

Role of Prognostic Nutritional Index (PNI) as a Prognostic Marker for Early Postoperative Complications in Gastrointestinal Malignancy

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Abstract

Gastrointestinal malignancies are among the leading causes of cancer-related morbidity and mortality. Surgery remains the mainstay of treatment, but postoperative complications are common, particularly in patients with compromised nutritional and immune status. The Prognostic Nutritional Index (PNI), derived from serum albumin and lymphocyte count, has been proposed as a simple tool to assess preoperative risk. A retrospective observational study was conducted at Nepal Medicit Hospital, including patients ≥ 18 years who underwent elective surgery for histologically proven gastrointestinal malignancy between January and December 2024. PNI was calculated using Onodera's formula. The primary outcome was early postoperative complications within 30 days. Fifty-three patients met the inclusion criteria (mean age 60.9 ± 7.5 years; 52.8% male). Colorectal resections (56.6%) were the most common surgeries. The mean PNI was 49.5 ± 10.8 . ROC analysis yielded an area under the curve of 0.66, and the cutoff value was set at 45. Nineteen patients (35.8%) developed at least one early complication, with surgical site infection (20.8%) most frequent. Complications occurred in 57.9% of patients with PNI < 45 compared with 23.5% of those with PNI ≥ 45 ($p=0.017$). Preoperative PNI was significantly associated with early postoperative complications in gastrointestinal malignancy. A cutoff of 45 effectively stratified patients into high- and low-risk groups. As a simple and inexpensive marker based on routine laboratory values, PNI can be integrated into preoperative assessment to identify patients who may benefit from nutritional optimization and enhanced perioperative care.

Keywords: Prognostic Nutritional Index; Gastrointestinal malignancy; Postoperative complications; Surgical oncology

1. Introduction

Gastrointestinal malignancies are a major cause of cancer-related morbidity and mortality worldwide. Surgery remains the cornerstone of treatment; however, postoperative complications are frequent, particularly in nutritionally compromised patients [1,2]. Malnutrition and systemic inflammation adversely affect wound healing, immune competence, and recovery [3]. In every surgery, more importantly in surgery done for malignancy, accurately predicting the prognosis will help to improve surgery outcome and to provide important information to the patients.

The prognostic nutritional index (PNI) was first proposed by Buzby GP et al. in 1980 to assess the nutritional and immunological status of patients undergoing gastrointestinal surgery [4]. While Buzby's initial proposal was in 1980, the simplified formula, often referred to as Onodera's PNI, was proposed by Onodera T et al. in 1984 [5]. It incorporates serum albumin and lymphocyte count to reflect both nutritional and immunological status. Several studies have validated PNI as a predictor of outcomes in colorectal, gastric, and pancreatic cancers [6–8].

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Given the high prevalence of malnutrition in South Asian cancer patients, this study aimed to investigate whether preoperative PNI predicts early postoperative complications in gastrointestinal malignancy.

2. Materials and Methods

This retrospective observational study was conducted at Nepal Mediciti Hospital, Nepal. Data were collected for patients undergoing surgery for histologically proven GI malignancy between January 2024 to December 2024.

2.1. Inclusion criteria

- Age ≥ 18 years
- Elective surgery for GI malignancy

2.2. Exclusion criteria

- Emergency surgeries
- Palliative surgeries
- Incomplete records of albumin or lymphocyte counts
- Incomplete records of postoperative complications
- Patient who received neoadjuvant therapy

The clinicopathological characteristics and preoperative records were obtained retrospectively from the medical records. Onodera's PNI was calculated in accordance with the well-known formula [5]

$$\text{PNI} = (10 \times \text{serum albumin as g/dl}) + (0.005 \times \text{PBL per mm}^3)$$

2.3. Outcomes

Primary outcome: Early postoperative complications occurring within 30 days after surgery. They were graded by the widely used Clavien–Dindo system. [9]

- Grade I: deviations from normal post-operative course that do not require surgical, endoscopic or radiological intervention;
- Grade II: PCs requiring drug treatments other than those allowed for grade I PCs;
- Grade III: PCs requiring surgical, endoscopic or radiological intervention;
- Grade IV: Life-threatening PCs, including central nervous system PCs;
- Grade V: Death

2.4. Statistical analysis

Data were analyzed with SPSS v25. Continuous variables were summarized as mean $\pm$ SD. Group comparisons used chi-square. $p < 0.05$ was considered significant.

3. Results

In this retrospective study, the records of 53 patients who fulfilled the inclusion criteria were retrieved. The mean age of the study group was 60.92 ± 7.49 years. Most of the patients were male ($n=28, 53.8\%$). Colorectal resections ($n=30; 56.6\%$) were the most common procedures followed by gastrectomy ($n=10; 18.86\%$), LAR ($n=5; 9.43\%$) whipple's procedure ($n=5; 9.43\%$) and small bowel resection ($n=3; 5.66\%$).

Table 1 Patient Characteristics

Age	Mean	60.92±7.49
	Range	48-78
Gender	Male	28 (52.8%)
	Female	25 (47.2%)
Type of surgery	Colectomy	30
	Gastrectomy	10
	LAR	5
	Whipple's	5
	Small bowel resection	3
PNI	Mean	49.54±10.75
	Range	29-69

Using early postoperative complications as an end point, the area under the ROC curve for the PNI was 0.66, the cutoff value of the PNI so was set at 45. Then, patients with a PNI ≥ 45 and those with a PNI < 45 were classified into the PNI-high and PNI-low groups, respectively.

Of 53 patients included in the study 19 had low PNI. In our study group, 35.53% (n=19) of patients had at least one early postoperative complication. A total of 27 different complications occurred in 19 patients. Most frequent was surgical site infection (n=11; 20.75%) then paralytic ileus (n=8; 15.09%), UTI (n=5; 9.43%), anastomotic leak (n=3; 5.66%) and others (n=4; 9.43%)

Table 2 Early postoperative complications

Surgical Site Infection	11(20.75%)
Paralytic Ileus	8(15.09%)
UTI	5(9.43%)
Anastomotic leakage	3(5.66%)
Others (Pneumonia, Intrabdominal abscess, ARDS)	4(7.54%)

Postoperative complications occurred in 11 (57.89%) of 19 patients with a PNI < 45 compared with 8 (23.52%) of 34 patients with a PNI ≥ 45 (p value 0.017). Low PNI was significantly associated with early postoperative complications.

Table 3 PNI and Early Postoperative Complications

		Early postoperative complications		P value
		Yes	No	
PNI	High	8	26	0.017
	Low	11	8	

4. Discussion

Postoperative complications following surgery for malignancy vary widely from 7.2% to 65.5%, depending on the severity of complications, type of surgery, experience of the surgeon and patient factors [10,11]. In our study, we observed a complication rate of 35.53%. Poor nutritional status compromises tissue repair, weakens host immunity,

and diminishes cardiopulmonary reserve, all of which contribute to heightened postoperative morbidity and mortality [12]. Therefore, assessment of nutritional parameters serves as an important tool in anticipating the risk of surgical complications.

In this retrospective study of 53 patients undergoing surgery for gastrointestinal (GI) malignancies, we demonstrated that a lower Prognostic Nutritional Index (PNI) was significantly associated with an increased incidence of early postoperative complications. Patients with PNI <45 experienced complications more frequently (57.9%) compared with those with PNI ≥45 (23.5%), supporting the role of preoperative nutritional and immunological status as a critical determinant of short-term surgical outcomes.

Our findings are consistent with previous studies in GI oncology that have identified PNI as a reliable prognostic marker. Mohri et al. [6] reported that low PNI was an independent predictor of postoperative morbidity in colorectal cancer, while Nozoe et al. [7] observed similar trends in gastric cancer patients. The ROC-derived cutoff of 45 in our analysis aligns with the thresholds used in these studies, further validating its clinical applicability across different GI cancer surgeries. Yano et al. also showed that preoperative PNI was a predictor of PCs in laparoscopic colorectal surgery [13].

Interestingly, colorectal resections constituted the majority of procedures in our cohort, which may explain the relatively high incidence of surgical site infections and ileus. The observation that nearly one-third of patients developed at least one complication underscores the need for meticulous preoperative risk assessment in this population.

Nevertheless, several limitations of this study must be acknowledged. The retrospective design and relatively small sample size may limit the generalizability of our findings. The heterogeneity of surgical procedures performed also introduces variability in complication risks, although it reflects real-world clinical practice. Furthermore, we did not assess long-term outcomes such as overall survival or disease-free survival, where PNI has also shown prognostic relevance in previous reports.

5. Conclusion

This study demonstrates that a low Prognostic Nutritional Index is significantly associated with an increased risk of early postoperative complications in patients undergoing surgery for gastrointestinal malignancies. With an optimal cutoff of 45, PNI proved to be a simple, inexpensive, and effective marker for perioperative risk stratification. Given its basis on routine laboratory values, PNI can be readily incorporated into preoperative evaluation to identify high-risk patients who may benefit from nutritional optimization and closer postoperative monitoring. Larger prospective studies are warranted to validate these findings and to determine whether targeted preoperative nutritional interventions can improve surgical outcomes in patients with gastrointestinal cancers.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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