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Original Research Article

The prevalence of urinary tract infection in severe acute malnutrition children

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Abstract

Background: UTI in SAM prevalence rates range from 6% to 37% in developing countries. The most common bacterial isolates are Gram negative organisms. Due to increase in the magnitude of antibiotic resistance, there is a need to routinely investigate specific pathogens causing UTI and use effective antibiotics.
Methodology: It was a hospital based prospective study. All children who fulfilled WHO criteria for SAM, admitted at KIMS were included. Fresh urine samples were collected at admission and sent for urine microscopy and culture sensitivity. Urine dipstick for nitrites and leucocyte esterase was also done.
UTI was suspected when > 10 leucocytes/mm3 in an uncentrifuged sample or positive leukocyte esterase and nitrite test by dipstick was seen. UTI was further confirmed by positive urine culture.
Results: Of total 104 SAM children, prevalence of UTI was found to be 25.9%. 51.9% were females and 48.1% were males. In culture positive cases, mean age in years was 1.48 years $\pm$0.96.
70.4% of urine culture positive samples had >5 pus cells in the urine. Dipstick leucocyte esterase was highly sensitive in detecting UTI (81.5%). Combineddipstick leucocyte esterase and nitrite test was highly specific (100%). *E. coli* was the most common organism isolated (59.2%) followed by *Klebsiella* (14.8%). Most of the organisms isolated were sensitive to piperacillin tazobactam (59.2%). Most isolates were resistant to Ampicillin.
Conclusion: In our study, high prevalence of UTI (25.9%) was seen. Bedside dipstick tests can be used effectively to detect UTI. Commonest organisms isolated were Gram negative bacteria and showed good sensitivity to piperacillin tazobactam. Early detection and treatment of UTI in SAM children is necessary to prevent long term complications.

Keywords: urinary tract infection, severe acute malnutrition, causative organism

Introduction

The World Health Organization (WHO) defines Malnutrition as “The cellular imbalance between the supply of nutrients and energy and the body’s demand for them to ensure growth, maintainance and specific functions”. Many factors can cause malnutrition, most of which relate to poor diet or severe and repeated infections, particularly in underprivileged populations [1].

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Childhood undernutrition is an underlying cause in an estimated 45% of all deaths among under 5 children. According to the National Family Health Survey (NFHS) 4 (2015-2016), 36% of India's children under the age of five are underweight, 38% are stunted and 21% are wasted. It is estimated that only 10% of children between the age of 6-24 months have adequate nutritional intake. Most children in this country are thus 'nutrition hungry' in this critical phase of life [2].

Severely malnourished children have a high mortality rate; almost 56% of childhood death is attributed to malnutrition. It is not only an important cause of childhood morbidity and mortality but leads to impairment of physical and possibly of mental growth of those who survive. These children are more prone for infections [3, 4]. The judicious use of antibiotics in these children is dependent on culture reports [1].

It is well known that there is synergistic interaction between malnutrition and infection; any kind of infection can worsen the nutritional status. Severe malnutrition leads to an immunodeficiency state known as NAIDs (Nutritionally Acquired Immune Dysfunctions). The ability of malnourished child to handle infections is lower, hence common infections from Streptococcus pneumoniae, Klebsiella pneumoniae, Escherichia coli and Hemophilus influenza are more common in them [5] leading to pneumonia, septicemia, diarrhoea, meningitis, tuberculosis and a higher incidence of urinary tract infections as compared to normal children [6].

Child is said to have complicated SAM if any of these is present-severe edema, lack of appetite, medical complications on clinical examination (e.g. severe anaemia, pneumonia, diarrhoea, dehydration, cerebral palsy, tuberculosis, HIV, heart disease. etc.) and danger signs according to IMNCI algorithm [2].

Urinary tract infection is more common in malnourished children; it ranks next to respiratory tract and gastrointestinal infections, as the third most common bacterial infection.

UTIs occur in 1% of boys and 1-3% of girls. UTIs are more common in uncircumcised boys, especially in 1st year of life. In girls, the first UTI usually occurs by the age of 5 years, with peaks during infancy and toilet training [7].

From the global reports, UTI in SAM prevalence rates range from as low as 6% to as high as 37% in developing countries while the most common bacterial isolates from urine cultures are Gram negative coliform organisms such as *Escherichia coli* and *Klebsiella* species [8].

Children with SAM having UTI are generally asymptomatic or may present in infants and young children with non-specific symptoms and signs, such as irritability, fever, vomiting and diarrhoea. Hence high index of suspicion is required for its correlation in children especially with SAM. Therefore, rapid evaluation and treatment of UTI is important to prevent renal parenchymal damage (renal scarring) that can cause hypertension and chronic renal failure later. UTI further aggravates malnutrition and vicious cycle is formed [9].

The risk of bacteriuria increases significantly with the severity of malnutrition. The increased susceptibility might be due to breakdown of anatomical barriers, decreased cell-mediated immunity, depressed opsonic activity, decreased phagocytosis and vitamin A deficiency [10].

Due to increase in the magnitude of antibiotic resistance, there is a need to routinely investigate specific pathogen causing UTI in every case so that effective antibiotic treatment can be used [8]. However, data regarding UTI among malnourished children is limited because most of the times severe and moderately malnourished children are afebrile despite significant bacteruria.

Methodology

A. Source of data

All SAM children admitted in pediatric department.

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B. Duration of the study

One year.

C. Type of study

This was a hospital based prospective study.

D. Inclusion criteria

All SAM children as per WHO criteria were included. Severe acute malnutrition (SAM) among children 6-59 months of age is defined by WHO and UNICEF as any of the following criteria 64:

i) Weight-for-height below-3 standard deviation (<-3SD) on the WHO Growth Standard.
ii) Presence of bipedal edema.
iii) Mid upper arm circumference (MUAC) below 11.5 cm.
iv) Severe visible wasting.

In a child below 6 months of age, the MUAC is not used as a criterion.

E. Exclusion criteria

i) Children who have received antibiotics in preceding one week.
ii) Children who had congenital anomalies of urogenital tract.

A total of 128 SAM children who fulfilled inclusion criteria were included in the study out of which 24 children had received antibiotics in the preceding one week, hence were excluded. Remaining 104 children were included in the study.

A predesigned and pretested proforma was prepared to collect relevant information. Informed consent was taken from the parents or guardian of the children enrolled in the study. Data related to age, sex, socioeconomic status, symptoms and nutritional status were noted. A thorough physical examination and systemic examination was done in all the patients.

Urine sample was collected from the patient by appropriate method at admission. Routine blood counts, urine microscopy, urine culture and sensitivity were performed. Urine dipstick was done at the bedside immediately. All SAM children were investigated and managed further according to SAM protocol.

Data was entered in the proforma.

Results

Table 1: Mean age distribution with respect to Culture results

	Culture				P value
	Positive		Negative		
	Mean	SD	Mean	SD	
Age in Years	1.48	0.96	2.25	1.20	0.003*
Age in Months	17.78	11.48	27.00	14.41	0.003*

In culture positive cases, Mean Age in years was 1.48 years ± 0.96 and in culture negative it was 2.25 years ± 1.20.

In culture positive cases, Mean Age in months was 17.78 ± 11.48 months and in culture negative it was 27 ± 14.41months.

There was a significant difference in mean age distribution with respect to culture results.

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Table 2: Association between Age distribution and Culture positivity

		Culture					
		Positive		Negative		Total	
		Count	%	Count	%	Count	%
Age	<1 year	13	44.8%	16	55.2%	29	100.0%
	1 to 3 years	12	20.3%	47	79.7%	59	100.0%
	3 to 5 years	2	12.5%	14	87.5%	16	100.0%
	Total	27	26.0%	77	74.0%	104	100.0%

$\chi 2 = 7.849$, df = 2, p = 0.02*

In the study, among children in the age group <1 year, 44.8% (13) were culture positive, among children in the age group 1 to 3 years, 20.3% (12) were culture positive, among children in the age group 3 to 5 years, 12.5% (2) were culture positive. There was significant association between age group of less than 1 year and culture positivity.

Table 3: Sex distribution of subjects

		Count	%
Sex	Female	54	51.9%
	Male	50	48.1%
	Total	104	100.0%

In the study, 51.9% were females and 48.1% were males.

Table 4: Sex distribution with respect to Culture results

		Culture			
		Positive		Negative	
		Count	%	Count	%
Sex	Female	15	55.6%	39	50.6%
	Male	12	44.4%	38	49.4%

$\chi 2 = 0.193$, df = 1, p = 0.661

In culture positive, 55.6% were females, 44.4% were males.
In culture negative, 50.6% were females, and 49.4% were males.
There was no significant difference in sex distribution with respect to culture results.

Table 5: Socioeconomic Status distribution of subjects

		Count	%
Socioeconomic Status	Class 2	2	1.9%
	Class 3	51	49.0%
	Class 4	50	48.1%
	Class 5	1	1.0%
	Total	104	100.0%

In the study, none belonged to class I, 1.9% belonged to Class 2, 49% belonged to Class 3, 48.1% belonged to Class 4 and 1% belonged to Class 5.

Table 6: Socioeconomic Status distribution with respect to Culture results

	Culture			
	Positive		Negative	
	Count	%	Count	%

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Socioeconomic Status	Class 2	0	0.0%	2	2.6%
	Class 3	13	48.1%	38	49.4%
	Class 4	14	51.9%	36	46.8%
	Class 5	0	0.0%	1	1.3%

$\chi 2 = 1.166$, df = 3, p = 0.761

In Culture Results Positive, 48.1% were in Class 3 and 51.9% were in Class 4. In Culture Results Negative, 2.6% were in Class 2, 49.4% were in Class 3, 46.8% were in Class 4 and 1.3% were in Class 5. There was no significant difference in socioeconomic status distribution with respect to culture results.

Discussion

The prevalence of urinary tract infection (UTI) has been increasing in children with severe acute malnutrition. UTI remains one of the most common causes of febrile illness in pediatric practice. Most studies conducted among hospitalized children with complicated SAM have reported high prevalence rates of UTI. The presence of urinary secretory IgA (sIgA) is one of the defense mechanisms against UTI, and its role in UTI episodes has been reported. Low urinary sIgA may represent an important predisposing factor to recurrent UTI. Therefore, UTI risk in malnourished children may partly be related to impaired sIgA response.

With the reported high prevalence of UTI among these children and concerns over antibiotic resistance, more extensive data is required using standardized microbiological methods.

Thus, the assessment of the performance of urine dipsticks and microscopy against the gold standard urine culture is an important step towards strengthening the evidence for the therapeutic guidelines for UTI in children with SAM.

This study was a hospital based prospective study carried out at department of Pediatrics, KIMS, Hubballi over a period of 12 months to determine the prevalence of urinary tract infection in SAM children between 0-5 years. A total of 104 SAM children were included in the study.

In the present study, prevalence of UTI in SAM children was 25.9% (27) which is similar to study conducted by Maimuna Ahmed *et al*. at Tanzania 16 where the prevalence noted was 20.6% and study conducted at Tikrit Medical College Iraq by Mohammad Muhsin *et al*. *et al*. [11] where prevalence of 27% was seen. In another hospital-based study in Turkey (Middle East), 103 children with malnutrition were investigated prospectively for UTI. The authors reported a UTI prevalence rate of 30% which was higher compared to our study 71. In contrast to the present study, lower prevalence of UTI in SAM children were seen in studies conducted by Arvind Bagga *et al*. [12] 15.2%.

Higher prevalence could be attributed to the fact that our study was conducted in rural population where it might be due to poor hygiene and poor socioeconomic status. The differences in the prevalence in various studies can be due to different methods of sample collection in different studies (including urine bag, midstream urine sample, SPA) with variable sensitivity and specificity. The increase susceptibility to UTI in SAM can be attributed to immunosuppression resulting from impairment in the cell-mediated immunity.

Among 104 children, 27.9% (29) were < 1 year, 56.7% (59) were between 1-3 years and 15.4% (16) were between 3-5 years. In the study among children in the age group <1 year, 44.8% (13) were culture positive, among children in the age group 1 to 3 years, 20.3% (12) were culture positive, among children in the age group 3 to 5 years, 12.5% (2) were culture positive. Youngest SAM child with UTI was found to be 2 months old.

In the present study, prevalence of culture positive UTI was higher in the age group of less than 1 year (44.8%) and there was significant association between culture positivity and age (p<0.005) which is similar to study conducted by Anne Laure Page *et al*. in Niger [14] where

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UTI's were more frequent in children under 1 year of age (24%). Higher prevalence of UTI in younger children can be explained by the fact that at this age, children are not toilet trained

hence more predisposed to UTI from faecal contamination.

The study conducted at Tanzania by Maimuna Ahmed *et al*. [15] also showed that the prevalence of UTI in SAM was found to be greater in children below 2 years whereas study conducted at Tikrit Iraq [11] showed that the most common age group of UTI in SAM was 1-3 years (35%) in comparison to age group 2-12months (25.5%).

Among the culture positive cases, 55.6% were females and 44.4% were males. There was no significant association between culture positivity and sex of the child in our study which is similar to the study conducted at Iraq by Mohammad Muhsin *et al*. [11] where there was no significant difference in incidence of UTI among males and females as malnutrition occur in both sexes with the same precipitating factors. Study conducted at Nigeria by Anne-Laure Page *et al*. [14] also showed no significant association with sex. There was a preponderance of girls with UTI in SAM in a study conducted at Nigeria by Umma Abdulsalam Ibrahim *et al*. [13] (20.3%in girls and 13.3% in boys). In a study conducted at Tanzania by Maimuna Ahmed *et al*. [15], female sex had 11% increased risk of significant bacteriuria compared to male sex.

Many studies have recorded female predominance among children with UTI. This observation is attributed to the short female urethra, which is in close proximity to the anus from which it can be easily contaminated by faecal matter.

Conclusion

- Prevalence of UTI in SAM children was 25.9%.
- Urine culture is the gold standard test in diagnosing UTI. Urine culture positivity was more in urine analysis showing >5 pus cells/HPF in centrifuged sample (70.4%).

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