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RESEARCH ARTICLE

CHANGING TREND OF ANTIBIOTIC SUSCEPTIBILITY PATTERN OF COMMON GRAM NEGATIVE BACILLI ISOLATED FROM MEDICAL INTENSIVE CARE UNIT OF TERTIARY CARE HOSPITAL AHMEDABAD, GUJARAT, INDIA

***Dr. Parimal H. Patel[1], Dr. Sanjay Rathod[2], Dr. Bimal Chauhan[3], Dr. Hetal Rathod[4], Dr. Jayshree Pethani[5], Dr.Parul Shah[6]**

[1]Tutor, Department of Microbiology, Smt. NHL Municipal Medical College Ahmedabad, India-380006

[2]Associate Professor, Department of Microbiology, Smt. NHL Municipal Medical College Ahmedabad, India-380006

[3]Assistant Professor, Department of Microbiology, Smt. NHL Municipal Medical College Ahmedabad, India-380006

[4]1st Year Resident, Department of Microbiology, Smt. NHL Municipal Medical College Ahmedabad, India-380006

[5]Associate Professor, Department of Microbiology, Smt. NHL Municipal Medical College Ahmedabad, India-380006

[6]Professor & Head, Department of Microbiology, Smt. NHL Municipal Medical College Ahmedabad, India-380006

ABSTRACT

Introduction: Resistance among Gram-negative bacilli antimicrobial remains a significant problem for patients in the intensive care unit (ICU). Multi-resistant gram-negative bacilli are important pathogens in ICUs, causing high rate of mortality. The purpose of this study was to investigate change in antimicrobial resistance patterns among common Gram-negative bacilli isolated from Medical ICU patients.

Method and Materials: In duration of two years (2011, 2012) all Gram negative bacilli isolated from different clinical specimens from MICU were evaluated for sensitivity patterns by Kirby-Bauer disc diffusion method.

Results: The most frequently isolated organisms were *Acinetobacter baumannii*, *Pseudomonas aeruginosa, Escherichia coli* and *Klebsiella sp..* Antibiotic susceptibility patterns significantly declined in those organisms, *A baumannii* showed decreased susceptibility to carbapenem (4.2% to 56.2% resistant), ampicillin sulbactam (48.1 to 62.5% resistant)and netilmycin (68.5 to 87.7% resistant).*Pseudomonas aeruginosa* also showed decreased susceptibility for carbapenem (6.2 % to 43.9% resistant),netilmycin and for quinolones(II)(resistant up to 65.1 & 76.2% respectively).Same way susceptibility to commonly use antibiotics for *E.coli* and *Klebsiella sp.* were also decreased.

Conclusion: Antimicrobial resistance is an emerging problem in MICU. Continuous monitoring of antimicrobial susceptibility and strict adherence to infection prevention guidelines are essential to eliminate major outbreaks in the future.

KEY WORDS: MICU, Antibiotic resistance, Gram negative bacilli

INTRODUCTION:

Critically ill patients admitted in intensive care units (ICUs) are always at a higher risk of developing infections with various antibiotic resistant organisms. Infection caused by multidrug-resistant bacteria constitutes a serious problem for intensive care patients throughout the world. The mortality rate associated with multidrug-resistant bacteria in these patients is high in some intensive care units (ICUs).[1] Antibiotic resistant bacteria are becoming an increasingly difficult problem for management in intensive care units. Infection in the ICU leads to increased mortality and cost.[2]

Globally, patients in the ICU have encountered an increasing emergence and spread of antibiotic-resistant pathogens. The worldwide median rate is 9 infections per 100 discharged ICU patients or 23.7 infections per 1000 patient days. Although 5% to 10% of all patients are treated in ICUs, they account for 25% of all nosocomial infections and the incidence is 5 to 10 times higher than in general hospital wards. The increased risk of infection is associated with the severity of the patient's illness and underlying conditions, length of exposure to invasive devices and procedures, increased patient contact with healthcare personnel and length of stay in the ICU.[3]

Knowledge of an ICU's most common bacterial isolates and their antibiotic susceptibility patterns facilitates effective empirical antibiotic therapy and supports decisions to restrict or reduce the clinical availability of certain antibiotics. Antibiotic interventions should aim to limit the emergence of antibiotic resistance whilst simultaneously improving patient outcomes and decreasing drug costs.[4]The purpose of this study was to evaluate the change in antimicrobial resistance patterns among gram-negative bacteria isolated from patients who were admitted to ICU.

MATERIAL AND METHODS:

A retrospective study was conducted of all reports of Gram-negative bacili isolates from MICU of V.S.General

*Corresponding author: Dr. Parimal H. Patel

Hospital (VSGH) from January 2011 to December 2012. Gram-negative organisms were identified by standard methods, including colony morphology, Gram stain and biochemical methods.[5] After the isolation of bacteria, The antimicrobial susceptibility testing was performed with the help of the Kirby-Bauer disc diffusion method using commercially available discs on Muller- Hinton (MH) agar, and results were interpreted according to the guidelines of the Clinical and Laboratory Standards Institute (CLSI).[6] as per CLSI recommendations. Quality control was performed by testing these same antimicrobials on *E coli* ATCC 25922, *P. aeruginosa* ATCC 27853.[6]The proportion of resistant isolates was calculated as the sum of resistant organisms relative to the total number of organisms tested.

RESULTS:

For conveniences of statistical analysis and to know trend of resistant pattern, isolates from clinical specimens in duration of two year were divided in four phase(Phase -1 Jan to June 2011, Phase -2 July to Dec. 2011, Phase - 3 Jan to June 2012, Phase -4 July to Dec. 2012). The most common Gram negative bacteria isolated were *Acinetobacter baumanii*, *P. aeruginosa*, *Klebsiella sp.* and *E coli* accounted for 94.75%(831/877) of total isolates, other less common isolates including *Proteus sp., Enterobacter,Citrobacter sp.,Providencia sp., Morganella morganii etc.* Over the study period, *A baumannii* susceptibility markedly decreased to imipenem (Resistance 4.3%,12.8%,,22%,56.2% respectively in each phase), netilmycin (Resistance 68.5%,73.9%,95.9%,87.7% respectively in each phase) ampicillin sulbactam(Resistance 48.1%,35%,34.3%,62.5% respectively in each phase).Antibiotic susceptibility pattern of *A.baumanii* is shown in table.1 Resistant of *P.aeruginosa* to carbapenem was consistently increased in each phase of study(6.2% to 43.9) while for pip.tazobactam reiststance was increased in each phase except phase 3. Susceptibility of other antibiotics are shown in table 2. Susceptibility of *E.coli* for carbapenem, netilmycin and ampi.sulbactam were markedly decreased and in *Klebsiella sp.* susceptibility for carbapenem and netilmycin were decrease but susceptibility to ampi.sulbactam was increased. Antibiotic susceptibility for *E.coli* and *Klebsiella sp.* are shown in table 1. and resistance pattern in general for all Gram negative bacilli isolated from Medical intensive care unit in study period shown in figure 1.

Table 1: shows antibiotic resistant in percentage

Antibiotic name/ class	Organisms											
	Acinetobacter baumanii				*E.coli*				*Klebsiella sp.*			
↓ Phase →	1	2	3	4	1	2	3	4	1	2	3	4
Ampicillin/Sulbactam	48.1	35	34.3	62.5	58.3	71.4	63.6	61.5	71.9	75.6	76.2	56.8
Ceftazidime	98.1	100	100	98.5	97.2	90.9	91.4	97.5	98.2	95.6	97.8	98
Cefepime	97.9	100	100	96.1	74.2	81.8	62.9	81.2	92	91.1	93.5	87.9
Carbapenem	4.3	12.8	22	56.2	3.2	0	13	41.2	0	4.8	8.3	20
Netilmicin	68.5	73.9	95.9	87.7	47.2	42.3	37.1	50	66.7	61.5	82.6	71.4
Quinolones(II)	–	64.3	39.7	64.6	–	16.7	14.3	35	–	18.2	28.3	53.1
Quinolones(I)	–	100	100	98.5	-	-	-	-	-	-	-	89.8
Trimethoprim/Sulfamethoxazole	97.3	97.7	87.7	87.5	87	88.9	60	84.8	93.8	94.2	84.8	88.2
Poypeptide	0	0	0	0	0	0	0	0	0	0	0	0
Chloramphenicol	–	100	84.5	90.9	-	-	-	-	-	-	43.5	59.1
Teteracycline	83.3	95.5	97.3	95.1	91.7	96.3	100	100	84.2	92.3	95.7	97.1

Table 2: Antibiotic resistant of *Pseudomonas aeruginosa* in percentage

Antibiotic name/ class				
↓ Phase →	**1**	**2**	**3**	**4**
Piperacillin/Tazobactam	37.9	41.2	26.2	61.9
Ceftazidime	89.8	73.5	50	88.9
Cefepime	77.6	75.5	45.2	75
Carbapenem	6.2	19.4	19.2	43.9
Netilmicin	-	56.7	47.6	65.1
Quinolones(II)	-	50	73.8	76.2
Quinolones(I)	-	60	78	89.7
Polypeptide	0	0	0	0
	1	**2**	**3**	**4**
	37.9	41.2	26.2	61.9
	89.8	73.5	50	88.9

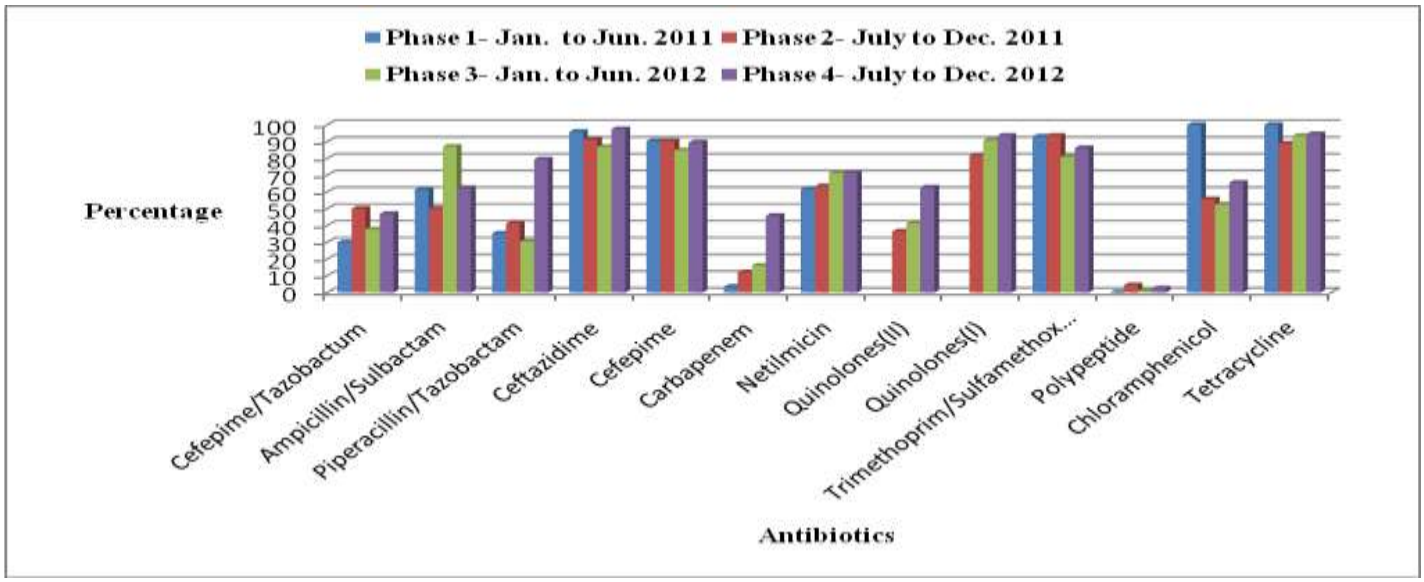
*– = data not available

*Quiolones(II) = Levofloacin,Gatifloxacin,Moxifloxacin

* Quiolones(I) = Ofloxacin

*Polypeptide = Colistin, Polymixin B

Figure 1: Resistance pattern (%) in general for all Gram negative bacilli isolated from Medical intensive care unit



- Data for quinolones in Phase 1 not available.

DISCUSSION:

Antimicrobial resistance is an increasingly emerging problem worldwide, especially in ICUs. Identifying the resistance pattern of microorganisms in every hospital is the key to success in the appropriate treatment of patients. Surveys of the prevalence and susceptibility patterns of bacterial isolates are important in determining optimum empirical therapy for infections in critically ill patients. Non fermentors are most common class of organisms isolated in our Medical ICU. The reasons for this high prevalence nonfermentors could be are, factors associated with the acquisition of nonsocial pathogens in patients with recurrent or long termhospitalization, complicating illness or the immunocompromised condition[7].Common Gram negative organisms isolated from MICU were similar to study done by Sameera M. *et al* [8]. Resistance to ceftazidime was > 90% for *E.coli*, *A.baumanii* and *klebsiella sp.* and 50% to 89.8% resistance for *P.aeruginosa*.

In our study *E.coli* and *Klebsiella sp.* Shows higher resistance to ceftazidime.How ever this data is important given in the increase in the incidence of extended spectrum betalactamase. ESBL producing gram negative bacteria that are mostly resistant to ceftazidime and cefotaxime in ICU.

Similar study done by Kaul *et al* in which resistant to ceftazidime was increased for *E.coli* while resistance was decreased for *Klebsiella sp.*[9] suggest the change in antibiotic susceptibility pattern. In our study there was increased in resistance for antibiotics carbapenem,quinolones(II) and netilmycin while in ceftazidime and cefipime which were already resistant for GNB isolated from MICU almost more than 90% and maintain their resistance level. Resistance of ampicilin sulbactam for *E.coli* and *A.baumanii* was increased. The resistance of some of the isolates is due to inherent resistance of the microorganisms .Beta-lactams are the most widely used antibiotics all over the world, and resistance to this antibiotic has resulted in a major clinical crisis [10].In this study the most commonly used antibiotics belonging to penicillins, cephlosporins, fluoro-quinolones, aminoglycosides, co-trimoxazole and carbapenems were tested against the bacterial isolates to have an update current status of the resistance pattern.

The higher resistance in these patients is probably due to different antibiotic prescribing practices as it varies enormously[11]. Very high resistance rate to the most commonly used antibiotics including; fluoroquinolones is most likely due to misuse, overuse and over-the-counter availability of these antibiotics. The emergence of antimicrobial resistance among a number of bacterial pathogens changes the way we practice medicine and places some of our patients at risk of dying from their infections. The overuse and misuse of antibiotics are major contributing factors to bacterial resistance; therefore it is incumbent on each of us to use antibiotics judiciously and appropriately. Judicious antibiotic use means that antibiotics are prescribed only when indicated and that the drug chosen is the most narrow spectrum agent that will be effective. Appropriate use means choosing not only the correct antibiotic but also the appropriate dose and duration, factors that can influence the development and carriage of resistant organisms[12].

CONCLUSION:

Considering the increasing antimicrobial resistance rate in hospitals, a committee for rational drug administration is needed to collaborate with infection control committees. Most ICU-associated infections can be prevented and controlled by applying the principle procedure and these include hand-washing, timely use and de-escalation of antibiotic therapy, timely change or removal of indwelling 'lines', early extubation and physiotherapy. The clinical specimens should be subjected to bacterial culture and antibiotic susceptibility testing prior to antibiotic therapy to determine the appropriate drug and also surveys of the prevalence and susceptibility patterns of bacterial isolates are important in determining optimum empirical therapy for infections in critically ill patients.

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