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Does the Surgical Apgar Score predict serious complications after elective major cancer surgery?

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ABSTRACT

Background: Major cancer surgery is associated with significant risks of perioperative morbidity and mortality, resulting in delayed adjuvant therapy, higher recurrence rates, and worse overall survival. Previous retrospective studies have used the Surgical Apgar Score (SAS) for perioperative risk assessment. This study prospectively evaluated the predictive value of SAS to predict serious complication (SC) after elective major cancer surgery.

Methods: Demographic, comorbidity, procedure, and intraoperative data were collected prospectively for 405 patients undergoing elective major cancer surgery between 2014-17. The SAS was calculated immediately postoperative and outcome data were collected prospectively. Rates of SC according to SAS risk category were compared using Cochran-Armitage trend test. Receiver operating characteristic curves and area under the receiver operating characteristic curves were generated and 95% confidence intervals were calculated.

Results: Eighty percent, 17.3%, and 2.7% of patients were low (SAS 7-10), intermediate (SAS 5-6), and high risk (SAS 0-4), respectively, for SC based on their SAS. Forty-six (11.4%) had an SC within 30 days; 3.7% returned to the operating room, 3.7% experienced a urinary tract infection, 3.2% experienced a respiratory complication, 2.7% experienced a wound complication, and 1.2% experienced a cardiac complication. Overall, 9.3%, 18.6%, and 27.3% of patients with SAS 7-10, 5-6, and 0-4 experienced an SC, respectively ($P = 0.005$). The overall discriminatory ability of the SAS was modest (area under the receiver operating characteristic curves 0.661; 95% confidence intervals, 0.582-0.740).

Conclusions: Although there was an overall association between SAS and higher risk of subsequent postoperative SC in our cohort, the ability of the SAS to accurately predict risk of postoperative SC at the patient level was limited.

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Introduction

Surgical resection is the cornerstone of therapy in patients with nonmetastatic (and some metastatic) solid tumors. Many cancer patients are older, have significant comorbidity, and require neoadjuvant systemic and/or radiation therapy before surgical resection. Major cancer surgery may involve multivisceral resection, significant blood loss, plastic surgery reconstruction, and/or long operative times.[1] Not surprisingly, elective major cancer surgery (EMCS) is often associated with significant risks of perioperative serious complications (SCs) and mortality.

SCs after EMCS often result in longer hospital stays, returns to the operating room, hospital readmissions, and decreased postoperative quality of life. In addition, SCs can decrease the chances that patients will receive planned adjuvant therapy, such as systemic and/or radiation therapy. Recent studies have suggested that they may be associated with an increased risk of cancer recurrence and decreased chance of long-term, cancer-specific survival.[2-7]

Previous retrospective studies have evaluated the Surgical Apgar Score (SAS), a simple score on a scale of 0 to 10 calculated from 3 parameters collected during an operation (estimated blood loss, lowest mean arterial blood pressure, and lowest heart rate), for perioperative risk assessment.[8-20] The SAS was designed in 2007 by retrospectively analyzing perioperative data in general or vascular surgical procedures and identifying the main influential parameters.[8] In subsequent validation studies involving general and vascular surgery patients, there was good correlation between the score and incidence of major complications or death occurring within 30 days, even after controlling for patients' acute condition, comorbidities and/or operative complexity.[9-20]

More recent retrospective studies have promoted the use of the SAS to "predict" perioperative morbidity and mortality after gastrointestinal, gynecologic, and urologic cancer surgery.[11,12,16,18,20] The purpose of this present study was to prospectively evaluate the "true" predictive value of the SAS to accurately identity patients at risk for SC after EMCS and validate its utility in this clinical setting. More specifically, we prospectively collected data from a large cohort of patients who underwent one of several procedures (historically associated with higher perioperative morbidity and mortality) to evaluate the association between immediate postoperative SAS and 30-day rate of SCs in this clinical setting. In addition, we analyzed the ability of the SAS to accurately predict risk of postoperative SCs at the patient level.

Methods

Study population

We conducted a prospective analysis of patients undergoing EMCS at a National Cancer Institute–designated center who consented to participate in a randomized controlled trial of perioperative risk stratification and risk-based, protocol-driven management between July 2014 and March 2017; only patients who were randomized to the control arm (i.e.,"usual care") were analyzed in this study. Patients were included if they were ≥18 years old, Eastern Cooperative Oncology Group performance status 0-3, and had probable (i.e., clinically suspicious) or histologically/cytologically confirmed, primary or recurrent, malignant neoplasm, malignant neuroendocrine tumor, or carcinoma *in situ* (any stage). Patients were scheduled for at least one of the following EMCS (based on based on their principal current procedural terminology code): head and neck surgery (i.e., glossectomy, pharyngectomy, laryngectomy, or neck dissection), thoracic surgery (i.e., esophagectomy or lung resection), upper gastrointestinal/hepatico-pancreatico-biliary surgery (i.e., gastrectomy, pancreatectomy, or hepatectomy), colorectal surgery (i.e., colectomy or proctectomy), gynecologic surgery (i.e., hysterectomy/myomectomy or gynecologic reconstruction), urologic surgery (i.e., prostatectomy, nephrectomy, or cystectomy), or soft tissue/plastic surgery (i.e., breast reconstruction or flap reconstruction). We focused on these procedures in our trial (and the present study) because they are associated with higher risk of perioperative morbidity and mortality and either "targeted" by the American College of Surgeons National Surgery Quality Improvement Program (ACS NSQIP) or performed frequently at our institution. All patients were electively brought from their home (or normal living environment) to our cancer center on the day before or the day of the index surgery. Patients who received antineoplastic or antitumor agents (e.g., chemotherapy, radiation therapy, immunotherapy, and/or hormonal anticancer therapy) within 14 days of study registration, underwent urgent or emergent surgery, and/or did not have complete 30-day follow-up data were excluded. The study was reviewed and approved by our institutional review board.

Study data

Demographic, comorbidity, procedure, and immediate perioperative data were collected prospectively by a dedicated study coordinator. The independent variable of interest was SAS, and the three elements of the SAS (estimated blood loss, heart rate, mean arterial pressure) were calculated and recorded immediately postoperatively by the anesthesiologist or nurse anesthetist who completed the case. After the fact, the study coordinator calculated and assigned an SAS to each case based on the sum of the point from each category (Fig. 1).

Outcome data were collected prospectively by a separate study coordinator (who previously served as a Surgical Clinical Reviewer for ACS NSQIP at our institution). The primary outcome of interest was SC. Patients who experienced any of the following occurrences, as defined by ACS NSQIP and regardless of cause, within 30 days after EMCS were defined as having a postoperative SC: deep incisional superficial site infection (not present at the time of surgery [not PATOS]), organ space superficial site infection (not PATOS), wound disruption, myocardial infarction, cardiac arrest, unplanned intubation, pneumonia (not PATOS), pulmonary embolus, progressive renal insufficiency, acute renal failure, urinary tract infection (not PATOS), venous thrombosis requiring