove DM, Thurer RC, Lytle BW, Gill CC, Peter M, Loop FD. Blood conservation during myocardial revascularization. Ann Thorac Surg 1978; **28:** 184–9.