Malnutrition in Children with Uncomplicated Versus Complicated Appendicitis

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Abstract

Background : Acute appendicitis is one of the commonest surgical emergencies in children and malnutrition is prevalent in the country. This study was designed to compare if complicated appendicitis occurs more in malnourished children.

Materials and methods: This cross-sectional study was conducted in Department of Paediatric Surgery, Chittagong Medical College Hospital from March 2017 to December 2019 with 155 children. Anthropometric measurements (Height, weight, Mid Upper Arm Circumference (MUAC) Triceps Skin Fold Thickness (TSFT) were recorded and biochemical assessment (Haemoglobin, albumin and total lymphocyte count) were done before surgery. Patients were grouped into two groups: Group A (Acute uncomplicated appendicitis; n=65) and Group B (Acute complicated appendicitis, n=90). Anthropometric and biochemical indices were compared between these two groups.

Results: Age ranged from 2 -12 years (Mean 9.2 ±2.5 years) (Male: female- 1.35:1). Among the five anthropometric indices abnormal measurements in Group A vs Group B were respectively. Abnormal TSFT (73.8% vs 80%, p=0.4) wasting (38.5% vs 44.4%, p=0.4) low MUAC for age (13.8% vs 17.8%, p=0.8) low weight for age (30.8% vs 36.7%, p=0.5) and low height for age (21.5% vs 24.4%, p=0.7) low albumin (52.3% vs 83.3%, p<0,001); low haemoglobin (61.5% vs 60.0%, p=0.6)) and low total lymphocyte count (39.5% vs 44.8%, p=0.7).

Conclusions: Malnutrition was widely prevalent in both groups. Although the proportion of malnutrition was more with acute complicated appendicitis, it was not statistically significant. The lower serum albumin level in these patients might be due to the consequence of the disease rather than prevailing malnutrition.

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Introduction

Acute appendicitis is one of the commonest surgical emergencies in paediatric age group worldwide (1–2% in paediatrics surgical admissions in worldwide).[1] About 20-30% of children presenting with abdominal pain have acute appendicitis.[2] The outcome varies between acute uncomplicated appendicitis and acute complicated appendicitis and unrecognized and untreated acute appendicitis leads to life threatening complications.[3] Many factors increase the complications in patients of acute appendicitis. A study conducted among 278 children with acute appendicitis in Ethiopia in 1991 found that the risk of perforation is associated with nutritional status of the patients.[4] Little is known about the influence of malnutrition on the diagnosis or surgical outcomes after acute appendicitis. In a study by Timmerman et al. it was revealed that, underweight children were misdiagnosed more often, stay in hospital longer, and experience more postoperative complications than children of normal weight.[5] No systemic data has been found in Bangladesh regarding malnutrition with acute appendicitis. In this context, this study was conducted to compare the nutritional status between acute uncomplicated versus acute complicated appendicitis who had underwent appendectomy in Chittagong Medical College Hospital (CMCH). The aim of the study o evaluate and compare the nutritional status in acute uncomplicated and acute complicated appendicitis in pediatric patients.

Materials and methods

This descriptive cross-sectional study was conducted during the period from March 2017 to December 2019 at the Department of Pediatric Surgery, Chittagong Medical College Hospital (CMCH), Chattogram. All patients with a diagnosis of acute appendicitis below 12 completed years of age admitted and underwent open or laparoscopic appendectomy in the pediatric surgery department during the study period.

Sampling technique: Consecutive sampling, sample size: 30 in each group

Inclusion criteria:

i) Patients admitted with clinical diagnosis of acute appendicitis below 12 completed years of age.
ii) Preoperative diagnosis of acute appendicitis which was confirmed by per operative findings.

Exclusion criteria:

i) Incidental findings of acute appendicitis during laparotomy or laparoscopy.
ii) Patient who had undergone interval appendectomy for recurrent appendicitis.
iii) Patients with major comorbid conditions such as nephrotic syndrome, tuberculosis, malignancy.
iv) Guardians of the patients not willing to participate in the study by signing informed consent form.

The study participants were selected by careful history taking, clinical examination and operative findings. Patients admitted in the pediatric surgical ward with diagnosis of acute appendicitis and would underwent operation were the study population. Informed written consent was obtained from the guardian of the patients after explaining the purpose of the study. After taking socio-demographic history and history related to disease, a complete physical examination was done. Next, anthropometric measurements were taken by standard procedure and blood was collected for hematological examinations by laboratory technician. The following parameters were recorded on the day of admission - weight, height, triceps skin fold, mid arm circumference. The anthropometric values of BMI, Weight for age, Height for age, Weight for height were calculated using WHO AnthroPlus software using computer.[6]

The measurement for skin fold thickness was taken at the posterior arm midpoint between the acromioclavicular joint and olecranon process of the right arm using a skin fold caliper. The measurement of mid arm circumference was taken at this same point. These measurements were done by the researcher himself. Percentiles for triceps skin fold and mid arm circumference measurements were derived from WHO child growth standards.

After exploration, patients with negative appendectomy were excluded and rest of the patients were grouped in to two groups:

Group A-Patients with acute uncomplicated appendicitis

Group B-Patients with acute complicated appendicitis

Data analysis was performed using Microsoft Xcel and SPSS, version 23. Continuous data were reported as the means ± SD or median and inter quartile range. Qualitative or categorical data were described as frequencies and proportions. Proportions were compared using chi-square or Fisher's exact test whichever was applicable. Unpaired t-tests or Mann-Whitney U tests were used for between-group comparisons, as appropriate. Paired t-test or Wilcoxon sign rank test were used to compare the paired data. Statistical significance was defined as $p < 0.05$.

Ethical approval was taken before starting the study from the Ethical Review Committee of Chittagong Medical College (Memo no: CMC/PG/2019/527).

Results

A total of 155 patients were included in the study. Among them, 65 were diagnosed as Acute uncomplicated appendicitis under group-A and other 90 were diagnosed as Acute complicated appendicitis under group-B peroperatively. There was no statistically significant difference between uncomplicated and complicated appendicitis groups in terms of these demographic characteristics (Table I).

Table I Baseline socio-demographic characteristics of the patients

Characteristics	Total (n=155)	Group A (Uncomplicated) (n=65)	Group B (Complicated) (n=90)	p value*
Age (Years)				
Median (IQR)	10 (8.0-11.0)	10 (8.5-12.0)	9 (8.0-10.2)	0004
Mean ±SD	9.2±2.5	9.8±2.2	8.7±2.6	
Range	2-13	3-12	2-13	
<5 years	14 (9.0)	4 (6.2)	10 (11.1)	
5-9 years	61 (39.4)	21 (32.3)	40 (44.4)	0.113
≥10 years	80 (51.6)	40 (61.5)	40 (44.4)	
Sex				
Male	89 (57.4)	37 (56.9)	52 (57.8)	1.0
Female	66 (42.6)	28 (43.1)	38 (42.2)	
Residence				
Urban	44 (28.4)	21 (32.3)	23 (25.6)	0.290
Rural	111 (71.6)	44 (67.7)	67 (74.4)	

Data are expressed as frequency (Percentage) if not otherwise mentioned; p values were obtained from either Mann Whitney-U test or Chi-square test as appropriate.

A greater proportion of children with complicated appendicitis had operation >72 hours from their symptom onset in comparison of the children with uncomplicated appendicitis (75.6% versus 50.8% respectively, p=<0.001).

There was no association between weight, height and BMI for age z score, MUAC and TSFT with acute appendicitis condition (Table II and III).

Table II Comparison of Weight, Height, BMI for age between uncomplicated and complicated acute appendicitis patients

	Uncomplicated (n=65)	Complicated (n=90)	p value*
Weight for age z score category			
• Underweight (<-2SD)	20 (30.8)	33 (36.7)	0.445
• Normal weight (≥-2SD)	45 (69.2)	57 (63.3)	
Height for age z score category			
• Stunted (<-2SD)	14 (21.5)	22 (24.4)	0.672
• Normal height (≥-2SD)	51(78.5)	68 (75.6)	
BMI for age z score category			
• Thinness/ wasting (<-2SD)	25 (38.5)	40 (44.4)	
• Normal (<- 2 to +2 SD)	38 (58.5)	47 (52.2)	0.742
• Overweight (>2SD)	2 (3.1)	3 (3.3)	

Table III Comparison of MUAC and TSFT between uncomplicated and complicated acute appendicitis patients

	Uncomplicated (n=65)	Complicated (n=90)	p value*
MUAC category			
• Severely malnourished <115 mm	0	2 (2.2)	
• Malnourished <125 mm	0	1 (1.1)	0.806
• Normal >125 mm	65 (100)	87 (96.6)	
TSFT category			
• Lean	48 (73.8)	72 (80.0)	
• Ideal	12 (18.5)	16 (17.8)	0.379
• Average	4 (6.2)	2 (2.2)	
• Over fat	1 (1.5)	0 (0)	

Data are expressed as frequency (Percentage), p value was obtained from Chi-square test.

Nutritional status as assessed by serum albumin, majority (47.7%) of the children with acute uncomplicated appendicitis had normal albumin level. On the other hand, only 16.7% children with acute complicated appendicitis had normal albumin level. There was a significant association between albumin level and acute complicated appendicitis status (p<0.001) (Table IV). Proportion of children with mild anaemia was higher in uncomplicated group compared to complicated group and vice versa for moderate anaemia. However, these differences were not statistically significant (p=0.591). Total lymphocyte count did not significantly differ between two groups (p=0.707). More than half of the patients in both groups had normal lymphocyte count.

Table IV Comparison of nutritional status by serum albumin, Hb level and lymphocyte count between uncomplicated and complicated acute appendicitis patients

Biochemical parameters	Uncomplicated (n=65)	Complicated (n=90)	p value*
Based on Albumin level			
• Nourished	31 (47.7)	15 (16.7)	
• Mild malnutrition	22 (33.8)	33 (36.7)	
• Moderate malnutrition	11 (16.9)	34 (37.8)	<0.001
• Severe malnutrition	1 (1.5)	8 (8.9)	
Based on Hemoglobin level			
• No anemia	25 (38.5)	36 (40.0)	
• Mild anemia	22 (33.8)	21 (23.3)	0.591
• Moderate anemia	18 (27.7)	33 (36.7)	
Based on Lymphocyte count			
• Normal	40 (61.5)	49 (54.4)	
• Mild depletion	16 (24.6)	27 (30.0)	
• Moderate depletion	5 (7.7)	10 (11.1)	0.707
• Severe depletion	4 (6.2)	4 (4.4)	

Discussion

In the present study, overall prevalence of malnutrition varies from 23% to as high as 82% depending upon the criteria to define nutritional status. In a study from Malaysia Lee and Ahmad showed that approximately one in seven children (14%) who required hospital care had acute undernutrition, while 14% had chronic undernutrition upon admission.[7] A similar study from Canada, where only 8.8% of children admitted to a tertiary-care paediatric hospital were undernourished.[8] In contrast to other more developed countries, the prevalence of malnutrition was more in among patients in this study. A study from Saudi Arabia, Al-Bassam observed such high prevalence like ours in the paediatric patients admitted for surgical causes. Eighty percent of their patients have one or more abnormal values suggestive of protein-calorie malnutrition.[9]

Nutritional status of the children was assessed by both anthropometric indices and certain serologic markers, such as serum albumin, lymphocyte counts. Regarding anthropometric indices neither

of them (Weight for age, height for age, BMI for age, MUAC and TSFT) had any significant association with the per-operative status of the appendicitis (Uncomplicated/complicated). However, a significantly higher proportion of children with acute complicated appendicitis had moderate or severe malnutrition as defined by serological marker serum albumin compared to the children with acute uncomplicated appendicitis. Since most of the patients with acute complicated appendicitis presented late, it can be assumed that the reduced albumin level was due to the ongoing disease process rather than the patients' nutritional status.

In the present study, we found that as the duration of symptoms increases, the proportion of acute complicated appendicitis increases. More than 75% patients presented with acute complicated appendicitis when the duration of symptom was >72 hours. This finding is confirmed by other studies. Mean duration of pain of all patients was 38.6 hours. Over 60% patients presented with acute complicated appendicitis when the duration of pain was >72 hours. Bickell et al. conducted a study on 219 patients and found that rupture risk was ≤2% in patients with <36 hours of untreated symptoms.[10] For patients with untreated symptoms beyond 36 hours, the risk of rupture rose to and remained steady at 5% for each ensuing 12-hours period. Rupture was greater in patients with 36 hours or more of untreated symptoms. Papaziogas et al. in a study of 169 patients found that the risk of perforation was negligible within the first 12 hours of untreated symptoms, but then increased to 8% within the first 24 hours. It then decreased to approximately 1.3-2% during 36-48 h, and subsequently rose again to approximately 6% (7.6-5.8%) for each ensuing 24-hours period.[11]

In the present study, five anthropometric indices were used for nutritional assessment. Among these five indices most frequent abnormal measurements were TSFT (81.9% abnormal) followed by abnormal BMI (45.1%), low MUAC for age (44.5%), low weight for age (34.2%), and low height for age (23.2%). Cooper et al assessed nutritional status among all patients admitted in a tertiary hospital in Philadelphia with similar parameters and their results were similar to this study.[12] Al-Bassam investigated correlation of preoperative nutritional status with postoperative morbidity among paediatric surgical patients in Saudi Arabia and their findings were also similar to this.[9] Besides anthropometric indices three biochemical indices (Namely Haemoglobin, albumin and total lymphocyte count) were used in the present study. Among these three indices most frequent abnormal measurements were low albumin (70.3%) followed by low haemoglobin (60.6%) and low total lymphocyte count (42.6%). The number of combined abnormal measurements showed 89% of patients had three or more abnormal findings. Only 3.2% had at least one abnormal nutritional finding and 12 patients (7.7%) had two abnormal nutritional findings. None of the included children in the study had all normal measurement. None of the abnormal values were associated with the status of appendix.

Limitations

These results should be interpreted in the light of several limitations of our study.

- Sample size was not adequate enough as anticipated.
- This was a single-center study. All the patients were from a government run tertiary care hospital.

Conclusion

Majority of the children had three or more abnormal findings in the indices of nutritional assessment and none of them had normal finding in all of the indices. There was no significant association between nutritional status and type of acute appendicitis except serum albumin status. However, as the duration of symptom increases, the proportion of acute uncomplicated to acute complicated appendicitis increases significantly. So, it can be concluded from this study that malnutrition is not associated more with acute complicated appendicitis than with acute uncomplicated appendicitis.

Recommendation

Nutritional status of our children should be improved. In patients with acute appendicitis nutritional status should be objectively assessed as there is a high prevalence of it and malnutrition should be corrected. Further study with larger sample from different centre is needed to confirm these findings.

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Contribution of authors
MTSC-Conception, data collection drafting & final approval.
RK-Interpretation of data, critical revision & final approval.
TAC-Data collection, analysis of data, drafting & final approval.
MAAF-Data analysis, critical revision & final approval.
MKAS-Design, interpritation of data, critical revision & final approval.
TKC-Conception, data collection, analysis of data, drafting & final approval.

Disclosure
All the authors declared no conflict of interest.

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