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IMPACT OF PREOPERATIVE NUTRITIONAL STATUS ON POSTOPERATIVE RECOVERY IN GENERAL SURGERY PATIENTS: A PROSPECTIVE STUDY

General Surgery

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ABSTRACT

Background: Preoperative nutritional status is a critical factor influencing surgical outcomes, yet its impact on postoperative recovery quality remains understudied. **Objective:** To investigate the relationship between preoperative nutritional status and postoperative recovery in patients undergoing elective abdominal cancer surgery. **Methods:** This prospective observational study included 150 patients aged ≥40 years undergoing elective abdominal cancer surgery at Mahatma Gandhi Medical College and Hospital, Jaipur, from January 2023 to February 2024. Nutritional status was assessed using the Mini Nutritional Assessment Short-Form (MNA-SF). The primary outcome was the Quality of Recovery-15 (QoR-15) score at 3, 5, and 7 days post-surgery. **Results:** Patients with poor preoperative nutritional status (MNA-SF score ≤11) had significantly lower QoR-15 scores at all time points ($p<0.001$) and longer hospital stays (9.8 ± 3.2 vs. 7.2 ± 2.5 days, $p<0.001$) compared to those with normal nutritional status. Multiple regression analysis confirmed poor nutritional status as an independent predictor of lower QoR-15 scores ($\beta = -12.5$, 95% CI: -16.8 to -8.2, $p<0.001$). **Conclusion:** Preoperative nutritional status significantly influences postoperative recovery and length of hospital stay in abdominal cancer surgery patients. These findings underscore the importance of preoperative nutritional screening and potential interventions to improve surgical outcomes.

KEYWORDS

Nutritional status, Postoperative recovery, Quality of Recovery-15, Abdominal cancer surgery, Length of hospital stay, Mini Nutritional Assessment Short-Form

INTRODUCTION

Optimal postoperative recovery is a crucial aspect of surgical care, influencing patient outcomes, healthcare costs, and overall patient satisfaction. While various factors contribute to recovery, the role of preoperative nutritional status has gained increasing attention in recent years.[1,2,3] Malnutrition is prevalent among surgical patients, particularly those undergoing major abdominal procedures, and has been associated with increased postoperative complications, prolonged hospital stays, and higher mortality rates.[4,5,6,7]

The complex relationship between nutritional status and surgical outcomes is multifaceted. Malnutrition can impair immune function, delay wound healing, and reduce muscle strength, all of which can compromise recovery.[8,9] Furthermore, the metabolic stress induced by surgery can exacerbate pre-existing nutritional deficits, creating a vicious cycle that hinders recovery.[10,11] Understanding and addressing these nutritional challenges in the perioperative period is essential for improving surgical outcomes.

The Quality of Recovery-15 (QoR-15) score has emerged as a validated tool for assessing postoperative recovery, encompassing various aspects of patient well-being.[12,13] It provides a comprehensive evaluation of recovery, including physical comfort, emotional state, physical independence, psychological support, and pain. However, the relationship between preoperative nutritional status and QoR-15 scores has not been extensively studied, particularly in the context of abdominal cancer surgery. This gap in knowledge presents an opportunity to explore how nutritional status might influence the patient's subjective experience of recovery.

Previous studies have primarily focused on the impact of nutritional status on specific postoperative complications or mortality.[14,15] While these outcomes are crucial, they may not fully capture the patient's experience of recovery. The QoR-15 score offers a more patient-centered approach to assessing recovery, providing insights into aspects of well-being that are important to patients but may not be captured by traditional clinical endpoints.[16] By incorporating this measure, we can gain a more holistic understanding of the recovery process and how it is influenced by preoperative nutritional status.

This study aims to bridge this knowledge gap by investigating three key aspects: (1) the effect of preoperative nutritional status on the QoR-15 score after surgery; (2) the differences between the preoperative nutritional status groups in the mean values of each item in the QoR-15 on postoperative day 3; and (3) the association between preoperative nutritional status and length of hospital stay. By examining these relationships, we seek to provide a more comprehensive understanding of how preoperative nutritional status influences the quality of postoperative recovery. This knowledge could inform preoperative nutritional interventions and guide postoperative care strategies to optimize patient outcomes, ultimately leading to improved surgical care and patient satisfaction.

METHODOLOGY

This prospective observational study was conducted at Mahatma Gandhi Medical College and Hospital, Jaipur, from January 2023 to February 2024. The study protocol received approval from the institutional ethics committee and written informed consent was obtained from all participants, ensuring adherence to ethical standards and patient autonomy.

The study population comprised 150 inpatients aged 40 years or older who were scheduled for elective abdominal cancer surgery. This sample size was determined based on previous studies, assuming a moderate effect size with 80% power and a 5% significance level.[17] Inclusion criteria encompassed patients aged ≥40 years scheduled for elective abdominal cancer surgery and able to provide informed consent. We excluded patients undergoing emergency surgeries, those with cognitive impairment preventing completion of questionnaires, individuals refusing to participate and those concurrently enrolled in other clinical trials. These criteria were established to ensure a representative sample while minimizing confounding factors.

Nutritional Assessment

Preoperative nutritional status was assessed using the Mini Nutritional Assessment Short-Form (MNA-SF), a validated tool for nutritional screening.[18] The MNA-SF evaluates six key areas: food intake, weight loss, mobility, psychological stress or acute disease, neuro-psychological problems, and body mass index (BMI). Scores range from 0 to 14, with higher scores indicating better nutritional status. Based on their MNA-SF scores, patients were categorized into two groups: those with poor nutritional status (MNA-SF score ≤11) and those with normal nutritional status (MNA-SF score >11). This assessment was conducted by trained research nurses within 48 hours

of admission, prior to surgery, to ensure consistency and accuracy in nutritional status classification.

Outcome Measures

The primary outcome measure was the Quality of Recovery-15 (QoR-15) score, assessed at 3, 5, and 7 days after surgery. The QoR-15 is a comprehensive, patient-reported outcome measure covering five dimensions: pain, physical comfort, physical independence, psychological support, and emotional state.[12] Scores range from 0 to 150, with higher scores indicating better quality of recovery. Secondary outcomes included length of hospital stay, postoperative complications (graded according to the Clavien-Dindo classification[19] and 30-day readmission rates. These outcomes were chosen to provide a holistic view of the recovery process, encompassing both patient-reported and clinical measures.

Data collection involved recording demographic information, clinical characteristics, and surgical details using a standardized case report form. This included age, gender, BMI, American Society of Anesthesiologists (ASA) physical status, cancer type, surgical procedure, and duration of surgery. QoR-15 questionnaires were administered by trained research assistants at the specified time points. To minimize bias, these assistants were blinded to the patients' nutritional status, ensuring objective assessment of recovery outcomes.

Statistical Analysis

Statistical analysis was performed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation and compared using unpaired t-tests, while categorical variables were presented as frequencies and percentages and analyzed using chi-square tests or Fisher's exact test as appropriate. To assess the effects of preoperative nutritional status on the QoR-15 score on postoperative day 3, multiple regression analysis was conducted, adjusting for potential confounders including age, gender, ASA status, and type of surgery. The association between nutritional status and length of hospital stay was analyzed using Cox proportional hazards regression. A p-value <0.05 was considered statistically significant, and all analyses were two-tailed. This comprehensive statistical approach allowed for robust analysis of the relationship between nutritional status and postoperative recovery outcomes.

RESULTS

A total of 150 patients were enrolled in the study. Based on the MNA-SF scores, 62 patients (41.3%) were classified as having poor nutritional status, while 88 patients (58.7%) had normal nutritional status. The baseline characteristics of the study population reveal important differences between patients with poor and normal nutritional status. Patients with poor nutritional status were significantly older (61.5±10.2 years vs. 56.7 ± 8.3 years, p=0.002) and had a lower BMI (22.1 ± 3.8 kg/m² vs. 25.3 ± 3.2 kg/m², p<0.001) compared to those with normal nutritional status. There was also a significant difference in ASA status distribution (p=0.024), with a higher proportion of ASA III patients in the poor nutritional status group. These findings suggest that poor nutritional status is associated with advanced age and higher perioperative risk. Interestingly, there was no significant difference in gender distribution or cancer type between the two groups. The duration of surgery was slightly longer in the poor nutritional status group, although this difference did not reach statistical significance (p=0.178). These baseline differences underscore the importance of considering nutritional status in preoperative risk assessment and highlight the potential confounding factors that need to be accounted for in the analysis of postoperative outcomes (Table 1).

Table 1: Baseline Characteristics of the Study Population

Characteristic	Poor Nutritional Status (n=62)	Normal Nutritional Status (n=88)	P-value
Age (years)	61.5 ± 10.2	56.7 ± 8.3	0.002
Gender (Male/Female)	34/28	48/40	0.981
BMI (kg/m²)	22.1 ± 3.8	25.3 ± 3.2	<0.001
ASA Status (I/II/III)	8/38/16	22/54/12	0.024
Cancer Type			
- Colorectal	28 (45.2%)	42 (47.7%)	0.357
- Gastric	18 (29.0%)	24 (27.3%)	
- Pancreatic	10 (16.1%)	12 (13.6%)	
- Other	6 (9.7%)	10 (11.4%)	
Duration of Surgery (min)	242 ± 68	228 ± 59	0.178

QoR-15 Scores

The analysis of QoR-15 scores at different time points reveals a consistent and significant impact of nutritional status on postoperative recovery. Patients with poor nutritional status demonstrated substantially lower QoR-15 scores compared to those with normal nutritional status at all measured time points (Days 3, 5, and 7 post-surgery). The mean differences were most pronounced on Day 3 (14.5 points, 95% CI: 10.1 to 18.9, p<0.001) and remained significant through Day 7 (10.3 points, 95% CI: 6.6 to 14.0, p<0.001). This persistent gap in recovery scores suggests that the impact of poor nutritional status on postoperative well-being is not only immediate but also sustained throughout the early recovery period. The gradual decrease in the mean difference over time (from 14.5 on Day 3 to 10.3 on Day 7) indicates that while both groups show improvement in recovery, patients with poor nutritional status continue to lag behind their well-nourished counterparts. These findings emphasize the potential long-term consequences of preoperative malnutrition on patient-reported outcomes and highlight the need for targeted interventions to improve recovery in nutritionally compromised patients (Table 2).

Table 2: QoR-15 Scores at Different Time Points

Time Point	Poor Nutritional Status (n=62)	Normal Nutritional Status (n=88)	Mean Difference (95% CI)	P-value
Day 3	98.2 ± 14.6	112.7 ± 12.8	14.5 (10.1 to 18.9)	<0.001
Day 5	107.5 ± 13.2	119.8 ± 11.5	12.3 (8.2 to 16.4)	<0.001
Day 7	114.3 ± 11.8	124.6 ± 10.2	10.3 (6.6 to 14.0)	<0.001

QoR-15 Item Analysis

The detailed analysis of individual QoR-15 items on postoperative Day 3 provides valuable insights into the specific aspects of recovery most affected by nutritional status. Patients with poor nutritional status scored significantly lower across all QoR-15 items, with the most pronounced differences observed in the ability to return to work or usual home activities (mean difference: 1.8, 95% CI: 1.1 to 2.5, p<0.001) and feeling rested (mean difference: 1.7, 95% CI: 1.1 to 2.3, p<0.001). The ability to enjoy food also showed a notable difference (mean difference: 1.6, 95% CI: 1.0 to 2.2, p<0.001), which is particularly relevant given the nutritional focus of this study. Even in areas where the differences were less pronounced, such as getting support from hospital staff (mean difference: 0.8, 95% CI: 0.4 to 1.2, p<0.001), the impact of nutritional status remained statistically significant. These results suggest that poor nutritional status affects a broad spectrum of recovery domains, including physical function, comfort, and emotional well-being. The consistent pattern across all items underscores the pervasive impact of nutritional status on the overall quality of postoperative recovery and emphasizes the need for comprehensive support strategies for patients with poor nutritional status (Table 3).

Table 3: Mean Values of QoR-15 Items on Postoperative Day 3

QoR-15 Item	Poor Nutritional Status (n=62)	Normal Nutritional Status (n=88)	Mean Difference (95% CI)	P-value
Able to breathe easily	7.2 ± 1.8	8.5 ± 1.5	1.3 (0.8 to 1.8)	<0.001
Been able to enjoy food	5.8 ± 2.1	7.4 ± 1.7	1.6 (1.0 to 2.2)	<0.001
Feeling rested	6.1 ± 1.9	7.8 ± 1.6	1.7 (1.1 to 2.3)	<0.001
Able to communicate with family or friends	7.5 ± 1.6	8.6 ± 1.3	1.1 (0.6 to 1.6)	<0.001
Getting support from hospital doctors and nurses	8.1 ± 1.4	8.9 ± 1.1	0.8 (0.4 to 1.2)	<0.001
Able to return to work or usual home activities	4.9 ± 2.2	6.7 ± 1.9	1.8 (1.1 to 2.5)	<0.001
Feeling comfortable and in control	6.5 ± 1.7	8.1 ± 1.4	1.6 (1.1 to 2.1)	<0.001

Analysis of hospital stay duration reveals a significant difference between patients with poor and normal nutritional status. Patients with poor nutritional status had a markedly longer mean hospital stay (9.8 ± 3.2 days) compared to those with normal nutritional status (7.2 ± 2.5 days), a difference that was statistically significant (p<0.001). This finding suggests that preoperative nutritional status has a substantial

impact on recovery time and resource utilization, with poorly nourished patients requiring an average of 2.6 additional days of hospitalization (Table 4).

Table 4: Length of Hospital Stay by Nutritional Status

Nutritional Status	Mean Length of Stay (days)	Standard Deviation	P-value
Poor (n=62)	9.8	3.2	<0.001
Normal (n=88)	7.2	2.5	

Multiple regression analysis confirms that poor nutritional status is an independent predictor of lower QoR-15 scores on postoperative day 3, even after adjusting for potential confounders. Poor nutritional status was associated with a significant decrease in QoR-15 score (β = -12.5, 95% CI: -16.8 to -8.2, p<0.001). Other significant predictors included age and ASA status III, while gender did not show a significant effect. Among cancer types, pancreatic cancer was associated with significantly lower QoR-15 scores compared to colorectal cancer. The model explained approximately 35% of the variance in QoR-15 scores (Adjusted R^2 = 0.35), indicating that while nutritional status is an important factor, other variables not captured in this model also influence postoperative recovery (Table 5).

Table 5: Multiple Regression Analysis for QoR-15 Score on Postoperative Day 3

Variable	Coefficient (β)	95% CI	P-value
Poor Nutritional Status	-12.5	-16.8 to -8.2	<0.001
Age (per year increase)	-0.3	-0.5 to -0.1	0.008
Female Gender	-2.1	-5.7 to 1.5	0.254
ASA Status III (vs. I/II)	-4.8	-8.9 to -0.7	0.022
Cancer Type (vs. Colorectal)			
- Gastric	-3.2	-7.5 to 1.1	0.142
- Pancreatic	-5.6	-10.9 to -0.3	0.038
- Other	-1.9	-7.8 to 4.0	0.525

R^2 = 0.38, Adjusted R^2 = 0.35

The analysis of postoperative complications and readmissions reveals important clinical implications of preoperative nutritional status. Patients with poor nutritional status experienced a significantly higher rate of complications (Clavien-Dindo grade II or higher) compared to those with normal nutritional status (35.5% vs. 18.2%, p=0.015). This nearly two-fold increase in complication rate underscores the clinical importance of preoperative nutritional status and its potential impact on surgical outcomes. While the difference in 30-day readmission rates did not reach statistical significance (12.9% vs. 5.7%, p=0.121), there was a noticeable trend towards higher readmissions in the poor nutritional status group. The lack of statistical significance in readmission rates may be due to the study's sample size, which was not primarily powered to detect differences in this secondary outcome. Nevertheless, the observed trend aligns with the overall pattern of poorer outcomes in patients with compromised nutritional status. These findings highlight the potential for preoperative nutritional interventions to not only improve patient-reported recovery but also to reduce the incidence of clinically significant complications and possibly decrease readmission rates (Table 6).

Table 6: Postoperative Complications and Readmissions

Outcome	Poor Nutritional Status (n=62)	Normal Nutritional Status (n=88)	P-value
Complications (Clavien-Dindo ≥ Grade II)	22 (35.5%)	16 (18.2%)	0.015
30-day Readmission	8 (12.9%)	5 (5.7%)	0.121

DISCUSSION

This prospective study demonstrates a significant association between poor preoperative nutritional status and impaired postoperative recovery in patients undergoing abdominal cancer surgery. Our findings align with previous research highlighting the importance of nutritional status in surgical outcomes.[20-23]

The consistently lower QoR-15 scores observed in patients with poor nutritional status across all time points suggest that the impact of malnutrition on recovery persists beyond the immediate postoperative period. This underscores the potential long-term consequences of preoperative malnutrition and the importance of early nutritional intervention. Similar findings have been reported in other surgical populations, such as cardiac surgery patients[24,25], orthopedic surgery patients[26,27], and liver transplant recipients.[28]

The item analysis of the QoR-15 revealed that physical aspects of recovery, particularly comfort and independence, were most affected by poor nutritional status. This finding is consistent with the known physiological effects of malnutrition, including muscle wasting and impaired wound healing.[29] The reduced ability to enjoy food in the malnourished group is particularly noteworthy, as it may contribute to a cycle of poor nutrition and delayed recovery.

The prolonged hospital stay observed in patients with poor nutritional status has significant implications for healthcare resource utilization and costs. This finding supports the potential economic benefits of preoperative nutritional optimization programs.[30] A systematic review by Burden et al. found that preoperative nutritional support can reduce the length of hospital stay in patients undergoing gastrointestinal surgery[31], further emphasizing the importance of addressing nutritional deficits before surgery.

The higher rate of postoperative complications in the poor nutritional status group aligns with previous studies demonstrating the association between malnutrition and adverse surgical outcomes.[32,33] While our study was not powered to detect differences in specific complications, the trend towards higher readmission rates in the malnourished group warrants further investigation.

The multiple regression analysis confirmed that poor nutritional status is an independent predictor of lower QoR-15 scores, even after adjusting for potential confounders such as age, gender, ASA status, and type of surgery. This robust association suggests that nutritional status should be considered alongside other established predictors of surgical outcomes when assessing perioperative risk. The independent nature of this relationship underscores the potential value of nutritional interventions, even in patients with other risk factors for poor outcomes.

Our findings regarding the impact of nutritional status on specific QoR-15 domains provide valuable insights for tailoring postoperative care. The pronounced effect on physical comfort and independence suggests that early mobilization and enhanced recovery protocols may need to be modified for patients with poor nutritional status. Additionally, the observed difficulty in enjoying food postoperatively in this group highlights the need for specialized nutritional support that not only meets caloric and protein requirements but also addresses issues of palatability and food acceptance.

The relationship between poor nutritional status and increased postoperative complications observed in our study has significant clinical implications. While our study was not designed to elucidate the mechanisms underlying this association, previous research has suggested several potential pathways. Malnutrition has been associated with impaired immune function[34], delayed wound healing[35], and reduced functional capacity[36], all of which can contribute to postoperative complications. Future studies should aim to delineate these mechanisms more clearly, potentially identifying specific nutritional deficits that are most strongly associated with adverse outcomes.

The trend towards higher readmission rates in the poor nutritional status group, although not statistically significant, is concerning and merits further investigation. Readmissions represent a significant burden on healthcare systems and are increasingly used as a quality indicator.[37] If confirmed in larger studies, this finding would provide additional impetus for implementing comprehensive nutritional optimization programs in the perioperative period.

Our study has several strengths, including its prospective design, use of validated assessment tools, and comprehensive evaluation of recovery using both patient-reported and clinical outcomes. The inclusion of the QoR-15 provides a patient-centered perspective on recovery, which is increasingly recognized as an important outcome in perioperative care.[38] However, some limitations should be acknowledged. The single-center design may limit the generalizability of our findings to other settings or patient populations. Additionally, the observational nature of the study precludes us from establishing a causal relationship between nutritional status and outcomes.

Another potential limitation is the use of the MNA-SF as the sole measure of nutritional status. While this tool is widely validated and easy to administer, it may not capture all aspects of nutritional status relevant to surgical outcomes. Future studies could incorporate more

comprehensive nutritional assessments, including biochemical markers and body composition analysis, to provide a more nuanced understanding of the relationship between nutritional status and postoperative recovery.

The findings of this study have important implications for clinical practice and future research. Firstly, they underscore the need for routine preoperative nutritional screening in patients undergoing major abdominal surgery. The MNA-SF, given its ease of use and predictive value demonstrated in this study, could be a valuable tool for this purpose. Secondly, our results suggest that targeted nutritional interventions in the preoperative period could potentially improve postoperative outcomes. However, the optimal timing, duration, and composition of such interventions remain to be determined.

Future research should focus on developing and evaluating preoperative nutritional optimization strategies. Randomized controlled trials are needed to establish the efficacy of specific nutritional interventions in improving QoR-15 scores, reducing hospital stay, and decreasing complication rates. Such studies should also investigate the cost-effectiveness of these interventions, providing valuable information for healthcare policy and resource allocation decisions.

Additionally, the integration of nutritional optimization into existing enhanced recovery after surgery (ERAS) protocols warrants further investigation. While ERAS protocols have significantly improved postoperative outcomes in various surgical specialties[39], the specific needs of patients with poor nutritional status may not be fully addressed in current guidelines. Tailoring ERAS protocols to account for preoperative nutritional status could potentially enhance their effectiveness, particularly for nutritionally vulnerable patients.

CONCLUSION

Our study provides compelling evidence for the significant impact of preoperative nutritional status on postoperative recovery in patients undergoing abdominal cancer surgery. The consistent association between poor nutritional status and adverse outcomes across multiple domains highlights the critical need for increased attention to nutritional assessment and optimization in the perioperative period. By identifying nutritional status as a modifiable risk factor, we open avenues for targeted interventions to improve surgical outcomes. Future research should focus on translating these findings into effective clinical strategies, with the ultimate goal of enhancing recovery, reducing complications, and improving the overall quality of surgical care for all patients, regardless of their preoperative nutritional status.

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