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Perioperative Cardiovascular Risk of Prior Coronary Stent Implantation Among Patients Undergoing Noncardiac Surgery

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ABSTRACT

BACKGROUND Previous studies have observed high rates of perioperative cardiovascular events in patients with coronary stents undergoing noncardiac surgery (NCS). It is uncertain whether this finding reflects an independent association.

OBJECTIVES The goal of this study was to assess the independent relationship between prior coronary stent implantation and the occurrence of perioperative major adverse cardiac and cerebrovascular events (MACCE) and bleeding and its relation with time from stenting to NCS.

METHODS A total of 24,313 NCS cases at the Mayo Clinic (Rochester, Minnesota) from 2006 through 2011 were included in the study; 1,120 (4.6%) cases involved patients with coronary stents. MACCE was defined as death, myocardial infarction, cardiac arrest, or stroke. Age-adjusted odds ratios (aORs) were calculated after propensity adjustment for Revised Cardiac Risk Index factors and other conventional risk factors.

RESULTS The 30-day MACCE rates were 3.7% and 1.5% in stented and unstented patients, respectively ($p < 0.001$). The risk of MACCE was largely related to the time from stent implantation to NCS, indicating substantially elevated risk in the first year after stenting (aOR: 2.59; 95% confidence interval [CI]: 1.36 to 4.94) but not thereafter (aOR: 0.89; 95% CI: 0.59 to 1.36). Bleeding displayed a similar pattern, indicating elevated risk in the first year after stenting (aOR: 2.23; 95% CI: 1.55 to 3.21) but not thereafter (aOR: 1.07; 95% CI: 0.89 to 1.28). Subgroup analysis in patients with known stent type found that the increased risk of both MACCE and bleeding >1 month after stent implantation was not limited to only those with drug-eluting stents.

CONCLUSIONS This study found that prior coronary stent implantation is an independent risk factor for MACCE and bleeding when time from stenting to NCS is <1 year, both in patients with bare-metal and drug-eluting stents.
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With an estimated number of 454,000 procedures in the United States in 2010 alone, percutaneous coronary intervention (PCI) with implantation of bare-metal stents (BMS) or drug-eluting stents (DES) has become the cornerstone of the invasive management of patients with ischemic heart disease (1). As the number of patients with coronary stents increases, clinicians more commonly encounter patients with previously implanted stents who require noncardiac surgery

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(NCS) for other conditions. Numerous studies among patients early after stenting have observed high rates of perioperative cardiovascular events in the setting of NCS (2–9). International guidelines now recommend delaying nonurgent NCS for at least 1 month after BMS implantation and 6 to 12 months after DES implantation (10,11). Recent studies, however, reporting on elevated risk up to 6 to 12 months after both BMS and DES implantation suggest that this time frame may not be enough (2–4). It is important to note that most studies thus far have been conducted exclusively in patients with coronary stents and that the lack of a control group limits assessment of the independent risk associated with prior coronary stent implantation.

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The goal of the present study was to investigate if prior stent implantation is an independent risk factor for the perioperative occurrence of major adverse cardiac and cerebrovascular events (MACCE) and bleeding and whether this risk depends on time from stent implantation to NCS in an unselected cohort of patients undergoing NCS.

METHODS

STUDY DESIGN. The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) is the leading source of short-term general and vascular surgical outcomes in the United States, and the Mayo Clinic in Rochester, Minnesota, has been a contributor to this database since it started participating in April 2006. Details on the ACS NSQIP database have previously been published, including sampling methods (12), variable definitions (12,13), and methods to ensure that data are of high quality and reliable (14). Briefly, hospitals participating in the ACS NSQIP program prospectively submit preoperative through 30-day postoperative data on a random sample of 15% to 20% of their surgical practice to the ACS NSQIP database. Data are collected by trained nurses using a variety of methods, including medical chart review and telephone follow-up. Definitions are determined by a central committee, and participating centers are audited to assure appropriate sampling and data collection. According to these audits, the overall disagreement rate for all participating centers is approximately 1.8% (12). The ACS NSQIP database does not cover patients aged <18 years, acute trauma cases, or cases of cardiac surgery, ophthalmologic surgery, or transplantation.

After obtaining institutional review board permission, the ACS NSQIP database was interrogated for the present study to obtain baseline, procedural, and outcome data on patients undergoing NCS from 2006 through 2011 at the Mayo Clinic in Rochester, Minnesota. Data on prior coronary stent implantation were acquired by matching the surgical database with the Mayo Clinic PCI Registry. In addition, medical charts were reviewed to identify all prior stent implantations performed elsewhere. Because the youngest patient with a stent was 28 years old, patients without stents age <28 years were not deemed to be appropriate control subjects and were excluded. No further inclusion or exclusion criteria were applied.

METHODS OF MEASUREMENT. Baseline, procedural, and 30-day postoperative outcome data were obtained from the ACS NSQIP database; full data definitions have been published previously (12,13). Current smoking was defined as having smoked cigarettes in the past year. Prior cardiac surgery was defined as previous major coronary or noncoronary cardiac surgery (thus excluding pacemaker and implantable cardioverter-defibrillator insertions), and peripheral vascular disease was defined as a history of revascularization or amputation for peripheral vascular disease. Functional status reflected the patient's ability to perform activities of daily living in the 30 days before surgery and was coded as independent versus partially/totally dependent. Revised Cardiac Risk Index factors (15) were also available and were coded as diabetes mellitus requiring insulin treatment, congestive heart failure in the last 30 days, recent angina (<1 month preoperatively) or myocardial infarction (<6 months preoperatively), prior cerebrovascular disease (any prior stroke or transient ischemic attack), renal failure (preoperative serum creatinine >177 μmol/l [>2.0 mg/dl]) or preoperative dialysis dependence, and performance of vascular surgery. Classes according to American Society of Anesthesiologist guidelines were graded by the attending anesthesiologist, as described previously (16). Due to a high rate of stent implantations performed in outside institutions, interrogation of the PCI registry and medical chart review could only disclose the most recently implanted type of stent in 69% of patients (85% when time from stenting to NCS was <1 year). All other reported data were available in ≥99% of patients, except for preoperative serum creatinine level (81%).

ENDPOINTS. Our primary endpoint was the intraoperative through 30-day postoperative occurrence of MACCE. This composite measure included death, myocardial infarction, cardiac arrest, and stroke.

ABBREVIATIONS AND ACRONYMS

ACS NSQIP = American College of Surgeons National Surgical Quality Improvement Program

aOR = adjusted odds ratio

BMS = bare-metal stents

CI = confidence interval

DES = drug-eluting stents

MACCE = major adverse cardiac and cerebrovascular events

NCS = noncardiac surgery

PCI = percutaneous coronary intervention