Original Article

Antibiogram Pattern of Urinary Tract Infections

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ABSTRACT

Objective: To determine the susceptibility pattern of three most common uropathogens; E. Coli, Enterococci sp and Klebsiella sp.

Study Design: A cross-sectional study

Place and Duration of Study: This study was conducted at the Department of Urology, National Institute of Kidney Diseases, Shaikh Zayed Hospital, Lahore from 1st March to 30th June 2021.

Materials and Methods: One hundred and thirty patients were selected with confirmed UTI symptoms. Early morning mid-stream urine was collected in sterile wide mouth containers and exposed to CLED (a differential media) to get pure growth. The isolated microbes were subjected to Kirby-Bauer disk diffusion method to obtain antibiotic susceptibility pattern of each uropathogen. Muller Hilton agar plate was used to receive susceptibility pattern to test antibiotics. Uropathogens were declared sensitive, intermediate or resistant by using CLSI.

Results: E.coli, Enterococci sp and Klebsiella sp were found 46.20%, 33.10% and 21.70%, respectively in 130 clinically verified UTI patients. Escherichia Coli showed 90% sensitivity to Colistin and 86.70% to Nitrofurantoin. Whereas, Enterococci sp manifest 100% sensitivity to Linezolid, Teicoplanin and Gentamycin. Klebsiella sp exhibited maximum sensitivity to Aminoglycosides group (Amikacin 92.6% and Gentamycin, 92.6%).

Conclusion: E. coli was the most common pathogen in the urine of the UTI patients. Irrational consumption of antibiotics is increasing and the pipeline to develop new antibiotics is dry. Antibiotics should be used rationally in clinical setups employing locally designed antibiogram patterns.

Key Words: Antibiogram, Uropathogens, Antibiotics, Culture

INTRODUCTION

Almost 150 million people are suffering from UTI in the world.[1] Incidences of patients suffering from UTI are exected to be 18/1000 per year in general population and ranked on second highest infections globally.[2] In Pakistan the UTI cases are on the rise which accounts for 18-20 % of clinical diagnosis. Apart from financial constraint it significantly affects the quality of life of the patients.[3] It is more prevalent in women of reproductive age which is influenced by educational and marital status.[4] In comparison with males (7.4%), females (14.6%) are more prone to UTI.[5]

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E.coli, Enterococcos sp and Klebsiella sp are the most common causative agents.[6] E.coli has the ability to form intracellular capsules that enables them to evade the hummoral immune response.[7] E.coli is followed by Enterococcos sp in term of most common cause of UTI.[2] Enterococcos sp has intrinsic affinity to invade cells and form intracellular colonies to prevent host responses revealed by confocal microscopy.[8] Enterococcos feacalis in Enterococcos sp has tropism in kidney which may persists in kidney for about two weeks causing pyelonephritis as presented in Murine Models.[9] Unjudicious use of antibiotics to treat UTI has birth out the escalating prevalence of resistant uropathogens.[10] Unauthorized prescription of antibiotics, lack of appropriate surveillance of Drug Regulating Authority of Pakistan (DRAP) and patient's education has given rise to resistant uropathogens.[11] Antibiogram is the generation of antibiotic susceptibility pattern of different uropathogens for rational use of antibiotics.[12] It is essential to ensure rational use of antibiotics as the clinical pipeline for new antibiotics is dry.[13] In view of the above there is a dire need to carry out investigations on uropathogens of the UTI patients and determine the local antibiogram pattern for susceptibility of various antibiotics. Consequently, a study was designed at NIKD, SHZ Lahore to find out the local antibiogram pattern of uropathogens.

MATERIALS AND METHODS

This cross–sectional study was devised on UTI patients presented with complaints of burning micturation at NIKD, SZH, Lahore from March to June 2021. Consecutive sampling technique was opted for the study. 250 patients with burning micturation complaints were enrolled for this study. However, finally 130 patients were selected with confirmed UTI clinical symptoms like burning micturation, dysuria along with uropathogen growth of about 10^5CFU/ml (Krass Criteria) in urine culture.

Identification and Isolation: Urine sampling was done under sterile conditions. Patients were provided with sterile containers with the instructions to void mid-stream urine in the morning into these containers that were tightly packed and sent to the Microbiology Department of SZH, Lahore. A sterile loop was entered into each container and 2 microliter film was produced in the loop and then placed on the CLED agar (Cystine-Lactose-Electrolyte Deficient). It was then placed inside the incubator at 35-37°C for 48 hours. Colony forming units were apparent on the CLED after 48 hours. Colonized bacterial growth was then placed on to the nutrient enriched agar (Muller Hilton Agar) to enhance the bacterial growth and then the antibiotic susceptibility plate is placed over the bacteria enriched Muller Hilton Agar for 48 hours. Disk Diffusion Test was performed by allowing the antibiotics to diffuse the bacteria enriched agar and zone of inhibition was measured by CLIS criteria to declare the sensitivity of a uropathogen to a specific antibiotic by measuring the zone of inhibition.Uropathogens were identified by Biochemical and Gram stain test.

Antibiotic Susceptibility Test: E. coli was exposed to Colistin, Amikacin, Fosfomycin, Gentamycin, Nitrofurantoin and Polymycin B antibiotics. Enterococci sp was subjected to Ampicillin, Amoxicillin, Linezolid, Teicoplanin, Vancomycin, Nitrofurantoin, Fosfomycin and Gentamycin. While Klebsiella was exposed to Pipracillin/Tazobactam, Colistin, Amikacin, Gentamycin, Imipenem and Polymycin B and antibiotic susceptibility pattern of each uropathogen was calculated. For the data interpretation Microsoft Excel was used to generate histograms.

RESULTS

Escherichia coli is found in 46.20% of the cases. Enterococci sp accounts for 33.10% that is the second highest infection revealed in our analysis whereas, Klebsiells sp is present in 21.70% of urine analysis of the UTI patients (Fig. 1).

Aminoglycosides sensitivity pattern for E.coli is following: Amikacin, Gentamycin and Nitrofurantoin show 85%, 88.3% and 86.70% sensitivity respectively. Fosfomycin is susceptible in 56.70% in E.coli sp. While

Polymycin B and Colistin susceptibility is detected in 85% and 90% of the UTI cases (Fig. 2).

Linezolid, Teicoplanin and Gentamycin are sensitive in 100% of cases. Enterococci sp is sensitive to following antibiotics: Ampicillin (74%), Amoxicillin (72%), Vancomycin (91%), Nitrofurantoin (86%), Fosfomycin (65%), Linezolid (100%),Teicoplanin(100%) and Gentamycin (100%) [Fig. 3].

Sensitivity of Klebsiella sp to various antibiotics is following: Pipracillin/Tazobactam (81.48%), Colistin (81.48), Amikacin (92.60%), Gentamycin (92.60%), Polymycin B (88.80%) and Imipenem (96.29%) (Fig. 4).
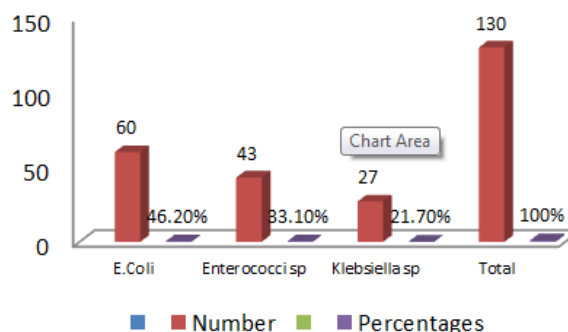

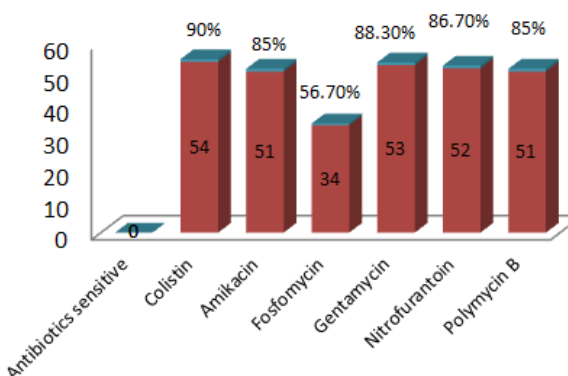**Figure No.1: Percentages of different uropathogens**

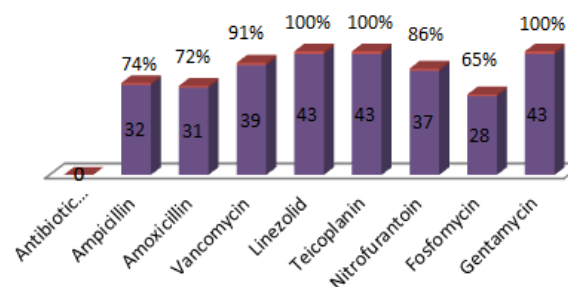**Figure No.2: Susceptibility pattern of E. coli to various antibiotics.**

Figure No.3: Percentages of Enterococcos sp susceptibility to various antibiotics
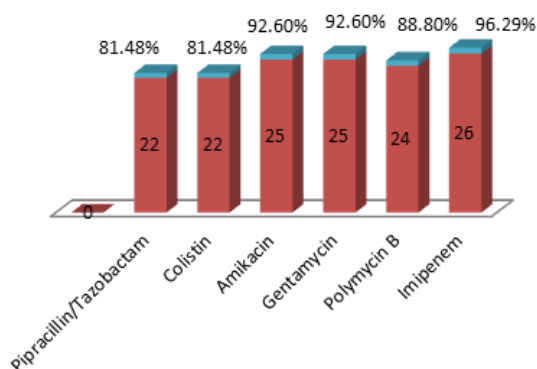
Figure No.4: Percentages of Klebsiella sp sensitive to each antibiotic

DISCUSSION

The current study reveals that out of 130 UTI patients, E.coli was found in 46.20% cases. E.coli showed highest vulnerability to Colistin (90%), Amikacin (85%) and Polymycin B (85%) in our analysis. Kumar et al., (2013) have reported the ability of Nitrofurantoin to E.coli as an effective antibiotic which is consistent with our study.[15] Antibiogram pattern of Aminoglycosides (Amikacin and Gentamycin) of this study showed similar results with the findings of Daoud et al. However, Fosfomycin has not been proven as effective as declared by Daoud et al.[16] Outcome of the present work regarding efficacy of Colistin against E.coli shows consistency with the findings of Dharati et al.[17] The present work shows that Amikacin is a rational treatment plan for urinary E.coli.[18] Current investigation reveals that Polymycin B is effective against E.coli which is parallel with the work reported by Ezadi.[19] Enterococcos sp accounts for 33.10% of the cases. Glycopeptides like Vancomycin and Teicoplanin shows 91% and 100% efficacy while Aminoglycosides like Nitrofurantoin has 86% effective against urinary Enterococcos sp in terms of antibiotic sensitivity and our findings are articulated with the work done by Maria.[20] and Muzammil et al. However, Teicoplanin sensitivity is seen in 72% of Enterococci sp in analysis retrieved by Muzammil et al.[21] Enterococcos sp are found 100% susceptible to Gentamycin which is an essential antibiotic in armamentarium against urinary Enterococci sp that is in line with the analysis of Kumari.[22] Linezolid and wide spectrum pencillinase inhibitors (Ampicillin and Amoxicillin) are effective against urinary Enterococci sp and our findings endorse the work of Muzammil (2020).**21.** Barros (2009) has reported the efficacy of Ampicillin (67%) and Amoxicillin (78%) against Enterococci sp similar to the findings of our study.[23] Teicoplanin and Linezolid have come up with stupendous result and encouraging efficacy against Enterococci sp as delineated in our study.[24]

As far as the Klebsiella sp are concerned, it holds a share of about 16% of total cases.[25] Present study endorses the effectiveness of Amikacin for Klebsiella sp by 92.60% similar to the efficacy ratio calculated by Virawan.[25] Present work indicates 81.48% efficacy of Klebsiella sp for Colistin that is parallel with the results presented by Kathia et al.[26] Polymycin B showed 88.80% effective regimes for Klebsiella sp in the current study while Bukhari (2019) has asserted 100% efficacy of Polymycin B for Klebsiells sp.[17] Pipracillin/Tazobactam and Imipenem are an effective antibiotics for management of urinary Klebsiella sp as prsented by the study of Abdullah et al.[27] Aminoglycosides (Gentamycin and Amikacin) have intrinsic activity to nullify urinary Klebsiella sp symptoms with reference to our investigation.[26,28] and our study is in contrast with the Bouamri et al., (2015) who have claimed 21% efficacy for Gentamycin and 11% efficacy for Amikacin.[29]

CONCLUSION

The present study reveals that E.Coli, Enterococcos sp and Klebsiella sp are the most common pathogens found in the UTI patients. E.coli and Klebsiella sp responded maximally to Polymycins and Aminoglycosides while, Enterococcos sp showed efficacious response to Glycopeptides, Oxazolidinone (linezolid), Penicillins and Aminoglycosides.

Author's Contribution:

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Final Approval of version:	Muhammad Tayyab Naeem

Conflict of Interest: The study has no conflict of interest to declare by any author.

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