Morbidity and mortality after emergency lower extremity embolectomy

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ABSTRACT

Objective: Emergency lower extremity embolectomy is a common vascular surgical procedure that has poorly defined outcomes. Our goal was to define the perioperative morbidity for emergency embolectomy and develop a risk prediction model for perioperative mortality.

Methods: The American College of Surgeons National Surgical Quality Improvement database was queried to identify patients undergoing emergency unilateral and lower extremity embolectomy. Patients with previous critical limb ischemia, bilateral embolectomy, nonemergency indication, and those undergoing concurrent bypass were excluded. Patient characteristics and postoperative morbidity and mortality were analyzed. Multivariate analysis for predictors of mortality was performed, and from this, a risk prediction model was developed to identify preoperative predictors of mortality.

Results: There were 1749 patients (47.9% male) who met the inclusion criteria. The average age was 68.2 ± 14.8 years. Iliofemoral-popliteal embolectomy was performed in 1231 patients (70.4%), popliteal-tibioperoneal embolectomy in 303 (17.3%), and at both levels in 215 (12.3%). Fasciotomies were performed concurrently with embolectomy in 308 patients (17.6%). The 30-day postoperative mortality was 13.9%. Postoperative complications included myocardial infarction or cardiac arrest (4.7%), pulmonary complications (16.0%), and wound complications (8.2%). The rate of return to the operating room ≤30 days was 25.7%. Hospital length of stay was 9.8 ± 11.5 days, and the 30-day readmission rate was 16.3%. A perioperative mortality risk prediction model based on factors identified in multivariate analysis included age >70 years, male gender, functional dependence, history of chronic obstructive pulmonary disease, congestive heart failure, recent myocardial infarction/angina, chronic renal insufficiency, and steroid use. The model showed good discrimination (C = 0.769; 95% confidence interval, 0733-0.806) and calibrated well.

Conclusions: Emergency lower extremity embolectomy has high morbidity, mortality, and resource utilization. These data provide a benchmark for this complex patient population and may assist in risk stratifying patients, allowing for improved informed consent and goals of care at the time of presentation. (J Vasc Surg 2017;65:754-9.)

Acute limb ischemia (ALI) secondary to a thromboembolic event is a common vascular surgery emergency, often occurring in elderly patients with multiple comorbidities.[1] ALI is characterized by a sudden loss in perfusion in the lower extremity that can be both limb and life threatening.[2] Surgical treatment for a thromboembolic event that is not secondary to in situ thrombosis, such as seen in acute-on-chronic occlusive disease, is often by an open thromboembolectomy.[3]

The prognosis of ALI caused by thromboembolism is poor, even with early intervention, with 30-day mortality rates of 7% to 18%.[4,5] Although mortality rates have been reported, data documenting the risk factors associated with both postoperative mortality and major morbidity are lacking. Available data include heterogenous populations consisting of patients with both acute-on-chronic disease and acute embolic events, and many studies are small and from a single center.[4,5]

Our goal was to establish benchmark rates of postoperative morbidity and mortality after lower extremity embolectomy for ALI using a multi-institutional contemporary analysis of a large cohort of patients. Our secondary goal was to develop a mortality predictive risk score that could be used as a quantifiable assessment of outcomes to guide discussion about informed consent and shared decision making for surgeons, patients, and their surrogates.

METHODS

The Boston University Institutional Review Board approved this study. Patient consent was waived.

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Patient selection. The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) is a multicenter database for surgeons providing outcomes that are risk-adjusted and prospective. More than 250 participating centers report morbidity and mortality outcomes for patients undergoing a wide range of surgical procedures. Members have access to >135 variables and patient-level demographics through the Participant User Files, a resource with data gathering, sampling, and structure that has been validated in prior studies.[6-10]

The ACS NSQIP and the hospitals participating in the ACS NSQIP are the source of the data used in this report. They have not verified and are not responsible for the statistical validity of the data analysis or the conclusions derived by the authors.

We used ACS NSQIP Participant User Files to identify all patients undergoing emergency lower extremity embolectomy for ALI after a thromboembolic event from 2005 to 2012. The analysis excluded patients with previous critical limb ischemia based on the rest pain/tissue loss variable in the database to minimize the subset of patients with chronic disease. Bilateral embolectomy was also eliminated to exclude patients with a potential aortic occlusion. To further isolate unilateral embolectomy outcomes, the need for bypass was excluded to avoid confounding of postoperative outcomes. Concurrent bypass and nonemergency cases were also excluded. Patients undergoing embolectomy were identified by Current Procedural Terminology (American Medical Association, Chicago, Ill) codes 34201 and 34203, corresponding to an embolectomy of the iliofemoral-popliteal arteries and popliteal-tibial-peroneal arteries, respectively. A separate Current Procedural Terminology code for an ankle incision for distal tibial embolectomy is not available.

Variables and outcome definitions. The primary outcome that was analyzed was 30-day mortality. Secondary outcomes included composite cardiac complications defined by the Revised Cardiac Risk Index to include myocardial infarction (MI) and cardiac arrest, pulmonary complications (composite reintubation, pneumonia, prolonged intubation), any wound complication (superficial surgical site infections [SSI], deep SSI, non-SSIs, organ space SSI, or wound dehiscence), return to the operating room, length of stay, and readmission.[11]

Demographic variables considered included age, sex, race, and preoperative independent, partially dependent, or totally dependent functional status, as defined by a patient's ability to perform activities of daily living. Body mass index was separated into nonobese and obese categories. Coexistent medical conditions included diabetes, chronic obstructive pulmonary disease (COPD), congestive heart failure (CHF), dyspnea, history of transient ischemic attack/stroke, recent MI or unstable angina, hypertension, renal disease, and use of steroids.

ARTICLE HIGHLIGHTS

- **Significance:** The manuscript defines mortality rates after embolectomy for acute lower extremity ischemia and develops a risk prediction model for perioperative mortality.
- **Type of Research:** Retrospective analysis of prospectively collected data using the ACS NSQIP database.
- **Take Home Message:** Patients requiring emergency lower extremity embolectomy had a 13.9% mortality. Functional dependence, chronic kidney disease, steroid use, and age >70 years predicted the highest mortality.
- **Recommendation:** The study suggests that patients and caregivers should be aware of the high mortality after embolectomies and use the proposed risk prediction model to predict perioperative mortality.
- **Strength of Recommendation:** 2. Weak.
- **Level of Evidence:** C. Low or very low.

Statistical analysis. Sample characteristics and primary and secondary outcomes are described using means and standard deviations for continuous variables and as counts and percentages for categoric variables. Logistic regression was used to assess demographic characteristics, medical history, and procedure characteristics were assessed individually as potential predictors of 30-day mortality. The associations are expressed with odds ratios (OR) and corresponding 95% confidence intervals (CI). Demographic factors and variables significantly associated with 30-day mortality at the $P = .2$ level were considered in the prediction model. Backward elimination procedure with a .2 significance level to stay in the model was used to construct the parsimonious prediction model. Model discriminative ability was assessed, and C statistics with the corresponding 95% CIs are reported. Internal validation was used to calculate the C statistic adjusted for optimism. Model fit was assessed using Hosmer-Lemeshow goodness-of-fit test. A calibration plot was constructed to compare observed and predicted 30-day mortality. To simplify the use of the risk algorithm in clinical practice, the prediction model was used to develop a scoring scheme using the method described by Sullivan et al.[12] Statistical analyses were performed using SAS 9.3 software (SAS Institute Inc, Cary, NC).

RESULTS

We identified 1749 embolectomies from 2005 to 2012 that met our inclusion and exclusion criteria. Iliofemoral-popliteal embolectomy was performed in 1231 patients (70.4%), popliteal-tibioperoneal embolectomy in 303 (17.3%), and at both levels in 215 (12.3%). The etiology of these thromboembolic events was not described in the database. Fasciotomies were performed