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Bacteriuria by extended-spectrum β-lactamase-producing *E.coli* and *Klebsiella pneumoniae*

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ABSTRACT

Antibiotic resistant mutants producing extendedspectrum beta-lactamase (ESBL) have emerged among *Escherichia coli* and *Klebsiella pneumoniae*. This study was done to determine the frequency of ESBL-producing *E coli* and *K pneumoniae* species isolated from urine samples of our patients. A study was conducted on (180) urine isolates (90) *E coli* and (22) *K.pneumoniae*) in the laboratory. Microbial sensitivity tests were done on Mueller-Hinton agar plates with disk diffusion method. Broad-spectrum resistance was defined as resistance to ampicillin or cephalothin; ESBL resistance, as resistance of these bacteria to one of ceftriaxone, ceftazidime, or ceftizoxime; and MDR-ESBL; as resistance to (Ampicillin, Amikacin,Ciprofloxacin) of the following antibiotic groups: trimethoprim-sulfamethoxazole, aminoglycosides, fluoroquinolones, and nitrofurantoin. An ESBL resistance was detected in (13.3) % of isolates with *K pneumoniae* and (65.33) % of those with *E coli*. The MDR-ESBL pattern was detected in (91.8) % of the isolates. These included (13.3) % of the *K pneumoniae* and (65.33) % of the *E coli* isolates. Broad-spectrum resistance was detected in all *K pneumoniae* isolates and (65.33) % of (90) *E coli* isolates. Our study showed a high rate of ESBL resistant strain of *E coli* and *K pneumoniae* and the emergency of multiple drug resistance to these bacteria in our patients.

KEYWORDS

ESBL;
E coli;
K.pneumoniae;
MDR-ESBL.

INTRODUCTION

Beta-lactam antibiotics are among the safest and most frequently prescribed antimicrobial drugs in the world; however, emergency of resistance to betalactam antibiotics in clinically important pathogens has increasingly limited their utility. Antibioticresistant mutants producing extended-spectrum beta-lactamase (ESBL) have emerged among gramnegative bacteria, predominantly *Escherichia coli* and *Klebsiella pneumoniae*[1]. In 1983, the first ESBL producing organism was isolated in Germany[2]. Soon thereafter, such organisms were reported in the United States[3,4] followed by outbreaks of infections caused by these pathogens.[5,6] In the recent years, the importance of such ESBL-mediated infections has been increasingly recognized[7-9]. NCCLS

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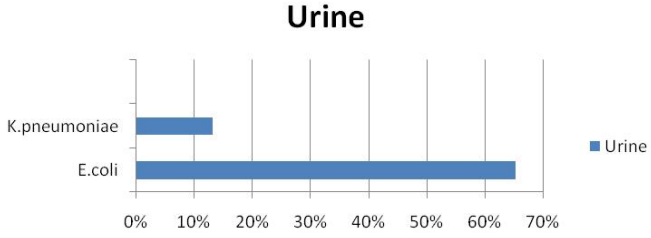
recommends ESBL screening methods and confirmatory tests[10]; however, their use in microbiology laboratories has been neglected[11]. Antibiotic selection for treatment of serious infections due to ESBL-producing *E .coli* and *K. pneumoniae* (ESBL-EK) is a clinical challenge because of the complex nature of in vitro susceptibility testing and its relation to in vivo condition[11]. On the other hand, prevalence of multiple drug resistance among ESBL-EK strains is increasing[10]. However, we lack enough evidence on the current epidemiology and clinical pattern of these microorganisms in our country. Accordingly, we decided to carry out a study to determine the frequency of ESBL-EK and multiple drug resistant- ESBL (MDR-ESBL) in urine samples of patients from South Gujarat region.

MATERIALS AND METHODS

In this study, only samples with significant bacterial growth were studied. Significant growth was defined as the presence of more than (1 million) colony-forming units per milliliter of *E. coli or K. pneumoniae in the* urine culture. Isolated bacteria were identified by standard techniques. All the urine cultures were done in a single laboratory and read by one investigator. A total of (120) urine isolates (65.33%)with *E. coli and (13.3%) with K. pneumoniae) were included. Microbial sensitivity* tests were done on the Mueller-Hinton agar plates with disk diffusion method according to the Kirby-Bauer method[11]. The following diskswere applied onto the plates: (10) -µg ampicillin, (10)-µg cephalothin, (10)-µg ceftriaxone, (30)-µg ceftazidime, (30)-µg ceftizoxime, (10)-µg trimethoprim-sulfamethoxazole, (30)-µg amikacin, (5)-µg gentamicin, (5) -µg ciprofloxacin, (5)-µg norfloxacin, (5) -µg nalidixic acid, and (10)- µg nitrofurantoin.

TABLE 1 : Specimen containing organisms

Specimen	No: of specimens	*E.Coli* (%)	*K.Pneumoniae* (%)
Urine samples from South Gujarat region	120	65.33%	13.3%



Graph 1 : % Presence of pathogens in urine sample

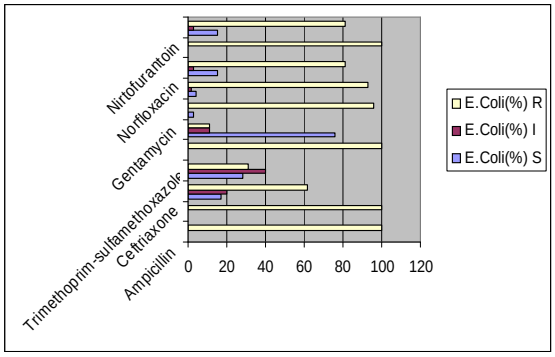
TABLE 2 : Antibiotic pattern of *E. coli*

Antibiotics	E.Coli (%) S	E.Coli (%) I	E.Coli (%) R
Ampicillin	0	0	100
Cefazolin	0	0	100
Ceftriaxone	17	20	62
Ceftazidime	28	40	31
Trimethoprim-sulfamethoxazole	0	0	100
Amikacin	76	11	11
Gentamycin	3	0	96
Ciprofloxacin	4	2	93
Norfloxacin	15	3	81
Nalidixic acid	0	0	100
Nirtofurantoin	15	3	81

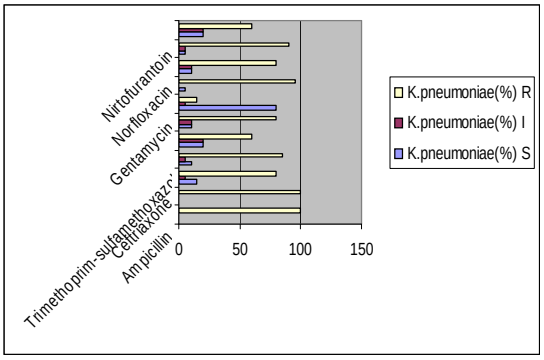
TABLE 3 : Antibiotic pattern of *K. pneumoniae*

Antibiotics	K.pneumoniae (%) S	K.pneumoniae (%) I	K.pneumoniae (%) R
Ampicillin	0	0	100
Cefazolin	0	0	100
Ceftriaxone	15	5	80
Ceftazidime	10	5	85
Trimethoprim-sulfamethoxazole	20	20	60
Amikacin	10	10	80
Gentamycin	80	5	15
Ciprofloxacin	5	0	95
Norfloxacin	10	10	80
Nalidixic acid	5	5	90
Nirtofurantoin	20	20	60

Broad-spectrum resistance of *E .coli and K. pneumoniae was defined as resistance to ampicillin or* cephalothin. An ESBL-EK resistance was defined as resistance of these bacteria to one of the following drugs: ceftriaxone, ceftazidime, or ceftizoxime. An MDR-ESBL was considered as resistance to 3 of the following antibiotic groups by the ESBL-EK species: trimethoprim-sulfamethoxazole, aminoglycosides (amikacin or gentamicin), fluoroquinolones

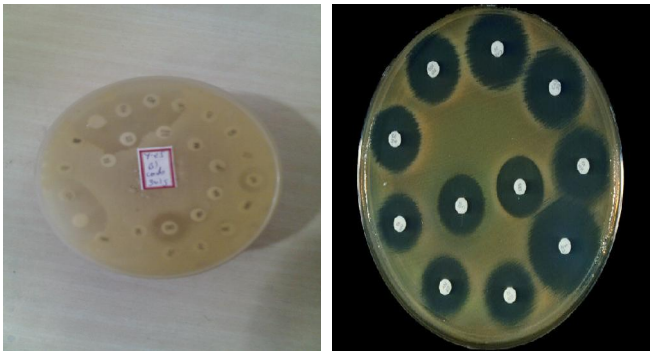


E. coli



Kleibsiella. pneumoniae

Graph 2 : Antibiotic pattern of *E. coli* & *Kleibsiella. pneumoniae*



Photograph of Multiple Drug Resistant of *E. coli* & K.pneumoniae

(ciprofloxacin, norfloxacin, or nalidixic acid), and nitrofurantoin.

The resistance pattern of *E. coli and K .pneumoniae* isolated form (120) urine samples are shown in the Table. Broad-spectrum resistance was detected in (Amikacin) (75 %) of the isolates. All of the (13.3%) *K. pneumoniae* isolates and (65.33%) *E. coli isolates were* broad-spectrum resistant. The ESBL-EK resistant isolates was observed in E.coli) (67.77 %) of the isolates, including *K. pneumoniae* ((13.3) %) and *E. coli ((*65.33) *%) isolates. There was* no significant correlation between species of the isolates in the ESBL resistant pattern (31.81) percent of the *K. pneumoniae isolates and* (44.44) % of the *E .coli isolates were sensitive* to amikacin ((76.25%)*).* The MDR-ESBL pattern was detected in (91.8%)isolates (0f *E.coli* and *K.pneumoniae*). These included (13.33%) of the *K. pneumoniae and* (65.33%) *of the E. coli* isolates. There was not a significant correlation between the two kinds of isolates in the MDR-ESBL resistant pattern.

DISCUSSION

In this research, the prevalence of resistance to fluoroquinolones by the ESBL-EK (more than 30%) was compatible with that reported by Burgess and colleagues.Fluoroquinolones are particularly useful for the treatment of urinary tract infections, because high concentrations of the drug in the urine can be achieved. A multicenter prospective study on *K pneumoniae bloodstream infection conducted* in 7 countries found that 18% of ESBL-producing isolates were resistant to ciprofloxacin.12Increasing resistance to fluoroquinolones has been reported up to 30%, which it is in agreement with the findings in the present study[13]. In this study, aminoglycosides showed variable activities against *E.coli and K.pneumoniae with about (76.25%)*amikacin resistance and (90)% gentamicin resistance. Indeed, (31.81%)% of *K.pneumoniae and* (44.44)% of *E.coli isolates were sensitive to amikacin. It means* sensitivity of *E.coli isolates to amikacin is much more* likely than *K.pneumoniae. The risk of resistance to* aminoglycosides has been reported to be increasing by fold[14]. In the present study, all of the *K pneumoniae* isolates and more than (67)% of *E coli isolates had* broad-spectrum resistance.

CONCLUSION

Our study showed the emergence of MDR-ESBLproducing *E.coli and K.pneumoniae. Treatment of* MDR will become more complex in the coming years, because of further limitation of available drugs. Determination of resistant patterns can help us to choose the best antibiotics in such a situation.

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