Urinary Tract Infection Associated Co-Morbidities in Febrile Children in Maiduguri

Asheikh MM[1], Yusuf HM[1], Garba MA[2], Farouk AG[2], Abatcha MB[1], Mustapha MG[2]

ABSTRACT

Background: Fever is a common symptom in children and urinary tract infection (UTI) is one of the most common causes of fever in children. This study evaluated the co-morbidities associated with UTI in febrile children at the University of Maiduguri Teaching Hospital. Methods: Proforma detailing the history, physical examination and clinical diagnosis of the subjects were filled for all the 200 children aged 2 months to 15 years who were consecutively recruited. Urine samples were collected from each of the subjects for dip-stick urinalysis as well as microscopy, culture, and sensitivity. Data was analysed using IBM SPSS version 25. Results: Thirty-nine subjects had UTI giving a prevalence of 19.5%. The common symptoms in the subjects with UTI were poor appetite and vomiting. Genito-urinary symptoms were not common among the children studied. Co-morbidities associated with UTI were malaria, (OR = 2.808; 95%CI = 1.243 – 6.346; p = 0.013), acute respiratory tract infection (OR = 0.324; 95%CI = 0.073 – 1.439; p = 0.139) and enteric fever (OR = 1.382; 95%CI = 0.544 – 3.515; p = 0.497), with malaria being the most common co-morbidity. Conclusion: Co-morbidities in children presenting with fever are common, especially in developing countries and the occurrence of UTI in the absence of genito-urinary symptoms in febrile children is not uncommon. Recommendations: Clinicians managing febrile children should have a high index of suspicion for UTI even in the absence of genito-urinary symptoms and evaluate the children for co-morbidities, for appropriate management.

Keywords: urinary tract infection, co-morbidity, fever, children, Maiduguri.

[1] Department of Paediatrics, University of Maiduguri Teaching Hospital, Nigeria. [2]Department of Paediatrics, Faculty of Clinical Sciences, College of Medical Sciences, University of Maiduguri, Nigeria.

Corresponding Author:

Dr Asheikh Mele Masu
Department of Paediatrics, University of Maiduguri Teaching Hospital, PMB 1414, Maiduguri, Borno State, Nigeria.

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Introduction

Urinary tract infection is a common cause of fever in children and remains a bacterial infection of concern in young children even in the era of improved immunisation.[1,2] It contributes to about 4 – 40% of the burden of febrile illness in children.[3–8] Urinary tract infection is mainly caused by bacteria, though, other micro-organisms including fungi and viruses can also cause the infection.[9,10] The symptoms of UTI in older children are similar to those in adults and include frequent urination, urgency, dysuria and the desire to urinate when the bladder is empty. In young children, the symptoms are usually non-specific such as fever, irritability, diarrhoea and vomiting.[10,11] The fact that urinalysis and urine culture are not routinely performed on febrile children results in many children with UTI being missed.[12] This can lead to both short-term and long-term sequelae including End-Stage Kidney Disease.[3] Urinary tract infection can occur as an isolated entity or can co-exist with other febrile illnesses. Studies have demonstrated the co-existence of UTI with conditions such as malaria, respiratory tract infection, skin/soft-tissue infections and acute gastroenteritis.[13–15] Therefore, this study was conducted to identify the co-morbidities associated with UTI in febrile children in Maiduguri.

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Methods

This study was cross-sectional, conducted at the Department of Paediatrics of the University of Maiduguri Teaching Hospital (UMTH) from February 2020 to January 2022 in which 200 febrile children aged 2 months to 15 years were consecutively recruited using a non-probability sampling method. The 200 subjects studied were determined by calculating the minimum sample size using Fischer's formula[16] and 10% of the calculated sample size added to cover for possible unforeseen events. Ethical clearance was obtained from the UMTH Research Ethics Committee. Children presenting fever (axillary temperature ≥38ºC)[17] made up the study population. Those with conditions that are known to predispose to UTI (Congenital anomalies of the kidneys and urinary tract {CAKUT}, sickle cell anaemia {SCA} and severe acute malnutrition {SAM}) and those who were on antibiotic 72 hours prior to presentation were excluded. After a thorough history, physical examination, and clinical diagnosis of the subjects, clean-catch, mid-stream, or urethral catheter urine samples were collected from each of the subjects irrespective of their clinical diagnosis for dip-stick urinalysis as well as microscopy, culture, and sensitivity. Wet mount method was used for microscopy. Culture was done by inoculating each sample on cystine lactose electrolyte deficient (CLED) and blood agar, then incubated at 35°C - 37°C for 18 – 24 hours. Where there were growths, colony count were performed by grossly counting the number of colonies on the blood agar and multiplied by 1000 to get Colony Forming Unit (CFU)/mL of urine.[18,19] Susceptibility tests using disc diffusion method were performed on well-isolated colonies that were considered significant. Bacteriuria was defined as bacterial colony count of ≥100,000 CFU/mL in the culture of urine specimen collected by clean catch and mid-stream methods, while growth of ≥ 50,000 CFU/mL was considered bacteriuria in samples collected by urethral catheterization.[20] Presence of bacteriuria was considered as UTI in this study. The two hundred children enrolled into the study were screened for the following common causes of fever:

Malaria: thick and thin blood films were made, stained with Giemsa and examined for the presence of plasmodium species as per the Nigerian national guideline for the diagnosis and treatment of malaria.[21]

Upper respiratory tract infection was diagnosed clinically in children presenting with symptoms such as fever, cough, nasal discharge, sore throat, or ear tugging/discharge in the absence of dyspnoea.

Pneumonia was diagnosed clinically in children presenting with dyspnoea in addition to the other features of URTI and/or radiologic evidence.

Enteric fever was diagnosed clinically.

Measles was diagnosed in the presence of fever, maculopapular rash and either on or more of the following: cough, coryza and conjunctivitis.

Sepsis is defined as presence of tachycardia/bradypnoea, tachypnoea and absence of obvious focus of infection or failure to respond to antimalarial.

The data obtained was entered into a computer and analysed using the International Business Machine Statistical Package for Social Sciences (IBM SPSS) software version 25. Tables and Figures were used for data presentation as appropriate. The categorical variables were compared using chi-square (x^2)/Fisher's exact tests, while the student t-test and Mann-Whitney U test were used to compare normal and skewed continuous variables respectively. Univariate regression analysis was used to determine the association of clinical diagnoses with UTI. A p-value of < 0.05 was considered statistically significant at 95% confidence interval (CI).

Results

Socio-demographic characteristics of the subjects

The socio-demographic characteristics of the subjects are presented in Table I. Most of the subjects were within the age range of 1 – 5 years, median age was 5 years (IQR = 2 – 10 years). The male-to-female ratio of 1.7:1. Majority belong to the low socio-economic class.

Table 1: Socio-demographic characteristics of the subjects

VARIABLES	FREQUENCY	PERCENTAGE (%)
Age (years)		
< 1	22	11.0
1-5	80	40.0
6-10	58	29.0
11-15	40	20.0
Gender		
Male	127	63.5
Female	73	36.5
Socio-economic Class		
Low	104	52.0
Middle	77	38.5
High	19	9.5

Relationship of the clinical characteristics of the subjects with UTI.

The univariate regression of the clinical features of the subjects showed only frequency (OR = 2.348, 95% CI = 1.095 – 5.034, p = 0.028) was significantly associated with UTI. Details are presented in Table II.

Table 2: Clinical features in subjects with UTI and without UTI

Variables	UTI present Frequency (%) n=39	No UTI Frequency (%) n=161	Total	OR (95% CI)	p-value
Chills					
Yes	11 (28.2)	46 (28.6)	57	1.018 (0.468 – 2.214)	0.964
No	28 (71.8)	115 (71.4)	143		
Rigors					
Yes	14 (35.9)	42 (26.1)	56	0.630 (0.300 – 1.325)	0.223
No	25 (64.1)	119 (73.9)	144		
Dysuria					
Yes	11 (28.2)	27 (16.8)	38	0.107 (0.228 – 1.154)	0.107
No	28 (71.8)	134 (83.2)	162		
Bedwetting					
Yes	1 (2.6)	6 (3.7)	7	1.343 (0.156 – 11.575)	0.483
No	30 (76.9)	134 (83.2)	164		
Not applicable	8 (20.5)	21 (13.0)	29		
Abdominal pain					
Yes	19 (48.7)	55 (34.2)	74	0.546 (0.269 – 1.108)	0.094
No	20 (51.3)	106 (65.8)	126		
Constipation					
Yes	2 (5.1)	10 (6.2)	12	1.225 (0.257 – 5.831)	0.799
No	37 (94.9)	151 (93.8)	188		
Diarrhoea					
Yes	12 (30.8)	37 (23.0)	49	0.671(0.310 – 1.454)	0.312
No	27(69.2)	124 (77.0)	151		
Vomiting					
Yes	19 (48.7)	73 (45.3)	92	0.873 (0.433 – 1.759)	0.873
No	20 (51.3)	88 (54.7)	108		

Poor appetite					
Yes	25 (64.1)	117 (72.7)	142	0.672 (0.320 – 1.408)	0.292
No	14 (35.9)	44 (27.3)	58		
Frequency					
Yes	14 (35.9)	31 (19.3)	45	2.348 (1.095 – 5.034)	0.028*
No	25 (64.1)	130 (80.7)	155		
Change in urine colour					
Yes	3 (7.7)	24 (14.9)	27	2.102 (0.599 – 7.375)	0.246
No	36 (92.3)	137 (85.1)	173		
Loin pain					
Yes	4 (10.3)	11 (6.8)	15	0.642 (0.193 – 2.135)	0.469
No	35 (89.7)	150 (93.2)	185		

*statistically significant p-value.

Clinical diagnoses of the study subjects

Malaria (both uncomplicated and severe) and UTI were the most common clinical diagnoses of the subjects. Details of the clinical diagnoses are presented in Figure 1.

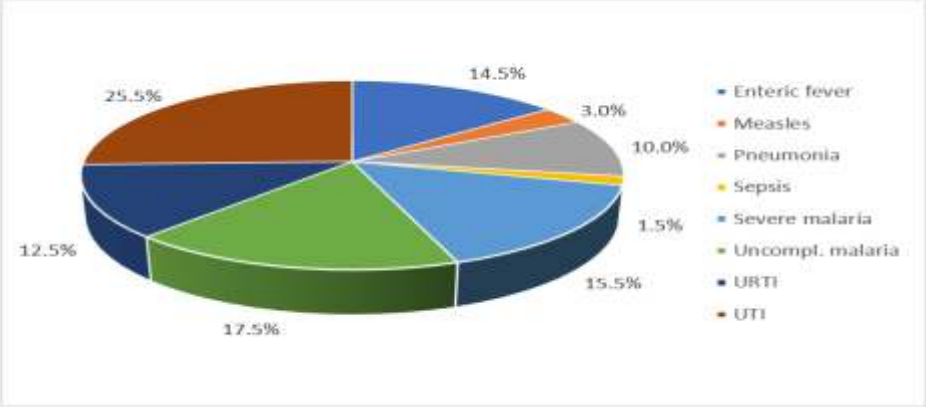

Fig 1: Clinical diagnoses of the subjects.

Association of clinical diagnoses with UTI

Uncomplicated malaria was the commonest co-morbidity in children with UTI and was significantly associated with UTI (OR = 2.808; 95%CI = 1.243 – 6.346; p = 0.013). The association of the other diagnoses with UTI was not statistically significant as shown in table III.

Table 3: Association of clinical diagnoses with UTI in the subjects.

Clinical diagnoses	UTI present Frequency (%) n=39	No UTI Frequency (%) n=161	Total	X^2	p-value	OR (95% CI)	p-value
UTI	13 (25.5)	38 (74.5)	51	1.565	0.211	1.618 (0.758 – 3.456)	0.214
Uncomplicated malaria	12 (34.3)	23 (65.7)	35	6.510	0.011	2.808 (1.243 – 6.346)	0.013
Severe malaria	4 (12.9)	27 (87.1)	31	1.017	0.343	0.567 (0.186 – 1.728)	0.318
Enteric fever	7 (24.1)	22 (75.9)	29	0.465	0.495	1.382 (0.544 – 3.515)	0.497
URTI	2 (8.0)	23 (92.0)	25	2.407	0.121	0.324 (0.073 – 1.439)	0.139
Pneumonia	1 (5.0)	19 (95.0)	20	2.976	0.084	0.197 (0.026 – 1.516)	0.119
Others	0 (0.0)	9 (100.0)	9	2.283	0.131	0.000 (0.000)	0.999

Discussion

The most common symptoms among the subjects with UTI in our study were poor appetite, increased urinary frequency, abdominal pain and vomiting. Of these, only frequency was significantly associated with UTI. This is similar to the symptoms reported by Kulkarni *et al*.[22] On the other hand, Dagli *et al*.[23] and Narreddy *et al*.[24] both reported dysuria and frequent urination as the commonest symptoms in children with UTI. While this study recruited all febrile children irrespective of their clinical diagnosis, Dagli *et al*. recruited only children with confirmed UTI, hence, symptoms specific to the urinary tract were common. Secondary enuresis was the least symptom observed in the subjects in our study. Contrary to this, Adegun *et al*.[25] reported secondary enuresis, vomiting, abdominal pain and frequent urination with the same frequency as the commonest symptoms in children with UTI. This contrary finding could be due to the inclusion of children with diabetes mellitus and afebrile children coupled with the small number of subjects with UTI (24 subjects). Enuresis was not a significant feature in our study. The reason for this was not immediately clear.

Our study found a third of the children with UTI had uncomplicated malaria, and about 12% had severe malaria as a co-morbidity. This is not surprising as malaria is endemic in Maiduguri with high parasitaemia even in asymptomatic persons. However, the presence of parasitaemia in symptomatic patients should be considered as a case of malaria and treated accordingly.[21] This is in conformity with the findings of other studies that reported the prevalence of co-existence of malaria and UTI of 9% reported by Okunola *et al*.[26] from Benin, Southern Nigeria, 15.8% reported by Ephraim *et al*.[27] from Ghana, and 40.2% reported by Jiya *et al*.[28] among children with sickle cell anaemia in Sokoto, North Western Nigeria. The co-existence of enteric fever in about a quarter of subjects with UTI in this study is not surprising since enteric fever is a multi-systemic disease. This is similar to the findings by Sohail *et al*.[29] from India where 5.56% of children with provisional diagnosis of enteric fever had UTI. Ibeneme *et al*.[14] also reported that 50% of patients with enteric fever had UTI co-existence. The differences in the prevalence of UTI among subjects with enteric fever could be due to the variation in the timing of urine sampling from the onset of the illness since it is known that the yield of salmonella in urine is after the first week of the illness.[30] Eight per cent of subjects with UTI had upper respiratory tract infections (including pharyngotonsillitis and otitis media) co-morbidity.

Conclusion

Children with a febrile illness often have co-morbidities, the presence of clinical features of a disease entity does not rule-out the possibility of co-morbidity as demonstrated in this study where about a third of the children with UTI had malaria as a co-morbidity.

Recommendations

Clinicians managing febrile children should have a high index of suspicion for UTI even in the absence of genito-urinary. Children presenting with fever should be evaluated for co-morbidities through history, physical examination and investigations to arrive at the correct diagnosis or diagnoses and treated appropriately.

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