The American Journal of Surgery (2012) 204, 586–590

The American Journal of Surgery®

Association of VA Surgeons

Impact of perioperative events on mortality after major vascular surgery in a veteran patient population

Sonia T. Orcutt, M.D.[a], Carlos F. Bechara, M.D.[a,b], George Pisimisis, M.D.[a,b], Neal R. Barshes, M.D.[a,b], Panagiotis Kougias, M.D.[a,b,*]

[a]Department of Surgery, Baylor College of Medicine, Houston, TX, USA; [b]Michael E. DeBakey Veterans Affairs Medical Center, Houston, TX, USA

KEYWORDS:
Vascular surgical procedures;
Postoperative complications;
Mortality

Abstract

BACKGROUND: The aim of this study was to characterize the impact of perioperative events on long-term mortality after major vascular surgery at a single institution.

METHODS: A retrospective analysis of patients undergoing major vascular surgery was performed. The primary end point was all-cause long-term mortality. Cox regression analyses were performed to identify predictors of this outcome.

RESULTS: A total of 1,182 procedures in 706 patients were identified, including endovascular or open aortic aneurysm repair, open repair of aortoiliac or infrainguinal occlusive disease, amputations, and carotid endarterectomy. Perioperative cardiac and respiratory complications occurred in 4.9% and 1.4% of operations, respectively. On multivariate Cox regression analysis, adjusting for patient factors and operation performed, perioperative cardiac (hazard ratio, 5.3; 95% confidence interval, 1.7–15.9) and respiratory complications (hazard ratio, 5.01; 95% confidence interval, 1.48–16.98) were significant predictors of long-term mortality.

CONCLUSIONS: Although serious perioperative cardiac and respiratory events are infrequent, they have a significant impact on long-term mortality after major vascular surgery, even when adjusted for comorbidities and type of operation.

Patients with peripheral vascular disease have high rates of concurrent comorbidities, including coronary artery disease, diabetes, hypertension, dyslipidemia, and tobacco use.[1] The presence of extensive comorbidities places these patients at high risk for perioperative morbidity, including cardiac, respiratory, and neurologic adverse events.[2] However, the impact of perioperative events on long-term mortality is not clear. In the general surgery literature, postoperative complications have been identified as independent factors predictive of decreased long-term survival.[3,4] In vascular surgery, however the results of studies examining the impact of perioperative events on long-term survival have been inconsistent.[5–8] In addition, the emphasis in most of these studies has been on perioperative cardiac events specifically, as opposed to all serious adverse events, because of the close association between peripheral vascular disease and cardiac disease.

On the basis of these considerations, it is apparent that the impact of adverse perioperative events on long-term survival after vascular surgery has not been clearly elucidated. Therefore, the goal of this study was to describe the incidence of perioperative cardiac, respiratory, and cerebrovascular events after major vascular surgery at our institution. In addition, we sought to identify prognostic factors

* Corresponding author: Tel.: 713-794-8629; fax: 713-794-7542.
E-mail address: pkougias@bcm.edu
Manuscript received April 5, 2012; revised manuscript July 10, 2012

0002-9610/$ - see front matter © 2012 Published by Elsevier Inc.
http://dx.doi.org/10.1016/j.amjsurg.2012.07.014

associated with long-term mortality after major vascular surgery, and we hypothesized that perioperative events, independent of baseline characteristics, would be associated with decreased long-term survival.

Methods

Study population

A retrospective cohort study was performed of consecutive patients who underwent major vascular surgery at a Veterans Affairs tertiary referral center from 2008 to 2011. Procedures analyzed included endovascular or open aortic aneurysm repair, open repair of aortoiliac or infrainguinal occlusive disease, major amputations (defined as either above or below the knee) for ischemic etiologies, and carotid endarterectomy. Demographics, operative and perioperative data, and long-term follow-up were recorded. This study was approved by the institutional review board at Baylor College of Medicine and the Veterans Affairs hospital.

Study outcomes

The primary outcome of interest was all-cause long-term mortality. Secondary outcome was the incidence of postoperative adverse events. These included cardiac and respiratory complications, as well as cerebrovascular accidents. Cardiac events consisted of myocardial infarction, arrhythmias requiring long-term anticoagulation or interventional treatment, the development of congestive heart failure (CHF; regardless of preoperative diagnosis), and cardiac arrest. Myocardial infarction was initially suspected clinically and was subsequently confirmed with combination of electrocardiographic and circulating biomarker levels. The CHF outcome included patients with new-onset or deteriorating CHF. New-onset CHF was suspected initially on clinical grounds as the development of shortness of breath in previously stable patients, and it was confirmed radiographically with chest x-ray. In patients with preexisting CHF, the presence of shortness of breath, fluid overload on chest x-ray, and echocardiographic confirmation of ejection fraction by 10% compared with baseline were used to define a deteriorating CHF. Patients with histories of CHF who developed shortness of breath in the absence of deteriorating ejection fraction were not included in our analysis. Respiratory events consisted of prolonged (>48 hours) ventilator time, postoperative reintubation, and the development of pneumonia. Diagnoses were made by the treating surgeons and based on clinical grounds, with confirmatory testing when appropriate.

Statistical analysis

For time-to-event analysis, a multivariate Cox proportional-hazards model was fitted using forward stepwise regression, with the P value to enter set at .15. Variables with P values $< .05$ were retained in a final shared frailty Cox regression model to account for clustering at the individual patient level and adjust for multiple procedures performed on the same patient. Parameter estimates are presented as hazard ratios (HRs) and 95% confidence intervals (CIs). Results were considered significant at α levels $< .05$. All analyses were performed using Stata version 12.1 (StataCorp LP, College Station, TX).

Results

Patient characteristics

Long-term follow-up data were available on 1,182 procedures performed on 706 patients. Ninety-eight percent of patients were male, as expected from a Veterans Affairs population. The mean age of the cohort was 66 ± 8 years, and the median body mass index was 27 ± 5 kg/m^2 (see Table 1). This was a fairly high cardiac risk patient population, with 29% of patients having Revised Cardiac Risk Index class III or IV.[9]

Operative characteristics

Patients undergoing 6 major operations were analyzed. Case distribution was as follows: 373 (32%) underwent

Table 1 Patient demographics (n = 1,182)

Variable	Value
Age (y)	65.9 ± 8.4
Body mass index (kg/m^2)	26.6 ± 5.3
Race	
White	720 (69.8%)
Nonwhite	311 (30.2%)
Revised Cardiac Risk Index	
I	416 (35.6%)
II	418 (35.8%)
III	227 (19.4%)
IV	108 (9.2%)
Coronary artery disease	542 (45.9%)
Diabetes mellitus	499 (42.2%)
Chronic obstructive pulmonary disease	306 (25.9%)
Renal disease (chronic renal insufficiency or end-stage renal disease)	208 (17.6%)
Hyperlipidemia	276 (23.4%)
History of smoking	1,002 (84.8%)
Statin therapy	891 (75.4%)
Antiplatelet therapy	985 (83.3%)

Data are expressed as mean ± SD or as number (percentage). Some information was not available for all patients, so the corresponding percentages reflect the portion of the cohort for which data were available.