International Journal of Reproduction, Contraception, Obstetrics and Gynecology
Ali Z et al. Int J Reprod Contracept Obstet Gynecol. 2016 Jun;5(6):1796-1800
www.ijrcog.org

pISSN 2320-1770 | eISSN 2320-1789

DOI: http://dx.doi.org/10.18203/2320-1770.ijrcog20161665

Research Article

Surgical Apgar score in prediction of post-operative complications in gynecological surgery

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Received: 16 February 2016
Revised: 25 February 2016
Accepted: 12 March 2016

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ABSTRACT

Background: This study was aimed at estimating the ability of 10-point "Surgical Apgar Score" (SAS) to predict postoperative complications in gynecological surgery.
Methods: All women undergoing laparotomy (elective and emergency) in the Department of Obstetrics and Gynecology at Kasturba Hospital, Manipal, between November 2014 and June 2015, were included. Age, BMI, comorbidities and postoperative complications were analyzed. The SAS was calculated from the estimated blood loss, lowest heart rate, and lowest mean arterial pressure. Descriptive statistics and univariate statistics were used. Occurrence of major postoperative complications represented the primary outcome.
Results: A total of 146 cases meeting the inclusion criteria were analyzed. The patients belonged to the age group of 20-60 years. One or more comorbidities were seen to be present in 50 (34.2%) of the patients. With regard to BMI, 62 (42.5%) of the patients were in the normal category. Major post-operative complications were identified in 11 cases (7.5%). On univariate analyses, occurrence of postoperative complications were associated with presence of comorbidities (p=0.047) and SAS belonging to the high-risk category (p=0.001).
Conclusions: The SAS is a significant predictor of postoperative complications following gynecological surgery. This metric, along with a consideration of comorbidities, can be helpful in determining prognosis, directing decision making in the operation theatre, and in postoperative care.

Keywords: SAS, Gynecological surgery, Comorbidities

INTRODUCTION

The Apgar score is familiar to most professionals in the medical community. Developed by anesthesiologist Virginia Apgar in 1952, it is a method to provide a quick summary of the health of new-born children. It is determined by examining the new-born baby on five simple criteria, on a scale from zero to two. The five values thus obtained are then added to yield the Apgar score which ranges from zero to ten.

While the Apgar score is an accepted and convenient method for reporting the status of the new-born infant and deciding the need for immediate medical attention, it does not necessarily help to predict long-term problems or adverse neurologic outcome in individual patients.

Recently, Gawande and colleagues sought to develop a similar scoring system to assess patients undergoing surgery. Called "Surgical Apgar Score" (SAS), it is calculated on a ten-point scale using a three-item aggregate which is arrived at after estimating the estimated blood loss, lowest heart rate, and lowest mean arterial pressure (Table 1). All the three parameters are collected during the operation. Gawande and colleagues further validated the SAS as a predictive tool - lower the SAS score is, higher the chances of complications in the post-operative period.[1]

SAS has been found to provide an objective, immediate, simple means of measuring and communicating patient outcomes in surgery, using data routinely available in any setting.[2] The present study focuses on gynaecological surgery and seeks to examine whether the Surgical Apgar Score can be used to accurately predict postoperative complications in all laparotomy operations. The need for this arises due to the current scenario.

Table 1: Gawande's "Surgical Apgar Score": a 10-point score to rate patient's condition after surgery.

	0 points	1 point	2 points	3 points	4 points
EBL (mL)	>1000	601-1000	101-600	≤100	-
Lowest MAP (mmHg)	<40	40-54	55-69	≥70	-
Lowest HR (beats/min)	>85	76-85	66-75	56-65	≤55

EBL: Estimated blood loss; MAP: Mean arterial pressure; HR: Heart rate.

In recent years, with the increasing availability of health care facilities and awareness of health issues, along with longer life expectancy, women in India are seeking more gynecological services than ever before. Consequently, there is an increase in gynecological surgeries too. Surgeries, of course, come with a host of risks, including death.[3] In addition to the expected risks such as bleeding, infection and anesthetic problems, gynaecological surgeries pose a set of unique risks. Due to the close proximity of the female genital organs to the bowel and urinary tract, gynecological surgeries present risks for intra-operative injury to the ureters, bladder and bowel as well as the major pelvic blood vessels. Postoperative complications specific to gynecologic surgery include hemorrhage, infection, thromboembolism, and visceral injury. Such complications significantly prolong the duration of hospital stay and increase the cost of surgery manifold. It is therefore imperative that, along with providing curative gynaecological services, thorough steps be taken to prevent post-operative complications.

In the perioperative course of treatment, there are techniques and strategies that health care professionals can use to prevent postoperative complications. Some of these, such as timely antibiotics, are generally accepted; while others are becoming increasingly prominent. An especially important strategy is preoperative assessment which includes risk assessment. Risk assessment often uses clinical prediction tools (also known as clinical decision tools or risks scores) which are helpful in increasing the accuracy of clinical assessments, aiding complex decision making, and identifying patients at risk for poor outcomes. The creation of a clinical prediction tool involves the quantification of known variables, such as the patient's medical history, physical examination, and diagnostic tests, in order to predict a diagnosis or prognosis. These tools have been used to identify patients at risk for postoperative cardiac events and delirium. In addition, prediction tools specific to individual surgical procedures have been created to predict postoperative morbidity and mortality.

METHODS

The present study is a prospective observational one. All women undergoing laparotomy in a tertiary care referral hospital between November 2014 and June 2015, were included. Exclusion criteria were cesarean section, laparoscopic surgery and vaginal surgery. Inpatient, outpatient and anesthesia records were reviewed. Demographic data, information on clinico-pathologic characteristics, presence of comorbidities, and intra and postoperative complications were collected. Comorbidities that require periodic and chronic medical care, and/or medical problems undergoing active treatment were also recorded. Information on pulmonary disease (asthma, pneumonia, restrictive lung disease and chronic obstructive pulmonary disease), cardiovascular disease (stroke, coronary artery disease, peripheral vascular disease and congestive heart failure), nephropathy, rheumatic disease, diabetes mellitus and liver disease were specifically identified and collected.

As previously described, Surgical Apgar Score (SAS) was calculated from three parameters collected during operation - lowest heart rate, lowest mean arterial blood pressure and estimated blood loss. SAS was determined by adding points assigned for each of the three individual parameters. For the purpose of analysis, SAS was classified as low (≤4 points), intermediate (5-6 points) and high (7-9 points). Major complications that were defined in this study included those Gawande et al had reported during development and validation of the Surgical Apgar Score.[1] Complications collected and analysed included admission to ICU, re-laparotomy, sepsis/ SIRS, blood transfusion requiring >4 PRBCs, wound disruption, secondary haemorhage, venous thromboembolism, unplanned readmission <30 days of discharge, unplanned intubation and acute renal failure.

Descriptive statistics were used to characterize the study population and determine the number of cases with and without postoperative complications. The associations between postoperative complications and risk, age, comorbidity and BMI were analysed using Fisher's test. Significance was set at a p-value of 0.05. Statistical analyses were performed using Statistical Package for the Social Sciences (IBM SPSS Statistics).

RESULTS

A total of 146 cases meeting the inclusion criteria were identified during the study period. Demographics and clinico-pathologic characteristics for the study population are presented in Table 2. Of the patient population, 88 patients (60.27%) were in the age group of 40-60 years; the rest were between 20-40 years of age. The presence of

comorbidities was determined by the ASA physical status classification system. Category ASA II or higher indicated the presence of comorbidities. In this study population, comorbidities were seen to be present in 50 (34.2%) of the patients. With regard to BMI, 62 patients (42.5%) were in the normal category, with more patients with higher-than-normal BMI than lower-than-normal. Of the 146 cases, 24 patients (16.4%) were underweight.

Table 2: Patient demographics and clinicopathologic characteristics.

	Postoperative complications present (N=11)		Postoperative complications absent (N=135)	
	N	%	N	%
Age				
20-40 years	2	3.4	56	96.6
0-60 years	9	10.2	79	89.8
Comorbidities				
Present	7	63.6	43	31.9
Absent	4	36.4	92	68.1
BMI category				
Underweight	2	18.2	22	16.3
Normal	5	45.5	57	42.2
Overweight	4	36.4	35	25.9
Obese	0	0.0	21	15.6

Risk was determined by the Surgical Apgar Score. As shown in Table 3, there were 12 patients (8.2%) in the high-risk category, 92 patients (63%) in the intermediate category, and 42 patients (28.8%) in the low-risk category. Major post-operative complications (Table 4), as specifically defined for this study, were identified in 11 cases (7.5%). One of these patients was admitted in the ICU due to inability to maintain vitals even on inotropic support. Other complications included wound disruption, unplanned intubation, re-laparotomy, blood transfusion requiring >4 PRBCs, secondary hemorrhage and unplanned readmission within 30 days of discharge. Re-laparotomy was done because of intestinal obstruction. Both the cases who were readmitted soon after discharge were due to wound infection.

Table 3: Risk category.

Risk category	N = 11	%	N = 135	%
High risk (0-4)	5	41.7	7	58.3
Intermediate risk (5-7)	5	5.4	87	94.6
Low risk (8-10)	1	2.4	41	97.6

The post-operative complications were observed in only 11 (7.5%) patients. complications were higher in high risk group which was significant. SAS was calculated for the entire study population. A significant association (0.001) was seen between the presence of postoperative complications and SAS. Overall, SAS was found to be the most significant predictor of postoperative complications.

Table 4: Postoperative complications.

	N = 11	%*
ICU admission	1	0.7
Unplanned intubation	3	2.1
Wound disruption	1	0.7
Blood transfusion requiring >4 PRBCs	2	1.4
Secondary haemorrhage	1	0.7
Re-laparotomy	1	0.7
Readmission <30 days of discharge	2	1.4

ICU: Intensive care unit; PRBCs: Packed red blood cells; * in relation to total number of cases (N=146).

On univariate analysis, postoperative complications were significantly associated with the presence of comorbidities (p = 0.047). However, the occurrence of postoperative complications were not found to be associated with BMI (p = 1.00) or age (p = 0.201).

DISCUSSION

The likelihood of the occurrence of postoperative complications is influenced by the patients' pre-existing comorbid state, the type of surgery, and perioperative management. This study, therefore also sought to assess the association of few significant variables of the patients' comorbid state – age, BMI and the presence of comorbidities – with postoperative complications.

With regards to age, the current study did not find any significant association with postoperative complications. This is somewhat consistent with previous studies which found that only age 80 or older was associated with increased major postoperative complications after gynecologic procedures.[4] Parker and colleagues reported that of 77 patients undergoing benign gynecologic procedures in women age more than 80 years, there was a 14.3% prevalence of postoperative complications, and no mortalities.[5] As displayed in Table 2, there were no patients in this study above the age of 60 years. Iyer and colleagues and Zighelboim and colleagues found age to be a significant predictor of postoperative complications but it is relevant to point out here that they had included only gynecological oncology surgery patients while this study included all women undergoing laparotomy.[6,7]

BMI was also not found to be associated with postoperative complications. Previous studies had found that unintentional weight loss, which is a marker of frailty, and morbid obesity (BMI ≥40 kg/m^2) are associated with increased major postoperative complications. However, they did not find an association if women were dichotomized into obese (BMI ≥30 kg/m^2) and non-obese women.[4,8] Thus, only extremely

low or extremely high BMI appear to be associated with adverse surgical outcomes. This finds further evidence in the present study which, with no obese patients, found no significant association between BMI and postoperative complications. Further, this finding is consistent with Zighelboim and colleagues 'study which dealt with ovarian cancer patients undergoing surgical cytoreduction. They did not find any significant association between BMI and postoperative complications either.[7]

The presence of comorbidity was found to be an independent predictor of adverse outcome in this study. This is consistent with the findings of aforementioned studies.[4,6,7] Zighelboim et al recorded comorbidities in the same way as was done in the study (described in 'Materials and methods') and found multiple comorbidities to be significantly associated ($p = <0.00001$) with significant postoperative complications.[7]

As seen from the results, SAS was found to be significantly associated with postoperative complications. This indicates that it can be appropriately used in the field of gynecology to predict postoperative complications. The suitability of SAS as a predictive tool has previously had been proved by other studies too. Gawande et al. demonstrated that such a system is useful in predicting the patient condition after general and vascular operations and can help in preventing poor outcomes.[1,2] Another study established its ability to predict major postoperative complications among patients undergoing cytoreduction for advanced ovarian cancer. Complications included were wound disruption, unplanned intubation, acute renal failure, pneumonia etc.[7] Many similar studies have found that the score can be effective in identifying patients at higher- and lower-than-average likelihood of major complications and/or death after surgery and may be useful for evaluating interventions to prevent poor outcomes.[9]

While the results of this study are consistent with prior research, there are several limitations to it. Firstly, this was a study based in a single institution that has superior health care and facilities in comparison with the rest of the country. In many areas (especially, rural areas) here in India and in other developing countries, poverty, lack of regular follow-up, resource constraints and lack of technical skills pose major challenges in providing quality health care.[10] Therefore, results of this study cannot be generalized. Secondly, it is possible that both the SAS assigned and the patient's risk for postoperative outcomes per se were influenced by confounding factors such as the use of beta-blockers, intraoperative resuscitation and ascites. Moreover, the attending surgeons involved in the surgeries of patients taken for this study had variable levels of experience and expertise. Some of these surgeons were medical residents who may have had a relatively negative influence in the duration of surgery, blood loss etc. Another noteworthy confounding factor is the somewhat unavoidable complications which arise after surgery without any known cause. Finally, since the SAS is based on several parameters determined at the time of surgery, it cannot be used to guide preoperative decisions directed towards decreasing post-operative risks.

CONCLUSION

The present study suggests that Surgical Apgar Score can be suitably used to predict complications after gynecological surgery and could potentially improve postoperative outcome. It is easily calculated intra-operatively, and can provide a routine, objective evaluation of patient's condition to inform postoperative prognostication and guide safety interventions in the operating theatre. Future studies can be aimed at validating the role of the Surgical Apgar Score and prospectively evaluating strategies for postoperative management based on this metric.

ACKNOWLEDGMENTS

The authors would like to extent our gratitude to Dr.M V Pai, Dr.Pratap Kumar, Dr.Lavanya Rai, Dr.Jyothi Shetty and Dr.Shripad Hebbar for sharing their pearls of wisdom with us during the course of this research which greatly improved the manuscript.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Ali Z, Mundkur A. Surgical Apgar score in prediction of post-operative complications in gynecological surgery. Int J Reprod Contracept Obstet Gynecol 2016;5:1796-1800.