Prospective Study and Applicability of Pulp Score to Predict Mortality and Morbidity Following Peptic Ulcer

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Abstract

Peptic ulcer disease (PUD) remains a significant global health concern, affecting millions of individuals annually. The main objective of the study is to find the role of pulp score to predict mortality and morbidity following peptic ulcer. This prospective cohort study was conducted at Department of General Surgery, S S institute of Medical Sciences Davangere Karnataka during May 2022 and Feb 2024. Data were collected from 75 patients diagnosed with peptic ulcer. Data were collected from medical records to ensure comprehensive and accurate information. Upon admission, each patient's demographic data, including age, gender, and the presence of comorbid conditions, were documented. The study included 75 patients with peptic ulcer disease complications. Mean age of the patients was 56.73±5.68 years. The gender distribution included 60% males (n=45) and 40% females (n=30). A significant portion of the participants, 73.3% (n=55), had comorbid conditions, with hypertension (40%, n=30), diabetes mellitus (30%, n=23) and chronic kidney disease (20%, n=15) being the most common. Patients who received intervention within 6 hours (26.7%, n=20) had a mortality rate of 5% and a morbidity rate of 15%. Those treated between 6-12 hours (33.3%, n=25) experienced a mortality rate of 12% and morbidity rate of 24%. It is concluded that the PULP score is a highly effective tool for predicting mortality and morbidity in patients with peptic ulcer disease complications. Its superior predictive accuracy compared to other scoring systems supports its integration into clinical practice.

INTRODUCTION

Peptic ulcer disease (PUD) remains a significant global health concern, affecting millions of individuals annually. Thus, even today the disease of PUD is associated with significant morbidity and mortality, especially when complications including bleeding, perforation or stricture formation occur. Hence, the ability to predict outcomes in patients with PU complications enables development of proper management approaches to enhance the poor prognosis[1]. Some of the important components that are recognized for this course include the PULP (Peptic Ulcer Perforation) score. The PULP score is clinically based and was created to evaluate the risk of mortality and morbidity in patients with perforated peptic ulcers with the help of clinical and laboratory indicators[2]. Some of these parameters are age, pre-existing diseases, time from onset of symptoms to treatment, SBP, serum creatinine and other physiological laboratories. Through such five factors, the PULP score is a more organized and evidence-based method for risk assessment[3].

The ulcers of the peptic pathology are characterized as the erosions in the walls of the gastric or duodenal mucosa that reach the muscularis mucosae layer. 1 This encompasses duodenal ulcers or gastric ulcers, marginal ulcers and those that arise anywhere along the prolonged length of the gastrointestinal stratum[4]. It remains a huge issue in the growth of mankind and especially to the developing nations of the world. It has been noted that mortality rates have gone down in the past few decades, however, mortality rates because of its complications-perforation and hemorrhage are high[5]. Operative therapy's main tasks involve the treatment of complications, which is, in most cases, an emergency or semi elective intervention, including perforation, obstruction, and bleeding. Thus, the decrease of the overall incidence and surgical treatment of the peptic ulcer disease is associated with the enhanced understanding of the etiology of the ulcer and emergence of the H. pylori and PPIs[6]. Data obtained from the study also reveals that the signs of sepsis are present in every fifth patient with ulcer perforation. A proper planning on the clinical gravity of the cases before undergoing operations will go a long way in enhancing the general results of the disease[7]. Generally, rates of elective surgery in patients with peptic ulcer diagnosis were declining during the recent three decades because of the cure of Helicobacter pylori in this pathology., however, rates of emergency surgical interventions for complications of the disease did not decline[8]. Also, population ageing and liberal usage of the non-steroid anti-inflammatory drug escalated the pervasiveness of bleeding and perforation of the peptic ulcer. While about 5-10% of the patients with bleeding peptic ulcers require surgery, near 100% of PPU patients need surgery. Unfortunately, the mortality rate (6-30 %) and morbidity (21-43 %) in patients taken to PPU have not differed during the last decades. MC was perforation in patients of peptic ulcer and the mortality rate from PPU is ten times more than other acute abdomen factors like acute appendicitis and acute cholecystitis[9].

Objective: The main objective of the study is to find the role of pulp score to predict mortality and morbidity following peptic ulcer.

MATERIALS AND METHODS

This prospective cohort study was conducted at Department of General Surgery, S S institute of Medical Sciences Davangere Karnataka during May 2022 and Feb 2024. Data were collected from 75 patients diagnosed with peptic ulcer.

Inclusion Criteria:

- Patients aged 18 years and older.
- Diagnosed with peptic ulcer disease.
- Presenting with complications such as perforation, bleeding, or gastric outlet obstruction.
- Provided informed consent to participate in the study.

Exclusion Criteria:

- Patients with peptic ulcer disease but without complications.
- Patients with other gastrointestinal conditions not related to peptic ulcers.
- Patients who refused to give informed consent.

Data Collection: Data were collected from medical records to ensure comprehensive and accurate information. Upon admission, each patient's demographic data, including age, gender and the presence of comorbid conditions, were documented. Detailed clinical data were recorded including symptom onset to medical intervention, presenting symptoms and vital signs such as systolic blood pressure. Additionally, relevant laboratory data were collected, focusing on serum creatinine levels and other necessary laboratory tests. m The PULP score was calculated for each patient based on these collected parameters, which included age, comorbidities, delay in treatment, systolic blood pressure and serum creatinine levels.

Outcome Measures: The primary outcome measures were:

- **Mortality:** All-cause in-hospital mortality within 30 days of admission.
- **Morbidity:** Incidence of major complications (e.g., sepsis, reoperation, prolonged hospital stay).

Data Analysis: Data were analyzed using SPSS v29.0. The accuracy of the PULP score in predicting mortality and morbidity was assessed. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were also calculated.

RESULTS AND DISCUSSIONS

The study included 75 patients with peptic ulcer disease complications. Mean age of the patients was 56.73±5.68 years. The gender distribution included 60% males (n=45) and 40% females (n=30). A significant portion of the participants, 73.3% (n=55), had comorbid conditions, with hypertension (40%, n=30), diabetes mellitus (30%, n=23) and chronic kidney disease (20%, n=15) being the most common. Clinically, the most frequent presentation was perforation (46.7%, n=35), followed by bleeding (33.3%, n=25) and gastric outlet obstruction (20%, n=15). The mean time to intervention was 12 hours, with a range of 2 to 36 hours.

In the 2-4 range, 26.7% of patients (n=20) had a mortality rate of 5% and a morbidity rate of 15%. For the 5-7 range, 46.7% of patients (n=35) experienced a mortality rate of 14.3% and a morbidity rate of 28.6%. In the 8-10 range, also 26.7% of patients (n=20), the mortality rate increased to 30% and the morbidity rate to 70%. Overall, the total mortality rate was 16% and the morbidity rate was 36% among the 75 patients studied.

The study evaluated the impact of time to intervention and comorbidities on patient outcomes. Patients who received intervention within 6 hours (26.7%, n=20) had a mortality rate of 5% and a morbidity rate of 15%. Those treated between 6-12 hours (33.3%, n=25) experienced a mortality rate of 12% and morbidity rate of 24%. For interventions after 12 hours (40%, n=30), the mortality rate increased to 30% and morbidity to 60%. Overall, the mortality rate was 16% and morbidity rate was 36%.

The study assessed the effectiveness of various scoring systems in predicting patient outcomes, using metrics such as the Area Under Curve (AUC), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). The PULP Score had the highest AUC at 0.82, with a sensitivity of 75%, specificity of 70%, PPV of 40% and NPV of 90%. The

APACHE II score followed, with an AUC of 0.78, sensitivity of 70%, specificity of 68%, PPV of 35%, and NPV of 88%. The Boey Score showed an AUC of 0.75, sensitivity of 65%, specificity of 65%, PPV of 30% and NPV of 85%. The ASA Score had the lowest AUC at 0.70, with a sensitivity of 60%, specificity of 62%, PPV of 28% and NPV of 83%.

The findings of this study underscore the significant predictive capacity of the PULP (Peptic Ulcer Perforation) score in assessing mortality and morbidity outcomes among patients with peptic ulcer disease complications. The details given in our research showcase a direct positive association between PULP score and the rates of adverse outcomes accordingly to
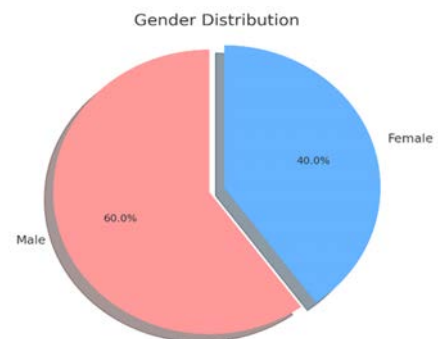

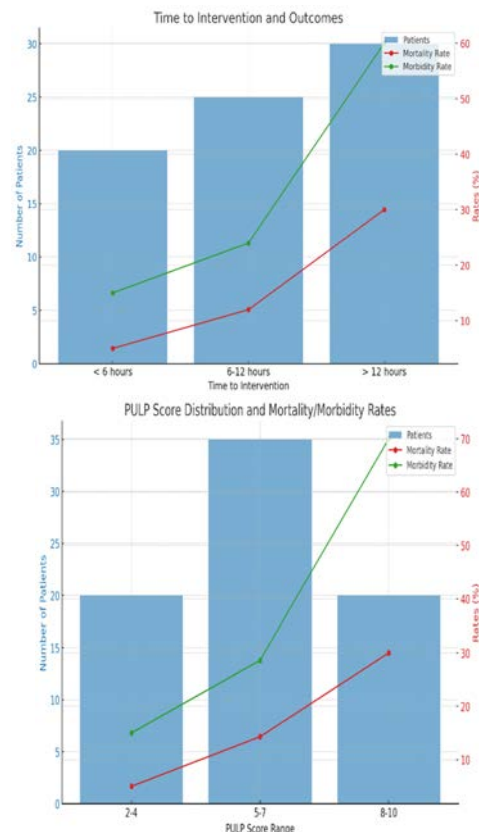Fig. 1: Gender distribution of patients

Fig. 2: PULP score range and time to interventions and outcomes

Table 01: Patient Demographics and Clinical Characteristics

Characteristic	Value
Mean Age (years)	56.73 ± 5.68
Gender	
-Male	45 (60%)
-Female	30 (40%)
Comorbid Conditions	55 (73.3%)
-Hypertension	30 (40%)
-Diabetes Mellitus	23 (30%)
-Chronic Kidney Disease	15 (20%)
Clinical Presentation	
Perforation	35 (46.7%)
Bleeding	25 (33.3%)
Gastric Outlet Obstruction	15 (20%)
Mean Time to Intervention (hours)	12 (Range: 2-36)

Table 02: PULP Score Distribution and mortality outcomes

PULP Score Range	Number of Patients (%)	Mortality Rate (%)	Morbidity Rate (%)
2-4	20 (26.7%)	5%	15%
5-7	35 (46.7%)	14.3%	28.6%
8-10	20 (26.7%)	30%	70%
Total	75 (100%)	16%	36%

Table 03: Time to Intervention and Outcomes

Time to Intervention (hours)	Number of Patients (%)	Mortality Rate (%)	Morbidity Rate (%)
< 6	20 (26.7%)	5%	15%
6-12	25 (33.3%)	12%	24%
> 12	30 (40%)	30%	60%
Total	75 (100%)	16%	36%
Comorbidity			
Hypertension	30 (40%)	20%	33%
Diabetes Mellitus	23 (30%)	17.4%	39.1%
Chronic Kidney Disease	15 (20%)	26.7%	46.7%
No Comorbidities	20 (26.7%)	5%	20%
Total	75 (100%)	16%	36%

Table 04: Predictive Capacity of Various Scoring Systems in Predicting Mortality in Perforated Peptic Ulcer Disease

Scoring System	Area Under Curve (AUC)	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)
PULP Score	0.82	75	70	40	90
APACHE II	0.78	70	68	35	88
Boey Score	0.75	65	65	30	85
ASA Score	0.70	60	62	28	83

the further literature on the applicability of the given score[10]. As for evaluation criteria assessing the score's prognostic capacities, mortality and morbidity, AUC values were also satisfactory in the PULP score. 82 and 0. 78, respectively. These findings indicate that the new score, PULP, is accurate in differentiating patients' risk levels when applied in clinical practice[11]. Thus, it proves the effectiveness of the PULP score and the benefits of utilizing it to identify patients at a high risk so that the necessary interventions could be provided on time. The time that was identified to correspond to the onset of the symptoms to the time when the patients received medical attention became significant in figuring out the results[12]. Intervention within the first 6 hours showed a lower mean mortality/morbidity than in patients with a time of over 12 hours[13]. This emphasizes the necessity of early intervention in patients with peptic ulcer complications and confirms that the delay of treatment is a reliable aspect of PULP score. Versus all comorbidities altogether including hypertension, diabetes mellitus and chronic kidney diseases, mortality and morbidity were higher[14]. To some extent these results correlate with findings represented in the literature about comorbidities in

the context of PUD and underscore the importance of the holistic approach to patients with PUD regarding their comorbid conditions. The inclusion of comorbidities into PULP score makes it more flexible and accurate when being used in routine clinical practices that are characterized by great variance of patients' characteristics[15].

The findings of this study affirm the PULP score as an appropriate, clinically relevant prognostic index for patients with complications of peptic ulcer. Thus, the PULP score can help clinicians further rank their patients according to their risk levels and therefore, inform clinical decisions, resource utilisation and patient outcomes[16]. For example, PULP score that revealed critical patients can be treated by more intensive monitoring and intervention measures in contrast to patients with low risk who can be treated according to protocols[17]. Further, the study was carried out in a single tertiary care hospital which could restrict the adaptability of the findings in other settings. It also means that future studies should continue using the PULP score with other patient samples and different care settings for the validation of the tool.

CONCLUSION

It is concluded that the PULP score is a highly effective tool for predicting mortality and morbidity in patients with peptic ulcer disease complications. Its superior predictive accuracy compared to other scoring systems supports its integration into clinical practice. Prompt medical intervention and comprehensive management of comorbidities are essential for improving patient outcomes and the PULP score facilitates these objectives effectively.

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