

# Prevalence and Antibiotic Susceptibility Pattern of *Klebsiella* spp. isolated from various clinical samples at a tertiary care centre

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## Abstract:

**Introduction:** *Klebsiella* belongs to the genus of Enterobacteriaceae family, which are ubiquitous in nature. *K. pneumoniae* and *K. oxytoca* are the most common pathogen. They cause many nosocomial infections like pneumonia, urinary tract infections, wound infections, bacteremia and septicemia. Multidrug resistance is seen in *Klebsiella* which serves as the most common cause of increased morbidity and mortality.

**Aim:** This study reveals the prevalence and antibiotic sensitivity pattern of *Klebsiella* species from various clinical samples.

**Material and Methods:** This prospective study was conducted in our tertiary care hospital RMCH&RC, Kanpur for a period of 1 year i.e., during the period from January 2021 to December 2021. A total of 155 non repeat isolates were obtained from various samples include blood, sputum, urine, and pus etc. Antibiotics sensitivity were tested by Kirby-Bauer's disc diffusion method according to the CLSI guidelines 2020.

**Results:** Out of the 155 isolates, 94 (60%) were male and 61 (40%) were females. Out of 155 isolates, the mean age group was 33-60 years of age. Among 155 *Klebsiella* isolates, 59 were urine samples, 49 were pus samples, 14 were sputum, 8 were tracheal tube, 7 were blood cultures, 4 were ET-secretion, 5 were Throat swab, 8 were sputum and 1 were Bone pus. Among the 155 *Klebsiella* spp identified, *K. oxytoca* was 83, and 72 were *K. pneumoniae* species and the sensitivity was noted to be higher to Polymyxin-B (100%) and Colistin (100%).

**Conclusions:** Thus, this study shows the prevalence rate of *Klebsiella oxytoca* to be high. Since the frequency of multiple drug resistance among *Klebsiella* species is alarmingly high, therefore periodic monitoring of antimicrobial susceptibility profile of these agents is much needed, to treat the infection with appropriate antibiotics.

**Keywords:** *Klebsiella oxytoca*, *Klebsiella pneumoniae*, *Klebsiella* species.

## Introduction

The genus *Klebsiella* belongs to the group of Klebsiellae, fits into fifth tribe of Enterobacteriaceae. *Klebsiella* is a nonmotile, rod-shaped, Lactose fermenting, gram-negative bacillus with a prominent polysaccharide capsule. They are omnipresent in nature. In humans, they colonize the skin, pharynx, and gastrointestinal tract. They present as normal flora in many parts of the colon, intestinal tract and biliary tract [1]. The most common opportunistic nosocomial *Klebsiella* infections are caused by *K. pneumoniae* and *K. oxytoca*, causing various infections like pneumonia, urinary tract infections, meningitis, wound infections, osteomyelitis, bacteremia, septicemia, and gastroenteritis [2]. Overuse of broad spectrum antibiotics and development of multidrug resistant (MDR) strains, has led to production of ESBL. They confer resistance to all extended spectrum cephalosporins and aztreonam, except the cephamycins and carbapenems. ESBL producing *Klebsiella pneumoniae* causes outbreaks of nosocomial infections.

They pose serious therapeutic challenge to clinicians due to limited therapeutic options [3, 4]. Carbapenems are preferred to treat the infections caused by multi drug resistant (MDR) isolates of *Klebsiella pneumoniae* but in recent years carbapenem-resistant *Klebsiella pneumoniae* has been reported (CRKP) [5]. Carbapenem-resistant *K. pneumoniae* (CRKP), resistance encoded by bla<sub>KPC</sub> gene and these multi drug resistant organisms poses a serious threat in terms of morbidity and mortality associated with them. [6]

The current study was undertaken to know the prevalence and antibiotic susceptibility pattern of *Klebsiella* spp. isolated from various clinical samples at a tertiary care centre...

## Material and Methods

The study was conducted in central laboratory, Department of Microbiology for a period of one year January 2021 to December 2021 at Rama Medical College Hospital and Research Centre. The study comprised of a total of 155 non-repeat isolates obtained from various clinical samples received in Microbiology lab for culture & sensitivity testing.

## Collection and Analysis of Urine Samples:

A total of 50 midstream urine samples were collected into a sterile urine container on the same day of enrollment. The samples were sent to the laboratory for

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analysis, and most of the samples were analyzed within one hour after collection. 10 µl of well-mixed urine samples were inoculated on MacConkey agar using a sterile loop following standard culture procedures. The plates were incubated at 37°C for 24 hours. Morphological colony identification and biochemical tests were used to confirm the *E. coli* organisms. Disc diffusion method was used to determine the antibiotic susceptibility of *E. coli*. Escherichia coli isolates were suspended in peptone water and incubated at 37°C until turbid and turbidity adjusted to a standard uniform concentration of 0.5 McFarland solutions. The isolates were then inoculated on Mueller Hinton agar the antibiotic discs containing precise concentration of the antibiotics were individually placed 1 cm from the wall from each other. The plates were then incubated at 37°C for 24 hours. The diameter zones of clearance were measured in millimeters and interpreted according to the Clinical Laboratory Standard Institute (CLSI) guidelines 2022 [13]. For quality control, *E. coli* ATCC 25922 provided in the laboratory was used as a control strain.

The study included all adolescent girls with any of these complaints:

- Burning during micturition
- Increased frequency of micturition
- Pain during micturition

**Exclusion criteria**

- Age between 10 and 19 years
- Any of the above complaints

**Exclusion criteria:**

- Age above 19 years

**Statistical analysis**

- Data recorded on the case report from and structured proforma were subsequently entered into a spreadsheet. Data management and analysis were performed using Microsoft Excel.

**Ethical Approval**

- Permission to collect sample will be obtained from Rama Medical Collage, Hospital & Research Centre, Kanpur, U.P.

**Results**

Out of 50 cases 13 adolescent girls who fulfilled the study criteria and participated in the study, 4 were less than 14 years of age, 8 were between the age 15 and 18 and rest 1 were more than 18 years of age (Table 1).

**Table 1: Age wise distribution**

Age group	Number	Percentage (%)
<14 years	4	30.78%
14-18 Years	8	61.53%
>18 years	1	7.69%

The most common urinary symptom was burning during micturition with 4 (30.76% girls) complaining it. This was followed by frequency, pain and blood in urine. Many girls had more than one symptom (Table 2).

**Table 2: Symptoms of urinary tract infection**

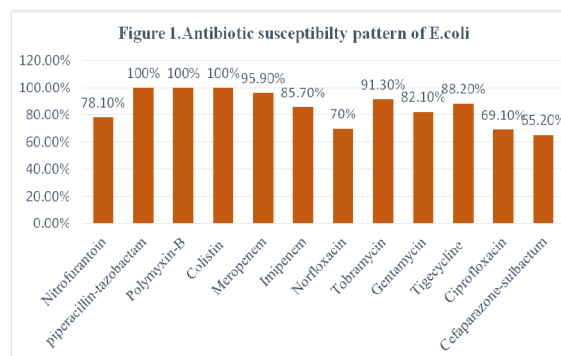
Symptoms	Number	Percentage (%)
Burning micturition	4	30.76%
Frequency	3	23.08%
Pain	2	15.39%
Blood in urine	1	7.69%
Other	3	23.08%

Low water intake (< 4glasses) was present in 9(69.2%%) girls. Poor menstrual hygiene was present in 7(53.8%%) girls. Improper perineal washing and poor nutrition was also found in the girls. Vaginal discharge was present in 4(30.7%) girls (Table 3).

**Table 3: Risk factor of urinary tract infection in Adolescent girls**

Risk factors	Number	Percentage
Inadequate water intake	9	69.20%
Poor menstrual hygiene	7	53.80%
Improperperineal washing	6	46.10%
Vaginal discharge	4	30.70%
Poor nutrition	3	23.00%
Pregnancy	2	15.30%

*E. coli* (13) isolates were most sensitive to Piperacillin–Tazobactam (100%), Polymyxin -B (100%), and Colistin (100%), followed by Meropenem (95.9%) Imipenem (85.7%), Tobramycin (91.3%), Tigecycline (88.2%).



**Figure 1: Antibiotic susceptibility pattern of E. coli.**

## Discussion

Urinary Tract Infection (UTI) most commonly occurs in adolescent age group [14]. Lower UTIs are considered as the most common adolescent girl's infection. At least one episode of UTI occurs in nearly 5-6% of girls during their entry from high schools to graduation. Compared to boys, the recurrence rate is 50% greater in girls [15]. The vagina and anus are positioned close to the urinary opening which makes females more prone for the development of UTI [16]. Due to UTI, every year nearly 6-7 million young women visit physicians and therefore it is a major concern for the parents and healthcare providers [14]. Any delay in the treatment leads to permanent kidney damage, bacterial endocarditis and infertility [14,17].

In our study the burning micturition was observed as the commonest symptom (30.76%) followed by frequency, pain, blood in urine and other. The finding is in accordance with Sarita Mohapatra et.al [18] (2022) burning micturition (37.6%) followed by frequency (30.4%).

In our study the Inadequate water intake and poor menstrual hygiene is most common risk factor followed by improper perineal washing, vaginal discharge, poor nutrition and pregnancy. The finding is similar to Shubha Srivastava et.al. [19] (2018).

In our study Antibiotic sensitivity pattern of *E. coli* revealed that maximum sensitivity was seen for piperacillin-tazobactam (100%), polymyxin -B (100%), and colistin (100%), followed by Meropenem (95.9%) Imipenem (85.7%), Tobramycin (91.3%), tigecycline (88.2%). The finding is in accordance with Akter Tet al. [20](2016) found that 100% of *E. coli* isolates were sensitive to gentamycin, amikacin, imipenem, meropenem, piperacillin-tazobactam, and tobramycin.

Among adolescent girls, poor hygiene and dysfunctional voiding pattern increases the risk for UTI. Silent UTI may occur among adolescent girls due to inadequate intake of water and infrequent passage of urine. The possible link between the prevalence of UTI among students residing in the hostel includes the use of western toilets, unhygienic mass toilets; improper menstrual hygiene and toileting habits [17].

## Conclusion

There should be very useful information to initiate and develop health intervention measures for the prevention and control of UTI among young adolescent girls. Its prevention, appropriate training to maintain adequate hygienic practices, food and life style modification was the need highlighted from this study. Educational talks on UTIs and its risk factors should be held periodically amongst the girls to improve knowledge and improve their preventive practices towards UTI

## References

1. Wald A. Hysterectomy: a risk factor for urinary incontinence? *Watch Women's Health*; 2007.

2. Hannestad YS, Rortveit G, Sandvik H, Hunskaar S. A community-based epidemiological survey of female urinary incontinence: The Norwegian EPINCONT Study. *J Clin Epidemiol*. 2000; 53(11):1150-7.
3. Nicolle LE. Uncomplicated urinary tract infection in adults including uncomplicated pyelonephritis. *Urol Clin North Am*. 2008; 35:1-12.
4. Salvatore S, Salvatore S, Cattoni E, Siesto G, Serati M, Sorice P, et al. Urinary tract infections in women. *Eur J ObstetGynecolReprod Biol*. 2011; 156:131-6
5. Winberg J, Anderson HJ, Bergstrom T, Jacobsson B, Larson H, Lincoln K. Epidemiology of symptomatic urinary tract infection in childhood. *Acta PaediatrScand Suppl*. 1974; 252:1-20.
6. Fonda D. Promoting continence as a health issue. *Eur Urol*. 1997; 32:28-32.
7. Ram S, Gupta R, Gaheer M. Emerging antibiotic resistance among the uropathogens. *Indian J Med Sci*. 2000 Sep; 54(9):388-94.
8. Singh MM, Devi R, Garg S, Mehra M. Effectiveness of syndromic approach in management of reproductive tract infections in women. *Indian J Med Sci*. 2001 Apr; 55(4):209-14.
9. Ahmed SM, Avasarala AK. Urinary tract infections (uti) among adolescent girls in rural Karimnagar district, AP – K.A.P. study. *Indian J Prev Soc Med*. 2009; 40:6-9.
10. F. S. Nas, M. Ali, M. S. Abdallah, and A. U. Zage, "Prevalence and antibiotic susceptibility pattern of *Escherichia coli* isolated from urine samples of urinary tract infection patients," *ARC Journal of Urology*.2019vol. 4, no. 1.
11. S. Sabir, A. A. Anjum, T. Ijaz, M. A. Ali, M. U. Rehman, and M. Nawaz, "Isolation and antibiotic susceptibility of *E. coli* from urinary tract infections in a tertiary care hospital," *Pakistan Journal of Medical Sciences*: 1969; vol. 30, no. 2, pp. 389–392.
12. M. Gajd'acs and E. Urb'an, "Resistance trends and epidemiology of *citrobacter-enterobacter-serratia* in urinary tract infections of inpatients and outpatients (RECESUTI): a 10- year survey," *Medicina*: 2019; vol. 55, no. 6, pp. 1–13.
13. Clinical Laboratory Standards Institute. Performance Standards for Antimicrobial Susceptibility Testing: Twenty-Fifth Informational Supplement M100-S25. CLSI; Wayne, PA, USA: 2022.
14. Saji N, Amrutha C, Varkey J. Effectiveness of structured teaching programme on prevention of UTI among adolescent girls. *International Journal of Science and Health Care Research*. 2018; 3(3):01-06.
15. Patel E. A descriptive study to assess the knowledge and practices regarding prevention of Urinary Tract Infection (UTI) among adolescent girls at selected higher secondary schools. *International Journal of Psychosocial Rehabilitation [Internet]*. 2020; 24(5):6899-904.
16. Sheerin N. Urinary tract infection. *Medicine*. 2011; 39(7):384-89.
17. Akshara P, Greeshma J, Aseem B, Divya U. A study to assess the knowledge regarding urinary tract infection among adolescent girls of Karthika Thirunal government vocational & higher secondary school for girls, Manacaud, Thiruvananthapuram. *J Nursing Today*. 2016; 4(1):37-40.
18. Sarita Mohapatra, RajashreePanigrahy, Vibhor Tak, Shwetha J. V: Prevalence and resistance pattern of uropathogens from community settings of different regions: an experience from India. *Access Microbiology*. 2022; 4:000321.

19. Srivastava S. et al, 'Analytical study of urinary tract infection in adolescent girls' International Journal of Reproduction. 2018; 7(4):1385-1388 [www.ijrcog.org](http://www.ijrcog.org).
20. Akter T, Hossain M, Khan M, Sultana H, Fatema K, Al Sanjee S, et al. Isolation, Identification and Antimicrobial Susceptibility Pattern Analysis of Escherichia coli Isolated from Clinical Samples of Bangladesh. Asian Journal of Biomedical and Pharmaceutical Sciences. 2016; 6:13-6.