Impact of prior intracoronary stenting on late outcomes of coronary artery bypass surgery in diabetics with triple-vessel disease

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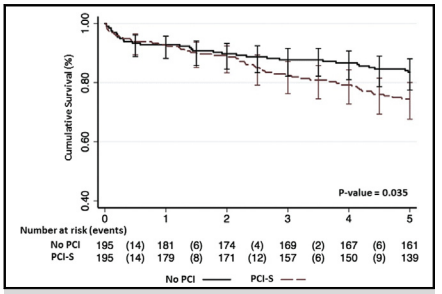
ABSTRACT

Objective: Recent studies have indicated that coronary artery bypass grafting (CABG) outcomes in patients with prior stents are suboptimal. We aimed to study the impact of prior percutaneous coronary intervention (PCI) with stenting (PCI-S) on late CABG mortality in diabetic patients with triple-vessel disease.

Methods: We reviewed the primary nonemergency CABG experience from a single U.S. institution (n = 7005; 1996-2007, Toledo, Ohio). Diabetics with triple-vessel disease (n = 1583) were identified and divided into 2 groups: (1) prior PCI-S (n = 202); and (2) no prior PCI (No-PCI [n = 1381]). Hierarchic Cox proportional hazards models were used to assess the effect of prior PCI-S on 5-year mortality after CABG. A propensity score for PCI-S and No-PCI patients was derived using a nonparsimonious logistic regression and used to generate a 1:1 (PCI-S to No-PCI) matched cohort.

Results: In model 1, after adjusting for preoperative clinical characteristics, medications, off-pump surgery, and isolated CABG surgery status, prior PCI-S was associated with a 39% increased risk of mortality (hazard ratio [HR] = 1.39, with 95% confidence interval [CI; 1.02, 1.90]; $P = .04$). Further adjustment for date of surgery (model 2) (HR = 1.39, with 95% CI [1.02, 1.91]; $P = .04$) or operative parameters (model 3) (HR = 1.38, with 95% CI [1.01, 1.88]; $P = .046$) did not alter the association. The 1:1 matched-cohort analysis confirmed the increased risk associated with PCI-S (HR = 1.61, with 95% CI [1.03, 2.51]; $P = .037$).

Conclusions: Patients who have both diabetes and triple-vessel disease, and have undergone prior PCI-S, have poorer long-term outcomes after CABG compared with those who have had no prior PCI-S. (J Thorac Cardiovasc Surg 2015;149:1302-9)



Comparison five-year Kaplan-Meier survival for 1:1 propensity matched prior PCI status groups.

Central Message

Diabetic triple-vessel disease patients with prior percutaneous coronary intervention with stent placement (PCI-S) have poorer long-term outcomes following CABG compared to patients with no prior PCI-S.

Perspective

We found prior PCI with intracoronary stenting to be associated with increased long-term mortality following primary CABG in triple-vessel diabetics. An early team-based approach including a cardiologist and cardiac surgeon should be implemented for optimal revascularization strategy selection in diabetics with triple-vessel disease and for close medical follow-up of those higher risk CABG patients with history of intracoronary stents. This may improve clinical decision-making in a high-risk CAD population arguably at most need for optimal medical management and intervention. Future investigation is needed to elucidate whether these findings derive from the underlying disease characteristics, implanted stents, or both.

See Editorial Commentary page 1310.

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Abbreviations and Acronyms

CABG = coronary artery bypass grafting
CAD = coronary artery disease
CI = confidence interval
DES = drug-eluting stents
HR = hazard ratio
ICD = International Classification of Diseases
PCI = percutaneous coronary intervention
PCI-S = PCI with stenting

The past decade has witnessed a surge in percutaneous coronary intervention (PCI) as a primary modality for coronary revascularization, driven in large part by its less-invasive nature compared with coronary artery bypass grafting (CABG). A recent national analysis reporting revascularization trends from 2001 to 2008 noted a steadily decreasing rate of CABG surgery in the face of a stable PCI rate, which is increasingly based on drug-eluting stents (DES).[1] Furthermore, the rate of multivessel stenting remained fairly constant, at approximately 12% of annual PCI-stenting (PCI-S) procedures.[2] Since the introduction of DES, PCI-S has been extended increasingly to high-risk patient groups, including those who have diabetes and those who have multivessel and left main coronary artery disease (CAD). Consequently, more patients with a prior history of PCI-S treatment of their CAD are being referred for CABG.

A possible adverse effect of prior PCI-S on early outcomes after CABG surgery has been described.[3,4] This effect has been attributed in part to the increased bleeding risk and perioperative stent thrombosis that results from an imperfect balance of perioperative anticoagulation.[5] Improved understanding of perioperative anticoagulation and optimal timing of surgery after PCI-S may decrease the rate of perioperative complications, with some reports suggesting no early adverse effects.[6,7]

How the long-term outcomes of patients after primary CABG may be affected by the presence of in situ stents has not been as thoroughly investigated.[6,8-12] Recent reports have postulated that such patients have increased inflammation and endothelial injury,[13-17] and that the grafts in those who have undergone CABG and have pre-existing intracoronary stents may have suboptimal placement and patency.[18] We hypothesized that in diabetic patients with triple-vessel disease, a history of PCI with stent placement portends poorer long-term survival, given the established endothelial dysfunction in diabetic patients[19,20] and the significant CAD burden associated with triple-vessel disease. We leveraged the availability of a real-world cardiac surgery registry with late-mortality follow-up, to assess the impact of prior stenting on 5-year all-cause mortality in patients who undergo primary CABG.

METHODS

Study Design and Data Collection

This study is a retrospective analysis of a prospectively collected cardiac surgery database surveying the CABG experience (n = 7005) of a single cardiac surgical team (Mercy Saint Vincent Medical Center, Toledo, Ohio) from January 1996 till March 2007. Data collection and reporting is in accordance with The Society of Thoracic Surgeons National Adult Cardiac Database definitions and criteria.[21] Patients who had undergone CABG with concomitant surgery for cardiac valvular or aortic disease were excluded. For the purposes of this study, inclusion was restricted to primary CABG patients who had both diabetes (n = 2555; 36.5%) and triple-vessel disease (n = 5248; 74.9%). Triple-vessel disease was defined as ≥50% stenosis in all 3 native coronary vessels, or left main artery plus right CAD.

A total of 1868 (26.7%) patients with triple-vessel disease had diabetes as well. Of these, 285 (15.3%) were excluded from the analysis for 1 or more reasons: having repeat CABG (n = 111), having emergency (n = 90) or salvage (n = 8) surgery, and/or being a nonemergency patient with a preoperative intra-aortic balloon pump and/or cardiogenic shock (n = 87). Patients with a history of having PCI before CABG were included only if the PCI entailed stenting, regardless of stent type. The final study population consisting of 1583 patients was divided into 2 comparison groups based on prior intra-coronary stenting status: (1) 202 (12.8%) with prior stents (PCI-S); and (2) 1381 (87.2%) with no prior PCI (No-PCI). The institutional review board approved the study. Informed consent was waived, based on the fact that the study is a deidentified retrospective analysis.

Outcome Measures

The primary endpoint was all-cause mortality. Long-term survival data were obtained from our service follow-up, and the U.S. Social Security Death Index database, and verified by cross-checking with the Ohio State Death Registry. Early mortality was defined as death within 30 days of CABG surgery or during the index hospitalization for surgery. Long-term follow-up was assessed at 5 years, with 30 patients (1.9%) lost to follow-up over this time period. Lastly, cause-specific mortality data were extracted from death certificates in the Ohio State Death Registry using International Classification of Diseases (ICD) –9 (1996-1998) and –10 (1999 onward) revision codes. Cause of death was known for 282 of 345 (81.7%) mortality events. Cardiac mortality was defined by ICD-10 codes I00 to I09, I11, I13, and I20 to I51, and their corresponding ICD-9 codes: 390 to 398, 402, 404, and 410 to 429. Coronary heart disease mortality was identified[22] using ICD-10 codes I20 to I25 and their corresponding ICD-9 codes, 410 to 414 and 429.2.

Statistical Analysis

Descriptive statistics for categorical variables are summarized as frequency (%) and compared among the prior PCI-S and No-PCI groups, using Pearson χ^2 analysis or the Fisher exact test, as appropriate. Continuous parameters are presented as mean ± SD, or as median (interquartile range), and compared using the unpaired Student *t* test or the nonparametric Wilcoxon rank sum test. Ejection fraction data were missing for 326 of 7005 (4.7%) patients in the database who had undergone CABG (49 of 1583 [3.1%] for the current analysis); these missing data were handled by multiple imputation.

Univariable and multivariable logistic regression were used to assess the effect of PCI-S on early mortality. The Kaplan-Meier survival method with the log-rank significance test was used to compare 5-year survival between the 2 groups, for the baseline population as well as in the propensity-matched subcohort. To determine the risk-adjusted effect of prior PCI-S on 5-year mortality, 3 hierarchic adjusted Cox proportional hazards models were constructed.

Model 1 included all preoperative clinical variables in Table 1, medications, off-pump versus on-pump surgery, and isolated CABG surgery status. Model 2, in addition to model 1, adjusted for year of