Prevalence of *Escherichia coli* among uropathogens in asymptomatic bacteriuria in a Nigerian Tertiary School in Jos, Nigeria

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Abstract

**Objective:** This study was carried out to determine the prevalence of *Escherichia coli* in asymptomatic bacteriuria among the students of Federal School of Medical Laboratory Technology, Jos.

**Methods:** Mid-stream urine samples from 213 students who consented were collected, cultured, isolates identified and antibiotic susceptibility test was carried out according to standard microbiological protocols.

**Results:** Of the 213 test samples screened, 9(4.2%) had asymptomatic bacteriuria. The study indicates that 9(4.2%) of the samples showed a significant count growth, 4(1.9%) had a non significant growth, while 199(93.4%) showed no growth. Of the 114 samples screened from female students, 9(7.9%) had significant bacteriuria, while of the 99 samples screened from the male counterparts non 0(0.0%) had significant bacteriuria. The bacterial isolates recovered in this study were *Escherichia coli* which had the highest with 6(66.7%) while *Klebsiella* species had the lowest with 3(33.3%). The distribution of microbial isolates recovered from the study shows that *Escherichia coli* had the highest prevalence of 6(60.0%), followed by *Klebsiella* species with 3(30.0%), while *Candida* species had 1(10.0%). The antibiotic susceptibility pattern for the *Escherichia coli* isolates reveals that all the 6(100%) isolates were susceptible to Nalidixic acid, Nitrofurantoin and Gentamycin, while Colistin Phosphate, Tetracycline and Streptomycin had 5(83.3%), 4(66.7%) and 1(16.7%) respectively. Ampicillin and Cotrimoxazole were resistant to all the *Escherichia coli* isolates.

**Conclusion:** Asymptomatic bacteriuria was recorded among the females, therefore this call for the need to create more awareness on prevention and control measures for UTIs among females. The antibiogram profile suggested possibilities of drug abuse.

**Keywords:** Asymptomatic Bacteriuria, Nigerian Tertiary institution

1. Introduction

The presence of a significant quantity of bacteria in a urine specimen properly collected from a person without symptoms or signs of a urinary tract infection (UTI) characterize asymptomatic bacteriuria. Asymptomatic bacteriuria is a microbiologic diagnosis determined with a urine specimen that has been collected in a manner to minimize contamination and transported to the laboratory in a timely fashion to limit bacterial growth. The usual quantitative definition is $10^5$ cfu/mL in two consecutive urine specimens.1

A common dilemma in clinical medicine is whether to treat asymptomatic patients who present with bacteria in their urine. There are few scenarios in which antibiotic treatment of asymptomatic bacteriuria has been shown to improve patient outcomes. Because of increasing
antimicrobial resistance, it is important not to treat patients with asymptomatic bacteriuria unless there is evidence of potential benefit. Women who are pregnant should be screened for asymptomatic bacteriuria in the first trimester and treated, if positive. Treating asymptomatic bacteriuria in patients with diabetes, older persons, patients with or without indwelling catheters, or patients with spinal cord injuries has not been found to improve outcomes.

Screening of asymptomatic subjects for bacteriuria is appropriate if bacteriuria has adverse outcomes that can be prevented by antimicrobial therapy. Outcomes of interest are short term, such as symptomatic urinary infection (including bacteremia with sepsis or worsening functional status), and longer term, such as progression to chronic kidney disease or hypertension, development of urinary tract cancer, or decreased duration of survival. Treatment of asymptomatic bacteriuria may itself be associated with undesirable outcomes, including subsequent antimicrobial resistance, adverse drug effects, and cost. If treatment of bacteriuria is not beneficial, screening of asymptomatic populations to identify bacteriuria is not indicated, unless performed in a research study to further explore the biology or clinical significance of bacteriuria.

*Escherichia coli* is the most common organism isolated from patients with asymptomatic bacteriuria. Infecting organisms are diverse and include Enterobacteriaceae, *Pseudomonas aeruginosa*, *Enterococcus species*, and group B *Streptococcus*. Organisms isolated in patients with asymptomatic bacteriuria will be influenced by patient variables: healthy persons will likely have *E. coli*, whereas a nursing home resident with a catheter is more likely to have multi-drug–resistant polymicrobial flora (e.g., *P. aeruginosa*).

*Escherichia coli* is the most common organism and is the most likely to occur in healthy persons. A variety of organisms may be found, however, including Enterobacteriaceae, *Pseudomonas aeruginosa*, *Enterococcus* species, and group B *Streptococcus*. In men, *Enterococcus* species and gram-negative bacilli are common. Catheterized nursing home residents may have polymicrobial asymptomatic bacteriuria (ABU).

This study aimed at determining the prevalence of *Escherichia coli* bacteriuria in asymptomatic students in a tertiary institution of learning and its antibiotic susceptibility pattern.

## 2. Materials and Methods

### 2.1 Study Area:
Plateau state is the twelfth largest state of Nigeria and is roughly located in the center of the country with its capital as Jos. It got its name from the Jos Plateau, a mountainous area in the north of the state with captivating rock formation and is celebrated as “Home of Tourism” with population of 437,217 people. Plateau is located in Nigeria’s middle belt with an area of 26,899 square kilometers, it is located between latitude 80°24’N and longitude 80°32’ and 100°38’ east. It has an average climatic temperature of 18 and 20°C. Harmattan winds cause the coldest weather between December and February, the mean annual rainfall varies from 131.75cm (52in) in the southern part to 146 (57in) on the plateau. Plateau state has educational institution which includes primary, secondary and tertiary institutions. Federal School of Medical Laboratory Technology, Jos University Teaching Hospital is one of the institutions found in the heart of the Jos the state capital. People from all over the country attend this great institution.

### 2.2 Ethical considerations:
Approval and permission was granted by the authority of the school before the commencement of the study. Consent of the students was obtained before samples were collected.

### 2.3 Study population:
The study population was 213 consented male and female students of Federal School of Medical Laboratory Technology, Jos. The sample population comprise of 99 male and 114 female students.

### 2.4 Specimen collection and processing:
A semi structured questionnaires were randomly administered to the students who consented to obtain some useful data. Clean–catch midstream urine was collected from each student into a sterile screw-capped universal container. The specimens were labeled and immediately ran into the laboratory for processing. Macroscopic examination was carried out on the samples. A loop full (0.002mL) of well mixed un-centrifuged urine was streaked on to the surface of blood agar and cysteine lactose electrolyte deficient (CLED) medium. The plates were incubated aerobically at 37°C for 24 hours and counts were expressed in colony forming units (CFU) per millilitre (mL). A count of up to 10⁵CFU/mL was considered significant to indicate bacteriuria. Ten mL of each well-mixed urine sample was centrifuged at 2000g for 5 minutes. The supernatant was discarded and a drop of the deposit was examined microscopically for urine deposits such as pus cells, red blood cells, epithelial cells, casts, crystals yeast-like cells and *Trichomonas vaginalis*. Pus cells ≥ 5 per high power field were considered significant to indicate infection. The isolates were identified based on gram reaction, morphology, and biochemical characteristics and antimicrobial susceptibility was performed via the disc diffusion technique using antibiotic discs in accordance to standard microbiological methods. The results obtained was Statistical analyzed using Chi-Square test. Values of P < 0.05 were considered statistically significant while values of P > 0.005 were non significant.
3. Results

Two hundred and thirteen (213) samples were collected and screened from students of Federal School of Medical Laboratory Jos who reside both in the hostel and other places within Jos metropolis.

Table 1 showed the distribution of bacterial growth pattern based on the total bacterial count in which the result indicate that 9(4.2%) of the samples showed a significant count growth, 4(1.9%) had a non significant growth while 199(93.4%) showed no growth. Table 2 showed distribution of bacterial isolates in relation to sex. Of the 114 samples screened from female students 9(7.9%) had significant bacteriuria while of the 99 samples screened from the male counterparts non 0(0.0%) had significant bacteriuria this showed a significant association (P< 0.05).

Table 3 showed that of the 2 bacterial isolates recovered in this study, *Escherichia coli* had the highest with 6(66.7%) while *Klebsiella species* had the lowest with 3(33.3%) although this does not showed any statistical significant relationship (P > 0.05).Table 4 showed the distribution of microbial isolates recovered from the study population. The result revealed that *Escherichia coli* had the highest prevalence of 6(60.0%), followed by *Klebsiella species* with 3(30.0%), while *Candida species* had 1(10.0%).

The antibiotic susceptibility pattern for the *Escherichia coli* isolates as shown in Table 5 revealed that all the 6(100%) isolates were susceptible to Nalidixic acid, Nitrofurantoin and Gentamycin, while Colistin Phosphate, Tetracycline and Streptomycin had 5(83.3%), 4(66.7%) and 1(16.7%) respectively. Ampicillin and Cotrimoxazole were resistant to all the *Escherichia coli* isolates.

| Growth of organisms | Number obtained (%) |
|---------------------|---------------------|
| Significant growth (>10⁵) | 9(4.2) |
| No significant growth (<10⁵) | 4(1.9) |
| No growth | 199(93.4) |
| No growth | 199(93.4) |

Table 2: Distribution of Bacterial Isolates In Relation To Sex

| Sex       | No of students examined | Positive isolate (%) |
|-----------|-------------------------|-----------------------|
| Male      | 99                      | 0(0.0)                |
| Female    | 114                     | 9(7.9)                |
| Total     | 213                     | 9(4.2)                |

X²=9.11; DF=1; P < 0.05

Table 3: Prevalence of *Escherichia Coli* In Relation To Other Bacterial Isolates

| Organism isolated | No. of isolates (%) |
|-------------------|---------------------|
| *Escherichia coli*| 6(66.7)             |
| *Klebsiella species* | 3(33.3)         |
| Total             | 9(100)              |

X²=0.9999; DF=1; P > 0.05

Table 4: Prevalence of *Escherichia Coli* In Relation To Other Microbial Isolates

| Organism isolated | No. of isolates (%) |
|-------------------|---------------------|
| *Escherichia coli*| 6(60.0)             |
| *Klebsiella species* | 3(30.0)          |
| *Candida species*  | 1(10.0)             |
| Total             | 10(100)             |

X²=3.8035; DF=2; P > 0.05
Table 5: Antibiotic Susceptibility Pattern for *Escherichia Coli*

| Antibiotic         | No. Sensitive (%) |
|--------------------|------------------|
| Nalidixic acid     | 6(100)           |
| Nitrofurantoin     | 6(100)           |
| Gentamycin         | 5(83.3)          |
| Tetracycline       | 4(66.7)          |
| Streptomycin       | 1(16.7)          |
| Ampicillin         | 0(0)             |
| Cotrimoxazole      | 0(0)             |

4. Discussion

A preliminary evaluation of the results of the total bacterial counts in males and females in the study showed an overall prevalence of urinary tract infection of 9(4.2%). The total number of samples with non-significant bacteriuria was 4(1.9%) while cultures that yielded no bacterial growth were 199 (93.4%). The low number of significant bacteriuria is not far fetch from the fact that the study population in this study were people with high level of enlightenments in the prevention and control of UTI and also the fact that they were asymptomatic individuals. The study reveals that bacteriuria was recorded only in females 9(7.9%). This agreed with earlier findings that females had higher chances of coming down with UTI than males. Close proximity of the female urethral meatus to the anus, shorter urethra, and sexual intercourse, incontinence, bad toilet habits have all been reported as factors that influence the higher prevalence in females.

This study indicates that *Escherichia coli* recorded the highest prevalence in relation to other bacterial isolates this was in consonance with earlier reports that *Escherichia coli* is the commonest causes of UTIs. *Escherichia coli* is responsible for more than 80% of all UTIs and causes both ABU and symptomatic UTI. *Klebsiella species* was the second bacterial isolates in this study which recorded 1.4% and this agreed with Arora and Arora who reported that *Klebsiella species* incidence rate as (1-5%), which in most cases a hospital acquired infection.

*Candida species* was isolated from a sample in this study giving a prevalence of 10%, this agreed with Aug et al. who stated that 10% of Candida are related to urinary source. The challenge comes from the fact that finding *Candida species* in urine can either be completely insignificant due to contamination or asymptomatic colonization or may be a marker of a very serious entity such as invasive renal parenchyma disease related to disseminated candidemia and also *Candida albicans* may cause urinary tract infection in diseased or uncompromised patients.

The in-vitro susceptibility pattern of *Escherichia coli* isolated in this study showed that Nalidixic acid, Nitrofurantoin and Gentamycin were the most sensitive drugs used. All the six *Escherichia coli* isolates were sensitive to the three drugs which gave a 100% susceptibility followed by Colistin Phosphate with 83.3%, Tetracycline had 66.7% and Streptomycin had 16.7% while Ampicillin and Cotrimoxazole were completely resistant to all the isolates. Resistance is mainly as a result of over use and misuse (abuse of antimicrobial agents). Pre-disposing factors for the development of bacterial resistance to antimicrobial agents include: inappropriate use of antimicrobials, wrong selection of drugs, inadequate control measures and prophylactic use of antimicrobials.

Resistance with the common drugs used in treatment of urinary tract infections may be as a result of drug abuse. This was confirmed in the work carried out in Calabar, Nigeria by Braid and Udoh who reported that some drug resistance pattern was due to drug abuse.

5. Conclusion

The study reveals that *Escherichia coli* is the most common organism isolated from students of Federal School of Medical Laboratory Technology, Jos, Nigeria. This was more commonly isolated in females and none in males as such it is recommended that more awareness campaign should be intensified especially to females on the need for proper hygiene, proper cleaning of their anal area after defecation, regular washing of their under wares. Although Nalidixic acid and Nitrofurantoin were the drugs of choice in this study, many experts advocated that treatment of such category of
asymptomatic subjects is of no any beneficial effects as such should be discouraged because it can rather lead to development of bacterial resistance than eliminating them.\textsuperscript{12,24,25} It will also be of great value to embark on public enlightenment campaign on the need for investigation before treatment and also the need to enact and enforce laws to guard against any form of indiscriminate treatment of patients without proper diagnosis of the ailment or abuse of drugs by any individual.

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