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# Postoperative complications after common femoral endarterectomy

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***Background:*** **Common femoral endarterectomy (CFE) for limited arterial occlusive disease is considered a fairly low-risk operation of short duration. This study investigated the timing of 30-day outcomes as they related to hospital discharge and predicted the risk of operative mortality of this procedure.**

***Methods:*** **All patients in the National Surgical Quality Improvement Program database who underwent isolated CFE between 2005 and 2010 were selected for the test sample. We identified postoperative mortality and morbidities occurring before and after hospital discharge. A risk calculator for 30-day mortality, developed in the test sample using logistic regression, was validated in a new sample of cases from 2011 to 2012.**

***Results:*** **A total of 1843 CFEs reported from 2005 to 2010 met the inclusion and exclusion criteria. The average operative time was 146 ± 69.5 minutes (median, 133; interquartile range, 98-179 minutes), and 10% of patients needed to return to the operating room. The average length of stay was 4 ± 7.5 days (median, 3; interquartile range, 2-5 days); 91% of patients were discharged ≤1 week of surgery. Occurrences of cardiovascular events, renal dysfunction, and pulmonary complication were relatively low. There was 3.4% mortality and 8% wound-related complications, 30% and 86% of which occurred after hospital discharge, respectively. Overall, there was a 15% risk of combined mortality/morbidity, and >60% of these events occurred after discharge. The independent predictors of 30-day mortality were age, nonindependent functional status, preoperative dialysis, sepsis, emergency status, and American Society of Anesthesiologists Physical Status Classification 4 or 5, and the association between risk strata and death in the validation sample was strong ($\varphi = 0.29$) and significant ($P < .001$).**

***Conclusions:*** **CFE is not as "benign" a procedure as previously believed. The risks of death and wound complications are not insignificant, and a high percentage of these complications occurred after patients were discharged from the hospital. Patients should be carefully selected, especially in the elderly population, and close postoperative follow-up should be considered. (J Vasc Surg 2015;61:1489-94.)**

Isolated common femoral arterial lesions are rare in lower extremity arterial occlusive disease, and the sole treatment of common femoral artery disease is quite effective in relieving the symptoms of claudication and rest pain, with high rates of limb salvage.[1-5] On one hand, because the common femoral artery is located at a high mobility area, stenting could lead to stent fracture and also preclude a potential access site for subsequent endovascular interventions. On the other hand, because the common femoral artery is easily accessible surgically, even under local anesthesia, most surgeons treat the disease with open endarterectomy because the procedure is considered to be technically straightforward and of short duration, with minimal postoperative complications.

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Most single-center studies on isolated common femoral endarterectomy (CFE) have reported a very limited number of patients. In this study, we used the American College of Surgeons National Surgical Quality Improvement Program (ACS-NSQIP) database to analyze a large volume of procedures, allowing in-depth study of the postoperative outcomes of this procedure and focusing specifically on the timing of the complications and the predictors of 30-day mortality.

## METHODS

We performed a retrospective cohort study using data from the ACS-NSQIP database. The George Washington University Institutional Review Board approved protocol for the NSQIP study. Informed consents were waived. All CFEs in the NSQIP database between 2005 and 2010 were selected by the Current Procedural Terminology (American Medical Association, Chicago, Ill) code 35,371. Profunda and superficial femoral endarterectomies were accepted as concurrent codes, but we excluded other major vascular procedures such as aneurysm repair, infrainguinal bypass, major amputation, and thrombectomy. Also excluded were reoperative or hybrid procedures that involved additional endovascular treatment of the inflow or outflow arteries.

Preoperative patient characteristics examined included age, weight, sex, race, American Society of Anesthesiologists (ASA) Physical Status Classification, cardiac risks

(smoking, diabetes, congestive heart failure, myocardial infarction, previous percutaneous coronary intervention, or coronary artery bypasses), chronic obstructive pulmonary disease, acute kidney injury, dialysis, the presence of rest pain, and surgical emergency status. Operative details recorded included procedure duration and the amount of intraoperative blood transfusion. Thirty-day outcomes included death, cardiac, pulmonary (prolonged intubation, pulmonary embolism, reintubation, or pneumonia), renal complications (acute kidney injury or dialysis occurred in patients without previous dialysis), sepsis, and graft failure. Wound-related complications in the NSQIP database are defined as superficial infection, deep wound infection, organ space infection, or wound dehiscence, which are combined into one main category of "wound complication" during data analysis.

In addition to reporting the incidence of postoperative outcomes, this study pursued a more focused analysis of the timing of major postoperative events before and after hospital discharge during a 30-day period. We took this approach for two main reasons. Clinically, it is important to examine whether there is a high risk of postdischarge complications that would warrant a closer postoperative follow-up. From a research perspective, it is important to know whether databases providing only inpatient outcomes can provide valid conclusions. The NSQIP variable indicating days from surgery to discharge was used, together with the outcome event timing variables, to determine whether mortality and morbidity of the respective events occurred before or after hospital discharge.

Another objective of our study was to find a prediction model for death and then validate it in a new patient sample. We used a stepwise logistic regression model. Initial variables that were considered for model entry included a wide variety of presurgery patient characteristics (sex, race, weight, albumin, emergency status, smoking, ASA class 4 or 5, rest pain, diabetes mellitus, surgery time, ventilator status, chronic obstructive pulmonary disease, pneumonia, ascites, esophageal varices, congestive heart failure, myocardial infarction, previous percutaneous coronary intervention or cardiac surgery, angina, hypertension, peripheral vascular disease, acute kidney injury, dialysis, impaired sensorium, coma, hemiplegia, cerebrovascular accident [CVA], transient ischemic attack, central nervous system tumor, wound infection, steroid use, weight loss >10%, paraplegia or quadriplegia, chemotherapy or radiotherapy, bleeding disorder, transfusion, sepsis, pregnancy, previous surgery ≤30 days). Stepwise regression was used to select relevant predictors, using $P < .05$ as a cutoff for model entry and exit. The regression parameters were then used to compute a simplified risk score for each patient by dividing each regression parameter by the smallest parameter and rounding off to the nearest integer. Risk strata with increasing likelihood of having the outcome were created, and their association with the outcome was examined using $\chi^2$.

To cross-validate the prediction model in a new sample, we used ACS-NSQIP data from 2011 and 2012. Patients were selected in the same way as described above, using the same exclusions. We computed risk scores for each patient using the prediction model and cut-points for risk strata that were developed in the 2005 to 2010 data set and examined the association of predicted risk with actual outcomes.

In addition to 30-day mortality, predictors for other complications with incidence greater than 5% were also examined. All analyses were done using SAS 9.3 software (SAS Institute Inc, Cary, NC) with $P < .05$ considered significant.

**Table I.** Patient demographics and comorbidities

| *Variables* | *Mean ± SD or No. (%) (N = 1843)* |
|---|---|
| Age,[a] years | 69.2 ± 11.6 |
| Nonindependent status[a] | 239 (13) |
| Weight, kg | 78 ± 18.6 |
| Albumin < 3 mg/dL | 113 (6.1) |
| Female sex | 742 (40.3) |
| Race | |
| Black | 122 (6.6) |
| White | 1138 (61.8) |
| Other | 583 (31.6) |
| Emergency surgery[a] | 236 (12.8) |
| ASA class 4 or 5[a] | 378 (20.5) |
| Pre-op sepsis[a] | 91 (5.0) |
| Diabetes | 614 (33.3) |
| Hypertension | 1558 (84.5) |
| Peripheral vascular disease | 772 (41.9) |
| Rest pain | 527 (28.6) |
| Congestive heart failure | 56 (3.0) |
| History of | |
| Angina | 81 (4.4) |
| Myocardial infarction | 88 (4.8) |
| PCI | 428 (23.2) |
| Cardiac surgery | 467 (25.3) |
| Transient ischemic attack | 154 (8.4) |
| Stroke | 116 (6.3) |
| Smoker | 636 (34.5) |
| COPD | 252 (13.7) |
| Pneumonia | 9 (0.5) |
| Steroid use | 93 (5.1) |
| Acute kidney injury | 20 (1.1) |
| Dialysis[a] | 66 (3.6) |

*ASA class*, American Society of Anesthesiologists Physical Status Classification; *COPD*, chronic obstructive pulmonary disease; *PCI*, percutaneous coronary intervention; *SD*, standard deviation.
[a]Independent predictors of 30-day mortality.

## RESULTS

A total of 1843 CFEs were reported during 2005 to 2010. Patient demographics and preoperative comorbidities are summarized in Table I. The average age was 69 ± 12 years, and 40% were women. Twenty-three percent were positive for rest pain, and 13% were emergencies with critical limb ischemia. Eighty percent of the patients had hypertension, 33% were diabetic, and 34% were smokers. Although 23% to 25% of patients had undergone cardiac surgery or coronary stenting, <5% had a history of angina or myocardial infarction. There were 3% of patients on dialysis preoperatively. Five percent of patients