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ORIGINAL RESEARCH

Prognostic Nutritional Index is A Useful Predictive Marker for Morbidity and Mortality in Surgery for Perforated Peptic Ulcer

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Background: Prognostic Nutritional Index (PNI) is a useful predictor of outcomes in surgical patients. Emergency surgery for perforated peptic ulcer (PPU) remains associated with high morbidity and mortality. However, the relationship between PNI and outcomes after PPU surgery has not been fully explored. This study aimed to assess the performance of PNI in predicting morbidity and mortality among patients undergoing surgery for PPU.

Methods: This retrospective study included patients who underwent emergency surgery for PPU between 2018 and 2023. Multivariate analyses were performed to identify risk factors associated with postoperative morbidity and mortality. The predictive performance of PNI was evaluated using the area under the receiver operating characteristic curve.

Results: A total of 320 patients were included. The overall morbidity and mortality rates were 26.6% and 17.8%, respectively. The PNI was significantly lower in patients who experienced morbidity or mortality. Multivariate analysis showed that a low PNI was an independent predictor of both morbidity (Odds Ratio [OR], 1.05 per-point decrease; 95% Confidence Interval [CI], 1.01–1.10; P = 0.02) and mortality (OR, 1.09 per-point decrease; 95% CI, 1.02–1.16; P = 0.01). Patients were categorized into three PNI groups: normal (PNI ≥ 50, n = 78), mildly low (PNI 45–50, n = 61), and severely low (PNI < 45, n = 181). Mortality and morbidity rates significantly differed across these groups: 1.3%, 7.4%, and 28.7% for mortality, and 10.3%, 16.4%, and 37% for morbidity, respectively (P < 0.001). The area under the curves (AUC) for PNI predicting morbidity and mortality were 0.73 (95% CI, 0.67–0.79) and 0.81 (95% CI, 0.76–0.86), respectively.

Conclusion: PNI is a reliable predictor of morbidity and mortality following surgery for PPU. A PNI-guided risk assessment could be useful for the perioperative management of PPU patients.

Keywords: perforated peptic ulcer, surgery, prognostic nutritional index, mortality, morbidity

Background

Peptic ulcer disease is common with a lifetime prevalence in the general population of 5–10% and an incidence of 0.1–0.3% per year.[1] Perforated peptic ulcer (PPU) is a complication of peptic ulcer disease in which gas and gastro-duodenal fluid leak into the peritoneal cavity. The incidence has been estimated at six to seven per 100,000 inhabitants.[2,3] The standard operation to repair PPU disease is the Graham omental patch, with suturing of the defect and placement of an omental patch.[4] The postoperative mortality rates reaching 30% and morbidity rates of up to 50% have been reported.[4–6] Early identification of patients at increased risk for complications is essential for optimizing management and improving outcomes. Despite numerous predictive factors and scoring systems proposed to identify high-risk patients, none have proven to be universally ideal.[5–7] Among the most frequently used are the American Society of Anesthesiologists (ASA) score, the Boey score and the peptic ulcer perforation (PULP) score. The Boey score is the most frequently used score, but with varying degree of accuracy.[6–8] The PULP score appears more accurate, yet it is impractical with its complexity.[7] ASA as a scoring system is non-specific for PPU, and its major drawback is its subjective assessment.[5–7]

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Malnutrition, frequently observed in surgical patients, is linked to diminished immunocompetence, impaired respiratory function, and delayed wound healing.[9,10] Given that nutritional risk correlates with heightened postoperative complications in gastrointestinal surgery, evaluating preoperative nutritional status is crucial.[10–12] Common nutritional screening tools, such as the Mini Nutritional Assessment Short Form (MNA-SF) and Nutritional Risk Screening 2002 (NRS-2002), necessitate complex assessments or subjective inputs, which limits their utility in emergencies where rapid decision-making is essential.[13] These tools also exhibit limited sensitivity in acute inflammatory states because they depend on anthropometric measurements that may not accurately reflect real-time immunometabolic status.[13] In contrast, the Prognostic Nutritional Index (PNI) overcomes these limitations by utilizing objective, routinely available biomarkers–serum albumin and lymphocyte count–that directly correlate with the immunonutritional status of patients.[14] PNI's simplicity and objectivity make it uniquely suitable for rapid risk stratification in PPU, where delays worsen outcomes. Previous studies have demonstrated that PNI is a strong predictor of postoperative complications and outcomes in patients with malignancies, cardiovascular diseases, and infections.[14–17] However, its role in PPU patients has remained unexplored. Consequently, this study aims to investigate the impact of PNI on surgical outcomes in PPU. We hypothesized that PNI would independently predict morbidity and mortality in patients undergoing emergency surgery for PPU.

Methods

Patients

This retrospective study included patients who underwent surgical treatment for gastric or duodenal PPU at our hospital from August 2018 to March 2023. Patients who received medical treatment or had malignant ulcers were excluded. Informed consent was waived because only deidentified retrospective data were used and strict confidentiality protocols were followed to protect patient privacy throughout the research process. This study complied with the Declaration of Helsinki, and was approved by the Ethics Committee of the Affiliated Hospital of Xuzhou Medical University.

Data Collection

The following variables were collected: age, sex, American Society of Anesthesiologists (ASA) score, history of previous ulcers, preoperative shock (defined as systolic blood pressure < 100 mmHg and heart rate > 100 beats per minute), comorbidities, use of non-steroidal anti-inflammatory drugs (NSAIDs), aspirin, steroids, and anticoagulants, delay in surgery (defined as > 24 hours from perforation to surgery), ulcer site, type of surgery and surgical approach, ICU referral, and preoperative laboratory data.

Calculation of Prognostic Nutritional Index

The PNI was calculated using the formula:PNI = 10×albumin level (g/dl) + 0.005 × total lymphocyte count (per mm^3). We adopted a PNI cut-off of 45, proposed by Onodera et al[14] and divided the patients into 3 groups by the PNI: normal (PNI ≥ 50), mildly low (PNI 45–50), and severely low (PNI < 45).

Outcome Measures

Mortality was defined as any in-hospital death. Morbidity was defined as any Clavien-Dindo grade ≥II complication occurring during hospitalization.[18]

Statistical Analysis

Descriptive statistics were used to summarize data as frequencies and percentages. The χ^2 test was applied to compare proportions. Variables with a $P < 0.05$ in the univariate analysis were entered into the multivariate analysis along with the PNI. The predictive ability of PNI for morbidity and mortality was evaluated using the area under the receiver operating characteristic (ROC) curve (AUC). Data were analyzed using IBM SPSS version 20.0, and a P value of < 0.05 was considered statistically significant.

Results

A total of 320 patients were included in the study, with a median age of 68 years (range 12–98). Of these, 230 (71.9%) were male, and 37 (11.6%) had an ASA score of 3 or 4. Comorbidities were present in 164 (51.3%) patients, including hypertension (24.1%), heart disease (13.8%), cerebrovascular disease (11.9%), diabetes (10%), and respiratory distress (7.5%). The use of aspirin, NSAIDs, anticoagulants, and steroids was reported in 12.8%, 2.8%, 1.3%, and 1.3% of patients, respectively. Only 31 (9.7%) had a history of previous ulcers. Approximately 70% of patients underwent surgery within 24 hours of presentation, while 77 (24.1%) were in shock preoperatively. Half of the patients had laparoscopic repair, with the majority (> 98%) undergoing simple closure; only 1.2% required gastrectomy. Most perforations occurred in the stomach (86.9%). Two hundred patients (62.5%) were admitted to the ICU. Patients who experienced morbidity or mortality tended to be older, with more comorbidities, higher ASA scores, and worse preoperative biochemical parameters, such as lower hemoglobin and albumin levels. Significant differences were also observed in terms of PNI, preoperative shock, delay in surgery, surgical approach, and ICU admission. Baseline characteristics are summarized in Table 1.

The median PNI of the cohort was 42.9 (range, 22.4–69.4). Based on the PNI, 78 patients (24.4%) were classified as normal, 61 (19.1%) as mildly low, and 181 (56.6%) as severely low. Patients with lower PNI scores were older, more

Table 1 Baseline and Demographic Characteristics of Patients

Characteristic	Total (n = 320)	Morbidity (+) (n = 85)	Morbidity (-) (n = 235)	*P* Value	Mortality (+) (n = 57)	Mortality (-) (n = 263)	*P* Value [a]
Age ≥ 65 years	190 (59.4)	68 (80.0)	122 (51.9)	**<0.001**	52 (91.2)	135 (51.3)	**< 0.001**
Male	230 (71.9)	50 (58.8)	180 (76.6)	**0.003**	35 (61.4)	195 (74.1)	0.073
Type of comorbidity	164 (51.3)	57 (67.1)	107 (45.5)	**0.001**	45 (78.9)	119 (45.2)	**< 0.001**
Active malignant disease	22 (6.9)	9 (10.6)	13 (5.5)	0.114	4 (7.0)	18 (6.8)	0.963
COPD	24 (7.5)	8 (9.4)	16 (6.8)	0.435	12 (21.1)	12 (4.6)	**< 0.001**
Diabetes	32 (10.0)	10 (11.8)	22 (9.4)	0.527	6 (10.5)	26 (9.9)	0.884
Chronic heart disease	44 (13.8)	20 (23.5)	24 (10.2)	**0.002**	13 (22.8)	31 (11.8)	**0.029**
Cerebrovascular disease	38 (11.9)	20 (23.5)	18 (7.7)	**< 0.001**	16 (28.1)	22 (8.4)	**< 0.001**
Liver cirrhosis	15 (4.7)	9 (10.6)	6 (2.6)	**0.003**	7 (12.3)	8 (3.0)	**0.003**
Hypertension	77 (24.1)	27(31.8)	50 (21.3)	0.053	19 (33.3)	58 (22.1)	0.071
Previous peptic ulcer disease	32 (10.0)	10(11.8)	22 (9.4)	0.531	4 (7.0)	28 (10.6)	0.625
Delayed surgery	97 (30.3)	56(65.9)	41 (17.4)	**< 0.001**	53 (93.0)	44 (16.7)	**< 0.001**
ASA 3–4	37 (11.6)	20(23.5)	17 (7.2)	**< 0.001**	23 (40.4)	14 (5.3)	**< 0.001**
Use of anticoagulants	4 (1.3)	3(3.5)	1 (0.4)	**0.027**	2 (3.5)	2 (0.8)	0.090
Use of aspirin	41 (12.8)	17(20)	24 (10.2)	**0.021**	12 (21.1)	29 (11.0)	**0.040**
Use of steroids	4 (1.3)	2(0.9)	2 (0.9)	0.286	2 (3.6)	2 (0.8)	0.090
Use of NSAIDs	9 (2.8)	4 (4.7)	5 (2.1)	0.218	3 (5.3)	6 (2.3)	0.217
Shock on admission	77 (24.1)	47 (55.3)	30 (12.8)	**< 0.001**	44 (77.2)	33 (12.5)	**< 0.001**
Gastric ulcer	278 (86.9)	74 (31.5)	204 (86.8)	0.56	49 (86.0)	229 (87.1)	0.829
PNI < 45	181 (56.6)	67 (78.8)	114 (48.5)	**< 0.001**	52 (91.2)	129 (49.0)	**< 0.001**
ALB (g/L) < 40	187 (58.4)	69 (29.4)	118 (50.2)	**< 0.001**	54 (94.7)	133 (50.6)	**< 0.001**
HGB (g/L) < 100.0	43 (13.4)	25 (29.4)	18 (7.7)	**< 0.001**	16 (28.1)	27 (10.3)	**0.001**
White blood cell count (10^9/L) > 10	128 (40.0)	50 (58.8)	78 (33.2)	**< 0.001**	28 (49.1)	120 (45.6)	0.662
Neutrophil count (10^9/L) > 7.5	202 (63.1)	47 (55.3)	155 (66.0)	0.09	30 (52.6)	172 (65.4)	**< 0.001**
Lymphocyte count (10^9/L) < 0.8	144 (45.0)	52 (61.2)	92 (39.1)	**0.001**	19 (28.1)	125 (47.9)	0.053
Platelet count (10^9/L) < 100	12 (3.8)	6 (7.1)	6 (2.6)	0.09	4 (7.0)	8 (3.0)	0.238
Approach				**0.002**			**< 0.001**
Laparoscopy	160 (50.0)	30 (18.8)	130 (81.3)		15 (9.4)	145 (55.1)	
Open	160 (50.0)	55 (34.4)	105 (65.6)		42 (26.3)	118 (44.9)	
Operation type				0.712			0.546
Repair	316 (98.8)	84 (98.8)	232 (98.7)		56 (98.2)	260 (98.9)	
Resection	4 (1.3)	1 (1.2)	3 (1.3)		1 (1.8)	3 (1.1)	
ICU referral	200 (62.5)	78 (91.8)	122 (51.9)	**< 0.001**	57 (100)	143 (54.4)	**< 0.001**

Notes: Data are presented as n (%); statistically significant values ($p < 0.05$) were formatted in bold. [a] χ^2 tests were performed for significance testing.
Abbreviations: ALB, albumin; ASA, American Society of Anesthesiologists; COPD, chronic obstructive pulmonary disease; HGB, hemoglobin; ICU, intensive care unit; NSAID, non-steroidal anti-inflammatory drug; PNI, Prognostic Nutritional Index.

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likely to be female, and had a higher prevalence of comorbidities. These patients also exhibited higher rates of previous ulcer history, preoperative shock, and ICU referral. Notably, mortality and complication rates differed significantly across the groups (both $P < 0.001$; Table 2).

The overall mortality rate was 17.8% (57 patients), with rates rising from 1.3% in those with normal PNI to 7.4% and 28.7% in those with mildly low and severely low PNI, respectively (Table 2). The causes of death were as follows: septic shock (26 cases), multi-organ failure (15 cases), cardiopulmonary arrest (12 cases), hemorrhagic shock (3 cases), and cerebral hemorrhage (1 case). The median PNI was significantly lower in nonsurvivors than in survivors [34.6 (23.9–49.9) vs 45.2 (22.4–69.4); $P < 0.001$]. Univariable analysis identified several factors associated with increased mortality, including lower PNI, older age, higher ASA score, a history of ulcers, use of ulcerogenic drugs, shock, comorbidities, delayed surgery, and open surgery. Multivariable analysis revealed that lower PNI (OR, 1.09 per unit decrease; 95% CI, 1.02–1.16), higher ASA score (Odds Ratio [OR], 6.58; 95% Confidence Interval [CI], 1.80–24.06), shock (OR, 3.15; 95% CI, 1.15–8.67), and delayed surgery (OR, 20.22; 95% CI, 5.54–73.78) were independent risk factors for mortality (Table 3).

The overall morbidity rate was 26.6% (85 patients), increasing from 10.3% in those with normal PNI to 16.4% and 37% in those with mildly low and severely low PNI, respectively (Table 2). The numbers of patients with CDC grades II, III, and IV complications were 17 (5.3%), 36 (11.3%), and 32 (10.0%), respectively. Some patients experienced multiple complications. The most common complications included pulmonary infections (13.8%), surgical site infections (5.6%), cardiac events (3.8%), gastrointestinal bleeding (2.5%), wound infections (2.2%), hemorrhage (1.3%), wound disruption

Table 2 Patient Characteristics by Prognostic Nutritional Index

Characteristic	Normal PNI (n = 78)	Mildly Low PNI (n = 61)	Severely Low PNI (n = 181)	*P* Value [a]
Age ≥ 65 (years)	21 (26.9)	33 (54.1)	134 (74.0)	**< 0.001**
Male	63 (80.8)	50 (82.0)	117 (64.6)	**0.004**
Comorbidity				
Active malignant disease	7 (9.0)	3 (4.9)	12 (6.6)	0.632
COPD	1 (1.3)	3 (4.9)	20 (11.0)	**0.016**
Diabetes	7 (9.0)	5 (8.2)	20 (11.0)	0.361
Heart disease	2 (2.6)	4 (6.6)	38 (21.0)	**< 0.001**
Cerebrovascular disease	4 (5.1)	9 (14.8)	35 (19.3)	**0.013**
Liver cirrhosis	1 (1.3)	2 (3.3)	13 (7.2)	0.107
Other chronic disease	2 (2.6)	5 (8.2)	18 (9.9)	0.126
Previous peptic ulcer disease	10 (12.8)	11 (18.0)	10 (5.5)	**0.009**
Delayed surgery	5 (6.4)	11 (18.0)	81 (44.8)	**< 0.001**
Use of anticoagulants	0 (0)	0 (0)	4 (2.2)	0.211
Use of aspirin	4 (5.1)	6 (9.8)	31 (17.1)	**0.022**
Use of steroids	0 (0)	2 (3.3)	3 (1.7)	0.299
Use of NSAIDs	0 (0)	2 (3.3)	7 (3.9)	0.064
Shock on admission	3 (3.8)	7 (1.6)	70 (38.7)	**< 0.001**
Gastric ulcer	67 (85.9)	52 (85.2)	159 (87.8)	0.837
Operative approach				
Laparoscopy	44 (56.4)	33 (54.1)	83 (45.9)	0.231
Open	34 (43.6)	28 (45.9)	98 (54.1)	
Operation type				
Repair	77 (98.7)	61 (100.0)	178 (98.3)	0.602
Resection	1 (1.3)	0 (0)	3 (1.7)	
ICU referral	22 (28.2)	37 (60.7)	141 (77.9)	**< 0.001**
Mortality	1 (1.3)	4 (6.6)	52 (28.7)	**< 0.001**
Morbidity	8 (10.3)	10 (16.4)	67 (37.0)	**< 0.001**

Notes: Data are presented as n (%); statistically significant values ($p < 0.05$) were formatted in bold. [a] χ^2 tests were performed for significance testing.
Abbreviations: COPD, chronic obstructive pulmonary disease; ICU, intensive care unit; NSAID, non-steroidal anti-inflammatory drug; PNI, Prognostic Nutritional Index.

Table 3 Association Between Clinical Characteristics and Adverse Outcomes

Characteristic	Morbidity				Mortality			
	Univariate		Multivariable		Univariate		Multivariable	
	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value	OR (95% CI)	*P* Value
Age	1.04 (1.02–1.05)	<0.001	0.99 (0.97–1.01)	0.28	1.08 (1.05–1.11)	<0.001	1.02 (0.98–1.06)	0.38
Male	2.22 (1.31–3.76)	0.03	1.40 (0.71–2.75)	0.33	0.56 (0.30–1.01)	0.05	0.59 (0.22–1.57)	0.29
ASA score of 3–4	2.89 (1.96–4.25)	<0.001	2.31 (0.89–5.98)	0.84	12.03 (5.66–25.60)	<0.001	6.58 (1.80–24.06)	**0.004**
Shock on admission	8.16 (4.60–14.45)	<0.001	2.01 (0.88–4.59)	0.10	27.07 (12.96–56.53)	<0.001	3.15 (1.15–8.67)	**0.026**
Comorbidity	2.53 (1.50–4.25)	<0.001	1.03 (0.51–2.07)	0.94	4.54 (2.30–8.97)	<0.001	1.50 (0.52–4.36)	0.46
Use of ulcerogenic drugs	2.37 (1.26–4.45)	0.01	1.66 (0.75–3.69)	0.21	2.63 (1.33–5.19)	0.01	1.20 (0.40–3.62)	0.74
Delayed surgery	1.01 (1.00–1.02)	<0.001	3.62 (1.63–8.04)	**<0.001**	65.95 (22.70–191.62)	<0.001	20.22 (5.54–73.78)	**<0.001**
Open surgery	2.30 (1.37–3.87)	<0.001	1.5 1(0.81–2.83)	0.20	3.30 (1.74–6.26)	<0.001	2.44 (0.92–6.49)	0.08
History of ulcer	1.12 (0.50–2.54)	0.78	3.12 (1.19–8.21)	**0.02**	4.54 (2.30–8.97)	<0.001	4.26 (0.68–26.54)	0.12
PNI (per unit decrease)	1.10 (1.05–1.14)	<0.001	1.05 (1.01–1.10)	**0.02**	1.16 (1.11–1.22)	<0.001	1.09 (1.02–1.16)	**0.01**

Notes: Statistically significant values (p < 0.05) were formatted in bold.
Abbreviations: ASA, American Society of Anesthesiologists; CI, confidence interval; OR, odds ratio; PNI, Prognostic Nutritional Index.

(0.9%), pulmonary embolism (0.6%), and paralytic ileus (0.3%). All surgical site infections were managed successfully with intravenous antibiotics and percutaneous drainage. Among the gastrointestinal bleeding cases, two required endoscopic intervention, and one patient required re-laparotomy. Univariable analysis showed that PNI, age, sex, ASA score, shock, delayed surgery, comorbidity, use of ulcerogenic drugs, and open surgery were associated with morbidity. In multivariable analysis, lower PNI (OR, 1.05 per unit decrease; 95% CI, 1.01–1.10), a history of ulcers (OR, 3.12; 95% CI, 1.19–8.21), and delayed surgery (OR, 3.62; 95% CI, 1.63–8.04) were independent predictors of morbidity (Table 3).

Receiver operating characteristic (ROC) curves were generated to assess the predictive ability of PNI for surgical outcomes. The AUC for PNI in predicting morbidity was 0.73 (95% CI, 0.67–0.79), and for mortality, it was 0.81 (95% CI, 0.76–0.86; Figures 1 and 2).

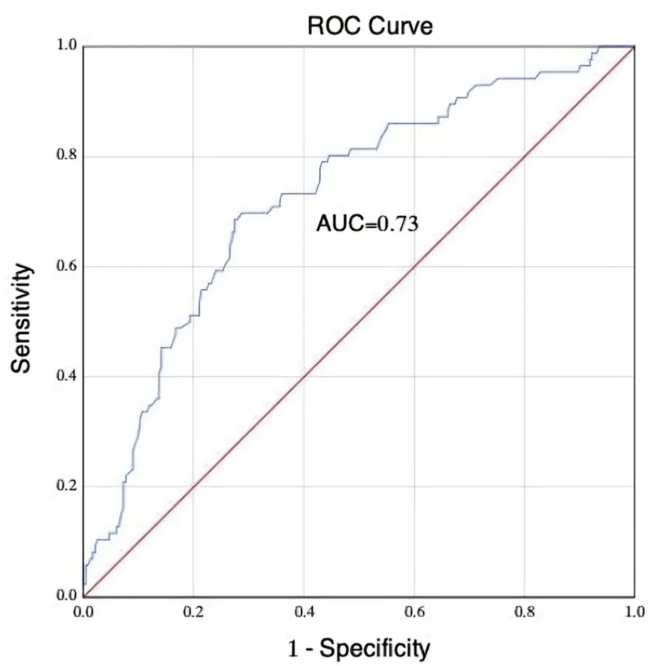

Figure 1 Receiver operating characteristic analysis of PNI for postoperative morbidity. Area under the curve (AUC) of 0.73 (95% CI, 0.67–0.79).
Abbreviation: PNI, Prognostic Nutritional Index.

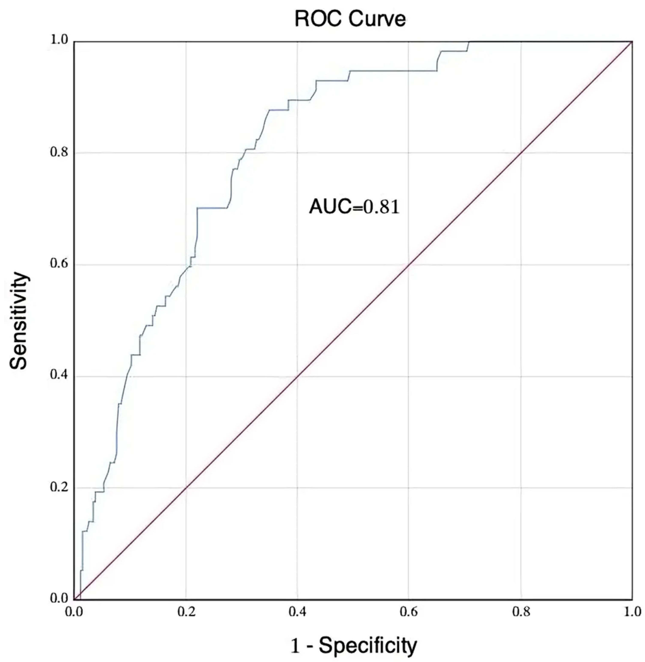

Figure 2 Receiver operating characteristic analysis of PNI for postoperative mortality. Area under the curve (AUC) of 0.81 (95% CI, 0.76–0.86).
Abbreviation: PNI, Prognostic Nutritional Index.

Discussion

Our findings reveal a significant association between low preoperative PNI and increased postoperative morbidity and mortality in PPU surgery patients. The PNI score independently influenced short-term postoperative outcomes, even when adjusting for other negative prognostic factors such as ASA status, preoperative shock, and delayed surgery.[5] Furthermore, when stratifying patients based on preoperative PNI scores, we observed a marked increase in morbidity and mortality as PNI decreased. These results underscore the utility of PNI as a valuable tool for clinical decision-making, enabling the stratification of PPU patients into distinct risk categories.

PPU represents a critical surgical emergency, often associated with poor clinical outcomes.[4] In our study, post-operative morbidity and mortality rates were 26.6% and 17.8%, respectively. The literature reports PPU morbidity rates ranging from 9.1% to 50%, which are consistent with our findings. Similarly, mortality rates, which vary from 0.8% to 30% in existing studies, align with our observed outcomes.[19–22]

Malnutrition is prevalent among patients admitted to the emergency room and constitutes a significant risk factor for postoperative complications due to its impact on immune response and wound healing.[11,23] In our study, 56.6% of PPU patients were identified as being at nutritional risk based on the PNI. In individuals with peptic ulcer disease, systemic inflammation triggered by the release of proinflammatory cytokines, such as TNF-α and IL-6, contributes to fatigue, muscle wasting, and lipolysis, which ultimately leads to malnutrition.[24] Patients with PPU are particularly vulnerable to malnutrition, given the severe catabolic effects induced by stress-related and proinflammatory cytokines and hormones.[25]

The finding that patients with a lower PNI undergoing surgical treatment for PPU have a substantially higher risk of morbidity and mortality compared to those with normal PNI is not surprising. This has been similarly observed in both cardiac and general surgery populations.[10,15,17,26] The PNI is a simple and reliable measure of both nutritional and inflammatory status, based on serum albumin concentrations and total lymphocyte counts—parameters readily evaluated in clinical laboratories. Albumin, the primary component of the PNI, is a negative acute-phase protein essential for regulating immune functions and maintaining vascular permeability.[27] Hypoalbuminemia is not only an indicator of malnutrition but also reflects a systemic inflammatory response, as albumin production is decreased by both malnutrition and inflammation, leading to an increased susceptibility to infectious complications.[25] Another critical component of the PNI is peripheral lymphocytes, white blood cells that play an essential role in both humoral and cell-mediated immunity. Lymphocytopenia disrupts the systemic inflammatory response and is often associated with a heightened risk of infectious complications.[28] Therefore, the PNI effectively reflects both immune function and nutritional status, with low PNI indicating impaired immunity and malnutrition. In this study, we found that patients with a low PNI score were at a significantly higher risk of postoperative complications and mortality. Notably, our study is the first to report that the odds ratios (ORs) for postoperative complications and mortality based on PNI were 1.05 (95% CI, 1.01–1.10) and 1.09 (95% CI, 1.02–1.16), respectively. The PNI demonstrated strong predictive power for morbidity (AUC, 0.73) and mortality (AUC, 0.81) in PPU patients. We believe that the PNI can be easily integrated into clinical practice to assess surgical risk in PPU patients. Furthermore, implementing a perioperative care protocol, incorporating evidence-based interventions and the Surviving Sepsis Campaign guidelines for high-risk patients, was associated with a significant reduction in both morbidity and mortality rates.[4]

Surgical delay is a critical determinant of survival following ulcer perforation.[5,29] Buck et al[29] reported that every additional hour of delay was associated with a 2.4% reduction in the probability of survival. In our study, 30% of patients were admitted to the operating room more than 24 hours after perforation. We found a strong association between surgical delay and outcomes, with delays exceeding 24 hours increasing mortality risk by 20.2 times and complication rates by 3.6 times. A potential explanation for this strong correlation is the heightened risk of developing severe septic shock. Prolonged perforation exacerbates diffuse peritonitis and worsens the patient's overall condition.[30,31] Our findings align with previous studies, emphasizing the critical importance of minimizing preoperative delay.[2,4,29]

The ASA score is commonly used to assess a patient's preoperative health status. Studies have demonstrated a correlation between ASA classification and postoperative morbidity and mortality in PPU cases.[32,33] For instance, Kocer et al[33] reported that each increase in ASA score doubled morbidity and increased mortality by 4.5 times. In our study, we identified ASA score as a significant predictor of mortality (P = 0.004), but not morbidity (P = 0.84). Patients with ASA scores of 3 to 4 had 6.6 times the mortality risk compared to those with scores of 1 to 2.

Limitations

This study has several limitations. First, being retrospective, it is subject to potential selection bias. The retrospective design limits causal inference. Second, it was conducted at a single center, limiting the generalizability of the findings. Third, changes in PNI before and after surgery were not evaluated. Finally, we did not compare it with other nutritional tools that may perform better than PNI in predicting PPU outcomes. Further research is necessary to validate our results.

Conclusion

In conclusion, preoperative PNI is a useful predictor of postoperative mortality and morbidity in patients with PPU. A PNI-guided risk stratification approach may assist in selecting appropriate, risk-adjusted interventions to improve surgical outcomes for PPU patients.

Disclosure

The authors report no conflicts of interest.

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