Journal of Investigative Medicine 56(6):878–881, 2008

BRIEF REPORT

Perioperative Risk of Patients Undergoing Noncardiac Surgery After Coronary Artery Bypass Surgery

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■ ABSTRACT

Background: Most data suggesting that noncardiac surgery early after coronary artery bypass surgery carries low risk are derived from post hoc analyses of randomized controlled trials, with only limited data derived from contemporary, nonselected, and nontrial patients.

Methods: We retrospectively reviewed the medical records of patients who underwent coronary artery bypass surgery at our institution between January 1999 and October 2006 to determine whether they subsequently had major noncardiac surgery and what the outcomes of the noncardiac surgery were.

Results: During the study period, 1065 patients underwent coronary artery bypass surgery, and 272 (26%) subsequently underwent 467 major noncardiac surgeries. The mean interval from coronary artery bypass to noncardiac surgery was 1.9 ± 1.9 years (range, 0–7.8 years). A major complication occurred in 3 surgeries (0.6% [95% confidence interval, 0.1%–1.9%]). Two patients died (both from respiratory arrest during the postoperative period: 1 patient had a tongue cancer excision, and the other patient had polycythemia vera), and the third patient had a perioperative arrhythmia.

Conclusions: Noncardiac surgery is often required early after coronary artery bypass surgery and carries very low risk for cardiac complications, suggesting that preoperative cardiac evaluation may not be required in most such patients.

Key Words: coronary artery bypass graft surgery, noncardiac surgery, complications

Coronary artery bypass graft surgery (CABG) is very common: during 2004, approximately 427,000 (14.6 per 10,000 population) CABG operations were performed in nonfederal US hospitals participating in the National Hospital Discharge Survey.[1] Many CABG patients subsequently require noncardiac surgery.

According to the 2002 guidelines of the American College of Cardiology/American Heart Association (ACC/AHA) on preoperative cardiac evaluation of noncardiac surgery, the risk of perioperative death or myocardial infarction (MI) is extremely low in patients who had "complete surgical revascularization in the past 5 years" and had no recurrent signs or symptoms of ischemia.[2] No further cardiac testing was recommended for such patients.[2] The 2007 ACC/AHA guidelines on perioperative cardiovascular evaluation recommend no further cardiac evaluation in asymptomatic coronary artery disease patients who have good functional capacity.[3] Most of the data showing low perioperative risk in post-CABG patients comes from post hoc analyses of randomized trials, such as the Coronary Artery Surgery Study[4] and the Bypass Angioplasty Revascularization Investigation[5] study, which were performed several years ago. However, other studies suggest that preoperative coronary revascularization may not offer adequate cardiac protection during subsequent major vascular surgery.[6]

The goal of our investigation was to examine the risk of perioperative complications during major noncardiac surgery among contemporary nonselected patients undergoing noncardiac surgery after CABG in a tertiary referral medical center.

■ METHODS

We retrospectively reviewed the records of all 1065 consecutive patients who underwent CABG (CABG was combined with valvular surgery in 101 patients or another procedure in 32 patients) at the Dallas Veterans Affairs Medical Center between January 25, 1999, and October 16, 2006, and subsequently underwent a major

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noncardiac surgery. Patients who died after CABG (including 5 patients who died after having noncardiac surgery during their index CABG hospitalization) were excluded from the current study.

The collection of data was performed in June 2007. The following data were collected: (*a*) patient characteristics (sex, age, ethnicity, tobacco abuse, diabetes, hypertension, congestive heart failure, and hyperlipidemia), (*b*) date and type of CABG, and (*c*) frequency and complications of noncardiac surgery performed after CABG. Hyperlipidemia was defined as a total cholesterol of greater than 200 mg/dL or as intake of an antilipidemic medication. Diabetes mellitus was defined as a fasting glucose of greater than 125 mg/dL or as intake of insulin or an oral hypoglycemic medication. Hypertension was defined as a systolic blood pressure of greater than 140 mm Hg on at least 2 separate measurements or as intake of antihypertensive medications.

The end points of our study were perioperative (before hospital discharge) death, nonfatal acute MI, and other cardiovascular complications, such as arrhythmias. Myocardial infarction was defined using the following criteria (universal definition of MI)[7]: (1) detection of rise and/or fall of cardiac biomarkers with at least 1 value above the 99th percentile of the upper reference limit together with evidence of myocardial ischemia with at least one of the following: symptoms of ischemia, electrocardiographic changes indicative of new ischemia (new ST-T changes or new left bundle branch block), development of new pathological Q waves in the electrocardiogram, and imaging evidence of new loss of viable myocardium or new regional wall motion abnormality; (2) sudden, unexpected cardiac death, involving cardiac arrest, often with symptoms suggestive of myocardial ischemia, and accompanied by presumably new ST elevation, or new left bundle branch block and/or evidence of fresh thrombus by coronary angiography and/or at autopsy, but death occurring before blood samples could be obtained or at a time before the appearance of cardiac biomarkers in the blood. Postoperative measurement of cardiac biomarkers was done at the discretion of the treating physicians.

Continuous parameters were reported as mean ± SD, and discrete parameters were reported as percentage. All analyses were done using JMP IN 5.1 (SAS Statistical Institute, Cary, NC). The study was approved by our institutional review board.

■ RESULTS

Of the patients who underwent successful CABG, 272 patients subsequently underwent 467 noncardiac surgeries: 176 patients had 1 surgery, 51 patients had 2, 22 patients had 3, and 23 patients had 4 surgeries or greater. The mean ± SD and median (interquartile range) number of surgeries per patient were 1.7 ± 1.4 and 1 (1–2), respectively. The mean interval from CABG to noncardiac surgery was 1.9 ± 1.9 years (range, 0-7.8 years). The types of noncardiac surgery are as follows: orthopedic (22%), vascular (19%), abdominal (17%), thoracic (15%), urological (11%), head and neck (9%), or other (7%).

Table 1 summarizes the baseline characteristics of the study population. Most patients were men (99%) and white, almost all had hypertension and hyperlipidemia, approximately half had diabetes mellitus, and approximately one third were active smokers. The mean ± SD and median (interquartile range) number of grafts per patients were 3.1 ± 1.0 and 3 (2–4), respectively, and 92% of the patients received a left internal mammary artery graft. A major complication occurred in 3 noncardiac surgeries (0.6% [95% confidence interval 0. 1%–1.9%]). Two patients died, and 1 had an arrhythmic event. The first patient underwent resection of tongue cancer 4.1 years after CABG and died 8 days after surgery from respiratory arrest. The second patient, who had polycythemia vera, underwent splenectomy 0.9 years after CABG and died 4 days later also from respiratory arrest. The third patient underwent colon adenocarcinoma resection 5 months after CABG and, during surgery, developed a supraventricular tachycardia causing hypotension; the surgery was stopped but was reattempted and successfully completed 3 days later without any other complications.

■ DISCUSSION

Our study shows that noncardiac surgery is frequently performed early after CABG and carries a very low risk of cardiac complications.

The reported incidence of perioperative complications in post-CABG patients is 1.4% to 10.9%. Among 3368 patients participating in the Coronary Artery

TABLE 1. Clinical Characteristics of the Study Patients

Variable	*Patients*
Age, mean ± SD	63 ± 8
Male, n (%)	269 (99)
Ethnicity, n (%)	
White	234 (86)
African American	26 (10)
Hispanic	11 (4)
Other	1 (0)
Smoking, n (%)	
Current	87 (32)
Past	120 (44)
Never	65 (24)
Diabetes, n (%)	122 (45)
Hyperlipidemia, n (%)	267 (98)
Hypertension, n (%)	259 (95)
History of congestive heart failure, n (%)	72 (26)

Surgery Study registry who underwent noncardiac surgery after 4.1 years from CABG, perioperative death or MI occurred in 1.7%.[4] The Bypass Angioplasty Revascularization Investigation trial randomized patients with multivessel coronary artery disease to balloon angioplasty or CABG. During a mean follow-up of 7.8 ± 0. 9 years, 501 (53.6%) of 934 study patients underwent 1049 noncardiac surgeries at a median of 29 months after the most recent revascularization procedure with a very low incidence of perioperative complications (1.4%), which was similar in balloon angioplasty (1.6%) or CABG (1.3%) patients.[5]

Mahar et al[8] examined the outcomes of 99 patients who underwent 169 noncardiac surgeries after CABG. Thirty-five patients had no prior MI and experienced no perioperative complications (mean interval to noncardiac surgery was 1.8 years). Only 1 in 64 patients who had a prior MI died after surgery because of stroke (mean interval to noncardiac surgery was 2.7 years).[8] Similarly, Nielsen et al[9] reported a perioperative complication (death, MI, arrhythmia, and congestive heart failure) in 7 (3.9%) of 181 patients undergoing noncardiac surgery 1.9 years after CABG. However, Back et al.[6] reported a 10.9% incidence of perioperative adverse cardiac events or death among 100 prior CABG patients undergoing major vascular surgery (within 5 years from CABG in approximately two thirds of the patients) at an academic Veterans Affairs Medical Center similar to ours. This could be in part due to the higher average risk of vascular operations.

The findings of our nontrial contemporary study are similar to the results of most published studies[4,5,8,9] and show a very low risk of perioperative complications during noncardiac procedures among prior CABG patients.

Recent studies suggest that preoperative coronary revascularization may not decrease the perioperative cardiac risk,[10] even in high-risk patients.[11] This reinforces the ACC/AHA guidelines statement that preoperative revascularization to "get a patient through" noncardiac surgery is appropriate only in a small subset of very high–risk patients.[2,3] Preoperative revascularization before noncardiac surgery would, however, be recommended if noncardiac surgery is not urgent and if revascularization could improve the long-term outcome of the patient. Especially if noncardiac surgery is needed early after revascularization, CABG may be preferable to percutaneous coronary intervention[12] because noncardiac surgery after percutaneous coronary intervention with stent implantation may be complicated by stent thrombosis, a catastrophic complication with high morbidity and mortality.[13]

■ LIMITATIONS

Our study is limited by the retrospective design and the relatively small number of patients included but provides data on a contemporary, nonselected, and nontrial cohort of patients. Almost all studied patients were men, and our results may not necessarily be applicable to women. Most of the noncardiac surgeries were done early after CABG (mean interval, 1.9 ± 1.9 years), and the risk of noncardiac surgery may increase later because of progression of native atherosclerosis and development of graft failure.[14] Measurement of cardiac biomarkers after noncardiac surgery was done at the discretion of the treating physicians; therefore, some small postoperative acute MI may have been undetected, although it is unlikely that large acute MI would have not been detected.

■ CONCLUSIONS

Noncardiac surgery is frequently performed early after CABG and carries a very low risk of postoperative complications. Our findings support the following ACC/AHA guideline recommendations: (*a*) post-CABG patients do not require repeat preoperative cardiac assessment, in the absence of new signs and symptoms of ischemia; and (*b*) the indication for preoperative testing is limited to the group in whom coronary revascularization may be beneficial, independent of noncardiac surgery.[2,3]

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