

Surgical Morbidity in Malnourished Children - A Pilot Study

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Abstract

Objectives: Nutritional status is an important and independent factor influencing postoperative outcome of elective and emergency surgical procedures. We evaluate the influence of nutritional status on postoperative complications in our pediatric surgical patients.

Methods: Retrospective study of malnourished children who underwent elective and emergency surgeries from 2015-2018 (4 years) in our hospital was done. Demographic data like age, sex, anthropometric measures like weight and biochemical parameters like hemoglobin, albumin, and electrolytes were collected. Patient's nutritional status and post-operative complications like wound dehiscence, wound infection; respiratory tract infection, sepsis, and need for ICU care and prolonged hospital stay were compared.

Results: 20 patients in the study period were found to be below 3rd percentile of body weight. They had high incidence of postoperative complications like wound dehiscence or burst abdomen (55%), prolonged ICU care (44%) and sepsis (44%). They also had prolonged hospital stay (average 51 days).

Conclusion: Nutrition status is an important factor determining postoperative outcomes. Hence steps should be taken to optimize nutrition in pediatric children undergoing surgery and close monitoring of biochemical and clinical parameters needed to identify complications in children with malnutrition postoperatively.

Keywords: Malnutrition; Pediatric Surgery; Morbidity; Postoperative Outcome

Introduction

Malnutrition is of special importance for the surgical patients due to its influence on postoperative outcome.

Preoperative malnutrition is known to be associated with postoperative complications like infection, delayed wound healing, and increased length of hospital stay. There are many studies in adults showing these relationships, but studies in pediatric age group is lacking. We looked herein at malnourished pediatric patients who underwent surgery in our center and their post-operative outcome.

Methods

A retrospective pilot study was done on surgical patients with poor nutritional status, who underwent elective and emergency surgeries during 2015-2018 (4 years) in our hospital. Children with weight for age less than 3rd centile in the WHO weight for age chart were included in this study (Group A). Demographic data of age, sex, anthropometric measures like weight and biochemical parameters like hemoglobin, albumin, and electrolytes were collected where available. Pre-op and post-operative nutritional support was noted. Post-operative complications including wound dehiscence, wound infection, respiratory tract infection, sepsis, need for ICU care and prolonged hospital stay were noted.

Similar data from a group (Group B) of well-nourished surgical children operated in the same time period with weight for age above 25th centile were collected and post-operative outcomes were compared with the malnourished group.

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Results

20 surgical patients (11 boys and 9 girls) whose weight for age were less than 3rd centile were included in our study (Group A). Median age of these children were 8.5 months (range 2 months to 17 years). The cause for malnutrition was poor enteral feeding related to gastro-intestinal issues in most instances. Out of 20 children, 15 children were admitted for fundoplication and gastrostomy (75%). Other procedures included bowel resection and anastomosis in 3 (15%), thoracotomy for recurrent tracheo-esophageal fistula (TEF) in 1 (5%) and ventriculo-peritoneal (VP) shunt in 1 (5%). The commonest indication for surgery in these children was Global Developmental Delay with Gastro Oesophageal Reflux Disease and poor weight gain (12). Remaining indications were esophageal stricture with reflux (3) post esophageal atresia repair, ileal/sigmoid stricture (3), raised intracranial pressure with hydrocephalus (1) and recurrent aspirations with TEF (1).

Out of 20 children in our study, 9 children (45%) developed 13 post-operative complications. These complications included wound dehiscence or burst abdomen in 55% (5/9), prolonged ICU care in 44% (4/9) and sepsis in 44% (4/9).

Low hemoglobin was not found to be associated with complications in our series; 4 (36%) of the 11 children with Hb less than 10gm/dl developed post-operative complications compared to 5(55%) of 9 children with hemoglobin more than 10gm/dl. Pre-operative enteral supplementation for median period of 3 weeks (Range 1 to 4 weeks) were given for 8(40%) of the children. However, weight gain was documented only in 3 children (37%). TPN was given preoperatively for 2-3 days for 3(15%) and 9(45%) did not receive any nutritional supplementation. Post-operative complications in these children are summarized in **Table 1**. The 3 children who had weight gain preoperatively following nutritional supplementation also developed postoperative morbidity like wound breakdown (1), gastrostomy site leak (1) and prolonged ICU care for sepsis and ventilation (2).

	Total	Weight gain	Complications
Pre op Enteral feeding	8	3	4/8 (50%)
Pre op TPN	3	0	1/3 (33%)
No pre op feeding	9	0	4/9 (44%)

Table 1: Preoperative enteral nutrition and outcome. TPN- Total Parenteral Nutrition.

Majority of patients in our study were operated electively; 3 were operated as emergency, and out of them 2 children (66%) developed complications. Late mortality following surgery was seen in 2 children due to unrelated sepsis and underlying disorder. All others are well after surgery and thriving in follow up. Post-operative stay of children in our study ranged from 4 days to 98 days with average stay in hospital of around 51 days. Children who developed major postoperative complications like burst abdomen and sepsis had longer post-operative stay. 20 children in Group B with weight for age more than 25th centile included 8 boys and 12 girls, with median age of 6 years (range 2 months to 14 years). Surgeries underwent by these children include fundoplication/gastrostomy, open appendectomy, bowel resection/anastomosis, manual reduction of

intussusception, oopheropexy, colostomy closure and adhesiolysis. 2 (10%) of these 20 children developed post-operative complications. One child developed lung consolidation and needed brief ICU care and another had wound infection post perforated appendicitis. 5(25%) had haemoglobin level less than 10 gm/dl; none had any post-operative complications. Post-operative hospital stay ranged from 2 to 12 days (average 6 days). Comparison of events between Group A and B is shown in **Table 2**.

Discussion

Nutrition is an important factor promoting wound healing, resistance of body towards pathogens and early recovery from stress after surgery. Poor nutritional intake or lack of individual nutrients can cause increase in complications during postoperative period. Malnutrition is common and it occurs in about 30% of surgical patients with gastrointestinal disease and in up to 60% of those in whom hospital stay has been prolonged [1]. Relation between preoperative nutrition status and post-operative complications in adults have been extensively studied, which shows that patients with poor nutrition status suffer from more post-operative complications like wound infection, wound dehiscence, ICU care and ventilation, sepsis, multi organ failure and hospital stay [2,3]. Hence preoperative nutritional assessment is an important factor in predicting post-operative outcome in patients. Studies related to nutritional status of pediatric surgical patients and their postoperative outcomes are very few. Prevalence of malnutrition in hospitalized children is reported to be 2.5% to 19% [4]. Several anthropometric measurements have been used to objectively assess nutritional status in children [5]. The World Health organization (WHO) classifies standardized anthropometric measurements (Z-scores) into "wasting" (low weight for height), "stunting" (low height for age), and "overweight/obese" (high weight for height or BMI). Triceps Skin Fold (TSF) and Mid Arm Circumference (MAC) have also been used as anthropometric measures for assessment of nutritional risk [6]. Despite evidence that nutritional state is a valid predictor of most child health outcomes, a paucity of evidence exists to characterize the relationship between preoperative nutritional state and postoperative outcomes in children undergoing surgery [5].

Majority of pediatric patient are assessed only based on clinical and biochemical parameters and there is lack of guidelines for malnutrition assessment in children. Faith Ross et al., demonstrated the impact of malnutrition, indicated by a low height-for-age z-score or weight-for-age z-score, on mortality and adverse outcomes after pediatric cardiac surgery in a wide range of patient ages and cardiac pathology [7]. They observed the strongest relationship between chronic malnutrition in the form of a low height-for-age z-score and several adverse surgical outcomes, including mortality. Abdullah Alshehri et al., found that stunted children had a 16% adjusted odds increase in overall 30-day postoperative occurrences in a study done on children undergoing abdominal and thoracic surgery [5]. The commonest complications encountered in this subset of patients were postoperative sepsis (2%), SSI (4.8%) and need for blood transfusion (2.6%). In this retrospective study, we were not able collect of the mentioned anthropometric

Events	Malnourished Group	Well-nourished Group
M:F	11:9	8:12
Median age	8.5 months(2 months -17 years)	6 years(2 months to 14 years)
Surgeries	Gastrostomy/Fundoplication- 15	Gastrostomy/Fundoplication- 6
	Bowel resection and anastomosis- 3	Open appendectomy- 4
	Thoracotomy- 1	Bowel resection and anastomosis- 3
	VP shunt- 1	Manual reduction of intussusception- 3
		Oopheropexy - 2
		Adhesiolysis - 1
		Colostomy closure - 1
Post-operative complications	65% (13/20)	10% (2/20)
	Wound dehiscence - 5	ICU care for lung consolidation - 1
	Sepsis - 4	Wound infection - 1
	ICU care - 4	
Post-operative hospital stay	51 days (4 days - 98 days)	6 days (2 days – 12 days)

Table 2: Comparison of events between malnourished group and well-nourished group. VP Shunt- Ventriculo Peritoneal shunt; ICU- Intensive Care Unit.

data and we hence included children less than 3rd centile weight for age. In our study, majority of the children had gastro esophageal reflux disease with global developmental delay and other gastrointestinal conditions causing poor enteral intake as the major cause of poor weight gain. 45% of these malnourished children developed post-operative complications which were infection related and non-infection related. Complications ranged from superficial wound infection to life threatening sepsis due to lowered immunity and poor wound healing in these children. Comparison with the children in well-nourished group who had adequate weight for age showed absence of major post-operative complications and fewer days of post-operative hospital stay.

Multiple markers have shown to have correlation with postoperative outcome like serum albumin [6,8], total protein, hemoglobin, hematocrit, platelet count, sodium, calcium, aspartate transaminase (AST) and glucose in critically ill adult patients [6]. However, low hemoglobin value in our study was not associated with post-operative complications in either group. Thus it cannot be used in isolation, but needs other biochemical data in conjunction, as a marker of malnutrition. Being a retrospective study, we were unfortunately not able to collect biochemical data like albumin in all our patients. We are now starting a prospective study to address the limitations of retrospective study with regard to anthropometric and biochemical data. Regarding pre-operative nutritional support, K. Lakshman noted in their review that only severely malnourished patients will be benefited from nutrition support whereas increase in infectious complication are seen in moderately malnourished patients with preoperative parenteral nutrition supply [2]. However, Farez Ayoub et al showed preoperative Total Parenteral Nutrition (TPN) more than 60

days in adults with inflammatory bowel disease (Crohn's) have reduction of non-infectious complication with no associated increase in infectious complications [9]. Even though some children received nutritional supplementation in Group A, the supplementation given in most were short term. Weight gain was documented in only 3/9 children, all of whom received preoperative nutritional supplementation for 4 weeks. We have not shown a lower complication in these children too, which leads us to think that a longer period of supplementation with documented weight gain would be needed to improve the outcome. A prospective study with larger numbers of patients is needed to study this further.

Conclusion

Children with malnutrition undergoing elective and emergency surgery have increased postoperative morbidity. A major cause for malnutrition in pediatric surgical patients is poor enteral feeding related to gastro-intestinal causes like severe Gastro-esophageal reflux, esophageal and intestinal strictures, and poor intake related to global developmental delay. Short term nutritional supplementation either enterally or parenterally does not improve the outcome significantly; hence longer term correction of at least 6 weeks is required before elective surgery.

Key Messages

1. Malnutrition plays an important role in adverse postoperative outcome in pediatric surgical patients.
2. Adequate nutrition scoring system and guidelines for diagnosing malnutrition in paediatric patients are needed.
3. Correction of malnutrition by nutritional supplementation in elective cases over 4-6 weeks may help in preventing major preventable post-operative complications.

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