



## “Surgical Apgar Score” predicts postoperative complications after cytoreduction for advanced ovarian cancer

Israel Zigelboim<sup>a,\*</sup>, Nora Kizer<sup>a</sup>, Nicholas P. Taylor<sup>b</sup>, Ashley S. Case<sup>c</sup>, Feng Gao<sup>d</sup>, Premal H. Thaker<sup>a</sup>, Janet S. Rader<sup>a</sup>, L. Stewart Massad<sup>a</sup>, David G. Mutch<sup>a</sup>, Matthew A. Powell<sup>a</sup>

<sup>a</sup> Division of Gynecologic Oncology, Department of Obstetrics and Gynecology, Washington University School of Medicine and Siteman Cancer Center, 4911 Barnes Jewish Hospital Plaza, Box 8064, St. Louis, MO 63110, USA

<sup>b</sup> Division of Gynecologic Oncology, Department of Obstetrics and Gynecology, Jersey Shore University Medical Center, 1945 State Route 33, Neptune, NJ 07753, USA

<sup>c</sup> Division of Gynecologic Oncology, Hope A Women's Cancer Center, 626 Wickhams Fancy Dr, Biltmore Lake, NC 28715, USA

<sup>d</sup> Division of Biostatistics, Washington University School of Medicine and Siteman Cancer Center, 660 South Euclid Avenue, Box 8067, St. Louis, MO 63110, USA

### ARTICLE INFO

#### Article history:

Received 28 October 2009

Available online 16 December 2009

#### Keywords:

Ovarian cancer  
Apgar  
Surgical score  
Cytoreduction  
Debulking  
Morbidity  
Mortality

### ABSTRACT

**Objective.** A 10-point “Surgical Apgar Score” (SAS) for predicting postoperative complications after general and vascular operations has recently been developed and validated. We sought to estimate the ability of this metric to predict major postoperative complications in women undergoing ovarian cancer cytoreductive procedures.

**Methods.** All eligible patients with stage III and IV epithelial ovarian, fallopian tube and primary peritoneal cancer undergoing surgical cytoreduction at our institution between 1999 and 2005 were included. Medical records were reviewed and demographic data, clinicopathologic characteristics, comorbidities and intra and postoperative complications were analyzed. The surgical score was calculated from intraoperative blood loss, lowest mean arterial pressure and lowest heart rate as previously described. Descriptive statistics, univariable and multivariable analyses were used as appropriate. Occurrence of major postoperative complications represented the primary outcome.

**Results.** A total of 232 cases were analyzed. Mean age was 62 years. Most patients were Caucasian (92%) and diagnosed with stage III disease (83%). Mean duration of surgical procedure was 171 (70–350) minutes. Median SAS was 6 points (range 1–9). On multivariable analyses, occurrence of major postoperative complications was associated with multiple comorbidities (OR 2.2; 95% CI:1.5–3.1;  $p < 0.0001$ ), stage IV disease (OR 2.5; 95% CI:1.1–5.7;  $p = 0.03$ ), ASA class (OR 2.4; 95% CI:1.2–4.7;  $p = 0.01$ ) and SAS  $\leq 4$  (OR 7.4; 95% CI:2.9–18.8;  $p < 0.0001$ ).

**Conclusions.** Lower SAS ( $\leq 4$ ) is the most powerful predictor of postoperative complications in patients undergoing cytoreductive surgery for advanced epithelial ovarian cancer. This prognostic tool may prove helpful for triaging such patients to optimal postoperative levels of care and directing counseling, monitoring and management in the postoperative period.

© 2009 Elsevier Inc. All rights reserved.

### Introduction

Epithelial ovarian cancer represents the most common cause of death from gynecologic cancer. With 14,600 deaths per year it is also the fifth most common cause of cancer related deaths among women in this country [1]. Approximately 60% of patients with epithelial ovarian cancer present with advanced stage disease, which accounts for the associated poor long-term survivorship [2].

Patients with advanced disease derive a survival benefit from aggressive surgical cytoreduction followed, or sometimes preceded, by combination platinum-based chemotherapy. These surgical procedures are indicated in the primary and sometimes recurrent setting

with the ultimate goal of achieving minimal ( $< 1$  cm) or no gross residual disease [3–6]. However, these surgeries can be extensive and may result in major postoperative complications [7].

Most ovarian cancers occur in elderly women, and approximately 30% of patients are older than 75 years of age at the time of diagnosis [2]. Many of these older patients undergoing aggressive surgical management have preexisting comorbidities which may further increase their risk of serious postoperative complications. Elderly patients diagnosed with ovarian cancer may tolerate serial surgery and chemotherapy poorly and may frequently experience very serious postoperative complications and a relatively high proportion of postoperative deaths [8]. Conversely, some have suggested that aggressive surgical effort followed by platinum-based combination chemotherapy in women  $> 65$  yields outcomes similar to those of younger patients [9].

\* Corresponding author. Fax: +1 314 362 2893.  
E-mail address: [zigelboimi@wustl.edu](mailto:zigelboimi@wustl.edu) (I. Zigelboim).