Utilization and Outcomes of Unprotected Left Main Coronary Artery Stenting and Coronary Artery Bypass Graft Surgery

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Background. Limited contemporary information is available on outcomes for patients with unprotected left main coronary artery (LMCA) disease who are revascularized.

Methods. We examined the relative frequency, severity of illness, and outcomes of stenting and coronary artery bypass graft (CABG) surgery for treating unprotected LMCA disease in New York between January 1, 2000 and December 31, 2004. A total of 16,336 (98.7%) patients who underwent CABG surgery and 212 (1.3%) who underwent stenting were included in this study.

Results. Stent patients had higher preprocedural severity of illness (eg, they were older, more likely to be female, and had more comorbidities). A total of 135 stent patients were matched to 135 CABG patients on baseline characteristics identified by a propensity model as predictors of type of procedure received. At the end of follow-up on December 31, 2004, the respective 2-year survival rates were 94.1% and 82.0% (hazard ratio = 0.32, $p = 0.005$) for the 135 pairs of matched CABG and stent patients. The respective 2-year rates for freedom from subsequent revascularization were 93.7% and 62.7% (hazard ratio = 0.15, $p < 0.001$). In the drug-eluting stent era between October 1, 2003 and December 31, 2004, the same trends in mortality (hazard ratio = 0.73, $p = 0.69$) and repeat revascularization (hazard ratio = 0.10, $p = 0.03$) were observed among the 56 pairs of matched CABG and drug-eluting stent patients.

Conclusions. Most patients with LMCA disease who needed coronary revascularization received CABG surgery; stent patients were sicker. This study found that surgery patients experienced lower risk of long-term death and repeat revascularization. However, more studies comparing these procedures are needed, especially in the drug-eluting stent era.

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For patients with unprotected left main coronary disease, coronary artery bypass graft (CABG) surgery is recommended when revascularization is needed according to the latest guidelines of the American College of Cardiology and American Heart Association [1, 2]. These recommendations are largely based upon studies conducted in the 1970s and 1980s. However, recent improvement in outcomes for left main percutaneous coronary intervention (PCI) by the use of bare-metal stents and drug-eluting stents has led to studies comparing the outcomes of left main PCI with CABG surgery [3–12]. Three single-center observational studies [13–15] and a small-scale randomized trial [16] have recently found no differences in intermediate-term mortality between the two treatments, despite inconsistent findings regarding differences in composite outcomes (major adverse cardiac and cerebrovascular events). Such studies have prompted examining whether it is time to replace CABG surgery by stenting when treating unprotected left main coronary disease [17, 18]. Consequently, more studies are needed to compare utilization and long-term outcomes of these two treatments, especially in population-based settings. In this study, we examined the differences in utilization, patient severity of illness, and long-term mortality and subsequent revascularization rates between unprotected left main coronary stenting and CABG surgery in patients who underwent procedures in New York State between January 1, 2000 and December 31, 2004.

Material and Methods

Databases and Patient Population

Patients in this study were identified using the New York State Cardiac Surgery Reporting System (CSRS) and Percutaneous Coronary Intervention Reporting System (PCIRS). The CSRS and PCIRS are population-based registries that have been in place since 1989 and 1991, respectively. These two registries collect detailed information on patients' demographic characteristics, preprocedural risk factors, procedural information, postproce-

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Table 1. Baseline Characteristics (% or Mean When Indicated) of Patients With Left Main Coronary Artery Disease Undergoing Coronary Artery Bypass Grafting (CABG) Surgery and Stenting

Risk Factor	CABG (n = 16,336)	Stenting (n = 212)	*p* Value
Age (years):			<0.001
< 50	4.8	4.7	
50–59	17.5	14.2	
60–69	29.9	22.2	
70–79	34.5	33.5	
80+	13.4	25.5	
Mean age (SD)	67.9 (10.4)	70.6 (12.2)	0.002
Race/ethnicity:			0.08
Hispanic	6.2	8.0	
White, non-Hispanic	83.0	76.9	
Black, non-Hispanic	6.2	7.6	
Other, non-Hispanic	4.6	7.6	
Gender:			0.02
Male	71.1	63.7	
Female	28.9	36.3	
Mean body surface area (SD)	1.99 (0.25)	1.91 (0.23)	<0.001
Ejection fraction:			<0.001
< 0.20	1.9	2.8	
0.20–0.29	6.6	10.9	
0.30–0.39	12.1	9.4	
0.40+	78.2	69.8	
Missing	1.2	7.1	
Degree of stenosis of left main coronary artery:			<0.001
50%–69%	39.1	15.6	
70%–89%	40.0	55.7	
90%+	20.9	28.8	
Number of diseased vessels (stenosis ≥ 70%):			<0.001
0	7.5	16.5	
1	18.1	34.0	
2	32.9	30.2	
3	41.5	19.3	
Hemodynamic state:			<0.001
Stable	98.4	94.3	
Unstable	1.4	3.3	
Shock	0.2	2.4	
Previous myocardial infarction (MI):			0.001
1–7 days	17.2	10.4	
8–14 days	4.5	9.0	
15 + days	21.4	20.3	
No previous MI	56.9	60.4	
Cerebrovascular disease	23.4	16.0	0.01
Peripheral arterial disease	13.3	12.7	0.92
Congestive heart failure:			<0.001
This admission	14.4	19.8	
Before this admission	3.7	7.6	
None	81.9	72.6	
Malignant ventricular arrhythmia	1.3	1.9	0.36
Chronic obstructive pulmonary disease	19.6	12.3	<0.001
Diabetes	29.7	22.2	0.02
Renal failure:			0.41
Requiring dialysis	1.7	2.8	
Creatinine > 2.5 mg/dL	2.0	2.4	
No renal failure	96.3	94.8	
Mean CSRS-CABG risk score (SD)	3.6 (2.6)	4.4 (3.4)	<0.001
Mean PCIRS risk score (SD)	8.7 (4.0)	9.8 (4.9)	0.001

CSRS = cardiac surgery reporting system; percutaneous coronary intervention reporting system.

dural complications, and discharge status for all cardiac procedures and PCIs performed in nonfederal hospitals in New York State. Completeness and accuracy of the registries are assured by extensive periodic auditing.

The study population consisted of patients with left main coronary artery disease (stenosis ≥ 50%) who underwent isolated CABG surgery without other major cardiac procedures, or who underwent stent placements in the left main coronary artery and were discharged between January 1, 2000 and December 31, 2004 in New York State. Patients were excluded if they had a previous revascularization (4,139 cases), had a myocardial infarction within 24 hours prior to the procedure (420 cases), or were not residents of New York State (704 cases). A total of 16,336 CABG cases and 212 stenting cases were included in this study and were followed until December 31, 2004.

Outcomes

The main outcome measures in this study were long-term survival and freedom from subsequent revascularization (CABG surgery or PCI) after the index procedure. Short-term mortality, defined as in-hospital death or death within 30 days of procedures (in-hospital/30-day mortality), was also examined. Deaths after discharge were identified by linking patients' Social Security numbers to the Vital Statistics Death File maintained by the New York State Department of Health; subsequent revascularizations were ascertained using the CSRS and PCIRS registries.

Statistical Analysis

Differences between CABG and stent patients in baseline characteristics were compared. Patient characteristics included age, race/ethnicity, sex, size of body surface area, ejection fraction, diseased vessels, hemodynamic state, and a variety of comorbidities (history of myocardial infarction, cerebrovascular disease, peripheral arterial disease, congestive heart failure, malignant ventricular arrhythmia, chronic obstructive pulmonary disease, diabetes, and renal failure). The CSRS-CABG risk score [19] and the PCIRS risk score [20] were also used to describe