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Original Research Article

Predictive validity of the Boey scoring system for postoperative outcomes in perforated peptic ulcer disease: a prospective study from a tertiary center of Nepal

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ABSTRACT

Background: Perforated peptic ulcer (PPU) is a surgical emergency with high morbidity and mortality, making risk stratification critical. The Boey score (comorbidity, preoperative shock (SBP <90 mmHg), presentation delay >24 h) is a simple preoperative tool for predicting PPU outcomes.
Methods: Authors conducted a prospective observational study (February 2023–Mar 2025) in Kathmandu, including 94 adults (18-80 years) undergoing emergency laparotomy for PPU. We recorded each patient's demographics and calculated the Boey score. All patients received standard surgical repair (Graham's patch and lavage). Outcomes were 30-day postoperative morbidity, mortality and hospital stay.
Results: Patients (mean age 40.05±18.17 years, 92.6% male) were stratified: Boey 0 (31.9%), Boey 1 (45.7%), Boey 2 (11.7%), Boey 3 (10.6%). Overall morbidity was 42.6%, increasing significantly: 13.3% (score 0), 46.5% (score 1), 72.7% (score 2), 80.0% (score 3) ($p<0.001$). Overall, 30-day mortality was 9.57%, rising sharply with Boey score: 0% (score 0), 4.65% (score 1), 9.1% (score 2), 60% (score 3) ($p<0.001$). Boey score ≥2 predicted morbidity with 40.0% sensitivity and 90.7% specificity (AUC=0.755, 95% CI 0.65-0.85). Boey score=3 predicted mortality with 66.7% sensitivity and 95.3% specificity (AUC=0.882, 95% CI 0.76-0.97). The mean hospital stay was 9.0±3.62 days.
Conclusions: In this study, a higher Boey score strongly predicted worse postoperative outcomes in PPU. Patients with Boey ≥2 had substantially higher complication and death rates. The simple Boey score is a valid preoperative triage tool for PPU in resource-limited settings.

Keywords: Boey score, Hospital stay, Morbidity, Mortality, Perforation, Peptic ulcer, Postoperative outcomes, Surgery

INTRODUCTION

Peptic ulcer disease (PUD) remains a common gastrointestinal condition worldwide. It affects about 4 million people each year. Although often managed medically, a substantial fraction of PUD patients (10–20%) develop complications and about 2–10% of ulcers will perforate.[1,2] Surgery is the primary treatment for perforations leading to peritonitis. While acid-reducing vagotomy (with or without drainage) was historically a mainstay, the current preferred approach is primary repair using interrupted sutures and omental patching.[2] PPU carries high morbidity and mortality. The prognosis of PPU is influenced by several key factors: delayed hospital presentation, perforation diameter >1 cm, age ≥60 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.[3] Reported mortality rates after PPU range widely–roughly 6-14% overall and up to 30%-60% at 90

days in high-risk groups.[1] In South Asia, PUD remains highly prevalent. For example, a recent Nepalese endoscopy series found that nearly 50.8% of dyspeptic patients had some peptic disease (gastritis), with active gastric or duodenal ulcers in about 19.7% of cases.[4]

To stratify risk in PPU, clinicians use scoring systems based on preoperative factors. The Boey score is one of the simplest and most widely applied. It assigns one point each for three adverse factors: major medical comorbidity, preoperative shock (systolic blood pressure <90 mmHg) and a delay to surgery longer than 24 hours.

In Boey's original analysis, mortality rose steeply with each additional point: 0%, 10%, 45.5% and 100% for patients with 0, 1, 2 or 3 points, respectively. Because it uses only three easily assessed inputs, the Boey score remains popular.[5] Multiple authors have confirmed that it has high predictive accuracy for death in PPU patients. Its simplicity facilitates early triage and decision-making, even if it may be less sensitive for predicting non-fatal complications.[1,2,6]

Aims and objectives

The primary objective of this study is to evaluate the accuracy of the Boey score in predicting 30-day postoperative mortality in patients with PPU. The secondary objective includes assessing the correlation between Boey scores and postoperative morbidity (surgical complications) and evaluating the association between Boey scores and the duration of hospital stay.

METHODS

Study design and setting

This hospital-based prospective observational study was conducted in the Department of General Surgery at the National Academy of Medical Sciences (NAMS), Kathmandu, Nepal, over two years (February 2023 to March 2025). The study enrolled 94 consecutive patients who underwent emergency laparotomy for surgically confirmed PPU. The study included adult patients aged 18–80 years who had a confirmed diagnosis of perforated peptic ulcer (PPU) during surgery and underwent emergency laparotomy for definitive management.

Patients were excluded if the perforation was due to trauma or gastric malignancy, if they declined surgical treatment or if they were managed conservatively without operative intervention. After hemodynamic stabilization, detailed patient data were collected, including demographic profile (age, gender and risk factors such as smoking, alcohol use, NSAID intake and comorbidities), clinical assessment findings (vital signs, laboratory investigations and imaging results) and Boey risk score (ranging from 0 to 3) for perioperative risk stratification (Table 1). Informed written consent was obtained from all participants or their guardians. All patients underwent standard midline laparotomy under general anesthesia with Graham's omental patch repair, peritoneal lavage and drain placement. Postoperative care included parenteral antibiotics, fluids and supportive measures. Oral feeding began after bowel motility returned (2–5 days) and drains were removed once output was <50 ml/day without signs of infection. Discharge followed clinical stability. Key outcomes assessed were hospital stay, complications, mortality and Boey score associations. The study focused on 30-day postoperative morbidity and mortality, aligning with standard benchmarks for short-term surgical outcomes.

Data collection

Data were collected at three key stages: preoperative, intraoperative and postoperative. Preoperative parameters included the Boey score criteria (time from perforation to admission >24 hours, systolic blood pressure <90 mmHg and presence of comorbidities), along with demographic details, vital signs and laboratory and imaging findings. Intraoperative data encompassed the surgical approach and size of perforation. Postoperative outcomes were assessed for morbidity, including surgical site infection, intra-abdominal sepsis and anastomotic leak, as well as 30-day mortality and duration of hospital stay (in days). This structured data collection allowed for a comprehensive analysis of risk factors and clinical outcomes in patients undergoing surgery for perforated peptic ulcer.

Statistical analysis

All statistical analyses were performed using IBM SPSS Statistics (Version 22.0) and Microsoft Office Excel. Descriptive statistics were used to summarize baseline characteristics, with categorical variables presented as frequencies and percentages and continuous variables expressed as mean±standard deviation (SD). For comparative analyses, the Chi-square test was employed to evaluate associations between Boey score categories (0-3) and key outcomes, including morbidity, length of hospital stays and mortality.

A p value<0.05 was considered statistically significant. Additionally, receiver operating characteristic (ROC) curve analysis was performed to determine the score's discriminative ability in forecasting postoperative morbidity and mortality. This comprehensive analytical approach ensured robust evaluation of the Boey score's clinical utility in risk stratification and outcome prediction following surgical management of perforated peptic ulcer.

RESULTS

This prospective study of 94 patients undergoing emergency laparotomy for perforated peptic ulcer revealed a striking male-to-female ratio of 12.4:1 (87 males (92.55%) vs 7 females (7.44%)). The cohort had a

mean age of 40.05±18.17 years and exhibited high rates of modifiable risk factors, including smoking (77.7%), alcohol consumption (63.8%) and NSAID use (12.8%) (Table 2). The age distribution analysis revealed that the majority of patients (69.1%) were under 40 years old, with the highest proportion in the 21-30 years age group (26.6%). Notably, younger adults (18-40 years) accounted for 61.7% of cases, while elderly patients (≥61 years) represented 21.3% of the cohort.

The youngest age group (18-20 years) comprised 13.8% of patients, demonstrating that perforated peptic ulcers can occur even in late adolescence. The distribution showed a gradual decline in frequency after age 40, with only 4.3% of cases occurring in patients aged 71-80 years (Table 3). Among 94 patients, 14 had comorbidities. Hypertension (HTN) was most frequent, with 8 cases, including 2 isolated cases and combinations with ischemic heart disease in 2, diabetes mellitus (DM) in 2 and chronic renal failure in 1. One patient had chronic obstructive pulmonary disease (COPD) with DM and HTN. Other findings included 2 cases each of isolated COPD, isolated DM and COPD with DM. The majority, 80 patients, showed no comorbidities. Out of 94 patients, 47 (50 %) presented over 24 hours post-perforation, indicating delayed presentation. 25 patients (26.6 %) had preoperative systolic BP below 90 mmHg, reflecting critical hypotension.

These findings highlight two key risk factors for poor outcomes: delayed intervention and hemodynamic instability before surgery. Postoperative complications occurred in 42.6% of patients (Table 4). The most frequent complication was wound infection (n=16, 17.0%), followed by pneumonia (n=12, 12.8%), fever (n=4, 4.3%), intra-abdominal collections and paralytic ileus, each occurred in 2 patients (2.1%). Anastomotic leak was the least common (n=1, 1.1%). Notably, 3 patients (3.2%) experienced multiple complications: one case each of fever with wound infection, pneumonia with fever and wound infection and paralytic ileus with pneumonia (Table 4).

Among 94 patients with perforated peptic ulcers, Boey scores were 0 (31.9%), 1 (45.7%), 2 (11.7%) and 3 (10.6%). Morbidity rose with higher scores: 13.3% (score 0) to 80% (score 3), with overall morbidity of 42.6% (Table 5). Mortality also increased: 0% (score 0) to 60% (score 3), with overall mortality of 9.57% (Table 6). Chi-square analysis showed significant associations with both morbidity (χ^2=20.59, p<0.001) and mortality (χ^2=33.75, p<0.001), confirming the Boey score's predictive validity.

Hospital stay was analyzed for survivors (n=85), excluding deaths (n=9). The mean stay was 9.0±3.62 days. Patients with Boey scores of 0–1 had shorter stays, with most discharged within 14 days. In contrast, higher scores (2–3) were linked to prolonged hospitalization, with 5 patients staying beyond 14 days. The association was statistically significant (χ^2=15.45, p=0.017), indicating that higher Boey scores predict longer hospital stays (Table 7).

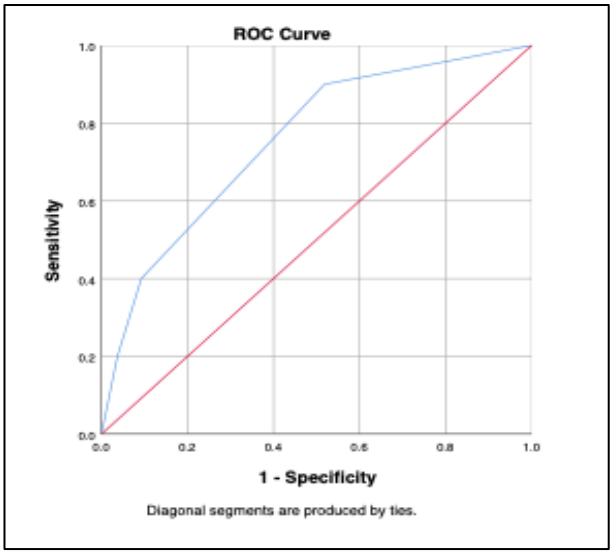

Figure 1: ROC curve for predicting 30-day postoperative morbidity using the Boey score. The diagonal line represents no discriminatory power (AUC=0.50).

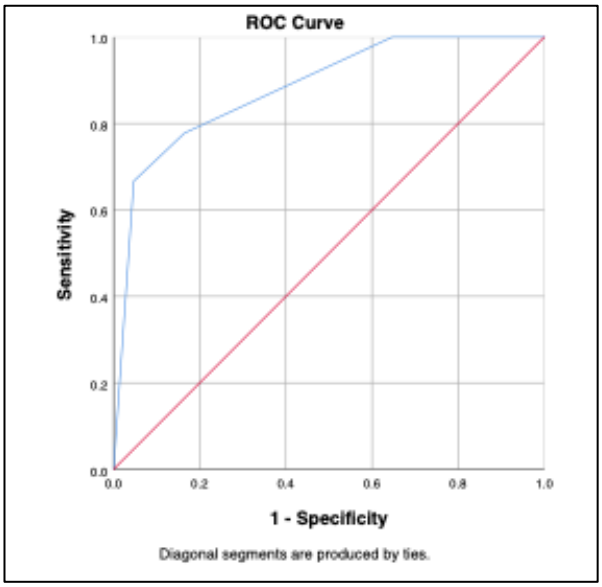

Figure 2: ROC curve for predicting 30-day postoperative mortality using the Boey score. The diagonal line represents no discriminatory power (AUC=0.50).

Receiver-operating curve character

The Boey scoring system demonstrated clinically useful performance for predicting postoperative morbidity, with an AUC of 0.755 (95% CI 0.65-0.85, p<0.001) (Figure 1). At the optimal threshold Boey score of ≥2, the score showed moderate sensitivity (40%) but high specificity

(90.7%). For mortality prediction, the Boey score exhibited even stronger discriminative ability (AUC=0.882, 95% CI 0.76-0.97, p<0.001) with a threshold Boey score of=3, providing 66.7% sensitivity and 95.3% specificity (Figure 2).

Table 1: Boey score.[5]

Risk factors	Score
Time from perforation to admission >24 hours	1
Preoperative blood pressure<90 mm Hg	1
Any one or more systemic illnesses: Heart disease, liver	1
None of the above risks present	0
Total score	3

Table 2: Baseline characteristics, risk factors.

Variable	Total (n=94)	%
Age (mean±SD)	40.05±18.17	—
Sex (Male/Female)	87 / 7	90.4 / 7.4
Smokers	73	77.7
Alcohol use	60	63.8
NSAID use	12	12.8

Table 3: Age distribution of patients with perforated peptic ulcer.

Age group (in years)	Frequency	%
18–20	13	13.83
21–30	25	26.60
31–40	20	21.28
41–50	8	8.51
51–60	8	8.51
61–70	16	17.02
71–80	4	4.26

Table 4: Distribution of postoperative complications among PPU patients.

Complication	Number of cases (N)	%
Wound infection	16	17.0
Pneumonia	12	12.8
Fever	4	4.3
Intra-abdominal collection	2	2.1
Paralytic ileus	2	2.1
Anastomotic leak	1	1.1
Combined complications		
Fever+wound infection	1	1.1
Pneumonia+fever+wound infection	1	1.1
Paralytic ileus+pneumonia	1	1.1
Total complications	40	42.6

Table 5: Association of Boey score with postoperative morbidity.

Boey score	Total patients	Morbidity	Morbidity (%)
0	30	4	13.3
1	43	20	46.5
2	11	8	72.7
3	10	8	80
Overall	94	40	42.6

Chi-square value: 20.59, p-value<0.001.

Table 6: Association of Boey score with postoperative mortality.

Boey Score	Total patients	Mortality (N)	Mortality (%)
0	30	0	0 %
1	43	2	4.65 %
2	11	1	9.09 %
3	10	6	60 %
Overall	94	9	9.57 %

Chi-square value: 33.75, p-value:<0.001.

Table 7: Distribution of length of hospital stay by Boey score.

Boey Score	Length of hospital stay		
	5-7 days	**8-14 days**	**>14 days**
0	16	14	0
1	20	17	4
2	4	3	3
3	0	2	2
Overall	40	36	9

Chi-square value: 15.45, p-value: 0.017.

DISCUSSION

In this study, patients were relatively young (mean age of 40.05±18.17 years) with a striking male predominance (92.6%). This mirrors the pattern seen in South Asian series, though our male ratio was even higher than most reports (for example, 85%–96% male in recent Indian cohorts.[7,8] Likewise, our mean age is lower than in many series: Shah et al reported a mean age of 42.38±14.71 years, Agarwal et al, reported 46.5 years and a recent Iranian series reported 47.56±17.36 years.[7-9] These findings highlight that PPU in Nepal and neighboring countries tends to occur in relatively younger adults.[7,8]

Common risk factors were also prevalent: 77.7% of our patients smoked and 63.8% consumed alcohol, proportions higher than in comparable studies (e.g., 45% smokers and 65% drinkers in the Ahmedabad series.[7] NSAID use (12.8%) was less common than in some Indian and Western studies.[7,10] Only 15% of our patients had significant comorbid illnesses, reflecting a younger, otherwise healthier population. Established predictors such as preoperative hypotension and delayed presentation were also frequent: 26.6% presented in shock and 50% had >24 hours delay in presentation. These factors (along with age ≥60, co-morbidity, etc.) are repeatedly identified as adverse prognostic markers.[9,11] For example, the recent multicenter GRACE study (n=1874) found that age >50, female gender, shock at admission and acute kidney injury were strongly associated with both 30-day morbidity and mortality, but delayed presentation was only associated with 30-day morbidity.[11] An Iranian cohort similarly flagged age>60, low albumin level, hypotension, renal failure and altered consciousness as predictors of death.[9] Our cohort's demographic and risk profile is thus consistent with known high-risk PPU features.

The overall 30-day mortality in our series was 9.57%, with 42.6% experiencing one or more complications. These rates are comparable to or slightly lower than many recent reports. For example, a large South Indian series (n=500) reported 11.6% mortality and Shah et al (Ahmedabad) found 11.67% mortality.[7,8] Likewise, the global GRACE study (52 countries) found 30-day mortality of 9.3% and morbidity of 48.5%, very similar to our outcomes.[11] In contrast, an Indonesian series reported much higher mortality (52.8%) likely reflecting differences in case severity or resources.[12]

The morbidity rate (42.6%) falls between these values (e.g., 31.7% in Shah et al and 48.5% in GRACE).[7,11] Consistent with other series, most complications were infective (wound infection, pneumonia) and related to systemic decompensation. Multivariate analyses in many cohorts (including GRACE and Iranian data) have repeatedly identified shock, age and comorbidity as the strongest predictors of poor outcome, trends reflected in our analysis of Boey components.[9,11]

The Boey score (0–3) showed a marked stepwise association with outcomes. Our findings closely parallel those of recent studies: Shah et al, reported that morbidity rose from 8.69% (Boey 0) to 62.5% (Boey 3) and mortality from 0 to 37.5%.[7] Another study by Saafan et al reported a 30-day morbidity rate increased progressively with higher Boey scores, demonstrating a stepladder pattern: 6.2% (score 0), 9.2% (score 1) and 55.5% (score 2).13 Our AUC for 30-day morbidity and mortality was 0.755 and 0.882, respectively, comparable to 0.751 (morbidity) and 0.854 (mortality) reported by Shah et al.[7]

In summary, these results reinforce that a higher Boey score strongly discriminates risk: patients with a score≥2 had dramatically higher complication and death rates (in

our data, Boey 3 had a 15-fold higher mortality than score 2). This is in line with the original Boey validation and more recent confirmations that higher Boey predicts a steep rise in adverse outcomes.[7,8] Postoperative stay in survivors averaged 9.0 days in our study. This is in the range reported elsewhere. Shah et al, found a mean stay of 9.43±4.10 days, whereas Agarwal et al reported a longer mean stay of ~14 days.[7,8] The GRACE study's global cohort had a shorter median stay (7 days).[11] Importantly, length of stay was significantly longer for higher Boey scores in our data, consistent with observations that high-risk patients require protracted care. For example, in our series, no Boey-0 patient needed >14 days, whereas the majority of Boey-3 patients stayed beyond 8–14 days. This pattern agrees with other reports (including our χ^2 test showing the Boey index is strongly associated with prolonged hospitalization) and highlights how preoperative risk stratification can predict resource use.[7,8]

The Boey score retains significant clinical utility as a rapid, preoperative risk-stratification tool in PPU due to its simplicity relying solely on three easily assessable variables (comorbidity, hypotension and delay>24 hours) which permits expedited triage and resource allocation for high-risk patients (Boey ≥2). The PULP (Peptic Ulcer Perforation) score, which incorporates physiological and laboratory parameters (e.g., serum creatinine, albumin and respiratory rate), offers enhanced accuracy for morbidity prediction, while the APACHE-II score provides superior ICU prognostication.

Combining the Boey score with organ dysfunction or sepsis-focused systems (e.g., SOFA, PULP) creates a more comprehensive risk-assessment framework, optimizing both surgical decision-making and postoperative management in complex cases. Our findings support the continued use of the Boey score as a simple bedside tool. Despite newer models (e.g., the PULP or qSOFA scores), Boey's ease and strong predictive ability make it valuable in practice.[14] Shah et al, noted that "Boey score is simple, clinically relevant and can precisely predict postoperative morbidity, mortality and length of stay", a conclusion echoed by others.[7]

In agreement, our data show that patients with Boey≥2 constitute a high-risk group who can be identified immediately on admission, allowing early triage and aggressive management. The score's high specificity for mortality also means that a Boey-3 patient should be recognized as critical. In resource-limited settings like ours, the Boey score requires no special tests and can quickly guide decisions (e.g., level of monitoring or surgical approach) an approach recommended in recent surgical guidelines and global studies.[7,11] Overall, our results align well with recent literature from South Asia and elsewhere: high Boey scores reliably flag patients with poor outcomes, while low scores predict uneventful recoveries. The mortality (9.57%) and morbidity (≈42.6%) we observed are comparable to contemporary series.[7,11] Our younger patient profile is characteristic of the region and our high rates of smoking and alcohol use underscore the need for public health measures. Clinically, the Boey score remains a useful, validated tool to stratify PPU patients and its performance in our study confirms its practical utility for guiding care and counseling in this population.[11]

Limitations

Single-center design

Findings from one tertiary hospital in Nepal may not generalize to other settings with differing resources or patient demographics.

Limited subgroup sizes (especially Boey 2–3) reduce precision for high-risk cohort outcomes. Absence of benchmarking against other risk tools (e.g., PULP, APACHE-II) prevents relative utility assessment.

Short-term focus

30-day outcomes may miss late complications or mortality linked to the initial event.

CONCLUSION

This study validates the Boey score as a practical predictor. It is a reliable and practical tool for predicting postoperative morbidity and mortality in patients undergoing emergency surgery for perforated peptic ulcer disease. A clear stepwise increase in complications and mortality with higher Boey scores underscores its strong prognostic utility. Given its simplicity, ease of application and strong predictive validity, the Boey score can serve as an effective risk stratification tool in emergency surgical settings, especially in resource-limited environments such as Nepal. Incorporating this scoring system into routine clinical practice could aid in early triage, informed surgical decision-making and targeted intervention to improve patient outcomes.

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