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Assessment of antimicrobial sensitivity profile of ESBL producing E. coli isolates from various clinical samples

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Abstract

Background: To assess antimicrobial sensitivity profile of ESBL producing E. coli isolates from various clinical samples. **Methodology:** Seventy-Eight E. coli isolates recovered from samples including pus, urine, blood, cerebrospinal fluid (CSF), stool, sputum, and different body fluids from inpatient and outpatient department received in the bacteriology laboratory in the department of microbiology were selected. ESBL screening and confirmation along with antimicrobial susceptibility test was done by Kirby–Bauer disk diffusion method according to the Clinical Laboratory Standards Institute (CLSI) guidelines. **Results:** Out of 48 inpatients samples of E. coli, 11 were found in pus, 20 in urine, 10 in blood, 4 in stool and 3 in sputum. Out of 30 outpatient samples, 7 were found in pus, 13 in urine, 5 in blood, 3 in stool and 2 in sputum. The difference was significant (P< 0.05). Antimicrobial susceptibility pattern of E. coli in pus, urine and blood against Ampicillin was 34%, 27% and 35%. Against Piperacillin was 43%, 42% and 60%. Against Piperacillin/Tazobactam was 91%, 85% and 82.4%. Against Amoxicillin/Clavulanic acid was 82%, 70% and 72%. Against Cefoperazone/Sulbactam was 80%, 78% and 84%. Against Cefoperazone was 32%, 27% and 54%. Against Cefoxitin was 27%, 35% and 32%. Against Ceftriaxone was 26%, 25% and 31%. Against Aztreonam was 37% , 23% and 20%. Against Imipenem was 100%, 100% and 100%. Against Gentamicin was 76%, 49% and 66%. Against Amikacin was 81%, 62% and 45%. Against Ciprofloxacin was 55%, 52% and 48%. Against Ofloxacin was 52%, 56% and 53% respectively. There was 62% ESBL producer in inpatients and 47% outpatient samples. There was 38% non-ESBL producers in inpatient and 53% outpatient samples. A significant difference was observed (P< 0.05). There was significant difference in antimicrobial susceptibility pattern of ESBL producing E. coli in urine and blood against various antibiotics (P< 0.05). **Conclusion:** There was high prevalence of ESBL against inpatient and outpatient samples obtained from blood, pus and urine.

Keywords: ESBL, E. coli, Urine.

INTRODUCTION

Resistant bacteria are emerging world-wide as a threat to favorable outcomes of treatment of common infections in community and hospital settings. Urinary tract, gastrointestinal, and pyogenic infections are the common hospital-acquired infections caused by members of Enterobacteriaceae.[1] Among Enterobacteriaceae, Escherichia coli has been the most commonly isolated species. E. coli are very well known to exhibit multidrug resistance. Prolonged antibiotic exposure, overstay in hospitals, severe illness, unprecedented use of third generation cephalosporin, and increased use of intravenous devices or catheters are important risk factors for infection with multidrug resistant E. coli.[2]

Beta lactamase production is perhaps the single most important mechanism of resistance to penicillins and cephalosporins. E. coli possess a naturally occurring chromosomally mediated Beta lactamase or plasmid mediated Beta lactamase.[3]

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Extended spectrum Beta lactamase (ESBL), enzymes that show increased hydrolysis of Oxyimino Beta lactamase which include cefotaxime, ceftriaxone, ceftazidime and aztreonam has been reported in recent years from different geographic areas. ESBL producing strains are probably more prevalent than is currently recognized because they often go undected by routine susceptibility testing methods.[4]

ESBL producing strains are probably more prevalent than is currently recognized because they often remain undetected by routine susceptibility testing methods.[5] ESBL strains have been associated with resistance to other non β-lactam antibiotics like the aminoglycosides and chloramphenicol. Another property of these ESBL strains is that they might show a false sensitive zone of inhibition in the Kirby– Bauer disk diffusion method.[6] Considering this, we performed this study to assess the antimicrobial sensitivity profile of ESBL producing E. coli isolates from various clinical samples.

METHODS

After considering the utility of the study and obtaining approval from ethical review committee, seventy- eight E. coli isolates recovered from samples including pus, urine, blood, cerebrospinal fluid (CSF), stool, sputum, and different body fluids from inpatient and outpatient department received in the bacteriology laboratory in the department of microbiology were selected.

Samples were processed and identified as per routine laboratory protocol. ESBL screening and confirmation along with antimicrobial susceptibility test was done by Kirby–Bauer disk diffusion method according to the Clinical Laboratory Standards Institute (CLSI) guidelines. Diameter of zone of inhibitions were measured and recorded in millimeters with the help of sliding calipers and organism was labelled as sensitive, resistant, or intermediate as per CLSI 2012 guidelines. The results were compiled and subjected for statistical analysis using Mann Whitney U test. P value less than 0.05 was set significant.

RESULTS

Table 1: Distribution of E. coli in various samples.

Specimen	Inpatient (48)	Outpatient (30)	P value
Pus	11	7	0.05
Urine	20	13	
Blood	10	5	
Stool	4	3	
Sputum	3	2	

Out of 48 inpatients samples of E. coli, 11 were found in pus, 20 in urine, 10 in blood, 4 in stool and 3 in sputum. Out of 30 outpatient samples, 7 were found in pus, 13 in urine, 5 in blood, 3 in stool and 2 in sputum. The difference was significant (P< 0.05) [Table 1].

Table 2: Antimicrobial susceptibility pattern of E. coli.

Antibiotics	Pus (18)	Urine (33)	Blood (15)
Ampicillin	34%	27%	35%
Piperacillin	43%	42%	60%
Piperacillin/Tazobactam	91%	85%	82.4%
Amoxicillin/Clavulanic acid	82%	70%	72%
Cefoperazone/Sulbactam	80%	78%	84%
Cefoperazone	32%	27%	54%
Cefoxitin	27%	35%	32%
Ceftriaxone	26%	25%	31%
Aztreonam	37%	23%	20%
Imipenem	100%	100%	100%
Gentamicin	76%	49%	66%
Amikacin	81%	62%	45%
Ciprofloxacin	55%	52%	48%
Ofloxacin	52%	56%	53%

Antimicrobial susceptibility pattern of E. coli in pus, urine and blood against Ampicillin was 34%, 27% and 35%. Against Piperacillin was 43%, 42% and 60%. Against Piperacillin/Tazobactam was 91%, 85% and 82.4%. Against Amoxicillin/Clavulanic acid was 82%, 70% and 72%. Against Cefoperazone/Sulbactam was 80%, 78% and 84%. Against Cefoperazone was 32%, 27% and 54%. Against Cefoxitin was 27%, 35% and 32%. Against Ceftriaxone was 26%, 25% and 31%. Against Aztreonam was 37% , 23% and 20%. Against Imipenem was 100%, 100% and 100%. Against Gentamicin was 76%, 49% and 66%. Against Amikacin was 81%, 62% and 45%. Against Ciprofloxacin was 55%, 52% and 48%. Against Ofloxacin was 52%, 56% and 53% respectively [Table 3].

Table 3: ESBL producing E. coli in in-patients and out-patients sample.

ESBL	Inpatient (48)	Outpatient (30)	P value
ESBL producer	62%	47%	0.05
Non-ESBL producers	38%	53%	0.04

There was 62% ESBL producer in inpatients and 47% outpatient samples. There was 38% non-ESBL producers in inpatient and 53% outpatient samples. A significant difference was observed (P< 0.05) [Table 3].

Table 4: Antimicrobial susceptibility pattern of ESBL producing E. coli in urine and blood.

Antibiotics	Urine (17)	Blood (8)	P value
Ampicillin	17%	25%	0.02
Piperacillin	41%	62%	0.01
Piperacillin/Tazobactam	85%	65%	0.01
Amoxicillin/Clavulanic acid	70%	62%	0.15
Cefoperazone/Sulbactam	72%	82%	0.82
Cefoperazone	27%	57%	0.04
Cefoxitin	35%	30%	0.93
Ceftriaxone	45%	32%	0.81
Aztreonam	23%	11%	0.01
Imipenem	100%	100%	1
Gentamicin	55%	62%	0.18
Amikacin	62%	42%	0.03
Ciprofloxacin	58%	41%	0.05
Ofloxacin	57%	51%	0.94

There was significant difference in antimicrobial susceptibility pattern of ESBL producing E. coli in urine and blood against various antibiotics (P< 0.05) [Table 4].

DISCUSSION

Antibiotic resistance is emerging worldwide as a major threat to favourable clinical outcomes both in hospitalized patients and out patients.[7,8] Urinary tract, gastro intestinal, pyogenic infections are commonly caused by Enterobacteriaceae. ESBL strains have been associated with resistance to other non-beta lactum antibiotics like amino glycosides and chloramphenicol Another property of these ESBL strains is that they might show a false sensitive zone of inhibition in the Kirby Bauer disc diffusion methods.[9] E. coli is the most commonly isolated species. E. coli is known to exhibit multiple drug resistance.[10,11] Considering this, we performed this study to assess the antimicrobial sensitivity profile of ESBL producing E. coli isolates from various clinical samples.

Our results showed that out of 48 inpatients samples of E. coli, 11 were found in pus, 20 in urine, 10 in blood, 4 in stool and 3 in sputum. Out of 30 outpatient samples, 7 were found in pus, 13 in urine, 5 in blood, 3 in stool and 2 in sputum. Sadhna et al.[12]12 highlighted the susceptibility pattern of E. coli in clinical specimens. Out of 542 E.coli isolates grown in the lab from urine, blood, pus, vaginal swab, stool, aural swab, BAL fluid, and conjunctival swab. 420 isolates showed sensitivity to imipenem, amikacin, meropenem, and piperacillin/tazobactum in more than 70 % cases.

Our results showed that antimicrobial susceptibility pattern of E. coli in pus, urine and blood against Ampicillin was 34%, 27% and 35%. Against Piperacillin was 43%, 42% and 60%. Against Piperacillin/Tazobactam was 91%, 85% and 82.4%. Against Amoxicillin/Clavulanic acid was 82%, 70% and 72%. Against Cefoperazone/Sulbactam was 80%, 78% and 84%. Against Cefoperazone was 32%, 27% and 54%. Against Cefoxitin was 27%, 35% and 32%. Against Ceftriaxone was 26%, 25% and 31%. Against Aztreonam was 37%, 23% and 20%. Against Imipenem was 100%, 100% and 100%. Against Gentamicin was 76%, 49% and 66%. Against Amikacin was 81%, 62% and 45%. Against Ciprofloxacin was 55%, 52% and 48%. Against Ofloxacin was 52%, 56% and 53% respectively. Kumar et al.[13] determined the antimicrobial sensitivity profile of ESBL producing E. coli isolates from various clinical samples. Of the total E. coli isolates, 100 (55.55%) isolates were ESBL producers and 80 (44.45%) isolates were non-ESBL producers. Among ESBL producers, the maximum number was isolated from blood (66.67%), followed by aspirate (65%), stool (57.14%), wound (55%), and urine (54.67%). Of the 105 organisms isolated from in-patients, 64 (60.95%) were ESBL producers while 36 (48%) out of 75 from out-patients were ESBL producers. ESBL producers were more common among in-patients than out-patients. ESBL and non-ESBL producers compared among in- and out-patients give significant result (P-0.001)

Our results showed that there was 62% ESBL producer in inpatients and 47% outpatient samples. There was 38% non-ESBL producers in inpatient and 53% outpatient samples. Kibret et al.[14] showed a high resistance to amoxicillin (86%) and tetracycline (72.6%) but a greater susceptibility to Nitrofurantoin (96.4%), Norfloxacin (90.6%) and Gentamycin (79.6%). Bam ford et al demonstrated a significant decline in susceptibility to Beta lactam antibiotics and fluoroquinolones.

There was significant difference in antimicrobial susceptibility pattern of ESBL producing E. coli in urine and blood against various antibiotics ($P < 0.05$). Maina et al.[15] documented a higher proportion of isolates resistant to ciprofloxacin, levofloxacin, and tetracycline, and approximately 100% sensitivity to carbapenems. Goyal et al.[16] on clinical isolates of ESBL producing E. coli, resistance found to amikacin was 14.7%, gentamicin 66.7%, trimethoprim/sulfamethoxazole 79.1%, and ciprofloxacin 93.8%.

CONCLUSION

There was high prevalence of ESBL against inpatient and outpatient samples obtained from blood, pus and urine.

REFERENCES

1. Agrawal P, Ghosh AN, Kumar S, Basu B, Kapila K. Prevalence of extendedspectrum beta-lactamases among Escherichia coli and Klebsiella pneumoniae isolates in a tertiary care hospital. Indian J Pathol Microbiol. 2008;51(1):139–142.
2. Aruna K, Mobashshera T. Prevalence of extended spectrum beta-lactamase production among uropathogens in South Mumbai and its antibiogram pattern. EXCLI J. 2012;11:363–372.
3. Dalela G. Prevalence of extended spectrum beta lactamase (ESBL) producers among gram negative bacilli from various clinical isolates in a tertiary care hospital at Jhalawar, Rajasthan, India. J Clin Diagn Res. 2012;6(2):182–187.
4. Abhilash KP, Veeraraghavan B, Abraham OC. Epidemiology and outcome of bacteremia caused by extended spectrum beta-lactamase (ESBL)-producing Escherichia coli and Klebsiella spp. in a tertiary care teaching hospital in south India. J Assoc Physicians India. 2010;58(suppl):13–17.
5. Subha A, Ananthan S. Extended spectrum β-lactamase (ESBL) mediated resistance to third generation cephalosporins among Klebsiella pneumoniae in Chennai. Indian J Med Microbiol. 2002;20(2):92–95.
6. Khurana S, Taneja N, Sharma M. Extended Spectrum β lactamase mediated resistance in urinary tract isolates of family Enterobacteriaceae. Ind J Med Res 2002;116:145–9.
7. Pamela BC. Enterobacteriaceae: Escherichia, Klebsiella, Proteus and other genera. In: Collee JG, Marmion BP, Fraser AG, Simmons A, eds. Mackie and McCartney Practical Medical Microbiology. 14th ed. UK: Churchill Livingstone; 2007:361–367.
8. Clinical Laboratory Standard Institute. Performance Standards for Antimicrobial Susceptibility Testing; Twenty-Second Informational Supplement. Vol 32. Clinical Laboratory Standard Institute. Wayne, Pennsylvania, USA; 2012:70–71.
9. Akram M, Shahid M, Khan AU. Etiology and antibiotic resistance patterns of community-acquired urinary tract infections in the JNMC Hospital Aligarh, India. Ann Clin Microbiol Antimicrob. 2007;6:4.
10. Padmini BS, Appalaraju B. Extended spectrum β lactamases in urinary isolates of E. coli and K. pneumoniae—prevalence and susceptibility pattern in a tertiary care hospital. Indian J Med Microbiol. 2004;22(3):172–4.
11. Bamford C, Bonorchis K, Ryan A, et al. Antimicrobial susceptibility patterns of Escherichia coli strains isolated from urine samples in South Africa from 2007–2011. South Afr J Epidemiol Infect. 2012; 27(2):46–52.
12. Sadhna S, Ranjana H. Indian Journal of Microbiology Research. Indian J Microbiol Res 2012;1(1):37-45.
13. Kumar D, Singh AK, Ali MR, Chander Y. Antimicrobial susceptibility profile of extended spectrum β-lactamase (ESBL) producing Escherichia coli from various clinical samples. Infectious Diseases: Research and Treatment. 2012 Jan;7:IDRT-S13820.
14. Kibret M, Abera B. Antimicrobial susceptibility of E. coli from clinical sources in northeast Ethiopia. Afr Health Sci. 2011; 11(suppl 1):S40–S45.
15. Maina D, Makau P, Nyerere A, Revathi G. Antimicrobial resistance patterns in extended-spectrum β-lactamase producing Escherichia coli and Klebsiella pneumoniae isolates in a private tertiary hospital, Kenya. Microbiology Discovery. 2011;1:5.
16. Goyal A, Prasad KN, Prasad A, Gupta S, Ghoshal U, Ayyagari A. Extended spectrum β-lactamases in Escherichia coli & Klebsiella pneumoniae & associated risk factors. Indian J Med Res. 2009;129:695–700.