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Surgical Apgar Score Predicts Postoperative Length of Stay Better Than American Society of Anesthesiologists Classification

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Citation

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Abstract

PURPOSE: The surgical Apgar score is a newly developed, simple scoring system that identifies surgical patients at risk for postoperative complications. The American Society of Anesthesiologists and surgical wound classifications are commonly used prognostic scores for postoperative complications. The purpose of our study was to determine whether the surgical Apgar score is useful compared to commonly used prognostic scores.

METHODS: The surgical Apgar score uses intraoperative estimated blood loss, mean arterial pressure, and heart rate to calculate a value between 0 and 10. We evaluated 249 patients for demographic data (age/gender/body mass index/comorbidities), operation type as well as major complications, mortality and in-hospital length of stay. Linear regression analysis was performed comparing the prognostics scores to collected data.

RESULTS: Linear regression analysis of length of stay with the surgical Apgar score revealed positive correlation (p = 0.0095, r2 = 0.3); whereas, American Society of Anesthesiologists classification showed less accurate correlation, (p = 0.03, r2 = 0.03). Surgical wound classification failed to correlate with length of stay.

CONCLUSIONS: The surgical Apgar score is more accurate than the American Society of Anesthesiologists classification for postoperative risk assessment. Use of the surgical Apgar score may better guide resource allocation.

PURPOSE

Several scoring systems have been developed to identify at-risk patients and inform resource allocation. The American Society of Anesthesiologist (ASA) classification is the most commonly used preoperative patient classification system in the world.[1] However, ASA has been criticized for being overly simplified and subjective.[2] Similarly, surgical wound classification (SW) is used ubiquitously to predict postoperative complications but has been shown to have uncertain utility.[3]

More complex scores have been developed but are often cumbersome to calculate; for example, an acute physiology and chronic health evaluation (APACHE II) is calculated from 12 physiological parameters.[4] Other scores such as the physiologic and operative severity score for the enumeration of mortality and morbidity (POSSUM) require laboratory data that may not be readily available.[5]

In 2007, Gawande et al used regression analysis to identify three, simple intraoperative parameters that correlate with postoperative morbidity and mortality. Intraoperative estimated blood loss (EBL), lowest heart rate (HR) and lowest mean arterial pressure (MAP) were used to create a simple 10-point scoring system; a higher total score indicates a patient who is less likely to experience major complications or death within 30 days of operation.[6] This correlation of the so-called Surgical Apgar Score (SAS) with major complication and mortality rates was then confirmed using a variety of retrospective analyses.[7-13]

Despite this flood of data, SAS has not been universally adopted, particularly in the community hospital setting and is not yet as commonplace in the perioperative setting as ASA or SW. To our knowledge, only one study of

SAS was performed in a community hospital setting,[14] and no study has compared the utility of SAS to ASA or SW.

The purpose of our study was to determine whether SAS is a useful prognostic tool compared to ASA and SW for the community hospital general surgeon.

METHODS

After receiving institutional review board approval, we retrospectively reviewed the charts of all patients who underwent cholecystectomy at a 350-bed community hospital in Brooklyn, New York during the academic year July 1, 2010 to June 30, 2011. The only inclusion criterion was a complete dataset available at the time of chart review. Exclusion criterion was an incomplete dataset.

From the electronic medical record, we tabulated demographic data (age/gender/body mass index (BMI)/preoperative comorbidities); operation type (laparoscopic or laparoscopic converted to open); SAS, ASA and SW parameters; and postoperative hospital length of stay (LOS). We reviewed the progress notes to assess for 30-day postoperative major complications (TABLE 1) and mortality.

Table 1

Acute Renal Failure
Hemorrhage requiring ≥ 4 units PRBCs within 72 hours
Cardiopulmonary arrest with CPR
Coma ≥ 24-hours
Deep venous thrombosis
Myocardial infarction
Unplanned intubation
Ventilator dependence ≥ 48 hours
Pneumonia
Pulmonary embolism
Stroke
Major wound disruption
Surgical site infection
SIRS/Sepsis
Septic shock
Unplanned return to OR
Biliary leak/biloma
Need for post-operative endoscopic retrograde cholangiopancreatography

We calculated SAS, ASA and SW and compared demographic data and operation type to each score. We then compared operation type to 30-day postoperative major complication and mortality rates and LOS. Afterward, we used SAS, ASA class and surgical wound class data with 30-day postoperative complication and mortality rates and LOS to perform linear regression analysis.

We used StatPlus software (Mac version 4.8.0; AnalystSoft Inc, Vancouver, British Columbia, Canada) to perform all statistical analyses. We used a p-value of .05 as a standard cutoff for statistical significance.

RESULTS

During the period analyzed, 261 patients underwent cholecystectomy of which 249 (95%) had complete datasets available for analysis and were included in the study.

The mean age of included patients was 45 years old. 76% of these patients were female, and the mean BMI was 31.8. Types of preoperative comorbidities ranged from neurological to cardiopulmonary disease, the most common being essential hypertension. 78 patients (31.3%) reported no preoperative comorbidities; 53 patients (21.2%) reported a single preoperative comorbidity; and a maximum of 10 preoperative comorbidities were attributed to a single patient. 25 patients (10%) underwent laparoscopic converted to open cholecystectomy; the remainder underwent laparoscopic cholecystectomy only. No operations were classified as emergent.

Among SAS parameters, EBL ranged from 5 to 400 milliliters (mL) with an average of 31.6mL. Lowest intraoperative MAP ranged from 20 to 128 millimeters of mercury (mmHg) with an average of 80.1mmHg. Lowest intraoperative HR ranged from 45 to 125 beats per minute (bpm) with an average of 70.2bpm. The calculated surgical Apgar scores ranged from six to ten and had an average of eight. All demographic data were unrelated to SAS (p = NS). SAS was also similar for patients undergoing laparoscopic converted to open cholecystectomy versus laparoscopic cholecystectomy only.

There were five major postoperative complications and a single mortality. Two patients developed bile leaks, one of which required endoscopic retrograde cholangiopancreatography (ERCP) and stent placement; the other bile leak was self-limiting. One patient developed a pulmonary embolus, requiring prolonged intubation. Another required prolonged intubation due to complications of chronic obstructive pulmonary disease. The fifth major complication was sepsis from bacteremia that developed on postoperative day 26. This episode of sepsis resulted in the study's only mortality.

SAS, ASA and SW each failed to correlate with 30-day postoperative major complication rate or mortality. However, regression analyses revealed a positive correlation between LOS and both SAS and ASA. LOS and SAS correlated with a p-value of 0.0095 and r2 of 0.3 (FIGURE 1); patients with a lower SAS had an increased LOS. Positive correlation of LOS with ASA was not as accurate with a p-value of 0.03 and r2 of 0.03 (FIGURE 2). SW did not correlate with LOS.

Figure 1

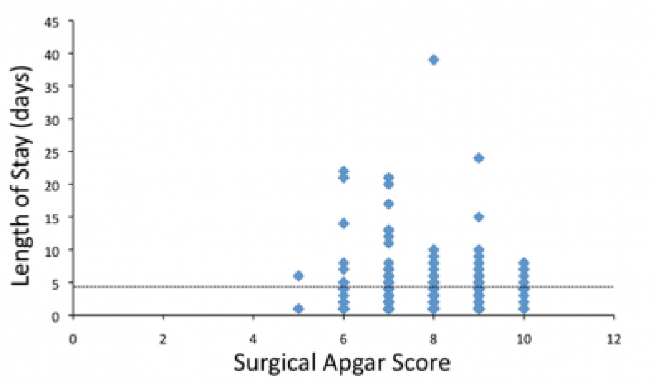
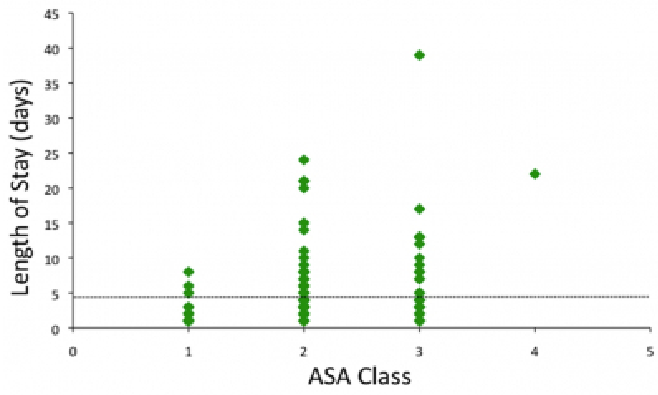


Figure 2



DISCUSSION

Like most hospitals, our institution primarily uses ASA to risk-stratify patients undergoing an operation; our institution also uses SW in this manner. To compare the utility of SAS with that of ASA and SW, we studied patients who underwent cholecystectomy during an academic year and calculated which score had the best prognostic value. Our results demonstrate that SAS correlates much better with in-hospital LOS than either ASA or SW.

Since both SAS and ASA class demonstrated significant positive correlation with LOS, our results suggest either tool may be useful. However, goodness-of-fit (r2) was higher by a factor of 10 for the correlation between SAS and LOS compared to that of ASA class and LOS. This difference correlates with the general understanding that while ASA class is good at identifying at-risk populations, it does not allow for limited utilization of resources by more specific identification. Because SAS better predicts which cholecystectomy patients are at risk for prolonged LOS, SAS may guide allocation of resources for postoperative discharge planning such as early contact with case management personnel. Studies assessing such allocation would demonstrate the utility of SAS as a guide for quality improvement.

Because our studied population has characteristics of stereotypical cholecystectomy patients in the community hospital setting, we believe our results may be generalized to this group. Demographic data revealed that our population was predominantly female, more than 40 years old and obese. Also, the patients studied had a range of preoperative health profiles, including approximately one-third who had isolated gallbladder disease and a minority with multiple comorbidities. There were no emergent cholecystectomies performed, in line with the generally elective nature of the operation, and the rate of conversion to open cholecystectomy was also perfectly in line with national standards (~10%).[15]

To our knowledge, this is the first study to directly compare SAS to traditional perioperative scoring systems and only the second study of SAS in the community hospital setting.

Given the generally low complication rate of cholecystectomy, our study was underpowered to predict major morbidity and mortality. However, LOS is considered an accurate surrogate for in-hospital complication rate. For example, a four-year review of 4,227 surgical patients demonstrated a direct correlation between incidence of postoperative complications and LOS.[16] A similar comparison of SAS, ASA and SW among a larger population is warranted to confirm our findings and extrapolate them to major morbidity and mortality.

CONCLUSIONS

The surgical Apgar score is more accurate than the American Society of Anesthesiologists classification for postoperative risk assessment. Use of the surgical Apgar score may better guide resource allocation.

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