

## Original Research Article

<https://doi.org/10.20546/ijcmas.2018.704.103>

## A Study on Prevalence and Antimicrobial Resistance Pattern of Urinary *Klebsiella pneumoniae* in a Tertiary Care Centre in South India

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### ABSTRACT

Urinary tract infections are the commonest infectious disease, seeking medical consultation and antibiotic therapy worldwide. *Klebsiella pneumoniae* is among the most common uropathogen responsible for recurrent infections and its antimicrobial susceptibility to commonly prescribed drugs vary significantly in different regions. Hence, the objective was to analyze the local etiology and antimicrobial susceptibility pattern of urinary *K. pneumoniae*, to optimize the rational empirical therapy. The current study was carried out for a period of one year from March 2016 to February 2017 in a tertiary care centre. *Klebsiella pneumoniae* isolated in this study were 13.8% (217) of the total isolates and ESBL producing strains were 17.5% (38), out of which 31 (81.5%) were isolated from hospitalized inpatients. Antibiotic susceptibility pattern revealed that the most effective antimicrobials were Imipenem (91.2%), Nitrofurantoin (81.6%) and Amikacin (79.7%) and followed by Ceftazidime (70%) and Ceftriaxone (63%). The isolates showed least susceptibility to Ampicillin (19%), Trimethoprim-Sulphamethoxazole (28.6%) and Ciprofloxacin (42%). This study emphasizes the importance of current knowledge of the uropathogens and their susceptibility pattern for the initiation of appropriate empirical therapy and to minimize the evolving resistant strains.

#### Keywords

Urinary tract infections,  
*Klebsiella pneumoniae*,  
Antimicrobial resistance,  
Extended spectrum beta  
lactamases

#### Article Info

Accepted:  
10 March 2018  
Available Online:  
10 April 2018

### Introduction

Urinary tract infections (UTI) are the commonest bacterial infectious diseases, seeking medical care and antimicrobial therapy worldwide. It is the second most prevalent disease of infectious etiology account for 1-3 % of all consultations in a year (HPA 2009). UTI is defined as presence of the pathogenic microbes in sterile urine, affecting any part of the urinary tract, extending from urethral meatus to the renal cortex. Though highly diverse microorganisms cause UTIs,

Gram negative bacilli are the frequently isolated uropathogens. *Escherichia coli* is the most constant cause of acute uncomplicated infections, accounting for approximately 75-90% of the isolates from the specimens. Other gram negative rods, especially *Klebsiella* is among the most common pathogens to infect urinary tract and responsible for recurrent infections and infections associated with urinary tract obstruction or urologic procedures. *Klebsiella pneumoniae* cause variety of infectious diseases including urinary tract infection, pneumonia, wound infections,

enteritis, neonatal meningitis and sepsis. *Klebsiella* is the frequent causative pathogen of nosocomial infections, accounting for 3-7% of all hospital and healthcare associated bacterial infections (Podschun *et al.*, 1998). In the recent decades appearance of plasmid mediated resistance to extended spectrum beta lactam drugs in hospital settings, is a major cause for therapeutic failure, leading to significant increase in morbidity and mortality. These extended spectrum beta lactamases (ESBLs) were more commonly found in isolates of *Klebsiella* spp., and less commonly in *Escherichia coli* (Phillipon *et al.*, 1989). In the last decade advent of carbapenemase producing *Klebsiella pneumoniae* became a considerable infection control issue.

In developing countries like India UTIs are often managed empirically with wide range of antibacterial agents usually by family physicians, even before the availability of laboratory reports. Worldwide, antimicrobial resistance of urinary *K. pneumoniae* to commonly prescribed drugs vary significantly in different regions (Perez *et al.*, 2007). To optimize the rational empirical therapy, it is vital to know the local etiology and susceptibility patterns of uropathogens. Hence, the present study was conducted to know the antimicrobial susceptibility and resistance pattern of urinary *K. pneumoniae*.

### Materials and Methods

This present retrospective study was conducted in a tertiary care centre for a period of one year from March 2016 to February 2017. Aseptically collected clean catch midstream urine samples in a wide mouth sterile container from both hospitalized inpatients and out patients were processed for bacteriological culture. Urine samples were inoculated using calibrated loops for semi-quantitative method on Blood agar and MacConkey agar. The uropathogen isolated

were identified to the species level by colony morphology, Gram's staining and conventional biochemical tests.

*Klebsiella pneumoniae* isolated were tested for antimicrobial susceptibility by Kirby Bauer disc diffusion method, on 5% Mueller Hinton blood agar, as per CLSI guidelines. All isolates were tested for following antimicrobials – Ampicillin (10µg), Amikacin (30µg), Ciprofloxacin (5µg), Ceftriaxone (30µg), Ceftazidime (30µg), Imipenem (30µg), Nitrofurantoin (300µg), and Trimethoprim-Sulfamethoxazole (1.25/23.75µg), as recommended by CLSI<sup>7</sup>.

*Klebsiella pneumoniae* strains identified as extended spectrum beta lactamases producers (ESBL) producers were confirmed by the double disk synergy test using Ceftazidime and ceftazidime-Clavulanic acid.

### Results and Discussion

In the present study, a total of 1564 organisms were isolated from the 6152 urine samples processed for culture and sensitivity. The most common isolates were *Escherichia coli* (922) 59% and followed by *Klebsiella pneumoniae* (217) 13.8% of the total isolates. Females (58%) were more often affected than male (42%). Nearly half the population belongs to the age group 21-50 years. Men are affected in their late ages above 50. Female in their reproductive age group. In the present study ESBL producing *Klebsiella pneumoniae* strains were 17.5% (38), 81.5% (31) were isolated from hospitalized inpatients and 18.5% (7) were isolated from out patients (Table 1 and 2).

Antibiotic susceptibility pattern revealed that the most effective antimicrobials were Imipenem (91.2%), Nitrofurantoin (81.6%) and Amikacin (79.7%) and followed by Ceftazidime (70%) and Ceftriaxone (63%) (Table 3).

**Table.1** Age and sex distribution of *Klebsiella pneumoniae* isolates from urine samples

Age in years	Male (n=91)		Female (n=126)		Total (n=217)	
	Number of isolates	Percentage %	Number of isolates	Percentage %	Number of isolates	Percentage %
1-20	9	10	17	13.5	26	12
21-50	38	41.7	64	50.8	102	47
51-80	44	48.3	45	35.7	89	41

**Table.2** Comparison of uropathogens isolated from inpatients and outpatients

Total		Inpatients		Outpatients	
		Number of organisms	Percentage %	Number of organisms	Percentage %
Uropathogens isolated (n=1564)		976	62.4	588	37.6
<i>Klebsiella pneumoniae</i> isolated	Total (n=217)	143	66	74	34
	ESBL producer (n=38)	31	81.5	7	18.5

**Table.3** Antibiotic susceptibility pattern of *Klebsiella pneumoniae* isolated from urine samples

Antibiotics	Number of Isolates (n=217) Sensitive	Percentage
Ampicillin	41	19
Amikacin	173	79.7
Ciprofloxacin	91	42
Ceftriaxone	137	63
Ceftazidime	152	70
Imipenem	198	91.2
Nitrofurantoin	177	81.6
Trimethoprim- Sulfamethoxazole	62	28.6

The isolates were highly resistant to Ampicillin, Trimethoprim-Sulphamethoxazole and Ciprofloxacin, the susceptibility to these drugs were 19%, 28.6% and 42% respectively.

In the recent years, indiscriminate use of broad spectrum antibacterial agents in the treatment of UTIs resulted in significant increase in multiple antibiotic resistant uropathogens. The emergence of multidrug resistant organisms is a major health concern in the community and hospital environment globally (Kumar *et al.*, 2006). Bacterial

isolates from patients with UTI showed variable levels of resistance to the tested antibiotics. Especially urinary *Klebsiella pneumoniae* revealed high rates of resistance to commonly prescribed antibiotics. So effective management of the UTIs depends on the causative agent and the selection of optimal susceptible drug.

In the present study the *Klebsiella pneumoniae* was the second most isolated pathogen next to *Escherichia coli* which was in accordance with the studies conducted in other part of the world (Khameneh *et al.*, 2009; Chin *et al.*,

2011). In this study UTI occurred more common in females than in males. Among females, frequency of UTI was more among sexually active young women 21-50 years age group. In males, the frequency of UTI was more in elderly patients (above 50 years), probably due to prostate enlargement and neurogenic bladder. These results were similar with the findings of various Indian studies (Dash *et al.*, 2013; Janakiram *et al.*, 2014; Sood *et al.*, 2010). In our study isolates have shown quite high resistance to commonly prescribed antibacterial agents- Ampicillin, Trimethoprim- Sulphamethoxazole and Ciprofloxacin, the results were in concurrence with previous studies (Metri Basavaraj *et al.*, 2014; Pai *et al.*, 2012). These antibiotics were used more frequently as first line drugs for years in the treatment of UTI in the community has led to it greater resistance. This high level resistance confirms that these agents cannot be currently initiated as first line in empirical therapy of UTI. Amikacin and Nitrofurantoin showed good antimicrobial susceptibility with *Klebsiella pneumoniae*, therefore should be used preferentially and have gained much importance in the treatment of UTIs.

Second and third generations cephalosporins are widely used in the treatment of infections caused by *Klebsiella spp* (Romero *et al.*, 2007). Our strains showed moderate antibacterial resistance to the third generation cephalosporins, in contrary to the study conducted by Singh *et al.*, (2003). ESBL producers are most often associated with UTIs (Melzer *et al.*, 2007). The cost of hospitalization and duration of stay and mortality rate are higher with ESBL producing strains of *Klebsiella spp.* than non-ESBL producing *Klebsiella spp* (Schwaber *et al.*, 2006; Kim *et al.*, 2002). ESBL producing *Klebsiella pneumoniae* isolated were 17.5% almost the same results were obtained in the other studies (Romero *et al.*, 2007; El

Bouamri *et al.*, 2015). This study shows that 91.2% of isolates were susceptible to Imipenem. Carbapenems are the agents of choice for dreadful infections caused by ESBL producers, due to their high susceptibility and high stability to  $\beta$  lactamase hydrolysis (Colodner *et al.*, 2004). Antimicrobial agents effective against ESBL producers are very limited, hence Imipenem should be considered as a reserved drug for the treatment of serious infection caused by *Klebsiella pneumoniae*.

In conclusion, in the present study urinary *Klebsiella pneumoniae* were resistant to commonly used antimicrobial agents. Our study concludes that, the clinicians are left with very few options in the selection of optimal antimicrobials for empirical treatment of UTI, due to the emergence of higher antimicrobial resistance among uropathogens. This study emphasizes the importance of current knowledge of the uropathogens and their susceptibility pattern for the initiation of appropriate empirical therapy and to minimize the evolving resistant strains. The treating physician should judiciously prescribe the drug when needed, based on the antibiogram of the isolated microorganisms and antibiotic policy of the concerned centre.

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#### How to cite this article:

Dillirani, V. and Suresh, R. 2018. A Study on Prevalence and Antimicrobial Resistance Pattern of Urinary *Klebsiella pneumoniae* in a Tertiary Care Centre in South India. *Int.J.Curr.Microbiol.App.Sci.* 7(04): 969-973. doi: <https://doi.org/10.20546/ijcmas.2018.704.103>