STUDY ON VULNERABILITY OF MALNOURISHED CHILDREN TO URINARY TRACT INFECTION

Bidhan Roy Chowdhury[1*] Suchanda Das[2]

Abstract

Background: Knowledge of baseline risk of urinary tract infection in malnourished child can help clinicians make informed diagnostic and therapeutic decisions. To see the prevalence of Urinary Tract Infection (UTI) in malnourished children & compare the prevalence of UTI between malnourished and well-nourished children. As well as to study the clinical features & to see organisms responsible for UTI and their antibiotic sensitivity patterns in malnourished children. **Materials and methods:** This prospective comparative study was carried out among fifty hospitalized malnourished children (Case) and fifty hospitalized well-nourished children (Control) during the period of July to December 2010. The relevant information from history and physical examination were noted in a preformed standard questionnaire. Laboratory investigations and other necessary tests were done as indicated. Clean-catch midstream urine samples were collected from all studied children in sterilized test tube and sent to laboratory within one hour of collection. **Results:** Prevalence of UTI in malnourished children was 16 percent, which was higher than those of control (4%), which was statistically significant. The prevalence of UTI in marasmic-kwashiorkor (66.67%) was much higher than those of kwashiorkor (5.26%) and marasmus (33.33%). Age and sex of the malnourished individuals did not contribute to the prevalence of UTI. Pyuria (Pus cell > 10/HPF) alone was not found to be diagnostic but had significant correlation with the presence of UTI. Symptoms and signs of UTI in malnourished children were scanty and not adequate for clinical suspicion. Organism responsible for UTI in malnourished children were E. coli (75.%) Proteus (12.5%) and Klebsiella (12.5%) which were almost sensitive to commonly used antibiotics, except amoxycillin. **Conclusions:** Prevalence of UTI is significantly high among malnourished children of all categories. But symptoms and signs of UTI are non-specific and scare in malnourished children. So, all malnourished children should be routinely investigated for UTI.

Key words

Malnutrition; Urinary tract infection; Pyuria.

Introduction

Malnutrition is a global problem. Children of developing and underdeveloped countries are the worst sufferers of different grades of malnutrition. The prevalence of Protein-Energy Malnutrition (PEM) in its various forms is high in India and Southeast Asia, most parts of Asia and the Middle-East, in the Caribbean Islands and in South and Central America. Prospective study suggest that severely underweight children (<60% of NCHS mean) have more than eight-fold & moderately underweight child (60-69%) have a four to five-fold greater risk of mortality then normally nourished child[1]. Pediatric Urinary Tract Infections (UTI) account for 0.7% of physician office visits and 5–14% of emergency department visits by children annually[2]. Accurate diagnosis of UTI has important clinical implications; as most febrile infants with UTI show evidence of renal parenchymal involvement (Pyelonephritis)[3]. Under nutrition and infection separately but more often together are major contributors to morbidity and mortality worldwide, particularly in the underprivileged young children. It has been observed by the clinicians that children having PEM are very prone to develop various acquired infections[4,5]. In this condition, the course of illness is prolonged, complications are severe and

1. Associate Professor of Paediatrics
Bangabandhu Memorial Hospital (USTC) Chittagong.
2. Assistant Professor of Gynaecology & Obstetrics
Chittagong Medical College, Chittagong.

***Correspondence:** **Dr. Bidhan Roy Chowdhury**
E-mail: drbidhan64@gmail.com
Cell : 01819 325077

Received on : 05.06.2018
Accepted on : 23.06.2018

the severity of infectious illness and rate or mortality is high. Infection in turn frequently worsens the severity of infectious illness and rate or mortality is high. Infection in turn frequently worsens the nutritional status, often precipitating overt symptoms and signs and causes immunosuppression[6].

The Urinary Tract Infections (UTIs) are common in children. The prevalence of UTIs varies markedly with sex and age[7,8]. UTI occur four times more frequently in girls than in boys, with the exception of first 6 months of life. The higher female incidence after the early months of life has been attributed to the short female urethra and ascending infections[9.10].

But in case of malnourished children Urinary Tract Infection (UTI) is a well-recognized complication with a similar incidence in boys and girls[11,12]. In Bangladesh, studies were scares to find out the prevalence of UTI in malnourished children. Hence, this study was undertaken.

Materials and methods

This is a prospective comparative study conducted from July 2010 to December 2010. The work has been carried out in the Department of Paediatrics, Bangabandhu Memorial Hospital (BMH), under the University of Science & technology Chittagong (USTC) and 'The Nutritional Block' under the Paediatrics department of Chittagong Medical College Hospital, Chittagong (CMCH).

A total number of 100 children aged 1-5 years were randomly selected for the present study. The selected children were divided into case and control as follows:

Case group

Fifty malnourished children were selected randomly from among the hospitalized children aged one to five years who had been suffering from protein-energy malnutrition. Weight-for-age (Compared with 50th centile of NCHS scales) of these children and presence or absences of oedema is as per Wellcome classification (WHO1999).

Control group

Fifty control children were selected randomly from among the hospitalized children aged 1-5 years. For each case, a normally nourished control matched for age, sex and suffering from diseases other than PEM i e. fever, diarrhoea etc.

Inclusion criteria

Age of the child	:	1 to 5 years
Weight-for-age (NCHS mean)	:	As per Wellcome classification
Study group	:	60-80% + no oedema =>underweight
		60-80% + oedema =>kwashiorkor
		< 60% + no oedema => marasmus
		<60%+ oedema => marasmic-kwashiorkor
Control group	:	=> 80 %

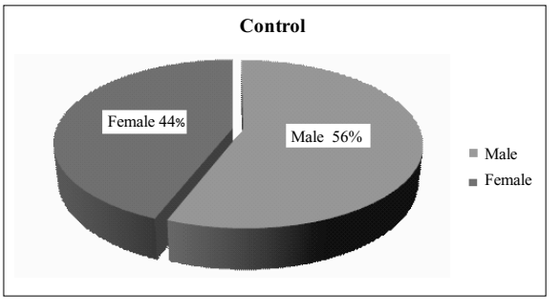
Exclusion criteria

Patients, who received antibiotic therapy for at least 24 hours before or after admission to the hospital, were excluded from this study. Patients with oedema due to other diseases like congestive cardiac failure, nephritic syndrome, cirrhosis of liver, etc. unconscious, not able to void urine on command or spontaneously were also excluded from the study.

Procedure

At the onset of selection of control and case, a detailed history, clinical examination, including anthropometry were performed. The purpose and procedure of the study was explained to the parents and their consent was taken. The genital area was cleaned with soap, and then with sterile water, clean-catch midstream urine sample was collected in sterilized test tubes. Physical character of urine samples was noted and were transferred to laboratory and subjected to microscopy and urine culture within one hour of collection. Pus cells >10 HPF of centrifuged urine was considered as criteria for significant pyuria. Urine was plated for culture and antibiotic sensitivity. Urine culture was done on blood agar and McConkey's agar media. Colony count was done by loop method. Bacterial isolates were tested for microbial sensitivity by disk impregnation method. A colony count of 10^5/ml or more was taken as a case of UTI. Plain X-ray KUB, Ultrasonography of KUB was done in selected cases to find abnormality in urinary tract. After collection of data these were checked, verified and then entered in to the computer. Data were analyzed in computer by using software SPSS version 17 (Statistical Package for Social Science). The results were subjected to statistical analysis according to standard procedure. Chi-square test and Z-test were used as the test of significance. Level of significance was expressed as p value. p value < 0.05 was considered as statistically significant and <0.001 was considered as highly significant.

Results



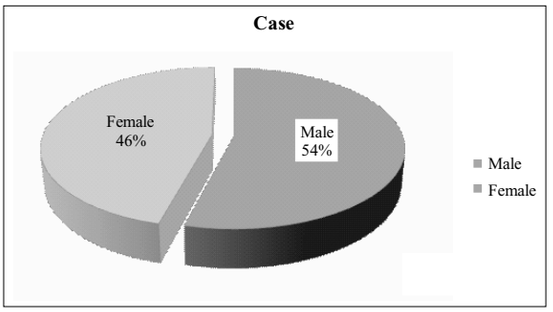


Fig 1 : Pie chart showing distribution of respondents by sex

Table I : Prevalence of UTI in well-nourished (Control) and malnourished (Case) children (n=100)

Group	UTI present	UTI absent	Total
	f (%)	f (%)	f (%)
Control	2(4)	48(96)	50 (100)
Case	8(16)	42(84)	50 (100)
Total	10(10)	90(90.0)	100 (100)

Chi-square test with Yates' correction:
χ^2= 4.549, df 1.0, p<0.05 (Significant)

Table II : UTI in various categories of malnourished children (n=50)

Categories of Malnutrition	UTI Present f (%)	UTI Absent f (%)	Total f (%)
1. Kwashiorkor	2 (5.26)	36 (94.74)	38 (100)
2. Marasmus	2 (33.33)	4 (66.67)	6 (100)
3. Marasmic-Kwashiokor	4 (66.67)	2 (33.33)	6 (100)
Total	8 (16.00)	42 (84.00)	50 (100)

Z-test:
1 vs 2 : Z = 2.2 (Significant)
2 vs 3 : Z = 2.06 (Significant)

Table III : Relationship between microscopic pyuria and urine culture

Group	Microscopic pyuria (Pus cell >10/HPF in fresh centrifuged urine)	UTI present	UTI absent	Total	p value[a]
Control	Pyuria	2	1	3	<0.001***
	Apyuria	0	47	47	
	Total	2	48	50	
Case	Pyuria	7	2	9	<0.001***
	Apyuria	1	40	41	
	Total	8	42	50	

[a]Chi-Square test with Yates' correction
***Highly significant

Table IV : Pathogens causing UTI and their antibiotic sensitivity

Group	Organism	Number of pathogens	Number of pathogens sensitive							
		f (%)	AM	CO	GM	CE	NA	NF	CP	CF
Control	E.coli	2	0	1	2	1	1	1	2	2
Case	E.coli	6 (75.0)	0	2	5	3	4	4	5	6
	Proteus	1 (12.5)	0	0	1	1	1	1	1	1
	Klebsiella	1 (12.5)	0	0	1	0	0	0	1	1
Total number		10	0	3	9	5	6	6	9	10
Percentage		100	0	30	90	50	60	60	90	100

** AM = Amoxycillin, CO = Cotrimoxazole, GM = Gentamicin, CE = Cephalexin, NA = Nalidexic acid, NF = Nitrofurantoin, CP = Ciprofloxacine, CF = Ceftriaxone

The results were subjected to statistical analysis according to standard procedure. After completion of data collection, all data were compiled, tabulated and analyzed according to objectives set for the study. The socioeconomic condition of almost all of 50 malnourished child was poor. Their parents were Ricksha pullar, auto-ricksha driver or daily labourer and most mothers were garments workers. Figure-1 shows sex distribution. In the control group, 22(44%) were female and 28(56%) were male. And 23(46%) were female and 27(54%) were male in the study group. Male to female ratio in control and cases were 1.27:1 and 1.17:1, respectively. Prevalence of UTI in well nourished and malnourished is shown in table-I. UTI was detected in 2 (04%) children among control (n=50) and in 08 (16%) children in study group (n=50). Statistical analysis

showed that the prevalence of UTI in malnourished children was significantly higher than well-nourished children. Prevalence of UTI in various categories of malnourished children was shown in table-II. In kwashiorkor 2 (5.26%) out of 38, in marasmic 2 (33.33%) out of 6, in marasmic-kwashiorkor, 4 (66.66%) out of 6 had UTI. Prevalence rate significantly differ in different categories of malnutrition. Relationship between microscopic pyuria and urine culture has been shown in table-III. In control group, 2 had culture positive out of 3 children with pyuria, and one was found culture negative out of 3 children with pyuria, and None was found to have culture positive out of 47 apyuric children. In study group out of 9 pyuric children, 7 (77.78%) had culture positive and only one out of 41 apyuric children. So it was found that microscopic finding (Pus cell) of urine is statistically significant for detection on UTI.

Table-IV shows pathogens causing UTI and their antibiotic sensitivity. All UTI in the control group were due to E. coli, but in study group, 6 cases (75%) were due to E. coli and 1 (12.5%) was due to Proteus and 1 (12.5%) was due to Klebsiella. E. coli showed sensitivity to Ceftriaxone (10 specimens) Ciprofloxacin (9 specimens) Nitrofurantoin (6 specimens) Nalidixic acid (6 specimens) Cephalexin (5 specimens) Gentamicin (9 specimens) Cotrimoxazole (3 specimens) in both control and study groups. Proteus was sensitive to all above antibiotics except cotrimoxazole & amoxicillin. Klebsiella was sensitive to Ceftriaxone, gentamicin and ciprofloxacin. Both E. coli, Proteus and Klebsiella were resistant to amoxicillin.

Discussion

Urinary Tract Infections (UTI) are a common cause of febrile illness in young children. Due to lack of overt clinical features in children less than two years, appropriate collection of urine samples and basic diagnostic tests at first level health facilities in developing countries, UTI are not generally reported as a cause of childhood morbidity[7]. Malnourished individuals are more vulnerable to infection and UTI occurs frequently in malnourished children[7,11,12]. In this study, prevalence of UTI in well nourished and malnourished is shown in table-I. UTI was detected in 2 (04%) children among control (n=50) and in 08 (16%) children in study group (n=50). Statistical analysis showed that the prevalence of UTI in malnourished children was significantly higher than well-nourished children. Kala and Jacos were found that 35 percent of total hospitalized malnourished black children suffer from UTI[13]. Whereas in other study it was claimed 26% percent of rural African malnourished children suffer from UTI[14]. So, malnourished children is highly vulnerable for UTI than that of well-nourished children, which is statistically significant.

The prevalence of UTI seems to be correlated with the degree of malnutrition and wasting[15]. There was significant difference between the prevalence of UTI in those with oedema i e. kwashiorkor and marasmic-kwashiorkor and the non-oedematous malnourished children[13]. The present study table-II showed significant difference in prevalence of UTI in different categories of malnutrition, i.e.kwashiorkor (5.26%) marasmus (33.33%) and marasmic-kwashiorkor (66.66%). This finding is almost consistent with the studied mentioned above.

Relationship between microscopic pyuria and urine culture has been shown in table-III. In control group, 2 had culture positive out of 3 children with pyuria, and one was found culture negetive out of 3 children with pyuria, and none was found to have culture positive out of 47 apyuric children. In case group out of 9 pyuric children, 7 (77.78%) had culture positive and only one out of 41 apyuric children. So it was found that microscopic finding (Pus cell) of urine is statistically significant for detection of UTI. Determination of pyuria is a helpful rapid investigation in children suspected of having symptomatic UTI. A urine sample without pyuria is not usually symptomatic UTI. However, presence of leucocytes in the urine is not diagnostic of UTI. Significant bacteriuria is usually associated with significant pyuria, but pyuria alone is not satisfactory criteria for diagnosis of UTI[16]. This series showed that among control, three urine specimens were pyuric and out of those 2 (66.66%) had UTI. In cases, pyuria were in 9 urine specimens out of which 7 (77.78%) had UTI. So, significant correlation between pyuria and UTI were found in this study but pyuria alone was not diagnostic. This was consistent with the studies of previous researchers[16,17].

Table-IV shows pathogens causing UTI and their antibiotic sensitivity. All (2) cases of UTI in the control group were due to E. coli, but in study group, 6 cases (75%) were due to E. coli and 1 (12.5%) was due to Proteus and 1 (12.5%) was due to Klebsiella. E. coli showed sensitivity to Ceftriaxone (8 specimens) Ciprofloxacin (7 specimens) Nitrofurantoin (5 specimens) Nalidixic acid (5 specimens) Cephalexin (4 specimens) Gentamicin (7 specimens) Cotrimoxazole (3 specimens) in both control and study groups. Proteus was sensitive to all above antibiotics except cotrimoxazole & amoxicillin. Klebsiella was sensitive to Ceftriaxone, gentamicin and ciprofloxacin. E. coli, Proteus and Klebsiella all organisms were resistant to amoxicillin. Eighty to ninety percent of first time UTI in children are due to E.coli [16]. Hossain et al isolated E.coli in 92 percent of cases in their studies[18]. All isolated organisms were sensitive to common antibiotics e.g Ceftriaxone (100%) Ciprofloxacin (90%) Gentamycin (90%) Nitrofurantoin (80%) Nalidixic acid (60%) Cephradin (50%) Cotrimoxazole (30%) but none was sensitive to amoxicillin. Kala and Jacobs concluded that similar pathogens are found in UTI of malnourished & well-nourished children and malnourished rural African children showed that 40 percent of total UTI are due to E.coli[13]. In this series, hundred percent of UTI in well-nourished (Control) and 93.33 percent of UTI in malnourished children Case were due to E.coli. Only 6.66 percent UTI in malnourished children (Case) were due to proteus. The findings of the present study are consistent with the findings of Kala and Jacobs. Jodal and Hansson Reed and Wegerhoff, Jodal and Hansson, Nath and Hossain et al[13,14,16-18].

Urinary tract infection in malnourished children is usually asymptomatic[19]. Many researcher in home and abroad in different study it was also proved[2,3,14-18]. Urinalysis is useful for screening for UTI in these subjects. Urine culture should be performed in patients showing an abnormal urinalysis, and if the likelihood of detecting bacteriuria is high (As in patients with fever or diarrhoea). Significant bacteriuria in malnourished subjects should be treated with appropriate antimicrobials.

In finally, UTI was significantly common in all categories of malnourished children and the prevalence was found to be correlated with the degree of malnutrition, with similar incidence in boys and girls[20]. Pathogens are likely to be similar as those found in UTI of well-nourished children and sensitive to commonly used antibiotics.

Acknowledgements
We are grateful to the patients & their parents as well as to the Doctors, sisters & other stuffs of the words for the participation in our study.

Contribution of author's
BRC-Conception, design, acquisition of data, analysis, interpretation of data and final approval.

SD-Interpretation of data, drafting, critical revision and final approval.

Conclusion
Prevalence of UTI is significantly high among malnourished children of all categories. But symptoms and signs of UTI are non-specific and scare in malnourished children. So strong suspicion is the key to diagnose UTI in malnourished children. All malnourished children should be routinely investigated for UTI. Routine urinalysis alone is not diagnostic of UTI. So attention needs to be paid for urine culture and sensitivity test of all malnourished children for proper diagnosis and treatment of UTI, along with the management of malnutrition.

Disclosure
Both the authors declare no competing interest.

References
1. William C. Heird. Food Insecurity, Hunger, and Undernutrition, Nelson Textbook of Paediatrics, 17th ed. 2004;167-173.

2. Freedman AL. Urologic diseases in North America Project: Trends in resource utilization for urinary tract infections in children. The Journal of urology. 2005;173(3):949-954.

3. Shaikh N, Morone NE, Bost JE, Farrell MH. Prevalence of urinary tract infection in childhood: A meta-analysis. The Pediatric infectious disease journal. 2008;27(4):302-308.

4. Gomaa H. Fungal and Bacterial Infection in Malnourished Children and its Relation to Severity of the Disease" Mamdouh R. Sakr," Ahmed A. El-Aiady,"Shadia H. Ragab,"Howayda E. Gomaa and "Hesham Gamal El Din. J. Med. Sci. 2006;6(3):432-438.

5. Vaez Zadeh F, Rahimkhani M et al. The incidence of urinary tract infection, Bacteriuria and pyurea in malnourished children. Tehran University Medical Journal. 2005;63(8):618-624.

6. Alam MB. Infection in malnourished children [Dissertation]. Bangladesh College of Physicians and Surgeons, Dhaka. 1983.

7. World Health Organization. Urinary tract infections in infants and children in developing countries in the context of IMCI. WHO/FCH/CAH/05.11

8. Durbin WA, Peter G. Management of urinary tract infections in infants and children. Pediatr Infect Dis. 1984; 3:564-573.

9. Gonzalez R. Urologic disorders in infants and children. In:Nelson WE, Behrman RE, Kliegman RM, Arvin AM (eds). Nelson Textbook of Pediatrics, 17th ed. WB Saunders Company, Philadelphia. 2004;1527-1553.

10. Cockburn F,Carachi R, Goel KN Young DG. Urinary Tract Infections. In: Children's Medicine and Surgery, 1st ed. Arnold, Great Britain. 1996;224-228.

11. Bagga A, Tripathi P, Jatana V, Hari P, Kapil A, Srivastava RN, Bhan MK. Bacteriuria and urinary tract infections in malnourished children. Pediatric nephrology. 2003;18(4):366-370.

12. UNICEF statistics. Malnutrition. News item. 2004 Sep 20.

13. Kala UK, Jacobs DW. Evaluation of urinary tract infection in malnourished black children. Annals of tropical paediatrics. 1992;12(1):75-81.

14. Reed RP, Wegerhoff FO. Urinary tract infection in malnourished rural African children. Annals of tropical paediatrics. 1995;15(1):21-26.

15. Tolkoff-Rubin NE, Rubin RH. Urinary tract infection in the immunocompromised host: Lessons from kidney transplantation and the AIDS epidemic. Infectious Disease Clinics. 1997;11(3):707-717.

16. Jodal U, Hansson S. Urinary tract infection. Pediatric nephrology. 1994;3:950-986.

17. Nath PK. Prevalence of urinary tract infection in malnourished children (Thesis). BSMMU. 2000.

18. Hossain MN, Ahme MGZ, Mostafi MM. Urinary tract infection in children: A study of 50 cases. Bangladesh Armed Forces Med J XX 1996.

19. WHO. Management of severe malnutrition: A manual for physicians and other senior health workers. World Health Organization, Geneva. 1999.

20. ICDDR,B. Socioeconomic inequities in childhood malnutrition in Bangladesh. 2002.