

A CLINICAL STUDY ON THE EFFECT OF PREOPERATIVE NUTRITIONAL STATUS ON POSTOPERATIVE WOUND HEALING IN ELECTIVE LAPAROTOMY CASES

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Abstract-

Background: Malnourishment is the scourge of the developing countries like India. Nutrition is important in many physiological processes like wound healing. In patients posted for surgery, their nutritional status plays an important part in the post operative wound healing and prevention of complications like wound gaping and leakage from anastomosis. In this study we try to establish the relation between four nutritional indices and their effect on the postoperative wound healing and there by the duration of hospital stay.

AIMS AND OBJECTIVES: To study the nutritional factors affecting wound healing.

MATERIALS AND METHODS: This prospective study was conducted by selection of random 50 cases posted for major elective surgery during the period from Apr 2021 to Sep 2022.

CONCLUSION: From our study it can be fairly concluded that the preoperative nutritional status of the patient has a major impact on the post operative wound healing. A poor pre operative status predisposes to many complications like wound gaping and leak.

Index Terms: Hypoalbuminemia; Hemoglobin ; Lymphocyte count ; Body Mass Index. (key words)

INTRODUCTION

Malnutrition remains a challenge and is highly prevalent among in-patients. Globally, current data suggest that 19 to 59% of hospitalised adults have malnutrition, with the higher range in low-income and middle-income countries. Malnutrition is of special importance for the surgical patient due to its influence on postoperative patient outcomes. The association between preoperative weight loss and surgical mortality was first documented in 1936 by Studley. Since then, considerable evidence has shown that preoperative malnutrition is associated with postoperative complications, including infection, delayed wound healing, and increased length of hospital stay. Furthermore, several studies have shown that treatment of severe malnutrition before surgery improves postoperative clinical outcomes.

Malnutrition refers to a state of inadequate or excess nutrition, with or without the presence of inflammation, which leads to changes in body composition and impaired physiologic function. Evidence-based recommendations are available to guide nutritional care in the perioperative period. Preoperative nutrition therapy recommendations are dependent on the patient's nutritional status. As such, all patients should be screened for malnutrition risk prior to surgery and evaluated by a dietitian if identified as high risk. If the patient is diagnosed with severe malnutrition and the surgical intervention is not emergent, the surgery should be postponed 7 to 10 days while the patient is given appropriate nutritional support.

There is no evidence that gastric decompression or fasting after surgery is beneficial. Rather, enteral feeding or a solid diet should commence within 24 hours. Due to the metabolic stress response, surgical patients have increased protein and kilocalorie requirements after surgery. At least 60% of protein requirements should be met within 7 to 10 days to prevent complications of malnutrition. Thus, the European Society of Enteral and Parenteral Nutrition guidelines state that all patients should be fed by mouth soon as possible, preferably within 24 hours, or initiated on enteral tube feeding if not anticipated to eat orally in 7 days. In cases of intestinal failure, parenteral nutrition should be initiated as soon as possible for a malnourished patient, or after 7 days for a well-nourished patient when oral or enteral nutrition does not seem feasible in the following 3–7 days.

Currently, there is paucity of data on the quality of nutrition care services offered to surgical patients in Malawi, against these evidence-based guidelines. Furthermore, there is dearth of data regarding the nutrition status of adult hospitalised patients in Malawi. Therefore, this prospective observational study was aimed at assessing the preoperative nutrition status and the currently available nutrition interventions for adult surgical patients undergoing laparotomy at a tertiary care hospital. The nutrition provided to patients by the hospital was evaluated for adequacy of protein and kilocalorie content, as surgical patients require increased intake of these nutrients to mitigate the catabolic effect of metabolic stress. The influence of these factors on postoperative outcomes was also investigated

AIM OF THE STUDY

To study the nutritional factors affecting wound healing.

MATERIALS AND METHOD

Study population

This prospective observational study was conducted at Tertiary care hospital and enrollment was done between April 2021 and September 2022. Adult patients admitted to the male and female surgical wards and scheduled for laparotomy were enrolled in the study. Because immunosuppression is one of the main drivers of malnutrition-related consequences, participants with HIV infection and confirmed cancer diagnosis were excluded from the study. Participants aged 65 years and above were also excluded. Using an alpha error of 5% and power of 80%, the sample size was calculated at 25 patients, to detect at least 20% prevalence of malnutrition in the study population. Written informed consent was sought and provided by all the participants before their inclusion into the study. To ensure the protection of privacy and confidentiality of the information provided, study codes (and not names) were used on the data collection sheets for individual participants. Data that could identify the individual participants was securely stored and was only accessible to the study investigators.

Nutrition assessment

The Subjective Global Assessment (SGA) was used to assess and classify each patient's nutritional status as severe malnutrition (SGA Class C), mild or moderate malnutrition (SGA Class B), or well nourished (SGA Class A). The SGA is a globally recognised, validated nutrition assessment tool that uses clinical history and physical exam to evaluate nutrition status and predict outcomes. SGA uses a scoring system based on the clinician's subjective assessment (mild, moderate, or severe) of the patient's reported dietary intake, weight changes, gastrointestinal symptoms and functional capacity along with the degree of metabolic stress in their diagnosis, and a physical examination. A registered dietitian trained medical students who were part of the study team how to use the SGA method.

Handgrip dynamometry was used to assess functional capacity. Height and weight were measured preoperatively. The anthropometrics were used to calculate body mass index (BMI). Postoperative protein and energy requirements for each participant were also estimated. Energy (kilocalorie) needs were estimated using the Harris-Benedict equation with an individualised stress factor of 1.2 or 1.3. Protein requirements were dosed between 1.2–1.5 grams/kg body weight. The specific stress factor and protein requirements were determined by an experienced registered dietitian, according to the severity of the surgery and other metabolic stressors.

Outcome monitoring

Patients were followed prospectively until discharge. Outcome variables including length of hospital stay and development of wound dehiscence or infectious complications were recorded. An infectious complication was considered when there was persistent fever (temperature >38 °C) 72 hours after surgery. Lastly, handgrip strength was measured in all patients on day 3 postoperative.

Menu analysis

The recipes for food provided to patients on a standard diet from the hospital kitchen were collected. The hospital menu was referenced and cross-checked with kitchen staff. Portion sizes are not standardised. Therefore, the researchers estimated the average portion sizes by observing the meal service. All the food served to one patient in one day was then analysed for protein and kilocalorie content using the Tanzania Food Composition. Since the menu is generally the same day to day, only one day's menu was analysed.

Statistical analysis

Statistical analysis of the data was done using Stata version 12 (StataCorp, USA) and GraphPad Prism version 7.01 (GraphPad Software, Inc, USA). Normality for the data was assessed using the Shapiro-Wilks test. Descriptive statistics were expressed as median (IQR) for the continuous data. The Wilcoxon rank-sum test (or Mann-Whitney U-test) was used to test the equality of two medians, to investigate differences in the measured variables. To test for differences between medians of the analysed variables at different points in time, the Wilcoxon paired rank-sum test and the Friedman test (K-related samples) were used. To measure the associations between the variables, Spearman's test of association was used. A p-value of <0.05 was considered statistically significant.

Results

A total of 34 patients were screened and 25 patients who fit the study criteria were included. The sample was well distributed between males and females. The major indication for laparotomy in the study sample was prostatectomy due to benign prostatic hypertrophy and intra-abdominal tumours that had not yet been diagnosed by histopathology. With regards to post-operative complications, 72 % of the study participants either developed incision-wound infection or dehiscence. No deaths were recorded from the participants during the study period. According to the BMI classification of nutritional status, most of the patients (76%) had normal weight, only a few were overweight (6%) and none was underweight or obese (see [Table 1](#)). Nevertheless, using the SGA classification of nutritional status, only 20% of the participants were categorised as well-nourished. The remaining 80% were either moderately malnourished (52%) or severely malnourished (28%).

Table 1 Characteristics of the study population

| | |
|---------------------------|--------------|
| Gender, n (%) | |
| Males | 13 (52%) |
| Females | 12 (48%) |
| Age [years], median (IQR) | 38 (28.5–49) |

| Indication for laparotomy n (%) | | | |
|---------------------------------|--|----|-------|
| Prostatectomy | | 11 | (44%) |
| Bowel obstruction | | 4 | (16%) |
| Intra-abdominal tumours | | 8 | (32%) |
| Exploratory laparotomy | | 2 | (8%) |

Handgrip strength was assessed in this study to measure the functional capacity of the patients both preoperatively and day 3 postoperatively. [Figure 2](#) shows a comparison of the handgrip strength between the two-time points. Notably, the median handgrip strength for the entire study group was 22.3 kg (20–33) preoperatively but decreased significantly to 18.4 kg (14–27) postoperatively ($p < 0.0001$). Handgrip strength was then analysed per SGA categories ([Figure 3](#)). Notably, the handgrip strength was associated with SGA class, where class A had a higher median handgrip strength than classes B and C both preoperatively (class A 33 kg (25.25 – 40.4), class B 25.55 kg (21.85 – 34), class C 20 kg (16 – 22)) ($p < 0.0001$) and postoperatively (class A 27 kg (16.5 – 39), class B 20 kg (17.25 – 27.75), class C 14 kg (12 – 15)) ($p = 0.0004$).

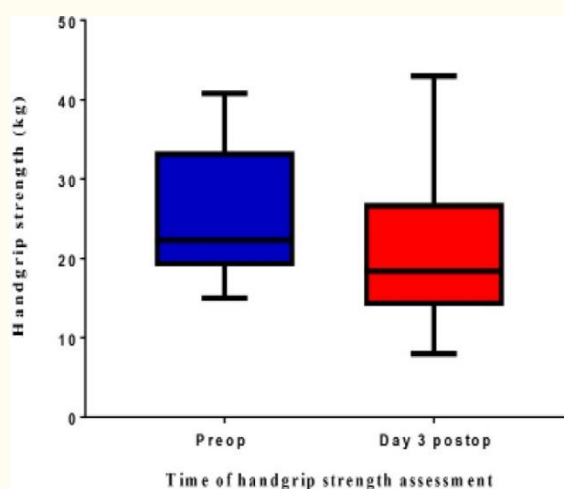


Figure 2

Box plot of handgrip strength of the dominant hand preoperatively and at day 3 postoperatively. The median handgrip strength at day 3 postoperative was significantly lower than the preoperative handgrip strength (Wilcoxon paired rank-sum test $p < 0.0001$).

The daily energy and protein requirement for each patient was calculated, accounting for both the basal physiological needs and the stress associated with surgery. The typical diet provided by the hospital was porridge with some sugar in the morning and (thick rice porridge) with beans, cabbage or both for lunch and supper.

The diet was analysed and an estimate of the total energy and protein provided through the diet was calculated. [Figure 3](#) depict comparisons between the total energy requirements and what was provided; and the protein requirements against what was provided. Both the total energy (1279.8 kcal) and protein (31.54) provided by the hospital diet were statistically significantly lower than the estimated requirements (1564 kcal (1488 – 1809 and 72 g (60.52 – 81) respectively) ($p < 0.0001$). According to the calculated estimates, none of the patients met their energy and protein requirements by the provided hospital diet alone. It should be noted, however, that none of the patients was provided with enteral or parenteral nutrition. Also, these calculations were based on a patient who solely depended on the nutritional support provided by the hospital, and hence no food items provided from other sources were included in the energy and protein analysis of this study. The proportion of postoperative complications in the study group was 72%. Of all these complications, 59% were observed in patients who were in SGA class C, while those of class B contributed 31% and only 10% SGA class A. The median length of hospital stay was 5 days (4 – 7). However, severely malnourished patients (SGA class C) had a median length of hospital stay of 8 days (7 – 9). Well-nourished patients (SGA class A) had a median length of stay of 4 days (4 – 4).

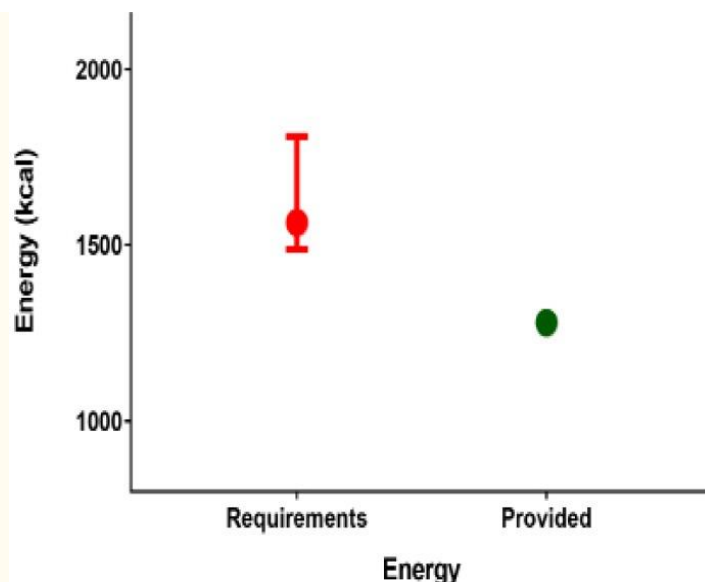


Figure 3

Comparison between the median (IQR) total energy requirements for the patients and the actual provision from the hospital diet. Total energy provided was significantly lower than the median energy requirement for patients (Wilcoxon rank-sum test $p < 0.0001$).

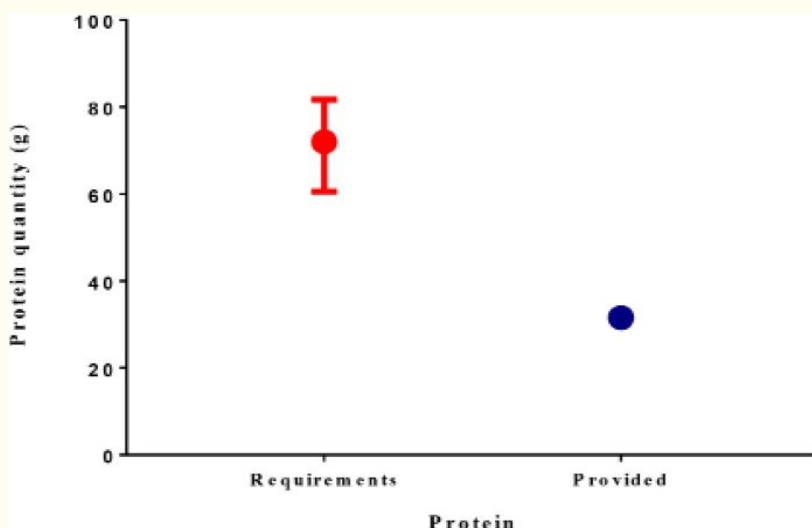


Figure 4

Comparison between the median (IQR) protein requirements for the patients against provision from the hospital diet. Total protein provided was significantly lower than the median protein requirement for patients using the Wilcoxon rank-sum test ($p < 0.0001$).

Those who were mildly or moderately malnourished (class B) had a median length of stay of 5 days (4 – 5) ($p < 0.0001$). Association between handgrip strength and outcome variables was assessed. Notably, both preoperative and day 3 postoperative handgrip strength significantly correlated negatively with the number of postoperative complications and length of hospital stay (see Table 2).

Table 2 Association between handgrip strength and outcome variables

| Study time | handgrip strength v. complications | | handgrip strength v. hospital stay | |
|--------------|------------------------------------|---------|------------------------------------|---------|
| | Spearman's rho | p-value | Spearman's rho | p-value |
| Preoperative | -0.46 | 0.02 | -0.49 | 0.01 |
| Day 3 postop | -0.49 | 0.01 | -0.48 | 0.01 |

Discussion

To our knowledge, this is the first study to assess the nutritional status, nutritional interventions and outcomes in a subset of surgical patients undergoing laparotomy at a tertiary hospital. The study has revealed that 80% of the patients had some degree of malnutrition with 28% severely malnourished. Other studies from low-income settings in have reported lower rates of in-hospital adult malnutrition. Uganda and Burundi reported rates of 47% and 59%, respectively. However, low-income regions within Brazil found 78% of adult inpatients, of which more than 50% were surgical patients, were malnourished. Multiple upper-middle income

countries have found about 50% of adult inpatients as malnourished. Even in high-income settings, for example Australia and the United States of America, the rate of malnutrition in surgical inpatients may be as high as 48%. The higher rate of malnutrition in the current study, therefore, is likely due to the coupled effect of the disease processes and inadequate nourishment owing to food insecurity, which increases the risk of malnutrition in the population.

Nutritional status in this study was assessed using the SGA classification, a validated tool for nutritional assessment for hospital patients. We observed that even though 80% of the patients were categorised as malnourished using the SGA classification, BMI did not identify anyone as undernourished (BMI <18.5). This confirms the limitation of BMI as a less sensitive tool for assessing malnutrition in acute and complicated clinical conditions which obscure undernutrition. BMI is a useful measure in the general population, where it correlates with mortality, although the traditional cutoffs for underweight (<18.5 kg/m²), overweight (>25 – 29.9 kg/m²), and obesity (>30 kg/m²) are derived from data in predominantly Asian populations. In an acutely ill individual, when metabolic changes and fluid shifts occur rapidly, BMI is not useful because weight changes are confounded by fluid status. The use of SGA is, therefore, preferable to BMI in such clinical settings. Since SGA does not rely on laboratory or anthropometric measures, it is a practical and cost-effective tool for hospitals.

Our finding that the severity of preoperative malnutrition according to SGA class correlated with postoperative complications and length of hospital stay is consistent with the literature. Poor SGA class has also been associated with increased mortality in other studies. This finding draws attention to the critical importance of nutritional assessment by a trained professional prior to surgery. Currently, to our knowledge, there is no formal nutritional screening or assessment performed in adult inpatients at QECH. Consequently, patients who would benefit from 7–10 days of nutrition repletion before surgery are not identified. There are simple screening tools such as the Nutrition Risk Score, Mini Nutrition Assessment (MNA) and the Malnutrition Universal Screening Tool (MUST) that could be implemented to identify patients at high risk of malnutrition for potential preoperative nutrition therapy.

In this study, handgrip strength was significantly lower at day 3 postoperatively than that at preoperative assessment. This is an indication of a decline in functional capacity due to loss of lean body mass. Major surgery elicits metabolic responses associated with increased muscle proteolysis and increased energy expenditure that puts patients at risk of acute disease-related malnutrition, where even an excess of adipose tissue will not prevent catabolism of lean tissue. This catabolic state cannot be reversed via protein and energy intake; however, adequate provision slows lean body mass wasting, mitigates the inflammatory response, and, if provided enterally, maintains the integrity of the gastrointestinal tract as a major immune organ. Handgrip strength correlates highly with nutrition status in hospitalised patients, as is replicated in the present study. Moreover, this tool objectively captures a change in nutrition status faster than any anthropometric or laboratory marker. The present study showed that handgrip strength both preoperatively and postoperatively correlated negatively with the length of hospital stay and the rate of complications postoperatively. These results indicate that in-hospital decline in nutritional status was associated with increased risk of complications. These findings, therefore, call to the importance of both the optimal nutritional status of patients before surgery and appropriate nutritional interventions postoperatively. The goal of nutrition therapy after surgery is to ensure the preservation of lean body mass and immune function, which is essential for healing in these patients. For a patient who already exhibits severe muscle wasting, it is imperative that oral, enteral, or parenteral nutrition support be initiated as soon as possible after surgery. Postoperatively, the usual practice at QECH is to start the patient on a liquid diet only after 24 hours and in the presence of bowel sounds. The diet is then gradually advanced to a regular solid diet. In special cases, clinicians prescribe a high protein diet (HPD), which might include an egg and milk. However, HPD is rarely feasible for the kitchen to provide due to budgetary constraints. Otherwise, there are no specialised nutritional interventions available. The analysis of the standard hospital diet in this study showed gross deficiencies in energy (284.2kcal) and protein quantity (40.46g). Such a deficient diet cannot ameliorate lean body mass wasting. It is also inadequate for tissue repair and several immune functions in an adult. According to ESPEN guidelines, four patients (16%) in the current study had indications for postoperative parenteral nutrition, which could not be provided. The overall decline in handgrip strength and high rate of complications, especially in malnourished patients, may be another indication of inadequate postoperative nutrition support. The resulting unmitigated muscle catabolism has consequences. Literature has shown that a 10% loss of lean mass is associated with impaired immunity and skin integrity, and that loss of 40–45% of lean body mass is incompatible with life.

Appropriate nutritional management is an effective intervention. A recent meta-analysis of randomised controlled trials showed that nutrition interventions in malnourished patients reduced the risk of postoperative infectious complications by 42% and noninfectious complications by 26%. The length of hospital stay was also reduced by 2.6 days. Appropriate nutritional interventions are also cost-effective. Studies indicate that, on average, malnourished patients (SGA class B and C) have 31–38% higher hospital costs than well-nourished patients. Nutritional interventions would, therefore, reduce morbidity, mortality and the associated hospital costs.

Given the findings of this study, nutrition interventions have the potential to catalyse significant improvement to health care delivery. Availability of registered clinical dietitians to assess and manage an individualised nutrition care plan is critical. Currently, there are no dietitians in Indian government hospitals. However, a program to train dietitians is presently training its first cohort. Availability of adequate nutrients, in the form of food, supplements, enteral formula, and parenteral solutions is also essential. This study identifies the need for hospitals in Malawi to integrate nutritional management as an essential part of health service delivery in adult patients, especially in conditions where the evidence points to its efficacy in improving outcomes.

Study Limitations

This study is limited by its design as an observational study, and, as such, can only report associations. Interpretation of the results of this study should be made in light of its design. The calculations of energy and protein content from the diet were based on a patient who solely depended on the nutritional support provided by the hospital, and hence no food items provided from other sources were included. Further to this, the calculations were based on what was provided by the hospital, and not on the actual

intake. Lastly, due to the limited time frame for this study, we were unable to follow up patients after discharge to monitor mortality or rate of readmission.

Conclusions

This observational study has shown that the prevalence of malnutrition in surgical patients undergoing laparotomy at a tertiary hospital is high. Patients with severe malnutrition experienced more postoperative complications and had increased length of hospital stay compared to well-nourished patients. The standard diet provided at the hospital for the patients was deficient in both energy and protein. Improved nutrition care may improve outcomes in surgical laparotomy patients. Further studies, with larger sample sizes in other patient populations and hospitals are required in this area.

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