Development and Validation of a Methodology to Reduce Mortality Using the Veterans Affairs Surgical Quality Improvement Program Risk Calculator

Deborah S Keller, MS, MD, FACS, Donald Kroll, MD, Harry T Papaconstantinou, MD, FACS, FASCRS, C Neal Ellis, MD, FACS, FASCRS, FACG

BACKGROUND: To identify patients with a high risk of 30-day mortality after elective surgery, who may benefit from referral for tertiary care, an institution-specific process using the Veterans Affairs Surgical Quality Improvement Program (VASQIP) Risk Calculator was developed. The goal was to develop and validate the methodology. Our hypothesis was that the process could optimize referrals and reduce mortality.

STUDY DESIGN: A VASQIP risk score was calculated for all patients undergoing elective noncardiac surgery at a single Veterans Affairs (VA) facility. After statistical analysis, a VASQIP risk score of 3.3% predicted mortality was selected as the institutional threshold for referral to a tertiary care center. The model predicted that 16% of patients would require referral, and 30-day mortality would be reduced by 73% at the referring institution. The main outcomes measures were the actual vs predicted referrals and mortality rates at the referring and receiving facilities.

RESULTS: The validation included 565 patients; 90 (16%) had VASQIP risk scores greater than 3.3% and were identified for referral; 60 consented. In these patients, there were 16 (27%) predicted mortalities, but only 4 actual deaths ($p = 0.007$) at the receiving institution. When referral was not indicated, the model predicted 4 mortalities (1%), but no actual deaths ($p = 0.1241$).

CONCLUSIONS: These data validate this methodology to identify patients for referral to a higher level of care, reducing mortality at the referring institutions and significantly improving patient outcomes. This methodology can help guide decisions on referrals and optimize patient care. Further application and studies are warranted. (J Am Coll Surg 2017;224:602–607. © 2017 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)

Calculating surgical risk is essential for patients and providers when considering surgical management. Patients, surgeons, and health care facilities benefit from accurate information about risk because it enables shared decision-making and informed consent.[1,2] Risk calculators, such as the American College of Surgeons NSQIP, have been developed to preoperatively provide patients with detailed information about personal morbidity, mortality, and benchmark surgeon and health care system performance.[2,3]

However, when assessing the performance of health care systems, there are high and low outliers. The Department of Veterans Affairs (VA) and the Centers for Medicare and Medicaid Services (CMS) are collaborating to calculate and report hospital performance, with hopes of reducing morbidity and mortality.[4] In 2009, the Veterans Affairs Surgical Quality Improvement Program (VASQIP) database was created from a congressional mandate to improve outcomes in surgery. The VASQIP database is an activity-derived database, adjusted for patient risk, containing information on all veterans who undergo surgery within the VA system. The information is available to providers for self-assessment and quality improvement purposes. Results of the data analysis are reported from the National Surgery Office for quarterly and annual

Disclosure Information: Nothing to disclose.

Presented at the Southern Surgical Association 128th Annual Meeting, Palm Beach, FL, December 2016.

Received December 18, 2016; Accepted December 19, 2016.

From the Departments of Surgery, Texas Tech University of the Health Sciences Permian Basin, Odessa, TX (Ellis); Baylor University Medical Center, Dallas, TX (Keller); Baylor Scott & White, Temple, TX (Papaconstantinou); and Gulf Coast Veterans Health Care System, Biloxi, MS (Kroll).

Correspondence address: Deborah S Keller, MS, MD, FACS, Division of Colorectal Surgery, Department of Surgery, Baylor University Medical Center, 3500 Gaston Street, R-1013, Dallas, TX 75246. email: debby_keller@hotmail.com

http://dx.doi.org/10.1016/j.jamcollsurg.2016.12.033
ISSN 1072-7515/17

Abbreviations and Acronyms

AUC = area under the curve
ROC = receiver operating characteristic
VA = Veterans Affairs
VASQIP = Veterans Affairs Surgical Quality Improvement Program

review of surgical quality and patient care issues. The VASQIP was the first national, prospective outcomes-based program for comparative assessment and continuous quality improvement of surgical care.[5,6] The VASQIP developed a risk calculator using reliable patient information on pre-surgical risk factors (Table 1; Fig. 1), surgical process of care, and 30-day morbidity and mortality rates for use by clinicians.

As health care outcomes and complications become linked to reimbursement and financial penalties, risk assessment will become increasingly important for all health care facilities.[7,8] With the cost of managing complex patients, and penalties from the Centers for Medicare and Medicaid Services impending for adverse events, the desire to provide care for individual patients within a health care system must be balanced against the negative consequences for both the patient and health care system if there are poor surgical outcomes.

Systems-based practice is a core competency for residents by the Accreditation Council for Graduate Medical Education. A component of this is the ability to incorporate considerations of cost awareness and risk/benefit analysis into patient care.

When a patient's needs are determined to exceed the capabilities of a specific health care system, it may be appropriate to refer them to a tertiary care facility with more capabilities for a higher level of care. Traditionally, surgeons have used their experience and training to make this determination, although not always successfully.[9,10]

Risk calculators rely on databases derived from surgeons and health care systems with widely variable capabilities and may not accurately represent the institution-specific risk for an individual patient. There is a need to quantify acceptable risk and define appropriate thresholds at the institutional level for referral for tertiary care.[9-11] In an attempt to meet this need and preoperatively identify patients appropriate for referral to a higher level of care and reduce 30-day postoperative mortality after elective surgery, our goal was to develop and validate a methodology, using the VASQIP Risk Calculator, which could accurately assess institution-specific surgical risk in a VA intermediate surgical level facility. Our hypothesis was that this methodology could proactively optimize patient referrals and reduce mortality after elective surgical procedures.

Table 1. Veterans Affairs Surgical Quality Improvement Program Risk Calculator

Characteristic	Yes	No
Alkaline phosphatase > 125 U/L		
Ascites		
Bilirubin > 1 mg/dL		
Bleeding disorders		
BUN > 25 mg/dL		
Creatinine > 1.2 mg/dL		
CVA/stroke with no neurologic deficits		
Preoperative disseminated cancer		
DNR		
Emergency case		
Esophageal varices		
Hematocrit > 51%		
Hemiplegia		
History of angina		
History of congestive heart failure		
History of COPD		
Impared sensorium		
Platelets < 150 × 1,000/mm^3		
Preoperative pneumonia		
Preoperative renal failure		
Rest pain/gangrene		
SGOT > 40 U/L		
Serum sodium <135 mEq/L		
Steroid for chronic condition		
Open wound/wound infection		
Weight loss >10% at 6 months preop		

CHF, congestive heart failure; SGOT, serum glutamic oxaloacetic transaminase.

METHODS

The VASQIP database was analyzed for all patients undergoing elective noncardiac surgery, from January 1, 2014 to September 30, 2014, at a single VA intermediate surgical level center with 6 intensive care beds staffed by a critical care physician during regular hours. After-hours care was provided by the staff surgeons. Predicted mortality was retrospectively calculated using the VASQIP Risk Calculator. Patients with known outcomes were stratified into those with 30-day mortality and those without 30-day mortality, and then matched on patient and procedural factors. The VASQIP risk data were evaluated by receiver operating characteristic curve (ROC) analysis. Analysis of ROC provided sensitivity and 1-specificity for 30-day mortality and generated an area under the