International Surgery Journal
Acharya S et al. Int Surg J. 2025 Aug;12(8):1234-1239
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20252272

Original Research Article

Accuracy of predictive score of mortality in perforated peptic ulcer to predict mortality and morbidity in patients with perforated peptic ulcer

Susheel Acharya[1], Suresh Maharjan[2]*, Sabnam Sangraula[3]

[1]Department of General Surgery, Rapti Provincial Hospital, Tulsipur, Dang, Nepal
[2]Department of General Surgery, National Academy of Medical Sciences, Bir Hospital, Mahabouddha, Kathmandu, Nepal
[3]Department of Anesthesia and Critical Care, Rapti Provincial Hospital, Tulsipur, Dang, Nepal

Received: 26 April 2025
Revised: 10 June 2025
Accepted: 19 June 2025

***Correspondence:**
Dr. Suresh Maharjan,
E-mail: sureshmaharjan2024@gmail.com

ABSTRACT

Background: Peptic ulcer perforation (PPU) remains a significant surgical emergency with high morbidity and mortality, despite advancements in medical therapy. Timely and accurate prognostication is essential for optimal management. The predictive score of mortality in perforated peptic ulcer (POMPP) offers a simple, objective scoring system based on age, serum albumin and blood urea nitrogen (BUN) levels. This study aimed to assess the accuracy of the POMPP score in predicting postoperative outcomes in PPU patients.
Methods: A prospective observational study was conducted at Bir Hospital, Kathmandu, over a 12-months period from August 2021 to July 2022, including 55 patients who underwent surgery for PPU. Data were collected using a structured proforma and POMPP scores (ranging from 0 to 3) were assigned at admission. Logistic regression and ROC curve analyses were used to assess the score's predictive performance.
Results: Patients with higher POMPP scores demonstrated significantly increased rates of both mortality and morbidity ($p<0.001$). The area under the ROC curve was 0.952 for mortality and 0.971 for morbidity, indicating strong predictive accuracy. A POMPP score ≥2 was associated with a 282-fold increase in mortality risk. The score showed 85.71% sensitivity, 97.92% specificity and 95.83% accuracy for predicting mortality, while for morbidity, it showed 58.33% sensitivity, 100% specificity and 92.88% accuracy.
Conclusions: The POMPP scoring system is a practical and effective tool for predicting mortality and morbidity in PPU patients. Its simplicity and reliance on readily available parameters make it particularly useful in resource-limited settings. Early identification of high-risk patients using the POMPP score can facilitate prompt intervention and potentially improve outcomes.

Keywords: Blood urea nitrogen, Duodenal ulcer perforation, *H. pylori*, NSAIDs, Peptic ulcer disease, POMPP score

INTRODUCTION

Peptic ulcer disease (PUD), which includes gastric and duodenal ulcers, arises from an imbalance between stomach acid-pepsin and the protective mucosal barriers. It affects approximately 4 million people globally each year, with an estimated incidence of 1.5% to 3% and a mortality rate between 1.3% and 20%.[1-3] Non-steroidal anti-inflammatory drugs (NSAIDs), *Helicobacter pylori* infection, stress, smoking, corticosteroid use and a history of PUD are known risk factors for perforated peptic ulcer (PPU), with *H. pylori* and NSAIDs being the primary causes of peptic ulcer disease.[4,5] Patients with PPU typically present with sudden, severe epigastric pain, sometimes radiating to the shoulder due to pneumoperitoneum.[6] The classic triad sudden abdominal pain, tachycardia and abdominal rigidity is characteristic of PPU.[7] Among the complications of PUD, perforation is the most common reason for emergency surgery, followed by bleeding and gastric outlet obstruction.[8]

Although 10–20% of PUD patients develop complications, only 2–14% of ulcers result in perforation, often presenting as an acute abdomen with significant risk of morbidity and mortality.[6,9] The lifetime prevalence of perforation in PUD patients is around 5%.[10] While only 5–10% of bleeding peptic ulcers require surgery, nearly all cases of perforated peptic ulcer with peritonitis (PPU) need emergency surgical intervention.[11] Despite advances, PPU continues to carry a high mortality rate of 6–30% and morbidity of 21–43%, with little change over recent decades.[12]

Around 11 scoring systems have been developed to predict mortality in PPU patients. Among them, the PULP score shows the highest accuracy but is complex and involves eight variables, making it less practical.[13,14]

The Boey score is simpler and more practical, though its predictive value has varied across different studies.[15] Both scoring systems depend on detailed history-taking to determine symptom duration and co-morbidities. However, accurately tracking the time from symptom onset to admission and surgery is often difficult due to recall bias.[13-15]

The mortality prediction score for perforated peptic ulcer, developed by Menekse et al, is practical and user-friendly.[16] It includes age >65 years and two simple lab tests (albumin <1.5 g/dl and BUN >45 mg/dl). The POMPP scoring system is easy to apply, offers satisfactory predictive power and allows surgeons to quickly assess mortality risk in PPU based on objective data.[17]

The POMPP scoring system, based on three easily available parameters age, serum albumin and blood urea nitrogen can help identify patients who need early intervention. In rural settings, it allows for timely referrals, potentially reducing patient mortality and morbidity. The study aims to evaluate the accuracy of the POMPP scoring system and its effectiveness in predicting mortality and morbidity in PPU patients within our region.

METHODS

After obtaining ethical approval from the Institutional Review Board of the National Academy of Medical Sciences, a prospective observational study was conducted in the Department of General Surgery at Bir Hospital, Kathmandu, Nepal. The study was carried out over a 12-month period, from August 2021 to July 2022 and included a total of 55 patients diagnosed with perforated peptic ulcer (PPU).

Sampling method

Convenient sampling was used to enroll patients who were admitted and clinically diagnosed with peptic ulcer perforation requiring surgical intervention.

Inclusion criteria

Patients admitted and diagnosed clinically with peptic ulcer perforation requiring surgical intervention were included.

Exclusion criteria

Patients were excluded if they met any of the following criteria.

Did not provide informed consent, Age below 15 years, managed conservatively, medically unfit for general anesthesia, underwent procedures other than primary closure with omentoplasty. perforation due to trauma, peritonitis caused by perforation of other hollow viscera.

Definition of perforated peptic ulcer

Perforated peptic ulcer was defined as a full-thickness defect in the gastric or duodenal wall, confirmed intraoperatively, along with clinical signs of peritonitis and/or radiological evidence of pneumoperitoneum.

Data collection

Data were collected using a structured proforma, which included demographic information, clinical history, laboratory values and intraoperative findings. Variables relevant to the POMPP (predictive score of mortality in perforated peptic ulcer) were specifically recorded.

Age >65 years, serum albumin<1.5 g/dl, blood urea nitrogen (BUN) >45 mg/dl. Each variable was assigned a score of 1, with a total POMPP score ranging from 0 to 3.

Statistical analysis

Data were entered in Microsoft Excel and analyzed using SPSS version 25. Logistic regression and receiver operating characteristic (ROC) curve analysis were employed to evaluate the predictive accuracy of the POMPP score for postoperative morbidity and mortality. The chi-square test was used to assess the significance of associations.

Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were calculated. The area under the ROC curve (AUC) was used to assess the discriminative power of the score. Mortality within 30 days of surgery was considered as the endpoint. A 95% confidence interval was used and a p value of less than 0.05 was considered statistically significant.

RESULTS

The mean age of participants with perforated peptic ulcer was 41.91±18.14 years, ranging from 16 to 80 years. Approximately 32.7% were aged 26-35 years and 5.5% were over 75 years (Table 1).[18] After diagnosis of PPU,

each patient was assigned POMPP score. Highest proportion of the patient got zero score (69.1%) and the maximum score was seen in 5.5% (Table 2). Table 3 demonstrates that patients over the age of 65 have a 27.5 times higher risk of mortality compared to those under 65. Additionally, patients with a BUN level greater than 45 mg/dl have a 17.5 times higher risk of mortality than those with BUN levels below 45 mg/dl. Furthermore, patients with serum albumin levels greater than 1.5 mg% exhibit a 49 times higher risk of mortality compared to those with levels below 1.5 mg%.

Table 4 shows the association between different morbidities and the POMPP score, with statistically significant relationships for all except DVT. Those participants with high POMPP score had high rate of mortality (p value<0.01) as compared to those with low POMPP score (Table 5).[3]

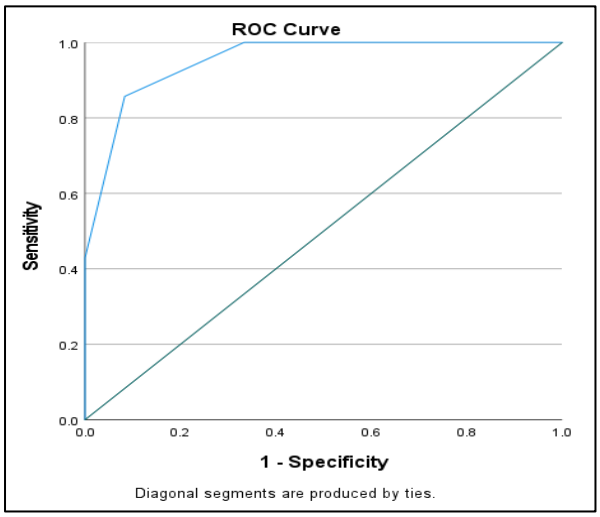

Figure 1: ROC curve of POMPP score in predicting mortality.

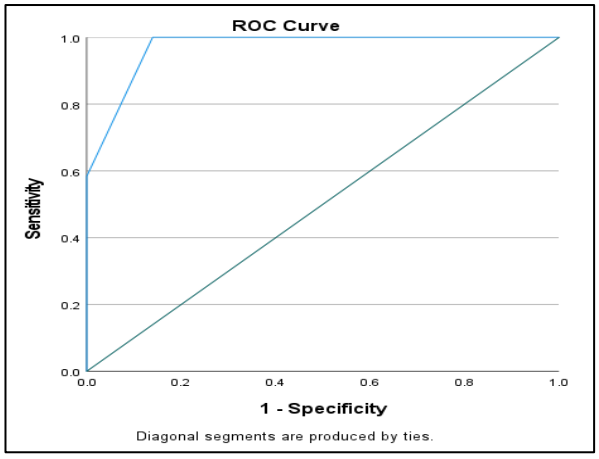

Figure 2: ROC curve of POMPP score in predicting morbidity.

ROC analysis was performed to assess the accuracy of predicting mortality based on the POMPP score at admission. The area under the curve was 0.952 (95% CI 0.886-1.000, p=0.000), indicating statistical significance (Figure 1).

ROC analysis was conducted to evaluate the accuracy of predicting morbidity based on the POMPP score at admission. The area under the curve was 0.971 (95% CI 0.934-1.000, p=0.000), which was statistically significant (Figure 2). Table 6 shows that among patient of PPU, those having POMPP score≥2 has 282 times higher chance of mortality than patient with POMPP score<2. Table 8 shows that the POMPP score has 85.71% sensitivity for mortality and 58.33% for morbidity, with 97.92% specificity for mortality and 100% for morbidity. The accuracy is 95.83% for mortality and 92.88% for morbidity.

Table 1: Age-wise distribution of participants (n=55).

Age interval (in years)	Number of patients	%
16-25	9	16.4
26-35	18	32.7
36-45	11	20.0
46-55	3	5.5
56-65	5	9.1
66-75	6	10.9
>75	3	5.5

Table 2: POMPP score assigned to patients.

POMPP score	Number of patients	%
0	37	67.3
1	11	20.0
2	4	7.3
3	3	5.5
Total	55	100.0

Table 3: Association of mortality among patients of DU perforation and their age (years), BUN (mg/dl), albumin (mg%).

Variables	Mortality		Binary logistic regression		
	Yes (%)	No (%)	OR	95% CI	P value
Age<65 (in years)	2	44	1 (Ref)		<0.001
Age≥65 (in years)	5	4	27.50	3.979-190.041	
BUN<45	2	42	1 (Ref)		0.01
BUN≥45	5	6	17.50	2.753-111.244	
Albumin<1.5	6	0	1 (Ref)		0.001
Albumin≥1.5	1	48	49.0	7.042-340.931	

Table 4: POMPP score and morbidity association.

Morbidity	POMPP score				Total	P value
	0	1	2	3		
Wound infection	0	3	3	2	8	0
ARDS	0	2	2	1	5	0.002
Repair site leakage	0	0	1	1	2	0.014
Intraabdominal abscess	0	0	0	2	2	0.02
Fever	0	4	4	3	11	<0.001
DVT	0	0	1	0	1	0.126
Relaparotomy	0	0	1	1	2	0.013
Ileus	0	1	1	2	4	0.001

Table 5: POMPP Score with mortality.

POMPP score			0	1	2	3	Total
Mortality	No	Count	37	10	1	0	48
		% within mortality	77.1	20.8	2.1	0.0	100
	Yes	Count	0	1	3	3	7
		% within mortality	0	14.3	42.9	42.9	100
Total	Count		37	11	4	3	55
	%		67.3	20	7.3	5.5	100
P value<0.01							

Table 6: Association of mortality among patients of DU perforation with their POMPP score.

POMPP score	Mortality		Binary logistic regression		
	Yes (%)	No (%)	OR	95% CI	P value
Score <2	1	47	1		<0.001
Score ≥2	6	1	282.000	15.530-5120.598	

Table 7: Morbidity among patients of DU perforation with their POMPP score.

POMPP scores	Morbidity	
	Yes (%)	No (%)
Score <2	7	0
Score ≥2	5	43

Table 8: Sensitivity, specificity, PPV, NPV, accuracy of POMPP score in predicting mortality and morbidity.

		Mortality	Morbidity
Sensitivity	TP/(TP+FN)	85.71%	58.33%
Specificity	TN/(TN+FP)	97.92%	100.00%
Positive predicting valve	TP/(TP+FP)	89.46%	100.00%
Negative predicting value	TN/(TN+FN)	97.08%	92.09%

Continued.

		Mortality	Morbidity
Accuracy	(TP+TN)/(TP+TN+FN+FP)	95.83%	92.88%

DISCUSSION

Peptic ulcer disease (PUD) was a major cause of morbidity and mortality until the late 20th century. Although the overall incidence has declined significantly with the introduction of H2 receptor antagonists and proton pump inhibitors, complications such as hemorrhage and perforation remain prevalent. The proportion of patients requiring surgery for perforated peptic ulcer (PPU) has remained steady, with considerable associated morbidity and mortality.

PUD results from an imbalance between aggressive factors like gastric acid and pepsin and the mucosal defense mechanisms. Various scoring systems including the Boey score, POMPP score, ASA classification and Mannheim Peritonitis Index (MPI) are utilized to predict postoperative mortality in PPU patients. This study aimed to evaluate the accuracy of the POMPP scoring system in predicting outcomes in patients with perforated peptic ulcer.

In our study, patients with a POMPP score of 0 had no mortality, while those with a score of 1 had a 14.3% mortality rate. Scores of 2 and 3 were both associated with a 42.9% mortality rate. Age over 65 was significantly linked to poorer outcomes, with a mortality rate of 71.4% and morbidity rate of 66.7% in this group ($p<0.001$), supporting age as an independent predictor, similar to the findings of Thorsen et al.[18]

Additionally, albumin levels below 1.5 mg/dl were associated with 85.7% mortality and 50% morbidity ($p=0.001$), consistent with Putra et al.[19] Elevated BUN levels (>45 mg/dl) were also strongly correlated with increased mortality (71.4%) and morbidity (63.6%), reinforcing BUN as a reliable preoperative predictor, in line with Menske et al.[16]

The analysis in this study demonstrated that higher POMPP scores at admission were strong predictors of both mortality and morbidity in patients with perforated peptic ulcer (PPU). Receiver operating characteristic (ROC) analysis showed excellent predictive performance, with an AUC of 0.952 for mortality and 0.971 for morbidity (both $p<0.001$).

Binary logistic regression further confirmed a significant correlation between POMPP scores and clinical outcomes. The POMPP score exhibited high accuracy in predicting mortality, with a sensitivity of 85.71%, specificity of 97.92% and overall accuracy of 95.83% ($p<0.001$). Notably, patients with a score ≥2 had a 282-fold increased risk of mortality. In predicting morbidity, the score had a sensitivity of 58.33%, specificity of 100% and accuracy of 92.88%, with higher scores indicating a greater risk of complications. These findings are consistent with previous studies, reinforcing the utility of the POMPP score as a reliable prognostic tool.

Given its high sensitivity and specificity, the POMPP score can be effectively used in rural settings where advanced diagnostic tools may not be readily available. Simple prognostic scoring systems, based on accessible resources, have proven to be both valid and reliable.

Limitations of our study are relatively small sample size and single center study.

CONCLUSION

Peptic ulcer perforation is among the most common surgical emergencies. In resource-limited settings like ours, the POMPP score may serve as a valuable prognostic tool for predicting morbidity and mortality in PPU patients.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Acharya S, Maharjan S, Sangraula S. Accuracy of predictive score of mortality in perforated peptic ulcer to predict mortality and morbidity in patients with perforated peptic ulcer. Int Surg J 2025;12:1234-9.