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Antimicrobial susceptibility pattern of bacteria isolated from urinary tract infection in Federal Teaching Hospital Ido Ekiti

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Abstract

The problem of antibiotic resistance remains a major concern among the patients and health care provider. This study was carried out therefore to determine the antibiotics resistance susceptibility pattern bacteria with urinary tract infections among patients attending Federal Teaching Hospital Ido-Ekiti. A total of 200 patients suspected of having a UTI were recruited for the study. The urine samples were cultured on Cysteine Lactose Electrolyte Deficient Agar (CLED) and the colonies were identified using colonial morphology and biochemical test. Antibiotics susceptibility testing was carried out using Kirby-Bauer disk diffusion techniques. Out of 200 urine samples analysed 82 (41.0%) yielded significant bacteria growth belonging to 4 different genera with Escherichia coli having the highest isolation rate 42 (81.2%) followed by Pseudomonas aeruginosa 16 (19.5%), Staphylococcus aureus 14 (17.0%) and Klebsiella aerogenes 10 (12.1%). Female patients had the highest isolation rate of 48 (58.5%) compare to their male counterpart with 34 (41.5%) isolation rate. Age group 31-40yrs had the highest isolation, rate of 20 (24.4%). The antibiotic resistance pattern exhibited by all the bacteria ranged from 14.3% to 90.5%. Gentamicin exhibited the least resistance rate. However, antibiotics resistance is frightening; therefore, there is a need for antibiogram before prescription of antibiotics for the treatment of urinary tract infection.

Keywords: Antibiotic Resistance; Wound; Bacteria; Ekiti State; Nigeria

1. Introduction

UTI is one of the most common infectious disease ranking next to upper respiratory tract infection and is the cause of morbidity and mortality in human both in the community and hospital settings [1, 2]. Worldwide, approximately 150 million people are diagnosed with UTIs resulting in USD 6 billion health care expenditures [3, 4].

UTI can be asymptomatic or symptomatic, characterized by a wide spectrum of symptoms ranging from mild irritative voiding to bacteremia, sepsis or even death. Other major symptoms may include: strong urge to urinate frequently, even immediately after the bladder is emptied (Urgency), painful burning sensation when urinating (Dysuria), discomfort, pressure, or bloating in the lower abdomen, pain in the pelvic area or back, cloudy or bloody urine (Haematuria), which may have a strong smell, urination during the night (Nocturia), frequent urination (Polyuria) [5, 6].

UTIs that occur in a normal genitourinary tract with no prior instrumentation are considered as “uncomplicated,” whereas “complicated” infections are diagnosed in genitourinary tracts that have structural or functional abnormalities, including instrumentation such as indwelling urethral catheters, and are frequently asymptomatic [7-9].

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UTI occurs in all age groups of both genders [10, 11]. This is as a result of anatomic position, physiological changes, vaginal intercourse, use of contraceptive methods like spermicide and diaphragm, and lack of prostatic fluid which acts as an antibacterial agent, almost 50% of women experiencing at least one episode of UTI during their lifetime [12-14]. Even though the episode of UTI is less in men than females, it is more serious when it happens [15, 16]. Despite these clear increased risks of UTI, clinicians lack scientifically valid methods to identify and ultimately treat patients with UTI complains [17, 18].

It was found that, one survey results performed in the USA estimated that a UTI episode was associated with an average of 6.1 days with symptoms, 2.4 days of reduced activity and 0.4 days of bed rest, thus generating an estimated annual cost (direct and indirect) of 1.6 billion dollars. [19-21]. In China, UTIs account for 9.39–50% of nosocomial infections. Most cases of UTI are caused by Gram negative bacilli, with Escherichia coli sometimes accounting for over 90% of uncomplicated UTIs [22, 23].

Urinary Tract Infection (UTI) has become the most common hospital-acquired infection, accounting for as many as 35 % of nosocomial infections, and it is the second most common cause of bacteraemia in hospitalized patients. It accounts for a significant proportion of the work load in clinical microbiology laboratories and enteric bacteria remained the most frequent cause, although the distribution of causative pathogens is changing by locality and by intrinsic and extrinsic factors [22, 24].

Bacteria are the major causative organism and are responsible for more than 95 % of UTI cases. Several studies on the prevalence of bacterial isolates from suspected urinary tract infection patients have shown that the commonest isolates were species of Escherichia, Staphylococcus, Klebsiella, Pseudomonas and Proteus [25-29]. In acute uncomplicated UTI acquired in the community, Escherichia coli, is by far the most common causative bacteria being responsible for about 80 percent of infections [5, 30-32]. The remaining 20 percent is caused by other gram-negative enteric bacteria such as Klebsiella and Proteus species, and by gram positive cocci particularly Enterococci and Staphylococcus saprophyticus. In all Gram-negative isolates formed a major constituent of bacterial uropathogens [5, 31].

The geographical agents and their susceptibility patterns of UTI vary in regions and geographical location [33]. Use of antimicrobial prophylaxis may lead to unnecessary prolonged antimicrobial dosing which can contribute to development of resistance due to selection pressure [34]. The increasing antibiotic resistance trends are likely to have important clinical implications for the empirical use of antibiotics [35-38].

Increasing antimicrobial resistance complicates uncomplicated UTI treatment by increasing patient morbidity, cost of reassessment and retreatment and use of broader spectrum [39]. Drug resistance among bacteria causing UTI has increased since introduction to UTI chemotherapy. Regular analysis of bacterial flora is important to formulate updated guidelines [3]. For effective treatment and control of UTI in a particular area /hospital, a good knowledge is of ultimate importance [40].

Furthermore, baseline estimates of the magnitude of the problem and the extent of antimicrobial resistance among the nosocomial pathogens are the minimum essential prerequisites for any hospital infection control programme [41]. The etiology of UTI and the antimicrobial susceptibility of urinary pathogens in both the community and hospitals have been changing, and in recent years antibiotic resistance has become a major problem worldwide due to several factors related to the genetic nature of the organisms and selective antimicrobial pressure in humans and animals. Furthermore, prevalence of the urinary pathogens and their susceptibility reactions to antibiotics differ from places to places with time. It is essential to know the current trends of UTI in other to ease diagnosis and thus establish the suitable antimicrobial agents for such infections in order to facilitate quick recovery, prevent/minimise complications of antimicrobial resistance.

2. Methodology

2.1. Study Location

This study was conducted at Federal Teaching Hospital (FETH) Ido Ekiti, Nigeria. FETH is located in Ido Ekiti, the principal town in Ido/Osi Local Government Area of Ekiti State with an estimated population of 107,000. It is geographically located in the northern part of Ekiti State which covers an estimated total area of 6353 km/ 2453 square mile and an estimated population of 2,737,186, where the routes from Kwara and Osun State converges. FETH, Ido Ekiti is serving five contiguous States (Ekiti, Osun, Ondo, Kogi and Kwara States).

2.2. Study Population

The study population for this were patients attending Federal Teaching Hospital presenting with urinary tract Infections.

2.3. Ethical Consideration

The ethical clearance for this research was given by Federal Teaching Hospital ethical committee after due processes. Before the collection of the sample, information regarding the study was explained to the subjects. Oral and written consent for participation in the study was obtained.

3. Questionairre and informed consent

Questionnaire to obtain the demographic characteristics and other relevant information to the study as well as an informed consent were administered to the participant.

3.1. Sample Sizes

A total 200 urine samples were collected from the patients of the above named hospital. The samples were transported to the laboratory as soon as possible.

3.2. Collection of Samples

The method described by Marami *et al* [42] was used for sample collection. Single voided clean-catch midstream fresh urine (10mL) was collected from each participant in a leak-proof and sterilized wide-mouthed screw-capped container. The specimens were kept in a cold box (4°C) and transported within 30 minutes of collection.

3.3. Cultivation of Urine Sample

A calibrated standard wire loop was used for inoculating culture plate. A loopful (0.002mL) of well mixed un-centrifuged urine will be plated on a dried CLED agar media. These plates were incubated aerobically at 37°C for 24hours [43].

3.4. Identification of Colony

The isolated colonies were examined and recorded based on the type of growth, elevation, size, colour, margin, edge, consistency, opacity, and change in medium [43].

3.5. Gram Stain

The colony was Gram stained using method described by Cheesbrough [43].

3.6. Biochemical Test

The following biochemical tests were used for the identification of the bacteria [44]. Gram-negative bacteria were tested for catalase, motility, indole, citrate and oxidase test, while Gram positive bacteria were tested for catalase and coagulase. The result of the biochemical tests were compared with standard identification chart.

4. Antimicrobial susceptibility testing

4.1. Disk Diffusion Testing

In this study antimicrobial susceptibility testing was done using Mueller- Hinton agar using disk diffusion (Kirby Bauer's) method according to the clinical and laboratory standards institute (CLSI) guidelines using the following antimicrobial agents: Gentamicin (10 µg), Ciprofloxacin (5 µg), Nitrofurantoin (30 µg), Cefepime (30 µg), and Amoxicillin- Clavulanic Acid (30 µg) for all Bacterial isolates.

5. Results

Table 1: Shows the isolation rate of bacteria from urine of patient. It revealed that out of 200 urine samples analysed. 82 (41.0%) yielded significant bacteria growth while 118 (59.0%) yielded no bacteria growth with P value 0.06 which is not statistically significant.

Table 1 Prevalence of bacteria isolated from urinary tract infection in Federal Teaching Hospital, Ido-Ekiti

Urinary Tract Infection	No examined (%)	p value
Bacterial Growth	82(41.0)	0.06
No bacterial Growth	118(59.0)	
Total	200(100)	

Table 2 Shows the isolation rate of bacteria from urine in relation to bacteria type. It showed that *Escherichia coli* had the highest isolation rate 42(51.2%), followed by *Pseudomonas aeruginosa* 16 (19.5%), while *Staphylococcus aureus* and *Klebsiella aerogenes* had prevalence rate of 14 (17.0%) and 10 (12.1%). This is statistically significant with P value 0.00.

Table 2 Prevalence of bacteria associated with urinary tract infection in relation to bacteria type

Bacteria	No examined (%)	p value
Escherichia coli	42(51.2)	0.00
Pseudomonas aeruginosa	16(19.5)	
Staphylococcus aureus	14(17.0)	
Klebsiella aerogenes	10(12.1)	
Total	82(100.0)	

Table 3 show the isolation of bacteria from urine in relation to sex. It showed that female subjects had highest isolation rate of bacteria compare to their male counterpart 34 (41.5%). This is statistically not significant P value equal to 0.77.

Table 3 Isolation rate of bacteria from urine in relation to sex

Sex	No examined (%)	p value
Male	34(41.5%)	0.77
FeMale	48(58.5%)	
Total	82(100.0)	

Table 4 Show the prevalence of bacteria from urine in relation to Age. It showed that Age 31-40yrs had the highest isolation rate 24 (29.3%). The p value equal to 0.21 which is statistically not significant.

Table 4 Prevalence of bacteria from urine in relation to Age

Age (yrs)	No examined (%)	p value
1-10	4 (4.9)	0.21
11-20	12 (14.6)	
21-30	20 (24.4)	
31-40	24 (29.3)	
41-50	14 (17.1)	
51-60	4 (4.9)	
61-70	2 (2.4)	
71-80	2 (2.4)	
Total	82(100)	

Table 5 Shows the antibiotic resistance profile of bacteria isolated from urine. It showed that *Escherichia coli* had resistance of 14(66.7%), 20(47.6%), 36(85.7%), 38(90.5%) and 24(57.1%) to Augmentin, Ciprofloxacin, Cefepime, Gentamicin and Nitrofurantoin respectively. 12(75.0%), 8(50.0%), 14(87.5%), 14(87.5%) and 8(50.0%), *Pseudomonas aeruginosa* were resistance to Augmentin, Ciprofloxacin, Cefepime, Gentamicin and Nitrofurantoin respectively. However, 12(85.7%), 6(82.7%), 2(14.3%) and 6(42.9%), *Staphylococcus aureus* were resistance to Augmentin, Ciprofloxacin, Cefepime, Gentamicin and Nitrofurantoin respectively. While 8(80.0%), 6(60.0%), 6(60.0%), 4(40.0%) and 6(60.0%) *Klebsiella aerogenes* were resistance Augmentin, Ciprofloxacin, Cefepime, Gentamicin and Nitrofurantoin respectively.

Table 5 Antibiotics resistant profile of bacteria isolated from urine

	Antibiotics (%)				
Bacteria	**AUG 30 µg**	**CIP 5 µg**	**CEP 30 µg**	**GEN 10 µg**	**NIT 30 µg**
Escherichia coli (n=42)	28(66.7)	20(47.6)	36(85.7)	38(90.5)	24(57.1)
Pseudomonas aeruginosa (n=16)	12(75.0)	8(50.0)	14(87.5)	14(87.5)	8(50.0)
Staphylococcus aureus (n=14)	12(85.7)	6(42.9)	12(85.7)	2(14.3)	6(42.9)
Klebsiella aerogenes (n=10)	4(80.0)	6(60.0)	6(60.0)	4(40.0)	6(60.0)

Key: n= no of resistant bacteria; AUG= Augmentin; CIP= Ciprofloxacin; CEP= Cefepime; GEN = Gentamicin; NIT= Nitrofurantoin

6. Discussion

Urinary tract infection is a common health problem worldwide and the antibiotic resistance pattern associated bacteria varies from region to region. However, in this study, the overall isolation rate of bacteria pathogen is 82 (41. 0%).This appear to be higher than 19.0% reported by Farayinia *et al* [45] among both in and out patient. The outcome of this study is similar to the one reports by Chedi *et al* [46] who reported 47.9% among the patient in Nigeria. Magalit, [48] reported that environmental factors may have impacted the increase in the prevalence rate since urinary tract is influenced by the contact with exterior [47].

However, the pattern of bacteria isolated in this study showed that there were four different bacteria isolated and Escherichia coli had the highest prevalence 42(51.2%). This is supported by Williams, [47] who reported that Escherichia coli is the most common pathogen responsible for UTIs both among the hospitalised and out patients.

Table 3 showed the isolation of bacteria from urine in relation to sex. It revealed that female subjects had the highest prevalence rate than their male counterpart. This might be as a result of the anatomical structure of the female that predispose them to the pathogen implicated in urinary tract. This is supported by Chedi *et al* [46] who reported that there is higher frequency of isolation among female in all age group.

The distribution of the isolation rate in relation to age showed that age group 21-30 and 31-40years had the highest prevalence rate compare to other studied group. This is in agreement with Magalit, [48].

The antibiotic resistance of the bacteria showed that ciprofloxacin and nitrofurantoin had the least antibiotic resistance, compared to other antibiotics. This high resistance rate reported in this study suggested that there is a major problem in the therapeutic outcome of patients with UTI. This is in agreement with Williams [47].

7. Conclusion

This problem of antibiotic resistance remains a major concern among the patients and health care providers. This is because of the continuous in effectiveness of antibiotics in the management of UTI. Therefore, effort should be put in place to prevent over the counter sale of antibiotics and the need to follow prescription after laboratory investigation remain a good approach in this direction.

Recommendation

Antibiotic resistance is frightening. Nevertheless, the outcome of this study revealed that ciprofloxacin and nitrofurantoin remain drugs of choice for the management and treatment of urinary tract infection.

Compliance with ethical standards

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Disclosure of conflict of interest

Authors have declared that no conflict of interest regarding the publication of this paper.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study."

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