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## Accuracy of Surgical Apgar Score in Predicting Postoperative Complications in Emergency Laparotomy Patients.

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### ABSTRACT

Post-operative morbidity and mortality reduction is crucial in surgical procedures, particularly in emergency laparotomy, where patients often present with severe physiological stress. The Surgical Apgar Score (SAS) offers a practical method for predicting post-surgical outcomes based on hemodynamic parameters. This study aims to evaluate the accuracy of SAS in predicting the severity of post-operative complications in patients undergoing emergency laparotomy. A prospective observational study was conducted at a tertiary care center in Maharashtra from August 2024 to February 2025, involving 31 patients who underwent emergency laparotomy. Data on demographics, clinical parameters, and post-operative complications were collected and analyzed using IBM SPSS statistics version 28.0. Among the 31 patients, 23 were male, with the majority aged 40-60 years. The leading indications for surgery were peritonitis and intestinal obstruction. Complications were categorized based on SAS: 18 patients had mild to moderate complications, while 13 experienced severe complications. The most common complications included post-operative fever (26%) and surgical site infections (19%). The SAS demonstrated a sensitivity of 88.89%, specificity of 61.54%, and overall accuracy of 77.42%. The study confirms that low SAS scores correlate with a higher risk of severe complications, supporting its predictive value. While the SAS effectively identifies high-risk patients, improvements in specificity are needed to reduce false positives. Compared to other risk stratification tools, SAS is a reliable and simple tool, particularly beneficial in resource-limited settings. The findings underscore the importance of SAS in assessing surgical risk and improving patient outcomes in emergency laparotomy. By identifying patients at high risk for severe complications, SAS can guide preventive strategies and enhance recovery.

**Keywords:** SAS, Laparotomy.

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## INTRODUCTION

Post-operative morbidity and mortality reduction is the primary goal of all surgical procedures [1]. The key to achieving this lies in effective perioperative management, which involves thorough and objective patient evaluation. Emergency laparotomy is one of the most commonly performed delicate surgical procedures, typically performed on patients who are already in a state of severe physiological stress, including hemodynamic instability, severe hemorrhage, electrolyte imbalance, systemic inflammatory response, and sepsis [2-5]. These pre-existing conditions elevate the risk of complications, leading to high mortality rates, especially within 30 days post-operation. Among the complications, post-operative respiratory infections are particularly common, affecting around 40% of patients who undergo abdominal surgery.

To manage and reduce these risks, a risk scoring system can be a valuable tool. Risk scoring systems provide a standardized method for evaluating the likelihood of a patient developing complications, based on various factors such as the patient's morbidity status. However, many existing scoring systems are not easily calculated at the bedside because they require extensive data collection, including laboratory tests, and are not regularly applied in clinical practice for patient assessment and risk stratification.

The Surgical Apgar Score (SAS) presents an alternative approach. This score offers a feasible, immediate, and objective way to predict post-surgical outcomes by evaluating three key hemodynamic parameters: the lowest heart rate, the lowest mean arterial pressure, and estimated blood loss during surgery. The SAS assigns a score ranging from 0 to 10 and can be used to assess the risk of post-operative complications following general or vascular surgery. The score stratifies patients into three risk categories: low risk (SAS 7-10), medium risk, and high risk (SAS 0-4). Studies have shown that patients in the high-risk group (SAS 0-4) are 16 times more likely to experience major complications compared to those in the low-risk group (SAS 7-10).

Despite its advantages, the accuracy of SAS has not been tested in all settings, and its predictive power regarding the severity of post-operative complications remains uncertain. While some studies suggest that patients with a SAS score  $\leq 4$  experience a higher rate of major complications and mortality, there is limited evidence to confirm a statistical correlation between SAS risk levels and the severity of post-operative complications.

In conclusion, while SAS provides a practical and efficient tool for assessing surgical risk, further research is needed to validate its effectiveness in predicting the severity of complications and its application across different patient populations.

## MATERIALS AND METHODS

A prospective observational study was conducted in Department of General Surgery at tertiary care center, Maharashtra from August 2024 to February 2025. The study aimed to determine the accuracy of Surgical Apgar Score for prediction of post-operative complication severity among patients who underwent emergency laparotomy at tertiary care center, Maharashtra. We also aimed to describe the severity pattern of post-operative complication among patients who underwent emergency laparotomy and to evaluate the correlation between SAS and the severity of post-operative complication following emergency laparotomy.

### Sample size estimation

A total sample size of 31 patients was estimated using OpenEpi for analysis of SAS in emergency laparotomy.

### Statistical Analysis

The data was stored in Microsoft Excel Spreadsheet and data analysis was performed using IBM SPSS statistics version 28.0.

The data was represented in the form of tables and graphs. Frequency, percentage, and descriptive

statistics was used to summarize data.

**METHODOLOGY**

The patients undergoing emergency laparotomy in the department of general surgery was included in the study. Written and informed valid consent was taken from each patient willing to be a part of this study.

After resuscitating and stabilising the patient, data was collected prospectively from the onset of symptoms until discharge from hospital.

Following data was recorded in each patient

- Age
- Sex
- Surgical APGAR Score

The SAS is calculated based on three intraoperative parameters, each scored from 0 to 4: A )

**Heart Rate**

4 points: Heart rate <55 beats per minute  
 3 points: Heart rate >55- <65 beats per minute 2 points: Heart rate > 65-<75 beats per minute 1 point: Heart rate >75-<85 beats per minute 0 points: Heart rate >85 beats per minute

**Blood Pressure**

3points: mean arterial pressure >=70mmHg  
 2 points: mean arterial pressure > =55-<70 mm Hg 1 point: mean arterial pressure 40-<55 mm Hg  
 0 points: mean arterial pressure < 40 mm Hg

**Estimated Blood Loss**

3 points: Blood loss <=100ml  
 2 points: Blood loss > 100 -600ml 1 point: Blood loss >600-1,000 ml 0 points: Blood loss > 1,000 ml

Table I. Evaluation for the original surgical Apgar score.

Parameter scored	Score				
	0 Point	1 Point	2 Points	3 Points	4 Points
Estimated blood loss (ml)	>1000	>600-1000	>100-600	≤100	-
Lowest mean arterial pressure (mm Hg)	<40	40-<55	≥55-<70	≥70	-
Lowest heart rate	>85	>75-≤85	>65-≤75	>55-≤65	≤55

After relevant history, clinical examination, and emergency laparotomy, the patients was regularly followed up with examination of vitals and surgical APGAR score and noted and subsequently appropriately treated for any postoperative complications that may arise.

Patients will be followed up to 30 days of discharge.

**Eligibility Criteria**

**Inclusion criteria**

- Patients undergoing emergency laparotomy.
- Patients above 18 years of age. Exclusion criteria

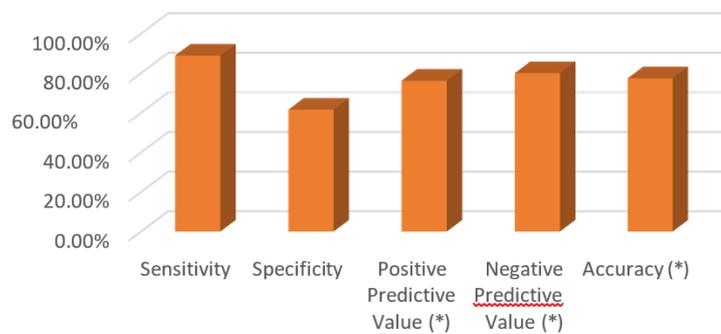
- Patient not giving consent to be a part of this study.
- Patients below 18 years of age.

**RESULTS**

A total number of 31 patients was selected in this study in which male were 23(74.19%) and female were 8(25.80%), most of the patients were in the age group of 40 to 60 yrs of age. Perforative Peritonitis and intestinal obstruction were the leading indications for emergency laparotomy.

Statistic	Value
Sensitivity	88.89%
Specificity	61.54%
Positive Predictive Value (*)	76.19%
Negative Predictive Value (*)	80.00%
Accuracy (*)	77.42%

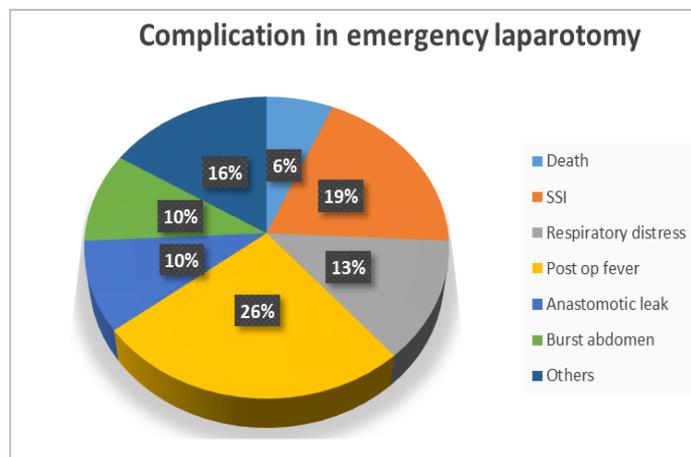
Accuracy of SAS in emergency laprotomy



Complications in post operative patients following emergency laparotomy are categorized according to surgical APGAR Score which is mild (SAS 7-10), moderate (5-6) and severe (0-4), higher the score less likely to develop complications. In this study 18 patients have mild to moderate complications whereas 13 developed severe complications.

Highest number of patients had post operative fever which was 8 (26%) , surgical site infection which was 6(19%), respiratory distress 4(13%), burst abdomen 3(10%), anastomotic leak 3(10%), and death 2(6%).

According to this study the Sensitivity of SAS was 88.89%, specificity was 61.54%, accuracy was 77.42%, positive predictive value was 76.19% and negative predictive value was 80.00% as shown in the graph.



## DISCUSSION

The study aimed to assess the accuracy of the Surgical Apgar Score (SAS) in predicting the severity of post-operative complications in patients undergoing emergency laparotomy. Patients with low SAS scores (0–4) exhibited an increased risk of developing severe complications, highlighting the predictive value of SAS in identifying high-risk patients.

Among the complications, post operative fever were the most common, affecting 19% of patients. Surgical site infections occurred in 16% of cases, lower than the 25% rate reported in a previous study. The mortality rate was 6%, which was similar to the 7.9% reported in a study from Kitui District Hospital, Kenya [14], but did not align with mortality rates ranging from 15–27.7% in other studies [7-12, 15].

The majority of patients were categorized as having severe complications according to SAS. SAS was divided into three risk categories: high risk (0–4), medium risk (5–6), and low risk (7–10) [12]. The study found that patients with high-risk SAS scores ( $\leq 4$ ) had significantly more severe complications, compared to those with low-risk scores ( $\geq 7$ ). This relationship was consistent with other studies.

In this study, the SAS test demonstrated an 88.89% sensitivity, indicating it is highly effective at identifying individuals who are at risk of developing complications, with only a small chance of missing true positives. Its specificity of 61.54% suggests that while it can identify some individuals with mild outcome, it also has a relatively high rate of false positives, misclassifying mild outcome as severe. The test's overall accuracy of 77.42% means it correctly classifies a good proportion of both mild and severe cases, though the balance between true positives and true negatives could be improved. With a positive predictive value (PPV) of 76.19%, those who have a severe prediction have a chance of actually developing complications, though false positives are still possible. Lastly, the negative predictive value (NPV) of 80.00% indicates that a negative result is generally reliable, but some false negatives still occur. Overall, while the score shows promise, particularly in identifying true positives, there is room for improvement in minimizing false positives and improving specificity.

Several risk stratification tools, such as the ASA classification and POSSUM, are used for predicting post-operative outcomes, but they have limitations [16]. The SAS, however, has proven to be a reliable, objective, and simple tool for assessing post-operative complications. It offers significant advantages, especially in resource-limited settings, as it can be computed quickly and objectively.

## CONCLUSION

The high morbidity and mortality rates linked to emergency laparotomy in the studied setting emphasize the need for an objective tool to assess risk levels and improve patient outcomes. The study demonstrates that the SAS is an effective predictor of the severity of post-operative complications following emergency laparotomy. By accurately assessing the risk, SAS can aid in the proactive management of patients, potentially reducing complications and enhancing recovery after surgery. The findings highlight the importance of using objective measures like SAS to better predict outcomes and improve clinical decision-making in emergency surgical settings. The study concluded that SAS could be an effective tool for identifying patients at high risk for severe complications, and it may help guide preventive strategies, such as optimizing intraoperative care, managing blood pressure, and providing timely blood transfusions [13].

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