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Prevalence of Urinary Tract Infection (UTI) Among Febrile Under-Five Children in Federal Medical Centre Owerri, Imo State, Nigeria: A Descriptive Cross-Sectional Study

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ABSTRACT

Urinary tract infection (UTI) in under-five children is a critical health concern, particularly in regions with high infectious disease burdens. Despite its significance, UTI often goes undiagnosed due to nonspecific symptoms, challenges in urine sample collection, and a lack of suspicion among healthcare providers. This study aimed to determine the prevalence of UTI in febrile under-five children visiting the Federal Medical Centre Owerri, providing insights into its frequency, symptoms, and implications for empirical antibiotic use. A descriptive cross-sectional design was adopted, involving 170 febrile children aged 0-59 months. Data collection included demographic details, clinical symptoms, and laboratory analysis of urine samples using dipstick urinalysis, microscopy, culture, and sensitivity testing. Results revealed an 18.8% prevalence of UTI among the studied cohort, with a higher occurrence in infants and notable disparities in symptoms presentation. Notably, a substantial proportion of children did not display specific UTI symptoms, highlighting the challenge of clinical diagnosis. These findings underscore the need for routine UTI screening in febrile under-five children to facilitate timely intervention and appropriate antibiotic therapy.

Keywords: Urinary Tract Infection, Febrile Children, Prevalence, Pediatric Health and Epidemiology

INTRODUCTION

Urinary tract infection (UTI) is a clinical entity characterized by symptoms and signs as well as the presence and multiplication of bacteria in the bladder urine [1, 2]. It is a common infection of young children affecting approximately 3-6% of children with fever in a large series in United States of America (USA) and United Kingdom (UK) [3,4]. Its main manifestation includes fever, which is also the most common presenting complaint among sick children less than five years [1,5]. In sub-Saharan Africa where malaria is endemic and morbidity and mortality from pneumonia is still very high, the diagnosis of UTI is rarely made in most sick children [6,7]. This could be attributed to the non-specific nature of symptoms, the difficulty with obtaining urine samples and the low index of suspicion among clinicians. The diagnosis of UTI is more likely to be missed in infants and younger children who are most likely to have UTI and to suffer from both its short and long-term complications such as hypertension, renal scarring and chronic kidney damage [8,9]. Hence, it is imperative to actively search for the presence of UTI in sick pre-verbal children.^{8,9} Several studies have documented the prevalence of UTI in under-five children in Nigeria to be between 9% and 28% indicating that it is a common cause of illness in children [9-14]. In addition, some of these studies have also reported a high, varied, dynamic and increasing prevalence of antibiotic resistance

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among the isolates causing UTI in different regions of the country [10-15]. This buttresses the need for routine regional surveillance of the bacterial pathogens causing UTI and background antibiotic susceptibility pattern. Knowledge of background antibiotic resistance pattern fosters the empiric use of the appropriate antibiotics, which remains the cornerstone of the management of bacterial infections. Given that UTI is grossly under diagnosed in under-five children, with its attendant short and long-term complications and the increasing resistance of uropathogens to empiric antibiotics, it is necessary to estimate the prevalence and antibiotic susceptibility pattern as well as the predictive value of dipstick urinalysis in the diagnosis of UTI in this age group. It is hoped that the findings from this study would add to the emerging evidence in paediatrics as well as serve as a guide for empiric antibiotic use among febrile under-fives in Federal Medical Centre Owerri. This study aimed at estimating the prevalence of UTI among under-five children in Federal Medical Centre Owerri? Imo State, Nigeria.

Research Question

What is the prevalence of urinary tract infection (UTI) among febrile under-five children in Federal Medical Centre Owerri?

Objectives

To determine the prevalence of UTI among febrile under-five children seen at the Federal Medical Centre Owerri.

METHODOLOGY

Study Area

The study was carried out at the Paediatric Outpatient Clinics and Emergency Paediatric Unit of the Federal Medical Centre Owerri, Imo state. The State is one of the five states of South-Eastern Nigeria and it is made up of 27 local government areas. Owerri is the capital of Imo State and it is made up of three local government areas namely: Owerri Municipal, Owerri North and Owerri West. The estimated population of Owerri is about 400,000. The projected population for 2020 is about 872,604. The Federal Medical Centre is a tertiary health facility located centrally in Owerri. It has two outreach centres located at Umunama-Mbaise and Izombe-Oguta and serves as a referral centre for hospitals from all over the state and the neighbouring states of Rivers and Anambra. The Paediatric Outpatient Clinics run from Mondays through Fridays between 8am and 4pm. An average of 70 patients are seen daily with an annual average of 13,000 patients. It is the first point of care for all sick children visiting the hospital except for emergencies and children who come to the hospital during the weekend who are managed in the emergency paediatric unit. Sick children presenting after 4pm are also seen at the emergency unit. The emergency paediatric unit runs a 24-hour service and an average of 300 patients seen monthly with an average of 4000 patients seen per annum.

Study Design

This was a hospital-based descriptive cross-sectional study.

Ethical Considerations

Ethical clearance and permission to carry out the study was obtained from the Research and Ethics Committee of the Federal Medical Centre Owerri. Also, parents and care givers of eligible children provided a written informed consent. The study was conducted in a manner that ensured that participation in the study did not result in undue delay of commencement of standard treatment or management. In addition, the results of children with positive urine culture were passed on to the team responsible for the care of the child as soon as it became available.

Study Population

The study population consisted of all febrile (axillary temperature $> 37.5^{\circ}\text{C}$)¹⁴ children between the ages of 0 and 59 months attending the Paediatric Outpatient Clinics and Emergency Paediatric Unit that met the inclusion criteria.

Inclusion Criteria

1. Children between the ages of 0 and 59 months presenting with fever (axillary temperature $> 37.5^{\circ}\text{C}$).
2. Children whose parents or caregivers provided written informed consent.

Exclusion Criteria

1. Very ill children requiring immediate resuscitation and commencement of antibiotics which would have delayed by participation in the study.
2. Children who received systemic (oral or parenteral) antibiotics within the previous 72 hours.

Sample Size Calculation

The minimum sample size was estimated using the Cochran formula for prevalence studies.

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$$\text{Sample size, } n = \frac{Z^2 pq}{d^2}$$

Where n = sample size

Z = Standard normal deviation at 95% confidence level = 1.96

P = Prevalence of UTI in febrile under 5 children in Enugu^o = 11%

Q = (1- p)

d = level of precision = 0.05

$$n = \frac{Z^2 pq}{d^2}$$

$$= [(1.96)^2 \times 0.11 \times 0.89] / (0.05)^2$$

Therefore, the minimum calculated sample size = 152

A further 10% (16) was added to the minimum sample calculated to factor in risk of attrition. Therefore 170 children were recruited for the study.

Sampling Technique

Eligible children were recruited consecutively.

Study Procedure

Each recruited subject had a detailed history and physical examination. The findings were documented in the data entry form. The variables entered into the form included demographic data (research number, age, and gender), history of fever, presence of symptoms suggestive of urinary tract infections and treatment received prior to enrolment in the study. Other information recorded in the form included the temperature reading, the presence of bladder mass, ballotable kidneys, uncircumcised penile shaft, neural tube defects and the presence of other focus of infections.

Temperature

Body temperature was measured by using mercury in glass clinical thermometer. This was placed in contact with the skin on the subjects' axilla for four minutes after which reading was recorded. A subject was considered febrile when the temperature was above 37.5°C.

Specimen Collection

After recruitment into the study, the investigator labelled the sample bottles appropriately and midstream urine was collected by the researcher or the caregivers under supervision. This was done by voiding the initial part of the urine stream into the toilet or another container and at approximately the middle of the urine flow the specimen bottle was positioned to capture urine. However, in children not yet toilet trained, spot urethral catheterization was carried out under aseptic conditions. In collecting the sample by urethral catheter, the researcher or the assistant wore sterile gloves then the child was placed in supine position and the labia or penis was cleaned with antiseptic swab. In females, the labia was parted to expose the urethral opening, the catheter was lubricated with sterile anaesthetic gel (KY jelly) before insertion into the urethral opening upward until urine begins to flow out. For the male child, the penis was lifted and the foreskin retracted in the uncircumcised. The urethral opening was cleaned with antiseptic swabs in a circular motion from the urethral opening to the base of the penis and a sterile lubricant was applied to the catheter before insertion. The penis was held with slight upward tension and perpendicular to the child's body and the catheter was inserted. The size of the catheter to be used was French gauge (Fr) 6 for children under one year of age while French gauge (Fr) 8 was used in subjects older than one year. Urine specimen was collected into two sterile wide necked leak proof universal bottles. One sample was used for dipstick urinalysis and the other for microscopy, culture and sensitivity in the laboratory. Specimens for culture were sent to the laboratory within 15-20 minutes of collection. In cases where a delay was anticipated before processing, specimens were stored in the refrigerator for no longer than six hours.

Specimen Processing

A macroscopic examination was done for every urine sample to record the colour and nature (to assess whether the urine was clear or turbid). Urinalysis was also carried out qualitatively using chemstrip-10 dipsticks (Roche Diagnostics Montreal, Quebec Canada) to detect the presence of protein, blood, nitrite and leucocyte esterase. The

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strip was dipped for no longer than one second into the specimen and excess urine was removed by drawing the edge of the strip along the rim of the container, the test strip was turned on its side and placed on a piece of absorbent paper to prevent mixing of chemicals. A timer was set for two minutes. After one minute, the strip was held close to the colour blocks printed on the reagent vial and read for protein, blood and nitrite while the leucocyte esterase was read at two minutes. Each test pad was carefully matched to its reference. All results were read and recorded between one and two minutes. Results were subsequently recorded in the questionnaire.

Urine Microscopy

Urine microscopy was carried out at the laboratory by the microbiologist with active participation of the investigator using a wet preparation. This was done using about 5 ml of well mixed urine which was aseptically transferred to a labelled conical tube and centrifuged at 2000 revolutions per minute (rpm) for five minutes. The supernatant was decanted into a second container. A drop of the well mixed sediment was transferred to a slide and covered with a cover glass. The preparation was viewed under a light microscope using 40x objective. Presence of pyuria (>5WBC/HPF) was regarded as significant and suggestive of UTI.

Data Analysis

Data was coded and entered into a computer. It was analysed using IBM Statistical Package for Social Sciences (SPSS) version 20.0. Frequency tables, charts and figures were used to summarize variables as appropriately required. Mean and standard deviation were used to summarize quantitative variables that were normally distributed. Chi square (χ^2) and where necessary Fisher's exact test and likelihood ratio were used to test for association between categorical variables. A p-value of < 0.05 was considered statistically significant. Security of data was ensured as information on the data entry form was made anonymous by excluding names and phone numbers. The proforma were also kept safe and made available only to the researcher, supervisors and research assistants.

RESULTS

Demographic characteristics of study subjects

One hundred and seventy children aged 0-59 months were recruited for this study. One hundred and fourteen (67.1%) of the 170 subjects were males while 56 (32.9%) were females with a male-female ratio of 2:1. Fifty (29.4%) of the subjects were aged 0-11 months. The mean age was 24.0 ± 16.1 months. (Table I)

Table I: Demographic characteristics of study subjects

Variables	Frequency n (%)
<i>Gender</i>	
Male	114 (67.1)
Female	56 (32.9)
<i>Age Groups (months)</i>	
0 – 11	50 (29.4)
12 – 23	39 (22.9)
24 – 35	37 (21.9)
36 – 47	22 (12.9)
48 – 59	22 (12.9)

Presenting complaints of febrile under-five children

Cough (103; 60.6%) and catarrh (93; 57.6%), were the most common symptoms at presentation to the hospital among the study participants. A small proportion of the children had symptoms suggestive of urinary tract infection; Twenty-three (13.5%), 4 (2.4%), and 4 (2.4%) had frequent urination, foul smelling urine and painful urination respectively. Most symptoms were non-specific. (Table II)

Table II: Presenting complaints of febrile under-five children

Symptoms	Frequency n (%)
Fever	170 (100)
Cough	103 (60.6)
Catarrh	93 (57.6)
Vomiting	46 (27.1)
Abdominal pain	30 (17.6)
Frequent urination	23 (13.5)
Diarrhoea	14 (8.2)
Convulsions	5 (2.9)
Foul smelling urine	4 (2.4)
Painful urination	4 (2.4)
Jaundice	1 (0.6)

Prevalence of urinary tract infection among Study subjects

Thirty-two children (18.8%) had urinary tract infection determined by presence of significant bacteriuria $\geq 10^5$ CFU/ml. (Figure 1)

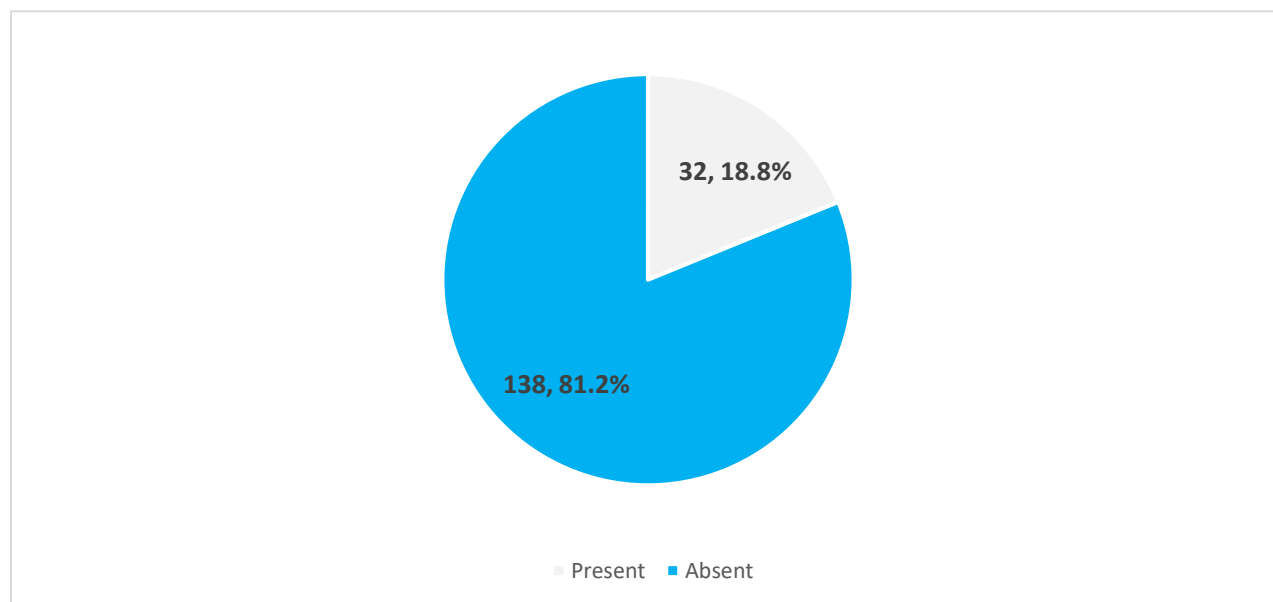


Figure1: Prevalence of urinary tract infection among study subjects

DISCUSSION

Urinary tract infection (UTI) occurred in 18.8% of the 170 febrile under-five children studied. A third of the UTI occurred in infants and female infants had the highest prevalence of 42.9%. Majority of the children presented with non-specific symptoms and only 18.3% had symptoms referable to the urinary tract. The prevalence of UTI among febrile under-five children in this study was 18.8% meaning approximately one in five febrile children had UTI. This high prevalence may be attributed to the low index of suspicion among clinicians, increased predisposition to

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infections and the non-specific nature of most symptoms of UTI in this age group. This finding is comparable to the prevalence reported by Frederick *et al* [16] in Tanzania. Much lower prevalence rates were documented by O'Brien *et al* [4] in the United Kingdom (UK) as well as by some Nigerian authors [9,10] in febrile under-five children. The low prevalence observed in the UK by these researchers could be attributed to their methodologies; while O'Brien *et al* [4] excluded some urine specimens that were negative on microscopy and also considered cultures that yielded mixed growth as contaminants. [16], only cultured clean catch urine specimens excluding those collected with urine collection bags. Therefore some cases of true UTI may have been missed unlike in the present study where all urine samples were cultured. Furthermore, while this study recruited children aged 0-59 months, [18] in Jos and Okunola *et al* [10] in Benin-City Nigeria excluded children below six months who are more prone to UTI. Also, only urine of subjects who were positive for nitrite, leucocyte esterase or both were cultured in the Jos study and the authors in Benin-City restricted their study to only febrile children with confirmed malaria [20]. These therefore may explain the disparities in the prevalence when compared to this study. In view of the high prevalence observed in this study, it is imperative to routinely screen every febrile under-five child for UTI.

CONCLUSION

The study's findings demonstrate a substantial prevalence of UTI among febrile under-five children attending the Federal Medical Centre Owerri, emphasizing the necessity for heightened clinical suspicion and routine screening for UTI in this vulnerable age group. The prevalence observed surpasses rates reported in various Nigerian studies, indicating a pressing need for increased attention to this underdiagnosed condition to mitigate its short and long-term complications. Routine screening may aid in early identification, prompt treatment, and the judicious use of antibiotics, thereby reducing the risk of antibiotic resistance and associated health implications in pediatric populations.

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