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EMERGENCE OF BETA LACTAM RESISTANCE IN CLINICAL ISOLATES OF UTI CAUSING PATHOGENS

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Abstract: The urinary tract infection (UTI) is the common infection of urinary tract with an increasing resistance to antibiotics. The bacteria that causes UTI includes *Staphylococcus,Pseudomonas*,*Proteus*, *Streptococcus,Corynebacterium,Lactobacillus*,*Entero bacter* and members of the family of *Enterobacteriaceae (E.coli, K.pneumoniae)*, while the fungus *Candida* (yeast) may also be pathogenic. The line of treatment includes prescribing antibiotics. A variety of antibiotics are available in the market and selection depends upon many factors including whether the infection is complicated, uncomplicated, primary or recurrent. Treatment decisions are also based on the type of patient (man or woman, a pregnant or non-pregnant woman, child, hospitalized or non-hospitalized patient, person with diabetes, etc). But, most of the antibiotics have side effects that vary from mild to severe. Another major problem of use of antibiotics is the emergence of drug resistant bacterial strain. The current study has been performed to analyze the MDR bacterial strains isolated from urine samples of UTI infected patients.

INTRODUCTION

The frequency of antibiotic resistant bacteria and the number of drugs to which they are resistant are increasing day by day. This is the major problem in the treatment of in- and out- patients. Two major factors contribute to the antibiotic resistance are – the antibiotic itself and the type of resistant traits. Initially, antibiotic resistance was a problem in developing countries but now it affects the whole world. The consequences of antibiotic resistance include higher mortality and greater morbidity. Infection with organisms resistant to antimicrobial agents leads to longer hospitalisation and greater expense. The drug resistance can endanger the life of any patient either with an acute or a chronic infection.

UTI is an infection of any part of the urinary system-kidneys, ureters, bladder and/or urethra. It is the second most common infection after respiratory tract. An increasing proportion UTIs are due to multidrug-resistant (MDR) pathogens for which there are limited treatment options[1]. So, it is very much essential to have urine culture and sensitivity report.

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Incompletely treated UTI patients may have an infection with a resistant organism. Acute infection may lead to chronic urinary tract infection leading to chronic renal failure.

Antibiotics are most commonly prescribed by physician in UTI. β-lactam antibiotics are the most frequently used antimicrobial agents. The adverse effects of β-lactam antibiotics are hypersensitivity, diarrhaea, fever, chill, skin rashes, nausea, headache, etc. Over the years, the continued use of various antimicrobials has led the bacteria to develop drug resistance[2]. The common mechanisms by which bacteria exhibit drug resistance are drug inactivation (enzymatic deactivation of antibiotic), alteration of target site (alteration of penicillin binding proteins), alteration of metabolic pathway and reduced drug accumulation (efflux pump)[3,4].

The beta lactam antibiotics are divided into four major groups (Penicillins or penam, cephalosporin or cepham, carbapenem and monobactam). Penem is further divided into two sub groups (Extended spectrum and narrow spectrum). Cepham are divided into five generations [5]. The beta lacta antibiotic resistance pattern has been studied by different scientist[6-10.]

The aim of this study was the to determine the susceptibility pattern to commonly used β-lactam antibiotics towards bacteria isolated from urine samples of UTI patients and evaluate the results so that the optimal empirical antibiotic therapy could be determined.

MATERIAL AND METHODS

Sample collection and processing

Total 100 urine samples from the patients suffering from UTI were collected in sterilized containers, from the various pathology labs. The collected samples were diluted in 1:100 with distilled water and streaked on UTI agar plates (Himedia DT001), incubated at 37^0C overnight. The single isolated bacterial colony was inoculated in an autoclaved nutrient broth, incubated at 37^0C for 18 hrs. This culture was used for biochemical characterization, identification and antibiotic susceptibility of bacteria[5].

Antibiotic susceptibility testing

The isolated bacteria *Escherichia coli, Enterococcus faecalis* and *Pseudomonas aeruginosa* [11] were tested for the susceptibility to eleven β-lactam antibiotics by disc diffusion method (Kirby-Bauer method) [12]. Table 1 enumerates the antibiotics utilized for susceptibility testing. These antibiotics were procured from Himedia, Mumbai.

Table 1: Antibiotics for susceptibility test

S.No.	Antibiotics	Abr.	MIC/ ml	Concentration used/ ml	Classified group	Catalogue number
1	Cefpodoxime	CPD	4µg	16 µg	3rd gen. cepham	SD725
2	Cephalexin	CN	0.24µg	0.96 µg	1st gen. cepham	HX035
3	Cefuroxime	CXM	4µg	16 µg	2nd gen. cepham	SD061
4	Cefixime	CFM	1 µg	4 µg	3rd gen. cepham	SD211
5	Ceftazidime	CAZ	0.5 µg	2 µg	3rd gen. cepham	SD062
6	Cefazolin	CZ	1 µg	4 µg	1st gen. cepham	SD047
7	Cefotaxime	CTX	8 µg	32 µg	3rd gen. cepham	SD040
8	Ceftriaxome	CTR	0.12 µg	0.48 µg	3rd gen. cepham	SD065
9	Cefaclor	CF	8 µg	32 µg	2nd gen. cepham	SD157
10	Feropenem	FAR	2 µg	8 µg	Broadest spectrum	SD279
11	Cefepime	CPM	8 µg	32 µg	4th gen. cepham	SD219

Abr: Abbreviation; MIC: minimum inhibitory concentrations; gen: generation

RESULT

The antibiotic resistance pattern obtained upon performing the susceptibility tests showed that 86% of the collected urine samples were UTI positive [11]. Eleven β-lactam antibiotics have been used to perform antibiotic susceptibility test. This showed remarkable results. *E.coli* is a common pathogen of UTI and became increasingly resistance to most of the antibiotics. It has shown the complete resistance to Cefpodoxie, Cephalexin, Cefuroxie and Cefazolin. Also the resistance to Cefixime, Ceftazidime and Ceftriaxome is at high risk. The resistances towards other antibiotics are increasing with high speed in *E. faecalis* and *P. aeruginosa*

Table 2: Antimicrobial resistance pattern for β-lactam antibiotics

Name of antibiotic	Name of clinical isolates showed resistance (%)		
	EC (n=24)	**EF (n=32)**	**PA (n=33)**
CPD	100.00	90.625	90.91
CN	100.00	96.875	87.88
CXM	100.00	78.125	72.73
CFM	95.84	71.875	90.91
CAZ	95.84	65.625	78.79

CZ	100.00	84.375	78.79
CTX	83.34	90.625	93.94
CTR	95.84	71.875	93.94
CF	83.34	40.625	72.73
FAR	75.00	59.375	81.82
CPM	79.17	87.50	72.73

EC: *E.coli*, EF: *E.faecalis*, PA: *P.aeruginosa*

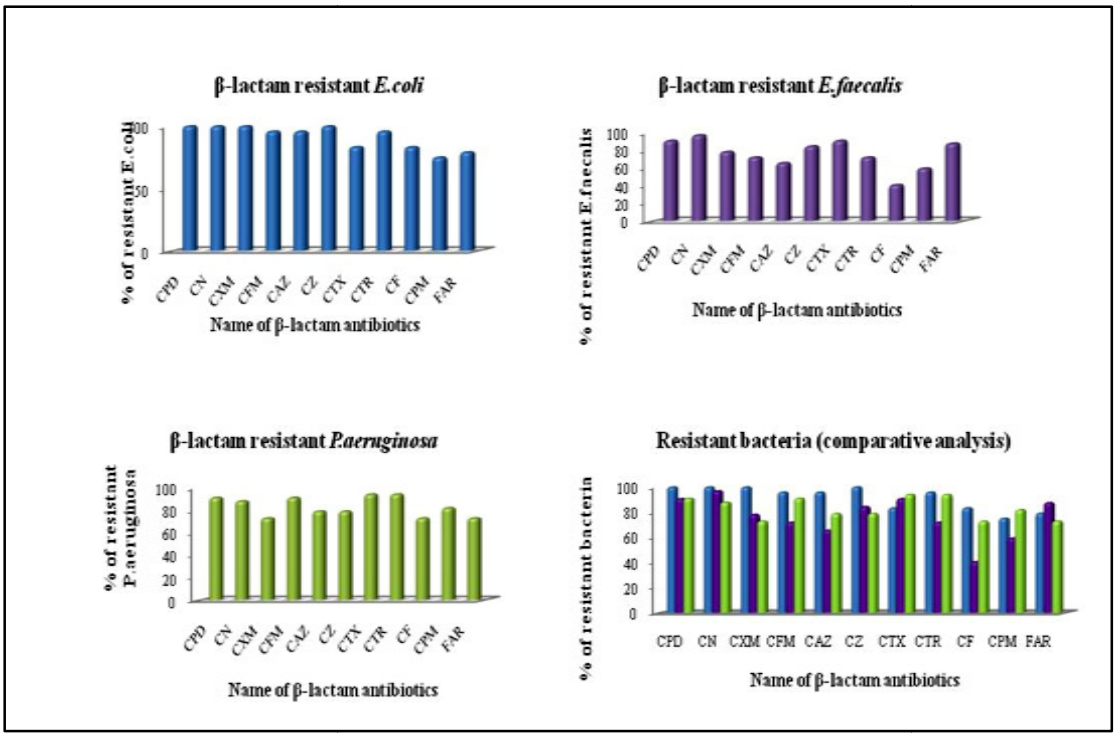

Fig-1: Graphical representation of the resistance pattern of UTI pathogens to β-lactam antibiotics

Discussion

The current study presents an antibiotic resistance pattern for eleven β-lactam antibiotics in almost 90 bacteria isolated from the urine samples of UTI patients. Each isolated bacteria showed resistance to the tested antibiotic. We have calculated the MIC of all antibiotics and then used four times the concentration of MIC of all antibiotics to check the resistance pattern. It has been observed that *E.coli* showed complete resistance to cefpodoxime (third generation cephalosporin), Cephalexin and cefazoline (1st generation cephalosporin), cefuroxime (2nd generation moderate spectra). The higher concentration of these antibiotics may be required to treat *E.coli* infection. *E.faecalis* showed the highest resistance to

Cephalexin followed by cefpodoxime and cefatoxime (3rd generation cephalosporin). *P. aeruginosa* showed highest resistivity for cefotoxime and ceftriaxome (3rd generation cephalosporin) followed by cefpodoxime and cefixime. The data may be helpful to the clinicians for prescribing the medicines to the patients suffering from urinary tract infection. This piece of work can be further extended to all other pathogenic bacteria not only causing UTI but other systemic infections as well.

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