Section: Microbiology

Original Research Article

A STUDY ON URINARY TRACT INFECTIONS CAUSED BY MULTIDRUG RESISTANT KLEBSIELLA SPECIES IN A TERTIARY CARE HOSPITAL

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Abstract

The study focuses on urinary tract infections (UTIs) caused by multidrug-resistant Klebsiella species in a tertiary care hospital. Klebsiella, a Gram-negative bacterium, poses a significant health threat due to its resistance to common antibiotics. The research aims to isolate Klebsiella strains, identify their antibiotic susceptibility patterns, and assess the prevalence of multidrug resistance. Results indicate a high incidence of MDR Klebsiella among inpatients, particularly in critical care units, with 25.26% overall MDR prevalence. Notably, 65.95% of MDR Klebsiella are sensitive to ceftazidime-avibactum, and 38.29% to cotrimoxazole, suggesting potential strategies for managing and controlling these infections in hospital care settings through combination therapy and stringent infection control measures.

INTRODUCTION

Multidrug-resistant Klebsiella species (MDR-Klebsiella species) are becoming increasingly common over the world. Klebsiella is a Gram-negative bacterium that can be frequently found in the mouth, on the skin, and in the intestines, as well as in natural environments like water and soil. [1] Klebsiella is emerging as an important bacterial isolate causing Urinary tract infections in adults having multiple drug resistant to common antibiotics. The WHO has reported Escherichia coli and Klebsiella pneumoniae as the most common bacteria causing UTIs. [2] Antimicrobial resistance is the capability of a microorganism to resist the action of the different antimicrobials. [3] In this type of resistance, microbes can resist the medication that could once be successful against them. Globally, the drug resistance is increasing due to indiscriminate use of antimicrobial agents. Resistance microbes are hard to treat, requiring alternative or higher doses of antimicrobials or lack/shortage of effective antimicrobials, adversely affecting countries at all levels of development. As per the statement of World Health Organization (WHO), MDR pathogens called 'superbugs' are one of the major public threats that yearly cause several million deaths globally. [4] The burden of UTIs worldwide leads to increased antibiotic usage, including both self-administration and inappropriate prescribing. Although about 80% of those with UTI are managed in outpatient departments, inappropriate empirical therapy is associated with prolonged treatments, hospital stays, increased costs and higher mortality.

The isolation and identification of resistance pattern of Klebsiella infection helps in selection of appropriate antibiotics, reducing the morbidity of patients and in reducing the spread of resistant strains in community.

Objectives

- To isolate the Klebsiella species causing Urinary tract infections.
- To identify the antibiotic susceptibility pattern of multidrug resistant Klebsiella species causing Urinary tract infections.

MATERIALS AND METHODS

The study was conducted at the department of Microbiology, Govt Kilpauk Medical College and hospital for a period of 3 months from July 2022 to September 2022. Around 2654 urine samples collected from both outpatient and inpatient departments presenting with symptomatic urinary tract infections during this period were included in the study and processed in routine culture medium, CLED (Cysteine Lactose Electrolyte Deficient Medium). Around 186 urine samples grew Klebsiella

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species which was identified based on the routine biochemical reactions like Indole, Triple sugar Iron agar, Citrate and Urease tests respectively. The Klebsiella species isolated were streaked on to Muller Hinton agar and antibiogram was performed by Kirby Baur disc diffusion method. Phenotypic confirmatory tests for ESBL, MBL and Amp C producers were also done as per CLSI 2022. [5]

RESULTS

Out of the 186 Klebsiella species isolated from the urine samples, 82 (44.1%) were from outpatient departments and 104 (55.9%) were from in patient departments [Table 1]. Out of 186 Klebsiella isolated 47 (25.26%) were found to be multidrug-resistant. Out of 47 MDR Klebsiella isolated 5(10.63%) was from outpatient and 42(89.36%) was from in patient departments [Table 1.1].

The predominant Klebsiella isolated were from female patients 142 (76.34%), but in MDR Klebsiella both sexes were equally affected, 24 (51.06%) in males and 23 (48.93%) in females [Table 2].

Most of the Klebsiella isolated were from Medical ICU (41.34%), Surgery ICU (26.92%) and Ortho HDU (20.19%) [Table 3].

All the Klebsiella including MDR Klebsiella isolated were mostly sensitive to Ceftazidime avibactum (65.95%), Cotrimoxozole (38.29%) and Cefaperazone sulbactum (21.27%) [Table 4] [Table 5].

Table 1: Distribution of Klebsiella species in outpatient and inpatient departments n=186

	No of Klebsiella species isolated(N)	%
OP	**82**	**44.1**
IP	**104**	**55.9**
Total	**186**	**100**

Table 1.1 Distribution of MDR Klebsiella n=47

	MDR Klebsiella	%
OP	5	11
IP	42	89
Total	47	

Table 2: Sex distribution of the Klebsiella species isolated from the urine samples

	No of male patients		No of female patients	
Klebsiella species isolated n=186	44	23.65%	142	76.34%
MDR Klebsiella isolated n=47	24	51.06%	23	48.93%

Table 3: Ward distribution of Klebsiella species isolated from in patient departments

S.NO	WARD	No of Klebsiella species isolated N=104	%	MDR-Kleb isolated N=42	%
1.	IMCU	43	41.34	15	35.71
2.	Surgery ICU	28	26.92	15	35.71
3.	Ortho HDU	21	20.19	12	28.57
4.	Obstetrics HDU	5	4.80	-	-
5.	Other wards	7	6.73	-	-

Table 4: Antibiotic susceptibility pattern of the Klebsiella species isolated N=186

S.NO	NAME OF THE DRUG	SENSITIVE	%
1.	Ampicillin (AMP)	-	-
2.	Amikacin (AK)	135	72.58
3.	Amoxyclav (AMC)	110	59.13
5.	Ceftazidime-avibactum (CZA)	166	89.24
6.	Cefaperazone-sulbactum (CFS)	138	74.19
7.	Cefazolin (CZ)	115	61.82
8.	Cefoxitin (CX)	112	60.20
9.	Cotrimoxazole (COT)	153	82.25
10.	Cefipime (CPM)	120	64.51
11.	Cefotaxime (CTX)	104	55.91
12.	Ceftriaxone (CTR)	104	55.91
13.	Gentamicin (GEN)	101	54.30
14.	Imepenem (IPM)	135	72.58
15.	Meropenem (MRP)	135	72.58
16.	Piperacillin tazobactum (PTZ)	142	76.34

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Table 5: Antibiotic Susceptibility Pattern of MDR Klebsiella species isolated N=47

S.NO	NAME OF THE DRUG	SENSITIVE	%
1.	Ampicillin (AMP)	-	-
2.	Amikacin (AK)	-	-
3.	Amoxyclav (AMC)	-	-
4.	Ceftazidime (CAZ)	-	-
5.	Ceftazidime-avibactum (CZA)	31	65.95
6.	Cefaperazone-sulbactum (CFS)	10	21.27
7.	Cefazolin (CZ)	-	-
8.	Cotrimoxazole (COT)	18	38.29
9.	Cefipime (CPM)	-	-
10.	Cefotaxime (CTX)	-	-
11.	Ceftriaxone (CTR)	-	-
12.	Gentamicin (GEN)	-	-
13.	Imepenem (IPM)	-	-
14.	Meropenem (MRP)	-	-
15.	Piperacillin tazobactum (PTZ)	7	14.89

DISCUSSION

Table 1&1.1 shows that among the 186 Klebsiella and 47 MDR Klebsiella species isolated majority of them were from in patients' urine samples (55.9%) (89.36) respectively. This is in concordance with the results of MDR Klebsiella isolated in the study conducted by B.L.Chaudhary et al.[6] In a study conducted by Mojgan Farhadi et al,[7] and Tuhina Banerjee et al,[8] showed the prevalence and emergence of Multidrug and extensively drug resistant Klebsiella in hospital settings. This shows that Klebsiella is a predominant pathogen in catheterised patients there by leading to colonisation and development of Multi drug resistance in Klebsiella species.

Table 2 shows that female patients attending both the outpatient and inpatient departments were predominantly affected (76.34%) whereas there was not much differences among in patients (51.06%) (48.93%). This was similar to the study conducted by Deepali A et al (64%). [9] This shows that though females having shorter urethra were more prone to get UTI but in catheterised in patients this difference is nullified due to the presence of catheter which may be the major cause for Hospital acquired Catheter associated Urinary Tract Infection. Table 3 also shows that admission of patients in various intensive care units has a great impact on the colonisation of MDR Klebsiella.

Table 4 shows the susceptibility pattern of the Klebsiella species isolated. Most of them were susceptible to Ceftazidime avibactum (89.24%), Cotrimoxazole (82.25%), Piperacillin tazobactum (76.34%), Cefaperazone sulbactum (74.19%) followed by Amikacin, Meropenam and Imepenam (72.58%). Table 5 shows that the 47 MDR Klebsiella isolated were also sensitive to Ceftazidime avibactum (65.95%), Cotrimoxazole (38.29%) and Cefaperazone sulbactum (21.27%). This was in concordance with the study conducted by Hui Zhang et al. [10] This shows that due to common usage of Meropenam, and Imepenam as first line drugs in many patients in Intensive care units, the emergence and spread of Multidrug resistant Klebsiella has become rampant in the Intensive care units. The higher prevailing rates of ESBL and associated multiple resistance mechanisms in Klebsiella species has been the causative factors for increasing multidrug resistant Klebsiella infections in tertiary care hospital. Biofilm formation in prolonged catheterised patients along with high virulence factors associated with Klebsiella adds on to these infections.

CONCLUSION

Outcome

Our study showed that majority of the MDR Klebsiella species isolated from urine were susceptible to ceftazidime-avibactum and Cotrimoxazole. Cotrimoxozole was also found to be an alternative drug for most of the MDR Klebsiella species isolated since it was not being widely used in the hospital as a first line drug. So, we conclude that a combination treatment with ceftazidime avibactum and strict infection control practice along with antibiotic cycling would help in restricting the spread of both MDR and XDR Klebsiella species in a tertiary care hospital setting.

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