PREVALENCE OF URINARY TRACT INFECTION IN MALNOURISHED CHILDREN

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ABSTRACT

BACKGROUND

Malnutrition involves hundreds of millions of children in the developing world. Malnutrition and infection is a vicious cycle. Malnourished children suffer from many infections like respiratory tract infection, UTI, diarrhoea. UTI is more common in malnourished children, and risk of UTI is related to severity of malnutrition. Severe acute malnutrition (SAM) is associated with immune deficiency, because of which they are more vulnerable to severe infection. Risk factors for urinary tract infection include female gender, uncircumcised male, vesicoureteral reflux, poor toilet training, voiding dysfunction, obstructive uropathy, urethral instrumentation, wiping from back to front in girls, bubble bath, tight clothing (underwear), pinworm infestation, constipation, sexually activity, neuropathy bladder, anatomic abnormality (labial adhesion), bacteria with P fimbriae and under nutrition. Urinary tract infection (UTI) is more common in malnourished children, and risk of UTI is related to severity of malnutrition. Severe acute malnutrition (SAM) is associated with immunodeficiency, for which they are more vulnerable to severe infection. We wanted to study the prevalence of UTI in malnourished children.

METHODS

72 malnourished children (WHO classification) who met the inclusion criteria were included in this study from June 2017 to May 2018. Detailed anthropometric measurements were done and grading of malnutrition was done according to WHO classification. Urine for routine examination and culture and sensitivity was done for each case. Early morning urine was collected. In children below 3 years of age urine was collected by catheterization and in toilet trained children (> 3 years of age) midstream clean catch urine sample under strict asepsis was collected in a sterile container. After collecting urine sample was sent within one hour to the laboratory.

RESULTS

UTI was found in 16.67% cases, mostly in female and more frequently in 6-12 months age group and most common organisms was gram negative bacilli.

CONCLUSIONS

Among the various risk factors of urinary tract infection, malnutrition especially under-nutrition itself is a risk factor for UTI or sometimes urinary tract infection also can lead to malnutrition. UTI is common in malnourished children and most common causative organisms are gram negative bacilli.

KEY WORDS

UTI, Malnutrition, Urine C/S

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BACKGROUND

Malnutrition is a widespread public health problem contributing considerably to mortality and morbidity in areas where it is prevalent.^(1,2) WHO defines malnutrition as "the cellular imbalance between supply of nutrients and energy and the body's demand for them to ensure growth, maintenance and specific functions."⁽³⁾ They mostly occur in low-and middle-income countries.⁽³⁾ There has been a slow reduction in under-nutrition in the country but still now India has maximum burden of malnourished children in the world.^(4,5) Urinary tract infection (UTI) is a common medical problem in children, affecting 3-10% girls and 1-3% boys.

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They are an important cause of morbidity and might result in renal damage, often in association with vesicoureteric reflux (VUR). Beyond infancy, the Prevalence of UTI is higher in girls. During infancy, UTI are equally common in boys and girls because the route of infection is often hematogenous and boys have a higher Prevalence of urinary tract anomalies. In most cases, UTI are caused by E. coli that forms the predominant periurethral flora, and uncommonly by klebsiella, enterobacter and staphylococci epidermidis. Proteus and Pseudomonas infections occur following obstruction or instrumentation, while Candida infection occurs in immunocompromised children or after prolonged antimicrobial therapy. The diagnosis of UTI is based on growth of significant number of organisms of a single species in the urine. Significant bacteriuria is defined as a colony count of >10⁵/ ml of a single species in a clean catch sample. Urine is obtained by suprapubic aspiration or urethral catheterization in children below 2 years. Any colonies on suprapubic aspiration and >50,000/ml on urethral catheterization are considered significant. The occurrence of significant bacteriuria in absence of symptoms is termed as asymptomatic bacteriuria.

METHODS

This cross-sectional study was conducted at the department of paediatrics from June 2017 to May 2018 after obtaining approval from the institute ethics committee. 72 children who met the inclusion criteria were included in this study. Written informed consent was taken from parents/guardians for enrolment of their children in the study. Through history, particularly the nutritional history of the subject and other systemic examination was done. Detailed anthropometric measurements were done and grading of malnutrition was done according to WHO classification. Length/ height of child was measured to the nearest millimeter (mm). Weight was recorded to the nearest 100 gm. Mid arm circumference was measured to the nearest millimeter. Body mass index (BMI) in Kg/m² was calculated from weight and height using the formula -BMI=Weight (Kg)/ (Height/length in m)². BSA was measured by the equation of, $BSA = \sqrt{[Wt (Kg) \times Ht/ length (cm)]/3600}$.

All cases were subjected to routine and microscopic examination of urine and urine for culture and sensitivity test. Early morning urine was collected. In children below 3 years of age urine was collected by catheterization and in toilet trained children (> 3 years of age) midstream clean catch urine sample under strict asepsis was collected in a sterile container. After collecting urine sample was sent within one hour to the laboratory. In case if sample could not be sent for culture test within one hour after collection then sample was stored at 4 degree Celsius in refrigerator and after that it was sent to the laboratory as soon as possible during the working hours. Urine sample was sent for microscopic examination, routine examination and culture and sensitivity test.

Urine culture was considered significant (positive) if the colony count was 100,000 (10⁵) or more per ml of freshly voided urine. Urinary tract infection was diagnosed in the presence of more than 5 pus cells per high power field in a centrifuged urine sample in a symptomatic patient and/ or positive urine culture.⁽²²⁾

Statistical Analysis

Statistical analyses were performed using SPSS version 20. Results were expressed as mean $\pm$ standard deviation for continuous variables and as number (%) for categorical data. Chi-square test was applied where it was applicable. A p value <0.05 was considered significant.

In this study, the mean ($\pm$ S.D.) weight was 7.61 $\pm$ 2.20 kg (range from 3.30 kg to 12.40 kg). The mean B.M.I. was 12.16 $\pm$ 1.43 kg/m² (range from 8.4 to 14.72). The mean ($\pm$ S.D.) body surface area was 0.41 $\pm$ 0.09 m² (range from 0.22 to 0.59). The mean ($\pm$ S.D.) length was 78.62 $\pm$ 12.08 cm (Range from 55 to 104 cm). The mean ($\pm$ S.D.) of MAC was 12.48 $\pm$ 1.15 cm (range from 9 to 14.5 cm) (Table I).

We found that majority of cases admitted with symptoms of cough (36.11%), followed by poor feeding (29.16%). Others symptoms was failure to thrive (23.61%), fever (18.05%) lethargy (18.05%), vomiting (16.67%), abdominal distension (15.28%), loose stool (12.5%), breathing difficulties (11.11%), crying during micturition (5.56%), frequency of micturition (4.17%), dysuria (1.39%) and hematuria (1.39%) (Table II).

From the table it was observed that UTI was present in 12 cases (16.67%) and absent in 60 (83.33%) cases (Table III).

In this study, female has more number of cases of UTI than male. Out of 47 male 4 (8.51%) had UTI and Out of 25 female 8 (32%) had UTI. There was significant difference of prevalence of UTI between male and female.

There was no significant difference of prevalence of UTI between moderate and severe malnutrition (P=0.57195) (Table V).

The prevalence of UTI in malnourished children in this study although lower than some previous reports (10,16,11,7,9,12,13) but is however higher than some other studies (6,8,14,15) (Table-VI). The wide variation in prevalence of UTI can be explained by the use of different study methods, geographical variation, as well as considerations or no considerations of study confounders.

In the current study, Female had more number of UTI (8 cases, out of 12, 66.67%) than male (4 case, 33.33%). This may be because of longer course of urethra in male and bacteriostatic substance secreted by prostate.

There was no significant association in the sex in the study of page et al.²⁰ and Rabasa⁶ et al. and in Kala UK⁽¹⁰⁾ et al, there was prevalence of UTI in male (81%) greater than female (19%).

In our study, it was found that prevalence of UTI more frequent in 6 to 12 months (33.33%) age of children. Similar result was found in study that was done by page et al.⁽²⁰⁾

In our study most common causative organism was gram negative bacilli, specially E. Coli (41.67%). Other organisms found Klebsiella 33.34%, Proteus 8.33% and Enterococcus 8.33%, Citrobactor 8.33% which had similarity with most of the previous study.^(6,20,10,11,7,12,13,14)

RESULTS

The mean $\pm$ SD age of malnourished children was 27.96 $\pm$ 16.75 months (Range 6-60). Majority of the children had severe malnutrition (68.06%).

Variables	Mean	$\pm$ S.D.
Weight (Kg)	7.61	2.20
Length/Height (cm)	78.62	12.08
MAC (cm)	12.48	1.15
BMI (Kg/m ²)	12.16	1.43
BSA (m ²)	0.41	0.09

Table I. Anthropometry

Symptoms	Number (n = 72)	Percentage (%)
Cough	26	36.11
Poor Feeding	21	29.16
Failure to Thrive	17	23.61
Fever	13	18.05
Lethargy	13	18.05
Vomiting	12	16.67
Abdominal Distension	11	15.28
Loose Stool	9	12.5
Abdominal Pain	8	11.11
Breathing Difficulties	8	11.11
Irritability	7	9.72
Crying During Micturition	4	5.56
Frequency of Urine	3	4.17
Dysuria	1	1.39
Hematuria	1	1.39

Table II. Symptoms at Admission

UTI	Number (n)	Percentage (%)
Present	12	16.67
Absent	60	83.33
Total	72	100.00

Table III. Prevalence of UTI

UTI	Male		Female		Total		p Value
	N	%	n	%	n	%	
Present	4	8.51	8	32.00	12	16.67	0.01089
Absent	43	91.49	17	68.00	60	83.33	
Total	47	100	25	100.00	72	100.00	

Table IV. Prevalence of UTI Among Males and Females

The chi-square statistic is 6.4831. The p-value is 0.010891. The result is significant at $p < .05$.

UTI	Moderate		Severe		p Value
	N	%	n	%	
Present	3	13.04	9	18.37	0.57195
Absent	20	86.96	40	81.63	
Total	23	100.00	49	100.00	

Table V. UTI among Moderate and Severe Malnutrition

The chi-square statistic is 0.3194. The p-value is 0.571949. The result is not significant at $p < .05$.

Study	Country	UTI Prevalence
Rabasaet al ⁶	Nigeria	11%
Shimeleset al ⁷	Ethiopia	37%
Thuoet al ⁸	Kenya	6%
Ahmed et al ⁹	Tanzania	20.3%
Kala et al ¹⁰	South Africa	34.7%
Berkowitz ¹¹	South Africa	31%
Caksenet al ¹²	Turkey	30%
Brown et al ¹³	Bangladesh	30%
Banapurmathet al ¹⁴	India	8%
G. Gopalet al ¹⁵	India	11.34%
Reed RP ¹⁶	Africa	26.1%
Present Study (2017-18)	Dibrugarh, Assam, India	16.67%

Table VI. Comparison of Prevalence of UTI in Malnourished Children with Other Studies

The presence of >10 leukocytes per mm^3 in fresh uncentrifuged sample, or >5 leukocytes per high power field is useful for screening dip stick examination, combining leukocyte esterase and nitrite, has moderate sensitivity and specificity for detecting UTI. Following treatment of the first episode of UTI plans are made for evaluation of the urinary tract. The aim of imaging studies is to identify urologic anomalies that predispose to pyelonephritis such as obstruction or vesicoureteric reflux, and detect evidence of renal scarring. All children with UTI are encouraged to take enough fluids and empty the bladder frequently to prevent stasis of urine routine alkalisation of the urine is not necessary. With appropriate therapy fever and systemic toxicity reduce and urine culture is sterile within 24-36 hours. Failure to obtain such a result suggest either lack of bacterial sensitivity to the medication or presence of an underlying anomaly of the Urinary tract. A repeat urine culture is not required during or following treatment unless symptoms failed to resolve despite 72 hours of therapy, symptoms recur suggesting recurrent UTI or contamination of the initial urine culture is suspected. Risk factors for urinary tract infection include female gender, uncircumcised male, vesicoureteral reflux, poor toilet training, voiding dysfunction, obstructive uropathy, urethral instrumentation, wiping from back to front in girls, bubble bath, tight clothing (Underwear), pinworm infestation, constipation, sexually activity, neuropathy bladder, anatomic abnormality (Labial adhesion), bacteria with P fimbriae and under nutrition.

Malnutrition and infection is a vicious cycle. Malnourished children suffer from many infections like respiratory tract infection, UTI, diarrhoea. UTI is more common in malnourished children, and risk of UTI is related to severity of malnutrition. Severe acute malnutrition (SAM)

is associated with immune deficiency, for which they are more vulnerable to severe infection.⁽¹⁷⁻¹⁹⁾

Most studies conducted in developing countries among hospitalized children with complicated SAM have reported high prevalence rates of UTI.^(20,21)

DISCUSSION

In the present study, conducted between age group 6-60 months with majority (26.39%) of the study population were 13-24 months of age and the mean $\pm$ SD age of malnourished children was 27.96 ± 16.75 months. In the present study majority of patients was male (65.28 %) rest were female (34.72%).

Distribution of Malnutrition

In the present study majority of [49 (68.06%)] cases was severe malnourished and rest [23 (31.94%)] cases belonged to moderate malnutrition (WHO classification).

Anthropometry

The mean $\pm$ S.D. weight was 7.61 ± 2.20 kg (Range from 3.30 kg to 12.40 kg). The mean $\pm$ S.D. B.M.I. was 12.16 ± 1.43 kg/m^2 (range from 8.4 to 14.72). The mean $\pm$ S.D. body surface area was 0.41 ± 0.09 m^2 (range from 0.22 to 0.59). The mean $\pm$ S.D. length was 78.62 ± 12.08 cm (range from 55 to 104 cm). The mean $\pm$ S.D. of MAC was 12.48 ± 1.15 cm (range from 9 to 14.5 cm).

Distribution of Location of Study Population

Majority of study population was from rural area (62.5%) rest was from urban (37.5%).

Distribution of Clinical Signs and Symptoms

In the present study, majority of cases admitted with symptoms of cough (36.11%). Other symptoms and signs were poor feeding (29.16%), failure to thrive (23.61%), fever (18.05%), lethargy (18.05%), vomiting (16.67%), abdominal distension (15.28%), loose stool (12.5%), breathing difficulties (11.11%), crying during micturition (5.56%), i.e. around 60% patients were admitted with respiratory tract/gastroenteritis infections. Pallor was present in 38.89% and vitamin deficiency was found in 41.67% cases.

Prevalence of UTI

In the present study out of 72 patients, 12 had UTI (16.67%) and all cases of UTI was culture proven. In this study UTI is more common than the same age group of general population.⁽²³⁾ Similar results were obtained in the study conducted by page et al,²⁰ Okomo et al,²⁴ Bagga et al.²⁵

Malnutrition decreases both cellular and humoral immunity as a result of which infection and malnutrition form a vicious cycle. Vitamin deficiency was found in 41.67% cases. Vitamin A maintains the integrity of epithelial barriers. This may be the cause of higher prevalence of UTI in our study.

CONCLUSIONS

UTI is common in malnourished children and most common causative organisms are gram negative bacilli. There are many problems encountered in malnourished children including tuberculosis infections, vitamin A deficiency, respiratory infections, gastro-intestinal infections, or other nutritional deficiencies. But, urinary tract infection especially

cystitis or acute pyelonephritis may be unrecognised if proper attention is not given or urine culture as a routine protocol for investigation is not included.

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