The Incidence and Timing of Noncardiac Surgery after Cardiac Stent Implantation

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BACKGROUND: In November 2007, national guidelines were released recommending delay of elective noncardiac surgery after cardiac revascularization with drug eluting stents (DES) for 12 months compared with 6 weeks after implantation of bare metal stents (BMS).

STUDY DESIGN: To determine the incidence of noncardiac surgery within 24 months after stent placement, national VA data on cardiac stent implantation were merged with data from the VA National Surgery Office and Medicare. Using chi-square tests and log-rank analyses, we measured the incidence of noncardiac surgery after BMS and DES in relation to guideline release and surgical characteristics.

RESULTS: From 2000 to 2010, 126,773 stent procedures were followed by 25,977 (20.5%) noncardiac operations within 24 months. Overall, 11.8% of the BMS surgery cohort had early surgery (less than 6 weeks) compared with 46.7% of the DES surgery cohort, which had early surgery (less than 12 months). The incidence of surgery differed significantly by stent type (BMS 24.1% vs DES 17.5%, $p < 0.001$) and in relation to guideline release (pre- 24.6% vs postguideline 13.1%, $p < 0.001$). Higher complexity operations (work relative value units) were more likely to occur in the early period for both BMS ($p < 0.0001$) and DES ($p < 0.003$). After guideline release, the incidence of surgery within 12 months decreased from 16.7% to 10.0% ($p < 0.0001$).

CONCLUSIONS: We found evidence that guidelines recommending delaying surgery appear to be effective in decreasing the incidence of early surgery; however, early surgery is still a frequent occurrence. Additional research is needed to better define the risk of cardiac and bleeding complications in patients undergoing subsequent noncardiac surgery, as well as the optimal time for surgery and method of antiplatelet management. (J Am Coll Surg 2012;214:658–667. © 2012 by the American College of Surgeons)

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Percutaneous coronary intervention with cardiac stent implantation for treatment of coronary artery disease has increased dramatically over the past 2 decades. Implantation of bare metal stents (BMS) was the mainstay of therapy until drug-eluting stents (DES) were approved in 2004.[1] DES are effective in preventing restenosis that occurs with BMS, however, the complication of acute stent thrombosis due to delayed or absent endothelialization of the DES was recognized shortly after introduction to the market. Acute stent thrombosis was most frequently reported to be associated with early cessation of dual antiplatelet therapy.[2-4]

It is estimated that approximately 5% to 15% of patients undergo a surgical procedure within 2 years of stent implantation.[5-11] Similar to reports of stent thrombosis after early cessation of antiplatelet therapy, case reports of acute stent thrombosis after noncardiac surgery appeared, particularly when the surgery occurred early after DES implantation. Perioperative stent thrombosis is associated with significant morbidity and death.[7,12-16] Reports of stent complications in surgical patients, as well as those describing adverse events in patients with early cessation of anti-

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Abbreviations and Acronyms

ACC/AHA = American College of Cardiology/American Heart Assoication
BMS = bare metal stents
CMS = Centers for Medicare and Medicaid Services
CPT = Current Procedure Terminology
DES = drug-eluting stents
FY = fiscal year
RVU = relative value units
VA = Veterans Affairs

platelet therapy, led to a modification of the American College of Cardiology/American Heart Association (ACC/AHA) Guidelines on Perioperative Cardiovascular Evaluation and Care for Noncardiac Surgery in 2007 to recommend that elective surgery in patients with DES be delayed 12 months after implantation. For urgent or higher acuity procedures that cannot be delayed, the guidelines recommend that the procedure be performed without cessation of aspirin therapy (current as of November 2011).[17]

A recent study examining the risk of bleeding after noncardiac surgery among individuals who had received a BMS or DES found that continuing both single and dual antiplatelet therapy at the time of noncardiac surgery significantly increased the risk of severe bleeding after surgery to 4% for aspirin and 21% for dual antiplatelet therapy.[4] A meta-analysis found that aspirin alone increased the risk of bleeding complications by as much as 50% depending on the type of operation.[18] Clopidogrel was associated with a slightly increased risk of bleeding as well as with a 2- to 5-times increased risk of reoperation after cardiac surgery.[19] In a survey of Veterans Affairs providers, 71% of surgeons agreed that the relative risk of stent thrombosis outweighs the risk of bleeding with continued aspirin therapy for noncardiac surgery after DES, and 89% reported that they would either delay surgery or continue aspirin for procedures performed within 12 months of a DES. These results suggest that there is broad knowledge of and adherence to the ACC/AHA guidelines, but that surgeons have concerns about operating when patients remain on antiplatelet therapy.[20]

In order to better define the magnitude of this problem in surgical patients, we undertook a cohort study of patients undergoing cardiac stent implantation using national Veterans Affairs (VA) data to determine the incidence, timing, and type of noncardiac operation after stent placement. We hypothesized that case reports of postoperative stent thrombosis and publication of the ACC/AHA guidelines would be associated with a decrease in the occurrence of early elective surgery after DES implantation.

METHODS

This is a retrospective cohort study examining patients with cardiac stents placed in the VA system between October 1, 1999 and September 30, 2010. Patients were followed through March 31, 2011 in order to examine noncardiac operations occurring within 24 months after stent placement. This study protocol was reviewed and approved by the VA Institutional Review Boards at each investigator's site, the Surgical Quality Data Use Group, the Clinical Assessment, Reporting, and Tracking System for Cardiac Catheterization Laboratories (CART-CL) Program,[21] and the VA Information Resource Center.

Patient population

To identify the study population, the VA Patient Treatment File and the VA CART-CL were queried for cardiac stent placement procedures between October 1, 1999 (FY2000) and September 30, 2010 (FY2010). Cardiac stents were identified by ICD-9 procedure codes 36.06 for BMS or 36.07 for DES.

Variable specification

VA National Surgery Office data were used to identify noncardiac surgical procedures occurring in the VA system within the 24 months after each identified cardiac stent placement. Noncardiac surgical procedures were defined using Current Procedure Terminology (CPT) codes from 10000 to 32999 and 34000 to 69999. Other exclusions included endoscopic procedures (CPT 43200 to 43272, 46600 to 46608), colonoscopic procedures (CPT 45300 to 45392), and minor musculoskeletal procedures such as application of a cast and joint aspiration (29000 to 29750). To assess the incidence of surgery outside of the VA system, Medicare data from the Centers for Medicaid and Medicare Services (CMS) were queried for the occurrence of noncardiac surgical procedures using the CPT codes defined above. For our study population, CMS data on patients undergoing cardiac stent placement in VA were available only through December 31, 2008 (Fig. 1).

The type of stent was determined using ICD-9 procedure codes as described above. When both a BMS and a DES were implanted on the same day, the stent type was defined as "DES & BMS" for the purposes of this analysis. The type of noncardiac surgery was classified into the following categories using the primary CPT code: 10040 to 19999, integumentary; 20000 to 29999, musculoskeletal; 30000 to 32999, respiratory; 34000 to 37799, vascular; 40000 to 49999, digestive; 50000 to 53999, urinary; 54000 to 58999, genital; 61000 to 64999, nervous; and 65000 to 69999, eye/ear. Procedures with a primary CPT code not in this list were categorized as "Other:" 10000 to