An observational study of perioperative nutrition and postoperative outcomes in patients undergoing laparotomy at Queen Elizabeth Central Hospital in Blantyre, Malawi

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Abstract
Nutritional status in patients undergoing surgery can influence their immune function, tissue repair and, hence, clinical outcomes. This study aimed to assess the perioperative nutrition and postoperative outcome of patients undergoing laparotomy at a tertiary hospital in Malawi.

Methods
A total of 25 patients were included in this prospective, observational study. The Subjective Global Assessment was used to classify each patient according to nutritional status. Handgrip strength was measured for each patient preoperatively and at day 3 postoperatively. Anthropometric measurements were also done. Protein and energy requirements for each participant were estimated and compared to the quantities provided by the hospital diet. Patients were followed up until discharge and outcome variables which included length of hospital stay and wound dehiscence or infectious complications were recorded.

Results
Of the study participants, 20% were well-nourished, 52% were moderately malnourished and 28% were severely malnourished. The median handgrip strength decreased at day 3 postoperatively from the preoperative handgrip strength. Well-nourished patients had higher handgrip strength than malnourished patients both preoperatively and postoperatively. Total energy and protein provided by the hospital diet were significantly lower than the estimated requirements for the patients. Severely malnourished patients had increased median length of hospital stay and increased rate of postoperative complications. Preoperative and postoperative day 3 handgrip strength correlated negatively with the number of postoperative complications and length of hospital stay.

Conclusion
This study showed high rates of malnutrition and inadequate in-hospital nutritional support which were associated with poor clinical outcomes, especially in severely malnourished patients. Proper nutritional assessment and provision of adequate nutritional support should be reinforced in surgical patients to promote favourable clinical outcomes postoperatively. Further studies with larger sample sizes in other patient populations and hospitals in Malawi are required in this area.

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 Stedley. 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. An individual who presents for surgical evaluation may have comorbidities that predispose to chronic disease-related malnutrition, such as HIV, organ failure, cancer, metabolic syndrome, and many other conditions characterised by persistent moderate inflammation. Preoperative malnutrition could also result from simple starvation-related malnutrition, defined as chronic undernutrition in the absence of an inflammatory condition. Regardless of preoperative nutrition status, all patients are at an increased risk of acute disease-related malnutrition after surgery. Any physiologic injury stimulates a metabolic stress response mediated by inflammatory cytokines and catecholamines. Collectively, these increase energy expenditure and muscle proteolysis in proportion to the severity of the injury. Coupling this with decreased or restricted nutrient intake and decreased mobility postoperatively leads to rapid deterioration of lean body mass and function. Thus, even a well-nourished or
over-nourished patient who undergoes a major surgery can develop severe acute disease-related malnutrition within as little as 10 days if not fed appropriately. 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 diettian 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.

On the day of surgery, the European Society of Anesthesiology recommends that patients be allowed to eat solid food up to 6 hours before surgery. Intake of clear liquids is encouraged up to 2 hours before surgery, from which point the patient should take nothing by mouth. The Enhanced Recovery After Surgery (ERAS) protocol, which has repeatedly shown significant benefits for patients undergoing gastrointestinal surgery, includes preoperative carbohydrate loading with a clear liquid beverage to possibly reduce postoperative insulin resistance, nausea, and vomiting.

After surgery, most patients can resume a normal diet. 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 demand, 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 Critical Care Medicine and Parenteral Nutrition guidelines state that all patients should be fed by mouth as soon as possible, preferably within 24 hours, or initiated on enteral tube feeding if not expected to eat orally in 7 days. In cases of intestinal failure, parenteral nutrition could 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 hospitalised patients in Malawi. Therefore, this prospective observational study was aimed at assessing the preoperative nutrition status of adult hospitalised patients in Malawi

The nutrition provided to patients by the hospital in Malawi. The nutrition provided to patients by the hospital in Malawi. The study protocol was approved by the College of Medicine Research and Ethics Committee (MMBRS/08/16/02). 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 nutritional 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. 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). Preoperative protein and energy requirements for each participant were also estimated. Energy (kcalorie) 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 postoperatively.

Menu analysis

The recipe 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 Table. Since the menu was referenced on 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-Wilk 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 the median 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 (see Figure 1). The characteristics of the study population are given in Table 1. The sample was well distributed between males and females. The major indication for laparotomy in the study sample was posttrauma due to severe blunt trauma, gastro-intestinal ailments and other 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%).

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 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 according to the SGA categories (Figure 3). Notably, the handgrip strength was associated with SGA class, where class A had a higher median handgrip strength than class B and C both preoperatively (class A 33 kg (25.25 - 40.4), class B 25.5 kg (21.85 – 34), class C 20 kg (16 – 22)) (p<0.0001) and postoperatively (class A 27 kg (16.39 – 30), class B 20 kg (17.25 – 27.75), class C 14 kg (12 – 15)) (p=0.0004).

The daily energy and protein requirement for each patient was calculated, according to 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 maize (musa) 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. Figures 4 and 5 depict comparisons between the total energy requirements and what was actually provided to the patients compared against what was provided. Both the total energy (1279.8 kcal) and protein (31.54) provided by the

Table 1. Characteristics of the study population

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Gender Percentage (%)</th>
<th>Age (years) median (IQR)</th>
<th>Indication for laparotomy n (%)</th>
<th>Prostatectomy</th>
<th>Bowel obstruction</th>
<th>Intra-abdominal tumours</th>
<th>Exploratory laparotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male (%)</td>
<td>13 (52%)</td>
<td>32 (25-46)</td>
<td>11 (44%)</td>
<td>4 (16%)</td>
<td>8 (32%)</td>
<td>2 (8%)</td>
<td>12 (48%)</td>
</tr>
<tr>
<td>Female (%)</td>
<td>12 (48%)</td>
<td></td>
<td></td>
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<td></td>
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</tbody>
</table>

https://dx.doi.org/10.4314/mmj.v30i2.5

Figure 1. Flowchart of patients who met inclusion/exclusion criteria for the study

https://dx.doi.org/10.4314/mmj.v30i2.5
Perioperative nutrition and postoperative outcomes

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

<table>
<thead>
<tr>
<th>Study time</th>
<th>Spearman’s rho</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preoperative</td>
<td>-0.46</td>
<td>0.02</td>
</tr>
<tr>
<td>Day 3 postop</td>
<td>-0.49</td>
<td>0.01</td>
</tr>
</tbody>
</table>

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 referral hospital in Malawi. The study has revealed that 80% of the patients had some degree of malnutrition with 28% severely malnourished. Considering that at least 39% of Malawians are food insecure and that patients at QECH are referred from district hospitals that serve rural communities, this result is not very surprising. Other studies from low-income settings in Africa 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 who 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%-56.

The higher rate of malnutrition in the current Malawian 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 Caucasian populations. In an acutely ill individual, when metabolic changes and fluid shifts occur rapidly, it is not useful because 25% of fluid 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 Malawian hospitals.

Table 3. Handgrip strength among the SGA classes preoperatively (A) and at day 3 postoperatively (B). Lower SGA classes B and C had handgrip strength compared to SGA class A using Friedman test, both preoperatively (p<0.0001) and at day 3 postoperatively (p<0.0004).

Handgrip strength v. complications

Association between handgrip strength and outcome variables

Table 4. Comparison between the median (IQR) protein requirements for patients and the actual provision from the hospital diet. Total protein provided was significantly lower than the median requirements for the patients against provision from the hospital diet were statistically significantly lower than the estimated requirements (1564 kcal (1488 – 1809) and 72 g (60.2 – 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. Handgrip strength among the SGA classes preoperatively (A) and at day 3 postoperatively (B). Lower SGA classes B and C had handgrip strength compared to SGA class A using Friedman test, both preoperatively (p<0.0001) and at day 3 postoperatively (p<0.0004).
Conclusions

This observational study has shown that the prevalence of malnutrition in patients undergoing laparotomy at a tertiary hospital in Malawi 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 was unable to meet the energy and protein requirements 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 immunity strength and high rate of complications, especially in malnourished patients, may be another indication of inadequate postoperative nutritional support. The resulting unmitigated muscle catabolism has consequences for the patient’s further management. Literature has shown 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 review of the randomized controlled trials showed that nutrition interventions in malnourished patients reduced the risk of postoperative infectious complications by 42% and non-infectious complications by 26%[1]. The length of hospital stay was also reduced by 2.6 days[2]. 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.4 Nutrition interventions would therefore, reduce morbidity, mortality and the associated hospital costs. Given the findings of this study, nutrition interventions have the potential to improve health care delivery in Malawi. Availability of registered clinical dietitians to assess and manage an individualised nutrition care plan is critical. Currently, there are no dietitians in Malawian 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.

References