ORIGINAL ARTICLE
Antimicrobial Sensitivity Pattern of Urine Culture Isolate in a tertiary Care Hospital

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ABSTRACT

Aim: To observe sensitivity patterns of urinary tract infections and the micro-organisms causing them in patients presenting with urinary tract symptoms.

Methodology: A sample of 206 patients presenting with complaints of lower urinary tract symptoms and ranging between the age group of 20 to 85 years was included in the study. This was a retrospective study that was carried out in the departments of nephrology at Dr. Akbar Niazi Teaching Hospital (ANTH), Islamabad, from January 2019 to January 2020. Urine samples were collected in sterile containers and processed. Culture and sensitivity analysis based on investigative testing was carried out. CLED medium was used to sub-culture the colonies to get pure growth of the micro-organisms. The Kirby-Bauer disc diffusion process was employed to find the susceptibility of antibiotic in isolated colonies.The bacterial growth was measured after incubation in compliance with the clinical and laboratory standards institute (CLSI) guidelines.

Results: Escherichia Coli was detected in 77 patients (84.6%) among the 91 positive urine cultures; Klebsiella species was found in 7 patients (7.7%); Enterococcus species was present in 6 patients (6.6%) and Pseudomonas was found in 1 patient (1.1%). Maximum efficacy was observed with Imipenem and Fosfomycin (80.5%) followed by Nitrofurantoin (75.3%). All cultures were resistant to Amoxicillin.

Conclusion: Our study shows, Imipenem and Fosfomycin to be the most effective drugs in treatment of UTIs. E coli remains the most common causative organism in this disease and the increase in drug resistance by uropathogens are of significant concern.Communities may benefit from implementation of health education to prevent antibiotic sharing and similar drug abuse.

Keyword: Anti-infective agents; Culture; Microbial sensitivity tests; Urine; Uropathogens; Urinary tract infections.

INTRODUCTION

A Urinary Tract Infection is one of the most common infections in local primary care[1]. Clinically UTIs can be classified as uncomplicated and complicated. Uncomplicated UTIs occur in patients who have a normal, unobstructed genitourinary tract, who have no history of recent instrumentation and whose symptoms are confined to the lower urinary tract. These occur more commonly in young and sexually active woman[2,3]. Complicated UTIs are related with factors that hinder urinary tract host defense including obstruction and presence of foreign bodies such as calculus, indwelling catheters or other drainage devices, neurological disease, renal failure, renal transplant with immunosuppression and pregnancy[4,5].

They are most common cause of hospital acquired infection accounting for approximately 40%[3]. Most common causative agent for both complicated and uncomplicated UTIs is Uropathogenic Escherichia coli (UPEC). Followed by UPEC in preference are Gram negative and positive bacteria and certain species of fungi[6-8].

In uncomplicated cases, UTIs are treated with short course of antibiotics, for example Nitrofurantoin or Trimethoprim/Sulfamethoxazole[9]. Cephalosporins, Amoxicillin, Clavulanic Acid and Fluoroquinolones may also be used[10]. However resistance to Fluroquinolones amongst bacteria that cause urinary infection has been increasing[11].

Due to over the counter use of drugs, antibiotic resistance has become common in our population therefore 7-day course of Oral Cephalosporins is used in areas where resistance rate is greater than ten percent however if local resistance rates are greater than 10 percent, a doze of IV Ceftriaxone is suggested. If symptoms don't improve in 2 to 3 days further diagnostic testing maybe needed[12].

The objectives of the study were to determine the etiological bacterial pathogens of UTI and their sensitivity pattern.

METHODOLOGY

After approval of ethical committee of the hospital, this retrospective study was carried out in the departments of general medicine &nephrology at Dr. Akbar Niazi Teaching Hospital (ANTH), Islamabad from January 2019 to January 2020. After informed written consent a total of 206 patientswho were presenting for the first time to a tertiary care hospital with lower urinary tract symptoms and had no known co-morbid conditions were included in this study. Patients who were already on antibiotic therapy, catheterized, immunocompromised, and/or had previous culture &sensitivity tests showing positive results were excluded from the study. All urine samples sent to the laboratory for urine culture examination during study time period.

For collection of urine samples, patients were provided with sterile, wide-mouthed containers supplied by the laboratory and advised to catch a clean midstream urine specimen in them. These containers were then immediately brought back to the lab for analysis. Isolation and identification of the bacterial pathogens was done by microscopy and conventional culture methods.

The urine sample (0.01ml) was inoculated on cysteine lactose electrolyte deficient (CLED) medium using a standard sterile calibrated wire loop. The plates were read after 24 hours of aerobic incubation at a temperature of 37C⁰. They were then further incubated for another 24 hours before a negative report was issued[13].

Antibiotic susceptibility testing was done on Mueller-Hinton Agar using the Kirby-Bauer disk diffusion method[13]. The zone of the inhibition of the bacterial growth was measured after incubation in compliance with the clinical and laboratory standards institute (CLSI) guidelines. The organisms were subjected to the following antimicrobial drugs: Imipenem, Piperacillin/Tazobactam, Fosfomycin, Minocycline, Nitrofurantoin, Levofloxacin, Gentamicin, Amikacin, Amoxicillin, Cefuroxime, Augmentin, Cotrimoxazole, Cefotaxime, Cefixime, Sulfamethoxazole, Nalidixic Acid, Aztreonam, Ceftriaxone, Ceftazidime, Ampicillin, Ciprofloxacin, Polymyxin and Cephradine, Clindamycin, Erythromycin, Vancomycin, Chloramphenicol and Linezolid. Micro-organisms that

had intermediate susceptibility to the antibiotics were considered resistant to those specific antibiotics.

Data analysis was performed using Microsoft Excel Software for windows (Microsoft Corporation, Redmond, Washington) to determine the susceptibility and resistance patterns of the organisms.

RESULTS

In this study, 91(44.2%) patients out of the total206 showed positive urine culture reports. Amongst these, 59(64.8%) were found to be female while 32(35.2%) patients were male. The total number of patients afflicted and above the age of 50 years was 56(61.5%) while those less than 50 years of age were 35 (38.5%).

The most commonly detected organism was Escherichia Coli (84.6%) followed by Klebsiella (7.7%), enterococcus species(6.6%) and pseudomonas(1.1%).Table 1 depicts the detailed numbers and percentages of all microorganisms identified.
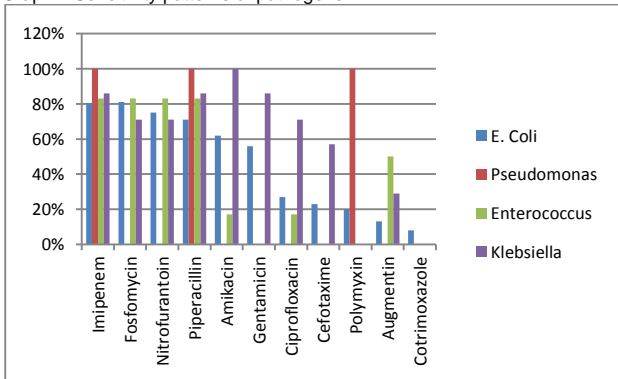
Table I: Distributions of isolates identified from urine cultures

Name of Isolate	Isolated organisms	%age
Escherichia Coli	77	84.6%
Klebsiella	7	7.7%
Enterococcus sp.	6	6.6%
Pseudomonas Aeruginosa	1	1.1%

Escherichia Coli was the predominantly isolated micro-organism 14 of the total, 77 E. coli isolates were found to be ESBL positive. Amongst these 77 positive cultures of E. coli, the antimicrobials that showed maximum efficacy were Imipenem and Fosfomycin (80.5%) bothaffecting 62 of the isolates, followed by Nitrofurantoin (75.3%) to which 58 of the isolates were susceptible. All 77(100%) cultures were resistant to Amoxicillin. Following this, maximum resistance was seen for Minocycline (64.9%) and Cefuroxime (54.5%). The detailed patterns of sensitivity and resistivity for all antimicrobials tested for E.coli are described in graph I&II below.

After E.coli in all the positive cultures were Klebsiella isolates 7(7.7%). Amongst these, all 7 (100%) were sensitive to Amikacin while 6 isolates (85.7%) each were susceptible to Imipenem, Piperacillin/Tazobactam and Gentamicin. Similar susceptibility patterns were seen for Fosfomycin, Nitrofurantoin and Ciprofloxacin (71.4%) by 5 isolates each, respectively. The highest resistance was observed towards Cotrimoxazole, Ampicillin and Amoxicillin by 6(85.7%) isolates to which 0.0% of the samples were susceptible. The detailedpattern is as follows (graph I&II).
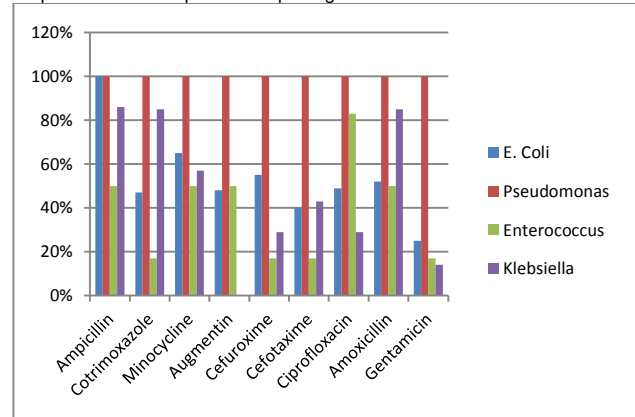
Graph I: Sensitivity patterns of pathogens

Enterococcus species were detected in 6(6.6%) patients. Identical efficacy (83.3%) was seen by Vancomycin, Linezolid, Fosfomycin, Imipenem, Piperacillin/Tazobactam and Nitrofurantoin towards 5 of these samples, respectively. This was followed by 3(50%) of the cultures responding to Minocycline, Ampicillin, Amoxicillin and Augmentin. The drugs towards which 0.0% susceptibility was detected were the Cephalosporins, Erythromycin and Clindamycin.

Maximal resistance was seen towards Levofloxacin, Ciprofloxacin, Erythromycin and Clindamycin (Pseudomonas aeruginosa was spotted in 1(1.1%) of the positive cultures. The single growth showed absolute susceptibility to Imipenem, Tazobactam/Piperacillin and Polymyxin whereas complete resistance (100%) was noticed towards Levofloxacin, Cotrimoxazole, Gentamicin, Cephalosporins and Amikacin (graph I&II).

Graph II: Resistance patterns of pathogens

DISCUSSION

The incidence of UTI is more frequently observed in women, due to the design of their anatomy which consists of a smaller urethra as compared to men and its close proximity to the anal canal and vagina. This makes it easier for the bacteria to reach the urinary tract. The current study consisted of 91 total positive cultures, of which 59 (64.8%) belonged to females while only 32(35.2%) belonged to males. This gives us an approximate ratio of 2:1. Similar findings were reported by Anwar Ullah et al in Mansehra which showed a predominance of women with UTI[12].

In our study, most frequently occurring uropathogens were the E coli and Klebsiella spp, Ecoli accounted for 84.6% of the total positive cultures, while Klebsiella spp were seen afflicting 7.7%. These findings were similar to other studies conducted within the country[14,15]. In other studies conducted worldwide, analogous results were obtained which showed that the predominant pathogen causing UTI was E coli[16].

There is a trend of increasing antibiotic resistance in pathogens causing urinary tract infection. Antimicrobial resistance in developing countries is due to community level poor hygiene, self-medication and frequent prescription of antibiotics as empirical therapy are amongst the main causes for rise in. In our study, Ampicillin had the highest level of drug resistance, to which 86 of the total 91 positive samples were resistant. This is a percentage of 94.5% resistance by urinary pathogens. Resistance to Ampicillin was followed by Minocycline (62.6%), Amoxicillin (53.8%), Cotrimoxazole (53.8%) and Cefuroxime (51.6%). All of these showed a resistance pattern of greater than 50% in our study.The most effective antibiotic against urinary tract infections was Imipenem to which 74(81.3%) of the samples were susceptible. Second-line agents included Fosfomycin (79.1%) and Nitrofurantoin (74.7%).

It has been stated that in Pakistan, ampicillin is highly resistant for E coli, as observed by Rahman and Zaidi et al.[15,16]In the current study, 100% resistance was noted towards ampicillin which is similar to the previous findings of Noor et al[17]. Multiple other studies also done within the country have observed similar findings[18-20]. Second in line to ampicillin was minocycline to which a resistance of 64.9% was exhibited by our E. coli isolates. This data differed from a previous study done in Islamabad which discovered a much lower resistance rate of 5% to minocycline[18]. A resistance

of 54.5% was also seen towards Cefuroxime by the uropathogens in our study. In recent times, the use of cefuroxime has increased for the treatment of UTI within multiple hospitals across the globe. This indicates towards the poorer action of the drug.

Imipenem and Fosfomycin were the most effective antimicrobial agents towards E.coli in our study, exhibiting 80.5% sensitivity. Our results were supported by several other studies where the susceptibility rates of urinary pathogens to Imipenem specifically were found to be very high[19,20]. Selective administration to hospitalized patients based on culture reports and its uncommon use as empirical therapy may be accredited to the low resistance rates seen for this antimicrobial agent.

Limitation of study: The main limitation to our present analysis included the lack of clinical information as the study was of retrospective nature. This rendered us somewhat incapable of categorizing patients based on symptoms.

CONCLUSION

In our study, E coli still remains the commonest pathogen in urinary tract infections and the bacterial spectrum seems to have not changed much over the last couple of years. Antibiotic resistance however is certainly evolving at a remarkable rate for which continuous surveillance and a deeper search into finding the causes for drug resistance is warranted. Communities may also benefit from implementation of health education to prevent antibiotic sharing and similar drug abuse.

Conflict of interest: Nil

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