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Publications 2024

OPEN ACCESS
ONLINE ISSN: 2992-5460
PRINT ISSN: 2992-6041

NEWPORT INTERNATIONAL JOURNAL OF RESEARCH IN MEDICAL SCIENCES (NIJRMS)

Volume 5 Issue 1 2024

https://doi.org/10.59298/NIJRMS/2024/136.14357.1400

Exploring the Relationship Between Age, Gender, and Urinary Tract Infections In Febrile Under-Five Children At Federal Medical Centre, Owerri, Imo State, Nigeria

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ABSTRACT

Urinary tract infections (UTIs) in young children, particularly under-fives, remain a significant health concern, often overlooked due to non-specific symptoms and challenges in obtaining urine samples. This research aimed to discern the relationship between UTIs and demographic factors like age and gender. Conducted in a tertiary hospital in Nigeria, the study enrolled 170 febrile children aged 0-59 months, collecting urine samples and assessing symptoms. While the overall prevalence of UTI was not significantly different between genders or age groups, certain trends emerged. Female infants showed a notably higher UTI prevalence, potentially attributed to anatomical factors facilitating bacterial translocation. Interestingly, UTI was absent in older female participants (48-59 months), possibly due to increased immunity, improved hygiene, and toilet training. Non-specific symptoms predominated presentations, emphasizing the importance of considering UTI in the differential diagnosis for febrile under-five children.

Keywords: Urinary tract infection, under-five children, prevalence, age, gender, Nigeria.

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. Various risk factors contribute to urinary tract infections (UTIs), including gender-specific attributes and age-related vulnerabilities [8,9]. Females tend to face a higher risk of UTIs due to anatomical factors such as the shorter urethra, which facilitates the translocation of bacteria, particularly during hygiene practices. Studies from diverse locations like the USA, India, Pakistan, Tanzania, and Nigeria consistently report a higher prevalence of UTIs among females compared to males, emphasizing this gender-based susceptibility [10,11]. Conversely, age dynamics also play a role in UTI prevalence. Infancy emerges as a period of heightened vulnerability due to factors like an immature immune system, higher incidence of congenital urinary anomalies, and challenges in voiding patterns during toilet training. Studies conducted in the UK, Nigeria, India, and Pakistan illustrate the elevated risk of UTIs among infants. However, contrasting findings surface in certain studies that indicate a higher prevalence of UTIs beyond infancy, highlighting the significance of age distribution within study cohorts. These

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ONLINE ISSN: 2992-5460
PRINT ISSN: 2992-6041

insights underscore the complex interplay between demographic factors, emphasizing the need for comprehensive considerations when assessing UTI risks across different populations and age groups.

RESEARCH QUESTION

Does the prevalence of UTI vary with age and gender?

Aim

The aim of this research was to determine the relationship between Age, Gender, and Urinary Tract Infections in Febrile Under-Five Children at Federal Medical Centre, Owerri, Imo State, Nigeria

Specific Objective

To identify any association between UTI and demographic factors such as age and gender.

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°C) 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°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.[115]

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[9] = 11%

Q= (1-p)

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PRINT ISSN: 2992-6041

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 37.5^0C.

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 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

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PRINT ISSN: 2992-6041

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 1)

Table 1: Demographic characteristics of study subjects

Variables	Frequency n (%)
Gender	
Male	114 (67.1)
Female	56 (32.9)
Age Groups (months)	
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 2).

Table 2: 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 Subjects by Age and Gender

Overall, the prevalence of UTI in males was 16.7% which was lower than the 23.2% among females though not statistically significant. (p=0.31). Similarly, although the highest prevalence was in children aged 24-35 months, there was no statistically significant difference between the age categories. (p= 0.26) (Table 3)

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Table 3: Prevalence of urinary tract infection among Subjects by Age and Gender

Variables	Confirmed UTI **n (%)**		Total	χ^2	p-value
	Absent **n (%)**	Present **n (%)**			
Gender					
Male	95 (83.3)	19 (16.7)	114 (100)	1.27	0.31
Female	43 (76.8)	13 (23.2)	56 (100)		
Age category (months)					
12 – 23	33(84.6)	6(15.4)	39(100)		
24 – 35	27(73.0)	10(27.0)	37(100)		
36 – 47	18(81.8)	4(18.2)	22(100)		
48 – 59	21(95.5)	1(4.5)	22(100)		

Association between urinary tract infection and gender and age categories

Among males, those aged 24-35 months had the highest prevalence of UTI (21.7%) while only one male (7.1%) aged 48-59 months had UTI(p=0.77). Female infants had the highest prevalence (42.9%) of UTI and this was statistically significant (p=0.03). However, UTI was absent in females participants aged 48-59months (Table 4).

Table 4: Association between urinary tract infection and gender and age categories.

Gender		UTI (n %)		Total	χ^2	p-value
	Age (months)	Absent	Present			
Male	0 - 11	31 (86.1)	5 (13.9)	36	1.84	0.77
	12 - 23	22 (81.5)	5 (18.5)	27		
	24 -35	18 (78.3)	5 (21.7)	23		
	36 - 47	11 (78.6)	3 (21.3)	14		
	48 - 59	13 (92.9)	1 (7.1)	14		
	Total	95 (83.2)	19 (16.7)	114		
Female	0 - 11	8 (57.1)	6 (42.9)	14	10.40¥	0.03
	12 - 23	11 (91.7)	1 (8.3)	12		
	24 -35	9 (64.3)	5 (35.7)	14		
	36 - 47	7 (87.5)	1 (12.5)	8		
	48 – 59	8 (100.0)	0	8		
	Total	43 (76.8)	13 (23.2)	56		

¥ - Likelihood ratio

DISCUSSION

A third of all UTI occurred in infants in this study. This may be due to immaturity of the immune system in infants which makes them more prone to infections including UTI, also the high rate of undetected congenital anomalies of the kidneys and urinary tract (CAKUT) may be contributory factors to the high prevalence seen in this age group. While the finding of this study is similar to O'Brien *et al* [4] in the UK and Ibeneme *et al* [9] in Enugu, some Nigerian researchers [10,11] have reported higher prevalence beyond infancy. The exclusion of younger infants by Okunola *et al* [10] in Benin-City who found the highest prevalence among subjects aged 13-24 months may explain the variable finding. In this study female infants significantly had the highest prevalence of UTI. This observation could be due to the shortness of the female urethra and its proximity to the anal orifice which makes for easy translocation of faecal matter into the urethra. Furthermore, prolonged contact with faecal matter in female infants who are mostly still on diapers at this age could also facilitate the ascension of colonic bacteria into the urethra. Female infants having the highest rates of UTI was corroborated by [12] in Ibadan and [15] in Abakaliki Nigeria. Conversely, Taneja *et al* [16] in India and Dixon –Umo[17] in Uyo Nigeria documented higher prevalence among male infants. Though there was no obvious reasons for the findings in Uyo, the authors inferred that the high prevalence of CAKUT usually seen in infancy could be contributory; more so when a large proportion of subjects in

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PRINT ISSN: 2992-6041

the Indian study had PUV, VUR and other congenital anomalies which predisposed them to UTI. Consequently, a high index of suspicion should prompt screening of febrile infants particularly females to reduce cases of unrecognized and untreated UTI with its attendant complications. Urinary tract infection was found to be absent in female participants aged 48-59months.The observation in this study may be attributed to the development of a stronger immunity as the children get older, improved hygienic as well as the achievement of toilet training which all reduce the risk of UTI in this age group. This was comparable to the findings by Adebowale [18] in Ibadan and Amajor [19] in Calabar Nigeria. On the contrary West *et al* [20] in Port Harcourt documented a high prevalence of UTI in the same age group. Even though the study in Port Harcourt found a high prevalence they did not categorize their work according to gender which may explain this disparity. Majority of the children in this study presented with non-specific symptoms, only 18.3% of the symptoms were referable to the urinary tract. Several researchers in the UK [4,21-28], Tanzania [29,30-39] and Nigeria [11,40] have observed similar findings. On the contrary,[36] in Iran and Singh and Parihar[119] in India documented dysuria in majority of the study subjects. The finding of dysuria in the later studies may be attributed to the fact that the Iranian researchers included older children who can communicate pain symptoms better than younger children while the Indian researchers recruited preschool children who had symptoms suggestive of UTI. Given that most participants in this study had non-specific symptoms, UTI should be strongly considered in all febrile under-five children to reduce cases of missed diagnoses.

CONCLUSION

This study delved into the prevalence of UTIs among febrile children under five years old, highlighting notable trends in gender and age groups. Female infants exhibited a significantly higher prevalence of UTIs, possibly due to anatomical vulnerabilities and hygiene practices. Surprisingly, older female children did not present with UTIs, suggesting developmental and hygienic factors might mitigate risks in this age group. Non-specific symptoms predominated, emphasizing the need for vigilance in considering UTIs among febrile young children, even when symptoms are not explicitly indicative.

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CITE AS: Nwigwe U. M., Esezobor C. I., Iregbu F. U. and Ushie S. N. (2024). Exploring the Relationship Between Age, Gender, and Urinary Tract Infections In Febrile Under-Five Children At Federal Medical Centre, Owerri, Imo State, Nigeria. NEWPORT INTERNATIONAL JOURNAL OF RESEARCH IN MEDICAL SCIENCES 5(1): 136-143. https://doi.org/10.59298/NIJRMS/2024/136.14357.1400