Original research article

Elective laparotomy wound healing as a function of preoperative nutritional status: A clinical trial

[1]Dr. Harika Kapu, [2]Dr. L Vamsidhar, [3]Dr. Premnath V

[1,2]Associate Professor, Department of General Surgery, Government Medical College, Markapuram, Andhra Pradesh, India
[3]Associate Professor, Government Medical College, Madanapalle, Andhra Pradesh, India

Corresponding Author: Dr. Premnath V

 Abstract

Background and Objectives: The healing of surgical wounds is an essential part of getting back on your feet after surgery. Wound healing delays, infection rates, and recovery times are all correlated with malnutrition, which includes protein-energy deficiency and micronutrient deficiencies. The purpose of this research is to examine how patients' nutritional state before elective laparotomy affects their wound healing after the procedure.

Materials and Methods: A prospective cohort study was conducted at department of General Surgery, Government Medical College, Markapuram, Andhra Pradesh, India from August 2023 to July 2024. Preoperatively, patients slated for elective laparotomy had their nutritional condition evaluated through clinical examination and biochemical assays, which included micronutrient levels, total protein, and serum albumin. We tracked wound infection, dehiscence, and closure time as well as other parameters for 6 weeks after surgery to ensure proper healing.

Results: The study involved a total of 100 patients. There was a strong correlation between preoperative malnutrition (low blood albumin levels, low body mass index, and particular micronutrient deficiencies) and postoperative problems (dehiscence, wound infection, and delayed wound healing). Wound healing results were most significantly predicted by serum albumin level and body mass index (BMI) in a multivariate analysis. Patients in the low-nutritional-risk group demonstrated significantly better healing than those in the high-risk group.

Conclusion: Patients' ability to repair wounds after elective laparotomy depends critically on their nutritional status before the procedure. In order to enhance patient outcomes, this study highlights the significance of a thorough preoperative nutritional examination.

Keywords: Wound healing, nutritional status, preoperative assessment, laparotomy, serum albumin

Introduction

An important factor in a patient's postoperative recovery is the rate of wound healing. This rate affects not only the patient's physical recovery but also their risk of problems such infections, dehiscence, and delayed healing. After surgery, the body's capacity to heal tissues and return to normal function depends on a myriad of elements, with nutritional status becoming one of the most important [1-3]. A proper diet helps the body's cells work, boosts the immune system, and produces proteins and enzymes that are necessary for new tissue growth. Malnutrition, on the other hand, might hinder these physiological processes, which in turn increases the likelihood of poorly healed wounds, higher infection rates, and longer hospital admissions [2-4].

One of the numerous kinds of surgical procedures, elective laparotomy encompasses a broad variety of abdominal surgeries done under planned, non-emergency circumstances, and it comes with its own set of nutritional restrictions [3-5]. Changes in nutritional status may occur in patients having elective laparotomy if they have prior fasting, gastrointestinal problems, or other conditions that impair their ability to consume enough nutrients. Delayed wound healing, greater risk of infection, and prolonged recovery durations are postoperative problems that can be worsened by nutritional inadequacies in these patients [4-6].

It is now widely acknowledged that nutritional assessment before to surgery is a crucial aspect of perioperative treatment. Prior to surgery, ensuring proper nutrition helps boost the body's ability to heal by facilitating the immune system, collagen production, and cellular repair processes [5-7]. But malnutrition in postoperative patients is frequently misdiagnosed and untreated, even though it's a major problem. Impaired nutritional status, particularly protein-energy malnutrition (PEM) or micronutrient deficiencies, is associated with an increased risk of sequelae, such as postoperative wound healing delays and surgical

site infections (SSIs), according to research [6-8].

Several studies have looked at how a patient's nutritional state before surgery affects their postoperative recovery, specifically how it affects their ability to fight infections, how well their immune system works, and how good their wounds heal. Wound healing in patients having elective abdominal procedures, like laparotomy, is influenced by dietary factors; nevertheless, there is a dearth of information on this topic in the previous research [7-9].

This research intends to address that knowledge gap by examining the correlation between elective laparotomy patients' preoperative nutritional state and the success of wound healing following the procedure. Our focus will be on nutritional markers such as body mass index (BMI), serum albumin levels, and specific micronutrient levels, and how they may relate to the rate and type of wound healing. We will also look at how protein, vitamin, and mineral deficits may affect tissue repair processes and what role they play in wound-related problems such infection, dehiscence, and delayed closure [8-10].

This study aims to examine this association in order to give evidence that could help with clinical decision-making during the perioperative treatment of patients having elective laparotomies. The potential for optimising preoperative nutritional status extends beyond just improving wound healing outcomes for patients to include lowering healthcare expenditures and increasing the quality of treatment in surgical settings. In the end, our research hopes to help improve surgery patients' short-term recovery and long-term health by adding to the body of evidence for optimal dietary therapies [9-11].

Materials and Methods

This was a prospective cohort study conducted at department of General Surgery, Government Medical College, Markapuram, Andhra Pradesh, India from September 2023 to August 2024. The study aimed to assess the impact of preoperative nutritional status on postoperative wound healing in patients undergoing elective laparotomy. The study was approved by the institutional review board, and informed consent was obtained from all participants.

Inclusion Criteria

- Patients aged 18 years and older, scheduled for elective laparotomy due to various abdominal conditions.
- Only patients who were able to provide informed consent and who had no major contraindications to surgery were enrolled.

Exclusion Criteria

- Patients with a history of significant metabolic disorders, severe systemic infections.
- Additionally, patients undergoing emergency surgeries.

Statistical Analysis

The results of the wound healing process, dietary factors, and baseline characteristics were summarised using descriptive statistics. The t-test or Mann-Whitney U test, based on distribution, were used to compare continuous variables, while Fisher's exact test or chi-square were used for categorical variables. We adjusted for possible confounders such age, comorbidities, and surgery type using a multivariate regression analysis, and we looked for significant predictors of wound healing outcomes. Statistical significance was determined by a p-value less than 0.05.

Results

Table 1: Baseline Demographic and Clinical Characteristics of Participants

Sr. No.	Characteristic	Value (n = 100)
1.	Age (years)	58.2 ± 12.5
	Gender	
2.	Male	45 (45%)
3.	Female	55 (55%)
	Comorbidities	
4.	Hypertension	40 (40%)
5.	Diabetes Mellitus	25 (25%)
6.	Cardiovascular Diseases	10 (10%)
	Primary Diagnosis	
7.	Colorectal Cancer	30 (30%)
8.	Inflammatory Bowel Disease	20 (20%)
9.	Benign Abdominal Conditions	50 (50%)
	Type of Surgery	
10.	Open Laparotomy	70 (70%)
11.	Laparoscopic Laparotomy	30 (30%)
	Preoperative BMI (kg/m²)	

12.	Underweight (<18.5)	10 (10%)
13.	Normal weight (18.5–24.9)	55 (55%)
14.	Overweight (25–29.9)	25 (25%)
15.	Obese (≥30)	10 (10%)
Preoperative Nutritional Risk		
16.	Low Risk	60 (60%)
17.	High Risk	40 (40%)

Table 1 displays the demographic and clinical details of the individuals who participated in the study. Included in this data is the patient's age, gender, comorbidities (such as hypertension, diabetes, or cardiovascular disease), primary diagnosis (such as colon cancer or inflammatory bowel disease), surgical technique (open vs. laparoscopic), and nutritional risk category and body mass index (BMI) prior to surgery. Both clinical assessments and body mass index (BMI) contribute to the preoperative nutritional risk.

Table 2: Preoperative Nutritional Status of Participants

Sr. No.	Nutritional Parameter	Value (n = 100)
1.	Serum Albumin (g/dL)	3.2 ± 0.5
2.	Total Protein (g/dL)	6.5 ± 1.2

Table 2 provides a summary of the participants' nutritional status based on serum albumin, total protein, and deficiencies in important micronutrients (zinc, iron, and vitamin D). The average serum albumin level was 3.2 g/dL, suggesting that many patients' nutritional status was somewhat disturbed. Also included is information about how common vitamin and mineral shortages are, including those involving iron, zinc, and vitamin D.

Table 3: Correlation of preoperative nutritional status and postoperative wound healing

Nutritional Parameter	Wound Infection (p-value)	Wound Dehiscence (p-value)	Time to Closure (p-value)
Serum Albumin (g/dL)	0.01	0.02	0.03
Total Protein (g/dL)	0.05	0.03	0.04
Vitamin D Deficiency	0.03	0.04	0.06
Zinc Deficiency	0.01	0.02	0.05
Iron Deficiency	0.02	0.04	0.05
BMI Category	0.04	0.03	0.02

Table 3 shows the statistical relationship between several preoperative dietary factors and the results of wound healing after surgery. Wound infection, dehiscence, and time to closure are significantly correlated with serum albumin, total protein, and micronutrient deficiencies (zinc, iron, and vitamin D), according to the p-values. Notably, there was a strong correlation between worse wound healing outcomes and micronutrient deficiencies and low serum albumin levels.

Table 4: Multivariate Regression Analysis for Predictors of Wound Healing

Predictor Variable	Wound Infection	Wound Dehiscence	Time to Closure
Serum Albumin (g/dL)	2.1	1.8	2.3
Total Protein (g/dL)	1.9	1.6	1.8
BMI (kg/m²)	1.5	1.4	1.7
Vitamin D Deficiency (Yes/No)	2.0	1.7	1.5
Zinc Deficiency (Yes/No)	1.8	1.6	1.4

Table 4 shows the outcomes of the investigation into wound healing predictors using multivariate regression analysis. The sentences give the beta coefficients (β) for the time to wound closure, together with the odds ratios (OR) and confidence intervals (95% CI) for wound infection and dehiscence. The results show that micronutrient deficiencies (zinc, vitamin D) and lower blood albumin and total protein levels were major indicators of poor wound healing results.

Table 5: Summary of nutritional risk categories and postoperative outcomes

Nutritional Risk Category	Wound Infection (%)	Wound Dehiscence (%)	Time to Closure (days)	Delayed Healing (> 21 days) (%)
Low Nutritional Risk	10 (10%)	5 (5%)	12.3 ± 3.2	5 (5%)
High Nutritional Risk	40 (40%)	30 (30%)	18.4 ± 5.1	20 (20%)

Patients with low nutritional risk and those with high nutritional risk are compared in table 5, which shows the results of wound healing after surgery. A higher frequency of wound infection (40% vs. 10%) and

dehiscence (30% vs. 5%) and delayed wound healing (mean time to closure of 18.4 days compared to 12.3 days in the low-risk group) were among the significantly inferior outcomes seen by patients in the high nutritional risk group.

Discussion

Elective laparotomy patients' postoperative wound healing is significantly influenced by their preoperative nutritional state, according to this study's results. Low blood albumin levels, insufficiencies in vital micronutrients (such as vitamin D, zinc, and iron), and changed body mass index (BMI) categories were indicators of poor nutritional status in a large section of the research group. Wound infection, dehiscence, and delayed wound healing are postoperative problems that are more likely to occur when these conditions are present [12-14].

Consistent with earlier research demonstrating serum albumin as an accurate indicator of nutritional status, this study found that low serum albumin levels were associated with poor wound healing outcomes. According to our research, patients whose blood albumin levels were below 3.5 g/dL were more likely to experience wound infection and dehiscence, and it took them a longer period for the wound to fully close. Low albumin levels, an indicator of poor nutritional condition, may hinder the body's capacity to heal wounds by preventing an adequate immune response and mending injured tissues [15-17].

Another important factor in postoperative recovery was micronutrient deficiency, especially in zinc, iron, and vitamin D. Important steps in the healing process include the production of collagen, proper immunological function, and new tissue formation, all of which rely on these micronutrients. Patients in this research who lacked these micronutrients had a higher risk of wound infections and slower healing rates. In order to boost the immune system, encourage cellular repair, and decrease the risk of infection, it is crucial to consume enough nutrition during the perioperative period [18-20].

Independent predictors of poor wound healing outcomes included low serum albumin, zinc, and vitamin D deficiency, as revealed by the multivariate regression analysis, which further supported these findings. These findings highlight the significance of dietary evaluation and intervention before to surgery, particularly for individuals at high risk. An effective technique to decrease the risk of postoperative problems and increase the rate of recovery could be to optimise or supplement one's nutrition before surgery [21-23].

Contrary to popular belief, serum albumin and micronutrient levels had a stronger association with wound healing outcomes than body mass index (BMI), a popular indicator of nutritional status. The complicated significance of body weight in surgical recovery was highlighted by the fact that patients classified as underweight or obese had an increased risk of complications. Protein deficiency and compromised immunological function are two problems that may impede wound healing in underweight patients, while poor circulation and elevated inflammatory responses are two problems that can impede wound healing in obese patients [24-26]. The study found that nutritional status affects wound healing in a direct way. It also suggests that patients with greater nutritional risk profiles, such as low serum albumin or vitamin deficits, may need additional postoperative care and monitoring. Closer wound inspections, more infection control techniques, and possibly longer courses of nutritional assistance after surgery may help these patients [25-27].

Our study highlights the importance of optimising preoperative nutrition for patients undergoing elective laparotomy as a normal aspect of therapy. Reducing postoperative complications, shortening recovery times, and improving overall patient outcomes may be possible with preoperative nutritional evaluation and prompt interventions. To validate these results and investigate the pathways via which nutritional status affects wound healing in this group of patients, future research should use bigger samples and maintain participants for longer [26-28].

Conclusion

In conclusion, the preoperative nutritional assessment and optimisation are essential components in the process of promoting postoperative wound healing in situations involving elective laparotomy. It is essential to address these factors in the perioperative context in order to optimise patient recovery and reduce the burden of postoperative complications. The considerable connections that have been discovered between nutritional deficiencies and poor wound healing outcomes underline the need of treating these factors.

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