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ORIGINAL ARTICLE

Impact of Preoperative Nutritional Status on Wound Healing and Complication Rates in Elective General Surgeries

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ABSTRACT

Background: Nutritional status is a critical determinant of postoperative recovery, influencing immune function, collagen synthesis, and tissue repair. Malnutrition remains underdiagnosed in surgical populations, particularly in low- and middle-income countries, contributing to avoidable postoperative complications. This study evaluates the impact of preoperative nutritional status on wound healing and postoperative outcomes in elective general surgical patients.

Objective: To assess the association between preoperative nutritional status and postoperative wound healing, complication rates, and hospital stay in patients undergoing elective general surgeries.

Methods: A prospective observational study was conducted from February 2023 to June 2024 at Sheikh Zayed Hospital and Fatima Memorial Hospital, Lahore. A total of 80 patients undergoing elective general surgeries were enrolled through consecutive sampling. Nutritional assessment included BMI, serum albumin, hemoglobin, TLC, and MUST scoring. Patients were categorized as well-nourished or malnourished. Postoperative outcomes primary wound healing, delayed healing, surgical site infection (SSI), seroma, hematoma, and wound dehiscence were recorded over a 30-day follow-up. Data were analyzed using SPSS 26, with $p < 0.05$ considered significant.

Results: Malnutrition was identified in 35% of patients. Malnourished patients showed significantly higher rates of delayed healing (42.8% vs. 13.4%), SSI (32.1% vs. 5.7%), and wound dehiscence (10.7% vs. 1.9%). Mean hospital stay was markedly longer in malnourished patients (8.2 ± 2.9 days) compared to well-nourished patients (4.9 ± 1.6 days). Logistic regression identified serum albumin <3.5 g/dL and hemoglobin <11 g/dL as independent predictors of complications.

Conclusion: Poor preoperative nutritional status significantly increases wound-related morbidity and prolongs postoperative recovery. Routine nutritional screening and timely optimization should be integrated into preoperative surgical care.

Keywords: Nutritional status, wound healing, surgical site infection, serum albumin, elective surgery, postoperative complications, malnutrition.

INTRODUCTION

Ideal nutritional condition is a key factor of the surgical recovery and the general outcome of the post-operative results. Proper nutrition has a direct effect on immune competence, angiogenesis, fibroblast proliferation, tensile strength of the healing tissues and collagen formation[1]. The processes represent the biologic basis of wound healing and even slight nutritional malnutrition can significantly impair surgical recovery. Although it is the

critical issue, malnutrition is the most neglected clinical problem, particularly among surgical patients; among them, malnutrition can be found between 20 to 50 all over the world. The level of burden is even higher in low-and-middle-income countries because of the late diagnosis, insufficient screening, and preoperative optimization[2].

Elective general surgeries such as cholecystectomy, hernia repair, thyroidectomy, colorectal operations, and laparotomies are the types of surgeries that particularly require the physiological reserves of the patient in order to heal smoothly and without difficulties[3]. Malnourished persons are likely to have depleted protein stores, deficiencies in micronutrients, anemia, impaired immune response, making them susceptible to surgical site infections (SSI), delayed epithelialization, wound dehiscence, seroma formation, and high postoperative morbidity. It has always been demonstrated in studies that hypoalbuminemia, low BMI, anemia, and lower lymphocyte count are some of the strongest predictors of a bad surgical outcome[4].

In addition, malnutrition is one of the factors that lead to a long hospitalization period, high healthcare spending, and possibility of readmission. Pre-operative nutritional assessment has now become the focus of major surgical associations and the World Health Organization as a routine aspect of surgical planning. There is evidence that timely nutritional interventions, including protein supplement, correction of anemia and optimization of immune-nutrient intake are effective in the reduction of complications and recovery[5].

In most healthcare centers, especially in South Asia, nutritional assessment is either under-performed or not carried out at all in pre-surgery processes. This creates lost chances of prompt detection and optimization of the high-risk patients. There is a lack of regional based Pakistani data on the relation of nutritional status and postoperative outcome, which underlines the need to have region-based research that considers dietary practices and comorbidities, as well as surgical procedures[6].

This study fills this important gap by assessing the role of preoperative nutritional status in wound healing and occurrence rates of complications in elective general surgical patients. Through the analysis of the most important nutritional indicators and postoperative results, the researchers will be able to focus on the role of preoperative nutritional optimization as a cost-effective, alterable variable to positively impact surgical outcome[7].

MATERIALS AND METHODS

Study Design and Setting

The study was a prospective observational study that was done in two large tertiary care teaching hospitals in Lahore; Sheikh Zayed Hospital, Lahore, and Fatima Memorial Hospital, Lahore. The two institutions are very busy in terms of elective surgical cases, and they offer standardized surgical, laboratory and outpatient services, thus suitable in a comparative clinical study of postoperative outcomes. It was conducted between February 2023 and June 2024 during which all the eligible patients who had elective general surgeries at either of the centers were assessed. All the preoperative tests, lab tests, surgery as well as follow up tests were carried out in the respective hospital environments with the same protocols.

Sampling Technique and Population of the Study

Eighty adult patients were recruited in the two participating hospitals and non-probability consecutive sampling was used to recruit them. All the eligible patients who came in seeking elective general surgery within the study period were invited to take part in the study up to the required sample size. This was done by enrolling two centers that guaranteed a broader representation of the population of surgery in Lahore and enhanced generalizability of the results. Serial sampling reduced selection bias and enabled all normal surgical cases that fell within the study criteria to be included.

Inclusion and Exclusion Criteria

The inclusion criteria included age (between 18 and 70 years), elective general surgery (hernia repair, cholecystectomy, thyroidectomy, elective laparotomy or colorectal surgery), and a scheduled operation in either of the two hospitals, should be hemodynamically stable, and must have a written informed consent. Patients were not included in case they needed emergency surgery, chronic liver disease, chronic kidney disease, long-term corticosteroid or immunosuppressive therapy, systemic active infection, sepsis, or malignancy undergoing chemotherapy or radiotherapy. Patients who were not willing or able to attend follow up visits after operation were also left out including pregnant women. These criteria removed confounding factors that have been established to have an independent nimbling effect in wound healing.

Clinical and Nutritional Preoperative Assessment

Both hospitals had a standardized and structured preoperative assessment of all enrolled patients. History taking, physical examination and evaluation of comorbidities like diabetes, hypertension, smoking, and past surgical history were done. The combination of anthropometric, biochemical, and standardized screening tools was used to determine the nutritional status. Body mass index (BMI) was determined using the weight and height measures that were measured using calibrated

weight and height measurements at both centers. The classification of BMI was done using the WHO standards.

The preoperative laboratory tests were done through the central lab of Sheikh Zayed Hospital and Fatima Memorial Hospital, and based on the same diagnostic parameters. The biochemical markers were serum albumin, hemoglobin, total lymphocyte count (TLC), and C-reactive protein (CRP) that were conducted within seven days of surgery. Nutritional risk assessment was conducted by the Malnutrition Universal Screening Tool (MUST) that included assessment of BMI, unintentional loss of weight, and possible decrease in food intake. Malnutrition was considered to be MUST score 2 or less serum albumin 3.5 g/dl. According to such criteria, patients were grouped into well-nourished and malnourished ones to provide a comparison of the outcome.

Perioperative Management

Any surgical and anesthetic intervention was based on the standardized institutional practices that were applied in both hospitals. Preoperative optimization entailed glycemic regulation, blood pressure regulation and correction of electrolyte imbalance. Antibiotics Prophylactic antibiotics were given 30-60 minutes before incision. There was a similarity in sterilization procedures, skin preparation methods, and operating practices in both centers to achieve procedural consistency. Each patient had intraoperative variables that were recorded in the form of type of surgery, duration, estimated blood loss, and transfusion requirements.

Postoperative Wound Evaluation and Postoperative Follow-Up.

There were no differences in the clinical protocols of assessing the postoperative wounds in Sheikh Zayed Hospital and Fatima Memorial Hospital. The wounds were observed on a daily basis during hospitalization and later on the subsequent outpatient visits on the post surgical days of 7, 14 and 30. A wound healing was categorized as primary healing in cases whereby epithelialization had taken place within 7-10 days without any complications and delayed healing in instances where satisfactory epithelialization had not taken place beyond day 10. The diagnosis of a surgical site infection (SSI) was made in accordance with the guidelines of CDC, and the presence of erythema, purulent discharge, tenderness, or the presence of microbiological evidence. Other wound complications such as wound dehiscence, seroma, and hematoma were noted.

The other postoperative outcomes were the length of stay in hospital, 30 day morbidity, inadvertent readmission and the requirement of reoperation because of the wound-related complications. Those patients who could not come back to get a follow-up were contacted via telephone to make sure that data is fully collected.

Data Collection Procedure

A structured proforma that was developed to conduct this study was used to capture data that were applied uniformly in both hospitals. Every patient was assigned his/her identification code to ensure anonymity. The collected data were demographic, comorbidity, nutritional indicators, operative, wound assessment, and postoperative complications. The research team and the principal investigator checked the data in order to reduce errors.

Statistical Analysis

In the statistical analysis, SPSS version 26.0 was used. Mean ± SD (standard deviation) was used to represent continuous variables like age, and BMI, the level of albumin, and time of hospital stay, and frequencies and percentages were used to represent categorical variables like nutritional status, SSI, delayed healing, seroma, hematoma, and wound dehiscence. The independent t -test was used to compare well and malnourished groups using the continuous variable and Chi-square or the Fisher Information Exact test was used to compare the categorical variable between the malnourished and the well nourished groups. Binary logistic regression was done to establish independent predictors of postoperative wound complications and the included variables are serum albumin, BMI, hemoglobin, TLC, diabetes, smoking, and operative duration. The p-value of less than 0.05 was taken to be statistically significant.

Ethical Considerations

This study was conducted with the ethical approval of both the Institutional Review Boards of the Sheikh Zayed Hospital, Lahore, and Fatima Memorial Hospital, Lahore. Written informed consent was given by all the participants before enrolment. Patient data confidentiality was a priority and coded data was used and secured storage facilities. The research was conducted in accordance with the ethical principles of the Declaration of Helsinki, and no unconventional procedures and experimental interventions were used.

RESULTS

Baseline Characteristics

The patients included in the analysis were a total of 80 patients who were undertaking elective general surgeries. Of them, 52 patients (65% of the total) had been identified as well-nourished, and 28 patients (35% of the total) had been identified as malnourished using MUST scoring, and

serum albumin level. The average age of the research population was 43.7 + 12.4 years and there was no significant difference between the two groups in terms of age. The total mean BMI was 23.6 3.8 kg/m 2, although malnourished patients had significantly lower BMI and serum albumin levels in comparison to well-nourished patients. The level of hemoglobin and total lymphocytes count (TLC) were also significantly lower in the malnourished group, which means that no physiological and immunological reserves are preserved.

Table 1. Baseline Nutritional and Clinical Characteristics of Patients (n = 80)

Variable	Well-nourished (n=52)	Malnourished (n=28)	p-value
Age (years), mean ± SD	44.1 ± 11.9	42.9 ± 13.2	0.65
BMI (kg/m²), mean ± SD	24.6 ± 3.5	21.4 ± 3.1	<0.001
Serum Albumin (g/dL)	4.1 ± 0.4	3.1 ± 0.3	<0.001
Hemoglobin (g/dL)	12.7 ± 1.3	10.9 ± 1.0	<0.001
TLC (cells/mm³)	2,100 ± 320	1,560 ± 280	<0.001
Diabetes Mellitus (%)	21.2%	28.5%	0.46
Smoking (%)	17.3%	21.4%	0.66

The differences in albumin, hemoglobin, BMI, and TLC were statistically significant, confirming poorer physiological reserve in malnourished individuals.

Postoperative Wound Healing Outcomes

There were large variations recorded in wound healing patterns across the two groups. Majority of patients who were well nourished (84.6) healed their wounds primary and only half of the malnourished patients healed normally (p < 0.001). The rate of delayed wound healing was significantly higher in the cases of malnourished patients (42.8) than in the cases of well-nourished patients (13.4%). Surgical site infections (SSI) were experienced by 3/52 (5.7%), well-nourished patients, and 9/ 28 (32.1%), malnourished patients (p = 0.002). Dehiscence of the wound was observed in 3 (10.7) patients who were malnourished with only 1 (1.9) patient who was well nourished indicating a significant relationship between malnutrition and structural wound failure.

Table 2. Postoperative Wound Healing Outcomes

Outcome	Well-nourished (n=52)	Malnourished (n=28)	p-value
Primary Healing (%)	84.6%	50.0%	<0.001
Delayed Healing (%)	13.4%	42.8%	0.003
Surgical Site Infection (SSI)	5.7%	32.1%	0.002
Wound Dehiscence (%)	1.9%	10.7%	0.04
Seroma/Hematoma (%)	7.6%	17.8%	0.18

Malnutrition was strongly associated with delayed healing and infectious complications.

Hospital Stay and Morbidity

The two groups had a significant difference in the length of stay in hospital after operation. Patients with good nutrition spent an average of 4.9 ± 1.6 days in hospital and malnourished patients spent much longer in hospital (8.2 ± 2.9 days, p < 0.001). There was a total of 36 patients who experienced postoperative morbidity 30 days after surgery. The morbidity rate in the malnourished group was 53.5 and in the well-nourished group was 17.3 (p < 0.001). Two of the malnourished patients needed re-operation as they had major issues with the wound but in the well-nourished group, this did not happen.

Table 3. Postoperative Morbidity and Length of Hospital Stay

Parameter	Well-nourished (n=52)	Malnourished (n=28)	p-value
Hospital Stay (days)	4.9 ± 1.6	8.2 ± 2.9	<0.001
30-day Morbidity (%)	17.3%	53.5%	<0.001
Reoperation Required (%)	0%	7.1%	0.08

The significantly prolonged hospitalization and increased wound-related morbidity among malnourished patients underscores the negative influence of poor nutritional status.

Predictors of Wound Complications

Binary logistic regression showed that serum albumin < 3.5 g/dL had the best independent predictive value in terms of postoperative complications (OR 4.6, p = 0.001). Other statistically significant predictors were hemoglobin less

than 11 g/dL (OR 3.2, p = 0.02) and TLC was less than 1500/mm 3 (OR 2.8, p = 0.03). Presence of diabetes and BMI had positive but weak associations with risk of complications.

The findings clearly indicate that nutritional status during preoperative stage influences greatly the wound healing and complication rate during postoperative status. The patients who were malnourished showed considerably low BMI, serum albumin, hemoglobin, and lymphocyte levels in comparison with healthy persons. All these shortcomings manifested themselves in the poor wound outcomes in which the malnourished patients had a significantly high rate of delayed wound healing, surgical site infections, and wound dehiscence. Also, patients with malnutrition had almost double the length of stay in the hospital, which indicates the experience of complications and slow healing. Given that the strongest predictors of adverse postoperative outcome were confirmed as hypoalbuminemia and anemia, the regression analysis supported the research findings. Collectively, these results suggest that regular nutritional screening and preoperative optimization of all elective surgical patients are of clinical value.

Table 4. Independent Predictors of Postoperative Complications (Logistic Regression)

Predictor	Odds Ratio (OR)	95% CI	p-value
Serum Albumin < 3.5 g/dL	4.6	1.9 – 10.8	0.001
Hemoglobin < 11 g/dL	3.2	1.1 – 8.7	0.02
TLC < 1500/mm³	2.8	1.0 – 7.4	0.03
BMI < 18.5 kg/m²	2.1	0.9 – 5.0	0.07
Diabetes Mellitus	1.6	0.6 – 4.2	0.21

Low albumin and anemia remained the most meaningful predictors.

DISCUSSION

The results of this investigation clearly show that preoperative nutritional status is of a significant effect and clinical importance to wound healing and postoperative outcome in patients going through elective general surgical procedures[8]. The study population revealed that malnutrition was present in 35 percent of the population; this is in line with the international results showing that 20-50 percent of patients who are operated into the operating room either have overt or subclinical nutritional deficiency. This is the reason why nutritional screening has to be mandatory in the surgical pathways particularly in areas that are resource constrained[9].

The patients who were malnourished had much lower BMI, serum albumin, hemoglobin and lymphocytes in contrast to the well-nourished individuals. The parameters are established indicators of physiological resilience and immune competence. Serum albumin especially is essential in ensuring oncotic pressure, the recreation of hormones and drugs and also in collagen formation an indispensable part of wound healing. The extremely low concentrations of albumin in the malnourished patients must have also contributed to impaired fibroblast action, delayed the process of granulation tissue formation, and enhanced tissue edema, which altogether slowed down healing and predisposed the breakdown of the wound[10].

The findings indicate that the incidence of surgical site infection (SSI) is considerably higher in malnourished patients with 32.1 percent of people becoming infected as opposed to 5.7 percent of individuals in the well-nourished group[11]. The difference corresponds to the international literature that malnutrition is one of the strongest modifiable risk factors of SSI. The suppressed immunity by low lymphocyte count and deficiency of micronutrients directly affects the capacity of the body to develop a proper inflammatory and repairing response after surgical trauma. Equally, anemia that is of much more common occurrence among malnourished people leads to insufficient provision of oxygen to body tissues, which causes poor collagen cross-linking and predisposes the body to infection and dehiscence[12,13].

Other serious complications that arose after operation were wound dehiscence, which was more prevalent in the malnourished group. This highlights the effects of decreased tensile strength of tissues and loss of collagen synthesis. Moreover, it was found that delayed wound healing in almost 50 percent of malnourished patients was direct evidence of nutritional deficiencies in influencing epithelialization and tissue regeneration. These findings are in line with the past literature that indicates that patients with hypoalbuminemia or anemia tend to experience slower wound healing and are also at risk of necrosis[14,15].

Malnourished patients had a very long hospital stay that was an average of over 8 days as opposed to 4.9 days in the well-nourished ones. Prolonged hospitalization not only entails high costs of healthcare but also the risk of secondary infections, family economic burden as well as decreased turnover of the bed in state-owned hospitals. The rate of postoperative morbidity in the 30 days of stay was threefold more in malnourished patients, which highlights how nutritional deficits have a persistent impact

on the recovery process long outside the acute postoperative phase[16].

The logistic regression analysis showed that serum albumin less than 3.5 g/dl was the strongest independent predictor of wound complications. This is in line with previous clinical report findings that found hypoalbuminemia to be the most significant nutritional biomarker of risk in the postoperative period. The level of hemoglobin and the lymphocyte count were also important predictors because of their involvement in tissue oxygenation and immune surveillance, respectively. Even though BMI was not so strongly related, extremely low BMI is an indicator of chronic energy deficiency and should be addressed on the clinical level[17,18].

On the whole, the results of this paper support the idea that nutritional optimization should be an inseparable part of preoperative preparation. There are indications that even temporary nutritional interventions like high-protein supplements, micronutrient-dense diets, or specific anemia treatment may go a long way to improve the outcomes of postoperative outcomes. Hospitals should implement standardized nutrition screening tools, i.e., MUST and introduce structured prehabilitation programs and particularly in high-risk populations. Malnutrition should be diagnosed and treated early to provide a low-cost and low-risk chance to minimize surgical morbidity and enhance recovery sort outlines[19].

Within the framework of the healthcare systems like that in Pakistan, where there are large patient loads and resources might be limited, it is possible and helpful to combine nutritional assessment. As the focus on the improved recovery after surgery (ERAS) pathways grows, preoperative nutrition becomes one of the pillars of safer and more effective surgical attention[20].

CONCLUSION

This paper has shown that impaired wound healing, high rates of surgical site infections, wound dehiscence, long hospitalization, and high postoperative morbidity in patients undergoing elective general surgeries closely relate with the poor preoperative nutritional status. Serum albumin, hemoglobin, and lymphocytes counts were found to be important independent predictors of postoperative complications, underscoring the importance of biological nutritional markers in the assessment of the risk of surgery. Malnutrition is also one of the most common and frequently ignored processes that have a strong impact on the outcomes of the surgery. Inclusion of regular nutritional screening and timely intervention in preoperative procedures can significantly help in eliminating complications and enhance recovery of patients. Such measures are clinically and economically beneficial, especially in large-volume hospitals of the sector. The results of the research point to the necessity of organized programs in nutrition optimization as a standard of surgical treatment. The solution to this problem is to address modifiable nutritional deficits preoperative to improve the quality of care in surgical patients by promoting postoperative healing, decreasing complications, and ultimately improving postoperative outcomes in surgical patients.

DECLARATION

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

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Authors' Contributions

Rohma Afzal: Study concept, data collection, manuscript drafting.
Haseeb Ahmad: Surgical supervision, data verification, critical manuscript revision.
Uswa Khalid: Literature review, data interpretation, drafting of results.
Zoha Zulfiqar: Statistical analysis, manuscript editing, table preparation.
Kalsoom Bibi: Final proofreading, formatting, and submission preparation.
All authors reviewed and approved the final manuscript.

Data Availability

The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

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