



FREQUENCY AND ANTIMICROBIAL SUSCEPTIBILITY PROFILES OF URINARY PATHOGENS

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Abstract

Urinary tract infections are among the commonly occurring microbial infections ranked as second frequently occurring infectious disease with 150 million diagnosed cases per year. (1) This study was intended to oversee the occurrence of pathogens isolated from urine cultures along with the anti-microbial susceptibility patterns of most common pathogen obtained in a tertiary care Centre. A retrospective study was conducted in the Microbiology department of Chaudhary Mohammad Akram Research and Training Hospital (CMA), Lahore during the period of March 2021 to December 2021. Urine cultures received during this 10 month period were analyzed and the most common organism isolated along with its susceptibility pattern was assessed. During study period, 200 urine cultures were received, out of which 93 turned out to be positive, making the percentage positivity of 46.5%. Most common organism was *E.coli* i.e. 43%, followed by *Candida species* i.e. (17%). *E.coli* was found in 52.5% of female population. Considering the susceptibility pattern of *E.coil*, most sensitive options of antibiotics were Nitrofurantoin (87.5%), followed by Imipenem (70%) & Amikacin (62.5%). Most resistant antibiotic options were Ampicillin, Nalidixic acid & Ciprofloxacin (2.5%). 82.5% of *E.coli* isolates were found to be ESBL producers. This research concluded that patients with UTI are at high risk of developing antibiotic resistance. Uro-pathogens isolated in the present study exhibited highest rate of susceptibility against nitrofurantoin, amikacin and imipenem which can be empirically utilized for treatment of urinary tract infections.

Key words: UTI, Nitrofurantoin, ESBL, *E.coli*

Introduction:

Urinary Tract Infections (UTI) are amongst the highly prevalent bacterial infection in human population and is also one of the most commonly occurring hospital acquired infections. Yearly about 150 million people are affected by it and causes roughly 6 billion US dollars healthcare cost burden to the international economy.(2) Uncomplicated UTI are generally more common, accounting for 25% of all antibiotic prescriptions.(3)

Literature Review:

Significant bacteriuria is greater than 10^5 organisms per ml in a midstream urine and caused principally by *Escherichia coli* (>75 % of cases), (4) followed by other members of *Enterobacteriaceae*, *Staphylococcus saprophyticus* and *Enterococcus faecalis*. Single bacterial specie is usually the cause of urinary tract infections but polymicrobial infections may also ensue.

Escherichia coli & *Enterobacteriaceae* are among the most common gram-negative bacteria instigating UTI in the community accounts for roughly 75% of the cases. (5) Antimicrobial resistance in urine cultures, is on a rise which postpones recovery and escalates morbidity.

It is estimated that during the period of life time approximately 35 % of females suffer from UTI. More women are affected by UTI as compared to men, most probably either due to anatomical predilection or additional host factors. (6) Most UTIs are preceded by vaginal colonization with urinary pathogens. The other influences backing to upsurge the incidence of UTI in females are sexual activity, pregnancy and obstruction. (7)

Broad spectrum antimicrobials are the mainstay of treatment of UTI and most cases are managed management empirically without carrying out culture and sensitivity. The emergence of multi drug resistant strains of bacterial pathogens is based on the inapt and non-judicious practice of antibiotics leading to global antibiotic resistance in bacteria. (8) European Survey of Antibiotic Consumption conducted a survey and concluded that multidrug-resistant (MDR) bacterial strains were accountable for a mortality rate approximately about 25,000 Europeans/year typically owing to complications caused by UTIs. (9)

Verification from the work done in Pakistan also concluded that *Escherichia coli* and *Klebsiella pneumoniae* are the two most common organisms causing UTI.(9) Most of the studies from Pakistan have similar findings. (9) This study engaged seventy females of reproductive age group with confirmed the diagnosis of UTI. Amikacin was acknowledged as being the utmost effective antibiotic (97.6%) against *E. coli* (10) followed by Nitrofurantoin (90%) according to another study conducted in Pakistan that tested fourteen antibiotics. In current years the response of urinary pathogen to antibiotics has been altering promptly and modification in resistance of these causative organisms acquired from the community has also augmented. Precisely the prodigious worry for UTIs is antimicrobial resistance and major reasons for treatment failure in infectious diseases. (4)

Rationale of Study:

This analysis was conducted to conclude the current standing of frequency of bacterial pathogens and susceptibility patterns of frequently isolated organism against antibiotics, isolated from urine culture samples received in a tertiary care hospital with the goal to formulate antibiogram for the correct choice of empirical therapy.

Aims & Objectives:

1. To find out the spectrum of bacterial isolates obtained from urine culture samples.
2. To evaluate the susceptibility patterns of most common isolated bacteria.

Materials & Methods:

This was a retrospective study conducted in Microbiology department of Chaudhary Mohammad Akram Research and Training Hospital (CMA), Lahore during the period of March 2021 to December

2021. Urine cultures received during this 10 month were processed and analyzed. According to the current standards organisms were identified by the microbiological techniques and Kirby Bauer Disc diffusion procedure was used for susceptibility testing according to the guidelines of Clinical and Laboratory Standards Institute (CLSI) 2021 and susceptibilities of most common isolated bacteria were analyzed and interpreted. Extended spectrum beta lactamase (ESBL) detection was done by double disc diffusion technique.

Inclusion: The susceptibility profile of *E. coli* has been incorporated solely for the selected antibiotic panel, reflecting a focus on high-frequency occurrences.

Exclusion: Less frequently encountered isolates have been deliberately excluded from consideration.

Results:

During the period of 10 months, starting from March 2021 to December 2021, 200 urine cultures were received in CMA laboratory, out of which 93 turned out to be positive, making the percentage positivity to be 46.5%. Figure 1 is showing the percentage of organisms obtained from positive urine cultures.

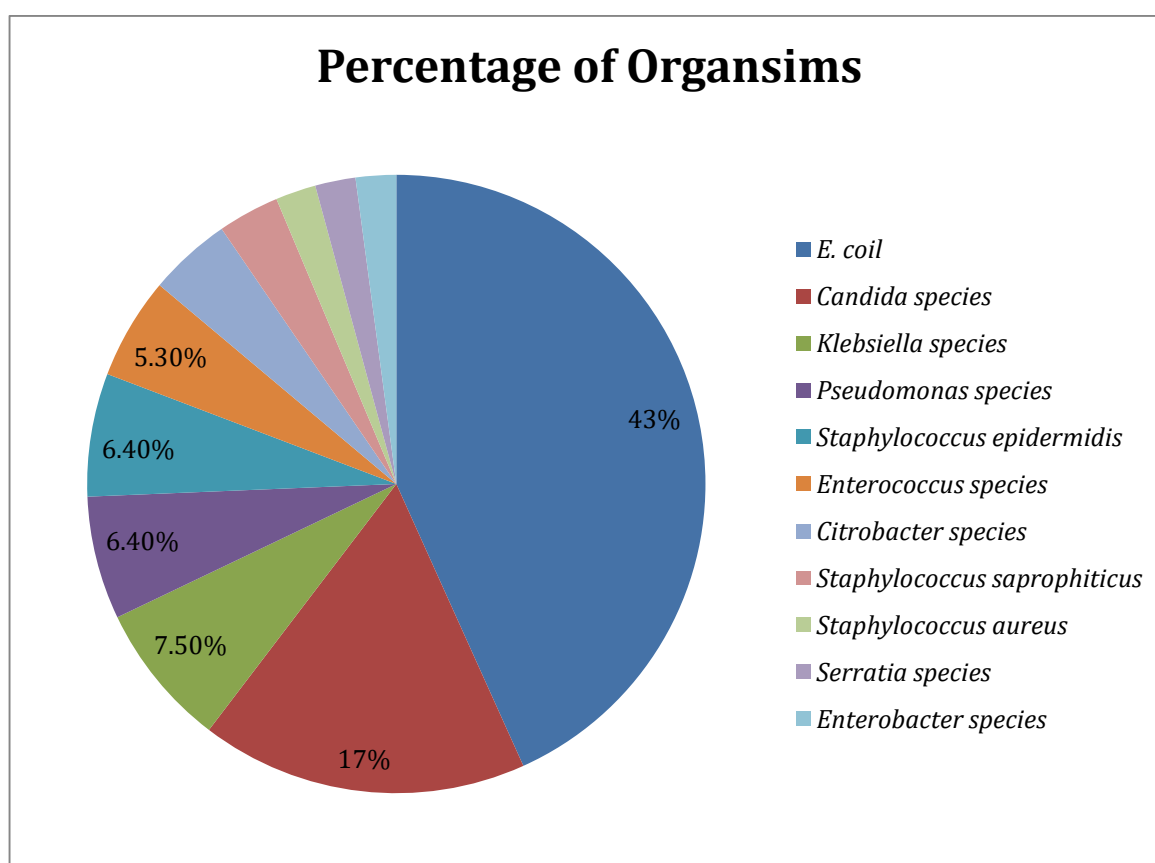


Figure 1: Percentage of Isolated Organisms

According to our findings, the most common organism obtained was *E.coli* i.e. 43%, with a slight tilt towards female population (52.5 % females). This was followed by *Candida species* i.e. (17%). Considering the susceptibility patterns of *E.coli*, the most sensitive options of antibiotics were Nitrofurantoin (87.5%), followed by Imipenem (70%) and Amikicin (62.5%). The most resistant antibiotic options for *E.coli* were Ampicillin, Nalidixic acid & Ciprofloxacin (2.5%). (Table: 1) Piperacillin-tazobactam (57.5%) and Fofomycin (52.5%) were also amongst more the 50% susceptible options of antibiotics. 33 isolates (82.5%) of *E.coli* were found to be ESBL producers i.e. resistant to all the 3rd generation cephalosporin and amoxicillin-clavulanic acid combination.

Table 1: Susceptibility Profile of *E.coli* against Selected Panel of antibiotics

Antibiotics	Resistant n (%)	Sensitive n (%)
Ampicillin	39 (97.5)	1 (2.5)
Amoxacillin clavulanic acid	33 (82.5)	7 (17.5)
Piperacillin tazobactam	17 (42.5)	23 (57.5)
Ceftazidime	33 (82.5)	7 (17.5)
Ceftriaxone	33 (82.5)	7 (17.5)
Cefixime	33 (82.5)	7 (17.5)
Cefuroxime	33 (82.5)	7 (17.5)
Imipenem	12 (30)	28 (70)
Meropenem	26 (65)	14 (35)
Amikacin	15 (37.50)	25 (62.5)
Gentamicin	23 (57.5)	17 (42.5)
Nalidixic acid	39 (97.5)	1 (2.5)
Ciprofloxacin	39 (97.5)	1 (2.5)
Levofloxacin	35 (87.5)	5 (12.5)
Nitrofurantoin	5 (12.5)	35 (87.5)
Fosfomycin	19 (47.5)	21 (52.5)
Trimethoprim sulfamethoxazole	35 (87.5)	5 (12.5)

Discussion:

E. coli is the major cause of UTI and a very common infection and its eradication is a challenge in the developing countries like Pakistan, due to the increasing resistance in the current scenario.

Keeping this in mind the current study was conducted to look in to the urinary pathogens and to find out the sensitive empirical treatment options for the most commonly isolated bacteria. Analysis of our study findings showed that 46.5% of the urine cultures received turned out to be positive for microorganisms. Almost similar results were observed from a study conducted in Bushenyi District in Uganda (32.2%). (11) This was in contrast to a study conducted in Italy and in National Hospital Abuja in Nigeria i.e. 13.1%. (12)

The outcome of our study showed that *E. coli* was found to be the most frequent cause of UTI in current study population, which are comparable with a study conducted in a paediatric population from Shiraz. (13) Similar results have been observed from studies performed in different regions of Iran, with a rising frequency up to 78.1% in reports from the west.(14, 15) *Escherichia coli* and *Enterococcus faecalis* as the most representative Gram-negative and Gram-positive strains obtained from a study from single Academic High-Volume Center in Italy during 2015–2019. (12)

E.coli is known to be the most common cause of urinary tract infections in young females. Similar findings were observed in our study, with a slight tilt towards female population i.e. 52.5%, comparable to studies from China and other parts of Pakistan.(16) Their high predisposition to contract infection is due to their genital anatomy. (17)

Considering the susceptibility profile of the study isolates, Nitrofurantoin proved to be most effective antibiotic for *E.coli* (87.5%) almost similar to studies from Nigeria and other parts of Pakistan. (18, 19) Likewise, study isolates showed 70% sensitivity to Imipenem followed by Amikacin i.e.62.5%. Almost parallel findings were observed in a study from Swabi, Pakistan. (20) Fosfomycin and piperacillin tazobactam also turned out to be susceptible around 50 percent, which is in contrast to a study from Italy showing a highly sensitive pattern for these two drugs i.e. almost above 90%. (12) Looking at the antibiotics that have lost their efficacy over a period of time, it was observed that, Ciprofloxacin that was once the treatment of choice for urinary tract infections turned out to be only 2.5 sensitive and similar was the case with Nalidixic acid and Ampicillin. These findings were consistent with the work done in Venezuela. (21)

Similarly Amoxicillin clavulanic acid was once amongst the choices for treatment of uro-pathogens, and only 17.5% of sensitivity was observed in our study isolates, comparable to study from Swabi.²³. The cause of resistance in this class of antibiotic is most commonly the production of ESBL in the *E.coli*.

82.5% of *E.coli* was found to be ESBL producers i.e. resistant to all the 3rd generation cephalosporin and amoxicillin-clavulanic acid combination, in contrast to the reports that showed the prevalence of ESBL producing *E.coli* to be only 33% from North of Pakistan. This rise in ESBL production is the usual trend both nationally and internationally.

Conclusion:

The study showed that UTI is the leading public-health problem mainly in women. In our study, the predominant isolated organism responsible for UTI was *E. coli* followed by *Candida species*. The strains represented in our study have focused attention on the poor control and management of UTI and injudicious use of antibiotics. Keeping this scenario in view, it is recommended that the choice of empirical antibiotic therapy should be based on awareness of the localized epidemiological trends.

Funding Information:

No funding involved

Authors' Contribution:

Dr. Sadia Ikram: Conception, planning of research, Data Collection, and writing of manuscript, Discussion. **Dr. Saima Inam:** Substantial contributions to acquisition of data and manuscript writing, **Dr Tariq Ahmed:** Help in references, Discussion. **Dr Ayesha Sarwar:** Substantial contribution to analysis and interpretation of data and referencing, **Dr Nida & Ifza Shahzadi:** Substantial contributions to analysis and interpretation of data, **Dr Syed Zeeshan Haider, Dr Aroosh Shabir & Dr Ashok Kumar:** Proof Reading and critically revised the paper in keeping with important intellectual content.

Conflict of Interest:

Authors state no conflict of interest.

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