



## Original Article

# Correlation of Preoperative Nutritional Status and Postoperative Wound Infection in Children

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### Abstract

**Background:** Despite improvements in antimicrobial therapy, surgical technique and postoperative care, wound infection is still a major concern in pediatric surgical practice particularly in developing countries like Bangladesh.

**Objective:** This study was conducted to ascertain the relationship between the preoperative nutritional status and postoperative wound infection in children as malnutrition is very prevalent among them. It was also decided to estimate the rate of wound infection in children and to identify the indicator of malnutrition that best predicts wound infection.

**Methods:** This prospective study was carried out in the Department of Pediatric Surgery, BSMMU, Dhaka during the period of January 2009 to September 2010 and included consecutive 100 children undergoing routine surgery. Nutritional status was assessed by measuring BMI, serum albumin, haemoglobin and total lymphocyte count and thus children were categorized preoperatively. The children were assessed during the first 30 postoperative days for the evidence of wound infection that were confirmed by culture and sensitivity.

**Results:** We found most of the wound infections among the malnourished children with low BMI and low serum albumin.

**Conclusion:** Preoperative good nutritional status is associated with less postoperative wound infection and BMI and serum albumin are good indicators but total lymphocyte count and haemoglobin are not good indicators of protein calorie malnutrition and serum albumin is the best predictor of wound infection.

### Introduction

Wound infections are common, serious and expensive complications after surgery and in pediatric surgical practice wound infection is still a major concern in

developing countries like Bangladesh. Wound infection may result from many predisposing factors<sup>1</sup> and there is evidence that malnutrition is an important predisposing factor. It is found that malnutrition influence wound healing and the incidence of postoperative surgical-wound infection<sup>2</sup>. It is also found that malnutrition is associated with an increased incidence of nosocomial infection<sup>3</sup>. Moreover, protein depletion has been correlated with sepsis, pneumonia and other infections particularly wound infection<sup>4</sup>. There is evidence that protein malnutrition is responsible for increased mortality and postoperative morbidity that includes impaired healing and increased rate of wound infection<sup>5</sup>. It has been estimated that nearly 50.6 million under-five children are malnourished and almost 90% of these children are from developing countries<sup>6</sup>. According to the State of the World's

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Children (SOWC) report 2008, issued by the United Nations Children's Fund (UNICEF), eight million or 48% of all under five children of Bangladesh are underweight<sup>7</sup> and according to UNICEF report 2009, Bangladesh has one of the highest child malnutrition rates in South Asia with a little fewer than 1 in 2 children being moderately or severely underweight and it is conceivable that as much hospitalized children are malnourished<sup>7</sup>.

The nutritional status of patients can be assessed by a variety of methods. At present, there is no universally accepted gold standard for defining patients with malnutrition or at risk of malnutrition<sup>8</sup>. The clinical parameters most commonly used to assess the nutritional status of surgical patients are the serum albumin, total lymphocyte count, haemoglobin and body mass index (BMI, kg/m<sup>2</sup>). These are practical and reproducible tests that are available in most surgical patients, even in our setting. Serum albumin less than 3.5 gm/dl and total lymphocyte count less than 1500/mm<sup>3</sup> are considered to represent clinical malnutrition<sup>9</sup>. According to the European e-journal of clinical nutrition and metabolism (ESPEN) guidelines for nutrition screening, the normal BMI range is defined as 20-25 kg/m<sup>2</sup>, moderately malnourished as 18.5 – 20 kg/m<sup>2</sup>, severely malnourished as less than 18.5

kg/m<sup>2</sup> and a BMI of more than 25 kg/m<sup>2</sup> is defined as overweight<sup>10</sup>. The haemoglobin is considered normal if it is >10gm/dl.

There is no study in Bangladesh that correlates malnutrition and postoperative wound infection. Thus, keeping in mind that malnutrition is so prevalent in this country, this study is being carried out to see the incidence of wound infection in pediatric surgical patients and to see the correlation of malnutrition and wound infection in children and to find the best indicator of malnutrition that predicts wound infection.

### Methods

It was a prospective and analytical study. The study was carried out in the Department of Pediatric Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka from January 2009 to September 2010. A total 100 patients were selected from the admitted patients scheduled for elective surgery in the Department of Pediatric surgery, BSMMU. Patients were categorized according to nutritional status within 7 days before the operation. BMI was considered as the primary determinant of nutritional status and patients with normal BMI (20-25 kg/m<sup>2</sup>) were Group I and patients with below normal BMI (< 20 kg/m<sup>2</sup>) were Group II. Data was processed and analyzed using computer based software.

### Results

**Table.** Demographic characteristics of patients (n=100)

Characteristics	Group I(n=24)		Group II(n=76)		Pvalue
	n	%	n	%	
Age in months					
13 – 60	15	62.5	43	56.6	
61 -120	5	20.8	16	21.1	
121 -180	4	16.7	17	22.4	
Mean±SD	66.5	±58.4	68.7	±55.3	0.869
Sex					
Male	17	70.8	56	73.7	0.783
Female	7	29.2	20	26.3	

Group I: BMI 20 - 25 kg/m<sup>2</sup>

Group II: BMI <20 kg/m<sup>2</sup>

**Table II.** Nature of wound of the study children (n=100)

Nature of wound	Group I(n=24)		Group II(n=76)		P value
	n	%	n	%	
Clean	17	70.8	56	73.7	0.784 <sup>ns</sup>
Potentially contaminated	7	29.2	20	26.3	

**Table III.** Post operative wound infection of the study children (n=100)

Wound infection	Group I(n=24)		Group II(n=76)		Pvalue
	n	%	n	%	
Present	1	4.2	15	19.7	0.006 <sup>s</sup>
Absent	23	95.8	61	80.3	

**Table IV.** Status of wound infection according to BMI of the children (n=100)

BMI (kg/m <sup>2</sup> )	Had wound infection (n=16)		No wound infection (n=84)		P value
	n	%	n	%	
<20 kg/m <sup>2</sup>	15	93.8	61	72.6	0.006 <sup>s</sup>
20 - 25 kg/m <sup>2</sup>	1	6.2	23	27.4	

**Table V.** Status of wound infection according to Serum albumin of the children (n=100)

Serum albumin (gm/L)	Had wound infection (n=16)		No wound infection (n=84)		P value
	n	%	n	%	
<35 gm/L	14	87.5	4	4.8	0.001 <sup>s</sup>
≥35 gm/L	2	12.5	80	95.2	
Mean±SD	29.1	±4.4	41.9	±4.9	0.001 <sup>s</sup>
Range (min - max)	(21	-38)	(30	-50)	

**Table VI.** Status of wound infection according to Total Lymphocyte count (TLC) of the children (n=100)

Total Lymphocyte count (/mm <sup>3</sup> )	Had wound infection (n=16)		No wound infection (n=84)		P value
	n	%	n	%	
≥1500 (/mm <sup>3</sup> )	16	100.0	83	98.8	0.500 <sup>ns</sup>
<1500 (/mm <sup>3</sup> )	0	0.0	1	1.2	

**Table VII.** Status of wound infection according to haemoglobin of the children (n=100)

Haemoglobin (gm/dl)	Had wound infection (n=16)		No wound infection (n=84)		P value
	n	%	n	%	
<10 gm/dl	5	31.3	14	16.7	0.154 <sup>ns</sup>
≥10 gm/dl	11	68.8	70	83.3	
Mean±SD	10.8	±1.8	11.2	±1.5	0.322 <sup>ns</sup>
Range (min - max)	(8.7	-15.1)	(8.0	-16.6)	

**Table-III.** Status of wound infection according to grading of nutrition of the children (n=100)

Grading of nutrition	Had wound infection (n=16)		No wound infection (n=84)		P value
	n	%	n	%	
Grade I A	1	6.3	23	28.6	0.002 <sup>s</sup>
Grade I B	0	0.0	0	0.0	
Grade II A	11	68.8	59	69.0	
Grade II B	4	25.0	2	2.4	

## Discussion

Despite improvements in antimicrobial therapy, surgical technique and postoperative intensive care, wound infection continues to be significant source of mortality and morbidity for the pediatric patient<sup>11</sup>. There is evidence that malnutrition is an important predisposing factor of wound infection<sup>2</sup>.

According to our study, majority of patients undergoing surgery in pediatric department (76%) were malnourished with BMI falling less than 20 kg/m<sup>2</sup>. This finding is similar to other studies in pediatric surgical patients at home<sup>12</sup> and abroad<sup>13</sup> where 80% of patients were found to be malnourished. The prevalence of malnutrition in pediatric surgical patients is clearly higher than is generally recognized<sup>14</sup>. In this study, no patient had BMI above normal range (20-25 kg/m<sup>2</sup>) indicating that trend towards obesity in general pediatric population is absent. When the relationships between indices were seen, statistically significant correlation was found between BMI and preoperative serum albumin. However, this is in contrast to who found no significant correlation between BMI and preoperative serum albumin<sup>15</sup>. Among other indices there was no significant correlation of BMI either with haemoglobin or with total lymphocyte count. This finding could not be compared owing to the absence of similarly designed studies in the literature.

In this study, 16 patients (16%) developed wound infection postoperatively and among them 7 patients (43.8%) had clean wound and 9 patients (56.2%) had potentially contaminated wound. In two other studies of general surgical patients wound infection was found to be 16.6% and 14.5% respectively<sup>16,17</sup>.

In this study, BMI correlated significantly with the rate of wound infection. Patients with low BMI (<20 kg/m<sup>2</sup>) had 5.66 times more rate of wound infection than that of patients with normal BMI (20-25 kg/m<sup>2</sup>). One study in cardiac surgical patients indicates that low BMI (<20 kg/m<sup>2</sup>) significantly influence postoperative wound infections<sup>15</sup>. The exact mechanism of this association remains unknown but the authors speculate that patients with low BMI have lower percentage of body fat, hence less nutritional reserve, which allow them to handle microorganism less efficiently, resulting in greater rate of wound infection<sup>15</sup>.

In this study, serum albumin also had significant positive relationship with wound infection and patients with low serum albumin (<35 gm/L) had 140 times greater rate of postoperative wound infection than the patients with normal serum albumin (≥35 gm/L). It has been found earlier that hypoproteinemia is associated with an increased incidence of postoperative wound infection and serum albumin among others have the strongest association with

surgical wound infection<sup>18</sup>. One study also support that low preoperative serum albumin is a significant predictor for surgical wound infection<sup>2</sup>. In hip and knee arthroplasty surgery, if serum albumin was less than 35 gm/L there was 7 times more rate of surgical wound infection<sup>19</sup>.

In this study, 99% of patients had total lymphocyte count more than 1500/mm<sup>3</sup> and total lymphocyte count however did not correlate either with nutritional status or with the rate of wound infection. Peripheral lymphocyte count was found to lack predictive value for wound infection in general surgical patients in earlier study<sup>20</sup>.

In this study, haemoglobin level had no significant correlation with wound infection. This finding could not be compared as there are no comparative studies in the literature.

In this study, most of the wound infections were found among the children with protein calorie malnutrition (PCM). BMI and serum albumin were good indicators of PCM but total lymphocyte count and haemoglobin were not good indicators of PCM. It was also found that BMI had significant correlation with serum albumin but not with total lymphocyte count or haemoglobin.

### Conclusions

Preoperative good nutritional status is associated with less postoperative wound infection and total lymphocyte count and haemoglobin are not good indicator of protein calorie malnutrition and serum albumin and BMI are good indicators of protein calorie malnutrition and serum albumin is the best predictor of postoperative wound infection. As malnourished children are more prone to wound infection we should improve nutritional status of malnourished patient before elective surgery to reduce morbidity due to wound infection and we should improve nutritional status of all children as we do not know who may require surgery in future.

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