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Previous percutaneous coronary intervention increases morbidity after coronary artery bypass grafting

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Abstract

Background—We hypothesized that the incidence of previous percutaneous coronary intervention (PCI) is increasing and that prior PCI influences patient morbidity and mortality after coronary artery bypass grafting (CABG).

Methods—A total of 34,316 patients underwent isolated CABG operations at 16 different statewide, institutions from 2001 to 2008. Patients were stratified into prior PCI ($n = 4346$; 12.7%) and no prior PCI ($n = 29,970$). Patient risk factors, intraoperative variables, and outcomes were compared by univariate and multivariate analyses.

Results—The incidence of prior PCI in CABG has risen from <1% to 22.0% from 2001 to 2008 ($P < .001$). Prior PCI patients were younger ($P < .001$) and more commonly had previous myocardial infarction ($P < .001$), but less commonly had heart failure ($P < .001$). The operative mortality was similar between groups (2.3% vs 1.9%; $P = .13$). Prior PCI patients had more major complications (15.0% vs 12.0%; $P < .001$), longer hospitalization ($P = .01$), and higher readmission rates ($P = .01$). Importantly, by multivariate analyses, prior PCI was not associated with mortality, but was an independent predictor of major complications after CABG (odds ratio, 1.15; $P = .01$).

Conclusion—The incidence of prior PCI in patients undergoing CABG is increasing. Previous PCI is associated with a higher risk of major complications, greater hospital length of stay, and higher readmission rates after CABG.

The advent of drug-eluting stents (des) has resulted in greater utilization of coronary stents in patients with coronary artery disease.¹ In this ‘stent era,’ PCI is the preferred modality of treatment for single and double vessel coronary artery disease (CAD) as well as in the setting of acute coronary syndrome. However, coronary artery bypass grafting (CABG) is still the ideal approach for patients with multivessel CAD, left main CAD, or those patients

with complex calcified vessels that are difficult to stent. The net result is that patients are often referred for CABG who frequently have undergone previous PCI.

The impact of prior PCI in patients undergoing CABG remains unclear. Previous studies have documented increased mortality in patients undergoing CABG with prior PCI; however, a recent, international, multicenter study suggested no such differences. Moreover, no study has evaluated the effect of previous PCI on major morbidities after CABG. We sought to determine whether the incidence of prior PCI has increased in patients undergoing CABG with the advent of DES. Furthermore, we hypothesized that patients with previous PCI undergoing CABG have worse morbidity and mortality than those patients undergoing CABG without previous PCI.

METHODS

Data collection

The Virginia Cardiac Surgery Quality Initiative (VCSQI) is a voluntary consortium of 16 different cardiac surgical centers and hospitals within the Commonwealth of Virginia that collectively captures approximately 99% of Virginia's cardiac operative procedures. Data analyses were exempt from the University of Virginia Institutional Review Board because the VCSQI database has no patient identifiers. In addition, participating institutions were exempt from Health Insurance Portability and Accountability Act consideration by the use of the Small Business Agreement for Business Associates agreements between each hospital and participating surgeons.

Patients

A total of 34,316 patients who underwent isolated CABG operations from 2001 to 2008 were reviewed. Isolated CABG operations were defined as those not accompanied by any other cardiac procedures. The exclusion criteria used for the study were: (1) concomitant PCI and CABG surgeries during same admission, (2) unsuccessful PCI necessitating urgent or emergent CABG, and (3) patients requiring other cardiac procedures such as valve or aneurysm repair, concurrently during CABG. Patients were stratified into 2 groups of prior PCI ($n = 4346$; 12.7%) and no PCI ($n = 29,970$).

The VCSQI contained detailed information on patient demographics, preoperative risk factors, operative notes, hospital duration of stay, and morbidity and mortality outcomes. The outcomes of interest were operative mortality and the composite incidence of major complications, which was defined as occurrence of 1 or more of the following within 30 days of surgery: Perioperative myocardial infarction (MI; 0–24 hours postoperatively), stroke (permanent; not resolved within 24 hours), prolonged ventilation (>24 hours), pneumonia (diagnosed by positive cultures of sputum, transtracheal fluid, bronchial washings, and/or clinical findings consistent with the diagnosis of pneumonia including chest x-ray diagnostic of pulmonary infiltrates), acute renal failure (1 or both of the following: Serum creatinine $3\times$ times baseline or ≥ 4.0 and new requirement for postoperative dialysis) and new-onset hemodialysis (may include peritoneal or hemodialysis). Established STS definitions for all preoperative and operative variables as

well as postoperative outcomes, were used.² Operative mortality included patient deaths that occurred before hospital discharge or within 30 days of surgery.

Statistical analysis

Appropriate tests were performed to assess the null hypothesis that outcomes after CABG were equivalent despite performance of prior PCI. Statistical significance was determined using an alpha of $<.05$. Descriptive statistics were utilized to analyze observed differences in patient characteristics, operative details, and postoperative outcomes as they related to the prior performance of PCI. Accordingly, univariate categorical comparisons were performed using either Pearson's chi-square or the Fisher exact tests. All categorical variables are presented as with-in group percentages. Continuous variables are reported as either mean values $\pm$ standard deviation for variables with normal distribution within the dataset or median (interquartile range) for all non-normally distributed data. Continuous variables were compared using the Student's *t* test or the Mann-Whitney *U* test for non-parametric data. All pairwise group comparisons represent the comparison of independent samples. All calculated test statistics were used to derive reported 2-tailed *P* values.

Multivariable logistic regression analysis was utilized to estimate the risk-adjusted effects of performance of prior PCI on the odds of operative mortality and major complications. Two separate logistic regression models were performed. The models utilized in this study proved to be adequate performers for the outcomes of mortality and composite incidence of major complications. In each model, potential confounders for patient mortality and major complications were included as covariates (Society of Thoracic Surgeons Predicted Risk of Mortality-STS PROM, operative year, number of arterial and venous bypass grafts, cardiopulmonary bypass time, and performance of prior PCI). The selection of these covariates was determined a priori, and all covariates were included in each model. Factors with strong collinearity were accounted for and competing variables were eliminated from the model. In each model, all variables entered were retained. The estimated measures of association for potential confounder is reported as an adjusted odds ratios (OR) with a 95% confidence interval (CI), and the relative contribution of each covariate to the model was assessed using the Wald chi-square statistic. The performance of each model was assessed by the area under the receiver operator characteristics curve and the Hosmer Lemeshow goodness-of-fit test.

RESULTS

Incidence of PCI has increased over time

A total of 34,316 patients underwent isolated CABG surgeries from 2001 to 2008. Of those, 4346 (12.7%) patients had previous PCI. Prior to 2004, $<1\%$ of patients undergoing CABG had previous PCI. Since 2004, the incidence of prior PCI among CABG patients significantly increased (7.8% in 2004, 21.5% in 2005, 23.4% in 2006, 25.3% in 2007, and 22.0% in 2008; $P < .001$; Fig 1).

Preoperative and intraoperative risk factors

Patient demographics and preoperative risk factors are presented in Table I. Patients with prior PCI were comparatively younger ($P < .001$) and more commonly presented with preoperative diabetes, dyslipidemia, hypertension, and previous MI ($P < .001$). In addition, this patient group had a greater incidence of previous CABG. However, prior PCI patients were less likely to have heart failure ($P < .001$), a family history of CAD ($P < .001$), or a smoking history ($P = .039$). Likely because of the presence of a coronary stent in the prior PCI group, their preoperative use of clopidogrel was substantially higher than their counterparts ($P < .001$). Increased rates of preoperative ventricular arrhythmias were also noted in the prior PCI group ($P < .001$); however, preoperative atrial arrhythmia rates were not different. Prevalence of preoperative chronic lung diseases in various severities ($P < .0001$) was greater in prior PCI group. Despite these differences, the STS preoperative predicted risk of mortality between the groups was similar ($P = .1$).

Intraoperative outcomes are presented in Table II. Emergent operations were more common in the prior PCI group while the no PCI group had a greater number of elective surgeries ($P < .001$). The use of a single internal mammary artery as well as double internal mammary artery was incrementally lower in the prior PCI group compared with the no PCI group ($P < .001$). Notably, aortic cross-clamping and total cardiopulmonary bypass times were not different between the groups undergoing CABG despite the performance of prior PCI.

Morbidity, not mortality, was higher with prior PCI

The postoperative outcomes are presented in Table III. Operative mortality was low and similar between groups (2.3% vs 1.9%; $P = .13$). There were no differences between postoperative atrial arrhythmia rates between the 2 groups. However, patients with prior PCI had composite incidence of 1 major complications such as perioperative MI, stroke, prolonged ventilation, pneumonia, acute renal failure, and new-onset hemodialysis (15% vs 12%; $P < .001$; Fig 2). Moreover, patients with prior PCI had higher rates of reoperation for bleeding likely owing to higher preoperative Clopidogrel use ($P < .001$). Finally, prior PCI patients had longer hospital lengths of stay ($P < .001$) and higher readmission rates within 30 days of procedure ($P = .01$).

Prior PCI-independent risk factor for major complications

After accounting for patient and operation related risk factors, multivariable logistic regression demonstrated that prior PCI was not significantly associated with operative mortality after isolated CABG (OR, 1.17; 95% CI, 0.91–1.51; $P = .23$). However, it was an independent predictor of major complications (OR, 1.15; 95% CI, 1.04–1.28; $P = .01$). Each model proved to be an adequate performer with area under the receiver operator characteristics of 0.78 and 0.71 for the outcomes of mortality and major complications, respectively. The models were well calibrated with Hosmer–Lemeshow P values of $< .05$.

DISCUSSION

Using a multicenter, retrospective analysis from 16 different statewide cardiac centers, we demonstrate that the incidence of PCI in patients undergoing CABG has risen since the

introduction of DES in 2004. The objective of the study was to investigate the independent effect of prior PCI in patients undergoing CABG. Although there was no relationship between prior PCI and mortality after CABG, we determined that the risk-adjusted in-hospital major morbidity is worse in patients with prior PCI.

For multiple reasons, the utilization of PCI in the United States has increased. PCI has become the primary treatment for many patients with CAD. In addition, early detection of CAD in patients has further lead to greater use of PCI. Even though several randomized trials and large studies^{3–6} have clearly established CABG as the preferred modality over PCI for coronary revascularization in multivessel disease, patients often still undergo PCI as first line therapy owing to referral patterns and less invasive nature of this treatment. Particular preference of PCI use also stems from the common theory that if it fails, CABG could still be used to establish revascularization. The recent criticism of long term DES outcomes being less efficacious also draws into question the “stent first” approach used to treat CAD.^{7,8} In select practices, even higher risk patient populations with multivessel diseases and diabetes are referred for PCI as initial treatment.^{9,10} Of patients with complex coronary lesions and multivessel involvement treated with PCI, 20–40% have evidence of restenosis and a need for subsequent re-vascularization.¹¹ As a result, the incidence of previous PCI has increased as much as 25% in patients undergoing CABG as seen in the present study. Reports regarding worse outcomes in prior PCI patients with repeat PCI have been documented.¹² As such, studies indicating increased incidence of major adverse cardiac events in patients with prior PCI undergoing noncardiac surgical scenarios^{13–15} and worse early mortality outcomes when prior angioplasty was followed up by a subsequent CABG¹⁶ come as no surprise.

Previous studies have not clearly outlined the effect of prior PCI on outcomes in patients undergoing CABG. Studies of smaller magnitude have produced conflicting results. Historical studies have shown worse mortality outcomes in patients with prior PCI; however, these studies were in the early experience with PCI.^{17–19} In contrast, a recent Australasian multicenter retrospective study conducted in 13,184 patients (11.1% prior PCI) showed no association between prior PCI and short and midterm mortality after CABG,²⁰ a finding that is consistent with our results. However, regarding morbidity, this international study focused only on major adverse cardiac events, composed of the composite endpoint of in-hospital death, MI, or stroke, and did not investigate other relevant complications, including pulmonary and renal complications, which can contribute significantly to the morbidity of the patient. That study did demonstrate postoperative renal failure was significantly higher in prior PCI patients, similar to our study. Specifically, we noted patients with prior PCI had a 4% incidence in postoperative acute renal failure, nearly 25% higher than those patients without previous percutaneous intervention.

The present study has the largest cohort size to date, thus depicting a wider distribution of patient population, and was unique in that it evaluated an additional endpoint of major complications, including perioperative MI, stroke, prolonged ventilation, pneumonia, acute renal failure, and new-onset hemodialysis. Each of these major complications was selected because they have been shown to have major impact in patient morbidity. For example, postoperative pulmonary dysfunction after CABG surgery is associated with a longer

duration of mechanical ventilation, difficulty weaning the patient, and prolonged hospitalization, and may be associated with higher mortality.^{21–23} Acute renal failure has clearly been linked with postoperative morbidity and mortality.^{24,25} Acute renal failure and new-onset hemodialysis indicate 2 very different degrees of insults on the kidneys. These complications were significantly more common in patients with prior PCI.

There were some important differences to note between the 2 groups. Prior PCI patients more frequently received clopidogrel both preoperatively and postoperatively. Although there were no differences in stroke between groups, the greater clopidogrel use may explain the higher bleeding and reexploration rates in the PCI group. Furthermore, internal mammary artery use, known to improve short- and long-term mortality, was less frequently used in prior PCI patients. Finally, the number of arterial and venous grafts was significantly lesser in the PCI group. Both of these important variables were covariates in the multivariate analysis. Despite these differences, prior PCI remained a risk factor for major complications.

Several plausible reasons may explain these worse outcomes in prior PCI patients after CABG. Because removal of the coronary stent is damaging to the coronary artery, prior PCI procedure could result in less target vessel to revascularize at the time of subsequent CABG. Second, branch vessels may have been sacrificed in vessels that have undergone previous stenting. This, in turn, can limit the run-off of the target vessel and may cause CABG patency to be diminished. Other potential causes for adverse outcomes in prior PCI with subsequent CABG could be disruption of physiologic endothelial function of the coronary artery owing to stent placement or a more aggressive disease status. Indeed, it is not uncommon to see progression of angiographically nondiseased vessels after stent placement in disease coronary arteries. Prior PCI may be a marker for sicker/more ill patients and owing to the earlier mentioned vascular restraints along with a higher tendency to bleed owing to clopidogrel use, could very well lead to poor outflow of the vessel, thus effectively decreasing the cardiac output and possibly leading to acute renal failure, new-onset dialysis, and prolonged ventilation, which are unrelated to revascularization directly.

This study has several limitations. The retrospective nature of the study introduced the possibility of inherent observational and selection bias. Completely deidentified patient data did not allow us to scrutinize certain aspects, including single or multiple prior PCI events, type and number of stents used, time interval between CABG occurrence and successful PCI, type of CABG surgery, quality of target vessel, and long-term major adverse cardiac events outcomes. The low overall operative mortality after CABG procedures could explain the lack of difference in mortality between the no PCI and prior PCI groups. Finally, the potential influence of an unmeasured confounder may, in part, explain some of the estimated effects observed between groups. Nonetheless, the results of this study provide a very important insight to base future prospective studies.

In conclusion, in this study, we document that the incidence of prior PCI in patients undergoing CABG is increasing. Importantly, previous PCI was not associated with operative mortality. However, it is associated with a significantly higher incidence and risk of major complications, longer duration of stay, and higher readmission rates after CABG.

As such, history of PCI should be considered a risk factor in patients being evaluated for CABG.

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References

1. Frutkin AD, Lindsey JB, Mehta SK, House JA, Spertus JA, Cohen DJ, et al. Drug-eluting stents and the use of percutaneous coronary intervention among patients with class I indications for coronary artery bypass surgery undergoing index revascularization: analysis from the NCDR (National Cardiovascular Data Registry). *JACC Cardiovasc Interv.* 2009; 2:614–21. [PubMed: 19628183]
2. Society of Thoracic Surgeons Adult Cardiac Surgery Database, STS Adult Cardiac Data Specifications. 2007. [2.61]
3. Malenka DJ, Leavitt BJ, Hearne MJ, Robb JF, Baribeau YR, Ryan TJ, et al. Comparing long-term survival of patients with multivessel coronary disease after CABG or PCI: analysis of BARI-like patients in northern New England. *Circulation.* 2005; 112(9 Suppl):I371–6. [PubMed: 16159849]
4. Hannan EL, Racz MJ, Walford G, Jones RH, Ryan TJ, Bennett E, et al. Long-term outcomes of coronary-artery bypass grafting versus stent implantation. *N Engl J Med.* 2005; 352:2174–83. [PubMed: 15917382]
5. Brener SJ, Lytle BW, Casserly IP, Schneider JP, Topol EJ, Lauer MS. Propensity analysis of long-term survival after surgical or percutaneous revascularization in patients with multivessel coronary artery disease and high-risk features. *Circulation.* 2004; 109:2290–5. [PubMed: 15117846]
6. Serruys PW, Ong AT, van Herwerden LA, Sousa JE, Jatene A, Bonnier JJ, et al. Five-year outcomes after coronary stenting versus bypass surgery for the treatment of multivessel disease: the final analysis of the Arterial Revascularization Therapies Study (ARTS) randomized trial. *J Am Coll Cardiol.* 2005; 46:575–81. [PubMed: 16098418]
7. Iakovou I, Schmidt T, Bonizzoni E, Ge L, Sangiorgi GM, Stankovic G, et al. Incidence, predictors, and outcome of thrombosis after successful implantation of drug-eluting stents. *JAMA.* 2005; 293:2126–30. [PubMed: 15870416]
8. Hofma SH, van der Giessen WJ, van Dalen BM, Lemos PA, McFadden EP, Sianos G, et al. Indication of long-term endothelial dysfunction after sirolimus-eluting stent implantation. *Eur Heart J.* 2006; 27:166–70. [PubMed: 16249221]
9. King SB III. Is surgery preferred for the diabetic with multi-vessel disease? Surgery is preferred for the diabetic with multivessel disease. *Circulation.* 2005; 112:1500–7. [PubMed: 16145014]
10. Dangas G, Moses JW. Is surgery preferred for the diabetic with multivessel disease? Debate on revascularization strategy for diabetic patients with multivessel coronary artery disease. *Circulation.* 2005; 112:1507–13. [PubMed: 16149172]
11. Taggart DP, Thomas B. Ferguson Lecture. Coronary artery bypass grafting is still the best treatment for multivessel and left main disease, but patients need to know. *Ann Thorac Surg.* 2006; 82:1966–75. [PubMed: 17126093]
12. Arjomand H, Willerson JT, Holmes DR Jr, Bamlet WR, Surabhi SK, Roukoz B, et al. Outcome of patients with prior percutaneous revascularization undergoing repeat coronary intervention (from the PRESTO Trial). *Am J Cardiol.* 2005; 96:741–6. [PubMed: 16169350]
13. Kaluza GL, Joseph J, Lee JR, Raizner ME, Raizner AE. Catastrophic outcomes of noncardiac surgery soon after coronary stenting. *J Am Coll Cardiol.* 2000; 35:1288–94. [PubMed: 10758971]
14. Vicenzi MN, Meisltzer T, Heitzinger B, Halaj M, Fleisher LA, Metzler H. Coronary artery stenting and non-cardiac surgery—a prospective outcome study. *Br J Anaesth.* 2006; 96:686–93. [PubMed: 16670113]

15. Wilson SH, Fasseas P, Orford JL, Lennon RJ, Horlocker T, Charnoff NE, et al. Clinical outcome of patients undergoing non-cardiac surgery in the two months following coronary stenting. *J Am Coll Cardiol.* 2003; 42:234–40. [PubMed: 12875757]
16. Johnson RG, Sirois C, Watkins JF, Thurer RL, Sellke FW, Cohn WE, et al. CABG after successful PTCA: a case-control study. *Ann Thorac Surg.* 1995; 59:1391–6. [PubMed: 7771816]
17. Hassan A, Buth KJ, Baskett RJ, Ali IS, Maitland A, Sullivan JA, et al. The association between prior percutaneous coronary intervention and short-term outcomes after coronary artery bypass grafting. *Am Heart J.* 2005; 150:1026–31. [PubMed: 16290991]
18. Barakate MS, Hemli JM, Hughes CF, Bannon PG, Horton MD. Coronary artery bypass grafting (CABG) after initially successful percutaneous transluminal coronary angioplasty (PTCA): a review of 17 years experience. *Eur J Cardiothorac Surg.* 2003; 23:179–86. [PubMed: 12559340]
19. Kalaycioglu S, Sinci V, Oktar L. Coronary artery bypass grafting (CABG) after successful percutaneous transluminal coronary angioplasty (PTCA): is PTCA a risk for CABG? *Int Surg.* 1998; 83:190–3. [PubMed: 9870771]
20. Yap CH, Yan BP, Akowuah E, Dinh DT, Smith JA, Shardey GC, et al. Does prior percutaneous coronary intervention adversely affect early and mid-term survival after coronary artery surgery? *JACC Cardiovasc Interv.* 2009; 2:758–64. [PubMed: 19695544]
21. Wynne R, Botti M. Postoperative pulmonary dysfunction in adults after cardiac surgery with cardiopulmonary bypass: clinical significance and implications for practice. *Am J Crit Care.* 2004; 13:384–93. [PubMed: 15470854]
22. Zupancich E, Paparella D, Turani F, Munch C, Rossi A, Massaccesi S, et al. Mechanical ventilation affects inflammatory mediators in patients undergoing cardiopulmonary bypass for cardiac surgery: a randomized clinical trial. *J Thorac Cardiovasc Surg.* 2005; 130:378–83. [PubMed: 16077402]
23. Hulzebos EH, Helders PJ, Favie NJ, De Bie RA, Brutel de la RA, Van Meeteren NL. Preoperative intensive inspiratory muscle training to prevent postoperative pulmonary complications in high-risk patients undergoing CABG surgery: a randomized clinical trial. *JAMA.* 2006; 296:1851–7. [PubMed: 17047215]
24. Chertow GM, Lazarus JM, Christiansen CL, Cook EF, Hammermeister KE, Grover F, et al. Preoperative renal risk stratification. *Circulation.* 1997; 95:878–84. [PubMed: 9054745]
25. Mangano CM, Diamondstone LS, Ramsay JG, Aggarwal A, Herskowitz A, Mangano DT. Renal dysfunction after myocardial revascularization: risk factors, adverse outcomes, and hospital resource utilization. The Multicenter Study of Perioperative Ischemia Research Group. *Ann Intern Med.* 1998; 128:194–203. [PubMed: 9454527]

Fig. 1.
Increase in incidence of prior PCI in CABG.

Fig. 2.
Incidence of major complications.

Table I

Preoperative variables

Variable	No PCI (%)	Prior PCI (%)	P value
Age	64.11 ± 10.7	62.75 ± 10.7	<.001
Race			
White	80.1	78	<.001
African American	12.4	13.8	.01
Hispanic	0.7	0.9	.457
Asian	1.9	1.9	.994
Other	1.2	1.6	.031
American Indian/Alaskan Native	0.1	0.1	.78
Native Hawaiian/Pacific Islander	0.01	0.01	.556
Female gender	26.5	24.8	.021
BMI (kg/m ²)	30.07 ± 24.23	30.13 ± 11.10	.874
BSA	2.03 ± 0.289	2.08 ± 0.259	<.001
Comorbidities			
PAD	14.8	14.3	.36
CVD	12.9	13.6	.176
Stroke	6.7	6.1	.151
Diabetes	37.5	41.1	<.001
Dyslipidemia	75.7	87.3	<.001
Family history of CAD	45.7	42	<.001
Hypertension	76.9	84	<.001
Immunosuppression	1.9	1.6	.305
Renal failure	5.1	4.6	.17
Dialysis	1.9	2.2	.243
CLD			
None	84.9	83.3	<.0001
Mild	8.6	9.6	
Moderate	4.6	5	
Severe	1.9	2.1	
Smoking	54.4	52.7	.039
Previous CABG	3.3	6.5	<.001
Previous valve surgery	0.2	0.3	.619
Atrial arrhythmia	4.3	4	.544
Ventricular arrhythmia	1.7	2.5	<.001
NYHA Class			
I	6.9	3.2	<.001
II	32.2	42.9	
III	41.4	36.6	
IV	19.4	17.4	
CHF	11.7	9.4	<.001

Variable	No PCI (%)	Prior PCI (%)	P value
MI	38.3	59.3	<.001
EF	51.45 ± 12.63	50.26 ± 12.02	<.001
Left main diseased >=50%	27.9	27.6	.663
Number of diseased vessels			
3	78.6	74.8	<.001
2	17.2	19.1	
Preoperative clopidogrel use	3.4	15.9	<.001
STS predicted risk of mortality	0.024 ± 0.03	0.023 ± 0.047	.099

BMI, Body mass index; *BSA*, body surface area; *CABG*, coronary artery bypass graft; *CAD*, coronary artery disease; *CHF*, congestive heart failure; *CLD*, chronic lung disease; *CVD*, cerebrovascular disease; *EF*, ejection fraction; *NYHA*, New York heart association; *PAD*, peripheral arterial disease; *PCI*, percutaneous coronary intervention; *STS*, Society of Thoracic Surgeons.

Table II

Intraoperative variables

Variable	No PCI (%)	Prior PCI (%)	P value
Status			
Elective	46.6	44.4	<.001
Urgent	50.2	49.6	
Emergent	3.1	5.7	
Emergent salvage	0.2	0.3	
IMA used			
Bilateral	3.2	2.8	<.001
Left/right	86.4	83.8	
Radial artery used			
Bilateral	1.2	1.1	<.001
Left/right	8.2	5.5	
Aortic cross clamp time (min)	66.3 ± 26.14	67.52 ± 26.20	.007
CPB time (min)	94.93 ± 35.954	96.03 ± 34.509	.072
Arterial anastomoses	1.13 ± 0.699	1.03 ± 0.610	<.001
Venous anastomoses	2.25 ± 1.18	2.15 ± 1.15	<.001

CPB, Cardiopulmonary bypass; IMA, internal mammary artery; PCI, percutaneous coronary intervention.

Table III

Postoperative outcomes

Variable	No PCI (%)	Prior PCI (%)	P value
Mortality	1.9	2.3	.129
Complications			
Any complication	30.8	32.8	.011
Graft harvest site infection	0.6	0.6	.534
Sepsis	1	0.9	.669
Deep sternal infection	0.5	0.3	.023
Permanent stroke *	1.3	1.3	.893
Transient stroke	0.7	0.6	.55
Perioperative MI *	0.3	0.4	.123
Reoperation for bleeding	1.8	2.3	.027
Reoperation for other cardiac reasons	1	0.7	.076
Atrial arrhythmia	15.7	16.8	.061
Cardiac arrest	1.2	1.5	.162
Gastrointestinal event	2	1.9	.811
Heart block	0.8	0.6	.391
Multisystem organ failure	0.7	1	.059
Tamponade	0.3	0.2	.419
Pneumonia *	3	3.3	.32
Prolonged ventilation *	8.3	11.3	<.001
Acute renal failure *	3.4	4.4	.001
New postoperative renal dialysis *	1.2	1.7	.023
Acute limb ischemia	0.2	<0.01	.104
Postoperative clopidogrel use	7.6	23.7	<.001
Hospital LOS			
Admit-discharge	9.26 ± 9.7	9.68 ± 8.2	.007
Surgery-discharge	6.88 ± 7.7	7.10 ± 7.4	.081
Readmit 30 days from surgery	7.4	8.5	.012

* Major complications.

LOS, Length of stay; PCI, percutaneous coronary intervention.