e-ISSN: 0976-822X, p-ISSN:2961-6042

Available online on http://www.ijcpr.com/

International Journal of Current Pharmaceutical Review and Research 2026; 18(6); 2319-2323

Original Research Article

Observational Prospective Study for the Utility of Surgical Apgar Score in Predicting Postoperative Morbidity and Mortality in Major Abdominal Surgery

Kritika Chaturvedi[1], Piyush Singh[2], A.N. Mhaske[3]

[1]Post Graduate Trainee MS General Surgery, Department of General Surgery, People's College of Medical Sciences & Research Centre, Bhopal, Madhya Pradesh, India

[2] Associate Professor, Department of General Surgery, People's College of Medical Sciences & Research Centre, Bhopal, Madhya Pradesh, India

[3]Professor, Department of General Surgery, People's College of Medical Sciences & Research Centre, Bhopal, Madhya Pradesh, India

Received: 01-03-2026 / Revised: 15-04-2026 / Accepted: 21-05-2026

Corresponding author: Dr. Kritika Chaturvedi

Conflict of interest: Nil

Abstract

Background: Major abdominal surgeries are associated with significant postoperative morbidity and mortality. Early identification of high-risk patients is essential for improving surgical outcomes. The Surgical Apgar Score (SAS) is a simple intraoperative scoring system used for perioperative risk assessment.

Methods: This prospective observational study was conducted in the Department of General Surgery at People's Hospital, Bhopal, from April 2024 to September 2025. A total of 98 patients aged 18–60 years undergoing major abdominal surgery were included. The SAS was calculated using estimated blood loss, lowest mean arterial pressure, and lowest heart rate recorded intraoperatively. Postoperative complications and morbidity were analyzed in relation to SAS categories.

Results: Most patients belonged to the low SAS category (<4). Lower SAS was significantly associated with higher postoperative complications including organ dysfunction, sepsis, cardiac arrest, prolonged ventilator use, and increased morbidity. No morbidity was observed in patients with good SAS scores.

Conclusion: Surgical Apgar Score is a simple, reliable, and effective predictor of postoperative morbidity and mortality in major abdominal surgery.

DOI: 10.25258/ijcpr.18.6.364

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0) and the Budapest Open Access Initiative (http://www.budapestopenaccessinitiative.org/read), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Major abdominal surgeries are among the most frequently performed and high-risk surgical procedures worldwide, contributing significantly to postoperative morbidity and mortality. Despite substantial advancements in surgical techniques, anesthesia, and perioperative critical care, postoperative complications continue to pose major challenges for surgeons and healthcare systems globally [1,2].

Early identification of patients at increased risk of adverse postoperative outcomes is essential for timely intervention, appropriate postoperative monitoring, and optimal allocation of healthcare resources.

Accurate perioperative risk stratification not only improves patient outcomes but also reduces healthcare costs and postoperative hospital stay [3]. Globally, nearly 313 million surgical procedures are performed annually, with a considerable proportion comprising major abdominal surgeries such as gastrointestinal resections, hepatobiliary procedures, and colorectal operations [4,5].

These procedures are associated with significant physiological stress and postoperative complications including surgical site infections, respiratory complications, sepsis, anastomotic leakage, thromboembolic events, and multiorgan dysfunction [6].

The incidence of postoperative morbidity following major abdominal surgery ranges from 10% to 37%, while mortality rates vary between 0.5% and 5%, depending on patient characteristics and surgical settings [7]. The burden is particularly higher in low- and middle-income countries (LMICs), where inadequate healthcare infrastructure, delayed presentation, and limited perioperative resources

contribute to poor surgical outcomes [8]. In India, postoperative morbidity and mortality rates following major abdominal surgeries remain substantially high, especially in emergency procedures and patients with multiple comorbidities [9,10].

Several scoring systems have been developed to predict postoperative outcomes, including the American Society of Anesthesiologists (ASA) grading, POSSUM, APACHE, and Charlson Comorbidity Index. However, many of these tools are complex, require extensive laboratory investigations, and are difficult to apply routinely in resource-limited settings [11].

To overcome these limitations, Gawande et al. introduced the Surgical Apgar Score (SAS) in 2007 as a simple and objective intraoperative scoring system based on estimated blood loss, lowest mean arterial pressure, and lowest heart rate during surgery [12]. The SAS ranges from 0 to 10, with lower scores indicating a greater risk of postoperative complications and mortality.

Owing to its simplicity and ease of calculation, SAS has emerged as a promising tool for intraoperative risk stratification across various surgical specialties [13,14].

However, limited prospective data are available regarding its utility in predicting outcomes following major abdominal surgeries in the Indian population. Therefore, the present study was undertaken to evaluate the effectiveness of the Surgical Apgar Score in predicting postoperative morbidity and mortality in patients undergoing major abdominal surgery.

Material & Methodology

The present study was designed as an observational prospective study conducted in the Department of General Surgery at People's Hospital affiliated with People's College of Medical Sciences and Research Centre from April 2024 to September 2025. The study population included adult patients aged between 18 and 60 years undergoing major abdominal surgery under general or spinal anesthesia. Patients fulfilling the inclusion and exclusion criteria and providing written informed consent were enrolled in the study.

Patients with uncontrolled comorbidities such as diabetes mellitus and hypertension, those undergoing laparoscopic or re-exploration surgeries, polytrauma cases requiring additional procedures, patients operated under local anesthesia or peripheral nerve blocks, patients with head injury, those discharged against medical advice, and patients unwilling to participate were excluded from the study. After obtaining Institutional Ethics Committee approval, all patients underwent detailed preoperative evaluation including history taking, clinical examination, and routine hematological, biochemical, and radiological investigations. Baseline demographic and clinical data were recorded in a predesigned proforma.

During surgery, intraoperative parameters including estimated blood loss (EBL), lowest intraoperative heart rate, and lowest mean arterial pressure (MAP) were recorded carefully by the anesthetic and surgical teams. Based on these parameters, the Surgical Apgar Score (SAS) ranging from 0 to 10 was calculated immediately after surgery.

All patients were followed postoperatively during their hospital stay for development of complications such as surgical site infection, respiratory complications, cardiovascular events, sepsis, or need for reoperation. Mortality, if present, was also documented. Data were compiled and analyzed using SPSS version 20 and Microsoft Excel. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages. A p-value <0.05 was considered statistically significant.

Result

A total of 98 patients undergoing major abdominal surgery were included in the study. The majority belonged to the 31–40 years age group (42.86%), with a mean age of 39.59 ± 9.79 years. Male patients predominated (77.55%) compared to females (22.45%). Most surgeries were emergency procedures (68.37%), while 31.63% were elective.

Regarding duration, 35.71% of surgeries lasted 241–300 minutes and 24.49% exceeded 300 minutes. Based on Surgical Apgar Score (SAS), 67.35% of patients were categorized as high risk (score <4), 28.57% as moderate risk (score 5–7), and only 4.08% as low risk (score 8–10). Postoperative complications were significantly more common among patients with lower SAS values.

Major complications, organ dysfunction, bleeding requiring transfusion, cardiac arrest requiring CPR, sepsis/septic shock, prolonged ventilator use, and unplanned intubation showed statistically significant associations with low SAS scores ($p<0.05$).

Postoperative morbidity was highest among patients with SAS <4, whereas no morbidity was observed in patients with good SAS scores. The findings demonstrated a clear inverse relationship between Surgical Apgar Score and postoperative morbidity and mortality, indicating that lower SAS was associated with poorer postoperative outcomes following major abdominal surgery.

Table 1: Demographic and clinical profile of patients with abdominal Tuberculosis

Variable	Frequency (n)	Percentage (%)
Age Group		
18-30 years	15	15.31 %
31-40 Years	42	42.86 %
41-50 Years	24	24.49 %
51-60 Years	17	17.35 %
Gender		
Male	76	77.55
Female	22	22.45
Elective	31	31.63 31%
Emergency	67	68.37 %
Mean age	39.59 ± 9.79	

Table 2: Duration of surgery and surgical Apgar score distribution (n=98)

Variable	Frequency(n)	Percentage (%)
Duration of Surgery		
150-180 min	12	12.24
181-240 min	27	27.55
241-300 min	35	35.71
>300 min	24	24.49
Surgical Apgar score category		
Low (<4)	66	67.35
Moderate (5-7)	28	28.57
Good (8-10)	4	4.08

Table 3: Association of surgical Apgar score with post-operative morbidity and complications

Parameters	High Risk (0-4)	Moderate Risk (5-7)	Low Risk (8-10)	p- Value
Major Complications	13	7	2	0.016*
Single organ dysfunction	7	2	1	0.045*
Multi organ dysfunction	8	2	0	0.005*
Bleeding (>4 units transfusion)	4	0	0	0.018*
Cardiac arrest requiring CPR	7	5	0	0.038*
Sepsis / septic shock/SIRS	5	1	0	0.030*
Ventilator used >48 hrs	11	3	1	0.003*
Unplanned intubation	2	1	0	0.049*
Post-operative morbidity	36	6	0	--

***P- value <0.005 Considered statistically significant**

Discussion

The present hospital-based prospective observational study was conducted to evaluate the utility of the Surgical Apgar Score (SAS) in predicting postoperative morbidity and mortality among patients undergoing major abdominal surgery. Major abdominal procedures are associated with substantial physiological stress and postoperative complications, thereby necessitating reliable perioperative risk stratification tools. The Surgical Apgar Score, introduced by Gawande et al. [12], provides a simple intraoperative scoring system based on estimated blood loss, lowest mean arterial pressure, and lowest heart rate. Owing to its simplicity and ease of use, the SAS has gained widespread acceptance as an effective predictor of adverse postoperative outcomes across different surgical specialties. [10,11] In the present study, the mean age of patients was 39.59 ± 9.79 years, indicating predominance of middle-aged individuals. Similar age distributions were reported by Samudrala VD et al. [15] and Onen BC et al. [16], whereas Choudhari R et al. [17], Srivastava N et al. [18], and Rajgopal V et al. [19] observed relatively older patient populations. Male predominance was noted in the current study, which was consistent with observations by Samudrala VD et al. [15], Choudhari R et al. [17], and Onen BC et al. [16]. The predominance of male patients may reflect the demographic pattern of major abdominal surgeries in tertiary healthcare centers.

Emergency surgeries accounted for the majority of cases (68.37%) in the present study. Similar findings were reported by Doda S et al. [20], Parimala G et al. [21], Samudrala VD et al. [15], and Global Surg Collaborative [22], all of whom demonstrated higher postoperative morbidity and

mortality following emergency abdominal surgeries. Prolonged operative duration was also observed in the present study, with most procedures lasting more than 240 minutes. Comparable findings were documented by Bhushanam KY et al. [23] and Howbora N et al. (24), suggesting that prolonged surgeries may increase intraoperative physiological stress and postoperative complications.

A major finding of the present study was that most patients belonged to the low SAS category (<4), indicating a high-risk surgical population. Similar associations between lower SAS and increased postoperative complications were demonstrated by Rajgopal V et al. [19], Bhushanam KY et al. [23], and Choudhari R et al. [17]. Patients with low SAS in the present study showed significantly higher rates of organ dysfunction, sepsis, cardiac arrest, prolonged ventilator use, and major postoperative complications. These observations were supported by studies conducted by Ngarambe C et al. [25], Haynes AB et al. (14), and Regenbogen SE et al. [13], who validated the predictive value of SAS for postoperative morbidity and mortality across diverse surgical populations.

Furthermore, postoperative morbidity was markedly higher among patients with SAS <4, whereas no morbidity was observed in patients with good SAS scores (8–10). Similar results were reported by Rajgopal V et al. [19], Doda S et al. [20], and Parimala G et al. [21], all of whom demonstrated an inverse relationship between SAS and postoperative complications. Therefore, the findings of the present study reaffirm that the Surgical Apgar Score is a simple, objective, and reliable tool for predicting postoperative morbidity and mortality in patients undergoing major abdominal surgery

Conclusion

The study demonstrated that the Surgical Apgar Score is a simple, reliable, and effective intraoperative tool for predicting postoperative morbidity and mortality in patients undergoing major abdominal surgery.

Lower SAS values were significantly associated with increased postoperative complications, organ dysfunction, sepsis, prolonged ventilator requirement, and adverse surgical outcomes. Patients with higher SAS had considerably better postoperative recovery and lower morbidity. Owing to its simplicity, objectivity, and ease of calculation, the Surgical Apgar Score can be routinely utilized for perioperative risk stratification and early identification of high-risk patients. Its use may assist clinicians in improving postoperative monitoring, timely intervention, and overall surgical outcomes.

Acknowledgement: The authors sincerely thank the Department of General Surgery, People's College of Medical Sciences & Research Centre, Bhopal, for their guidance and support throughout the study. We are also grateful to all the patients who participated in this research.

References

1. Cooper Z, Scott JW, Rosenthal RA, Mitchell SL. Emergency Major Abdominal Surgical Procedures in Older Adults: A Systematic Review of Mortality and Functional Outcomes. J Am Geriatr Soc. 2015;63(12):2563-2571.
2. McQueen K, Coonan T, Ottaway A, et al. Anesthesia and Perioperative Care. In: Debas HT, Donkor P, Gawande A, et al., editors. Essential Surgery: Disease Control Priorities. 3rd ed. Washington (DC): World Bank; 2015.
3. Nair A, Bharuka A, Rayani BK. The Reliability of Surgical Apgar Score in Predicting Immediate and Late Postoperative Morbidity and Mortality: A Narrative Review. Rambam Maimonides Med J. 2018;9(1):e0004.
4. Nepogodiev D, Martin J, Biccard B, et al. Global burden of postoperative death. Lancet. 2019;393:401.
5. Willner A, Teske C, Hackert T, Welsch T. Effects of early postoperative mobilization following gastrointestinal surgery: systematic review and meta-analysis. BJS Open. 2023;7(5):zrad102.
6. Strik C, Stommel MW, Schipper LJ, van Goor H, Ten Broek RP. Risk factors for future repeat abdominal surgery. Langenbecks Arch Surg. 2016;401(6):829-837.
7. Rapaka RR, Reddy MV. A study on assessment of postoperative complications among major abdominal surgeries using Clavien-Dindo classification. Int Surg J. 2020;7(6):1788-1792.
8. Kamarajah S, et al. Mechanisms and causes of death after abdominal surgery in low-income and middle-income countries: a secondary analysis of the FALCON trial. Lancet Glob Health. 2024;12(11):e1807-e1815.
9. Manoj P, Shashikumar HB, Fathimath Shihana. Mortality and morbidity rates in patients undergoing emergency laparotomy: an analysis in a tertiary care hospital. Asian J Med Sci. 2022;13(3):132-138.
10. Pittman E, Dixon E, Duttchen K. The Surgical Apgar Score: A Systematic Review of Its Discriminatory Performance. Ann Surg Open. 2022;3(4):e227.
11. Mirzaiee M, Soleimani M, Banoueizadeh S, Mahdood B, Bastami M, Merajikhah A. Ability to predict surgical outcomes by surgical Apgar score: a systematic review. BMC Surg. 2023;23(1):282.

12. Gawande AA, Kwaan MR, Regenbogen SE, et al. An Apgar score for surgery. J Am Coll Surg. 2007;204:201-208.
13. Regenbogen SE, Ehrenfeld JM, Lipsitz SR, Greenberg CC, Hutter MM, Gawande AA. Utility of the Surgical Apgar Score: validation in 4119 patients. Arch Surg. 2009;144(1):30-36.
14. Haynes AB, Regenbogen SE, Weiser TG, Lipsitz SR, Dziekan G, Berry WR, et al. Surgical outcome measurement for a global patient population: validation of the Surgical Apgar Score in 8 countries. Surgery. 2011;149(4):519-524.
15. Samudrala VD, Prabhu T, Ramkumar Jothimayachari, et al. Utility of Surgical Apgar Score in Predicting the Morbidity and Mortality of Patients Undergoing Surgery. Int J Med Public Health. 2025;15(2):1432-1436.
16. Onen BC, Semulimi AW, Bongomin F, et al. Surgical Apgar score as a predictor of outcomes in patients following laparotomy at Mulago National Referral Hospital, Uganda: a prospective cohort study. BMC Surg. 2022;22:433.
17. Choudhari R, Bhat R, Prasad K, et al. The utility of surgical Apgar score in predicting postoperative morbidity and mortality in general surgery. Turk J Surg. 2022;38(3):266-274.
18. Srivastava N, Bagawan MB. Surgical Apgar Score: Utility in Predicting Postoperative Outcome in Cases of Exploratory Laparotomy. J Pharm Res Int. 2022;34(16A):50-64.
19. Rajgopal V, Kulkarni SV. Efficacy of the surgical Apgar score in predicting post-operative morbidity and mortality in patients undergoing laparotomy. Int Surg J. 2019;6: 2791-2796.
20. Doda S, Sagar SK, Negi A. A Study of the Reliability of Surgical Apgar Score in Predicting Post Operative Morbidity and Mortality in Patients Undergoing Laparotomy. Int J Sci Res. 2025;14(3):805-810.
21. Parimala G, Venkatesh P, Vijayaraghavan. Utility of surgical APGAR score in predicting post-operative morbidity and mortality in patients undergoing laparotomy – A prospective study. IAIM. 2019;6(6):67-74.
22. Global Surg Collaborative. Mortality of emergency abdominal surgery in high-, middle- and low-income countries. Br J Surg. 2016;103:971-988.
23. Bhushanam KY, Samantaray A, Thottikat K, et al. Validation of surgical APGAR score in abdominal surgeries at a tertiary care teaching hospital in South India. J Clin Sci Res. 2021;10:85-90.
24. Howbora N, Thota RS, Pargunde S, et al. Utility of Surgical Apgar Score in Predicting Post-operative Complications After Whipple Procedure in Pancreatic Cancer Patients. Indian J Surg Oncol. 2025;16(4):819-826.
25. Ngarambe C, Smart BJ, Nagarajan N, Rickard J. Validation of the surgical apgar score after laparotomy at a tertiary referral hospital in Rwanda. World J Surg. 2017;41(7):1734-1742.