ORIGINAL ARTICLE

Urinary tract infection in febrile under five children in Enugu, South Eastern Nigeria

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Abstract

Background: Fever is a common symptom of urinary tract infection (UTI) in children less than 5 years of age. Little attention is however paid to UTI as a cause of fever in this age group.

Objective: The objective of the following study is to determine the prevalence of UTI in febrile children less than 5 years of age and relate it to demographic and clinical characteristics.

Materials and Methods: Urine specimen of febrile children aged 1-59 months obtained by suprapubic or midstream methods were analyzed using standard laboratory methods of microscopy, culture and sensitivity.

Results: A total of 200 children were enrolled; nearly 56% (112/200) were males. The mean age of the subjects was 31.14 ± 17.96 months. The prevalence of UTI was 11% and was significantly higher in females than in males ($P = 0.049$). Children below 12 months of age had a higher rate of UTI than those 12 months and above ($P = 0.028$). The common clinical features were vomiting, abdominal pain, diarrhea, urinary frequency and urgency but none had a significant association with UTI.

Conclusion: UTI is common in febrile under-fives especially among females and infants. No association was apparent between the occurrence of UTI and clinical parameters.

Key words: Fever, under-five children, urinary tract infection

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Introduction

Urinary tract infection (UTI) is a common cause of fever in children.[1] The presence of fever in infants and young children with UTI is of significant importance because it is a clinical marker of renal parenchymal involvement.[2] Renal parenchymal infections lead to renal scarring,[3] which is the prelude to chronic morbidities associated with UTI, such as hypertension, reduced renal function and chronic renal failure.[4] The relevance of UTI to childhood morbidity is more marked in under-fives amongst whom the risk of renal damage is more and diagnosis is often missed as the clinical features are seldom overt and in most cases not referable to the urinary tract.[5] Whereas UTI episodes if appropriately diagnosed and well-managed, can be effectively controlled with antibiotics, the attendant possible complications of untreated UTI, such as end-stage renal disease,[4] could have devastating consequences on the child, the family and the health system. This is especially so in Nigeria, where facilities for renal replacement therapy are very limited and generally not affordable. In most health facilities in Nigeria, infants and young children with fever are commonly treated with antimalarials and sometimes given antibiotics without prior examination of the urine. Thus, cases of UTI could either go unrecognized or are poorly treated.

A study in Benin,[6] South Nigeria reported the prevalence of UTI to be 9% in under-five children with fever showing that the burden is high. Similarly, prevalence of 13% was documented in Maiduguri, North East Nigeria among

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such children.[7] In our locality, no such documentation has been done and this dearth of information could limit clinician's consideration for UTI while evaluating under-five children with fever. Against this background was this study conducted so as to ascertain the contribution of UTI to febrile illnesses in under-five children in Enugu. Hence children at risk of renal damage could then be identified for prompt and proper treatment. Besides, clinicians' knowledge of the prevalence of UTI in various pediatric populations in our locality will strengthen their suspicion for UTI and may influence management decisions.

Materials and Methods

The study was a hospital-based cross-sectional descriptive study conducted between February and April 2010. Ethical approval was obtained from the Institution's Health Research and Ethics Committee before the commencement of the study. Children aged 1 month to 59 months presenting with fever (axillary temperature ≥ 37.6°C)[8] with or without localizing sign (s) were recruited consecutively. Exclusion criteria included children with history of antibiotic treatment or usage of antimalarials such as sulfamethoxazole/pyrimethamine less than 7 days to the day of enrolment, urologic manipulation such as catheterization and urinary tract anomalies (for example obstructive uropathy). Children with chronic illnesses such as severe protein energy malnutrition (PEM), sickle cell disease, malignancies, nephrotic syndrome, glomerulonephritis, chronic renal failure and human immunodeficiency virus/acquired immunodeficiency syndrome were also excluded as well as those on immunosuppressive drugs. Relevant information such as age, sex, place of domicile, symptoms, was obtained. Physical examination was carried out on each subject to identify possible focus of infection and other features that could facilitate the establishment of a clinical diagnosis. A clinical diagnosis of UTI was made in subjects with any of the following: Pain or crying on micturition, urinary frequency, urgency, loin pain, suprapubic tenderness, costo-vertebral angle tenderness.

Urine specimens were obtained by suprapubic aspiration from subjects younger than 2 years and by midstream collection in older children. The urine samples were collected in sterile, boric acid containing bottles and used for urine microscopy, culture and sensitivity within 1 h of collection according to standard methods.[9]

After inoculating the fresh urine sample on culture plates for urine culture, urine microscopy was then carried out on the rest of the sample. A volume of 5-10 ml of urine was centrifuged at 2000 rpm for 5 min (using Teco diagnostic centrifuge, Anaheim, CA 92807, USA) and a wet preparation of the sediment was examined under the light microscope using ×40 objective. Presence of any bacteria per high power field (HPF) or pyuria (more than 5 white blood cells [WBCs] per HPF) was regarded as significant and suggestive of UTI.[10]

Urine culture was done employing the quantitative method as described by Guttman and Stokes.[11] Each uncentrifuged urine sample was well-mixed and inoculated unto plates of cystine lactose electrolyte deficient medium and blood agar as described by Urquhart and Gould,[12] using a calibrated sterile standard wire loop, which delivers 0.001 ml of urine per loopful. The culture plates were incubated aerobically at 37°C for 24 h after which the colonies were counted with a colony counter. A pure growth of $\geq 10^5$ colony forming units per ml from midstream urine sample or growth of any number of uropathogen from urine obtained by suprapubic aspiration was considered significant. UTI was defined as the presence of significant bacteriuria.[13] Growth less than 10^5 CFU/ml from the midstream urine sample were regarded as contaminants and disregarded.

In cases with significant bacteriuria, systematic bacteriologic and biochemical tests using standard techniques[9] were carried out to identify the organisms. Subjects who had UTI were treated with appropriate antibiotics and referred to the Pediatric Nephrology Clinic of the hospital for subsequent evaluation and follow-up. Subjects with other clinical diagnoses were investigated accordingly and appropriate treatment given.

Data which included patients' history, physical findings and laboratory results were analyzed using the Statistical Package for the Social Sciences (SPSS) software version 15.0 for Windows® (SPSS Inc. 2006 Chicago, Illinois, USA). Descriptive statistics was used to describe the frequency, mean, median and standard deviation of continuous variables. Categorical variables were tested for association using Pearson Chi-square and Fisher exact test as appropriate. Significant level was set at *P* value of 0.05.

Results

General characteristics of the study population

There were 112 males (56%) out of 200 children enrolled in the study. Table1 Male to female ratio was 1.3:1. The mean age was 31.14 ± 17.96 months. The mean temperature was 38.3 ± 0.69°C. Fever duration was less than 7 days in

Table 1: Age and sex distribution of study population

Age group in months	Gender		Total (%)
	Males	Females	
<12	23	15	38 (19)
12-23	23	17	40 (20)
24-35	27	13	40 (20)
36-47	14	16	30 (15)
48-59	25	27	52 (26)
All ages	112	88	200 (100)

74% (148/200) of the subjects while 26% (52/200) had a fever of 7 days or more. Localized infections were identified in 15 (7.5%) of the subjects. The localized infections identified were tonsillitis, bronchopneumonia, otitis media, furunculosis and cellulitis. The most common presumptive diagnosis was malaria, which was made in 158 (79%) of the 200 subjects enrolled.

One hundred and eighty eight of the subjects (94%) had WBCs in their urine on urine microscopy, ranging from 1 to 15 WBCs per HPF with a median of 1 WBC/HPF. 8 (4%) of the 200 children had significant pyuria and four had significant bacteriuria by culture. A total of 15 subjects had bacteria debris in their urine sediment and 73.3% (11/15) of these had significant bacteriuria by culture.

Prevalence of UTI

Of the 200 subjects studied, significant bacteriuria by culture occurred in 22, giving an overall UTI prevalence of 11%. The prevalence of UTI was significantly higher in infants compared with non-infants (21.1% [8/38] vs. 8.6% [14/162]; odds ratio [OR] =2.8 [confidence interval (CI) =1.1-7.3] $\chi^2 = 4.84$, $P = 0.028$) Table 2. UTI occurred more in females than in males (15.9% [14/88] vs. 7.1% [8/112]; OR = 2.5 [CI = 1.0-6.2] $\chi^2 = 3.87$, $P = 0.049$) Table 2. There was no significant difference in the occurrence of UTI between male and female children below 12 months of age (17.4% [4/23] vs. 26.7% [4/15]; OR = 1.7 [CI = 0.4-8.3] $P = 0.69$ [Fisher exact]) but among those 12 months and above UTI occurred significantly more in females than in males (13.7% [10/73] vs. 4.5% [4/89]; OR = 3.4 [CI = 1.0-11.2]; $P = 0.038$ [Fisher exact]) Table 3.

Of 148 children with fever of less than 7 days, 16 (10.8%) had UTI while 6 (11.5%) of 52 children with fever of ≥7 days had UTI, $\chi^2 = 0.02$, $P = 0.885$. Of the 22 subjects in whom UTI occurred, only one had a clinical feature referable to the urinary tract, which was renal angle tenderness [Table 4]. No significant association was demonstrated between any clinical feature and occurrence of UTI [Table 4]. Of the 6 subjects in whom a clinical diagnosis of UTI was made due to signs and symptoms referable to the urinary tract, only one had significant bacteriuria [Table 5].

The organisms isolated from the 22 positive urine cultures were *Escherichia coli* 31.8% (7/22), *Staphylococcus aureus* 22.7% (5/22), *Klebsiella* species 13.6% (3/22) *Streptococcus faecalis* 13.6% (3/22), Proteus species 4.55% (1/22), *Pseudomonas* species 4.55% (1/22), *Enterobacter* species 4.55% (1/22) and *Serratia* species 4.55% (1/22). There were no mixed infections.

Table 2: Prevalence of UTI according to demographic characteristics

Demographic characteristic	Total no.	No. with UTI (%)	OR (95% CI)	*P* value
Age				
Infants (<12 months)	38	8 (21.0)	2.8 (1.1-7.3)	0.028
Non-infants (12-59 months)	162	14 (8.6)	0.4 (0.1-0.9)	
Gender				
Male	112	8 (7.1)	0.4 (0.2-1.0)	0.049
Female	88	14 (15.9)	2.5 (1.0-6.2)	

UTI=Urinary tract infection; CI=Confidence interval; OR=Odds ratio

Table 3: Gender differences in the prevalence of UTI in subjects aged <12 months and those ≥12 months

Age in months	Total no.	No. with UTI (%)	OR (95% CI)	*P* value
<12				
Male	23	4 (17.4)	0.6 (0.1-2.8)	0.69
Female	15	4 (26.7)	1.7 (0.4-8.3)	
12-59				
Male	89	4 (4.5)	0.3 (0.1-1.0)	0.038
Female	73	10 (13.7)	3.4 (1.0-11.2)	

UTI=Urinary tract infection; CI=Confidence interval; OR=Odds ratio

Table 4: Common presenting features and occurrence of UTI

Clinical features	Number of subjects with symptom	UTI present *n* (%)	χ^2	OR (95% CI)	*P* value*
Fever ≥7 days	52	6 (11.54)	0.02	1.1 (0.4-2.9)	0.89
Vomiting	61	8 (13.11)	0.40	1.3 (0.5-3.4)	0.53
Abdominal pain	21	2 (9.52)	0.05	0.8 (0.2-3.9)	0.82
Diarrhea	17	2 (11.76)	0.01	1.1 (0.2-5.1)	0.92
Urinary frequency	3	0 (0.00)	-	Undefined	-
Renal angle tenderness	1	1 (100.00)	-	Undefined	-
Urgency	1	0 (0.00)	-	Undefined	-
Dysuria	1	0 (0.00)	-	Undefined	-

**P* values for χ^2/Fisher exact test of the difference in the prevalence of UTI in patients with versus those without the stated symptoms. UTI=Urinary tract infection; CI=Confidence interval; OR=Odds ratio

Table 5: Clinical diagnoses and occurrence of UTI

Clinical diagnoses*	No. of subjects	UTI present *n* (%)
Malaria	158	16 (10.13)
URTI including otitis media and tonsillitis	85	12 (14.12)
Sepsis/cellulitis/ furunculosis	5	2 (40.00)
Bronchopneumonia	5	1 (20.00)
Gastroenteritis	16	1 (6.25)
Enteric fever	2	1 (50.00)
UTI	6	1 (16.67)

*Some subjects had more than one diagnosis. URTI=Upper respiratory tract infection; UTI=Urinary tract infection

Discussion

UTI in febrile children has been widely studied in different parts of the world.[14-16] The 11% prevalence among febrile children less than 5 years of age in this study is consistent with the reports by other Nigerian researchers that UTI is common in this group of children. This value is comparable with the figures of 9% and 13% documented in studies among febrile children of similar ages in Benin[6] and Maiduguri[7] respectively. The slightly higher prevalence in Maiduguri may be attributed to subjects' characteristics as this study included patients with PEM, a condition associated with a high incidence of UTI.[17] Lower value of 1.7% was obtained by Bauchner *et al*.[18] in USA among febrile children of similar ages. The higher prevalence of UTI in the index study and other Nigerian studies,[6,19] when compared with studies in USA[16,18] may be attributed to the higher incidence of bacterial infections in developing countries compared with the developed countries.[20]

The high rate of UTI among infants in this study is in consonance with findings in earlier studies that observed that symptomatic UTI is most common in the 1st year of life in both sexes.[21,22] Boothman *et al*.[23] in Glasgow documented the highest rate of bacteriuria (47%) among infants after initial urine cultures in preschool children. Immaturity of host defenses and enhanced exposure through fecal soiling to pathogens that enter the urinary tract have been suggested as predisposing factors to UTI in such children.[14]

Beyond infancy female children have shown a higher risk of UTI. This has been demonstrated by our study with females having about 3 times the risk of infection than male children in this age group. Such finding was noted by Aiyegoro *et al*.[19] in Ile-Ife. Similarly, Okafor *et al*.[24] in Enugu documented higher rate of asymptomatic bacteriuria among female preschool children. The reasons adduced for this are variable and include the short urethra in females, which facilitates the ascent of bacteria in the urinary tract.[25] On the contrary, UTI predominates in males during the 1st year of life especially in the 1st 3 months and has been ascribed to a greater prevalence of urinary tract abnormality in males.[25] Our study however did not demonstrate any significant gender difference in the occurrence of UTI among children under the age of 12 months. This may be attributable to the small number of infants studied. Furthermore, children especially males with a history suggestive of urinary tract abnormalities such as obstructive uropathy were excluded in our study and may have contributed to the observed trend.

Subjects with significant bacteriuria in this study had symptoms such as diarrhea, vomiting and abdominal pain but none was demonstrated to have statistical significant association with UTI. Similarly, Hoberman *et al*.,[14] in USA observed that whereas fever appears to be consistently present in young children with UTI, no other signs or symptoms, singly or in combination, had significant association with UTI in their study.[18] In contrast, Musa-Aisien *et al*.,[6] in Benin, Nigeria documented abdominal pain to have significant association with UTI in their series.

The paucity of symptoms and signs referable to the urinary tract in patients with UTI as noted in this study has been observed by other workers. Jeena *et al*.,[26] in South-Africa documented infrequency of urinary tract signs in their series as only 13% of patients with UTI in their study had signs attributable to the urinary tract. Similarly, Asinobi *et al*.[27] in South-western Nigeria found 11% of patients with UTI to have symptoms of UTI. This suggests that UTI may be present in a febrile child below the age of 5 years with or without symptoms and signs referable to the urinary tract. A contributory factor to the paucity of signs and symptoms may be the inability of infants and young children to verbalize. This further supports the need for a high index of suspicion for UTI.

A large proportion (83%) of subjects in whom the clinical diagnosis of UTI was made due to presence of urinary tract symptoms did not have significant bacteriuria. Urinary tract symptoms such as dysuria have been observed in patients with other conditions other than UTI such as balanitis, pin worm infestation, vulvo-vaginitis and chemical irritation from soaps and skin lotions.[28] This may imply that urinary tract symptoms when present may not be very reliable in identifying the child with UTI hence may require further investigation such as urine culture to specify the presence of UTI.

We therefore conclude that UTI is common in febrile under-five children in Enugu especially among infants and comparably more common in females beyond infancy and is consistent with other studies from Nigeria. No association was demonstrated between occurrence of UTI and clinical parameters.

We recommend that clinicians should consider UTI as a plausible diagnosis in febrile children under the age of 5 years. Therefore, urine culture as part of the diagnostic evaluation should be obtained in such children.

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