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Preoperative nutritional status assessment and clinical outcomes in pediatric patients undergoing gastrointestinal surgery: a prospective study

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ABSTRACT

Background: The objective was to assess the association between preoperative nutritional status and postoperative outcomes in children undergoing gastrointestinal surgery.
Methods: This prospective study recruited pediatric patients diagnosed with gastrointestinal surgical pathology from the pediatric surgical department in a tertiary care hospital during the period from April 2023 to October 2023. Sixty surgical cases were included in our study from both genders. An organized questionnaire was created. This questionnaire involved 3 major parts: demographic and nutritional status parameters at admission and discharge. Comparison of nutritional status pre- and postoperatively were done.
Results: A total of 60 pediatric patients were enrolled. According to both STRONGKIDS score and the subjective global nutritional assessment, 58.3% of upper gastrointestinal (GI) group were at risk of malnutrition. Wasting was more common in the upper GI group 75%; versus 36.8% in the lower GI group. Underweight was more common in the hepatobiliary and upper GI groups (nearly 41.7% for each group) than in the lower GI group (26.3%). Furthermore, stunted patients had a higher incidence of complications and a prolonged hospital stay (>7 days) (p=0.001 and p=0.028, respectively), while underweight lower GI patients showed a prolonged hospital stay (p=0.017).
Conclusions: Nutritional assessment is an essential part of surgical management of pediatric patients. Both underweight and wasting statuses were more common among hepatobiliary and upper GI groups. A long hospital stay and postoperative complications were more common among stunted patients.

Keywords: Malnutrition, Pediatric surgical patients, Anthropometric parameters, STRONGKIDS score, Postoperative outcomes

INTRODUCTION

Malnutrition is defined by the European Society for Clinical Nutrition and Metabolism (ESPEN) as a state of abnormal body composition caused by a lack of nutrition intake or uptake, resulting in altered body composition (decreased fat free mass) and body cell mass, leading to diminished mental and physical function and impaired clinical outcome from disease.[1]

Malnutrition is common among pediatric surgical patients particularly; patients undergoing GI surgery as a result of dietary restriction, anorexia, malabsorption, altered nutrient requirements and increased intestinal losses.[2]

Furthermore, the hypermetabolic state generated by surgical stress and postoperative restriction of oral intake can aggravate malnutrition; which results in immune suppression and stress resistance.[3]

Several studies demonstrate that the ability of a child to recover after surgery is highly dependent on adequate nutrition.[4]

Under these surgical, stress-induced catabolic response, malnutrition poses an even higher risk to children because, beyond increased metabolic demand from surgery or disease, there is an increased demand for growth and neurodevelopment.[5]

Therefore, hypermetabolic states are considered as a commutative risk factor for adverse events such as poor wound healing, infection, prolonged hospital stay, GI tract bacterial overgrowth, and mortality, so optimizing a child's pre-operative nutritional status could potentially lead to improved short- and long-term outcomes.[6]

We hypothesized that a malnourished pre-operative nutritional state is associated with poor outcomes after surgery, so studies can be performed to identify thresholds for nutritional optimization to improve outcomes after different surgical procedures. Variable interventions can be implemented to optimize the nutrition of these children before surgery to achieve improved outcomes.

We assessed different anthropometric parameters, namely, weight-for-age z score (WAZ), height-for-age z-score (HAZ), or body mass index (BMI)-for-age z-score (BAZ), associated with hemoglobin and serum protein levels (albumin and pre-albumin), subjective assessments included questionnaires and their influence on the post-operative outcomes of children who underwent scheduled gastrointestinal surgery.

This study aimed to assess the association between preoperative nutritional status and postoperative outcomes in children undergoing gastrointestinal surgery.

METHODS

Study subjects and design

We performed a single-center prospective observational cohort that was carried out in Benha University Hospital, a resource-abundant tertiary pediatric surgery during the period from April 2023 to October 2023. The participants for our study were recruited from the pediatric surgery department during the study period. All pediatric patients whose age ranged from 1 to 60 months were eligible for enrollment (this age group was vulnerable to malnutrition). Based on the designated inclusion criteria, 60 surgical cases were included in our study from both genders. Emergency pediatric surgical cases were excluded from the analysis. Patients were subdivided into 2 categories according to the length of hospital stay: short stay (less than 7 days) and long stay (more than 7 days). Throughout the study, nutritional support protocol provided by the clinical nutrition team was applied without any interference which relies on the proper calculation of caloric and protein requirements according to age nutritional support is provided orally either through encouraging breastfeeding or providing artificial formula or complementary diet except for gastrostomy patients with addition of micronutrients if needed.

We adopted the following methods to achieve our aim of the analysis including creating a research population, as well as preparing and administering a questionnaire.

After reviewing the literature, a standardized questionnaire was created to determine the nutritional assessment parameters and clinical outcomes. We designed a questionnaire that was formed of 3 parts.

Demographic characteristics including patients' age, sex, and associated comorbid conditions. Nutritional history involved presence of breast feeding, weaning problems, and previous nutritional support.

Objective and subjective nutritional assessment tools. The objective parameters included: measurements of weight, length, mid upper arm circumference (MUAC), triceps skin fold thickness (TSF), mid arm muscle circumference (MAMC). Weight and length were measured using a mechanical scale and a stadiometer, respectively. Using 2000 CDC growth charts, Z scores for weight-for-age, length-for-age, and weight-for-length-for-age of newborns aged 1 to 60 months were calculated.[7]

MUAC was measured at a point midway between the acromion and the olecranon, with the arm flexed at a 90° angle and the tape measured perpendicular to the long axis of the arm. TSF was measured using a skin fold caliper at the previously noted MUAC location, and MAMC was computed using the formula (MUAC-[3.14TSF]). The 2007 WHO Child Growth Standards were used to calculate Z scores for arm circumference for age and triceps skin fold for age in infants aged 3 to 60 months.[8]

We recorded 3 biochemical indicators to determine the nutritional status, including serum prealbumin, a marker of acute malnourishment, serum albumin, a marker of chronic malnourishment, and hemoglobin. Prealbumin, also known as transthyretin, has a serum half-life of approximately two days, making it more sensitive than albumin to short-term changes in protein energy status and its concentration closely reflects recent food consumption.[9]

Albumin has a half-life of approximately 20 days and is considered as a reflection of long-term protein dietary sufficiency.[10]

All biomarkers were drawn from the operating room prior to the start of surgery after 6 hours of fasting time and on day 7 postoperative because this is the standard duration for hospital stay in most of uncomplicated surgical cases. Until the time of processing, samples were kept at or below 30 degrees Celsius. The freezer time range for the samples was 7 to 90 days.

Weight change, nutritional intake, oral motor skill development, feeding tolerance, functional ability, muscular atrophy, and ankle edema were all indicators of SGNA. In assigning an overall score, all items were assessed in the context of each other. Patients were classified as well-nourished if they achieved normal ratings on all or most items, or as malnourished in case of moderate to severe ratings in most or all items.[11]

The STRONGKIDS screening tool included the following. Firstly, we considered the presence of an underlying illness, the prospect of a major surgery, and clinical nutritional assessment. Secondly, we considered the presence of one of the following items: (1) excessive diarrhea; (2) dietary intake reduction during the last few days; (3) preexisting nutritional intervention; and (4) inability to consume adequate food intake due to pain, weight loss or stationary weight. Assessment score ranged from 0 to 5. Patients were categorized to 3 groups according to the assessment score range from 0 to 5, those with a score 0 being at low risk for malnutrition; those with a score between 1 and 3 were at moderate risk of malnutrition; those with a score of more than 4 were considered to be at high risk of malnutrition.[12]

Postoperative clinical outcome assessment and classification included the existence of complications and length of hospital stay. Adverse events were divided into infectious postoperative events, which could be local, systemic, or both, and noninfectious events, that involved postoperative blood transfusion requirements and critical care unit admission. A standardized complication categorization system of Clavien-Dindo was utilized to monitor postoperative adverse events as follow:[13] grade I represented surgical site infection (SSI) with no systemic illness; grade II represented systemic infections and blood transfusion; grade IIIa represented patients who needed intervention under regional or local anesthesia; grade IIIb represented patients who needed surgical intervention under general anesthesia; grade IV represented the need for admission in the intensive care unit; grade V represented death.

Questionnaire administration

Both patients' nutritional assessment and reporting postoperative outcomes were performed by trained researchers who received adequate training in the pediatric department. The training included the different methods and techniques of nutritional parameters assessment.

Ethical considerations

The study was reviewed and approved by the Institutional Review Board prior to initiation of the study in accordance with the guidelines of the declaration of Helsinki. All methods were carried out in accordance with relevant guidelines and regulations. Written informed consent from the participants' legal guardian was obtained to participate in this study in accordance with the national legislation and the institutional requirements.

Data analysis

A statistical analysis will be performed using the statistical program Statistical Package for the Social Sciences (SPSS) version 23.0. Categorical variables were expressed by absolute frequency and percentages. Normally distributed continuous variables were expressed as mean and standard deviations. Continuous variables without normal distribution will be expressed as medians and range and will be compared using the nonparametric Mann-Whitney test. The comparison of categorical variables will be performed using the Student t test and Fisher exact test for independent samples in comparing 2 groups of normally distributed data, and Mann Whitney U test was used for non-normal variables. Numerical variables were compared before and after surgical intervention using paired t test for normally distributed continuous variables. Spearman correlation was used to examine the relationship between continuous data. Statistical significance was defined as a p value less than 0.05. To investigate the influence of nutritional status on surgical outcomes, each preoperative subjective and objective measure was connected discretely to postoperative problems and duration of hospital stay. The postoperative nutritional condition was also taken into account.

RESULTS

Patients' variables

Throughout the study period, there were 60 patients recruited in the analysis. Demographic data and their underlying surgical conditions were illustrated in Table 1 and 2 and Figure 1, with a proportion of male was 37 (61.7%) and female 23 (38.3%) with a median age of 11 months (interquartile range from 1-63 months). Patients were classified into 3 anatomical groups with 12 cases (20%) with upper GIT pathology, 38 cases (63.3%) with lower GIT pathology, and 10 cases (16.7%) with hepatobiliary pathology.

Comparison between patients' base line nutritional (preoperative) assessment and postoperative parameters were summarized in Table 2. In 20 patients, the preoperative weight-for-age z score was less than -2 (underweight), whereas 11 patients were stunted with a length-for-age z score less than -2. Also, there were 18 children with MUAC z-scores less than -2 and according to MAMC percentiles, our analysis showcased that 10 patients were ≤5th percentile. TSF was assessed in 51 patients with TSF z score less than -2 was found in 33 patients.

According to the SGNA score, there were 47 (78.3%) well-nourished patients and 13 (21.7%) malnourished patients. However, 49 patients (81.7%) were at low risk of malnutrition, while 11 patients (18.3%) were at moderate risk for malnutrition by using the STRONGKIDS.

Table 1: Demographic data of the studied patients.

General characteristics	N (%)
Age median (range) (months)	11 (1-63 months)
Sex	
Male	37 (61.7)
Female	23 (23.8)
Socioeconomic status	
High	6 (10)
Middle	32 (53.3)
Low	22 (36.7)
Underlying pathological site	
Upper GIT pathology	12 (20)
Lower GIT pathology	38 (63.3)
Hepatobiliary pathology	10 (16.7)

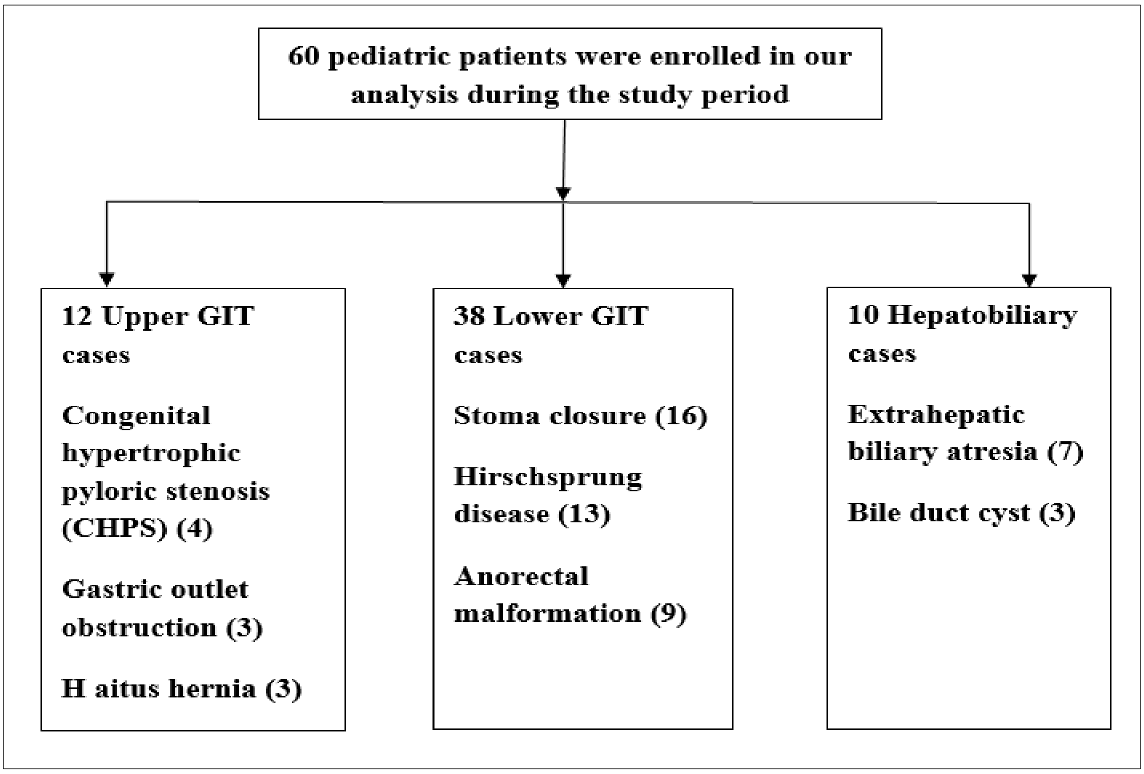

Figure 1: COHORT flowchart of the anatomical diagnosis of the pediatric patients included in the study.

Table 2: Anatomical classifications of the patients according to their pathology and surgical procedures.

Anatomical regions	Pathology	Surgical procedure	Number of patients
			N (%)
Upper GIT cases [12 cases (20%)]	Congenital hypertrophic Pyloric stenosis (CHPS)	Pyloromyotomy	4 (6.7)
	Gastric outlet obstruction (GOO)	Gastroduodonostomy	3 (5)
	Hiatus hernia (HH)	Nissen fundoplication	3 (5)
	Pure esophageal atresia	Esophageal replacement (gastric tube)	2 (3.3)
Lower GIT cases [38 cases (63.3%)]	Stoma closure	Revision of GIT continuity	16 (26.7)
	Hirschsprung Disease	Trans-anal pull through	13 (21.7)
	Anorectal malformations	Anorectoplasty	9 (15)

Continued.

Anatomical regions	Pathology	Surgical procedure	Number of patients
Hepatobiliary [10 cases (16.7%)]	Extrahepatic biliary atresia	KASAI operation	7 (11.7)
	Bile duct cyst	Resection with hepaticojejunostomy	3 (5)

Table 3: Comparison between patients' baseline nutritional (preoperative) assessment and postoperative parameters.

Nutritional status		Upper GIT cases		P value	Lower GIT cases		P value	Hepatobiliary cases		P value
		Pre	Post		Pre	Post		Pre	Post	
Weight for age (z-score)	Average	7	5	0.9	28	26	0.7	5	8	0.3
	Underweight (<-2)	5	7	0.9	10	12	0.7	5	2	0.3
Length for age (z-score)	Average	10	-	-	30	-	-	9	-	-
	Stunted (<-2)	2	-	-	8	-	-	1	-	-
Weight for length (z-score)	Average	3	3	0.8	24	24	0.7	5	8	0.6
	Wasted (<-2)	9	9	0.8	14	14	0.7	5	2	0.6
MUAC (z-score)	Average	8	7	0.02	29	30	0.15	3	2	0.02
	Z-score <- 2	4	5	0.02	9	8	0.15	5	6	0.02
MAMC percentile	Average	10	8	0.5	32	30	0.5	7	6	1
	Percentile < 5th	2	4	0.5	6	8	0.5	2	3	1
TSF (z- score)	Average	8	5	0.08	10	11	0.3	0	0	0.03
	Z-score < - 2	2	5	0.08	25	24	0.3	6	6	0.03
STRONGKIDS	Low risk of malnutrition	5	12	0.006	34	35	1	10	9	1
	Moderate risk of malnutrition (score 1-3)	7	0	0.006	4	3	1	0	1	1
SGNA (8)	Non-malnourished	3	8	0.24	34	32	0.6	10	8	0.3
	Malnourished	9	4	0.24	4	6	0.6	0	2	0.3
Hemoglobin	Normal	8	7	1	12	6	0.3	3	1	0.2
	Anemia	4	5	1	26	32	0.3	7	9	0.2
Albumin	Normal	9	5	0.19	31	27	0.07	4	1	0.04
	Hypoalbuminemia (< 3.5gm/dl)	3	7	0.19	7	11	0.07	6	9	0.04
Prealbumin	Normal	9	6	0.23	30	26	0.09	3	1	0.05
	Low prealbumin level (<10 mg/dl)	3	6	0.23	8	12	0.09	7	9	0.05

Table 4: Comparison of anthropometric parameters and length of the hospital stay for the patients according to the postoperative complication status.

Anthropometric parameters and hospital stay		Complicated cases (number=26)		Non-complicated cases (number=34)		P value
Z-score for weight		Mean (-1.67)	SD (1.58)	Mean (-1.11)	SD (1.55)	0.031
Underweight		Number (12)	% (46.2)	Number (10)	% (29.4)	0.212
Z-score for length		Mean (-1.46)	SD (1.96)	Mean (0.45)	SD (2.37)	0.002
Stunted		Number 10	% (38.5)	Number (3)	% (8.8)	0.001
weight for Length Z-score		Mean (-1.87)	SD (3.29)	Mean (-2.28)	SD (2.52)	0.552
Wasted		Number (13)	% (50.0)	Number (15)	% (44.1)	0.488
Length of hospital stay (days)	Short (<7)	Number (9)	% (34.6)	Number (29)	% (85.3)	0.001
	Long (>7)	Number (17)	% (65.4)	Number (5)	% (14.7)	0.001

Table 5: Comparison of anthropometric parameters and complications according to the length of the hospital stay.

Anthropometric parameters and complications		Short hospital stay (<7 days) (n=37)		Long hospital stay (>7 days) (n= 23)		P value
Z-score for weight		Mean (-1.23)	SD (1.63)	Mean (- 1.58)	SD (1.97)	0.073
Underweight		Number 10	% (27.02)	Number (12)	%(52.2)	0.017
Z-score for length		Mean (0.03)	SD (2.51)	Mean (-1.13)	SD (1.63)	0.031
Stunted		Number (5)	% (13.5)	Number (8)	% (34.8)	0.028
Weight for Length Z-score		Mean (1.68)	SD (2.83)	Mean (-2.24)	SD (3.39)	0.531
Wasted		Number (14)	% (37.8)	Number (13)	% (56.5)	0.649
Complications	Yes	Number (9)	% (24.3)	Number (17)	% (73.9)	< 0.002
	No	Number (28)	% (75.7)	Number (5)	% (21.7)	< 0.002

Table 6: Clavien-Dindo classification of postoperative complications.

Complications		Upper GI	Lower GI	Hepatobiliary
Grade I		2	7	0
Grade II		2	6	2
Grade III	IIIA	0	0	0
	IIIB	0	2	1
Grade IV		0	1	0
Grade V		1	0	2

The preoperative biochemical indicators of nutritional status were also displayed in Table 3. The mean concentrations of hemoglobin was found normal in 23 subjects (38.3%) while 37 subjects (61.7%) were anemic. Normal serum albumin level was showed in 44 (73.3%), whereas hypoalbuminemia was noted in 16 (26.7%) and serum prealbumin level was found normal in 42 patients (70%) and was noted low in 18 patients (30%).

On postoperative day 7, the upper GI group showcased a significantly lower difference in MUAC (p=0.02) while STRONGKIDS score showed decreased risk with statistically significant difference (p=0.006).

Regarding hepatobiliary group, there is a significant lower difference in TSF and MUAC values pre- and postoperative (p=0.03, p=0.02 respectively).

Regarding postoperative complications, infectious complications reported in 21 patients (35%) between 3 anatomical groups. The detected cases were 13 (21.7%), 4 (6.7%) and 3 (5%) among lower, upper GI and hepatobiliary groups respectively.

Preoperatively, we reported 10 (16.7%) patients received postoperative blood transfusion, most of them suffered from moderate anemia while 2 (3.3%) patients had mild degree of anemia. Two (3.3%), six (10%) and three (5%) among upper, lower GI and hepatobiliary groups required postoperative blood transfusion, respectively.

According to the length of hospital stay postoperatively, patients were categorized into 2 groups. There were 23 infants (38.3%) admitted for more than 7 days. The admitted cases in relation to anatomic groups were 7(58.3%), 11 (28.9%), 5 (50%) among upper GI, lower GI and hepatobiliary groups respectively.

Our analysis revealed a statistically significant lower difference between weight-for-age z score and length-for-age z score preoperatively in complicated cases (p=0.031, p=0.002 respectively) as shown in Table 4.

We also reported that length-for-age z score preoperatively was significantly lower in patients with prolonged hospital stay (p=0.031) as shown in Table 5.

According to Clavien-Dindo classification, the adverse events following GI surgery in children were outlined in Table 6. Grade I instances were identified in 2 cases with upper GI surgery and 7 cases among lower GI patients, while grade II occurred among patients of upper GI, lower GI and hepatobiliary (2, 6, 2 respectively). Grade IIIb occurred with 2 patients in the lower GI group and with 1 patient in the hepatobiliary group. There is one case among the lower GI patients’ group experienced grade IV. Mortality rate, represent grade V, occurred in one case among upper GI patients’ group and another two cases among hepatobiliary patients’ group.

There is no correlation between STRONGKIDS and SGNA scores and both postoperative complications and duration of hospital stay. Neither weight for length, MAC, TSF, nor MAMC was correlated to postoperative complications and duration of hospital stay. A marked prolonged length of hospital stay was observed with increasing the Clavien-Dindo classification grade of complication (p=0.002).

DISCUSSION

Malnutrition has been demonstrated to have a deleterious influence on children's growth and neurocognitive development.[14]

Surgical-induced catabolic response, which results in inflammation, protein catabolism, and nitrogen depletion, is considered detrimental to the patient, particularly with pre-existing malnutrition, and was proportional to the magnitude of the interventional technique.[15]

STRONGKIDS is a nutritional screening tool developed in accordance with the most recent ESPEN guidelines, whereas SGNA is a clinical judgment-based nutritional assessment method that can be adapted to determine pre-surgical malnutrition.[11,16]

By applying the SGNA and STRONGKIDS grading systems, the upper GI group of patients had represented the highest rate of preoperative malnourishment.

We observed that the overall incidence of wasting in the patients preoperatively was 46.7% with the highest incidence detected in upper GI and hepatobiliary groups, 75% and 50% respectively. Furthermore, we found that the underweight risk was about 41.7% and 50% in the upper GI and hepatobiliary groups respectively. Upper GI group had the highest incidence of both wasting and underweight. This could be related to periods of decreased intake, inappropriate feeding, malabsorption, and bowel losses created by the variety of surgical procedures that participated in the development of undernutrition in spite of efforts to supply adequate energy and other nutrients.[17,18]

According to the WHO, nutritional status should not rely on the weight evaluation only, other anthropometric parameters should be considered such as MUAC, MAMC and TSF due to its sensitivity to the full spectrum of malnutrition.[19]

Yang et al explained the fact that weight is not considered the optimal parameter of nutritional status evaluation because visceromegaly and ascites in patients with chronic liver diseases may disguise malnutrition with abnormal MAMC and TSF measurements, which could be attributed to the increased energy expenditure and fat malabsorption in almost 50% of this category of patients.[20]

Furthermore, these parameters are not affected by fluid accumulation and substantial third-space fluid accumulation that can be experienced in some patients, especially with reduced serum albumin levels in certain surgical procedures such as the correction of pure esophageal atresia, endo-anal pull-through for Hirschsprung disease, Kasai procedure, and choledochal cyst excision with hepatoduodenostomy.[8,21]

Stunting is considered a vital sign of chronic malnutrition, which increases the risk of morbidity and surgical complications.[22] The recorded prevalence of stunting among children under the age of 5 years was 21% in 2014, according to the Egypt Demographic and Health Survey, which could be attributed to low diet quality due to low socio-economic status and breastfeeding with relatively poor energy reserves, which are insufficient to produce a sufficient amount of milk for healthy infant growth and development.[23]

In our analysis, it was noted that 61.7% of our patients were anemic, and some of these patients required blood transfusion, with the highest rate of anemia among the hepatobiliary and lower GI patient groups (5% and 10%, respectively). This could be multifactorial due to the underlying surgical procedures, micronutrient deficiencies, recurrent infections, and associated morbidity.[24]

It is worthy to compare prealbumin, which has a shorter half-life, to albumin, as serum albumin is considered a negative acute phase reactant with a longer half-life that does not reflect the nutritional status.[25] Therefore, albumin is considered a predictor of morbidity except in hepatic patients.[26] Lower prealbumin level associated with hypoalbuminemia were common among hepatobiliary patients' group due to increasing the utilization of protein as a source of energy and the reduction in liver capacity for protein synthesis.[20]

It is challenging to account for the discrepancies in associations observed between WAZ, HAZ, and BAZ in our cohort to assess the association between nutritional parameters and clinical outcomes.

Our analysis demonstrated that there are no significant differences between preoperative and postoperative anthropometric measurements. However, postoperative TSF, MUAC, and MAMC levels were significantly lower in both upper GI and hepatobiliary patient groups, indicating alterations in muscle and fat storage.

Also, there were no significant changes in TSF, MUAC, and MAMC among the lower GI patients' group. This can be explained by the fact that this category started feeding within the first 24 hours following surgery and they experienced few hours of minimal nutritional intake preserving their nutritional status postoperatively.

According to Canada et al demonstrated that early postoperative feeding had been shown to resolve postoperative ileus earlier, promote wound healing, decrease infection rates, and shorten the length of hospital stay.[27] Indeed, adequate caloric intake and protein consumption definitely help to keep these nutritional parameters within the normal range.

ElKoofy et al observed that the overall incidence of infectious complications was 33.3% among the three different anatomical patients' group following surgical interventions which is similar to our data that showcased that SSI is considered the most frequent adverse events.[28]

Increased risk for wound-related and tissue healing complications for malnourished children can be explained by the fact that the body's natural stress response to surgery results in macronutrients being distributed from skeletal muscle, which is already compromised because of malnutrition and wasting, for wound repair and immune response; therefore, there may not be sufficient reserve to support effective postoperative healing, resulting in wound breakdown and surgical complications.[29]

It is worth mentioning that SSI is a considerable cause implicated the postoperative mortality and 8% of all deaths are caused by a nosocomial infection.[30-32] Furthermore, SSIs cause pain, and prolonged hospital stay with subsequent increased risk of infectious adverse events. In our analysis, 35% of our patients who had reported infectious complications are wasted.

Anemia with subsequent blood transfusion is considered the second most common complication in our analysis. Prior studies observed that incidence of blood transfusion, a noninfectious complication, with similar surgeries is about 31.1% in middle-income countries.[33]

Remarkably, identifying patients who are at risk of malnutrition prior to surgery is crucial for optimizing their nutritional status prior to the procedure and minimizing unsatisfactory outcomes. However, this is difficult due to lack of a commonly accepted definition for malnutrition that led to a restriction in evaluating preoperative patients for malnutrition.[27,34] Therefore, we evaluated a variety of nutritional markers associated with scoring methods to correlate with postoperative outcome like prior literature.

Additionally, we noted that pediatric patients diagnosed with malnutrition preoperatively have an increased rate of adverse events following surgery and a longer duration of hospitalization.

In alignment with Secker et al the study exhibited that there is a significant correlation between preoperative length-for-age and both postoperative adverse events, either infectious or noninfectious, as well as the postoperative length of hospital stay.[11] Nonetheless, we found statistically significant correlation between preoperative weight-for-age and postoperative adverse events.

According to Tool et al who reported that the incidence of complications in malnourished children with congenital heart disease undergoing cardiac surgery was substantially related to the length of hospital stay, we prospectively analyzed the correlation between the rate of complications in children with malnutrition preoperatively and the hospitalization duration following the surgical intervention and we found a significant positive correlation between the occurrence of these complications and the length of hospital stay.[35]

In this design, the subpopulation-based diversity in the correlations between preoperative nutritional status and surgical outcomes is demonstrated robustly. We hypothesized that, in addition to resource availability, this predicted diversity was caused in part by disparities in clinical practice norms.

In conjunction with prior observations of longer hospital stays and higher rates of adverse events among malnourished children undergoing surgery, our results support the notion that efforts to facilitate effective preoperative interventions to improve nutrition and patient outcomes are warranted.

Limitations

Our study has several limitations. First, our study was a single institution study and it may not be possible to extrapolate our results to other populations. Secondly, there was a small numbers of patients, restricting our ability to perform meaningful analysis to evaluate the outcomes of these subsets of patients. It would also have been captivating to assess the effect of nutritional status on long term outcomes such as mortality at 1 year or neurodevelopment.

CONCLUSION

This prospective study of pediatric patients undergoing gastrointestinal surgery demonstrated that postoperative complications are more common in stunted individuals than in underweight children, while prolonged hospital stays take place in both stunted and underweight children. Therefore, nutritional assessment is an indispensable aspect of an initial evaluation, and its implications for patient outcomes and safety merit continued evaluation.

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