

Pattern of Antimicrobial Susceptibility of *Klebsiella Pneumoniae* Isolated from Urinary Samples in urinary Tract Infection in a Tertiary Care Hospital, Kishanganj, Bihar, 5 Years' Experience

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ABSTRACT

Background: Urinary tract infection is very common infection in the community and hospital and multi drug resistant *klebsiella pneumoniae* is noted as most alarming prevalent infecting organism worldwide. The aim was to know the pattern of susceptibility to antibiotics of *klebsiella pneumoniae* in urinary tract infection.

Materials and methods: In this retrospective cross sectional study morning midstream urine sample of 1550 symptomatic patients was taken for culture and sensitivity. Only 208 patients' (145 females and 63 males) urine demonstrated growth of *klebsiella pneumoniae* susceptible to different antibiotics.

Results: Out of 208 patients 145 were females (69.71%) and 63 males (30.28%). *Klebsiella pneumoniae* was sensitive to was highly sensitive to polymyxin (91.82%), colistin (89.42%), Imipenem (88.94%), meropenem (79.32%), ertapenem (75%), moderately sensitive to aminoglycoside group (amikacin 59.13%, gentamicin 52.40%, Netilmicin 50.96%), piperacillin-tazobactam (53.84%) mildly sensitive to tobramycin (49.51%), nitrofurantoin (48.07%), cefoperazone-tazobactam (45.67%) levofloxacin (45.19%). Least sensitive drugs (below 20%) were chloramphenicol, ticarcillin, amoxicillin, amoxicillin-clavulanic acid, cefuroxime, azithromycin, aztreonam, cefoxitin.

Conclusion: Since multi-drug resistant *klebsiella pneumoniae* become highly prevalent in the community, so prevention in the form of health education to the community as well as early detection of resistance to different antibiotics is very appropriate to prevent the spread of resistance.

Keywords: Urinary Tract Infection, *Klebsiella Pneumoniae*, Culture And Sensitivity, Hospital,

is very common infection in both sexes but more common in female but this infection should be treated as early as possible to prevent sepsis mainly in elderly. So Physicians use to prescribe antibiotic to the patient to give him or her early relief.^{6,7} Delayed use of antibiotics is always associated with high mortality and morbidity.⁸ This inappropriate and excessive antibiotic use give rise to multidrug-resistance to the organism. Similar in case of *Klebsiella* there are resistance to many antibiotics. There are three mechanism of resistance, these are, first, Prevention of interaction of drug with target organisms, secondly, due to decreased influx or increased efflux of the antimicrobial agent decreased net accumulation of this agents, thirdly, enzymatic destruction of modification to inactive compound.^{9,10} But mechanism of major drug resistance done by *Klebsiella pneumoniae* is extended spectrum β -lactamase with or without AmpC β -lactamase production, as these isolates will be resistant to broad spectrum cephalosporin and/or inhibitors of β -lactam or β -lactamase.^{11,12} In the human being except drug and bacteria third factor is host. In most of the resistant cases microorganism escape from the contact of high concentration of antibiotics hence the disease will recur in future. In this case tissue response will attract bacteria preventing organism to be exposed against the antibiotic in the body as because the microorganisms are intracellular. So depending upon the percentage of penetration of antibiotics the organisms will be killed. Concentration of tetracycline is similar to that in extracellular fluid, Gentamicin may not penetrate and some have negligible penetration. During administration of any antibiotic physician should know the time-dose-response relationship to maintain a definite concentration in the tissue and blood during that period. According to WHO in 2012 there are many factors may come in the production of drug resistance, these are, firstly, poor utilization of antimicrobial agents, secondly, resistant bacteria may be transmitted from

INTRODUCTION

Klebsiella pneumoniae, gram negative bacteria belonging to family Enterobacteriaceae has prominent polysaccharide capsule has the ability to colonize in the skin, throat, gastrointestinal tract, nasopharynx, but it may be also found in urinary tract, sterile wound, bile duct. So it is able to produce infection in these organs in case of low immunity in community and health care settings.^{1,2,3,4} In triple sugar iron agar gel *Klebsiella* produces hydrogen sulfide gas, urease and lysine decarboxylase positive. This organism shows in vitro antimicrobial activity due to following factors, like, environmental pH, stability of the drug, components of the environment, sample amount for incubation, duration of incubation as well as microorganism's metabolic activity.⁵ Urinary tract infection

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patient and healthcare personnel to the other patient, thirdly, Absence or ignorance to follow the guidelines for judicious use of antibiotics, fourthly Absence of easy-to-use auditing tools for restriction of antibiotics.^{13,14} Klebsiella pneumoniae is nearly always resistant to commonly prescribed drugs, like, ampicillin, amoxicillin, cephalosporin, aminoglycosides, β -lactam antimicrobial agents.^{15,16} The aim of the study was to know the pattern of susceptibility to antibiotics of klebsiella pneumoniae in urinary tract infection.

MATERIAL AND METHODS

This cross sectional retrospective study was performed in Medicine department of MGM Medical College & LSK Hospital, Kishanganj, Bihar after getting permission from local Ethical Committee. Data was collected for the last 5 years. Morning mid-stream urine were collected aseptically from 1550 patients coming with burning sensations during micturition or high fever with chill and rigor.

Exclusion criteria were aspiration from suprapubic catheter, mixed growth of other uropathogens with klebsiella pneumoniae. The urine samples were processed with calibrated one microliter loop using semi-quantitative method of plotting into blood agar and Cysteine Lactose Electrolyte Deficient medium to isolate pathogens and incubated at 37° C for the period of 24 hours. Now the isolate of Klebsiella were subcultured in blood agar and MacConkey agar to check the purity. Then the species was identified using morphological, microscopy as well as biochemical test following standard method as described by Crown and Steel in 1974 and Cheesborough in 2006.^{17,18} This organism produced acid in both in Butt and slant along with production of gas was demonstrated positive result for utilization of citrate, Voges-Proskauer and urease. Klebsiella formed metallic blue colonies when it was allowed to grow on CHROMEagar candida. Then antibiotic sensitivity was performed by Kirby-Bauer method of Clinical Laboratory Standard Institute.^{19,20} Using reference broth microdilution method following guideline of the manufacturer and clinical and Laboratory Standards Institute (CLSI) in the year 2014.²¹ Now isolates were tested for the following bacteria: Ampicillin (10 μ g), Amoxiclav (20 μ g), Cotrimoxazole (25 μ g), Gentamicin (10 μ g), cefuroxime (30 μ g), cefotaxime (30 μ g), cephalixin (30 μ g), ceftazidime (30 μ g), ciprofloxacin (30 μ g), amikacin (30 μ g), ceftriaxone (30 μ g), nitrofurantoin (300 μ g), norfloxacin (10 μ g), meropenem (10 μ g), colistin (10 μ g), cefepime (30 μ g), piperacillin-tazobactem (100 μ g), Imipenem (10 μ g), cefoperazone (100 μ g), ofloxacin (5 μ g), tobramycin (10 μ g),

STATISTICAL ANALYSIS

Results were interpreted using descriptive statistics using with the help of percentages.

RESULTS

Among the 1550 symptomatic patients 208 (13.419%) demonstrated positive for klebsiella pneumoniae with different pattern of antibiotic sensitivity. Out of 208 patients 145 were females (69.71%) and 63 males (30.28%). In

Antibiotic	Sensitivity	Percentage
Amoxicillin	10	4.80
Amoxicillin-Clavulanic acid	39	18.75
Piperacillin-Tazobactam	112	53.84
Cefoparazone-Tazobactam	95	45.67
Cefuroxime	34	16.34
Cefotaxime	46	22.11
Cefoxitin	32	15.38
Ceftazidime	46	22.11
Ceftriaxone	58	27.88
Cefepime	48	23.07
Azithromycin	22	10.57
Aztreonam	37	17.78
Ertapenem	156	75
Imipenem	185	88.94
Meropenem	165	79.32
Gentamicin	109	52.40
Tobramycin	103	49.51
Netilmicin	106	50.96
Amikacin	123	59.13
Norfloxacin	61	29.32
Ciprofloxacin	70	33.65
Ofloxacin	63	30.28
Levofloxacin	94	45.19
Cotrimoxazole	72	34.61
Chloramphenicol	3	0.48
Polymyxin B	191	91.82
Colistin	186	89.42
Ticarcillin	14	6.73
Nitrofurantoin	100	48.07

Table-1: Pattern of antimicrobial Sensitivity pattern of Klebsiella infection of urinary tract (n=208)

the above table is was shown that klebsiella was highly sensitive to polymyxin (91.82%), colistin (89.42%), Imipenem (88.94%), meropenem (79.32%), ertapenem (75%), moderately sensitive to aminoglycoside group (amikacin 59.13%, gentamicin 52.40%, Netilmicin 50.96%), piperacillin-tazobactam (53.84%) mildly sensitive to tobramycin (49.51%), nitrofurantoin (48.07%), cefoperazone-tazobactam (45.67%) levofloxacin (45.19%). Least sensitive drugs (below 20%) were chloramphenicol, ticarcillin, amoxicillin, amoxicillin-clavulanic acid, cefuroxime, azithromycin, aztreonam, cefoxitin (table-1).

DISCUSSION

The present study demonstrated 69.71% were females with was consistent with many studies suggesting many factors responsible for female urinary tract infection. Firstly, close proximity of urethra to anus and genital tract, secondly, structurally female urethra is less effective to prevent entry of bacteria as compared to males, thirdly, there is adherence of urethral epithelial mucosa with the mucopolysaccharide lining, fourthly, repeated sexual activity which contaminates urethra as bacteria can be pushed during sexual intercourse. Fifth, In case of pregnancy bacteria can be massaged up the urethra into the bladder during birth of the child.²²⁻²⁸ On the other hand different anatomical position of urinary tract,

inhibitory substances secreted from prostate would play important role against pathogenic bacteria present in the urine are the causal factors for low susceptibility in case of male.²⁹

In the present study only 13.419% positive urine cultures demonstrated growth of klebsiella whereas Savda LA et al demonstrated 60.92% positive for klebsiella growth.³⁰

This present study showed only 4.8% sensitivity to amoxicillin, Cotrimoxazole was mildly sensitive (34.61%), cephalosporin group are least (16.34% -- 23.07%) sensitive whereas study done by Manikandan C. demonstrated sensitivity of cephalosporin group was high (cefotaxime, ceftriaxone 66.7%, ceftazidime 54.2%).³¹

Again, Varghese A et al. demonstrated more or less similar sensitivity of cephalosporin group (14.3% cefuroxime, cephalexin 20%). like the present study.³² But to the contrary to the present study where sensitivity of carbapenem group was very high (Imipenem 88.94%, meropenem 79.32%, ertapenem 75%), Varghese A et al showed only low sensitivity to carbapenem group (meropenem 34.3%) but sensitivity of imipenem was high (74.3%), in the same study it was shown as compared to this present study sensitivity of amoxicillin-clavulanic acid as 31.1% (vs. 18.75%), norfloxacin 52.4% (vs. 29.32%) was very high but in case of amikacin 67.7% (vs. 59.13%) it was nearly similar.³²

Again, Manikandan C. demonstrated high sensitivity to fluoroquinolone group as compared to the present study (ofloxacin 79.2% vs. 30.28%, ciprofloxacin 76.4% vs. 33.65%, norfloxacin 75% vs. 29.32%)²⁹, but sensitivity of nitrofurantoin is nearly similar (50% vs. 48.07%).³¹

According to the study of Mozafari et al demonstrated very low sensitivity of ciprofloxacin and gentamicin were (7.4% vs. 33.65% and 7% vs. 52.40%) respectively. Again as compared to the present study Taslima TL et al in her study showed sensitivity of ceftazidime (64% vs. 22%), gentamicin (73% vs. 52.40%).²⁹

This present study demonstrated very high sensitivity to colistin (89.42%) and polymyxin B (91.82%) which was similarly demonstrated in the Varghese A et al though the sensitivity of colistin was 77%.³¹ It may be due to cost of the antibiotics and method of administration is such that the patient has to be admitted.

So it is shown that the resistance to third and fourth generation of cephalosporins, amoxicillin, fluoroquinolone, and tetracycline have been spreaded to worldwide but moderate to high sensitive, costly, least used antibiotics, like, imipenem, colistin, polymyxin B and less costly but intravenous antibiotics, like, aminoglycoside groups have been found in few areas of the world.

CONCLUSION

Prevention is better than cure. So by improving the health care of females as well as males, hand hygiene, use of antibiotics only when necessary are the important measures to prevent generation of drug resistant organisms. Continuous monitoring of susceptibility of the organisms at the individual level will minimize the generation of drug resistant organism.

With the injudicious use of most available different types of cephalosporins, fluoroquinolones, amoxicillin, these drugs become now-a-days resistant to most of the organisms worldwide. So proper culture and sensitivity should be done prior to use of higher class of antibiotics to prevent development of resistance against them.

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