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Research Article

Association of Preoperative Nutritional Status (BMI, Albumin) With Wound Healing and Length of Stay After Gastrointestinal Resection: An Observational Study

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Abstract: ***Introduction:*** Preoperative malnutrition remains a common but under-recognized problem in patients undergoing gastrointestinal resection. Low body mass index and hypoalbuminemia can impair tissue repair, increase susceptibility to wound complications, and prolong recovery after surgery.**Objectives:** To evaluate the association of preoperative nutritional status, assessed by body mass index and serum albumin, with postoperative wound healing and hospital length of stay after gastrointestinal resection.**Methods:** This observational study was conducted on One hundred patients undergoing gastrointestinal resection were included. Preoperative nutritional assessment was performed using body mass index and serum albumin levels. Postoperative wound healing was categorized as normal healing, delayed wound healing, or surgical site infection. Length of stay was classified as <=7 days or >7 days. Data were analyzed using descriptive statistics and comparative assessment across nutritional strata.**Results:** Half of the patients had normal body mass index, while 18% were underweight. Normal serum albumin was present in 62%, whereas 38% had hypoalbuminemia. Satisfactory wound healing was observed in 78% of patients, delayed healing in 16%, and surgical site infection in 6%. Adverse wound outcomes were more frequent in underweight patients and in those with lower serum albumin. Prolonged hospitalization was also more common among underweight individuals and patients with hypoalbuminemia.**Conclusion:** Poor preoperative nutritional status, particularly underweight body mass index and low serum albumin, was associated with less favorable wound healing and longer hospital stay after gastrointestinal resection. Routine nutritional assessment before surgery can help identify high-risk patients and support perioperative optimization.

Keywords: body mass index; serum albumin; gastrointestinal resection; nutritional status; wound healing; length of stay; surgical site infection.

INTRODUCTION

Gastrointestinal resection is performed for a wide range of benign and malignant disorders and remains a major component of general surgical practice. Despite advances in anesthesia, perioperative monitoring, infection control, and enhanced recovery pathways, postoperative morbidity continues to be substantial in this group of patients. Among the common early concerns after gastrointestinal surgery, impaired wound healing and prolonged hospitalization carry important clinical and economic consequences. These complications increase the need for antibiotics, wound care, repeated procedures, and extended inpatient support, thereby affecting patient recovery and healthcare resource utilization [1,2].

Nutritional status is an important determinant of surgical resilience. Patients undergoing gastrointestinal surgery are especially vulnerable to nutritional depletion because of reduced oral intake, chronic inflammation, catabolic disease states, bowel obstruction, malignancy, malabsorption, and weight loss. Malnutrition can adversely influence collagen synthesis, immune competence, angiogenesis, fibroblast proliferation, and tissue remodeling, all of which are central to wound repair. Earlier work in gastrointestinal surgery showed that nutritional assessment measures, particularly serum albumin, help identify patients at increased risk of postoperative nutrition-associated complications [1]. Subsequent studies have consistently reported that poor nutritional status is associated with higher postoperative morbidity, increased infection rates, and longer hospital stay after abdominal and colorectal operations [2-6].

Among the available bedside indicators, body mass index (BMI) and serum albumin are frequently used because they are simple, inexpensive, and widely available. BMI provides a practical estimate of body habitus and chronic nutritional reserve, while serum albumin reflects protein status and systemic

inflammatory burden. Although BMI alone does not fully capture nutritional risk, both low BMI and abnormal albumin have been linked with adverse postoperative outcomes in surgical populations. Hypoalbuminemia, in particular, has emerged as a consistent predictor of surgical site infection, wound disruption, and prolonged length of stay in gastrointestinal and colorectal surgery [2,7-10]. At the same time, obesity-related technical difficulty and altered tissue perfusion can also contribute to wound complications, which makes comprehensive preoperative nutritional evaluation clinically relevant [11-13].

Evidence from diverse settings indicates that nutritional risk screening before gastrointestinal surgery can identify patients likely to experience delayed recovery [3-6,8,9]. However, local institutional data are valuable because patient mix, disease severity, perioperative practices, and background nutritional patterns differ across centers. In many routine-care settings, preoperative nutritional assessment is still not uniformly integrated into surgical risk stratification, even though simple markers such as BMI and albumin are available in most hospitals. Generating center-specific data can therefore support pragmatic perioperative decision-making and strengthen the case for nutrition-focused optimization in resource-conscious practice.

The objective of the present study was to assess the association of preoperative nutritional status, measured by BMI and serum albumin, with postoperative wound healing and length of hospital stay among patients undergoing gastrointestinal resection at a tertiary-care hospital.

Methodology

Study design and setting This hospital-based observational study was conducted in the Department of General Surgery, Tirumala Medicover Hospital, Vizianagaram, Andhra Pradesh, India, over a six month period from May 2025 to October 2025. The study was designed to evaluate the relationship between preoperative nutritional status and early postoperative outcomes in patients undergoing gastrointestinal resection.

Study population and sample size A total of 100 consecutive adult patients who underwent gastrointestinal resection during the study period were included in the analysis. The sample comprised patients undergoing elective or emergency gastrointestinal resections for benign and malignant conditions involving the stomach, small intestine, colon, rectum, or related gastrointestinal segments, as decided by the treating surgical team.

Eligibility criteria Patients aged 18 years and above who underwent gastrointestinal resection and had complete preoperative clinical assessment, BMI documentation, serum albumin estimation, and postoperative follow-up until discharge were eligible. Patients with incomplete records, those discharged against medical advice, patients with major pre-existing chronic wounds unrelated to the index surgery, and those with missing postoperative wound assessment were excluded from the final analysis.

Preoperative nutritional assessment Preoperative nutritional status was assessed using BMI and serum albumin. BMI was calculated as weight in kilograms divided by height in meters squared and categorized as underweight (<18.5 kg/m2), normal weight (18.5-24.9 kg/m2), overweight (25-29.9 kg/m2), and obese (>=30 kg/m2) according to standard WHO cutoffs [14]. Serum albumin was measured as part of routine preoperative biochemical work-up and categorized as normal (>=3.5 g/dL), mild hypoalbuminemia (3.0-3.4 g/dL), and moderate-to-severe hypoalbuminemia (<3.0 g/dL), in line with prior surgical nutrition literature [1,2,7].

Outcome measures The primary postoperative outcome was wound healing status. Surgical wounds were assessed clinically during the postoperative hospital stay and classified into normal wound healing, delayed wound healing, or surgical site infection. Delayed wound healing referred to wounds showing slow epithelialization, serous discharge, gaping, or the need for prolonged dressings without definite evidence of deep infection. Surgical site infection was identified on the basis of clinical features such as purulent discharge, local erythema, tenderness, induration, or need for antibiotic escalation and wound intervention. The secondary outcome was length of hospital stay, categorized as <=7 days and >7 days.

Data collection and statistical analysis Demographic data, preoperative nutritional variables, and postoperative outcomes were entered into a structured proforma from inpatient case records and operative notes. Continuous variables were summarized using appropriate descriptive measures, and categorical variables were expressed as frequency and percentage. The distribution of wound healing outcomes and length of stay was examined across BMI and albumin categories. The findings were interpreted in an observational framework to identify clinically meaningful associations between nutritional status and postoperative recovery [3-6,8,9].

Ethical considerations The study used hospital-based clinical data generated during standard patient care and maintained confidentiality by anonymizing patient identifiers during data compilation and analysis. Institutional permission was obtained from the hospital authorities before conduct of the study.

RESULTS

A total of 100 patients who underwent gastrointestinal resection were included in the present observational study. The results summarize the demographic characteristics of the study population, the distribution of preoperative nutritional status assessed by BMI and serum albumin, and their association with postoperative wound healing and hospital length of stay. Most patients belonged to the age group of 46-60 years (34%), followed by 31-45 years (32%). Male patients constituted 60% of the cohort, while females accounted for 40% (Table 1).

Table 1. Demographic characteristics of the study population (N = 100)

Variable	Category	n	%
Age group (years)	18-30	16	16.0
	31-45	32	32.0
	46-60	34	34.0
	>60	18	18.0
Sex	Male	60	60.0
	Female	40	40.0

Half of the patients (50%) had normal BMI. Underweight patients constituted 18%, whereas 32% of patients were either overweight or obese (Table 2).

Table 2. Preoperative nutritional status based on BMI (N = 100)

BMI category	n	%
Underweight (<18.5 kg/m2)	18	18.0
Normal weight (18.5-24.9 kg/m2)	50	50.0
Overweight (25-29.9 kg/m2)	22	22.0
Obese (>=30 kg/m2)	10	10.0

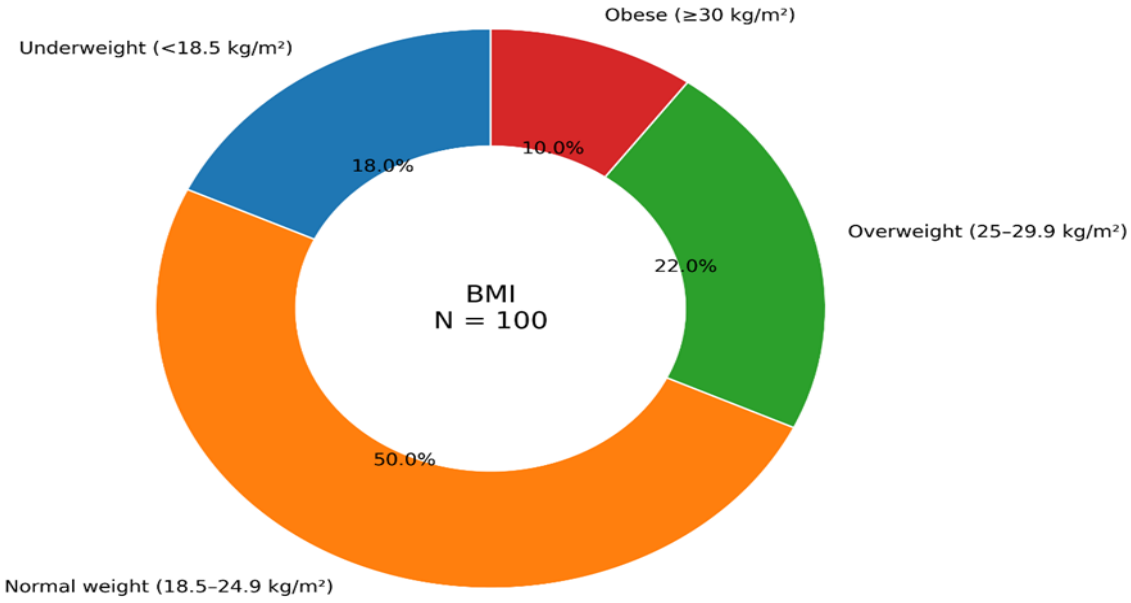

Figure 1: Preoperative nutritional status based on BMI

Normal serum albumin levels were observed in 62% of patients. Mild hypoalbuminemia was present in 24%, while 14% had moderate-to-severe hypoalbuminemia (Table 3).

Table 3. Preoperative serum albumin levels (N = 100)

Serum albumin level	n	%
>=3.5 g/dL (Noral)	62	62.0
3.0-3.4 g/dL (Mild hypoalbuminemia)	24	24.0
<3.0 g/dL (Moderate-severe hypoalbuminemia)	14	14.0

The majority of patients (78%) demonstrated satisfactory wound healing. Delayed wound healing occurred in 16%, and surgical site infection was documented in 6% of cases (Table 4).

Table 4. Postoperative wound healing outcomes (N = 100)

Wound outcome	n	%
Normal wound healing	78	78.0
Delayed wound healing	16	16.0
Surgical site infection	6	6.0

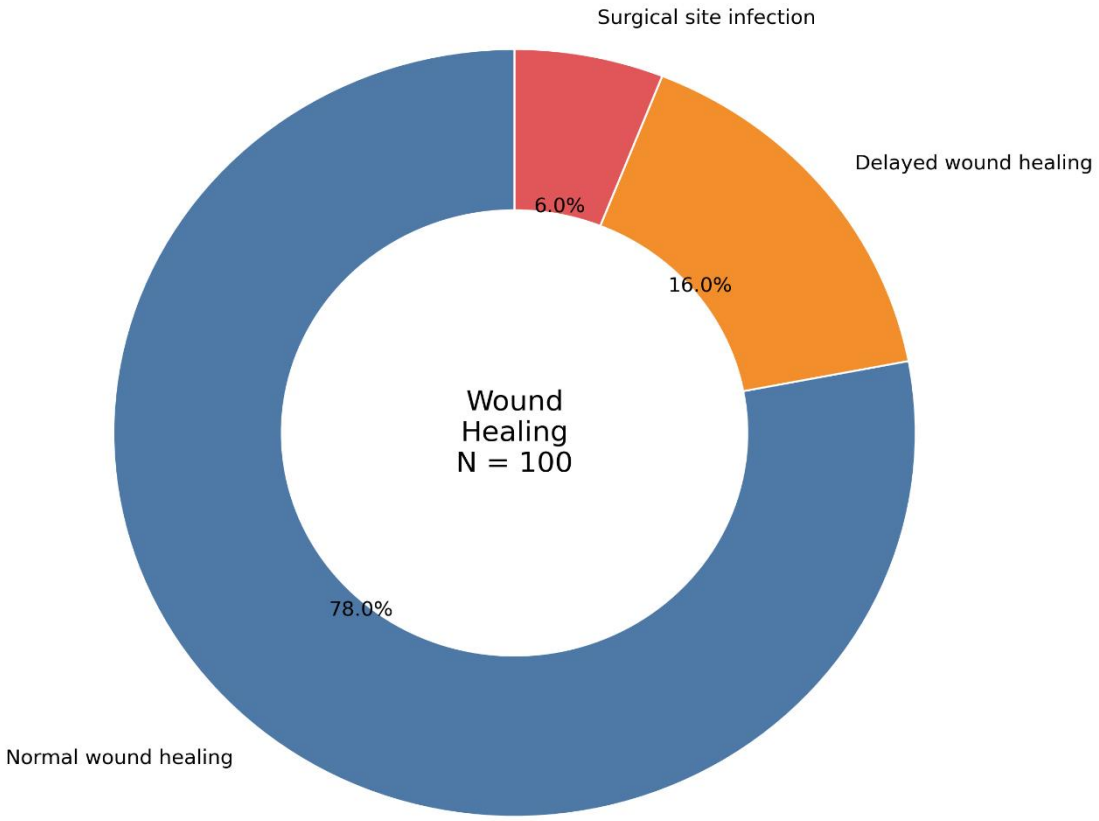

Figure 2: Postoperative wound healing outcomes

Patients with underweight BMI demonstrated the highest proportion of delayed wound healing and infection (44.4%), whereas patients with normal BMI showed the most favorable healing outcomes, with 88.0% showing normal wound healing (Table 5).

Table 5. Association between BMI category and wound healing outcome (N = 100)

BMI category	Normal healing n (%)	Delayed healing/SSI n (%)	Total
Underweight	10 (55.6)	8 (44.4)	18
Normal BMI	44 (88.0)	6 (12.0)	50
Overweight	17 (77.3)	5 (22.7)	22
Obese	7 (70.0)	3 (30.0)	10

Patients with normal albumin levels had better wound healing outcomes. Delayed healing and infection were progressively more frequent as albumin levels declined, reaching 50.0% among those with albumin below 3.0 g/dL (Table 6).

Table 6. Association between serum albumin levels and wound healing outcome (N = 100)

Albumin level	Normal healing n (%)	Delayed healing/SSI n (%)	Total
>=3.5 g/dL	54 (87.1)	8 (12.9)	62
3.0-3.4 g/dL	17 (70.8)	7 (29.2)	24
<3.0 g/dL	7 (50.0)	7 (50.0)	14

Patients with normal BMI and adequate serum albumin levels experienced shorter hospital stays. In contrast, underweight individuals and those with hypoalbuminemia had a greater likelihood of prolonged hospitalization exceeding seven days (Table 7).

Table 7. Length of hospital stay according to nutritional status (N = 100)

Variable	<=7 days n (%)	>7 days n (%)	Total
Normal BMI	36 (72.0)	14 (28.0)	50
Underweight	6 (33.3)	12 (66.7)	18
Albumin >=3.5 g/dL	44 (71.0)	18 (29.0)	62
Albumin <3.5 g/dL	10 (26.3)	28 (73.7)	38

Overall, compromised nutritional status characterized by low BMI and reduced serum albumin levels was associated with delayed wound healing, a higher frequency of postoperative wound complications, and prolonged hospital stay following gastrointestinal resection.

DISCUSSION

The present study demonstrates that compromised preoperative nutritional status was associated with poorer early postoperative recovery after gastrointestinal resection. Underweight BMI and low serum albumin were both linked to less favorable wound healing, and hypoalbuminemic patients also showed a distinctly greater frequency of prolonged hospitalization. In the current cohort, satisfactory wound healing was observed in 78% of patients overall, but adverse wound outcomes were more frequent among underweight individuals and those with reduced albumin levels. These findings reinforce the practical value of basic preoperative nutritional assessment in routine gastrointestinal surgical care.

The observed relationship between hypoalbuminemia and wound-related morbidity is consistent with previous literature. Detsky et al. first highlighted that albumin-based nutritional assessment could predict nutrition-associated postoperative complications in patients undergoing major gastrointestinal surgery [1]. Hennessey et al. further reported that preoperative hypoalbuminemia was an independent risk factor for surgical site infection after gastrointestinal surgery and was also associated with prolonged inpatient stay [2]. Similar associations between low albumin and wound-related complications, including dehiscence and infection, have been described in exploratory laparotomy and colorectal surgery studies [8,10,13]. Serum albumin remains clinically useful because it is readily available, objective, and capable of identifying patients with impaired physiological reserve even when overt cachexia is absent.

BMI-related findings in the present study also deserve attention. Underweight patients had the highest proportion of delayed healing or infection, whereas normal-BMI patients showed the most favorable wound outcomes. This pattern aligns with reports that malnutrition risk and low nutritional reserve adversely affect short-term surgical outcomes in gastrointestinal operations [3-6]. Although some studies have shown that low BMI alone does not uniformly predict complications across all upper gastrointestinal procedures [12], body habitus still provides meaningful context when interpreted alongside biochemical markers. At the other end of the spectrum, obesity has also been linked with higher risk of wound complications in abdominal and colorectal surgery because of impaired tissue perfusion, technical difficulty, and thicker subcutaneous tissue [11,13,14].

Length of stay in the present study showed a clear nutritional gradient. Patients with normal BMI and normal albumin more often had shorter admissions, whereas prolonged stay was common among underweight and hypoalbuminemic patients. This is in accordance with broader gastrointestinal surgery literature showing that malnutrition contributes to slower postoperative recovery, longer hospitalization, and higher resource use [3-6,8,9]. Mosquera et al. and Loan et al. both observed that poor nutritional status before gastrointestinal surgery was associated with longer postoperative stay [5,6]. Likewise, colorectal cancer series have shown that malnutrition and hypoalbuminemia identify patients at increased risk of morbidity and delayed recovery [7-9].

From a clinical perspective, the present findings support routine integration of BMI and serum albumin into preoperative evaluation for gastrointestinal resection. These measures do not replace comprehensive nutritional assessment, but they offer a feasible screening approach in day-to-day surgical practice. Patients identified as undernourished can be targeted for closer perioperative monitoring, early nutritional intervention, infection surveillance, and discharge planning. Such an approach is supported by contemporary evidence emphasizing preoperative nutritional optimization as part of perioperative quality improvement in abdominal surgery [4,9,11].

Limitations

This was a single-center observational study with a modest sample size and short in-hospital follow-up. The analysis relied on BMI and serum albumin rather than a multidimensional nutritional tool. Procedure-specific factors, comorbid burden, operative duration, blood loss, and disease severity were not stratified

separately, which restricts detailed risk adjustment and limits the generalizability of the findings to other gastrointestinal surgical populations.

CONCLUSION

Preoperative nutritional status showed a meaningful association with early postoperative recovery after gastrointestinal resection in this study. Underweight BMI and low serum albumin were linked with a higher frequency of delayed wound healing, surgical site infection, and prolonged hospital stay. Patients with normal BMI and adequate albumin demonstrated more favorable wound outcomes and shorter admissions. These findings support the routine use of simple nutritional markers during preoperative assessment in gastrointestinal surgery. Early identification of nutritionally vulnerable patients can help improve perioperative planning, strengthen postoperative surveillance, and promote timely nutritional optimization aimed at reducing wound-related morbidity and shortening hospitalization, thereby supporting safer recovery and more efficient surgical care.

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