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A Prospective Observational Comparative Study of Peptic Ulcer Perforation Score (Pulp) V/S Boey Score to Assess Best Predictor of Mortality in Peptic Perforation in Tertiary Health Care Centre in Ajmer, Rajasthan

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Abstract

Introduction: Perforated peptic ulcer (PPU) is a severe surgical emergency associated with substantial morbidity and high mortality rates, necessitating effective risk-stratification models like the Peptic Ulcer Perforation (PULP) and Boey scoring systems. Peptic ulcers are usually located in the stomach or proximal duodenum but can also be found in the esophagus or Meckel's diverticulum.

Objectives: This study aimed to compare the predictive accuracy of the PULP scoring system versus the Boey scoring system for 30-day mortality in patients presenting with peptic ulcer perforation, alongside evaluating demographic profiles, clinical presentations, and postoperative complications.

Material and Methods: This prospective, observational, comparative study was conducted in the Department of Surgery, Jawaharlal Nehru Medical

College and Associated Group of Hospitals, Ajmer, Rajasthan, from June 2024 to November 2025. A total of 175 adult patients diagnosed with peptic ulcer perforation who underwent emergency exploratory laparotomy were evaluated. Demographic parameters, clinical histories, Intraoperative findings, and postoperative outcomes were systematically recorded and analyzed.

Results: The study showed a mean age of 48.93 years with a marked male predominance (80.00%, n=140). The vast majority of patients (90.86%, n=159) presented more than 24 hours after perforation onset, and duodenal perforations (65.71%, n=115) were significantly more common than gastric perforations. The overall 30-day mortality rate was 19.43% (n=34). The PULP score effectively stratified mortality risk, demonstrating high sensitivity, specificity, and overall diagnostic accuracy. Conversely, while the Boey score identified high-risk patients, it classified a substantially larger proportion of survivors as high risk, resulting in a higher false-positive rate and lower diagnostic accuracy.

Conclusion: The PULP scoring system is a superior and more reliable prognostic tool than the Boey score for predicting 30-day mortality in patients with peptic ulcer perforation, optimizing clinical management and risk assessment.

Keywords: Perforated Peptic Ulcer, Peptic Ulcer Perforation Score, Boey Score

Introduction

Peptic ulcers (PUs) are usually located in the stomach or proximal duodenum but can also be found in the esophagus or Meckel's diverticulum[1]. The origin of perforated peptic ulcer (PPU) is multifactorial it is most commonly associated with Helicobacter pylori (HP) infection and non-steroidal anti-inflammatory drugs (NSAIDs)[2]. Peptic ulceration occurs due to acid peptic damage to the gastro-duodenal mucosa, resulting in mucosal erosion that exposes the underlying tissues to the digestive action of gastro-duodenal secretions. This pathology was traditionally related to a hyper secretory acid environment, dietary factors and stress[3].PPU carries high morbidity and mortality. The prognosis of PPU is influenced by several key factors: delayed hospital presentation, perforation diameter >1 cm, age ≥65 years, hemodynamic instability (shock), comorbid conditions and gastric (versus duodenal) perforation site. Additionally, preoperative shock, established sepsis and generalized peritonitis critically impact morbidity and mortality[4]. Peptic ulcer disease (PUD) affects 4 million people around the world yearly out of which 10% - 20% of these patients develop complications and 2% - 14% of the ulcers will perforate[5]. Mortality and morbidity following perforated peptic ulcer (PPU) is substantial, and mortality rates of 25–30% have been reported indifferent published studies[6]. The open abdominal approach is traditional, yet carries the risk of increased Intraoperative blood loss, length of stay (LOS), postoperative pain and overall complication rates in comparison with laparoscopic surgery for a variety of emergency and elective surgical procedures[7]. However, laparoscopic surgery is associated with increased procedure time and can be considered more challenging[8]. Even in recent reports, the mortality from perforated peptic ulcer (PPU) remains up to 27%[9] and complications are reported in 20–50% of the patients[10].

Two validated scoring systems are widely used

1. **Boey Score (Boey et al., 1987): Three** prognostic factors, namely preoperative shock, long-standing perforation, and associated medical diseases, were identified in patients with perforated peptic ulcer by

Boey *et al* in 1982 and validated in 1987.[11] Valued for simplicity and bedside applicability.

2. **PULP Score (Moller et al., 2012)[12]:** The Peptic Ulcer Perforation (PULP) score, derived by Moller et al. is a more comprehensive prediction rule for 30-day mortality in patients with PPU.

Aims and Objectives

The primary aim of this study is to compare the predictive accuracy of the Peptic Ulcer Perforation (PULP) scoring system with the Boey scoring system for predicting 30-day mortality in patients presenting with peptic ulcer perforation. The specific objectives include evaluating the demographic profile, clinical presentation, intraoperative findings, and postoperative complications of these patients, analyzing the risk distribution within the study cohort using both scoring systems, and assessing the diagnostic efficacy—including sensitivity, specificity, positive predictive value, negative predictive value, and overall accuracy—of the PULP score versus the Boey score in guiding clinical management and prognosis.

Material and Methods

This prospective, observational, comparative study was carried out in the Department of Surgery, Jawaharlal Nehru Medical College and Associated Group of Hospitals, Ajmer, Rajasthan, India, from June 2024 to November 2025.A total of 175 patients diagnosed with peptic ulcer perforation were evaluated to compare the predictive accuracy of the PULP and Boey scoring systems for 30-day mortality. The study included patients of both genders aged 18 years and older who were clinically and radio logically diagnosed with peptic ulcer perforation and underwent emergency exploratory laparotomy. Patients with non-peptic ulcer gastrointestinal perforations (such as appendicular, typhoid, or traumatic perforations), patients managed conservatively without surgery, pregnant women, and patients with incomplete medical records or those who were lost to follow-up were excluded. Detailed demographic data, clinical histories, presentation timelines, intraoperative parameters, and postoperative outcomes were systematically recorded and analyzed for each patient.

Composition and calculation of the scoring systems

Boey score[11].

Three preoperative variables, each scoring one point when present

- major concomitant medical illness
- preoperative shock (systolic blood pressure <90 mmHg at admission
- duration of perforation >24 hours. Total 0–3. For diagnostic analysis, a score of 2–3 was defined as "test positive" (high risk) and 0–1 as "test negative."

PULP score[17/13]

Eight weighted variables: age >65 years (3 points); comorbid active malignancy or AIDS (1); comorbid liver cirrhosis (2); concomitant steroid use (1); preoperative shock (1); time from perforation to admission >24 h (1); serum creatinine >1.47 mg/dL (2); and ASA class (ASA 2 = 1, ASA 3 = 3, ASA 4/5 = 5). Total 0–18. A score >7 was defined as "test positive" (high risk), in accordance with the originally described cut-off.

Data was mapped across four clinical phases: emergency triage (demographics, vitals, history of NSAIDs/ alcohol/ smoking, and co morbidities), laboratory/ radiological workup (chest X-ray for free gas, serum creatinine, ABG), Intraoperative documentation (site, size, and peritoneal contamination nature), and 30-day

postoperative monitoring via the Clavien - Din do classification system.

Statistical Analysis

Data was analyzed using the Chi-square test and 't'-test. A p-value of <0.05 was considered statistically significant.

Results

Table 1: Distribution of Demographic Parameters (Age and Gender) Among Patients with Perforated Peptic Ulcer (n = 175)

Demographic Parameter		Number of Patients (n)	Percentage (%) / Ratio	P-Value
Age	< 65 years	136	77.71%	< 0.0001 (S)
	>65 years	39	22.29%	
	Mean Age	175 (Total)	48.93±17.71 years	
Gender	Male	140	80.00%	< 0.0001 (S)
	Female	35	20.00%	
	M:F Ratio	--	04:01	

Table 2: Distribution of Presentation and Clinical History Parameters Among Patients with Perforated Peptic Ulcer (n = 175)

Presentation & Clinical History Parameter		Number of Patients (n)	Percentage (%)
Time from Perforation to Admission	> 24 hours	159	90.86%
Abdominal Pain	Yes	175	100.00%
Guarding and Rigidity	Yes	175	100.00%
Abdominal Distension	Yes	168	96.00%
Addiction History (Alcohol)	Yes	100	57.14%
Use of NSAIDs	Yes	119	68.00%

Table 3: Distribution of Intraoperative Parameters among Patients with Perforated Peptic Ulcer (n = 175)

Intraoperative Parameter		Number of Patients (n)	Percentage (%)	P-Value
Site of Perforation	Duodenal perforation	115	65.71%	< 0.0001 (S)
	Gastric perforation	60	34.29%	
Size of Perforation	0.5 to 1.0 cm	166	94.86%	--
	1.0 to 2.0 cm	9	5.14%	
Peritoneal Collection	Biliopurulent	159	90.86%	--
	Bilious	16	9.14%	

Table 4: Distribution of Postoperative Complications and Outcomes Among Patients with Perforated Peptic Ulcer (n = 175)

Postoperative Complication / Outcome	Number of Patients (n)	Percentage (%)
Surgical Site Infection (SSI)	56	32.00%

Fever	38	21.71%
Death (Mortality)	34	19.43%
Respiratory Complication	27	15.43%
Septicemia	22	12.57%
Pleural Effusion	19	10.86%
Repair Site Leak	16	9.14%
Burst Abdomen	15	8.57%
Acute Kidney Injury (AKI)	13	7.43%

Table 5: Comparison of Diagnostic Accuracy Parameters (True Positives, False Positives, True Negatives, and False Negatives) Between PULP and

Boey Scoring Systems (n = 175)

Scoring System	Test Result Threshold	True Positives (TP)	False Positives (FP)	True Negatives (TN)	False Negatives (FN)	Total Positive Cases	Total Negative Cases
PULP Score	> 7 (Positive Test)	30	13	--	--	43	--
	≤ 7 (Negative Test)	--	--	128	4	--	132
Boey Score	2–3 (Positive Test)	32	98	--	--	130	--
	0–1 (Negative Test)	--	--	43	2	--	45

Discussion

The demographic profile of the study showed a mean age of 48.93±17.71 years, indicating that perforated peptic ulcer most frequently affects middle-aged and older adults. A significant majority of the patients (77.71%, n=136) were under 65 years of age, whereas 22.29% (n=39) were aged 65 years or older (p<0.0001). Similarly, Saiphy G et al. (2022)[13] documented a mean age of 47.2 years, and Patel S et al. (2019)[14] who reported a mean age of 42.42 years. Furthermore, the study demonstrated a striking male predominance, with males accounting for 80.00% (n=140) of the cases and females making up 20.00% (n=35), resulting in a statistically significant male-to-female ratio of 4:1 (p<0.0001).Similarly, Sengupta S et al. (2023)[15] observed 68.35% males and 31.65% females. A higher male predominance was reported by Bharath B et al. (2022)[16], with 87.27% males and 12.73% females, while Saiphy G et al. (2022)[13] documented 89.1% males and 10.9% females.This higher vulnerability among men is broadly attributed to a higher prevalence of lifestyle risk factors, including increased rates of smoking, alcohol intake, NSAID usage, and occupational stress.(Table 1)

Analysis of the presentation and clinical history parameters revealed several critical patterns regarding disease severity and patient behavior upon admission. The vast majority (90.86%, n=159) presented more than 24 hours after the onset of perforation, while only a small minority (9.14%, n=16) arrived within 24 hours. In terms of clinical presentation, all 175 patients (100%) presented with sudden onset abdominal pain alongside guarding and rigidity, while 96.00% (n=168) exhibited

abdominal distension. These findings show absolute concordance with previous literature by Verma AM et al. (2020)[17] and Bharath B et al. (2022)[16], both of which also documented 100% patient presentation with acute abdominal pain. A positive history of alcohol consumption was documented in 57.14% (n=100) of the patients, and a substantial majority—68% (n=119)—reported regular use of non-steroidal anti-inflammatory drugs (NSAIDs). (Table 2)

Analysis of the Intraoperative parameters revealed crucial insights regarding the anatomical distribution, severity, and local contamination patterns associated with peptic ulcer perforation. Regarding the site of perforation, duodenal perforations accounted for a significant majority at 65.71% (n=115), while gastric perforations were observed in 34.29% (n=60), representing a statistically significant difference ($p < 0.0001$).In terms of perforation size, the vast majority of cases (94.86%, n=166) measured between 0.5 to 1.0 cm, with only a small fraction (5.14%, n=9) measuring between 1.0 to 2.0 cm. Intraoperative inspection of the peritoneal cavity demonstrated an overwhelming predominance of Biliopurulent peritoneal collection in 90.86% (n=159) of the patients, whereas purely bilious collection was seen in only 9.14% (n=16). (Table 3).

Regarding postoperative morbidity, complications developed in a substantial proportion of the cohort, reflecting the high baseline physiological stress and advanced peritoneal contamination associated with delayed presentation. Surgical site infections (SSI) and pulmonary complications such as pneumonia or atelectasis emerged as the predominant morbidities, frequently lengthening hospital stays and requiring targeted medical intervention. In terms of clinical outcome, the most common postoperative complications were surgical site infection (32%), fever (21.71%), and mortality (19.43%). Respiratory complications (15.43%) and septicemia (12.57%) were also notable. Overall, infectious and surgical complications were predominant. The overall 30-day mortality rate for the study was recorded at 13.71% (n=24), while the remaining 86.29% (n=151) of patients survived and were successfully discharged. Similarly, Sengupta S et al. (2023)[15] reported burst abdomen in 5.06%, postoperative sepsis in 10.13%, pulmonary infection in 13.92%, and SSI in 40.51%, showing slightly lower rates of burst abdomen, sepsis, and pulmonary infection but a higher incidence of SSI than the present study. Verma AM et al. (2020)[17] documented burst abdomen in 20%, pulmonary infection in 30%, and SSI in 28%, indicating substantially higher rates of burst abdomen and pulmonary infection but a slightly lower SSI rate compared with the present study. (Table 4)

In the present study, patients were categorized into Boey score risk groups, with 25.71% falling into the low-risk category (score 0–1) and 74.29% in the high-risk category (score 2–3), reflecting a substantial proportion of patients presenting with multiple adverse prognostic factors and severe disease. In comparison with previous studies, the distribution of Boey scores reveals notable variations across different patient cohorts. Nulukurthi TK et al. (2023)[18] and Tudu P et al. (2022)[19] reported that 21.36%, 26.21%, 22.33%, and 30.10% of their patients had Boey scores of 0, 1, 2, and 3 respectively, meaning more than half of their cohorts fell into the higher-risk categories (scores 2 and 3). Saiphy G et al. (2022)[13] observed 12.7% of patients with a score of 0, 58.2% with a score of 1, 24.5% with a score of 2, and only 5.0% with a score of 3, indicating a predominantly lower-risk group.

In the present study, 75.43% of patients had a PULP score <7 (low-risk category) and 24.57% had a score >7 (high-risk category). Comparing these findings with previous literature, Patel S et al. (2019)[14] reported nearly identical results with 74.21% and 25.79%. Meanwhile, Koranne A et al. (2022)[20] observed a slightly higher proportion of high-risk patients at 31.1% (68.9%<7), whereas Murchite SA et al. (2021)[21] noted the highest low-risk proportion at 84% (16%>7). (Table 5)

Conclusion

The PULP score effectively stratified patients according to mortality risk, with the majority of deaths occurring in patients with a PULP score >7, whereas most patients with a PULP score ≤7 survived. Although the Boey score also identified high-risk patients, it classified a substantially larger proportion of survivors as high risk, resulting in a considerably higher false-positive rate. Consequently, the PULP score demonstrated excellent diagnostic performance with high sensitivity, specificity, negative predictive value, and overall accuracy, whereas the Boey score, despite slightly higher sensitivity, showed poor specificity, low positive predictive value, and markedly lower overall diagnostic accuracy.

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