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The utility of surgical Apgar score in predicting postoperative morbidity and mortality in general surgery

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ABSTRACT

Objective: Many surgical scoring systems are used to predict operative risk but most are complicated. The aim of the study was to determine the utility of the Surgical Apgar Score (SAS) in predicting post operative mortality and morbidity in general surgical cases.

Material and Methods: This was a prospective observational study. All adult patients for emergency and elective general surgical procedures were included. Intraoperative data was collected, and post operative outcomes were followed up till 30 days. SAS was calculated from intraoperative lowest heart rate, lowest MAP and blood loss.

Results: A total of 220 patients were included in the study. All consecutive general surgical procedures were included. Sixty of the 220 cases were emergency and the rest were elective. Forty-five (20.5%) of the patients developed complication. Mortality rate was 3.2% (7 out of 220). The cases were divided into high risk (0-4), moderate risk (5-8) and low risk (9-10) based on SAS. Complication and mortality rates were 50% and 8.3% in the high risk group, 23% and 3.7% in the moderate risk and 4.2% and 0 in the low risk group, respectively.

Conclusion: The surgical Apgar score is a simple and valid predictor of postoperative morbidity and 30-day mortality among patients undergoing general surgeries. It is applicable to all types of surgeries for emergency and elective cases and irrespective of the patient general condition and type of anesthesia and surgery planned.

Keywords: Surgical Apgar score, postoperative risk, surgical mobidity

INTRODUCTION

Determination of patient condition after any surgery is important for post operative monitoring and follow up. Various scores such as Acute Physiologic Assessment and Chronic Health Evaluation II (APACHE II), Physiologic and Operative Severity Score for the enUmeration of Mortality (POSSUM) and Simplified Acute Physiology Score (SAPS) have been used for predicting outcomes (1,2). These scoring systems are complicated and depend upon various laboratory parameters for calculation. These are not commonly used in surgical practice and hence, there is a need for simple scoring systems to facilitate adequate post operative monitoring.

Gawande et al. have developed a simple scoring tool inspired by the pediatric Apgar score called the Surgical Apgar Score (SAS) (3). This is a 10-point score based on three clinical parameters: lowest heart rate, lowest mean arterial blood pressure measured intraoperatively and total estimated blood loss at the end of surgery (3). Lower score for the patient has been found to be associated with more chances of major complications and mortality.

SAS can determine need for monitoring and is especially beneficial in deciding shifting the patient to the intensive care unit (ICU) in a set up with limited resources and paucity of facilities. Melis et al. have validated the score in a retrospective cohort of 2125 patients having undergone general surgical procedures including cancer surgeries, and overall mortality and 30-day morbidity has been found to be inversely proportional to SAS (4). The authors have also found a low SAS score to be strong predictor of ICU need.

The score was initially developed for general surgical and vascular surgeries but since then has been extensively studied and applied across various surgeries; how-

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ever, the strength of correlation between various surgical specialty procedures and score prediction varies (2,5,6). The validity has been established in most of the situation barring a handful like orthopedic surgeries and Ivor Lewis esophagectomies (7,8). Modifications of the score have also been studied in gastrectomies and liver transplant surgeries, and the modified scores have been validated (9,10). Pearson et al. have replaced the estimated blood loss parameter with volume of packed red blood cells transfused among patients undergoing liver transplantation and found it correlated better than outcomes than the original score. This is likely due to the fact liver transplant usually has significant blood loss but transfused volume to maintain physiological balance is more accurate indicator of condition in these patients (9). Miki et al. have modified the score among gastrectomy cases due to the observation that gastrectomy is usually associated with lower blood loss then other major gastrointestinal surgeries and reduced the cut off for the blood loss variable to range between 147 to 525 mL instead to 100 to 1000 mL in the original score, only to find a better association of the modified score with patient outcomes (10).

However, the score has not been evaluated in the setting of general hospital which caters to all routine general surgical procedures ranging from simple to complicated in the elective as well as emergency setting to see if the applicability can be generalized. This was the aim of our study to assess the utility of the score in predicting post operative mortality and morbidity in all general surgical procedures at a district hospital in Southwestern India.

MATERIAL and METHODS

Study Setting

The study was carried out at two teaching hospitals affiliated to the authors' medical college comprising of a district level government hospital and a tertiary care private hospital.

Study Design

This was a prospective observational study.

Study Duration

The study was conducted from September 2019 to January 2021 until the required sample size was completed.

Inclusion Criteria

All adult (aged >18 years) patients presenting to the department of general surgery and undergoing both elective and emergency surgeries were included in the study after taking adequate informed consent. Only patients undergoing surgery under general anesthesia or spinal anesthesia were included.

Exclusion Criteria

The patients excluded from the study included those with polytrauma requiring any other surgical procedure apart from or in addition to general surgery, those undergoing surgery under local anesthesia or peripheral nerve blocks, discharged against medical advice, presenting with head injury, who refused consent and whose 30-day follow up could not be completed.

Sample Size Calculation

The minimum sample size required was 217 with a rate of complication estimated to be 18% (11), 5% error rate and 5% level of significance. Considering a 10% patient drop out rate, a total of 240 patients were initially enrolled.

Outcomes Measurement

Outcomes were taken as patient condition in the hospital till discharge and follow up until 30 days postoperatively. All major and minor complications of surgery were recorded including death and graded as per the Clavien Dindo classification of surgical complications (12). Among the patients who had more than one complication, the complication with the highest grade was included for analysis. Concordance of surgical Apgar score with occurrence of complications was calculated at the end of the study.

Data Collection

Patients' general details were collected from hospital records. Variables for calculation of the SAS were collected from anesthesia records for the heart rate and mean arterial pressure and surgeons notes to categorize blood loss (estimated blood loss). Preoperative and post operative hemoglobin and packed cell volume (PCV) were measured for each patient to calculate blood loss using the following formula.

Blood loss= $[(EBV \times (H_i - Hf) / \{(Hct_i + Hctf) /2\}] + (500 \times T_u)$ (13,14).

[Estimated blood volume (EBV) is assumed to be 70 cm^3/kg, H_i and Hf represent pre- and postoperative hemoglobin 24 hrs after surgery respectively, Hct_i and Hctf represent pre- and post-operative hematocrit 24 hrs after surgery respectively, T_u is the sum of autologous whole blood (ABW), packed red blood cells (PRBC), and cell saver (CS) units (FFP, Cryoprecipiatate) transfused].

The individual score for each patient was calculated using the variables with the standard cut offs given by Gawande et. al (Table 1) (3).

Follow Up

Post operative follow up was done by the investigators till discharge and till one month through telephonic conversation and OPD review. Any major or minor complications were recorded in the patient proforma.

Statistical Analysis

Data were analyzed using SPSS version 25.0 using univariate and multivariate analysis with p< 0.05. Categorical variables

Table 1. The 10 point Surgical Apgar score (SAS) (3)					
	0	**1**	**2**	**3**	**4**
Estimated blood loss (mL)	>1000	601-1000	100-600	≤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

*Occurrence of pathologic bradyarrhythmia, including sinus arrest, atrioventricular block or dissociation, junctional or ventricular escape rhythms, and asystole also receive 0 pts for lowest heart rate.

were expressed as frequencies and percentages and continuous normally distributed variables were expressed as mean ± standard deviation, and non normally distributed variables were expressed as median (interquartile range Q1-Q3). Univariate and Bivariate analyses were done by Chi-square test and Student's t-test. Spearman correlation index was calculated to determine individual risk factors and significance of the same. Receiver operating characteristics (ROC) curves were plotted, and area under the curve (AUC) was calculated to identify the cut off score and sensitivity.

RESULTS

A total of 240 patients were included into the study as per the study protocol accounting for about 10% drop out. All consecutive patients at the affiliated hospitals who consented for the study were included, and recruitment was stopped once the sample size was achieved. Of the included 240 cases, 20 were excluded as the 30-day follow up could not be completed and the final analysis was done on 220 cases.

Among the total 220 patients, 133 were males (60.5%). Mean age of the study subjects was 47 years (± 14.6). Among the study population, hypertension was the most common comorbidity being present in 25% (55/220) of the patients, with diabetes being second most common in 19.5% (43/220). None of the comorbidities and baseline factors were found to be statistically significant and associated with development of complications (Table 2).

The list of all surgeries performed is detailed in Table 3. Among the study population, open hernioplasty was the most common surgery performed for ventral or groin hernias. Among the total 220 surgeries, 60 were emergency and the rest were elective. Of the 160 elective cases, 30 patients (18.8%) developed any grade of complication in the postoperative period while 15 of the 60 emergency cases (25%) had no complication. This difference was not found to be statistically significant (p= 0.3). Similarly, no significant difference was seen in the patients requiring postoperative ICU care and 30-day mortality in both groups.

Table 2. Population baseline characteristics showing presence of comorbidities among the study sample				
	Total Study Sample - 220			**Chi-square/ Fisher's**
Comorbidities	**No of Patients**	**Percentage**	**Complication Rate**	**Exact Test**
Diabetes	43	19.5%	12 (27.9%)	0.18
Hypertension	55	25.0%	12 (21.8%)	0.77
IHD	9	4.1%	1 (11.1%)	0.48
Stroke	3	1.4%	2 (66.7%)	0.05
TB	4	1.8%	1 (25%)	0.82
Asthma	3	1.4%	2 (66.7%)	0.05
COPD	4	1.8%	2 (50%)	0.14
CLD	2	0.9%	0	0.47
Renal failure	4	1.8%	2 (50%)	0.14
Hypothyroidism	7	3.2%	2 (28.6%)	0.59
Previous surgery	44	20.0%	13 (29.5%)	0.09
Previous admission	94	42.7%	27 (28.7%)	0.009
Smoking	28	12.7%	6 (21.4%)	0.89
Alcohol	14	6.4%	3 (21.4%)	0.93
Drug abuse/tobacco	8	3.6%	2 (25%)	0.74

IHD: Ischemic heart disease, TB: Tuberculosis, COPD: Chronic obstructive pulmonary disease, CLD: Chronic kidney disease.

Table 3. Surgeries included in the final cohort of 220 patients	
Surgeries	**Number of Cases**
Above knee amputation	4
Adhesiolysis	2
Anterior resection	3
Below knee amputation	6
Cytoreductive surgery	7
Distal gastrectomy	1
Drainage of perianal abscess	4
Feeding gastrostomy/jejunostomy	4
Fistulectomy	1
Gastrojejunostomy	3
Grahams patch repair	7
Hemithyroidectomy	1
Hemorrhoidectomy	3
Hernioplasty-ventral and groin	29
Jaboulays procedure	3
Laparoscopic appendicectomy	13
Laparoscopic cholecystectomy	27
Laparoscopic hernia repair	6
Laparoscopic ovarian cyst excision	1
Major debridement	8
Modified radical hysterectomy	1
Modified radical mastectomy	10
Omental biopsy	2
Open appendicectomy	14
Open cholecystectomy/cholecystostomy	3
Peritoneal lavage	3
Pilonidal sinus excision with flap	1
Radical mastectomy	1
Ray amputation	1
Rectopexy	1
Right hemicolectomy	5
Small bowel resection anastomosis	16
Split skin grafting	7
Subtotal mastectomy/lumpectomy	2
Superficial parotidectomy	2
Thoracotomy and repair-diaphragmatic hernia	1
Total thyroidectomy	5
Transhiatal esophagectomy	1
Trendlenberg's procedure	1
Wide local excision for sarcoma	2
Wide local excision of oral malignancy with neck dissection	8

Among the total 220 surgeries, 167 (75.9%) were done under general anesthesia and 53 under spinal anesthesia. Thirty-six of the 167 patients (21.6%) under general anesthesia developed some complications compared to 9 of the 53 (17%) patients under spinal anesthesia. This difference was not found to be statistically significant (p= 0.47).

The overall complication rate was 20.5% (45/220 patients). Eight patients (40%) had grade I complication, 9 (20%) grade II, 4 (9%) grade III, 7 (16%) grade IV and 7 (16%) grade V including death. Twenty-one out of the 220 patients (9.5%) required postoperative ICU admission for various durations. Thirty-one patients (14%) required blood or blood product transfusion of which the most common product was packed red cells followed by fresh frozen plasma. In our study, surgical site infection was the most common complication and seen in 19 out of 220 patients (Table 4).

Among all patients, there was a total of seven deaths (3.2%). Of the seven deaths, two patients died of massive pulmonary thromboembolism, two patients due to intraabdominal sepsis secondary to anastomotic leak and peritonitis, one due to post op myocardial infarction (MI), one due to disseminated intravascular coagulopathy (DIC) and one due to post op hemorrhage and shock.

Mean lowest heart rate was 72 (± 15) and median (IQR) SAS score for lowest heart rate was 2.0 (1.0-3.0) (Table 5). The lowest mean arterial pressure was 81 (± 13) mmHg and median score

Table 4. Types of complications	
Complication	**Frequency**
Surgical site infection	19
Flap necrosis	5
Wound dehiscence	2
Exacerbation of COPD	2
Renal failure	2
Pulmonary embolism	2
Stump infection	2
Septic shock	2
Anastomotic leak	2
Hemorrhage	1
Ascending gangrene	1
Post op Ileus	1
Pneumonia	1
Post op fever	1
DIC	1
Myocardial infarction	1
Total	45

COPD: Chronic obstructive pulmonary disease, DIC: Disseminated intravascular coagulopathy.

Table 5. Operative baseline characteristics for the study population		
Patient Baseline Characteristics Factors (Units)	**Mean/Median**	**Std. Deviation/**
Duration of surgery (minutes)#	120	80-150
Lowest HR (beats per minute)*	72	15.4
Lowest MAP (mmHg)*	80.8	13.1
Estimated blood loss (mL)*	200	80-250
Pre op HB (gm/dL)*	12.7	2.1
Post op HB (gm/dL)*	11.6	2.1
Pre op PCV (%)*	38	6
Post op PCV (%)*	35	6
Patient Weight (kg)*	65.3	11.1
Calculated blood loss (mL)#	150	65-255
Median SAS for lowest heart rate#	2.0	1.0-3.0
Median SAS for lowest MAP#	3.0	3.0-3.0
Median SAS for calculated blood loss#	2.0	2.0-3.0
Median SAS for estimated blood loss#	2.0	2.0-3.0
Median Total SAS#	7.0	6.0-8.0

HR: Heart rate, MAP: Mean arterial pressure, HB: Hemoglobin, PCV: Packed cell volume, SAS: Surgical Apgar score.
*values expressed as mean ± SD, #values expressed as Median (25-75 IQR).

was 3.0 (3.0-3.0). Our data revealed that the median estimated blood loss (EBL) was 200 (80-250) mL and the calculated blood loss (CBL) was 150 (65-255) mL, which was not found to be statistically different. The assigned median score to estimated blood loss and calculated blood loss was both 2.0 (2.0-3.0). Total median SAS was 7.0 (6.0-8.0) in our study population. Median scores for complication group (n= 45) were found to be significantly lower for heart rate, calculated and estimated blood loss and total SAS and these parameters were found to individually correlate with presence of complications.

Median SAS was 5.0 in the complication group as compared to 8.0 in the no complication group (p= 0.00). Spearman correlation between SAS and grade of complication was also found to be -0.49 (p= 0.001), which was statistically significant and indicated a higher grade of complication associated with a lower SAS score. The Receiver Operating Characteristic (ROC) curve for the SAS had an area under the curve (AUC) of 0.8 (95% CI - 0.72-0.88) (Figure 1). A cut off of 7 for the score had a sensitivity of 82% to predict risk of complications post operatively.

Median SAS for patients requiring ICU care was five as compared to eight for those who did not (p= 0.00). The ROC curve for ICU need correlating to SAS (Figure 2) showed an area under the curve of 0.89 (95% CI 0.84 - 0.95). At a cut off value of 7, the score had a 90% sensitivity in predicting the need for ICU care.

Total number of deaths in our study was seven out of 220 (3.2%). This was the total 30-day mortality and was found to be associated significantly with lower mean values of score for heart rate, blood loss and SAS. Median SAS for the patients who died was

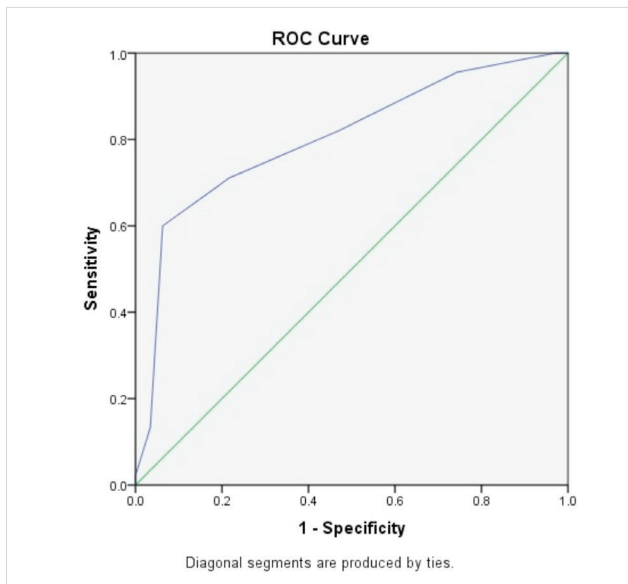

Figure 1. Receiver operating characteristic (ROC) curve for SAS against presence of complication (AUC - 0.8, 95% CI - 0.72-0.88).

5 as compared to 7.0 for those who did not (p= 0.001). The ROC curve for 30-day mortality correlating to SAS (Figure 3) showed an area under the curve of 0.88 (95% CI 0.81 - 0.94).

The cases were stratified into three groups (Table 6) with High risk (0-4), moderate risk (5-8) and low risk (9-10), and the distribution of complications, need for ICU care and death were all found to be significantly higher in the high-risk group with 50%

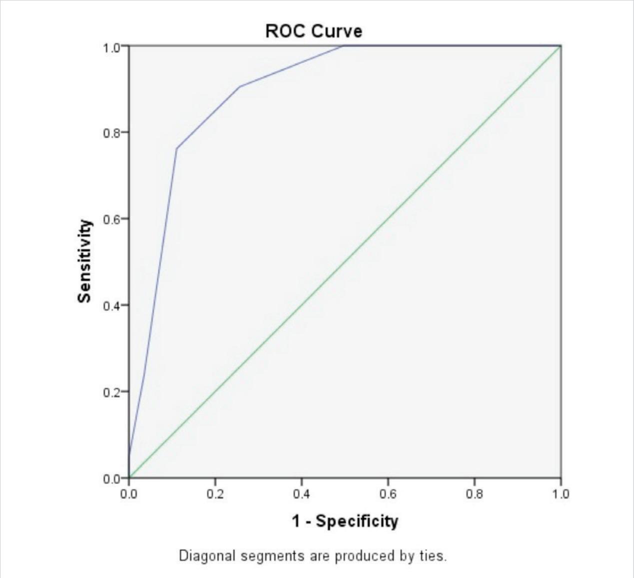

Figure 2. ROC curve for SAS against ICU need (AUC - 0.89, 95% CI - 0.84 -0.95).

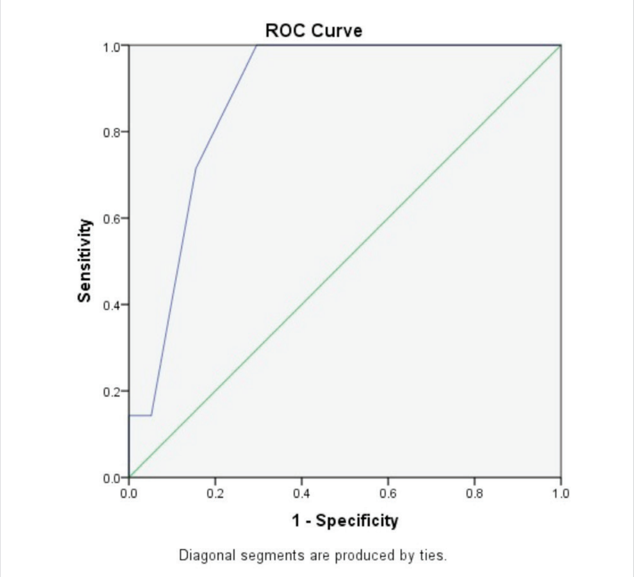

Figure 3. ROC curve for SAS against death (AUC – 0.88, 95% CI – 0.81 -0.94).

risk of 30 day morbidity and 8.3% risk of mortality compared with 4.3% and 0% in the low risk groups.

DISCUSSION

Our study was done on 220 patients under the general surgery department at our hospitals and included all elective and emergency cases. There was no significant difference in the baseline characteristics of the patients who did and did not develop complications. This finding was similar to the ones reported previously (4,15) where comorbidities did not affect the 30-day mortality and morbidity.

All major and minor general surgical procedures routinely carried out at a tertiary care district hospital were included, and repair of ventral and groin hernias was the most common surgery followed by laparoscopic cholecystectomy (Table 3). There were other major cases as well including gastrectomy, colonic and rectal resection, small bowel resection anastomosis and major lower limb amputation. There were also oncological procedures including wide local excision of soft tissue tumors, mastectomy, hysterectomy, ovarian cytoreductive surgery and wide local excision with neck dissection for oral malignancies. Such wide variety of cases have been only reported in a few studies previously where the authors have included all general surgical cases (11,16,17). However, the sample size was lesser than our study in two of these studies and one study included orthopedic procedures also with general surgical procedures comprising about 50% of the sample size (16).

Although our study included all types of cases ranging from minor to major, the results indicated that the score hold true irrespective of the magnanimity of the procedure. The parameters were based on intra operative heart rate, blood pressure and blood loss and were affected by the patients' state of health and response to surgical and anesthetic stress which reflected the likely post operative recovery. The heterogeneity of the cases offered a unique insight into the utility of the score in regular practice on a larger scale and validated its accuracy.

Among the total 220 surgeries in our cohort, 60 were emergencies (27%) and rest of them were electives. Twenty-five percent of the patients undergoing emergency surgery developed complications and 18.8% in the ones undergoing elective surgery. This difference was not statistically significant, and mean SAS in the two groups was also similar. The two groups were included together for the final analysis of the score as there were no statistical differences between them (p= 0.3). Literature suggests that emergency surgeries are generally associated with higher risk of complications due to under resuscitated patients

Table 6. Association between SAS and outcomes

SAS	No of Patients	Complications	ICU Need	Death
0-4	12	6 (50%)	5 (41.6%)	1 (8.3%)
5-8	161	37 (23%)	16 (9.9%)	6 (3.7%)
9-10	47	2 (4.2%)	0 (0)	0 (0)

and worse intraoperative conditions, the score seems to be applicable here as well (13,17,18). Shaikh et al. have reported a complication rate of 94% among emergency laparotomies, which is higher than that found in our study at 25% but this difference may be due to types of surgeries included in our study with not only laparotomies but also other procedures (13).

We included cases done under both general and regional anesthesia, and 76% of them were under general anesthesia with the rest under spinal anesthesia. The rates of complications and mean SAS for both types of anesthesia was not found to be statistically different and outcomes were similar. This is different than the results by Urrutia et al. and Nair et al., who have found that patients undergoing surgery under spinal anesthesia do not have a good correlation of the SAS to the outcomes (2,7). They hypothesize that the score maybe unreliable in cases of regional anesthesia as majority of procedures on the lower limbs are performed under spinal anesthesia which causes vasodilation induced hypotension and is easily corrected by crystalloid boluses but may not necessarily affect the surgical outcome (2). However, these authors have included orthopedic procedures in their studies whereas our cohort consisted of general surgical patients. Our results confirm the ability of the score to predict the outcomes irrespective of the type of anesthesia used.

The overall 30-day morbidity in our study was 20.5% with 45 of the 220 subjects developing some grade of complication. The overall complication rates have been variably reported in the literature ranging from 14-40% depending on the type of surgeries included (5,11,19). Among the studies reporting emergency surgeries and laparotomies, complication rates have been reported as high as 40-60% (13,17). Most studies have not mentioned the complications encountered but surgical site infections, pneumonia and sepsis are commonly reported (13,20,21).

Median SAS in our study was 7.0 (IQR 6-8). We also compared blood loss using the surgeons estimation post operatively and also calculated blood loss using a standardized formula (13,14). There has been a differing opinion regarding blood loss estimation and interobserver variability in previously conducted studies, and authors have always commented on the fallibility of this component of the score. To overcome this shortcoming, few authors have calculated blood loss from pre and postoperative blood parameters and shown this score to be valid. However, no previous studies have compared the methods of blood loss estimation and calculation and shown if any of them was superior. Our study attempted to correct this lacuna in the existing literature, and we demonstrated the two methods to be equally useful and accurate in calculating the score. The difference between the median estimated and calculated blood loss was not statistically significant, and there was a good interobserver agreement between the two values (κ 0.82).

In our study population, majority of the patients (161/220) fell in the moderate risk group followed by 47 in low risk and 12 in the high risk groups (Table 6). This distribution is similar to what is commonly observed in clinical practice, with most patients having an uneventful to a mildly turbulent post operative period whereas a small proportion of patients have a high risk of mortality and morbidity as seen in our high risk group. We did not categorise the surgeries by major or minor and the complications or SAS was not assessed for individual surgeries, which is a limitation of our study. However, the authors believe that the score is appropriate to all cases and can be applied in general practice in any hospital set-up.

Univariate analysis of the individual components and the score against the incidence of complications showed that the median score was lower (5) among the patients who developed any grade of complication as compared to eight among those with no complications. The lowest heart rate and blood loss also individually correlated with risk of complications with statistically significant lower mean values. Receiver operating characteristic (ROC) curve showed an area under the curve (AUC) of 0.8 (95% CI - 0.72-0.88) (Figure 1) indicating a good association between the score and chance of complication. The curve showed a cut off of 7 being able to predict risk of complication with 80% sensitivity. These findings are at par with previous studies that have shown similar AUC and predictive value of the score (19,22). We also assessed the association between the score and the grade of complication and was found to be inversely proportional. Bivariate analysis showed a negative Spearman correlation (-0.49), which was statistically significant ($p= 0.001$), and indicated a lower score being inversely associated with a higher grade of complication.

Of the study population, 21 patients required ICU admission and the median score among these patients was five as compared to eight in those who did not require ICU admission ($p= 0.00$). The ROC curve showed that SAS was significantly associated with prediction of ICU need with AUC of 0.89 (Figure 2). Similar results have been demonstrated previously and a cut of value of 7 has been suggested. In our study, a cut off value of <7 from the ROC curve had a 90% sensitivity in predicting postoperative ICU need. Among our subjects, high risk group (0-4) had 41.6%, moderate risk (5-8) had 10% and low risk (9-10) had 0% chance of ICU admission (Table 3). In a study by Melis et. al, low SAS has been shown to be a strong predictor of ICU need. High risk score 0-4 was associated with 79% chance of ICU admission compared to 17% if the score was 9-10 (23).

Mortality rate in our study was 3.2% (7 out of 220), and median SAS was significantly lower in these patients. The ROC curve also showed a good correlation with AUC of 0.88 (Figure 3). This is in line with previous studies where SAS has been inversely associated with linearly increasing risk of 30-day mortality (6). The score can be categorized into low risk (9-10), moderate risk (5-8) and high risk (0-4). Complication and mortality rates were 50% and 8.3% in the high risk group, 23% and 3.7% in the moderate risk and 4.2% and 0 in the low risk group respectively (Table 6), which can help as a simple guide to predict postoperative risk and plan care.

Regenbogen et al. have validated the score across all surgical procedures and found it to predict post operative outcomes with significant accuracy (18). Similarly, the score has also been studied in patients undergoing surgery for traumatic brain injuries, head and neck squamous cell carcinomas, gynecological surgeries, radical prostatectomy (14,20,21,24). Our findings show the applicability of the score across all general surgical procedures that are carried out at a secondary and tertiary care center. In majority of our set ups, intensive and critical care unit availability is limited, and judicious use of these resources is of utmost importance for optimal patient care. In such a scenario, a simple and effective tool like the SAS can help clinicians predict the need for ICU admission for patients and prioritize bed allotment.

The score is not fallible and multiple queries have been raised about its accuracy due to the dynamic nature of vital parameters used in calculation of the score and their labile nature. For instance, single run of arrythmia during surgery may warrant a low score or transient bradycardia may lead to a high score which may not reflect the entire duration of surgery and can cause inaccurate final assessment. Similarly, anesthetic drug induced hypotension during induction can lead to false MAP recording and alter the score. In addition, as the score is only calculated postoperatively, it cannot be used to plan preoperative counselling and assess risk (25).

There are significant concerns regarding SAS and include its exclusion of parameters like patient age, comorbidities, existing comorbidities, operative time, blood transfusions, use of intravenous fluids in surgery and other factors that have significant bearing on the outcome of the patient. Although majority of the studies are from single centers and represent homogenous type of procedures, the score holds true even when applied to a heterogenous population across all surgical procedures as demonstrated in our set-up. The score has stood the test of time and showed to be useful despite being simplistic and that is its greatest strength (6).

CONCLUSION

The Surgical Apgar score is a simple and valid predictor of postoperative morbidity and 30-day mortality among patients undergoing general surgeries. It is applicable at district hospital level to all types of surgeries and can be applied for emergency and elective cases and irrespective of the patient general condition and type of anesthesia and surgery planned.

Ethics Committee Approval: This study was approved by Kasturba Medical College Institutional Ethics Committee (Decision number: 10-19/480 Date: 16.10.2019).

Peer-review: Externally peer-reviewed.

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Cerrahi Apgar Skorunun postoperatif morbidite ve mortaliteyi öngörmedeki faydası

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ÖZET

Giriş ve Amaç: Ameliyat riskini tahmin etmek için birçok cerrahi skorlama sistemi kullanılır, ancak çoğu karmaşıktır. Bu çalışmanın amacı, genel cerrahi vakalarında cerrahi sonrası mortalite ve morbiditeyi öngörmede Cerrahi Apgar Skorunun (CAS) faydasını belirlemektir.

Gereç ve Yöntem: Bu ileriye dönük gözlemsel bir çalışmaydı. Acil ve elektif genel cerrahi işlemler için tüm yetişkin hastalar dahil edildi. İntraoperatif veriler toplandı ve postoperatif sonuçlar 30 güne kadar takip edildi. CAS, intraoperatif en düşük kalp hızı, en düşük ortalama arter basıncı (OAP), ve kan kaybından hesaplandı.

Bulgular: Toplam 220 hasta çalışmaya dahil edildi. Tüm ardışık genel cerrahi prosedürler dahil edildi. 220 olgunun 60'ı acil ve geri kalanı elektifti. Hastaların 45'inde (%20,5) komplikasyon gelişti. Mortalite oranı %3,2 idi (220'den 7'si) ve olgular SAS'a göre yüksek risk (0-4), orta risk (5-8) ve düşük risk (9-10) olarak ayrıldı. Komplikasyon ve mortalite oranı yüksek risk grubunda %50 ve %8,3, orta risk grubunda %23 ve %3,7 ve düşük risk grubunda %4,2 ve 0 olarak bulundu.

Sonuç: Cerrahi Apgar Skoru, genel cerrahi geçiren hastalarda postoperatif morbidite ve 30 günlük mortalitenin basit ve geçerli bir göstergesidir. Hastanın genel durumu ve planlanan anestezi ve ameliyat türü ne olursa olsun, acil ve elektif vakalarda her türlü ameliyata uygulanabilir.

Anahtar Kelimeler: Cerrahi Apgar Skoru, postoperatif risk, cerrahi hastalık

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