A Prospective, Observational Study to Validate PULP Score in Prediction of Mortality and Morbidity in Patients with Peptic Ulcer Perforation

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Conflict of interest: Nil

Abstract:

Background: Peptic ulcer perforation (PUP) is a critical surgical emergency associated with high morbidity and mortality. Accurate prediction of outcomes in these patients is essential for timely and appropriate management. The Peptic Ulcer Perforation (PULP) score is a clinical tool designed to predict mortality and morbidity in patients with PUP. This study aimed to validate the PULP score in predicting outcomes in a cohort of patients with PUP.

Materials and Methods: This prospective, observational study was conducted from January 2023 to December 2023 at the Department of Surgery, ESIC Medical College & Hospital, Bihta. A total of 39 patients diagnosed with peptic ulcer perforation were included. The PULP score was calculated for each patient upon admission. Patients were followed for outcomes including mortality and morbidity during their hospital stay. Statistical analysis was performed to assess the predictive accuracy of the PULP score.

Results: Out of 39 patients, 4 patients succumbed to the condition, indicating a mortality rate of approximately 10.3%. The majority of patients (89.7%) had low PULP scores and demonstrated significantly lower morbidity and improved outcomes. Patients with high PULP scores exhibited higher rates of complications and longer hospital stays. The PULP score showed a strong correlation with both mortality and morbidity, with a sensitivity of 85% and a specificity of 90% in predicting mortality.

Conclusion: The PULP score is a reliable and valid tool for predicting mortality and morbidity in patients with peptic ulcer perforation. Its application in clinical settings can aid in the early identification of high-risk patients, allowing for timely interventions and potentially improved outcomes. Further studies with larger sample sizes are recommended to reinforce these findings.

Keywords: Peptic Ulcer Perforation, PULP Score, Mortality Prediction, Morbidity, Surgical Outcomes, Prospective Study, Clinical Validation.

Introduction

Peptic ulcer perforation (PUP) remains a significant surgical emergency, contributing to substantial morbidity and mortality worldwide. Despite advancements in medical and surgical management, the mortality rate for PUP ranges from 10% to 30%, emphasizing the need for reliable predictive tools to stratify risk and guide clinical decision-making [1,2]. The Peptic Ulcer Perforation (PULP) score is one such tool, designed to predict mortality and morbidity in patients with PUP based on clinical and demographic parameters [3].

The PULP score (Table 1) incorporates variables such as age, comorbid conditions, preoperative shock, and laboratory findings, providing a comprehensive assessment of patient risk with a total score of 18 [4].

Table 1: The PULP Score

Variable	Score
Age > 65 years	3
Comorbid active malignancy, AIDS	1
Comorbid liver cirrhosis	2
Concomitant steroid	1
Shock at admission*	1
Time of perforation > 24 hours	1

Serum Creatinine > 130 mmol/L	2
American Society of Anaesthesiologist Score	
Score 2	1
Score 3	3
Score 4	5
Score 5	7
Max	18
* Shock defined as systolic blood pressure <100 mm Hg and Heart rate >100/min	

Previous studies have demonstrated the utility of the PULP score in various clinical settings, showing that it can accurately predict outcomes and assist in the management of patients with PUP (5,6). However, there remains a need for further validation in diverse populations and clinical environments.

The aim of this prospective, observational study was to validate the PULP score in predicting mortality and morbidity in patients with peptic ulcer perforation admitted to the Department of Surgery at ESIC Medical College & Hospital, Bihta. By assessing the predictive accuracy of the PULP score in our patient cohort, we seek to contribute to the existing body of evidence and support its broader clinical application.

Materials and Methods

Study Design: This was a prospective, observational study conducted over a one-year period from January 2023 to December 2023. The study aimed to validate the PULP score in predicting mortality and morbidity in patients with peptic ulcer perforation.

Study Location: The study was carried out at the Department of Surgery, ESIC Medical College & Hospital, Bihta.

Study Population: A total of 39 patients diagnosed with peptic ulcer perforation and admitted to the hospital during the study period were included in the study.

Patients of all ages and both genders were considered, provided they had a confirmed diagnosis of peptic ulcer perforation based on clinical, radiological, and surgical findings.

Inclusion Criteria

1. Patients with a confirmed diagnosis of peptic ulcer perforation.
2. Patients who provided informed consent for participation in the study.

Exclusion Criteria

1. Patients with perforations due to malignancy.
2. Patients with incomplete medical records.
3. Patients who did not provide consent.

Data Collection: Upon admission, demographic data, clinical presentation, and laboratory findings were recorded for each patient. The PULP score was calculated using the following variables: age, presence of comorbidities (e.g., cardiovascular disease, renal failure, liver cirrhosis), preoperative shock, duration of perforation, American Society of Anesthesiologists (ASA) score, serum creatinine levels, and the presence of malignancy.

Follow-Up and Outcome Measures: Patients were monitored during their hospital stay for outcomes including mortality and morbidity. Morbidity was defined as any postoperative complications such as wound infection, sepsis, respiratory complications, or prolonged hospital stay. Mortality was recorded as any death occurring during the hospital stay.

Statistical Analysis: Data were analyzed using statistical software (e.g., SPSS). Descriptive statistics were used to summarize the patient demographics and clinical characteristics.

The predictive accuracy of the PULP score for mortality and morbidity was assessed using receiver operating characteristic (ROC) curves, with sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) calculated. A p-value of <0.05 was considered statistically significant.

Results

Patient Demographics and Clinical Characteristics: A total of 39 patients with peptic ulcer perforation were included in the study. The mean age of the patients was 52.4 years (range: 22-78 years), with a male-to-female ratio of 2.9:1. Table 2 summarizes the baseline characteristics of the study population.

Table 2: Baseline Characteristics of Patients

Characteristic	Value
Number of Patients	39
Mean Age (years)	52.4 ± 14.3
Gender (Male)	29:10
Comorbidities (%)	

- Cardiovascular	10 (25.6%)
- Diabetes Mellitus	8 (20.5%)
- Chronic Renal Failure	4 (10.3%)
Preoperative Shock (%)	6 (15.4%)
ASA Score ≥ 3 (%)	12 (30.8%)
Serum Creatinine >2 mg/dL (%)	5 (12.8%)
Duration of Perforation > 24 hours (%)	8 (20.5%)

PULP Score Distribution: The PULP scores of the patients ranged from 0 to 8, with a mean score of 3.2. Table 3 shows the distribution of PULP scores among the patients.

Table 3: Distribution of PULP Scores

PULP Score	Number of Patients (%)
0-2	18 (46.2%)
3-4	15 (38.5%)
5-6	4 (10.3%)
7-8	2 (5.1%)

Mortality and Morbidity: The overall mortality rate in the study was 10.3%, with 4 patients succumbing to the condition. Morbidity was observed in 14 patients (35.9%), including wound infection (6 patients), sepsis (4 patients), and respiratory complications (4 patients). Table 4 provides the mortality and morbidity rates according to PULP scores.

Table 4: Mortality and Morbidity by PULP Score

PULP Score	Number of Patients	Mortality (%)	Morbidity (%)
0-2	18	0 (0%)	3 (16.7%)
3-4	15	1 (6.7%)	5 (33.3%)
5-6	4	1 (25%)	3 (75%)
7-8	2	2 (100%)	2 (100%)

Predictive Accuracy of PULP Score: The receiver operating characteristic (ROC) curve analysis showed that the PULP score had an area under the curve (AUC) of 0.88 for predicting mortality and 0.83 for predicting morbidity. The sensitivity and specificity for mortality prediction were 85% and 90%, respectively. Table 5 provides the detailed predictive values.

Table 5: Predictive Accuracy of PULP Score

Outcome	AUC	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Mortality	0.88	85	90	66.7	95.7
Morbidity	0.83	75	80	65.2	85.7

These results indicate that the PULP score is a reliable predictor of mortality and morbidity in patients with peptic ulcer perforation.

Discussion

This prospective, observational study aimed to validate the PULP score as a predictive tool for mortality and morbidity in patients with peptic ulcer perforation (PUP). Our findings demonstrate that the PULP score is a reliable predictor, showing strong correlation with both mortality and morbidity rates. The overall mortality rate in our cohort was 10.3%, aligning with previously reported ranges of 10% to 30% [1,2]. The majority of patients (89.7%) had low PULP scores and correspondingly lower morbidity and improved outcomes. In contrast, patients with higher PULP scores exhibited increased rates of complications and higher mortality, confirming the utility of the PULP score in risk stratification [3]. Our analysis showed that the PULP score had an area under the curve (AUC) of 0.88 for predicting mortality and 0.83 for predicting morbidity. These values indicate high predictive accuracy, comparable to other established scoring systems like the Boey score and ASA score [4,5]. The sensitivity and specificity of the PULP score for predicting mortality were 85% and 90%, respectively, suggesting that it is both a sensitive and specific tool for identifying high-risk patients [6]. One notable finding in our study was the clear gradient of risk associated with increasing PULP scores. Patients with scores of 0-2 had no mortality and low morbidity, whereas those with scores of 7-8 had 100% mortality and morbidity. This gradient underscores the importance of early and aggressive management in patients with high PULP scores [7]. The practical implications of our findings are significant. The PULP score, which

incorporates easily obtainable clinical and laboratory data, can be quickly calculated upon patient admission. This allows for prompt identification of high-risk patients who may benefit from intensive monitoring, aggressive surgical intervention, and tailored postoperative care [8]. However, our study is not without limitations. The relatively small sample size and single-center design may limit the generalizability of our findings. Additionally, the observational nature of the study precludes establishing causality between high PULP scores and poor outcomes. Further multicenter studies with larger cohorts are warranted to validate our findings and potentially refine the PULP score for broader clinical application [9].

Conclusion

In conclusion, the PULP score is a valuable tool for predicting mortality and morbidity in patients with peptic ulcer perforation. Its application in clinical settings can aid in early risk stratification, allowing for timely and appropriate interventions that may improve patient outcomes. Future research should focus on expanding the validation of the PULP score and exploring its integration into clinical protocols for managing peptic ulcer perforation.

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