## ACS National Surgical Quality Improvement Program (ACS-NSQIP)

Today's Healthcare environment demands more than ever of surgeons and the hospitals they work in. Payors, including Medicare, increasingly refuse to pay for treating complications deemed preventable, such as surgical site infections. A growing movement aims to tie reimbursements to outcomes—and publicly report the results. At the same time, hospitals face staffing shortages and financial pressures, trying to do more with less.

ACS NSQIP is the leading nationally validated, risk-adjusted, outcomes-based program to measure and improve the quality of surgical care in the private sector. ACS NSQIP has the tools, training, customization options and, most importantly, data, to keep your hospital ahead of the curve.

The National Surgical Quality Improvement Project database for years 2012 to 2014 was reviewed for patients undergoing spinal surgery, and 68 perioperative characteristics were analyzed.

A total of 111,892 patients who underwent spinal surgery were identified. The rate of reoperation was 3.1%, the rate of readmission was 5.2%, and the occurrence of either was 6.6%. Multivariate analysis found 20 perioperative factors significantly associated with both readmission and reoperation. Preoperative and operative factors found significant included age >60 years, African-American race, recent weight loss, chronic steroid use, on dialysis, blood transfusion required, American Society of Anesthesiologists classification  $\geq$ 3, contaminated wound, >10% probability of experiencing morbidity, and operative time >3 hours. Postoperative associations identified included urinary tract infection, stroke, dehiscence, pulmonary embolism, sepsis, septic shock, deep and superficial surgical site infection, reintubation, and failure to wean from ventilator. An unweighted and weighted risk score were generated that yielded receiver operating characteristic curves with areas under the curve of 0.707 (95% confidence interval [CI]: 0.701-0.713) and 0.743 (95% CI: 0.736-0.749) 0.708 (95% CI: 0.702-0.715), respectively.

Patients with an unweighted score  $\geq$ 7 had a more than 20-fold increased risk of reoperation or readmission and a more than 1000-fold increased risk of mortality than did patients with a score of 0<sup>1)</sup>.

VP shunts were placed in 3,984 patients either as an initial placement (n = 1,093) or as a revision (n = 2,891). Compared to the initial-placement group, the revision group was significantly more likely to experience shunt failure (14 vs. 8%, p < 0.0001). In the initial-placement group, congenital hydrocephalus was independently associated with shunt failure (OR 1.83; 95% CI 1.01-3.31, p = 0.047). In the revision group, cardiac risk factors (OR 1.38; 95% CI 1.00-1.90, p = 0.047), a chronic history of seizures (OR 1.33; 95% CI 1.04-1.71, p = 0.022), and a history of neuromuscular disease (OR 0.61; 95% CI 0.41-0.90, p = 0.014) were independently associated with shunt failure.

Identifying the factors associated with VP shunt failure may allow the development of interventions to decrease failures. Further refinement of the collected variables in the ACS National Surgical Quality Improvement Program (NSQIP) Pediatric specific to neurosurgical procedures is necessary to identify modifiable risk factors<sup>2)</sup>.

Cote et al., performed a search of the ACS National Surgical Quality Improvement Program (ACS-NSQIP) database for all patients undergoing operations with a neurosurgeon from 2006 to 2013. They analyzed demographics, past medical history, and post-operative respiratory failure, defined as unplanned intubation and/or ventilator dependence for more than 48 h post-operatively.

Of 94,621 NSQIP-reported neurosurgical patients from 2006 to 2013, 2325 (2.5 %) developed postoperative respiratory failure. Of these patients, 1270 (54.6 %) were male, with an overall mean age of 60.59 years; 571 (24.56 %) were current smokers and 756 (32.52 %) were ventilator-dependent. Past medical history included dyspnea in 204 patients (8.8 %), COPD in 198 (8.5 %), and congestive heart failure in 66 (2.8 %). The rate of post-operative respiratory failure decreased from 4.1 % in 2006 to 2.1 % in 2013 (p < 0.001). Of the 2325 patients with respiratory failure, 1061 (45.6 %) underwent unplanned intubation post-operatively and 1900 (81.7 %) were ventilator-dependent for more than 48 h. The rate of both unplanned intubation (p < 0.001) and ventilator dependence (p < 0.001) decreased significantly from 2006 to 2013. Multivariate analysis demonstrated that significant risk factors for respiratory failure included inpatient status (p < 0.001, OR = 0.165), age (p < 0.001, OR = 1.014), diabetes (p = 0.001, OR = 1.489), functional dependence prior to surgery (p < 0.001, OR = 2.081), ventilator dependence (p < 0.001, OR = 10.304), hypertension requiring medication (p = 0.005, OR = 1.287), impaired sensorium (p < 0.001, OR = 2.054), CVA/stroke with or without neurological deficit (p < 0.001, OR = 2.662; p = 0.002, OR = 1.816), systemic sepsis (p < 0.001, OR = 1.916), prior operation within 30 days (p = 0.026, OR = 1.439), and operation type (cranial relative to spine, p < 0.001, OR = 4.344).

Based on the NSQIP database, risk factors for respiratory failure after neurosurgery include preoperative ventilator dependence, alcohol use, functional dependence prior to surgery, stroke, and recent operation. The overall rate of respiratory failure decreased from 4.1 % in 2006 to 2.1 % in 2013 according to these data <sup>3)</sup>.

Data from adult patients who underwent surgery for spinal tumors (2011-2014) were extracted from the prospective National Surgical Quality Improvement Program (NSQIP) registry. Multivariable logistic regression was used to evaluate predictors of reoperation, readmission, and major complications (death, neurological, cardiopulmonary, venous thromboembolism [VTE], surgical site infection [SSI], and sepsis). Variables screened included patient age, sex, tumor location, American Society of Anesthesiologists (ASA) physical classification, preoperative functional status, comorbidities, preoperative laboratory values, case urgency, and operative time. Additional variables that were evaluated when analyzing readmission included complications during the surgical hospitalization, hospital length of stay (LOS), and discharge disposition.

Among the 2207 patients evaluated, 51.4% had extradural tumors, 36.4% had intradural extramedullary tumors, and 12.3% had intramedullary tumors. By spinal level, 20.7% were cervical lesions, 47.4% were thoracic lesions, 29.1% were lumbar lesions, and 2.8% were sacral lesions. Readmission occurred in 10.2% of patients at a median of 18 days (interquartile range [IQR] 12-23 days); the most common reasons for readmission were SSIs (23.7%), systemic infections (17.8%), VTE (12.7%), and CNS complications (11.9%). Predictors of readmission were comorbidities (dyspnea, hypertension, and anemia), disseminated cancer, preoperative steroid use, and an extended hospitalization. Reoperation occurred in 5.3% of patients at a median of 13 days (IQR 8-20 days) postoperatively and was associated with preoperative steroid use and ASA Class 4-5 designation.

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Major complications occurred in 14.4% of patients: the most common complications and their median time to occurrence were VTE (4.5%) at 9 days (IQR 4-19 days) postoperatively, SSIs (3.6%) at 18 days (IQR 14-25 days), and sepsis (2.9%) at 13 days (IQR 7-21 days). Predictors of major complications included dependent functional status, emergency case status, male sex, comorbidities (dyspnea, bleeding disorders, preoperative systemic inflammatory response syndrome, preoperative leukocytosis), and ASA Class 3-5 designation (p < 0.05). The median hospital LOS was 5 days (IQR 3-9 days), the 30-day mortality rate was 3.3%, and the median time to death was 20 days (IQR 12.5-26 days).

In a ACS National Surgical Quality Improvement Program analysis, 10.2% of patients undergoing surgery for spinal tumors were readmitted within 30 days, 5.3% underwent a reoperation, and 14.4% experienced a major complication. The most common complications were SSIs, systemic infections, and VTE, which often occurred late (after discharge from the surgical hospitalization). Patients were primarily readmitted for new complications that developed following discharge rather than exacerbation of complications from the surgical hospital stay. The strongest predictors of adverse events were comorbidities, preoperative steroid use, and higher ASA score. These models can be used by surgeons to risk-stratify patients preoperatively and identify those who may benefit from increased surveillance following hospital discharge <sup>4</sup>.

Using the American College of Surgeons' National Surgical Quality Improvement Program (ACS-NSQIP) dataset, a retrospective analysis of the complications experienced by patients that underwent surgical management of a UIA between the years of 2007 and 2013. The primary outcomes of interest were mortality within the 30-day perioperative period and adverse discharge disposition to a location other than home. Predictors of morbidity and mortality were elucidated using multivariable logistic regression analyses controlling for available patient demographic, comorbidity, and operative characteristics.

662 patients were identified in the ACS-NSQIP dataset for operative management of an unruptured aneurysm. The observed rates of 30-day mortality and adverse discharge disposition were 2.27% and 19.47%, respectively. A hundred and eight (16.31%) patients developed at least one major complication. On multivariable analysis, death within 30days was significantly associated with increased operative time (OR 1.005 per minute, 95% CI 1.002-1.008) and chronic preoperative corticosteroid use (OR 28.4, 95% CI 1.68-480.42), whereas major complication development was associated with increased operative time (OR 1.004 per minute, 95% CI 1.002-1.006), age (OR 1.017 per year, 95% CI 1-1.034), preoperative dependency (OR 3.3, 95% CI 1.16-9.40) and diabetes mellitus (OR 2.89, 95% CI 1.45-5.75). Lastly, increasing age (OR 1.017 per year, 95% CI 1-1.034) as well as ASA Class 3 (OR 1.73, 95% CI 1.08-2.77) and 4 (OR 2.28, 95% CI 1.1-4.72) were independent predictors of discharge to a location other than home.

The study yields morbidity and mortality benchmarks for UIA surgery in a representative, national surgical registry. It will hopefully aid in recognizing those patients at greater risk for postoperative complications following surgical management, leading to appropriate changes in treatment strategies for this selected group of patients <sup>5)</sup>.

2351 patients underwent peripheral nerve surgery, 120 complications were identified in 100 patients (4.25%), and 103 patients (4.38%) received nerve grafting. Thirty-one (1.95%) of the 1593 patients underwent unplanned readmission. Nerve grafting procedures had no association with postoperative

complications and unplanned readmission rates. Patients who experienced an inpatient procedure (OR= 2.54, P<0.001), a longer operative time (OR= 1.00, P<0.001) and worse wound classifications (OR= 1.83, P<0.001) all had increased odds of postoperative complications. An inpatient procedure (OR= 2.74, P=0.014) and any complications (OR= 24.43, P<0.001) were significantly associated with unplanned readmission.

The study confirms that peripheral nerve surgery and nerve graft procedures can be safely performed with low complication risks and low unplanned readmission rates. We also identified the risks associated with perioperative adverse outcomes, and these data may be used as an adjunct for risk stratification for patients under consideration for peripheral nerve surgery. This approach may enable the improved targeting of the most costly and harmful complications of preventive measures <sup>6)</sup>.

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