Original Article

BACTERIOLOGICAL PROFILE AND ANTIMICROBIAL SUSCEPTIBILITY PATTERN IN INTENSIVE CARE UNIT OF TERTIARY CARE HOSPITAL, AURANGABAD.

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ABSTRACT

Introduction: Multidrug resistant nosocomial infections are one of the leading causes of morbidity and mortality in hospitalized patients especially the critically ill patients in the intensive care unit (ICU), where a large number of drugs are administered to the patient which in turn leads to the generation of antibiotic resistant pathogens. **Method**: Over a period 12 months clinical samples (blood, urine, pus/ wound swabs, respiratory secretions etc) from patient admitted in ICU were processed according to the standard microbiologic methods, and their antimicrobial testing was performed using disk diffusion method. **Results**: A total of 464 samples, 164 (35.34%) were culture positive in which 133(81.1%) samples were monomicrobial and 31(63) (18.9%) samples were polymicrobial. Out of 196 isolates were obtained, 127 isolates were Gram negative and 69 isolates were Gram positive organisms. The most common isolate was *S. aureus* (29.1%) and *Klebsiella spp* (26%) followed by *E.coli* (17.3%), *Pseudomonas spp* (13.8%), *Streptococcus spp* (5.1%), *Acinetobacter spp* (4.1%), *Citrobacter* (2.6%), Proteus Spp (1%) and Coagulase Negative *Staphylococcus* (1%). Vancomycin and linazolid is more effect against the Gram positive organisms. For Gram negative organism's carbapenems remain the drug of choice followed by amikacin. **Conclusion**: Institutional antimicrobial surveillance and proper infection control practices are essential to prevent and control multi drug resistant bugs in ICUs and hospital.

KEY WORDS: Bacteriological profile, Antimicrobial profile, Intensive Care Unit infections, Nosocomial Infections.

INTRODUCTION

Intensive care units are specialized wards in hospitals to offer close monitoring and personalized care for very sick patients, who require intensive care in the form of support of a vital function until the disease process is arrested [1,2]. ICUs despite their apparent impact on patient outcome have become high-risk areas for health care associated infections. It was observed that patients in the ICU has a 5-7 fold higher risk of a health care associated infection and also, on an average 20-25% of all health care associated infection develops in ICUs [3, 4].

Infections due to different organisms like *Staphylococcus aureus* (including MRSA), *S. epidermidis, E. coli, P. aeruginosa, Klebsiella species, Proteus species*, *Acinetobacter* species (Including ESBL producers), *Enterobacter* species and Candida species continue to be one of the leading causes of morbidity and mortality in ICU. This is a consequence of a complex interaction between the patient's immune status, underlying disease, the severity of illness, the type of ICU, the duration of stay and the number, type and duration of invasive devices and procedure [2, 5].

The main sites of infections in ICU patient are urinary tract, lower respiratory tract (pneumonia), intravascular cannula entry site infection, primary bacteremia and gastrointestinal tract[2].

In addition to all these mentioned factors, the rate of nosocomial infections in the ICU is rising, mainly because of increase usage of invasive procedures which are performed in the ICU. The therapeutic interventions which are associated with infectious complications include indwelling catheters, sophisticated life support, intravenous fluid therapy, prosthetic devices, immunosuppressive therapy, and use of broad spectrum antibiotics leading to a spectrum of multi- drug resistant pathogens, which contributed to the evolution of the problem of nosocomial infection [5].

Medical care of these ICU patients involves closer and more frequent contact with nurses, physicians or technicians. Hand washing and asepsis may be overlooked in urgent conditions, which may further promote horizontal transmission [6]. Empirical and frequent use of broad-spectrum antibiotics results in the selection of resistant strains. Thus the ICU patient

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frequently experience colonization and infections by resistant pathogens, which pose major clinical problems despite the introduction of new and potent antibiotics. Rate of antibiotic resistance can vary enormously depending on geographical location as well as location among ICU types. For proper management of ICU infections, it is importance to have updated knowledge about prevalence of the causative agents and there antimicrobial susceptibility pattern in institutions specific ICUs [5, 7]. Understating the epidemiology of the most prevalent pathogens, sites of recovery and the antimicrobial susceptibility pattern of the microbial isolates from clinical specimens of ICU is an important factor in detecting major changes in the etiology of infections and the emergence of multiple drug resistant organisms. The current study was undertaken to know the bacteriological profile and antibiotic sensitivity pattern of pathogens isolated from patients admitted in ICUs .

MATERIALS AND METHODS

Study design: An observational descriptive study
Ethics approval: The study was approved by IEC of our institution
Study place: Present study was carried out in the department of Microbiology, Mahatma Gandhi Mission Institute of Health Sciences, a tertiary care hospital at Aurangabad.
Time frame: Over a period 12 months.
Inclusion criteria: All the suspected samples sent from four ICUs i.e Surgical ICU, Medical ICU, Pediatric ICU, Neonatal ICU were included in the study
Exclusion criteria: The repeat specimens and stool samples were not included in the study.
Sampling method: All the samples were collected according to the standard protocol by clinicians and sent to Microbiology Department from four ICUs.
Methodology: A total of 464 samples (blood, urine, pus/ wound swabs, respiratory secretions) from patient admitted in Surgical Intensive Care Unit (SICU), Medical Intensive Care Unit (MICU), pediatric Intensive Care Unit (PICU) and Neonatal Intensive Care Unit (NICU) were processed according to the standard microbiologic methods, and their antimicrobial testing was performed using disk diffusion method [8].

RESULTS

Out of 464 samples, 164 (35.3%) were culture positive and 300 (64.7%) were culture negative. Among culture positive, 133 cultures were mono-microbial and 31(63) were Poly-microbial. A total of 196 isolates were obtained from 164 culture positive samples. Out of 196 isolates, 127 (64.79%) isolates were Gram negative and 69 (35.20%) isolates were Gram positive isolates. The frequencies of microorganisms isolated from those patients admitted in different ICUs were shown in the Table 1. Distribution of organisms based on samples obtained from various ICUs is shown in the Table 2. Antibiotic sensitivity pattern of major Gram negative bacteria were shown in the Table 3. Antibiotic sensitivity pattern of *Staphylococcus aureus* were shown in the Table 4.
Streptococcus spp were 80% sensitive to linezolid, 70% sensitive to doxycycline, 60% sensitive to azithromycin and erythromycin, 50% sensitive to clindamycin.
Citrobacter spp were 40% sensitive to imipenem, 20% sensitive to levofloxacin and doxycycline. Whereas 100% resistant to cotrimaxazole, piperacillin – tazobactum, ceftazidime, amikacin, ceftriaxone and ciprofloxacin. Proteus spp were 100% sensitive to levofloxacin, piperacillin – tazobactum, amikacin, ciprofloxacin and ceftriaxone.

DISCUSSION

Infection caused by multidrug- resistant bacteria constitutes a serious problem for intensive care patients

Table 1. The frequency of microorganisms isolated from patients admitted in different ICUs

Organism	Total	NICU	PICU	MICU	SICU
	No (%)	No (%)	No (%)	No (%)	No (%)
Staphylococcus aureus	57 (29.1)	25 (51.0)	5 (50)	21 (23.3)	6 (12.8)
Klebsiella Spp.	51 (26.0)	10 (20.4)	2 (20)	23 (25.6)	16 (34.0)
Escherichia coli	34 (17.3)	9 (18.4)	0 (0)	12 (13.3)	13 (27.7)
Pseudomonas spp.	27 (13.8)	1 (2.0)	2 (20)	19 (21.1)	5 (10.5)
Acinetobacter spp.	8 (4.1)	1 (2.0)	0 (0)	3 (3.3)	4 (8.5)
Citrobacter Spp.	5 (2.6)	1 (2.0)	0 (0)	4 (4.4)	0 (0)
Proteus Spp.	2 (1.0)	0 (0)	1 (10)	1 (1.1)	0 (0)
Coagulase Negative Staphylococcus	2 (1.01)	0 (0)	0 (0)	1 (1.1)	1 (2.1)
Streptococcus spp.	10 (5.1)	2 (4.9)	0 (0)	6 (6.7)	2 (4.5)
Total	196	49 (25)	10 (5.1)	90 (45.9)	47 (23.8)

Surgical Intensive Care Unit: SICU, Medical Intensive Care Unit: MICU , Pediatric Intensive Care Unit: PICU, Neonatal Intensive Care Unit: NICU

Table 2. Distribution of organisms based on samples obtained from various ICUs

Organisms	Blood	Urine	Sputum	Swabs	Pus	Body fluids	Et. Tube	Total
	(n=56) (%)	(n=20) (%)	(n=28) (%)	(n=13) (%)	(n=20) (%)	(n=14) (%)	(n=45) (%)	(%)
E. coli	8 (14.3)	8 (40)	2 (7.1)	1 (7.7)	6 (30)	6 (42.6)	3 (6.7)	34 (17.3)
Klebsiella spp.	10 (17.9)	6 (30)	6 (21.4)	6 (46.1)	5 (25)	4 (28.6)	14 (31.1)	51 (26)
Proteus spp.	-	-	-	1 (7.7)	1 (5)	-	-	2 (1)
Citrobacter spp.	-	-	-	1 (7.7)	-	-	4 (8.9)	5 (2.6)
Pseudomonous spp.	1 (1.8)	2 (10)	6 (21.4)	4 (30.8)	2 (10)	-	12 (26.7)	27 (13.7)
Acinetobacter spp.	1 (1.8)	1 (5)	1 (3.6)	-	1 (5)		4 (8.9)	8 (4.1)
Staphylococcus aureus	34 (60.7)	2 (10)	8 (28.6)	-	5 (25)	2(14.3)	6 (13.3)	57 (29.1)
CONS	-	-	-	-	-	-	2 (4.4)	2 (1.0)
Streptococcus spp.	2 (3.6)	1 (5)	5 (17.9)	-	-	2 (14.3)	-	10 (5.1)
	56	20	28	13	20	14	45	196

Table 3. Antibiotic sensitivity patterns of major gram negative bacteria

Organism	*E.coli*		*Klebsiella Spp*		*Pseudomonas Spp*		*Acientobacter Spp*	
	N=34	%	N=51	%	N=27	%	N=8	%
Ampicillin (10 µg)	11	32	ND		ND		ND	
Amoxycillin/clavulanic acid (30 µg)	24	71	31	61	ND		ND	
Amikacin(30 µg)	27	79	34	67	13	48	2	25
Ciprofloxacin (5 µg)	14	41	20	39	13	48	1	12
Levofloxacin (5 µg)	23	68	28	55	21	78	1	12
Cotrimoxazole (25 µg)	13	38	23	45	15	56	0	0
Cefotriazone (30 µg)	16	47	28	55			0	0
Imipenam (10 µg)	27	79	40	78	20	74	4	50
Pipercillin/Tazobactum (100 /10 µg)	ND		ND		18	67	2	25

throughout the world. The mortality rate associated with multidrug- resistant bacteria in these patients is high in some intensive care units (ICUs) [9]. Microbiological surveillance studies were performed all over the world to monitor the organisms responsible for site specific infection rates (pneumonia, blood stream infections, urinary tract infections, surgical site infections), and to guide infection management and antibiotic prophylaxis (10). The knowledge of the causative agents of ICU infection has therefore proved to be helpful in the selection of empiric antimicrobial therapy and on infection control measures in hospital. The current study was undertaken to know prevalence of aerobic bacteria and their antimicrobial susceptibility pattern in ICU of tertiary care hospital.

Table 4. Antibiotic sensitivity patterns of *Staphylococcus aureus*

Antibiotic	*S. aureus*	
	No(57)	%
Cefoxitin (30 µg)	34	60
Erythromycin (15 µg)	30	53
Gentamycin (10 µg)	36	63
Cotrimoxazole (25 µg)	37	65
Ciprofloxacin (5 µg)	23	40
Vancomycin (30 µg)	57	100
Linezolid (30 µg)	57	100

A total 464 samples were analyzed, which included blood 261 (56.3%), body fluids 65 (14%), endotracheal tube 43 (9.3%), urine 40 (8.62%), pus 23 (5%), sputum 25(5.9%) and wound swabs 07 (1.5%).

Among them, 164 (35.34%) samples were positive for culture from a total of 196 (42.2%) isolates obtained. In 300 (64.7%) samples there was no growth. The culture positive rate ranges from 26.2% to 69.6%. The current study culture positive rate was 35.3% which is similar to other studies from India conducted by Patel et al (39.10%), Lovely et al (34%) and Zaveri et al (31.3%) culture positivity [9,11,12].

In the present study, out of 164 culture positive samples, 133 (81.1%) cultures showed single isolate and 31 (18.9%) were polymicrobial. From our screening, we were able to identify 127 (64.8%) isolates which were

Gram negative and 69 (35.2%) isolates which were Gram positive. Other studies also showed that Gram negative organisms (60% to 84.7%) were more when compare to Gram positive organisms (11.6 to 23.1%) [13, 10, 14] which is comparable to that of our observation. The variation in the percentage may be due to the difference in the ICU setup.

In the current study *S. aureus* was found to be 100% sensitive to vancomycin and linezolid which is similar to the other studies conducted from India [14, 15, 16]. The anti-biogram pattern for *S. aureus* were similar to that studies conducted by Sharma et al, and Abbas et al, from India [14, 17]. It is also observed that in the current study, *Enterobacteriaceae* members were found to be multi drug resistant to cephalosporin and quinolones. Similar observation was found in Maksum et al from Indonesia [18]. In addition *Pseudomonas spp* showed high resistance to ciprofloxacin and amikacin which is similar to Mehta et al [19]. The Gram negative organism showed high susceptibility to Imipenam, where the observation is similar to Patrick et al [20].

CONCLUSION

In conclusion in ICU facility, the Gram negative organisms are the commonest organism when compare to the Gram positive organisms. Vancomycin and linazolid is more effect against the Gram positive organisms. For Gram negative organism's carbapenems remain the drug of choice followed by amikacin. Institutional antimicrobial surveillance and proper infection control practices are essential to prevent and control multi drug resistant bugs in ICUs and hospital. This study also concludes that in-vitro testing prior to antibiotic use may help in the prevention and treatment of multi -drug resistant pathogens in ICU, which in turn will reduce morbidity and mortality of patients.

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