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Impact of Pre-Operative Nutritional Support on Surgical Outcome in Gastrointestinal Surgery

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ABSTRACT
Malnutrition is prevalent among patients undergoing gastrointestinal surgery and is associated with increased postoperative complications. This study aimed to investigate the effects of preoperative nutritional support on surgical outcomes in this patient population. We conducted a prospective cohort study with a parallel-group randomized controlled trial subset. Eligible adult patients scheduled for elective gastrointestinal surgery were randomized into two groups. The control group receiving standard preoperative care and the nutritional support group receiving individualized nutritional interventions. Primary outcomes included postoperative complications, while secondary outcomes comprised length of hospital stay, wound healing, nutritional status and infection rates. Statistical analyses were conducted using appropriate tests. In the nutritional support group, there was a significant reduction in surgical site infections (8% vs. 18% in the control group, $p = 0.042$), leading to an overall lower infection rate (14% vs. 28% in the control group, $p = 0.011$). Additionally, patients in the nutritional support group had a shorter length of hospital stay (6.4 vs. 7.2 days in the control group, $p = 0.016$) and exhibited superior wound healing (80% vs. 68% with excellent healing in the control group, $p = 0.049$). Nutritional markers, including serum albumin, prealbumin and total lymphocyte count, were significantly higher in the nutritional support group ($p<0.05$). Preoperative nutritional support in gastrointestinal surgery patients was associated with reduced postoperative complications, shorter hospital stays, improved wound healing and enhanced nutritional status. These findings underscore the potential benefits of incorporating nutritional support into preoperative care protocols for better surgical outcomes.

INTRODUCTION

Malnutrition, impaired immune function and increased susceptibility to complications are common challenges faced by patients undergoing gastrointestinal surgery. These individuals often have underlying gastrointestinal diseases, such as cancer, inflammatory bowel disease, or obstruction, which can significantly impact their nutritional status[1-3]. Surgical interventions, while necessary for the management of these conditions, can further exacerbate preexisting malnutrition or lead to new nutritional deficits[4]. Malnutrition not only weakens the body's defense mechanisms but also delays wound healing, impairs tissue repair and increases the risk of infections and other postoperative complications[5,6].

The importance of nutrition in the perioperative period has been well-established, with particular attention given to preoperative nutritional support[7]. Preoperative nutritional support encompasses various strategies, including enteral or parenteral nutrition, dietary counseling, and supplementation, with the primary goal of optimizing patients' nutritional status before surgery[8]. This optimization is expected to improve surgical outcomes, reducing the risks associated with gastrointestinal surgery.

Despite a growing body of literature examining the effects of preoperative nutritional support in gastrointestinal surgery, there is still a need for rigorous, evidence-based research to guide clinical practice. Many studies have reported positive outcomes but others have yielded inconclusive or conflicting results, making it essential to conduct a well-designed original study to address these gaps in knowledge.

Study objectives: The primary objective of this study is to investigate the impact of preoperative nutritional support on surgical outcomes in gastrointestinal surgery. We aim to assess parameters such as wound healing, infection rates, length of hospital stay and overall postoperative morbidity and mortality in patients receiving various forms of preoperative nutritional support compared to those who do not. Additionally, we will explore the potential mechanisms through which nutritional support may exert its effects, such as improvements in immune function, nutritional status and surgical stress response.

MATERIALS AND METHODS

Study design: This study employed a prospective cohort design with a parallel-group randomized controlled trial (RCT) subset to evaluate the impact of preoperative nutritional support on surgical outcomes in patients who underwent gastrointestinal surgery. The study adhered to ethical guidelines and received approval from the Institutional Review Board of our Medical College.

Study setting: The study was conducted at a tertiary care Hospital specializing in gastrointestinal surgery. Patients were recruited from the surgical wards and outpatient clinics.

Study participants

Inclusion criteria:

- Adult patients (age ≥18 years) scheduled for elective gastrointestinal surgery
- Patients with a confirmed diagnosis of gastrointestinal diseases, such as cancer, inflammatory bowel disease, or gastrointestinal obstruction
- Patients who provided informed consent to participate in the study

Exclusion criteria:

- Patients with contraindications to preoperative nutritional support, such as severe allergies or intolerances to nutritional supplements
- Emergency surgical cases
- Patients unable to provide informed consent or those with cognitive impairments

Sample size calculation: A sample size calculation was based on the primary outcome measure (postoperative complications). Assuming an expected effect size based on preliminary data, a power of 80%, and a significance level of 0.05, the calculated sample size required a total of 200 participants (100 in each group).

Randomization and allocation: Eligible participants were randomized into two groups using computer-generated randomization. Group allocation was concealed in sequentially numbered, opaque, sealed envelopes. Randomization was stratified by the type of nutritional support (e.g., enteral, parenteral) to ensure balanced representation.

Intervention

Control group (standard care): Patients in this group received standard preoperative care, including dietary recommendations and maintenance of their current nutritional status.

Nutritional support group: Patients in this group received preoperative nutritional support based on their individual nutritional needs, as determined by a registered dietitian. This could include enteral nutrition (e.g., oral nutritional supplements or enteral tube feeding) or parenteral nutrition, as appropriate.

Outcome measures: The primary outcome measures included:

- Postoperative Complications: Incidence of surgical site infections, anastomotic leaks, wound complications and other complications within 30 days post-surgery

The secondary outcome measures included:

- **Length of hospital stay:** The number of days the patient remained hospitalized post-surgery
- **Wound healing:** Assessed using standardized wound assessment tools
- **Nutritional status:** Measured by anthropometric data, serum albumin levels and other nutritional markers
- **Infection rates:** Overall rates of infections, including surgical site infections and systemic infections
- **Mortality:** Mortality rates within 30 days post-surgery

Data collection: Data were collected prospectively using standardized case report forms. Preoperative nutritional assessment included dietary history, anthropometric measurements and laboratory parameters. Postoperative data were collected during hospitalization and follow-up visits.

Statistical analysis: Descriptive statistics summarized patient demographics and baseline characteristics. Comparative analyses utilized appropriate statistical tests (t-tests, chi-square tests, or non-parametric tests) to evaluate differences between the control and nutritional support groups.

Ethical considerations: This study adhered to the principles outlined in the Declaration of Helsinki and informed consent was obtained from all participants.

RESULTS

Table 1 provides an overview of the baseline characteristics of the study participants, categorized by the control group and the nutritional support group. The average age in both groups was quite similar, with the control group having a mean age of 55.2 years and the nutritional support group having a mean age of 54.8 years. The small difference in mean age (0.4 years) was not statistically significant (p = 0.632). Gender distribution was balanced in both groups, with approximately equal percentages of male and female participants (52% male and 48% female in the control group, and 50% male and 50% female in the nutritional support group). The gender distribution did not significantly differ between the groups (p = 0.827). The primary diagnoses of participants in both groups were categorized into three main groups: Gastrointestinal cancer, inflammatory bowel disease and gastrointestinal obstruction. The percentages of patients with each diagnosis were quite similar between the groups and no statistically significant differences were observed.

Table 2 outlines the primary outcomes of the study, focusing on postoperative complications, including surgical site infections, anastomotic leaks, wound complications, and other complications within 30 days post-surgery. In the control group, 18% of patients experienced surgical site infections, while in the nutritional support group, only 8% of patients developed such infections. This difference was statistically significant (p = 0.042), indicating that preoperative nutritional support may reduce the risk of surgical site infections. Anastomotic leaks occurred in 10% of the control group and 6% of the nutritional support group. While the difference was not statistically significant (p = 0.301), it is noteworthy that the nutritional support group had a lower incidence of anastomotic leaks. Wound complications were observed in 12% of the control group and 5% of the nutritional support group. Although, the nutritional support group had a lower incidence the difference was not statistically significant (p = 0.127). Other complications occurred in 14% of the control group and 7% of the nutritional support group. This difference was also not statistically significant (p = 0.211). These results suggest that preoperative nutritional support may have a positive impact on reducing the incidence of surgical site infections, although further investigation is needed for other types of complications.

Table 1: Baseline Characteristics of study participants

Characteristic	Control group (n = 0)	nutritional support group (n = 100)	p-value
Age (years), Mean±SD	55.2±8.4	54.8±7.9	0.632
Gender (male/female)	52/48	50/50	0.827
Diagnosis			
Gastrointestinal cancer (%)	45	43	0.721
Inflammatory bowel disease (%)	30	32	0.549
Gastrointestinal obstruction (%)	25	25	1.000

Table 2: Primary outcome-postoperative complications

Outcome measure	control group (n = 100)	Nutritional support group (n = 0)	p-value
Incidence of surgical site infections (%)	18	8	0.042
Anastomotic leaks (%)	10	6	0.301
Wound complications (%)	12	5	0.127
Other complications (%)	14	7	0.211

Table 3: Secondary outcome-length of hospital stay

Outcome measure	Control group (n = 100)	Nutritional support group (n = 100)	p-value
Length of hospital stay (days), Mean±SD	7.2±2.1	6.4±1.8	0.016

Table 4: Secondary outcome-wound healing assessment

Outcome measure (%)	Control group (n = 100)	Nutritional support group (n = 100)	p-value
Excellent wound healing	68	80	0.049
Good wound healing	26	18	0.132
Poor wound healing	6	2	0.191

Table 5: Secondary outcome-nutritional status

Outcome measure	Control group (n = 100)	Nutritional support group (n = 100)	p-value
Serum albumin (g dL^{-1}) Mean±SD	3.7±0.2	3.9±0.3	0.037
Nutritional markers			
Prealbumin (mg dL^{-1}), Mean±SD	22.5±4.1	24.1±3.9	0.049
Total lymphocyte count (cells μL^{-1}), Mean±SD	1800.0±300	1950.0±350	0.021

Table 6: Secondary outcome-infection rates

Outcome measure (%)	Control group (n = 100)	Nutritional support group (n = 100)	p-value
Overall infection rate	28	14	0.011
Surgical site infection rate	18	8	0.042
Systemic infection rate	10	6	0.301

Table 3 addresses the secondary outcome of the study the length of hospital stay for patients in both the control and nutritional support groups. The average length of hospital stay in the control group was 7.2 days, with a standard deviation of 2.1 days. In contrast, the nutritional support group had an average length of stay of 6.4 days, with a standard deviation of 1.8 days. This difference was statistically significant ($p = 0.016$), indicating that patients in the nutritional support group experienced a shorter duration of hospitalization. This finding suggests that preoperative nutritional support may contribute to reduced hospital stays, potentially leading to cost savings and quicker patient recovery.

Table 4 evaluates the secondary outcome related to wound healing assessment. It categorizes wound healing into three categories excellent, good and poor. In the control group, 68% of patients exhibited excellent wound healing, whereas in the nutritional support group, 80% of patients had excellent wound healing. This difference was statistically significant ($p = 0.049$), indicating that preoperative nutritional support may enhance wound healing outcomes. 26% of the control group and 18% of the nutritional support group showed good wound healing. The difference, while not statistically significant ($p = 0.132$), suggests a trend toward better outcomes in the control group. Poor wound healing was observed in 6% of the control group and 2% of the nutritional support group. Though the nutritional support group had fewer cases, the difference was not statistically significant ($p = 0.191$).These results indicate that preoperative nutritional support may lead to a higher proportion of patients experiencing excellent wound healing.

Table 5 focuses on the secondary outcome related to nutritional status, with a specific emphasis on serum albumin levels and other nutritional markers. The control group had an average serum albumin level of 3.7 g dL^{-1} with a standard deviation of 0.2 g dL^{-1} while the nutritional support group had an average level of 3.9 g dL^{-1} with a standard deviation of 0.3 g dL^{-1}. This difference was statistically significant ($p = 0.037$), suggesting that preoperative nutritional support may result in higher serum albumin levels, indicating better nutritional status. Other nutritional markers, such as prealbumin and total lymphocyte count, were also assessed. The nutritional support group showed higher mean values for both prealbumin ($p = 0.021$) and total lymphocyte count ($p = 0.049$) compared to the control group, both of which were statistically significant. These findings suggest that preoperative nutritional support is associated with improved nutritional status as indicated by higher levels of serum albumin, prealbumin and total lymphocyte count.

Table 6 presents results related to secondary outcomes focusing on infection rates, including overall infection rates, surgical site infection rates and systemic infection rates. The control group had an overall infection rate of 28%, whereas the nutritional support group had a lower rate of 14%. This difference was statistically significant ($p = 0.011$), suggesting that preoperative nutritional support may reduce the overall risk of infections. Surgical site infection rates were 18% in the control group and 8% in the nutritional support group. This difference was statistically significant ($p = 0.042$), indicating a lower risk of surgical site infections with preoperative nutritional support. Systemic infection rates were 10% in the control group and 6% in the nutritional support group. While this difference was not statistically significant ($p = 0.301$), there was a trend toward a lower risk of systemic infections in the nutritional support group. These findings suggest that preoperative nutritional support may have a beneficial effect in reducing the incidence of infections, particularly surgical site infections.

DISCUSSIONS

The findings of this study, which investigated the impact of preoperative nutritional support on surgical outcomes in patients undergoing gastrointestinal surgery, offer valuable insights into the potential benefits of optimizing patients' nutritional status prior to surgery.

Our study demonstrated a significant reduction in the incidence of surgical site infections in the nutritional support group compared to the control group. This result aligns with the findings of previous studies by Braga *et al*.[1], Smedley *et al*.[3] and Lobo *et al*.[6] which reported decreased postoperative infections associated with preoperative nutritional support. These consistent results underscore the potential of preoperative nutritional support in bolstering the body's immune response and reducing the risk of postoperative infections.

While we observed a decrease in surgical site infections, our study did not find statistically significant differences in anastomotic leaks, wound complications, or other complications between the two groups. These findings are in line with the results reported by Bozzetti *et al*.[5] whose study of preoperative nutritional support in gastrointestinal cancer patients similarly did not reveal significant differences in these secondary outcomes. Nevertheless, it is worth noting that although statistical significance was not achieved in these secondary outcomes, a consistent trend toward better outcomes in the nutritional support group was evident, suggesting potential clinical benefits.

A notable outcome in our study was the significantly shorter length of hospital stay in the nutritional support group compared to the control group. This result is consistent with the findings of Gianotti *et al*.[2] and López *et al*.[7] both of which reported reduced hospitalization durations associated with preoperative nutritional support. A shorter hospital stay not only has cost-saving implications but also reflects improved patient recovery and well-being. The assessment of wound healing and nutritional status revealed significant results. Patients in the nutritional support group exhibited a significantly higher rate of excellent wound healing, along with elevated serum albumin levels, prealbumin and total lymphocyte counts. These findings are consistent with the study by Weimann *et al*.[4] which emphasized the potential of preoperative nutritional support to enhance nutritional status and wound healing. Improved wound healing is crucial in preventing surgical site complications and promoting recovery. Regarding infection rates, our study showed a significant reduction in overall infections and surgical site infections in the nutritional support group. These findings align with the results reported by Lobo *et al*.[6] and López *et al*.[7] both of which demonstrated a reduced risk of infections with preoperative nutritional support.

The outcomes of this study carry several clinical implications. Preoperative nutritional support emerges as a valuable strategy for optimizing surgical outcomes in patients undergoing gastrointestinal surgery. The reduction in surgical site infections, shorter hospital stays and enhanced wound healing and nutritional status suggest that incorporating nutritional support into preoperative care protocols can benefit patients and healthcare systems alike. These findings underscore the importance of early nutritional assessment and intervention in surgical candidates, particularly those with gastrointestinal diseases.

LIMITATIONS AND FUTURE DIRECTIONS

This study has certain limitations. It was conducted at a single tertiary care center, which may affect the generalizability of the results to other settings. Multi-center studies with larger sample sizes are needed for more robust evidence. Furthermore, while statistically significant differences were found in some outcomes, further investigation is required to establish their clinical significance. Future research should also focus on long-term outcomes and cost-effectiveness analyses to gain a more comprehensive understanding of the broader impact of preoperative nutritional support.

CONCLUSION

In conclusion, our study supports the use of preoperative nutritional support as a strategy to improve surgical outcomes in gastrointestinal surgery. The significant reduction in surgical site infections, shorter hospital stays and enhanced wound healing and nutritional status observed in the nutritional support group emphasize the potential benefits of this intervention. These findings are in harmony with previous research and underscore the importance of nutritional optimization as part of the preoperative care pathway. Further investigation, including additional multi-center trials and long-term follow-ups, is warranted to refine protocols and assess the long-term effects of preoperative nutritional support in diverse patient populations.

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