ORIGINAL ARTICLE

BACTERIOLOGICAL PROFILE AND ANTIBIOGRAM OF GRAM NEGATIVE ORGANISMS ISOLATED FROM MEDICAL AND NEUROLOGY INTENSIVE CARE UNIT WITH SPECIAL REFERENCE TO MULTI-DRUG RESISTANT ORGANISMS

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ABSTRACT

Introduction: Microbiological infection plays vital role in determining the outcome as well as cost and duration of the hospital stay for patients admitted in ICU setup. Therefore regular surveillance of important pathogens and its resistance pattern is mandatory.

Objectives: The objective of this study was to find out the organisms causes infection in patients admitted in ICUs and to know resistance pattern of isolates.

Material & Method: During the period from January 2012 to June 2012, total of 583 samples (blood, respiratory tract, urine etc.) from patients admitted in medical and Neuro-ICUs were collected and processed for culture, identification and antibiotic susceptibility testing according to CLSI recommendations. The medical and microbiological information were recorded from all patients whose samples were collected.

Results: Out of 583, 228 (39.10%) samples were culture positive. The number of Gram-negative and Gram-positive organisms isolated were 182 (79.82%) and 46 (20.18%) respectively. The most frequent Gram-negative organisms isolated were Pseudomonas spp. 53/182 (29.12%) followed by Acinetobacter spp. 45 (24.72%), Klebsiella spp. 42 (28.08%), Escherichia coli 35 (19.23%) and others 7 (3.85%). Out of 98, 8 (8.16%) of isolates of pseudomonas spp. and Acinetobacter spp. were carbapenem resistance. Extended-spectrum β-lactamase (ESBL) production was detected in 33/84 (39.28%) of Enterobacteriaceae.

Conclusion: This report reveals the Microbiology profile in patients in ICUs. Regular microbiological surveillance help in implementing better therapeutic strategies to reduce the high morbidity and mortality associated among the patients in critical care setting

Key Words: ICUs, Antimicrobial agents, multidrug resistant, ESBL, Carbapenemase.

INTRODUCTION

Various microorganisms have survived for thousands of years by their ability to adapt to antimicrobial agents. They do so via spontaneous mutation or by DNA transfer. This process enables some bacteria to oppose the assault of certain antibiotics, rendering the antibiotics ineffective.[1] Intensive Care units (ICUs), despite their apparent impact on patient outcome, have become high-risk areas for nosocomial infections. The patient in the ICU has a 5 to 7 fold higher risk of a nosocomial infection compared with the average patient and 20–25% of all nosocomial infections develop in ICUs.[2] 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). Surveys of the prevalence and susceptibility patterns of bacterial isolates are important in determining optimum empirical therapy for infections in critically ill patients. The purpose of study was, to find out the organisms

causing infection in patients admitted in ICUs and to know the resistance pattern of isolates.

OBJECTIVES

The objective of this study was to investigate the microbiological profile in association with antibiotic resistance among patients consecutively admitted to the Medical and Neuro-ICU in Tertiary care hospital.

MATERIALS AND METHODS

A total of 583 samples of patients admitted in ICUs during the period of January 2012 to June 2012 were collected. Processing of the sample for culture and isolate identification was done by standard methods on Nutrient agar, MacConkey's agar and Blood agar under strict aseptic precautions .[3]The blood agar plates were incubated at 37^0C, in presence of 5% CO_2 for 24 hours. Both Nutrient agar and MacConkey's agar plates were incubated aerobically at 37^0C for 24 hours. After overnight incubation, growth of suspected organisms were confirmed gram stain from culture growth, colonies characteristic various agars and biochemical characteristics[3]. All isolated organism's antibiotic susceptibility testing done on Muller Hinton agar with modified Kirby Bauer disc diffusion method according to Clinical and Laboratory Standards Institute (CLSI) recommendations.[4] The zone diameter of inhibition of growth was measured and interpreted as susceptible, intermediate or resistant. [4]

ESBL (Extended spectrum β- lactamase) and carbapenemase production detection were done separately from isolates. MDR was defined as acquired non-susceptibility to at least one agent in three or more antimicrobial categories.[5]

RESULT

Table 1: Details of various clinical samples received from different ICUs and numbers of gram negative organism isolations

Sample	Total samples	Positive for Gm -ve organisms (n=182) (%)
Type of Sample		
Urine	172	47 (27.32)
Blood	169	37 (21.89)
Swab	134	41 (30.60)
Resp. samples	96	47 (48.96)
Drain	12	10 (83.33)
Type of ICUs		
Medical ICU	477	144 (30.19)
Neuro-ICU	106	38 (35.85)

Out of total 583 samples processed, 182 (31.22%) showed growth of gram negative organisms. Table No. 1 show Details of various clinical samples received from different ICUs in our study.

Out of total 583 samples processed, 182 showed growth of gram negative organisms. Table 2 show number and percentage wise distribution of organisms.

Table 2: Number various gram negative organisms from different specimens

Organisms	Blood	Resp. samples	Swab	Urine	Drain	Total
Pseudomonas spp.	5	16	10	19	3	53
Acinetobacter spp.	14	10	16	5	0	45
Klebsiella spp.	12	16	5	6	3	42
E.coli	6	5	8	12	4	35
Citrobacter spp.	0	0	2	3	0	5
Proteus app.	0	0	0	2	0	2
Total	37	47	41	47	10	182

Table 2 and Table 3 shows, organisms isolates from various clinical specimens and multi drug resistance organisms (MDROs) pattern of various gram negative organisms respectively.

Table 3: MDROs pattern of various gram negative organisms

Organisms	Total Isolates	MDR Isolates (%)
Pseudomonas spp.	53	42 (79.25)
Acinetobacter spp.	45	35 (77.78)
Klebsiella spp.	42	34 (80.95)
E.coli	35	28 (80.00)
Citrobacter spp.	5	3 (60.00)
Proteus spp.	2	2 (100.00)

In this study bacterial isolation rate was 228 (39.10%), comprising 182 (79.82%) gram negative and 46 (20.18%) gram positive isolates. Most commonly isolated species were Pseudomonas spp. 29.12 % (53/182) followed by Acinetobacter spp. (45/182), Klebsiella spp. (42/182), Escherichia coli (35/182).

Table 4 shows resistance pattern (%) of Pseudomonas spp. About 13.2% of Pseudomonas spp. were producing carbapenemase enzyme. They were most sensitive to Colistin (100%), followed by Carbapenem-Imipenem (86.8%), higher Quinolones-Levofloxacin (56.63%), β-lactam + β- lactam inhibitor (50.94 %). Out of total 53 (100%) isolates, 42(79.25 %) were MDROs.

Table 4: Resistance pattern (%) of Pseudomonas spp.

Antibiotic	Resistance Isolates (n=53)	Resistance Rate (%)
Piperacillin	51	96.08
Ceftazidime	45	84.91
Cefepime	23	43.4
Ticarcillin-clavulinic acid	26	49.06
Piperacillin-Tazobactam	26	49.06
Cefepime-Tazobactam	26	49.06
Gentamycin	49	92.45
Netilmycin	42	79.24
Amikacin	40	75.47
Levofloxacin	23	43.37
Aztreonam	27	50.94
Imipenem	7	13.2
Colistin	0	0

Acinetobacter spp. is isolated second to Pseudomonas spp. 24.72%. Table 5 shows resistance pattern (%) of Acinetobacter spp. They were most sensitive to Polymyxin B (100%), followed by Carbapenem-Imipenem (97.88%), higher Quinolones-Levofloxacin (77.78 %), β lactam+ β lactam inhibitors Ampicillin/Sulbactam (68.89%), 2.22% of Acinetobacter spp. were producing carbapenemase enzyme. Out of total 45 (100%) isolates, 35(77.78%) were MDROs.

Among Enterobacteriaceae group, most common isolate was Klebsiella spp. (23.08%) followed by Escherichia coli (19.23%) and others 7 (3.85%). Chart 4 shows resistance pattern (%) of various gram negative organisms. They were most sensitive to Polymyxin B (100%- except proteus spp., intrinsic resistance), followed by Carbapenem-Imipenem (100%), higher Quinolones-Levofloxacin (95.24 %), β lactam+ β lactam inhibitor- Ampicillin/Sulbactam (64.29%), 39.28% were ESBL producers and none of them were produced carbapenemase enzyme. Out of total 84 (100%) isolates, 79.76% were MDROs.

Table 5: Resistance pattern (%) of various gram negative organisms

Antibiotic	Resistance Isolates & Resistance Rate (%)		
	Acinetobacter spp. (n=45)	Klebsiella spp. (n=42)	E. coli (n=35)
Cefaclor	-	38 (90.48)	31 (88.57)
Cefotaxime	42 (93.33)	34 (80.95)	28 (80)
Ceftizoxime	42 (93.33)	34 (80.95)	27 (77.14)
Cefepime	10 (88.89)	30 (71.43)	25 (71.43)
Ampicillin-sulbactam	14 (31.11)	-	-
Amoxcillin-clavulinic acid	-	15 (35.71)	15 (42.86)
Piperacillin-Tazobactam	32 (71.11)	14 (33.33)	12 (34.26)
Ceftriaxone-Tazobactam	32 (71.11)	14 (33.33)	12 (34.26)
Gentamycin	42 (93.33)	32 (76.19)	30 (85.71)
Amikacin	31 (68.89)	24 (57.14)	26 (74.26)
Levofloxacin	10 (22.22)	2 (4.76)	02 (5.71)
Tetracycline	36 (80)	31 (73.81)	29 (82.86)
Chloramphenicol	-	32 (76.19)	20 (57.14)
Trimethoprim-sulfamethoxazole	33 (73.33)	37 (88.1)	29 (82.86)
Imipenem	1 (2.22)	0	0
Polymyxin B	0	0	0

DISCUSSION

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). 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 and Neuro -ICUs. The reasons for this high prevalence non fermentors could be are, factors associated with the acquisition of nonsocial pathogens in patients with recurrent or long term hospitalization, complicating illness or the immunocompromised condition.[6] Isolation of Pseudomonas spp. (23.48 %) is comparable with study of Amit Varaiya et al, in which they found 25 % prevalence.[7]. Pseudomonas have the ability to metabolise a variety of diverse nutrients and combined with the ability to form biofilm, they are thus able to survive in a variety of unexpected places, Some recent studies have shown phenotypic resistance associated to biofilm formation or to the emergence of small-colony-variants may be important in the response of P. aeruginosa populations to antibiotic treatment. Because of this ability, most isolated Pseudomonas spp. were found resistant various antimicrobial agent.[8] Out of 98, 8 (8.16%) of isolates of pseudomonas spp. and Acinetobacter spp. were carbapenem resistant. Extended-spectrum β-lactamase (ESBL) production was detected in 33/84 (39.28%) of Enterobacteriaceae. The drug of choice in MDROs remains Carbapenems and higher Quinolones for all gram negative bacteria.

Though Tigecycline is highly effective against gram-negative members of Enterobacteriaceae (except Proteus spp.) and Polymyxin B (except Proteus spp.) class is highly effective against all gram negative organisms, it should be used judiciously.[9, 10, 11]

CONCLUSION:

The key to control of antibiotic-resistant pathogens in the ICU are rigorous adherence to infection control guidelines and prevention of antibiotic misuse. Antibiotic restriction policies clearly result in reduced drug costs and due to continuous changes in antibacterial susceptibility patterns, periodical antibacterial sensitivity assessment in ICUs should be mandatory. The high frequency of multidrug resistant bacteria in ICUs suggests that we need to prescribe broad-spectrum antibiotics more wisely in order to reduce pressure on sensitive strains. Emphasis was laid on various infection control measures such as adequate hand washing techniques, aseptic measures for all procedures, antibiotic cycling and health education for the health personnel.

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