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Implementing the Surgical Apgar Score in patients with trauma hip fracture

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ABSTRACT

Background: Trauma hip fractures in elderly patients are associated with high postoperative long-term morbidity and mortality and premature death. The high mortality in these patients can be explained by various factors, including the fracture itself; the preoperative poor condition and comorbidities of these patients; the influence of stressors, such as surgery and type of anaesthesia, on the patient's condition; and the postoperative development of major complications, such as cardiac failure, pulmonary embolism, pneumonia, deep venous thrombosis and acute renal failure. Thus, the Surgical Apgar Score (SAS) could be a valuable tool for objective risk stratification of patients immediately after surgery, and to enable patients with higher risk to receive postoperative ICU care and good management both during and after the hospital stay.

Methods: The SAS was calculated retrospectively from the handwritten anaesthesia records of 43 trauma hip fracture patients treated operatively in the University Hospital Centre Zagreb over a 1-year period. The primary endpoints were the 30-days major postoperative complications and mortality, length of the ICU and hospital stay, and 6-months major complications development. Statistical analysis was applied to compare SAS with the patients' perioperative variables.

Results: A SAS ≤ 4 in the trauma hip fracture patients was a significant predictor for the 30-days major postoperative complications with 80% specificity (95% CI: 0.587–0.864, $p = 0.0111$). However, the SAS was not significant in the prediction of 30-days mortality (95% CI: 0.468–0.771, $p = 0.2238$) and 6-months mortality (95% CI: 0.497–0.795, $p = 0.3997$) as primary endpoints in the hip fracture surgery patients.

Conclusion: The SAS shows how intraoperative events affect postoperative outcomes. Calculating the SAS in the operating theatre provides immediate, reliable, real-time feedback information about patient postoperative risk. The results of this study indicate that all trauma hip fracture patients with SAS ≤ 4 should go to the ICU postoperatively and should be under intensive surveillance both during the hospital stay and after hospital discharge.

Introduction

Hip fractures in the elderly are usually the consequence of weightless trauma because of poor bone quality [1]. They are the second main cause of hospitalisation in these patients, and increase the rate of postoperative complications and mortality in the short-term (30 days) and mid-term (6 months) [2,3]. According to the literature, the novel 10-point Surgical Apgar Score (SAS) has been considered a good independent predictor of major postoperative complications and mortality within 30 days after different types of surgery [4]. The SAS is a simple, objective, real-time parameter that is easily calculated as a sum of the three vital intraoperative variables, estimated blood loss (EBL), lowest heart rate (HR) and lowest mean arterial pressure (MAP), which are derived from data in the intraoperative anaesthesia records at the end of surgery [5]. Hence, preliminary, retrospective research was conducted to perceive a utility and validation of the SAS in rating

Abbreviations: ASA, American Society of Anesthesiologists; SAS, Surgical Apgar Score; EBL, estimated blood loss; HR, heart rate; MAP, mean arterial pressure.

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surgical outcome, and length of the ICU and hospital stay in trauma-vulnerable geriatric patients with hip fracture.

Patients and methods

Patient selection

All patient data required to analyse the importance of SAS were collected from the medical records and the University Hospital Centre Zagreb electronic medical database. The study included male and female patients aged more than 18 years who had undergone hip fracture surgery and were admitted postoperatively to the ICU in the University Hospital Centre Zagreb between March 1, 2013, and May 31, 2014. Other criteria for inclusion in the study were elective, expedited or emergency hip fracture surgery; general or spinal anaesthesia, and provision of written informed consent. Hip fracture patients with incomplete data were excluded. Data at 30-days' and 6-months' follow-up for the included patients were obtained from the University Hospital Centre Zagreb electronic medical database and in a private phone call to ascertain survival at 6-months. The preliminary retrospective research protocol was approved by the Human Research Ethical Committee of the University Hospital Centre Zagreb.

Calculation of the SAS

The SAS was calculated as the sum of three intraoperative variables obtained from the intraoperative handwritten anaesthesia records for each patient during the surgery period [4]. The three variables were EBL, lowest HR and lowest MAP, which were each assigned scoring points according to the measured values (Fig. 1). The sum of the points for these three intraoperative variables provides a total SAS value for each particular patient for the specific operation [5]. The surgery period was defined as the time from first incision to the time of skin closure to exclude the blood-pressure lowering and heart rate-lowering effects of anaesthetic during induction and intubation [4].

Patient preoperative characteristics and postoperative outcomes

Patient preoperative variables were bundled into four groups by organ system. Pulmonary comorbidity was defined as pneumonia, mechanical ventilator dependency, and preexisting chronic obstructive pulmonary disease. Cardiovascular comorbidity included earlier myocardial infarction, angina pectoris, congestive heart disease, coronary revascularisation, peripheral vascular disease and anamnesis of stroke and transient ischaemic attack. Renal comorbidity included history of acute or chronic renal disease. Coagulation comorbidity comprised hereditary and acquired coagulation disorder, and the use of anticoagulation agents, such as warfarin, acetylsalicylic acid and clopidogrel. Other preoperative variables were age, sex, American Society of Anesthesiologists (ASA) physical status (from 1 to 4) and length of operative delay [6]. Preoperative patient laboratory data consisted of haemoglobin and thrombocyte levels and prothrombin time.

The primary endpoints were occurrence of major postoperative complications and death within a 30-day follow-up period after hip fracture surgery, and length of the ICU and hospital stay. The major complications were defined as the development of the following: postoperative bleeding that required transfusion of four units or more of packed red blood cells within 72 h, cardiac arrest, myocardial infarction, deep venous thrombosis, pulmonary embolism, stroke or transient ischaemic attack, unplanned intubation, mechanical ventilation for 48 h or more, pneumonia, sepsis, septic shock, and acute renal failure [7,8]. Major postoperative complications were defined according to other research with the National Surgical Quality Improvement Programme and by reviewing the medical records. Complications were assessed by two independent researchers by reviewing handwritten medical records, laboratory data, radiology records and an electronic medical database and these were verified by cross-examination. Six months' postoperative mortality rate was obtained by a phone call to the patient or their family member.

Statistical analysis

A univariate analysis was performed to examine the relationship between preoperative and intraoperative variables and the

Surgical Apgar Score Points

	0 points	1 point	2 point	3 points	4 points
Estimated blood loss (ml)	> 1000	601-1000	101-600	≤100	—
Lowest mean arterial pressure (mmHg)	< 40	40-54	55-69	≥ 70	—
Lowest heart rate (beats/min)	> 85	76-85	66-75	56-65	≤ 55*

[1]The Surgical Apgar score is computed from the anaesthesia records at the end of the operation as the sum of the three intraoperative variables: estimated blood loss, lowest mean arterial pressure, and lowest heart rate.
*Occurrence of pathologic bradyarrhythmia including sinus arrest, atrioventricular block or dissociation, junctional or ventricular escape rhythms, and asystole, also receives 0 points for lowest heart rate.

Fig. 1. Calculating the 10-point Surgical Apgar Score. *Note*: The Surgical Apgar score is computed from the anaesthesia records at the end of the operation as the sum of the three intraoperative variables: estimated blood loss, lowest mean arterial pressure, and lowest heart rate. *Occurrence of pathologic bradyarrhythmia including sinus arrest, atrioventricular block or dissociation, junctional or ventricular escape rhythms, and asystole, also receives 0 points for lowest heart rate.