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Coronary Angioplasty in Patients with Prior Coronary Artery Bypass Surgery: All Prior Coronary Artery Bypass Surgery Patients and Patients More than 5 Years After Coronary Bypass Surgery

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Percutaneous transluminal coronary angioplasty (PTCA) has been used successfully in patients who have had prior bypass surgery (CABG) as a means of revascularizing the myocardium and avoiding repeat myocardial revascularization.^{2, 8, 9, 11-15, 19, 28} Percutaneous transluminal coronary angioplasty has been effective for lesions in relatively new bypass grafts (3 or less years old), bypass grafts that are not diseased diffusely, and in patients with a relatively high surgical risk because of significant medical problems and/or diminished left ventricular function (left ventricular ejection fraction less than or equal to 40 per cent). Old saphenous vein grafts (greater than 5 years) have been considered to be a relative and/or absolute contraindication to PTCA because of distal embolization^{21, 25}; in the opinion of some, PTCA of lesions at the aortic anastomosis or within the graft shaft was relatively contraindicated because of the high restenosis rate.^{21, 25, 29} The first section in this article will detail our experience with PTCA of prior CABG patients and the second section, with PTCA in the subset of patients 5 or more years after their last coronary bypass surgery.

MATERIALS AND METHODS

Patient Selection

All patients who underwent PTCA had one or more prior CABGs and had a significant coronary or vein graft stenosis(es) that produced severe angina or significant myocardial ischemia, confirmed by noninvasive studies.

The patient's anatomy (that is, the site of the stenosis(es), determined by cinearteriograms) was the determinant of whether or not PTCA was feasible technically and his clinical condition determined its appropriateness.

Patient Evaluation

In multiple-lesion PTCA, the "culprit" lesions always were considered accessible to the angioplasty catheter. Selected patients underwent PTCA of multiple lesions, despite the presence of significant disease in other coronary vessels that would not be dilated because of the disease's extensive and/or diffuse nature and/or the small caliber of the vessel. These patients

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agement if the culprit lesions were dilated successfully.

Selected patients preferentially underwent PTCA rather than repeat CABG because of an anticipated prohibitively high surgical morbidity and/or mortality risk (presence of multiple prior CABGs; functioning internal mammary graft(s); concomitant severe, debilitating medical conditions; cardiogenic shock; and/or severe left ventricular dysfunction [left ventricular ejection fraction less than or equal to 35 per cent]).

Patients were referred preferentially for PTCA when (1) there was a lack of obvious vein graft donor sources; (2) the significant lesion(s) was a vessel that had undergone coronary endarterectomy(ies); (3) the patient had a previously complicated and prolonged postoperative course; or (4) he probably would require valve replacement at a future time. These high-risk surgical patients agreed to an attempted PTCA with the realization that myocardial revascularization surgery would be avoided. A few of these specific patients recently underwent PTCA while on percutaneous femorofemoral cardiopulmonary bypass.

Patients were advised that complications arising from a coronary occlusion or embolization of debris from a vein graft would be managed with the use of continuous lytic therapy¹⁸ and would not be an indication for emergency surgery. The post-PTCA management has been published.¹²

Definitions

Multiple-lesion PTCA was defined by the dilatation of two or more individual lesions in varying combinations of two or more coronary vessels, vein grafts, internal mammary grafts, or in different segments of the same vessel. Multiple-lesion PTCA included the dilatation of tandem lesions when separated by an angiographically apparent lesion-free segment.

A dilatation procedure was considered successful when (1) all lesions attempted were dilated successfully (a 20 per cent or greater reduction in the per cent diameter stenosis with less than or equal to 50 per cent residual narrowing); or (2) the culprit lesion(s) was di-

lated successfully, and (3) those angiographically successful results were accompanied by a clinical improvement within 1 week of the procedure.

Clinical improvement was evaluated by the patient's subjective assessment of anginal status, and/or by noninvasive techniques. An apparent symptom-related lesion recurrence was considered present when a patient, clinically improved after PTCA, deteriorated and this worsening was associated with angiographic evidence of restenosis of one or more lesions.

Follow-up Data

Follow-up data of patients, both successful and unsuccessful, were obtained by periodic interviews (within 1 week, 3 months, 6 months, and yearly), via office visits, telephone calls, or written questionnaires that detailed the patient's vital status, anginal status, occurrence of a myocardial infarction, repeat hospitalizations, and/or subsequent PTCA or CABG. A late death was defined as an occurrence after hospital discharge. At a mean time of 3.3 years, data were obtained for 98 per cent of patients regarding vital status and in 92 per cent concerning anginal status.

Statistical Analysis

All data have been presented as the mean \pm one standard deviation. The Chi-square test with Yates' correction and univariate analysis was utilized. A *P* value of less than 0.05 was considered statistically significant. Life-table analysis was performed according to published methods.¹⁰

PERCUTANEOUS TRANSLUMINAL CORONARY ANGIOPLASTY IN PATIENTS WITH PRIOR CORONARY ARTERY BYPASS SURGERY

Results

Clinical Characteristics (Table 1)

Four-hundred twenty prior CABG patients (mean, 83 per cent) underwent PTCA, with 85

Table 1. Clinical Characteristics of 420 Prior CABG Patients who Underwent PTCA

Patients	420
Men	349 (83%)
Women	71 (17%)
Mean age (years)	58.3 ± 8.8
Prior infarction	258 (61%)
LVEF ≤35 per cent	49 (12%)
Anginal Class II–IV (CCSC)	355 (85%)
Chronic lung disease	15 (3.6%)
Prior stroke	15 (3.6%)
Chronic renal failure	9 (2.1%)

CABG = Coronary artery bypass grafting; CCSC = Canadian Cardiovascular Society Class; LVEF = left ventricular ejection fraction.

per cent having severe angina (Class II to IV). Severe left ventricular dysfunction was present in 12 per cent of the cases.

Angioplasty Data (Table 2)

Fifty per cent of patients required only one lesion, and 30 per cent had two lesions dilated to achieve the desired revascularization. A successful dilatation was achieved in 88 per cent of attempts—87 per cent in native arteries and 91 per cent in vein grafts. A clinical success (patient improvement) was obtained in 86 per cent of cases.

Complications (Table 3)

A significant complication (death, emergency surgery, or Q wave infarction) occurred in 21

Table 2. Angioplasty Data of 420 Prior CABG Patients

Lesions	784 (mean, 1.9 lesions/patient)
Lesions attempted per patient	
1 lesion	211 (50%)
2 lesions	127 (30%)
≥ 3 lesions	82 (20%)
Lesion success related to lesion site	
Native artery	450/517 (87%)
Vein graft	219/241 (91%)
Aortic anastomosis	65/76 (86%)
Shaft (body)	55/56 (98%)
Distal anastomosis	99/109 (91%)
Internal mammary artery	19/26 (73%)
Success	
Lesion success	688/784 (88%)
Patient success	361/420 (86%)
Patient success related to number of prior CABGs	
1 prior CABG	249/287 (87%)
2 prior CABGs	88/108 (81%)
3 prior CABGs	18/18 (100%)
≥4 prior CABGs	6/7 (86%)

CABG = coronary artery bypass grafting.

Table 3. Complications Encountered During PTCA in 420 Prior CABG Patients

PATIENTS	
Complications	
Myocardial infarction	22 (5.2%)
Q Wave MI	10 (2.3%)
Non-Q Wave MI	12 (2.9%)
Coronary occlusion	14 (3.3%)
Mortality	11 (2.6%)
PTCA related	10 (2.3%)
Not PTCA related	1 (0.3%)
Emergency CABG	6 (1.4%)
Distal embolization	16 (3.8%)
Number/SVG dilated	16/241 (6.6%)
Number/all lesions dilated	16/784 (2.0%)
Summary	
Cases with no complications	347 (83%)
Cases with significant complications	21 (5.0%)

MI = myocardial infarction; CABG = coronary artery bypass grafting; SVG = saphenous vein graft.

patients (5 per cent), with an in-hospital PTCA-related mortality of 2.3 per cent. Complications encountered were not mutually exclusive, with three of the six patients who died having had emergency surgery, and in 3 of the 12 deaths, an acute Q wave myocardial infarction was apparent.

Although patients with only a native artery dilatation(s) were more likely to have a significant complication (7.7 versus 2 per cent; $P < 0.05$) compared with vein graft dilatation patients, no specific complication (myocardial infarction, mortality, or emergency surgery) was found to be more likely to occur. Patients with vein graft dilatations had a low incidence of significant complications but an increased incidence of embolic episodes: Saphenous vein graft distal embolizations occurred in 16 patients (3.8 per cent) and in 6.6 per cent of all vein graft lesions attempted. Nevertheless, 83 per cent of patients experienced no complication.

Follow-up (Table 4)

During the follow-up period, an assumption was made so as not to underestimate the incidence of lesion recurrence: A lesion "restenosis" was responsible for (1) any cardiac-related death (36 patients); (2) all repeat CABGs, with or without preoperative angiography (27 patients); and (3) clinical deterioration requiring repeat PTCA (94 patients). Utilizing this assumption, the recurrence rate was 43 per cent (157 of 361 patients).

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