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Original Research Article

A prospective study of P-POSSUM score in predicting morbidity and mortality in patients undergoing gastrointestinal surgeries

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ABSTRACT

Background: The comparison of morbidity and mortality rates is an essential component of the surgical audit using severity scores, which helps in risk prediction, identification of patients with unexpected outcomes, and improving clinical decisions. The objective was to determine the accuracy of the Portsmouth-physiological and operative severity score for the enumeration of mortality and morbidity (P-POSSUM score) in predicting the anticipated morbidity and mortality rate and to compare it with the actual morbidity and mortality rate in patients undergoing gastrointestinal surgeries in the Indian population.
Methods: This study was conducted over 02 years at Mamata General Hospital. It included 80 patients who were clinically suspected cases of gastrointestinal diseases and underwent both elective and emergency gastrointestinal surgeries. Diagnosis was based on history, thorough physical examination and routine investigations. Operative parameters like operative severity, number of procedures, blood loss, peritoneal soiling, presence of malignancy, and mode of surgery were recorded for each patient as per a predetermined proforma. Patients were followed-up for a period of 30 days post-surgery.
Results: The commonest age group of the study population was less than 60 years (45%) followed by 61 to 70 years (43.8%). The male-to-female ratio was 1.6:1. The majority of the cases were of gastrointestinal perforation (22.4%) and cholelithiasis (22.4%). Surgical site infections (SSIs) were the most commonly encountered postoperative complications (55.6%). Only 05 cases of mortality were encountered. Among physiological severity parameters, systolic blood pressure, pulse rate, haemoglobin level, total leucocyte count, serum urea, and serum sodium were significantly associated with morbidity and mortality. Among operative severity parameters, blood loss, peritoneal soiling and mode of surgery were significantly associated with morbidity and mortality.
Conclusions: The P-POSSUM scoring system is a useful tool for surgical risk stratification and helps in predicting morbidity and mortality in patients undergoing gastrointestinal surgeries.

Keywords: P-POSSUM, Mortality, Gastrointestinal surgeries

INTRODUCTION

The basic aim of any surgical care is to reduce morbidity and mortality rates. It is done by comparing the influence on the adverse outcome. The comparison of morbidity and mortality rates is an essential component of the surgical audit. For a good audit, it is important to compare risk-adjusted mortality and morbidity rates rather than crude rates, as outcomes are directly related to the risks associated with surgery.[1] It is important to predict mortality and morbidity using severity scores, which help in risk prediction, identification of patients with unexpected outcomes, improve clinical decisions, help in conducting risk-adjusted audit and finally, assess the quality of patient care by hospitals.[3] The POSSUM, proposed in 1991, is a well-validated scoring system for

predicting postoperative morbidity, and Portsmouth 2 modification (P-POSSUM) is a validated scoring system for predicting 30-day postoperative mortality risk in patients undergoing general and emergency surgery.[3] The original POSSUM surgical scoring system was found to overestimate the mortality rate in low-risk patients consistently; thus, a modification, the Portsmouth-POSSUM (P-POSSUM), was made, which claimed to produce a closer fit with the observed outcomes.[2]The equation for predicting morbidity and mortality using P-POSSUM is: Log (R1/1-R1)=-5.91+(0.16×PS)+(0.19×OSS) and Log (S1/1-S1)=-9.37+(0.19×PS)+(0.15 × OSS) respectively, where R1 stands for predicted risk of morbidity and S1 denotes predicted risk of mortality.[3] Hence, this study was designed to test the utility of the P-POSSUM scoring system in the Indian scenario, where malnourishment is a common problem; presentation is frequently delayed; and the resources are limited, all of which can influence the patient's complication rate, even with adequate quality of care provided.

METHODS

This study was conducted in the Department of Surgery, Mamata General Hospital and Medical College, Khammam, over a period of 02 years from March 2023 to February 2025. The study was conducted among a study population of 80 patients, who underwent both elective and emergency gastrointestinal surgeries. These patients were included in this study with their written consents after a full explanation of the study protocol. The study was conducted with the prior approval of the ethical committee of the institution. Following inclusion and exclusion criteria were considered for the study.

Inclusion criteria

All the patients admitted to undergo various gastrointestinal surgeries, both elective and emergency surgeries, patients above 18 years of age, irrespective of sex, who were willing to participate in the study and patients in whom the follow-up criteria of the 30-day follow-up were met were included in the study.

Exclusion criteria

Patients who underwent non-gastrointestinal surgeries, patients below 18 years of age, not willing to participate in the study and patients in whom the follow-up criteria of 30 days were not met were excluded from the study.

A detailed clinical history was obtained, followed by a general physical examination with detailed local and systemic examination. Patients were subjected to routine investigations. Operative parameters like operative severity, number of procedures, blood loss, peritoneal soiling, presence of malignancy, and mode of surgery were recorded for each patient as per the preformed proforma. The follow-up period was 30 days post-surgery. The collected data was entered into an MS excel sheet, and analysis was done using the Statistical Package for Social Sciences software version 26. Descriptive statistics were employed to summarise quantitative variables of clinical data. Standard deviation was calculated as a measure of variation. Qualitative variables were expressed as percentages with 95% CI.

RESULTS

Out of the 80 patients included in the study population, 36 (45.0%) were aged ≤60 years, while 35 patients (43.8%) were between 61 and 70 years. Only 09 patients (11.2%) were above 70 years of age, indicating that most patients undergoing gastrointestinal surgeries in this study were under the age of 70 years. The mean age of the study population was 59.2±11.5 (Table 1).

Table 1: Distribution of patients by age, (n=80).

Age (in years)	N	Percentage
≤60	36	45
61-70	35	43.8
>70	09	11.2
Total	80	100

The male-to-female ratio (M: F) was 1.6 1. The most common diagnoses were cholelithiasis and gastrointestinal perforation, each accounting for 18 patients (22.4%), reflecting their prominence as causes for surgical intervention. The majority of patients (55%) underwent elective procedures, indicating stable presentations. Urgent surgeries after resuscitation were performed in 28.7% of cases, while 16.3% required immediate emergency surgical interventions. Post-operative complications were observed in 18 patients (22.5%), while the remaining 62 patients (77.5%) had an uneventful recovery (Figure 1).

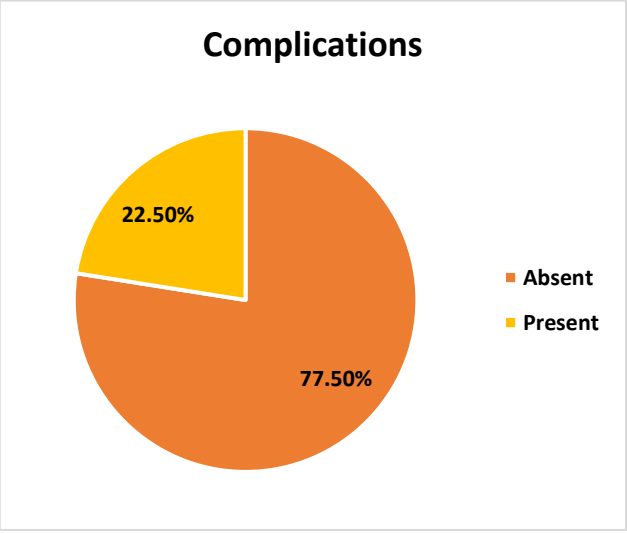

Figure 1: Distribution of patients according to post-operative complications.

Among the 18 patients who developed post-operative complications, the most common complication was SSIs, which occurred in 10 patients (55.6%). Other complications included wound dehiscence in 04 patients (22.2%), anastomotic leaks and hypotension in 02 patients (11.1%) each. A total of 05 patients (6.2%) succumbed to their post-operative complications, with cardiac failure being the most frequent cause of death.

The mean physiological severity score, as per the P-POSSUM system, was 21.5±8.65, while the mean operative severity score was 14.0±5.84. These scores were utilised to predict the risk of post-operative morbidity and mortality in the study population (Table 2).

Table 2: Physiological severity score and operative severity score.

P-POSSUM score	Mean	SD
Physiological severity score	21.5	8.65
Operative severity score	14.0	5.84

Regarding morbidity, the highest proportion of complications (50%) occurred in the group of patients having a systolic blood pressure (SBP) of 131-170 mmHg. Statistical analysis showed a highly significant association between SBP and morbidity (χ^2=22.134, p<0.001), indicating that elevated SBP is a strong predictor of postoperative complications. Regarding mortality, 04 out of 05 deaths (80%) occurred in the SBP group of 131-170 mmHg, suggesting a strong association between elevated SBP and postoperative mortality (Figure 2).

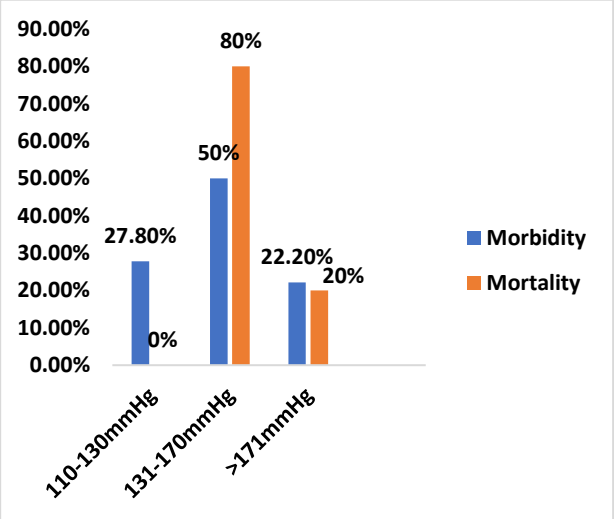

Figure 2: Association of SBP with morbidity and mortality.

The highest number of complications occurred in patients with pulse rates between 101 and 120 bpm, accounting for 10 out of 18 morbidity cases (55.6%), indicating a strong correlation between elevated pulse rate and postoperative morbidity with statistical significance. Concerning mortality, 04 out of the 05 total deaths (80%) occurred in the 101-120 bpm range, suggesting that elevated pulse rates are associated with an increased risk of death. The most common haemoglobin range among patients was 11.5-12.9 gm/dl (41.2%), followed by 10-11.4 gm/dl (31.2%). Both morbidity and mortality were significantly associated with lower haemoglobin levels. In terms of morbidity, a significantly higher proportion of complications occurred in patients with WBC counts ≥20.1×10¹²/L, comprising 61.1% of all morbidity cases. Considering mortality, 04 out of 05 deaths (80%) occurred in the ≥20.1×10¹²/L group, indicating that elevated WBC counts may serve as a predictor of poor postoperative outcomes, significantly associated with increased morbidity and mortality, highlighting the potential role of systemic inflammatory response or underlying sepsis in adverse surgical outcomes. The majority of patients (77.5%) exhibited no peritoneal soiling, with 10 (55.6%) of these developing morbidity, and 01 (20%) mortality. Statistical analysis indicated a significant association between peritoneal soiling and both morbidity (χ^2=10.874, p=0.012) and mortality (χ^2=17.697, p=0.001). These results highlight that extensive intra-abdominal contamination is a critical risk factor for adverse surgical outcomes, particularly mortality (Figure 3).

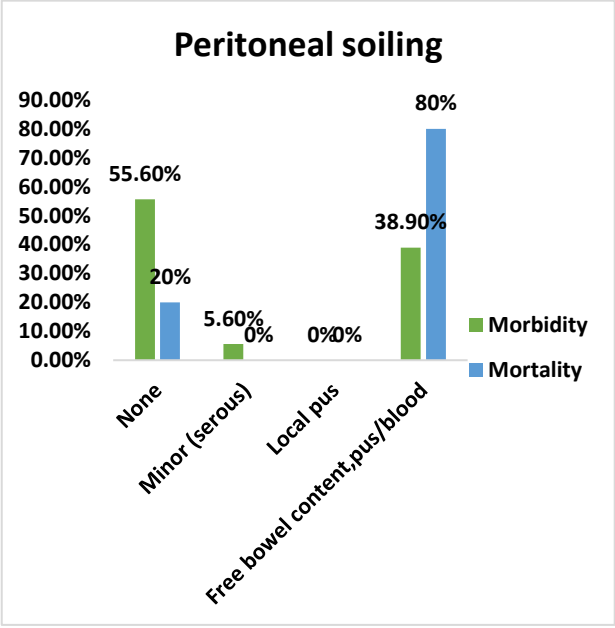

Figure 3: Association of peritoneal soiling with morbidity and mortality.

Among the 80 patients, 44 (55%) underwent elective surgery, showing the lowest rates of both morbidity (02 patients, 11.1%) and mortality (0%). In contrast, among the 23 patients (28.7%) who underwent semi-emergency procedures (requiring resuscitation and intervention within 24 hours), 07 (38.9%) developed complications, and 01 (20%) died. The statistical analysis indicates a highly significant association between the mode of surgery and both morbidity (χ^2=25.242, p<0.001) and

mortality (χ^2=16.414, p<0.001). Comparison of the predicted morbidity rate (based on the P-POSSUM physiological and operative severity scores) with the observed morbidity shows varying degrees of correlation across different predicted ranges, showing that there was no statistically significant difference between the predicted and observed morbidity rates. Comparison between the predicted mortality rate and the observed mortality rate using the P-POSSUM scoring system indicated no statistically significant difference between the predicted and observed mortality rates.

DISCUSSION

Gastrointestinal surgeries, ranging from elective resections to emergency laparotomies, are often associated with significant postoperative complications and mortality risks. Accurate prediction of these outcomes is crucial for surgical planning, patient counselling, and allocation of intensive care resources. The P-POSSUM scoring system was developed to refine the original POSSUM model, aiming to better estimate morbidity and mortality by incorporating a combination of physiological and operative parameters. By correlating predicted outcomes with actual clinical results, this research seeks to validate the utility of the P-POSSUM score as a reliable risk stratification tool in gastrointestinal surgery. In the studies done by Echara et al and Ngulbe et al consisting of 100 patients and 166 patients respectively, it was found that the majority of patients were in the age group ≤60 years, comparable to the age structure of this study.[1,2] In the present study, the most frequent diagnoses among patients undergoing major gastrointestinal surgery were cholelithiasis (22.4%) and gastrointestinal perforation (22.4%), which is comparable to the study conducted by Echara et al, Kumar et al, and Yelamannchi et al.[1,7,8] The most frequent postoperative complication observed in this study was surgical site infection (55.6%), followed by wound dehiscence (22.2%), and systemic complications (11.1%), such as hypotension, impaired renal function, and septicemia. These findings are consistent with earlier research done by Ngulube et al, Nambi et al which also highlighted SSIs and wound-related issues as common morbidities following emergency abdominal surgery.[2,3] The findings in this study indicate that operative severity was significantly associated with morbidity but not mortality Mohil et al also identified operative severity as a key determinant of postoperative outcomes, particularly morbidity.[13] There was a highly significant correlation between blood loss and both morbidity (p=0.002) and mortality (p=0.028). Morbidity and mortality rates increased with higher estimated blood loss. This distribution is relatively similar to the findings in the studies by Mohil et al and Tekkis et al.[4,5] The findings show a strong association between peritoneal soiling and both morbidity (p=0.012) and mortality (p=0.001). The most adverse outcomes were seen in patients with gross contamination by bowel contents, pus, or blood which is similar to the data from the study of Prytherch et al, Kumar et al and Yelamanchi et al.[6-8] This study showed a very strong association between mode of surgery and both morbidity and mortality which correlates with findings from the study by Yelamanchi et al.[8] The P-POSSUM system, as referenced in the study by Echara et al also reported a similar range of physiological parameters to determine the likelihood of complications.[1] The distribution of operative severity scores in this study aligns with the findings from the study by Tekkis et al where major surgeries were linked to higher scores and greater postoperative morbidity and mortality.[4]

CONCLUSION

This study highlights the utility of the P-POSSUM scoring system in predicting morbidity and mortality for patients undergoing gastrointestinal surgeries. The findings suggest that while the system provides valuable predictive insights, its effectiveness is somewhat limited by the patient population's characteristics, sample size, and lack of multivariate analysis. The study found that the observed morbidity and mortality rates were lower than the predicted rates, indicating potential overestimation by the scoring system in this cohort. The results also underline the importance of refining the predictive models, possibly through recalibration or the integration of additional factors such as surgeon experience and post-operative care quality. Despite its limitations, the P-POSSUM score remains a useful tool for surgical risk stratification, but further validation and larger-scale studies are needed to enhance its accuracy and applicability across diverse patient populations and surgical settings.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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