

Incidence of Urinary Tract Infection in a Rural Community of South-West, Nigeria

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DOI:10.36348/SJBR.2019.v04i09.002

Received: 31.08.2019 | Accepted: 09.09.2019 | Published: 30.09.2019

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Abstract

Background and Objectives: Urinary tract infections are one of the commonest community-acquired and nosocomial infections caused by bacteria in humans. Poor feeding habits, poor sanitation and low standard of living are related to urinary tract infections and these factors are rife in rural settings. Despite susceptibility of both sexes to this infection, there is a higher vulnerability of women due to their physiological and reproductive anatomy. This study was aimed to determine the prevalence and the rate of transmission of Urinary tract infections at our locations of study. **Materials and Method:** The study subjects were made up of 24 (15.9%) males and 127 (84.1%) females, with females as the predominant. This gives a male to female ratio of 1:3. Clean-catch midstream urine was collected in a sterile bottle from 151 individuals between the age range of 10 to 30 years. The urine samples were processed and microbial isolates identified. Susceptibility testing was performed on all bacterial isolates. **Results:** Results from this study indicated that 83 (55%) from 151 individuals assayed were positive to UTIs. With *coagulase negative Staphylococcus* constituting the predominant microorganism and was responsible for (36.1%) cases of UTIs. This was closely succeeded by *Klebsiella pneumoniae* (18.1%) *Staphylococcus aureus* (14.5%) *Pseudomonas aeruginosa* (13.3%) *Escherichia coli* (7.2%) *Micrococci* (3.6%) *Klebsiella ozaenae* (2.4%) *Enterococcus faecalis* (2.4%) *Candida albicans* (1.2%) *Proteus Vulgaris* (1.2%). **Conclusion:** The incidence of urinary tract infection of 55.0% uropathogen in this study particularly among sexually active women is of public concern, hence the need for improved and screening facilities for routine laboratory test especially among the sexually active females. There is also the need for the provision of improved, adequate and affordable health care services in the community.

Keywords: Incidence, Urinary tract infection, Bacterial Pathogen, Community.

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INTRODUCTION

Urinary tract infections are one of the commonest community-acquired and nosocomial infections caused by bacteria in humans and this infection is prevalent amongst diverse age ranges with a need for immediate treatment in most cases [1]. UTIs are a major cause of remains healthcare emergencies for individuals in various age groups, with an annual sum of 1.6 billion dollars in the United States of America [2].

Poor feeding and personal sanitation, low standard of living are related with UTIs and the stated elements are present in rural settings [3]. *Escherichia coli* has been reported as the predominant causative organism of urinary tract infection, few authors have reported changing patterns in the prevalence of

uropathogens [4,5]. Pathogenic organisms capable of causing UTIs particularly amongst community patients are known to consist of resistant strains to a wide range of frequently administered antibiotics [6]. Hence, periodic surveillance of causative organisms of UTIs, and susceptibility pattern of these organisms especially in a rural setting should be carried out. Against this background, as well as the paucity of reports of urinary tract infections in our rural community (Okada), this study was undertaken.

The aim of this study is to determine the prevalence of UTIs in Okada community alongside the consequence of gender and age on its occurrence. The causative factors and their sensitivity pattern will also be evaluated.

Urinary tract infection affects one or various parts of the urinary tract. These infections occur when there is a bacterial dislodgement from its normal location to another part of the urinary tract. UTIs affect millions of individuals annually as it is a prevalent infection caused by bacteria. It is mostly associated with females than males as a result of the proximity of the vagina to the anus and how short the urethra is (1.5 inches) as compared to that of men which is 8 inches.

It has been predicted that approximately one in two women and one in twenty men will be infected with UTIs throughout the lifetime. UTIs is capable of affecting individuals in all age ranges, although there is a higher susceptibility in women, especially pregnant women than in men due to various factors such as shortness of the urethra, easy infection of the urinary tract with facial flora [7]. Usually, men have a higher chance of getting infected with UTIs after the age of 50 and this is associated with the development of prostate problems. At the age of two, 1-2% of children develop UTIs as this denotes that children are also likely to be infected by UTIs.

UTIs are majorly caused by enteric gram-negative bacilli, *E. coli*. *Escherichia coli* is found in the intestinal tract and also as a normal flora on the skin. It is responsible for about 70-80% of UTIs presently while *Staphylococcus spp*, particularly *Staphylococcus saprophyticus* is responsible for approximately 15-25% while 10% is caused by other bacteria. Other microorganisms capable of causing UTIs that are gram-negative in nature are *Proteus*, *Pseudomonas*, *Klebsiella*, *Enterobacter* and *Citrobacter*. Gram-positive microorganism can such as *Enterococcus* is the only gram-positive microorganism capable of causing urinary tract infections. *Candida albicans* and *Schistosoma haematobium Trichomonas vaginalis* are fungi and parasites causing UTIs respectively [8].

Some microorganisms are responsible for UTIs through sexual contact although, UTIs are not sexually transmitted infections. Chlamydia and Mycoplasma are the main microorganisms responsible for UTIs associated with sexual contact while *E. coli* is the major causative organism of the infection. Based on several reports, it has been deduced by United Nation that approximately 70% of UTIs arise within 24hrs of sexual intercourse. (3)The farther the distance between the route of entry of the bacteria and the organ in the urinary tract, the lesser the chances of the organ infection[9].

The anatomical courting of the urethra of females to the vagina makes it susceptible to trauma during sexual contact. Women are at a higher risk of getting infected with UTIs due to biological changes. Research indicates that 20-25% of females at menopausal age get infected with UTIs. In addition to this, the moistness of the female's perineum allows for

rapid growth of microbes and exposes the female to bladder infection [5]. Factors like lack of proper hygiene of the vaginal area, napkin and sanitary towel use, pregnancy and sexual activities are responsible for an increased incidence of UTI in several females. Also, female urine has been discovered to have better osmotic pressure and suitable pH to allow for the growth of *E. coli* as compared to male urine [10].

Higher risk of infection can be caused by insufficient intake of water. Flushing of dislodged bacteria capable of causing pathogenicity due to exposure to a different environment can occur by sufficient water intake. Regular intake of large amounts of water enhances quick digestion and body regulation as it also aids in flushing out unwanted objects from the system.

Mechanical host defenses are disrupted due to the presence of an indwelling catheter in the urinary tract thereby leading to an overexpansion of the bladder and incomplete annulling leaving residual urine capable of allowing the growth of microbes. There are symptomatic and asymptomatic UTIs and symptom related with UTIs are dysuria (painful urination), constant urination, fever, vomiting, nausea, cloudy urine, haematuria [11].

This study aims at: Ascertaining the occurrence of UTIs among the volunteer subjects in our study population. To recognize the likely factors that predispose individuals to transmission of the infection and to advocate measures for controlling and preventing this infection with the aim of curbing the spread and possible complication of this infection.

Statement of the problem: According to Macnair, a prevalence of about 11 % and 4% of UTI has been observed among boys and girls before they reach age 16. At some point in their lives, 40 – 50 % of women and 12 % of men are infected with UTIs. Sexual activities have been presumed to be a major cause of an increased rate of infection as the issue starts when females begin to engage in sexual intercourse. In spite of this alarming report, the general populace is less concerned on the dangers of Urinary Tract Infections as compared to other kinds of infection like HBV and HIV infection. This study intends to emphasize on personal and environmental sanitation as well as the need for a more hygienic social lifestyle among our population of study.

Limitation of the Study

These include unwillingness of our volunteer subjects to meet up promptly to our sample collection time line coupled with apathy of the populace towards enlightenment. However, the confidence of our volunteer subjects was further strengthened after much persistence and enlightenment on the relevance of the study from the research team.

MATERIALS AND METHODS

Study size

Samples of urine were obtained from one-hundred and fifty-one (151) subjects comprising children and adults of both sexes between ages 10-30 years - these individuals were volunteer subjects and outpatients visiting the Omu-aran General hospital and the LUHC all in Omu-aran community.

Exclusion criteria

While collection of urine was carried out from volunteers, the following were exclusion criteria: - Individuals that have used antibiotics for 3 days and above were exempted, patients below age 10 and patients who consumed fluids in large amounts an hour less than their arrival to the clinic.

Materials and media sterilization

Nutrient Agar (NA), Nutrient Broth (NB), MacConkey agar (MCA), and Blood Agar (BA) were used. Proper washing of the glassware with the use of detergent and proper rinsing with water was done following drying. The dried glassware was later wrapped in aluminum foil and sterilization in a hot air oven at 160°C for 3 hours was done while autoclaving of all media used was done for proper sterilization.

Urine collection

Mid-stream urine samples were collected from patients in sterile universal bottles for collections and transported in ice packs for urinalysis and culturing in the laboratory.

Culturing of urine samples

Ten-fold serial dilutions were done by pouring 1.0 ml of the reagent into 9.0 ml of sterile physiological saline. 1ml of the solution was then added into petri dishes containing molten nutrient agar and mixed by gentle swirling. The petri dishes were placed in the incubator at 37°C for a day after leaving the solution to solidify. Enumeration of colonies of bacteria observed

on the dishes was done for the determination of the urine samples with significant bacteriuria. Streaking of the urine sample (a loopful) was done on MacConkey agar and Blood agar plate in order to isolate the bacteria present in the sample. Upon incubation, selection of the plates was done based on observation of colonies, isolation was also carried out with the use of an inoculating loop following sub-culturing on agar slants for storage.

Bacterial identification

Gram staining was done to identify and characterize isolated bacteria followed by tests for motility, microscopic analysis and biochemical tests using API 20E kit (BioMerieux).

RESULTS

Result obtained showed that Eighty-three (83/55%) Subjects recorded positive (cultures) growth of uropathogens out of 151 urine samples collected and analyzed, giving the UTIs incident of 55%. 68 (45.0%) from the 83 cases that had positive culture which were female volunteers. The microbe isolated from the urine includes *Staphylococcus aureus* (36.1%), *Klebsiella pneumoniae* (14.5%), *coagulase negative staphylococci* (13.3%), *Pseudomonas aeruginosa* (10.8%), *Escherichia coli* (7.2%), *Micrococci* (1.2%), *Enterococcus faecalis* (1.2 %) and *Proteus vulgaris* (1.2%). Meanwhile for the 15 positive cultures in male, the urinary isolated includes *Klebsiella pneumoniae* (3.6%), *Staphylococci aureus* (1.2%), *Pseudomonas aeruginosa* (2.4%), *Micrococci* (2.4%), *Klebsiella ozaenae* (2.4%), *Enterococcus faecalis* (1.2%) and *Candida albicans* (1.2%). Identification of isolated organisms was done based on colony morphological characteristics, grams reaction and biochemicals which include catalase, coagulase, indole, germ test tube, motility, oxidase, urease, citrate, glucose, lactose and sucrose. From the urinalysis examination, a high cellular response was observed in female than in males. No parasites were detected in the microscopic examination done.

Table-1: Distribution of Study Populace based on age and gender

Age (years)	Male (%)	Female (%)	Total
10 to 15	3(7.7)	36(92.3)	39
16 to 20	2 (6.3)	30(93.8)	32
21 to 25	11(17.7)	51(82.3)	62
26 to 30	8(44.4)	10(55.6)	18
Total	24(15.9)	127(84.1)	151

Table-2: Distribution of Study Populace based on education.

Education	Male (%)	Female (%)	Total
None	15 (44.1)	19 (55.9)	34
Secondary	5 (9.8)	46 (90.2)	51
Tertiary	4 (6.2)	62 (93.9)	66
Total	24 (15.9)	127 (84.1)	151

Table-3: Population distribution based on Risk factors and Clinical History

Risk Factors	Male (%)	Female (%)	Total
Involvement in Smoking	6(100)	- (0)	6
Intake of alcohol	9 (81.8)	4(36.4)	11
Prior sexual activity	10(40)	15(60)	25
Total	25(59.5)	19(45.2)	42
Clinical History			
Previous history of UTIs	-	5	5
Past record of bladder infection	-	5	5
Cloudy urine	1	23	24
Painful during urination	1	5	6
Total	2	38	40

Table-4: Identified organisms isolated in urinary tract infections

ORGANISMS ISOLATED	n =83 (%)
<i>Staphylococcus aureus</i>	30 (36.1)
<i>Klebsiella pneumoniae</i>	15 (18.1)
<i>Coagulase negative staphylococci</i>	12 (14.5)
<i>Pseudomonas aeruginosa</i>	11 (13.3)
<i>Escherichia coli</i>	6(7.2)
<i>Micrococci</i>	3(3.6)
<i>Klebsiella ozaenae</i>	2(2.4)
<i>Enterococcus faecalis</i>	2(2.4)
<i>Candida albicans</i>	1(1.2)
<i>Proteus Vulgaris</i>	1(1.2)

Table-5: Organisms identified as they relate to Gender distribution

ISOLATED ORGANISMS	GENDER n = 83		TOTAL (n)
	Male (%)	Female (%)	
<i>Staphylococcus aureus</i>	3 (3.6)	27 (32.5)	30
<i>Klebsiella pneumonia</i>	3 (3.6)	12 (14.5)	15
<i>Coagulase negative staphylococci</i>	1 (1.2)	11 (13.3)	12
<i>Pseudomonas aeruginosa</i>	2 (2.4)	9 (10.8)	11
<i>Escherichia coli</i>	-	6 (7.2)	6
<i>Micrococci</i>	2 (2.4)	1 (1.2)	3
<i>Klebsiella ozaenae</i>	2 (2.4)	- (0)	2
<i>Enterococcus faecalis</i>	1 (1.2)	1 (1.2)	2
<i>Candida albicans</i>	1 (1.2)	- (0)	1
<i>Proteus vulgaris</i>	- (0)	1 (1.2)	1

Table-6: Occurrence of UTIs in association with age distribution

Age range	NO. Tested (%)	Positive (%)	Negative (%)
10-15	39 (25.8)	12 (30.8)	27 (69.2)
16-20	32 (21.2)	20 (62.5)	12 (37.5)
21-25	62 (40.4)	38 (61.3)	24 (38.7)
26-30	18 (11.9)	13 (72.2)	5 (27.8)
Total	151(100.0)	83 (55.0)	68 (82.0)

DISCUSSION

Urinary tract infections (UTIs) is a major infection capable of infecting all gender and age range it is a common infection among females, as a result of the biological makeup of the female body. It occurs in hospitals as nosocomial infections and in the community. From this study, UTI was found to be common mostly among the adolescents and the young adults of the age 10-30 years. It can appear as asymptomatic in those individuals or with symptoms such as fever, nausea, vomiting, and loss of appetite as

a result of urethritis, cystitis and pyelonephritis in major cases.

The incidence of UTIs in the individuals studied was 83 (55%). Amongst this, 57 (37.7%) females recorded significant bacteriuria, compared to 27 (17.9%) found in males. This is in concordance with reports by Aiyegoro *et al.* in his studies among adolescents, who reported that from 124 females studied, 28 (22.4%) were recorded with positive cultures compared to 8 (4.6%) of 177 males

subjects[12]. The findings of 55% incidence of UTI cases recorded in this study are higher compared to reports by Okafor *et al.* which indicated an incidence rate of 16.5% which was reported in patients between the ages of 0-20. Nevertheless, Olowu gave a report of a prevalence of 28.1% among 2780 out-patients at the Lagos University Teaching Hospital and Anochie *et al.* reported an incidence rate of 30% among a population of 100 school children, between ages 4 - 18 in a rural community in Enugu. The outcome of our finding is higher than the findings of Okonko *et al.* that gave a report of an incidence of 47.5% at Ibadan, Nigeria and Ajayi *et al.* who stated 40% [13, 14]. However, this result is lower than an occurrence of 71.6% derived from a related research by Jellheden *et al.* 1996, 88.6% by Akerele *et al.* 2001 and 52.6% by Igwegbe *et al.* [15-17].

Staphylococcus aureus is the most common uropathogen isolated from this study (36.1%). This finding agrees with the work of Ajayi *et al.* 2012 in which *Staphylococcus aureus* was recorded as the most occurring organism in ASB in antenatal patient while Akobi *et al.* 2014 recorded 28.3 % [18]. Other isolated uropathogen in this study were *Klebsiella pneumoniae* (14.5%), *Coagulase negative staphylococci* (13.3%), *Pseudomonas aeruginosa* (10.8%), *Escherichia coli* (7.2%), *Micrococci* (1.2%), *Enterococcus faecalis* (1.2%) and *Proteus vulgaris* (1.2%). The urinary pathogens from fifteen (15) positive cultures in male were *Staphylococci aureus* (3.6%), *Klebsiella pneumoniae* (3.6%), *coagulase negative staphylococci* (1.2%), *Pseudomonas aeruginosa* (2.4%), *Micrococci* (2.4%), *Klebsiella ozaenae* (2.4%), *Enterococcus faecalis* (1.2%) and *Candida albicans* (1.2%). Stamey and Sexton 1975 deduced that most bacterial uropathogen may most likely evolve from gastrointestinal tract and spread via faecal-urethral route [19].

According to Okonko *et al.* The prevalent organisms commonly isolated from UTI patients are *Escherichia coli*, *Staphylococcus aureus*, *Klebsiella aerogenes*, *Pseudomonas aeruginosa*, *Proteus* species, *Streptococcus faecalis* and *Enterobacter* species [20]. The occurrence and extent of prevalence of one or more of these organisms amidst others are environmentally-dependent. In another study, Amali *et al.* reported that *Escherichia coli* accounts for 50% cases of UTI. While, Aiyegoro *et al.* also reported that *Escherichia coli* was responsible for 52.77% of urinary tract infection [12].

However, in the study carried out by Ramzan *et al.* It was estimated that *Staphylococcus spp* was present in 72% of patient and *Escherichia coli* was present in only 11% of patient [9]. Amali *et al.* in his study reported that *Staphylococcus aureus* was present in 56.34% and *Escherichia coli* were present in only 28.17%. In this study it was observed that the reduced frequency of *Escherichia coli* could be due to the environmental, seasonal, intrinsic and extrinsic factors.

In this study it was found that *staphylococcus aureus* was found to be predominate with an incidence of 36.1%, 32.5% in female and 3.6% in male and *Escherichia coli* with an incidence of 7.2% in females and none in male subjects.

Incidence rate of similar UTI significant factors showed that education has been evidenced to reduce rate of infection in that only 55% of the patients suffering from bacteriuria were literate while 45% falls within the category of illiterates or at lower levels of education and enlightenment. However, incidence of UTI among this category of subjects seems to be higher. In contrast, individual with high level of literacy tend to record a high level of UTI probably due to promiscuous lifestyle, which further exposes them to the risk of UTIs.

The prevalence of this infection in this study was quite high and this agrees with the report of Chevins that this infection was a common medical complaint among women in their sexually active years. The age class 21– 25 had the highest prevalent rate of 61.3 % among at this age range, women/girls tend to live active sexual life and promiscuity is sometimes on the increase. This also agreed with APUA that women at the peak of their sexual active years had high occurrence of UTIs. Women at this age range also feel ashamed of going for medical check – ups and therefore indulge in one form of self-medication or the other or even prefer to die in silence [21]. This is contrary to the work of Okonko *et al.* who showed that high incidence of UTI was found within the age group of 25-34 years [22]. And Fareid, who reported that increased prevalence of UTI was observed in the age group of 36-40 years[23]. The result obtained in this study could be unhygienic lifestyle and risky behaviors among this age group. The lowest incidence of UTI is observed in those aged 10-15years, with positive microbial isolate of 30.8%, with a record of the lowest case of pyuria (10.8%) and without a history of dysuria recorded.

CONCLUSION

The high occurrence of UTI of 55% uropathogen in this study is of major worry particularly among sexually active women. On the basis of this therefore, there is need for improved, adequate and affordable health care services in the communities while Promiscuity and unhygienic behavioral tendencies should be discouraged. Similarly the populace should be educated and well enlightened on the importance of personal hygiene.

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