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Association of Preoperative Prognostic Nutritional Index with Postoperative Outcomes After Emergency Surgery for Strangulated Bowel Obstruction: An Exploratory Retrospective Cohort Study

Yusuke Matsune
Showa Medical University
Takeshi Aoki
takejp@med.showa-u.ac.jp

Showa Medical University
Kazuhiro Matsuda
Showa Medical University
Yuki Takagi
Showa Medical University
Minagi Ishii
Showa Medical University
Yusuke Uchida
Showa Medical University
Shun Miyasaka
Showa Medical University
Yosuke Makuuchi
Showa Medical University
Ryo Katayama
Showa Medical University
Keisuke Oura
Showa Medical University
Ken Naito
Showa Medical University
Sadahito Iseki
Showa Medical University
Shodai Nagaishi
Showa Medical University

Yukari Shinohara
Showa Medical University
Kodai Tomioka
Showa Medical University
Hideki Shibata
Showa Medical University
Yoshihiko Tashiro
Showa Medical University
Hiromi Date
Showa Medical University
Ryohei Watanabe
Showa Medical University
Kimiyasu Yamazaki
Showa Medical University

Research Article

Keywords: Prognostic nutritional index, Strangulated intestinal obstruction, Ischemia, Postoperative complications, Length of stay, Risk assessment

Posted Date: November 1st, 2026

DOI: https://doi.org/10.21203/rs.3.rs-11110078/v1

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Additional Declarations: Competing interest reported. TA is an Editorial Board Member of BMC Surgery and did not assume responsibility for overseeing peer review of this manuscript. The other authors declare that they have no competing interests.

Abstract

Background

Strangulated bowel obstruction requires rapid perioperative risk assessment. Prognostic nutritional index (PNI) is calculated from routine blood tests; however, its value in this setting is unclear. We examined its association with postoperative outcomes.

Methods

In this single-center exploratory retrospective cohort study, we included all 43 consecutive adult patients who underwent emergency surgery for strangulated mechanical bowel obstruction from April 2023 to November 2024. PNI was calculated as 10 × serum albumin (g/dL) + 0.005 × total lymphocyte count (/μL). A receiver operating characteristic (ROC) curve-derived cutoff of 40.7 was used to define the low (≤ 40.7) and high (> 40.7) PNI groups. Complications were limited to in-hospital events of Clavien–Dindo grade II or higher during the index admission. A prespecified multivariable logistic regression model including age, American Society of Anesthesiologists Physical Status (ASA-PS), and PNI group was fitted.

Results

Overall, 14 patients had low PNI and 29 had high PNI. The ROC area under the curve was 0.675 (95% confidence interval [CI], 0.511–0.839; p = 0.049 vs. 0.5). Complications were more frequent with low PNI (78.6% vs. 34.5%; p = 0.010). In 37 patients with numeric oral-intake data, time to oral intake was longer with low PNI (median, 4.5 vs. 3.0 days; p = 0.041). In a full-cohort sensitivity analysis, 10/14 (71.4%) patients with low-PNI and 27/29 (93.1%) with high-PNI were alive and resumed oral intake during the index admission (p = 0.077). In the full cohort, postoperative stay was also longer (median, 17.5 vs. 11.0 days; p = 0.026). After adjustment for age and ASA-PS, low PNI was associated with higher odds of postoperative complications (adjusted odds ratio, 5.35; 95% CI, 1.05–27.03; p = 0.044), and including PNI improved model fit ($\Delta\chi^2 = 4.52$, degree of freedom = 1, p = 0.033).

Conclusions

Low PNI was associated with overall in-hospital postoperative morbidity and slower in-hospital recovery, but not with any individual complication. PNI may provide a rapid adjunct to emergency preoperative risk assessment; however, its modest discriminatory performance limits standalone use.

Background

Strangulated bowel obstruction is a common surgical emergency that can cause bowel ischemia and requires prompt operative management. Comprehensive preoperative assessment is often challenging because decision-making and treatment must proceed rapidly. Therefore, simple and readily available markers capable of identifying high-risk patients (postoperative morbidity and delayed recovery) are clinically valuable [1, 2].

The prognostic nutritional index (PNI) was originally described by Onodera et al. [3]. Although historically regarded as a nutritional index, serum albumin is strongly influenced by systemic inflammation and disease severity and should therefore not be interpreted solely as an indicator of nutritional status [4]. Accordingly, PNI may reflect multiple physiological domains, including inflammatory burden, immune competence, nutritional vulnerability, and overall physiological reserve.

Low PNI is associated with postoperative complications in elective gastrointestinal cancer surgery [5, 6]. Heterogeneous emergency abdominal surgery, incarcerated abdominal hernia, and emergency laparotomy investigations have examined PNI; their populations, PNI thresholds, and outcomes differ substantially [7–9]. Evidence specific to strangulated bowel obstruction remains scarce. We therefore investigated the association between preoperative PNI and in-hospital postoperative outcomes in patients undergoing emergency surgery for strangulated bowel obstruction. We hypothesized that low preoperative PNI is associated with increased in-hospital morbidity and delayed in-hospital recovery.

Methods

In this single-center exploratory retrospective cohort study, we included all consecutive adult patients (≥ 18 years) who underwent emergency surgery for strangulated mechanical bowel obstruction at our institution over an approximately 20-month period (from April 1, 2023, to November 30, 2024). This study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines. Strangulated bowel obstruction was defined as mechanical obstruction caused by an internal hernia, incarcerated hernia, volvulus, or a constricting adhesive band, with strangulation confirmed intraoperatively. Patients who were managed nonoperatively, those with paralytic ileus or simple mechanical bowel obstruction without strangulation, and those undergoing elective surgery were excluded.

Preoperative serum albumin and total lymphocyte count were available for all eligible patients. PNI was calculated from blood test results obtained on the day of surgery or the preceding day using the formula 10 × serum albumin (g/dL) + 0.005 × total lymphocyte count (/μL). Receiver operating characteristic (ROC) analysis for the primary outcome was used to estimate discrimination and identify the maximum-Youden-index cutoff. The resulting cutoff was 40.7; PNI ≤ 40.7 was defined as the low-PNI group and PNI > 40.7 as the high-PNI group. Since the cutoff was derived and evaluated in the same cohort, all cutoff-based analyses were considered exploratory and hypothesis-generating rather than externally validated. Body mass index (BMI) was calculated as body weight (kg) divided by height squared (m^2). Time from

symptom onset to operation was defined as the interval between the first symptom attributable to bowel obstruction and the start of surgery, as documented in the medical record.

All outcomes were restricted to the index hospitalization because complete post-discharge ascertainment was unavailable. The primary outcome was any postoperative complication of Clavien–Dindo grade II or higher occurring from surgery until discharge or in-hospital death. Secondary outcomes included anastomotic leakage, delayed perforation, paralytic ileus, respiratory complications, time to resumption of oral intake, and postoperative length of stay. Paralytic ileus was operationally defined using the consensus framework of Vather et al. as at least two of the following criteria on or after postoperative day 4 without prior resolution: nausea or vomiting, inability to tolerate oral diet for at least 24 h, absence of flatus for at least 24 h, abdominal distension, or radiologic evidence of ileus [10]. Respiratory complications were classified using European Perioperative Clinical Outcome definitions and included respiratory infection, respiratory failure, pleural effusion, atelectasis, pneumothorax, bronchospasm, or aspiration pneumonitis. Respiratory infection required antibiotic treatment for suspected infection along with at least one new or changed sputum, new or changed lung opacity, fever, or a white blood cell count > 12×10^9/L [11]. Only events of Clavien–Dindo grade II or higher were counted. Anastomotic leakage was evaluated among the 13 patients who underwent bowel resection with anastomosis (low PNI, n = 7; high PNI, n = 6). Six patients without numeric oral-intake data because of in-hospital death (n = 2) or alternative enteral access (n = 4) were excluded from the time-to-oral-intake analysis, which therefore included 37 patients (low PNI, n = 10; high PNI, n = 27). Sensitivity analysis retained all 43 patients, classifying the outcome as being alive with resumption of oral intake during the index admission; patients who died before oral intake or used alternative enteral access without oral intake were classified as not having achieved the outcome.

Univariable binary logistic regression analyses were used to examine age, American Society of Anesthesiologists Physical Status (ASA-PS), Glasgow Prognostic Score (GPS), PNI group, and systemic inflammatory response syndrome (SIRS) status, with postoperative complications as the modeled event. GPS was included as an inflammation-based comparator to PNI because it combines C-reactive protein and albumin. The related modified GPS has been evaluated in patients with incarcerated abdominal hernias [8]. Age was entered per 1-year increase, ASA-PS per one-class increase, GPS per one-point increase, PNI as low versus high (high PNI as the reference), and SIRS as present versus absent (absence as the reference). Odds ratios (ORs), 95% confidence intervals (CIs), and two-sided Wald p values were calculated. A prespecified multivariable logistic regression model included age, ASA-PS, and PNI group, with low PNI compared against high PNI as the reference. Adjustment variables were specified before model fitting on the basis of clinical relevance and prior evidence rather than by univariate p values. Model complexity was restricted because only 21 primary-outcome events were available. A complete-case analysis was used, and multicollinearity was assessed with variance inflation factors (VIFs).

Continuous data are presented as medians and interquartile ranges (IQR) and were compared using the Mann–Whitney U test. Categorical data are presented as frequencies and percentages and were

compared using Fisher's exact test; the Fisher–Freeman–Halton extension was used for tables with more than two categories. The full-cohort binary oral-intake sensitivity analysis used Fisher's exact test. ROC discrimination was summarized with the area under the curve (AUC), 95% CI, sensitivity, specificity, and a two-sided test of the null hypothesis AUC = 0.5. Overall fit of the full multivariable model versus the intercept-only model was assessed with a likelihood-ratio test and Nagelkerke's R^2. The incremental contribution of PNI was assessed using a prespecified likelihood-ratio comparison of the reduced model containing age and ASA-PS with the full model containing age, ASA-PS, and PNI group ($\Delta\chi^2 = 4.52$, degree of freedom [df] = 1, $p = 0.033$). All tests were two-sided, and $p < 0.05$ was considered significant. Since this was an exploratory study, no adjustment for multiple comparisons was performed. All statistical analyses were performed using SPSS version 27 (IBM Corp., Armonk, NY, USA).

Results

Among the 43 included patients, 33 underwent open surgery and 10 underwent laparoscopic surgery; and 13 underwent bowel resection and 30 had bowel preservation. The median PNI was 42.4 (IQR, 38.9–47.9). ROC analysis for in-hospital postoperative complications yielded an AUC of 0.675 (95% CI, 0.511–0.839; $p = 0.049$ for the test of AUC = 0.5). At the 40.7 cutoff, sensitivity was 52.4% and specificity was 86.4% (Fig. 1). Fourteen patients had low PNI and 29 had high PNI.

[insert Fig. 1]

Compared with the high-PNI group, the low-PNI group had a higher ASA-PS (median, 3.0 vs. 2.0; $p = 0.015$) and a different GPS distribution ($p < 0.001$). Median age was higher in the low-PNI group (84.0 vs. 70.0 years); however, the difference was not significant ($p = 0.052$). Serum albumin and continuous PNI were lower in the low-PNI group, whereas total lymphocyte counts did not differ significantly. BMI, sex, SIRS status, time from symptom onset to operation, bowel resection rate, and cause of strangulation did not differ significantly between groups (Table 1).

Table 1
Baseline characteristics according to PNI group

Variable	Low-PNI group (n = 14)	High-PNI group (n = 29)	p value
Time from symptom onset to operation (h)	15.0 (12.0–45.0)	12.0 (8.0–24.0)	0.175
Age (years)	84.0 (69.2–89.2)	70.0 (59.0–78.0)	0.052
BMI (kg/m²)	18.5 (17.1–22.3)	21.6 (17.1–23.1)	0.400
CRP (mg/dL)	0.92 (0.40–3.84)	0.44 (0.13–3.72)	0.338
Serum albumin (g/dL)	3.2 (2.6–3.3)	4.1 (3.9–4.5)	< 0.001
Total lymphocyte count (/μL)	740 (437.5–1092.5)	860 (620–1290)	0.213
PNI	33.4 (31.3–37.6)	46.4 (42.4–49.7)	< 0.001
ASA-PS	3.0 (2.0–3.0)	2.0 (2.0–2.0)	0.015
GPS			< 0.001
Score 0	0 (0.0%)	18 (62.1%)	
Score 1	7 (50.0%)	9 (31.0%)	
Score 2	7 (50.0%)	2 (6.9%)	
Sex			0.512
Male	4 (28.6%)	12 (41.4%)	
Female	10 (71.4%)	17 (58.6%)	
SIRS			0.292
Absent	8 (57.1%)	22 (75.9%)	
Present	6 (42.9%)	7 (24.1%)	
Bowel resection			0.077
Yes	7 (50.0%)	6 (20.7%)	

Data are presented as median (interquartile range) or n (%). Continuous variables were compared using the Mann-Whitney U test. Categorical variables with two categories were compared using Fisher's exact test; variables with more than two categories were compared using the Fisher-Freeman-Halton exact test. All tests were two-sided. PNI groups were defined using an exploratory ROC-derived cutoff of 40.7.

BMI, body mass index; CRP, C-reactive protein; ASA-PS, American Society of Anesthesiologists Physical Status; GPS, Glasgow Prognostic Score; PNI, prognostic nutritional index; SIRS, systemic inflammatory response syndrome; ROC, receiver operating characteristic.

Variable	Low-PNI group (n = 14)	High-PNI group (n = 29)	p value
No	7 (50.0%)	23 (79.3%)	
Cause of strangulation			0.151
Internal hernia	8 (57.1%)	18 (62.1%)	
Incarcerated hernia	3 (21.4%)	10 (34.5%)	
Volvulus	3 (21.4%)	1 (3.4%)	

Data are presented as median (interquartile range) or n (%). Continuous variables were compared using the Mann-Whitney U test. Categorical variables with two categories were compared using Fisher's exact test; variables with more than two categories were compared using the Fisher-Freeman-Halton exact test. All tests were two-sided. PNI groups were defined using an exploratory ROC-derived cutoff of 40.7.

BMI, body mass index; CRP, C-reactive protein; ASA-PS, American Society of Anesthesiologists Physical Status; GPS, Glasgow Prognostic Score; PNI, prognostic nutritional index; SIRS, systemic inflammatory response syndrome; ROC, receiver operating characteristic.

[insert Table 1]

Overall postoperative complications occurred in 11/14 patients (78.6%) in the low-PNI group and 10/29 patients (34.5%) in the high-PNI group (p = 0.010). No individual complication differed significantly between groups. Among the 13 patients who underwent bowel resection with anastomosis, anastomotic leakage occurred in 2/7 patients (28.6%) in the low-PNI group and 1/6 patients (16.7%) in the high-PNI group (p = 1.000). In the full cohort, delayed perforation occurred in 7.1% versus 0% (p = 0.326), paralytic ileus in 28.6% versus 24.1% (p = 1.000), and respiratory complications in 14.3% versus 3.4% (p = 0.243) in the low- and high-PNI groups, respectively (Table 2).

Table 2
Perioperative outcomes according to PNI group

Outcome	Low-PNI group (n = 14)	High-PNI group (n = 29)	p value
Operative time (min)	103.5 (78.5–143.0)	80.0 (69.0–98.0)	0.070
Estimated blood loss (mL)	26.0 (0.0–343.5)	0.0 (0.0–30.0)	0.067
Time to resumption of oral intake (days; low-PNI n = 10 / high-PNI n = 27)	4.5 (4.0–5.0)	3.0 (2.0–5.0)	0.041
Alive with resumption of oral intake during the index admission	10 (71.4%)	27 (93.1%)	0.077
Postoperative length of hospital stay (days)	17.5 (13.5–32.0)	11.0 (8.0–17.0)	0.026
Postoperative complications			0.010
No	3 (21.4%)	19 (65.5%)	
Yes	11 (78.6%)	10 (34.5%)	
Anastomotic leakage			1.000
No	5 (71.4%)	5 (83.3%)	
Yes	2 (28.6%)	1 (16.7%)	
Delayed perforation			0.326
No	13 (92.9%)	29 (100.0%)	
Yes	1 (7.1%)	0 (0.0%)	
Paralytic ileus			1.000
No	10 (71.4%)	22 (75.9%)	
Yes	4 (28.6%)	7 (24.1%)	
Respiratory complications			0.243
No	12 (85.7%)	28 (96.6%)	
Yes	2 (14.3%)	1 (3.4%)	

Outcome	Low-PNI group (n = 14)	High-PNI group (n = 29)	p value
Data are presented as median (interquartile range) or n (%). Continuous variables were compared using the Mann-Whitney U test, and categorical variables were compared using Fisher's exact test. All tests were two-sided.			
The time-to-oral-intake analysis included 37 patients (low-PNI group, n = 10; high-PNI group, n = 27); six patients were excluded because of death (n = 2, both low PNI) or alternative enteral access (n = 4, two per group). The sensitivity analysis included all 43 patients and defined the outcome as being alive with resumption of oral intake during the index admission; death before oral intake or alternative enteral access without oral intake was classified as not achieving the outcome. The sensitivity-analysis p value was calculated using Fisher's exact test.			
The anastomotic-leakage analysis included 13 patients who underwent bowel resection with anastomosis (low-PNI group, n = 7; high-PNI group, n = 6); percentages use these subgroup denominators.			
PNI, prognostic nutritional index.			

[insert Table 2]

Of the six patients without numeric oral-intake data, two died before resumption of oral intake (both in the low-PNI group), and four used alternative enteral access (two in each group). Among the 37 patients included in the time-to-oral-intake analysis (low PNI, n = 10; high PNI, n = 27), the median time to oral intake was longer in the low-PNI group (4.5 vs. 3.0 days; p = 0.041). In the full-cohort sensitivity analysis, 10/14 patients with low-PNI (71.4%) and 27/29 with high-PNI (93.1%) were alive and had resumed oral intake during the index admission (Fisher's exact p = 0.077). The median postoperative hospital stay was also longer in the low-PNI group (17.5 vs. 11.0 days; p = 0.026). Operative time and estimated blood loss did not differ significantly between groups (p = 0.070 and p = 0.067, respectively) (Table 2).

In univariable logistic regression analyses, higher ASA-PS (OR, 3.311 per one-class increase; 95% CI, 1.109–9.886; p = 0.032) and GPS (OR, 2.507 per one-point increase; 95% CI, 1.054–5.967; p = 0.038) were associated with greater odds of postoperative complications. Low PNI was associated with higher odds of postoperative complications than high PNI (OR, 6.967; 95% CI, 1.572–30.870; p = 0.011), whereas age and SIRS status were not associated with the outcome (Table 3A). All 43 patients had complete data for the multivariable model. The full model was significant compared to the intercept-only model (likelihood-ratio $\chi^2 = 11.49$, df = 3, p = 0.009; Nagelkerke $R^2 = 0.313$). Adding PNI to the reduced model containing age and ASA-PS improved model fit ($\Delta\chi^2 = 4.52$, df = 1, p = 0.033). VIFs ranged from 1.20 to 1.45. In the prespecified full model, low PNI was associated with higher odds of postoperative complications than high PNI after adjustment for age and ASA-PS (adjusted OR, 5.35; 95% CI, 1.05–27.03; p = 0.044) (Table 3B).

[insert Table 3]

Table 3

A. Univariable logistic regression analysis of factors associated with postoperative complications

Variable	With complications (n = 21)	Without complications (n = 22)	OR	95% CI	p value
Age	78.0 (59.0–87.0)	71.5 (62.5–79.8)	1.006	0.975–1.037	0.722
ASA-PS	3.0 (2.0–3.0)	2.0 (2.0–2.0)	3.311	1.109–9.886	0.032
GPS	1.0 (1.0–2.0)	0.0 (0.0–1.0)	2.507	1.054–5.967	0.038
PNI group					
Low PNI (≤ 40.7)	11 (52.4%)	3 (13.6%)	6.967	1.572–30.870	0.011
High PNI (> 40.7)	10 (47.6%)	19 (86.4%)	Reference	—	—
SIRS					
Absent	15 (71.4%)	15 (68.2%)	Reference	—	—
Present	6 (28.6%)	7 (31.8%)	0.857	0.233–3.159	0.817

Group data are presented as median (interquartile range) or n (%). Odds ratios were estimated using univariable binary logistic regression, with postoperative complications as the modeled event. Age was entered per 1-year increase, ASA-PS per one-class increase, and GPS per one-point increase. The high-PNI group and absence of SIRS were the reference categories. Two-sided p values were calculated using Wald tests.

OR, odds ratio; CI, confidence interval; ASA-PS, American Society of Anesthesiologists Physical Status; GPS, Glasgow Prognostic Score; PNI, prognostic nutritional index; SIRS, systemic inflammatory response syndrome.

Table 3

B. Prespecified multivariable logistic regression analysis for postoperative complications

Variable	OR	95% CI	p value
Age (per 1-year increase)	0.976	0.936–1.018	0.266
ASA-PS (per one-class increase)	3.475	0.875–13.795	0.077
PNI group: low (≤ 40.7) vs high (> 40.7; reference)	5.35	1.05–27.03	0.044
The full model included age, ASA-PS, and PNI group, with high PNI as the reference category. All 43 patients were included in the complete-case model; no model variable had missing data. VIFs ranged from 1.20 to 1.45. Overall fit of the full model versus the intercept-only model was significant (likelihood-ratio $\chi^2 = 11.49$, df = 3, p = 0.009; Nagelkerke $R^2 = 0.313$). Adding PNI to the reduced model containing age and ASA-PS improved model fit (likelihood-ratio $\Delta\chi^2 = 4.52$, df = 1, p = 0.033).			
OR, odds ratio; CI, confidence interval; ASA-PS, American Society of Anesthesiologists Physical Status; PNI, prognostic nutritional index; VIF, variance inflation factor.			

Discussion

Low preoperative PNI was associated with higher overall in-hospital postoperative morbidity, delayed resumption of oral intake, and prolonged postoperative hospitalization after emergency surgery for strangulated bowel obstruction. Low PNI remained associated with complications after adjustment for age and ASA-PS, and the nested-model comparison showed that adding PNI improved model fit. The full-cohort oral-intake sensitivity analysis was directionally consistent but did not reach significance, underscoring the uncertainty created by the small sample.

The mechanisms underlying the association between low PNI and adverse postoperative outcomes are likely multifactorial. In strangulated bowel obstruction, intestinal ischemia and reperfusion injury trigger systemic inflammatory activation and increase vascular permeability. Under these conditions, the albumin component of PNI is influenced by systemic inflammation, increased capillary permeability, and altered albumin kinetics rather than nutritional status alone, whereas the lymphocyte component reflects immune-inflammatory status [3, 4, 12]. Ischemia and reperfusion injury may also promote bacterial translocation, further reducing serum albumin concentration and lymphocyte counts, thereby lowering PNI [8, 13]. Consequently, a low PNI may reflect not only immune-nutritional vulnerability but also the early physiological response to bowel ischemia and systemic stress. Thus, PNI may serve as a composite marker of inflammatory burden, immune competence, nutritional vulnerability, and physiological reserve, identifying patients with limited capacity to tolerate emergency surgery and recover from postoperative stress. This reduced physiological reserve may help explain the observed higher overall postoperative complication rate, delayed resumption of oral intake, and prolonged postoperative hospitalization in the low-PNI group.

Unlike elective gastrointestinal surgery, where detailed nutritional and frailty assessments and preoperative optimization can be planned, strangulated bowel obstruction requires rapid evaluation and

timely operative management, leaving little opportunity for additional specialized testing or prolonged preoperative intervention [1, 2, 7, 14, 15]. PNI can be calculated rapidly from routine emergency blood tests [3, 7]. Its simplicity and rapid availability make it a practical adjunct to early preoperative risk stratification, supporting the identification of patients who may benefit from closer perioperative monitoring, and individualized postoperative nutrition and rehabilitation.

The present findings should be interpreted in the context of related studies. Abo-Ryia et al. prospectively studied 150 patients over 13 months after heterogeneous emergency major abdominal operations; only 21.3% had intestinal obstruction, ASA-PS ≥ III was excluded, PNI 40 was the cutoff, and overall short-term complications occurred in 75.3%, with PNI showing 66% diagnostic accuracy [7]. Our cohort was smaller, restricted to surgically confirmed strangulated obstruction, included higher-risk ASA-PS categories, used a similar internally derived cutoff of 40.7, and estimated an adjusted OR of 5.35 for in-hospital complications. Angın et al. retrospectively studied 125 surgically treated incarcerated abdominal hernias and evaluated intestinal or omental ischemia rather than postoperative recovery [8]. PNI was lower in patients with ischemia but was not an independent predictor, whereas GPS 2 and CALLY < 2.5 were independently associated with ischemia. Thus, this study supports the relevance of inflammation-based indices in an acute hernia population but addresses a different preoperative endpoint and does not define a PNI cutoff for postoperative complications.

Ravikumar et al. retrospectively evaluated 482 adult emergency laparotomies over five years and used a prespecified PNI cutoff of 50 rather than optimizing a cohort-specific threshold [9]. Their outcomes extended beyond admission to 30-day readmission and three-year mortality. All complications did not differ by PNI group, whereas low PNI was associated with longer hospitalization; after multivariable adjustment, PNI ≥ 50 vs. <50 was associated with less prolonged stay, while 30-day readmission was not independently associated with PNI. In contrast, our narrower strangulated-obstruction cohort found an association with the composite of in-hospital complications using a lower cutoff, but our limited follow-up precluded comparison of readmission or long-term mortality. Across these studies, differences in case mix, surgical inclusion criteria, cutoff selection, follow-up window, and modeled outcome likely explain variation in observed effect estimates and preclude direct threshold equivalence.

Our optimal cutoff was close to the threshold of 40 reported by Abo-Ryia et al. [7] but lower than the prespecified cutoff of 50 used by Ravikumar et al. [9]. AUC and sensitivity indicate only modest discriminatory performance. PNI should therefore support, rather than replace, clinical judgment and established measures such as ASA-PS, GPS, and SIRS [16–18]. It also cannot substitute for formal nutritional assessment [19–21]. In practice, its rapid availability may help identify patients who warrant closer postoperative monitoring, early mobilization, rehabilitation, and individualized nutrition planning.

This study has some limitations. First, its retrospective, single-center design and small sample size limited statistical power, restricted multivariable adjustment, and left residual confounding possible. Second, the internally derived cutoff requires external validation. Third, the heterogeneous composite outcome and small number of individual events limited complication-specific inference. Fourth, the

primary time-to-oral-intake analysis excluded six patients who died or used alternative enteral access; although addressed in the all-patient sensitivity analysis, its result was imprecise and not significant. Fifth, outcome ascertainment ended at discharge or in-hospital death; post-discharge complications, readmissions, reoperations, and later mortality could not be evaluated and may have been missed. Finally, interventions directed at patients with low PNI and their potential to improve recovery remain unknown.

Conclusions

In conclusion, low preoperative PNI was associated with higher overall in-hospital postoperative morbidity, delayed oral intake among patients with numeric oral-intake data, and prolonged hospitalization after emergency surgery for strangulated bowel obstruction.

Since PNI can be rapidly calculated from routine emergency laboratory data, it may provide a practical adjunct for early risk stratification. Its modest discriminatory performance, internally derived cutoff, limited follow-up, and small single-center sample preclude standalone use and require external validation. Multicenter prospective studies with standardized post-discharge follow-up are warranted to validate the cutoff and assess PNI-guided perioperative strategies.

Abbreviations

ASA-PS
American Society of Anesthesiologists Physical Status
AUC
area under the curve
BMI
body mass index
CI
confidence interval
CRP
C-reactive protein
df
degree of freedom
GPS
Glasgow Prognostic Score
IQR
interquartile range
OR
odds ratio
PNI
prognostic nutritional index

ROC
receiver operating characteristic
SIRS
systemic inflammatory response syndrome
VIF
variance inflation factor

Declarations

Ethics approval and consent to participate

The study was conducted in accordance with the Declaration of Helsinki and was approved by the Showa Medical University Research Ethics Board (approval ID: 2025 – 0237). Given the retrospective nature of the study, the requirement for individual written informed consent was waived, and an opt-out approach was used. All data were anonymized before analysis.

Consent for publication

Not applicable.

Competing Interests

TA is an Editorial Board Member of BMC Surgery and did not assume responsibility for overseeing peer review of this manuscript. The other authors declare that they have no competing interests.

Funding

This study received no specific grants from any funding agencies in the public, commercial, or not-for-profit sectors.

Author Contribution

YM: manuscript writing, data collection, and statistical analysis; TA: manuscript editing and research supervision; KMa: literature search and manuscript writing; YuT, MI, YU, SM, YoM, RK, KO, KN, SI, SN, YS, KT, HS, YoT, HD, RW, and KY: data collection and interpretation. All authors have read and approved the final version of the manuscript.

Acknowledgement

We would like to thank Editage (www.editage.com) for English language editing.

Data Availability

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Figures

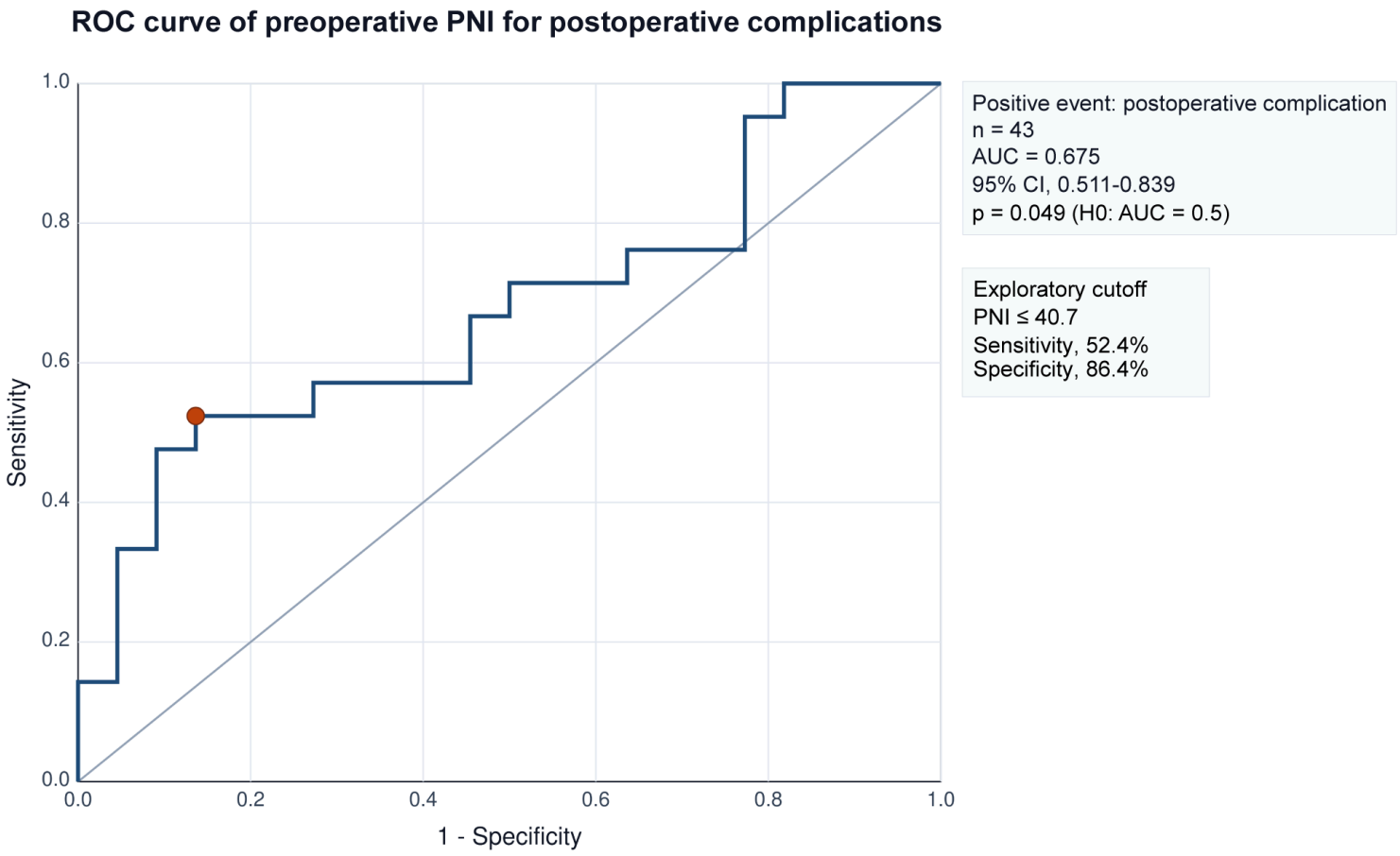


Figure 1

ROC curve analysis for the association between PNI and in-hospital postoperative complications. The p value tests the null hypothesis that the AUC equals 0.5.