

The Prevalence of UTI Pathogens in Urine Specimen Obtained from a Hospital in Rivers State Nigeria

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Abstract The incidence of urinary tract infections was carried out on patients attending a general hospital in Rivers State, Nigeria. One hundred and fifty urine specimens were collected in 2014, from the 150 specimen 52 were from males and 98 from females. The study was carried out to determine the current status of UTI among patients attending the hospital. Mid-stream urine specimen were collected in sterile universal bottles and analyzed. Urine specimen were examined macroscopically and Combi 9 urinalysis strip was dipped into the urine specimen to check the pH, glucose level and other chemical composition. Each urine sample was streaked onto prepared sterile CLED plates and incubated at 37°C for 24 hours. Results obtained showed that 34.6% of the male specimens were positive and 55.1% were positive from the female specimen. The occurrence of UTI with respect to isolated pathogen showed that *Klebsiella* sp was the highest occurring followed by *E. coli* while in both sexes *S. aureus* was the highest occurring pathogen. The least occurring pathogen was *Streptococcus* sp 4(4.8%) followed by *Candida albicans* 3(3.6%). *Candida albicans* was not found in the male subjects. The highest rate of infection was recorded in patients between the ages of 34-35 and the least was recorded in patients above 46 years. The prevalence of UTI recorded in female subjects was 77.4% and 22.6% in male subjects. UTI has been on the increase, it is recommended that awareness on UTI, factors leading to UTI, prevention and treatment should be increased to reduce the high rate of occurrence.

Keywords Pathogen, Subjects, Urinary Tract Infection

1. Introduction

Urinary tract infection has shown to be among the cause of morbidity among the general population and the second most common cause for people visiting the hospital [1, 2]. UTI occurrence is widely related to social class, age of patients, birth rank or size of family. UTI affects people in varying incidences depending on age group and gender. Most times boys are at greater risk before the age of 3 months but girls become at greater risk thereafter. Studies have shown that 3% of pre pubertal girls and 1% of pre pubertal boys are diagnosed with a UTI. In male infants, circumcision is associated with a decreased rate of UTI [3, 4]. When all age groups are combined, women are at greater risk than men of developing a UTI [5, 20]. In older men the case is different due to increasing prostatic hypertrophy which may affect urine flow there by increasing the risk of developing UTI. When UTI is present in older people, it is asymptomatic [6]. In young sexually active women, sexual activity is the cause of 75–90% of bladder infections, with the risk of infection related to the frequency of sex [11]. Women are also prone to

UTIs due to the shortness of the urethra and its closeness to the anus [7].

To distinguish between infected and contaminated urine specimen from asymptomatic patients, significant bacteriuria is been used. Patients without symptoms whose bacterial counts in their urine is greater than 10^4 /ml of the urine specimen do not have UTI. This was explained by Mehvish and Betty [8]. In their study significant bacteriuria was used to explain the presence of urinary tract infections in symptomatic patients. It was noted from their study that such patients also have bacterial counts that is greater than 10^5 organisms per milliliter. In symptomatic patients with UTI the count may fall to 10^4 organisms per milliliter, the counts may even be lower in the absence chemotherapy. Studies have shown that patients with UTI has only single bacterial species while the presence of two or more growths in UTI can be due to contamination.

The most frequent organism isolated from most urine specimen according to previous studies is *E. coli*. It is a harmless flora in human intestine and has some properties as virulence factors (VFs) to overcome the new environment. It has the ability to colonize and adhere to the uro-epithelial cell through its fimbriae (P fimbriae, type-1 fimbria), the prevalence of *P. fimbriation* from patients with severe UTIs such as urosepsis is high as 71% compared with 70% in pyelonephritis and 28% in other sources of infection [9].

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When the bladder is emptied regularly it can prevent the pathogens stasis within lower urinary tract. Due to this most of UTIs in children are incidental and promptly recovery with appropriate antibiotics or correction of daily hygiene. The common pathogenic sources are Gram-negative, mainly enteric organisms. *E. coli* are the most prevalent for 90% of episodes of UTIs [10]. Gram-positive organisms especially *Enterococci* and *Staphylococci* are also found in urine specimen. Hospital-acquired UTI show a wider pattern of organisms, such as *Klebsiella*, *Serratia* and *Pseudomonas* spp. Groups A and B *Streptococci* are common in newborn that have UTI [11]. The pattern of UTI depends on whether the infections are acute, recurrent, nosocomial, community acquired, sex, age and presence of underlying disease. Gram negative enteric (aerobic) *Bacilli* are responsible for very small percentage of UTIs in both acute and chronic infection.

2. Materials and Methods

2.1. Subjects

A total of 150 urine specimens were collected within the months of July to December 2014. The entire urine specimens were collected from in and out patients from a general hospital in Port Harcourt. Some of the patients were on admission while more of them were out patients. Universal sterile containers were issued to patients and instructions on how to collect urine specimen was passed to them. Universal containers had serial numbers and codes corresponding to individual patient and date of collection.

2.2. Examination of Urine Specimen

Urine specimen were examined in the laboratory macroscopically and cultured.

Macroscopic Method: Macroscopic examination was carried out on the urine specimen with the aid of naked eye to check the colour of the urine and particles or nature. The nature of urine is either amber, deep amber or strew, slightly cloudy or cloudy and clear. Combi 9 urinalysis strip was dipped into the urine sample to check for the pH, glucose level and other chemical compositions of the urine specimen.

Urine Culture: After macroscopic examination of the urine specimen they were cultured in the laboratory. The isolation technique employed was essentially based on that used by Cheesbrough [12]. The method was used for each specimen. Sterile wire loop of 0.05 mm in diameter was deeped into the urine and was aseptically and uniformly smeared on the half position of the sterile Cysteine Lactose Electrolyte Deficient Agar (CLED) plate. The wire loop was used to streak the plate from the plate of smear to have distinct colonies. This process was repeated for the entire specimen and incubated at 37°C for 24 hours. At any multiple growths the culture was repeated before acceptance of outcome. Cultures having up to 200 colonies which is equivalent to 10⁵ cfu/ml of the urine were noted and recorded

as being significant, while cultures having less than 200 colonies or mixed growth were regarded as non- significant. The numbers of colonies were counted to quantify organisms. Diagnosis of urinary tract infection for a single pathogen was defined based on significant colony count of $\geq 10^5$ CFU/mL for Gram negative and $\geq 10^4$ CFU/mL for Gram positive bacteria.

2.3. Identification of Isolates

Organisms isolated from urine specimen were identified using standard microbiological techniques. Biochemical test such as Gram staining catalase test, coagulase test, urease test, citrate, indole test, sugar fermentation and oxidase test were used to identify the isolates as shown in Table 1.

3. Results

3.1. Microorganisms Prevalent in Urine Specimen

From the 150 urine specimen analyzed 52 were males and 98 were females. Forty- eight percent (48%) of the total specimen collected were positive for UTI, 34.6% of the male specimen were positive while 55.1% of the female specimen analyzed were positive for a UTI. The occurrence of UTI and isolated pathogens with respect to the age groups and sex in test subjects shows that *Klebsiella* sp was the highest occurring UTI pathogen in both males and females (5 and 21 respectively), *E. coli* and *S. aureus* were the second highest occurring pathogens in both sexes (3 and 16 each, respectively). The highest rate of infection was recorded in patients between the age group (30-45) and the least infection was recorded in patients above 46 years. The prevalence of UTI recorded in female test subjects was 77.4% and 22.6% in male test subjects, female subjects of the age group 18-29 had the highest prevalence of 46.2% and least was recorded in subjects of the age group 30-45 (9.2%).

Male subjects with age 46 and above recorded the highest prevalence of 36.8% and the least was recorded in male subjects below 18 (5.2%). The pathogen and sex specific prevalence of the UTI's shows that *Klebsiella* sp had the highest frequency of occurrence of 30.9%, followed by *E. coli* and *S. aureus* (22.6%) each. The least occurring pathogen was *Candida albicans* (3.6%), among male subjects *Klebsiella* sp was the highest occurring pathogen (26.3%), followed by *E. coli*, *S. aureus*, *Pseudomonas* sp, and *Proteus* sp (15.8%) each, the least occurring pathogen was *Streptococcus* sp (10.5) and no *Candida albicans* infection was recorded. Among the female subjects *Klebsiella* sp was the most frequent pathogen (31.8%) followed by *E. coli* (24.2%), while *C. albicans* was the least occurring.

The prevalence of UTI recorded in females was 77.4% and 22.6% in males in respect to prevalence and frequency of UTI according to age and sex. The UTI prevalence recorded in females shows that females between 18-29 years had the highest prevalence of 46.2% and the least was recorded in

subjects of the age group 30 - 45 (9.2%). Male subjects 46 years and above recorded the highest prevalence of 36.8% and the least was recorded in subjects below 18 (5.2%).

Figure 1 illustrates the sex-specific prevalence of UTI in all tested individuals. Among male subjects the highest prevalence was recorded in the age group 46 and above, followed by 18-29 and the least prevalence was recorded in male subjects below 18. Among the female subjects the highest prevalence was recorded in the age group 18-29 followed by subject 46 and above and the least was recorded in female subjects below 18. The age group with the highest prevalence of UTI for both sexes is the age group 18-29.

Pathogen and sex specific prevalence of the UTI's recorded in the study is shown in Table 2. *Klebsiella* sp had the highest frequency of 30.9%, followed by *E. coli* and *S. aureus* (22.6%). The least occurring pathogen was *Candida albicans* (3.6%). Among male subjects *Klebsiella* sp was the highest occurring pathogen (26.3%), followed by *E. coli*, *S. aureus*, *Pseudomonas* sp, and *Proteus* sp (15.8%), the least occurring pathogen was *Streptococcus* sp (10.5) and no *Candida albicans* infection was recorded. Among the female subjects *Klebsiella* sp was the most frequent pathogen (31.8%) followed by *E. coli* (24.2%), while *C. albicans* was the least occurring pathogen (4.5%).

Table 1. Biochemical test to differentiate isolates present in urine specimen

Colony Morphology	Gram Rxn	Catalase	Coagulase	Oxidase	Citrate	Indole	Urease	Methyl-Red	V. proskauer	H ₂ S	Gas	Slope	Butt	Lactose	Glucose	Motility	Tentative Microorganism
Pink and mucoid colonies	-	+	-	-	+	-	-	-	+	-	+	Y	Y	+	+	-	<i>Klebsiella</i> spp
Bluish to greenish round colonies	-	+	-	-	-	+	+	+	-	+	+	R	Y	-	+	+	<i>Proteus</i> spp
Colonies raised and creamy	+	+	-	-	+	-	-	-	+	-	+	R	R	+	+	-	<i>S. aureus</i>
Yellow and slightly raised colonies	-	+		+	+	-	-	-	+	-	+	Y	Y	+	+	+	<i>Pseudomonas</i> spp
White small colonies	-	+	-	-	-	+	+	+	-	-	+	Y	Y	+	+	+	<i>E. coli</i>
Colourless small colonies	+	+	-	-	+	-	-	-	+	-	+	R	R	+	+		<i>Streptococcus</i> spp

Key: R= Acid Y= Alkaline

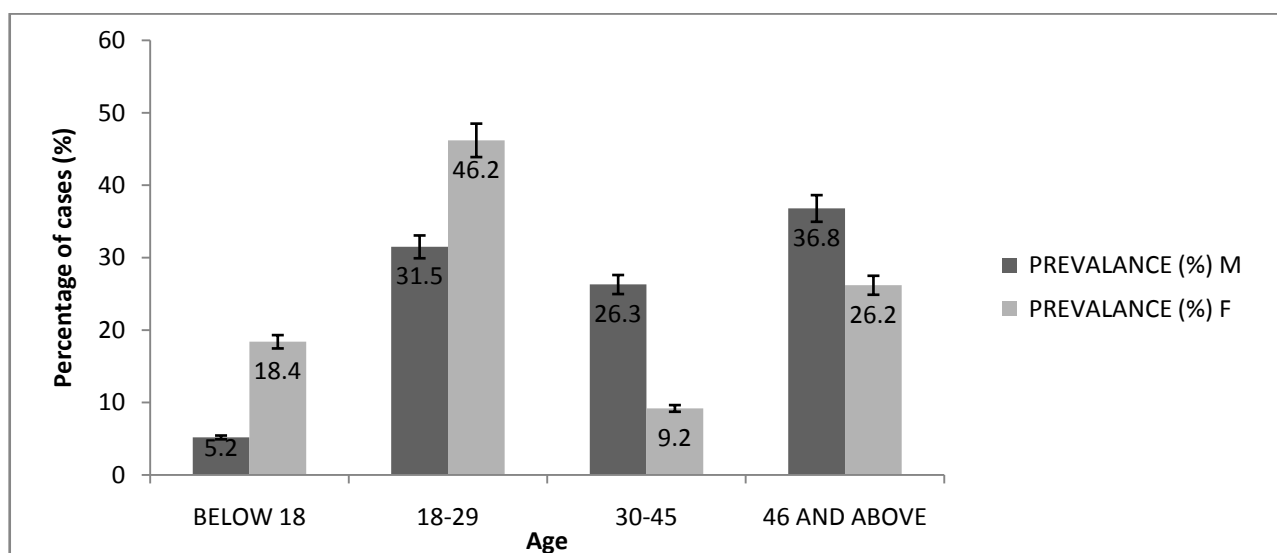


Figure 1. Sex specific prevalence of UTI in tested individuals

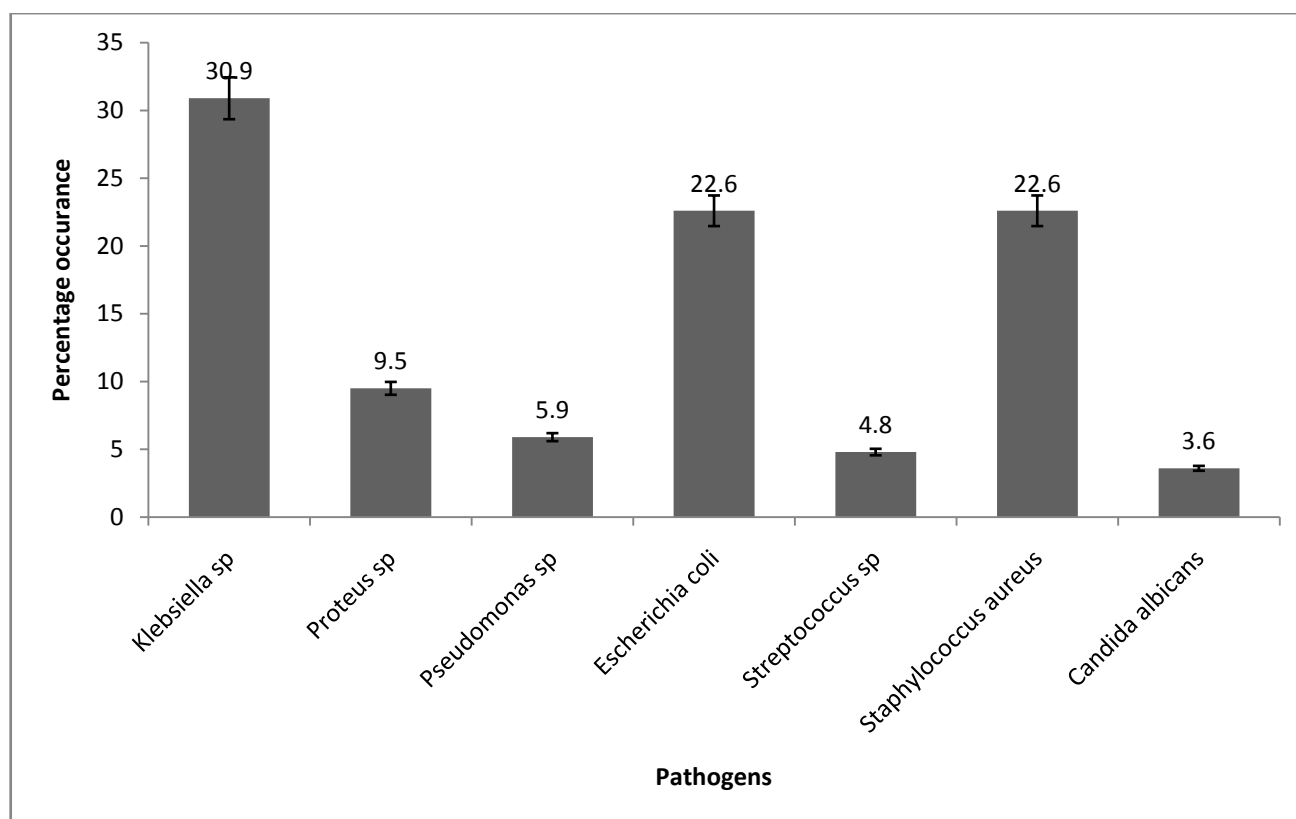


Figure 2. Frequency of Occurrence of Pathogens in Urine Specimen

Sex-related frequency of occurrences of the isolated UTI pathogens as shown in Table 2 shows that *Klebsiella* sp was the highest occurring pathogen in both male and female subjects tested, followed by *E. coli* and *S. aureus*. The least occurring pathogens in the female subjects were *Streptococci* and *Pseudomonas* spp. The least occurring pathogen among male subjects was *Streptococcus* sp. The frequency of occurrence of the UTI pathogens isolated from the urine specimen is shown in Figure 2. The frequency of occurrence is as follows; *Klebsiella* sp (31%), *Staphylococcus aureus* and *Escherichia coli* (23% each), *Proteus* sp (9%), *Pseudomonas* sp (6%), *Streptococcus* sp (5%) and *Candida albicans* (3%).

Table 2. Sex-Related Frequency Occurrence of Isolates from Urine Specimen

Pathogen	Frequency (%)		
	Male	Female	Overall
<i>Klebsiella</i> sp	5 (26.3)	21 (31.8)	26 (30.9)
<i>Proteus</i> sp	3 (15.8)	5 (7.6)	8 (9.5)
<i>Pseudomonas</i> sp	3 (15.8)	2 (3.0)	5 (5.9)
<i>Escherichia coli</i>	3 (15.8)	16 (24.2)	19 (22.6)
<i>Streptococcus</i> sp	2 (10.5)	2 (3.0)	4 (4.8)
<i>Staphylococcus aureus</i>	3 (15.8)	16 (24.2)	19 (22.6)
<i>Candida albicans</i>	0	3 (4.5)	3 (3.6)

4. Discussion

Urinary tract infection is responsible for frequent visits of in and outpatients visiting the hospital regularly. Despite the increase in the advancement in antimicrobial therapy UTI still remains a major cause of morbidity. Most times by the age of 24 most women must have been treated for UTI and 40% to 50% of women will have UTI beyond the age of 24 [2, 13, 14]. The present study was carried out to determine the occurrence of UTI's and UTI pathogens in patient specimen from a general hospital in Rivers State Nigeria. A total number of 150 urine specimens were analyzed, 52 were male and 98 were females. Forty-eight percent (48%) of the total specimen collected were positive for UTI. This result was slightly lower than the result obtained by Ibadin in a similar study [15]. The frequency of UTI 55.1% in female specimen was higher than the occurrence in male (34.6%) specimen. This finding is in agreement with studies carried out by Ibadin [15] and Okonko [5]. This also correlates with other studies by Swetha, Kibret and Abera, where UTI was higher in females compared to males [1, 2]. The high incidence of UTI in females could be attributed to the Physiological and anatomical differences in males and females. With respect to anatomical differences shows that the female s urethra and vagina makes it liable to trauma during sexual intercourse as well as bacteria been massaged up the urethra into the bladder during pregnancy and child birth [2, 11, 26]. Alteration in the micro flora of the vagina

allows colonization of some microorganisms that can lead to UTI [26, 27]. Females having a higher incidence UTI and uropathogens could also be attributed to menopause and the use of contraceptives. Males have a drier environment in the urethra which reduces microbial growth and longer distance between the anus and urethra meatus, all these factors are responsible for the reduced UTI in the males [1, 3, 7, 16]. The highest rate of infection was recorded in subjects between the age group (30-45) and the least infection was recorded in subjects above 46 years, this is in agreement with the study conducted by Ani and Mgbechi [24]. The high incidence of UTI between the ages of 30-35 is due to the relatively higher sexual activity that is observed in the age group and multiple sex partners. Subjects at this particular age bracket tend to hide UTI infection and treat secretly, they only visit the hospital when UTI infection is beyond control. Our findings is in contrast with the study carried out by Krieger where the prevalence of UTI increase with increasing age for both sexes [23, 25]. The high incidence observed in the present study in both sexes at age 46 and above can be attributed to the presence of a number of risk factors that arises due to age advancement. Such factors includes prostatic enlargement found in males, diabetes mellitus, reduced ambulation, osteoporosis, interventional instrumentations like catheterization and weak bladder sphincter [30].

The occurrence of UTI and isolated pathogens with respect to the age groups and sex shows that *Klebsiella* sp was the highest occurring UTI pathogen in both male and female (5 and 21 respectively), *E. coli* and *S. aureus* were the second highest occurring pathogens in both sexes (3 and 16 respectively). The pathogen and sex specific prevalence of the UTI's shows that *Klebsiella* sp had the highest frequency of 30.9%, followed by *E. coli* and *S. aureus* (22.6% each), the least occurring pathogen was *Candida albicans* (3.6%), this contradicts the reports in other studies [5, 17, 18]. *E. coli* is found to be responsible for most cases of UTI because they usually leave their place of normal flora due to their virulence factors, this enables them to adhere to the epithelia of the urinary pathway thus leading to the inflammation of the urinary tract [31]. Previous studies have has shown that *Staphylococcus* is an increasing cause of UTI, this was confirmed in the present study. The presence of *Staphylococcus* in UTI could be due to the increased use of instrumentation like bladder catheterization in patients admitted in the hospital with primary disease [30, 32]. Available data from previous studies on pathogens from urine specimen from Nigeria confirms with the organisms isolated from the present study [28, 29]. The disparity observed in the frequency of pathogen isolated from urine specimen by various researchers could be due to antibiotics taken by patients before visiting the hospital due to persistence of UTI, this can affect the frequency of pathogens isolated [4, 30, 31]. Results from the study carried out by Salwa [19] showed that 97% bacteria and 2.9% fungi were isolated from 104 urine specimen. The study showed that *E.coli* (45.2%) was the highest in occurrence followed

by *Klebsiella* (25%), *P. aeruginosa* (12.5%), *Proteus vulgaris* (7.7%), *S. aureus* (3.8%) and Beta hemolytic *Streptococci* (2.9%) was the lowest. Other studies have shown that of *E. coli* is the most predominant over *Klebsiella* spp in urine specimen [20, 21, 22]. The similarities and differences in the type and distribution of uropathogens in the current study and other studies conducted thus far in different countries may be due to source of the specimens, patients involved and the various environmental conditions and host factors. Standard hygiene practices, education, population and the socioeconomic standards of the different sources of specimen collected may be responsible for the differences observed in uropathogens from the different studies [23].

5. Conclusions

The relatively high prevalence of UTI among female subjects and subjects between age group 30-45 years may be due to unsafe sexual practices, unclean hygiene and or underlying immune related problems. It is recommended that awareness on UTI, factors leading to UTI, prevention and treatment should be increased to reduce the high rate occurrence.

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