Previous Percutaneous Coronary Intervention Does Not Increase Adverse Events After Coronary Artery Bypass Surgery

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Background. **Adverse effects of previous percutaneous coronary intervention (PCI) on clinical outcomes after coronary artery bypass grafting (CABG) are unclear. This study aimed to evaluate the effect of previous PCI on early outcomes after subsequent CABG by using data from the Japanese national database.**

Methods. **This study analyzed data from 48,051 consecutive patients that were retrieved from the Japan Adult Cardiovascular Surgery Database. These patients underwent primary, isolated, elective CABG between January 2008 and December 2013. Early mortality and morbidity rates in patients with previous PCI (n = 12,457, 25.9%) were compared with those in patients with no PCI (n = 35,594, 74.1%) by using multivariate logistic regression analysis and propensity score analysis.**

Results. **Operative mortality rates (no PCI, 1.2%; previous PCI, 1.2%; P = 0.970) and morbidity rates (no PCI, 7.4%; previous PCI, 7.2%; $p = 0.436$) were similar between the two groups. In risk-adjusted multivariate logistic-regression analysis, previous PCI (odds ratio [OR], 1.00; 95% confidence interval [CI], 0.82 to 1.22; $p = 0.995$) and morbidity (OR, 0.97; 95% CI, 0.89 to 1.05; $p = 0.391$) were not significant risk factors of operative mortality. Inverse probability of treatment weighting using the propensity score confirmed these results.**

Conclusions. **This study shows that a previous PCI procedure does not increase postoperative adverse events after subsequent CABG. In the setting of repeat coronary revascularization, the most appropriate method of revascularization should be selected by the heart team, without being affected by a history of a previous PCI procedure.**

(Ann Thorac Surg 2017;104:56–61)

After its introduction in the SYNTAX (SYNergy Between PCI With TAXUS and Cardiac Surgery) trial, the heart team approach has been widely adopted, and it improves efficiency and quality of coronary revascularization [1]. However, even in the era of the heart team, repeat revascularization after primary coronary revascularization poses challenging decision making. An unsolved problem in this decision making is whether previous percutaneous coronary intervention (PCI) increases early mortality and morbidity rates after subsequent coronary artery bypass grafting (CABG).

Many previous studies have evaluated the effect of previous PCI on outcomes after subsequent CABG [2–13]. A meta-analysis of these studies that compared patients who had CABG with and without previous PCI reported that a history of previous PCI increases early mortality rates after subsequent CABG [14]. In the current European Society of Cardiology/European Association for Cardio-Thoracic Surgery guidelines on myocardial revascularization, repeat PCI is recommended as the first-line treatment of recurrent ischemia after PCI (class IC recommendation) [15]. However, several studies have reported that a previous PCI procedure is not associated with increased mortality rates after subsequent CABG [7–10, 13]. Therefore, the prognostic effect of previous PCI on subsequent CABG remains controversial. To establish an effective treatment strategy for elective repeat revascularization after PCI, the effect of previous PCI on outcomes after subsequent CABG should be investigated in a large cohort of patients.

Accepted for publication Oct 10, 2016.

Presented at the Poster Session of the Fifty-second Annual Meeting of the Society of Thoracic Surgeons, Phoenix, AZ, Jan 23–27, 2016.

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The Supplemental Table can be viewed in the online version of this article [http://dx.doi.org/10.1016/j.athoracsur.2016.10.028] on http://www.annalsthoracicsurgery.org.

0003-4975/$36.00
http://dx.doi.org/10.1016/j.athoracsur.2016.10.028

Abbreviations and Acronyms

CABG = coronary artery bypass grafting
CI = confidence interval
JACVSD = Japan Adult Cardiovascular Surgery Database
MACE = major adverse cardiac events
OR = odds ratio
PCI = percutaneous coronary intervention

This study aimed to assess whether a history of previous PCI increases postoperative mortality and morbidity rates after elective subsequent CABG. We used a large dataset from the Japan Adult Cardiovascular Surgery Database (JACVSD).

Patients and Methods

Japan Adult Cardiovascular Surgery Database

The JACVSD was established in 2000 to enable evaluation of surgical outcomes after cardiovascular procedures in hospitals throughout Japan. As of 2013, the JACVSD had collected clinical information from more than 516 hospitals across Japan. The JACVSD data collection form has more than 300 variables (definitions are available online at http://www.jacvsd.umin.jp), which are nearly identical to those of The Society of Thoracic Surgeons National Database. The methods of data collection of the JACVSD have been previously described [16]. Data collection was approved by the institutional review board at each participating hospital. The Data Utilization Committee of the JACVSD approved the use of data for the present study. Data collection achieved a high level of completion, with less than 3% of entries missing for overall preoperative risk factors used in risk models. In the present study population, no preoperative variable had a rate of missing data higher than 1%. The accuracy of submitted data is maintained by regular auditing of data in which monthly visits are made to participating hospitals to check the reported data against clinical records. Data validity is further confirmed by an independent comparison of specific hospitals' volume of cardiac operations entered in the JACVSD with that reported in the annual survey of the Japanese Association for Thoracic Surgery.

Study Population

The data of patients included in the JACVSD from January 1, 2008 to December 31, 2013 were analyzed. Patients who underwent primary, isolated, elective CABG were included. Exclusion criteria were urgent, emergency, or salvage status, redo operation, and acute myocardial infarction within the preceding 2 weeks. These criteria were defined mainly to exclude patients who underwent urgent or emergency CABG after failed PCI. Records with missing data on age (or out of range), sex, or 30-day status (see "Study Endpoints" for an explanation) were excluded. With the exception of body surface area and preoperative creatinine values, all missing or out-of-range values were imputed using the variable-specific median value. After this data cleaning was performed, 48,051 patients were included in the present study. Patients were classified as either with previous PCI (previous-PCI group) or without previous PCI (no previous-PCI group) before CABG surgical procedures. In the JACVSD, a previous PCI procedure is defined as a PCI procedure before the index CABG operation. Data of details of the PCI procedure, such as stent placement, type of stent used, and the dates of the procedure, are not defined.

Study Endpoints

The primary endpoints were operative mortality and composite outcome consisting of operative mortality and major morbidity. Operative mortality was defined as death occurring within 30 days after operation and death during the index hospitalization. Major morbidity was defined as any of the following postoperative complications: stroke, reoperation for bleeding, mechanical ventilation required for more than 24 hours postoperatively, renal failure with newly required dialysis, or deep sternal wound infection, which occurred in the hospital or within 30 days after the operation.

Statistical Analysis

Continuous variables are expressed as mean ± standard deviation, and the unpaired t test or Wilcoxon rank sum test was used for comparisons. Categorical variables are expressed as percentages and were compared using the χ^2 test. The effect of previous PCI procedures on early mortality and morbidity was evaluated by two risk-adjustment methods. First, a risk-adjusted prognostic effect of previous PCI was estimated within a multivariate logistic regression model that included the clinically relevant covariates (listed in Table 1) and the use of bilateral internal thoracic arteries.

Second, inverse probability of treatment weighting was also performed to validate the estimated prognostic effect [17]. The propensity score with previous PCI as an outcome was calculated in a multivariate logistic regression model including the preoperative variables (Table 1) as covariates. The area under the receiver operating characteristic curve was 0.693 (95% confidence interval [CI], 0.688 to 0.699; $p < 0.001$). The inverse probability weights calculated by using the propensity score were applied to a logistic regression model to obtain the propensity-weighted odds ratio (OR) of previous PCI procedures. In addition, risk-adjusted ORs of previous PCI were also calculated in subgroups defined by preoperative risk factors. In all logistic regression models for the OR of previous PCI procedures, the annual isolated CABG case volumes of hospitals were included as a covariate to minimize the effect of institutional surgical volume. All reported p values are two sided, and $p < 0.05$ was considered statistically significant. Statistical analysis was performed using SPSS 20.0 software (IBM Corp, Armonk, NY).