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Original Research Article.

Evaluation of Drug Sensitivity among Patients Admitted to Intensive Care Settings at a Tertiary Care Centre

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ABSTRACT

Introduction: Resistance to antibiotics has emerged recently due to misuse of antibiotics and is a threat to health-care system. The present study was planned to assess the drug resistance and sensitivity patterns of the blood isolates recovered from ICU.

Materials and Methods: The present prospective study was conducted among 200 patients receiving antibiotics in the ICU in the Vedantaa Institute of Medical Sciences, Dahanu, Palghar, Maharashtra, India. The blood culture and sensitivity reports of 200 patients were analysed for bacteria isolated, culture and sensitivity reports.

Results: Pseudomonas spp (n=38) was the most common organism isolated from various clinical specimens followed by Acinetobacter spp. Acinetobacter showed resistance to Gentamicin, Ciprofloxacin, Meropenem, Amikacin, Cefoperazone and Ceftazidine. Klebsiella spp showed resistance to Gentamicin, Ciprofloxacin, Ceftriaxone, Meropenem and Amikacin Pseudomonas spp showed resistance to Gentamicin, Ciprofloxacin, Ceftriaxone, Meropenem, Amikacin, Cefoperazone and Ceftazidine.

Conclusion: Prescribing appropriate antibiotics for the right duration is very important to prevent drug resistance. Antimicrobial stewardship program with educational intervention and sensitization of medical students in rational antimicrobial prescription is the need of the hour to control the menace on antimicrobial resistance.

Keywords: Antibiotics; Antimicrobial Resistance; Sensitivity.

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INTRODUCTION

Resistance to antibiotics has emerged recently due to misuse of antibiotics and is a threat to health-care system[1] and among healthcare settings of high-risk infection, intensive care unit (ICU) is considered an "epicenter of infections".[2] Moreover, especially in developing countries like India where there are no antimicrobial stewardship programs in most of the ICUs.[3] Antimicrobial resistance results in increased economic burden on patients due to the higher cost of antibiotics, prolonged ICU stay, and increased mortality. Prescribing appropriate antibiotics for the right duration is very important to prevent drug resistance.[3] Patients in ICU are vulnerable to infections because they are exposed to a variety of invasive procedures, including intubation, mechanical ventilation, and vascular access. Moreover, some drugs (sedatives, muscle relaxants) commonly used for ICU patients also increase the risk for infection.[2] The present study was planned to assess the drug resistance and sensitivity patterns of the blood isolates recovered from ICU.

MATERIALS AND METHODS

The present prospective study was conducted among 200 patients receiving antibiotics in the ICU in the Vedantaa Institute of Medical Sciences, Dahanu, Palghar, Maharashtra, India. An informed written consent was taken from the patients and the ethical approval from the Ethics Committee of the institute. Patients were included in the present study in a consecutive manner and only those patients were enrolled who had blood cultures yielded bacterial isolates. The blood culture and sensitivity reports of 200 patients were analysed for bacteria isolated, culture and sensitivity reports. Culture media used for isolation of these organisms were blood agar, MacConkey agar and chocolate agar. Identification

was done based on the colony morphology and biochemical tests. Antimicrobial susceptibility testing was performed using the Kirby-Bauer disk-diffusion method and was reported according to Clinical Laboratory Standards Institute (CLSI) guidelines.[4] Data management and statistical analysis Interpretation and analysis of the results were carried out using SPSS 20.0.

Table 1: Isolates among clinical samples

Bacteria	No. of clinical samples
Acinetobacter spp	35
Pseudomonas spp	38
E.coli	29
Klebsiella	28
Enterococcus	20
Staphylococcus aureus	10
Enterobacter	10
Candida	13

Table 2: Resistance pattern of various Gram-positive and Gram negative bacteria

Antibiotics	Resistance%					
	Acinetobacter (n=35)	Klebsiella spp (28)	Pseudomonas spp (38)	E.coli (n=29)	Enterococcus (20)	S aureus
Cefuroxime	-	-	-	-	-	-
Gentamicin	81	66	66	61	23	29
Ciprofloxacin	84	71	63	85	-	64
Ceftriaxone	-	79	-	88	-	
Meropenem	78	39	52	19	-	-
Amikacin	83	46	57	21	-	-
Cefoperazone	23	-	19	-	-	-
Ceftazidine	89	-	71	-	-	-
Penicillin	-	-	-	-	-	83
Ampicillin	-	-	-	-	63	-
Erythromycin	-	-	-	-	-	39
Clindamycin	-	-	-	-	-	12
Tetracycline	-	-	-	-	22	-
Cefoxitin	-	-	-	-	-	41
Vancomycin	-	-	-	-	-	1

RESULTS

Table 1 shows that Pseudomonas spp (n=38) was the most common organism isolated from various clinical specimens followed by Acinetobacter spp (n=35), Escherichia coli (n=29), Klebsiella spp (n=28), Enterococcus spp (n=29), Staphylococcus aureus (n=10), Enterobacter (n=10) and Candida spp (n=13). Table 2 shows resistance pattern of various Gram-positive and Gram negative bacteria. Acinetobacter showed resistance to Gentamicin, Ciprofloxacin, Meropenem, Amikacin, Cefoperazone and Ceftazidine. Klebsiella spp showed resistance to Gentamicin, Ciprofloxacin, Ceftriaxone, Meropenem and Amikacin Pseudomonas spp showed resistance to Gentamicin, Ciprofloxacin, Ceftriaxone, Meropenem, Amikacin, Cefoperazone and Ceftazidine.

DISCUSSION

Antimicrobial Resistance (AMR) is on the rise and is a serious threat to global public health. Hence to prevent AMR, our first and foremost goal should be to use antimicrobials judiciously. AMR surveillance helps us to generate such information by providing a baseline data on pattern of microorganisms in the hospital and their susceptibility pattern which helps to choose the appropriate antimicrobials.[5]

In the present study, Pseudomonas spp (n=38) was the most common organism isolated from various clinical specimens followed by Acinetobacter spp (n=35), Escherichia coli (n=29), Klebsiella spp (n=28), Enterococcus spp (n=29), Staphylococcus aureus (n=10), Enterobacter (n=10) and Candida spp (n=13). Acinetobacter showed resistance to Gentamicin, Ciprofloxacin,

Meropenem, Amikacin, Cefoperazone and Ceftazidine. Klebsiella spp showed resistance to Gentamicin, Ciprofloxacin, Ceftriaxone, Meropenem and Amikacin Pseudomonas spp showed resistance to Gentamicin, Ciprofloxacin, Ceftriaxone, Meropenem, Amikacin, Cefoperazone and Ceftazidine. Perveen RA et al[6] observe the challenges of antibiotic consumption, related costs, and their resistance pattern in critically ill patients. Though the cephalosporins are the initial choice as the safest, cheaper antibiotics in developed countries, high rate of resistance was observed in this ICU. The overall sterilization and strict control of nosocomial infections may play a vital role in overcoming the challenges. Use of local antibiogram, narrow-spectrum antibiotics, infectious disease specialist consultation, and restricted authorization to prescribe antibiotics can effectively shift the antibiotic sensitivity and minimize the cost in ICU stay.

Qadeer A et al[7] determined the frequency of micro-organisms causing sepsis as well as to determine the antibiotic susceptibility and resistance of microorganisms isolated in a medical intensive care unit. Most common bacterial isolates were Acinetobacter (15.3%), Escherichia coli (15.3%), Pseudomonas aeruginosa (13%), and Klebsiella pneumoniae (10.2%), whereas Enterococcus (7%) and methicillin-resistant staphylococcus aureus (MRSA) (6.2%) were the two most common gram- positive bacteria. Mahendra M et al[3] carried a study among patients admitted to ICU with respiratory infection who were treated with antibiotics. More than half of patients (60%) had resistance to the Piperacillin-tazobactam, empirical antibiotic used in ICU, highlighting the need for antibiogram for each ICU. Thirty six percent of patient had prior antibiotic use and had mainly gram negative organisms with high resistance to commonly used antibiotics.

Bhandari P et al[8] determined drug resistant pathogens along with detection of extended spectrum β-lactamase (ESBL), AmpC β-lactamase (ABL), and metallo-β-lactamase (MBL) producing bacteria causing infection to ICU patients. A standard methodology was used to achieve these objectives as per recommendation of American Society for Microbiology. ESBL was detected by combined disc assay using cefotaxime and cefotaxime clavulanic acid, ABL by inhibitor based method using cefoxitin and phenylboronic acid, and MBL by imipenem-EDTA combined disk method. Two hundred and ninety-four different clinical samples such as tracheal aspirates, urine, pus, swabs, catheter tips, and blood were processed during the study. Most common bacteria were Acinetobacter spp. Of the total 58 Acinetobacter spp., 46 (79%) were MDR, and 27% were positive for ABL and 12% were for MBL. Of the 32 cases of Staphylococcus aureus, 18 (56%) were MDR. Findings of this study warrant routine β-lactamase testing in clinical isolates. In a study by Pollack M et al,[9] Gram-negative organisms were found in 51% of hand-cultures and 35% of throat-cultures. Klebsiella species were the most commonly isolated organisms (20% of hand and 19% of throat cultures). Compared with colonisation-rates on admission, serial cultures showed an almost fourfold increase in the percentage of hands and more than a twofold increase in the percentage of throats which were positive for klebsiella after two weeks in hospital. This increase in colonisation with klebsiella occurred almost entirely in those patients receiving antibiotics. A quarter of the klebsiella strains were resistant to multiple antibiotics. Of these 15 resistant strains, 14 were isolated from patients receiving antibiotics, and more than a half contained episomal-resistance-transfer factors (R factors). The frequency of R factors was greatest among klebsiella, less among enterobacter, and least among Escherichia coli strains. This study demonstrated the acquisition of resistant gram-negative organisms by patients receiving antibiotics within a hospital environment, and implicates transferable episomes as mediators of antibiotic resistance in a significant proportion of these organisms.

From various studies, it was found that five most utilized antibiotics are 3rd generation cephalosporins, meropenem, metronidazole, levofloxacin, and ceftriaxone. Acinetobacter spp and Pseudomonas spp are the major cause of infections in ICU patients.[10-12] It is found to be similar to present study. They are often found to be colonized on patient's respiratory tract. Being multidrug resistant, they flourish in the respiratory tract of ICU patients who are often on multiple antimicrobials. Presence of other comorbid conditions such as unconsciousness, endotracheal tube insertion, prolonged ventilation pave the way for aspiration of the colonized organisms to lower respiratory tract.[5]

CONCLUSION

In the present study, Pseudomonas spp was the most common organism isolated from various clinical specimens followed by Acinetobacter spp. Antimicrobial stewardship program with educational intervention and sensitization of medical students in rational antimicrobial prescription is the need of the hour to control the menace on antimicrobial resistance.

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