

**ANTIBIOTIC RESISTANCE AND SUSCEPTIBILITY PATTERNS OF BACTERIA IN
ICU AT TERTIARY CARE HOSPITAL****Dr. Smruti Mohanty¹ and Dr. Laxmi Kant Mohanty^{2*}**¹HOD (Microbiology) JLN Hospital and Research Centre, Bhilai.²Associate Professor Dept. of Respiratory Medicine CCM Medical College, Kachandur Durg.***Corresponding Author: Dr. Laxmi Kant Mohanty**

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ABSTRACT

Intensive care unit (ICU) plays the important role in the management of critically ill patient admitted in ICU and prevention of the infection. Emergence of the antibiotic resistance is becoming increasingly difficult problems in ICU for preventions and resistance. Because of this there are few therapeutic options available. In ICU, Nosocomial infections with multidrug resistant are becoming important cause of death and morbidity compared with an average patient. Antibiotic resistance pattern of organisms widely vary for different country as well as different hospitals even among ICUs. The main purpose of this study was to know prevalence of the drug resistance pattern for the patients admitted in ICUs. **Material and Methods:** The study was done for 106 isolates from ICU of 80 patients. It was conducted at the Department of Microbiology, JLN Hospital and Research Centre, Bhilai. Sample for the culture were taken from ICU patient, depending upon the infection like ventilator associated pneumonia, respiratory tract infection, sepsis, and post operative patients. Specimens like urine, pus, blood and CSF etc. according to the type of infection. All the specimens were processed and Antibiotic susceptibility testing was done by Kirby-Bauer method using Muller Hinton Agar (MHA). **Results:** In vitro susceptibility data of 106 isolates from ICU were analysis. Among 106 isolates from 80 patients male were 52(65.0%) and 28 (35.0%) females. Out of 106 isolates 86(81.14%) were Gram negative organisms and 20(18.86%) were Gram positive organisms. Among all Gram positive organism 13(65%) were Staphylococcus aureus in which 8(61.53%) and 7.55% among all isolates respectively. The most frequent species isolated from infections in ICU was E.coli, followed by Pseudomonas spp, klebsiella spp, Acinetobacter spp, Enterococcus, Proteus mirabilis and Providencia spp which were 18.87%, 16.03%, 6.60%, 1.89% and 0.94% respectively. 25(23.58%) were ESBL producer out of all isolate and 29.07% out of total Gram negative organism. **Conclusion:** This study concludes that gram negative organisms are causing more infection than gram positive organisms in ICU patients. E.coli was the most common organism isolated and shows highly resistance to Amoxicillin+Clavulanic acid, Ciprofloxacin whereas Erythromycin and Penicillin shows highly resistance to Enterococcus. Hence gram negative organisms are more resistance to higher antibiotics, so antibiotics are used carefully.

KEYWORDS: ICU, Bacteria, AST, Resistance, Sensitivity.**INTRODUCTION**

Intensive care unit (ICU) plays the important role in the management of critically ill patient and prevention of the infection to the patients admitted in ICU. In ICU antibiotics susceptibility and resistance play the important role in the management of infection. Emergence of the antibiotic resistance is becoming increasingly difficult problems in ICU.

Globally antibiotic resistant pathogens are encountered in ICU. Because of this there are few therapeutic options available.^[1] Methicillin-resistance Staphylococcus aureus and Vancomycin-resistance Enterococcus for gram positive cocci as well as drug resistance for gram negative bacilli is becoming a great problem in health care facilities. E.g. Extended spectrum beta-lactamase

(ESBL) producing gram negative bacteria and multi drug resistance (MDR) – Acinetobacter.^[2,3]

In ICU, Nosocomial infections with multidrug resistant are becoming important cause of death and morbidity compared with an average patient. Antibiotic resistance pattern of organisms widely vary for different country as well as different hospitals even among ICUs. Ventilator-associated pneumonias, urinary tract infection (UTI) and bloodstream infections are most common nosocomial infections.^[4]

The source for multi drug resistance bacteria may include repeated use of higher antibiotics, poor hand hygiene, reuse of items used for individual patients, lack of environmental cleaning, resource management and

education and surveillance. The main purpose of this study was to know prevalence of the drug resistance pattern for the patients admitted in ICUs. This study may provide that might improve the overall management of ICU.

MATERIAL AND METHODS

The study was done for 106 isolates from ICU of 80 patients. It was conducted in the Department of Microbiology and Dept. of Respiratory Medicine at JLN Hospital and Research Centre, Bhilai in Collaboration with CCM Medical College from Jan 2015 to Dec 2017. Sample for the culture were taken from ICU patient, depending upon the infection like sepsis, ventilator associated pneumonia, respiratory tract infection and post operative patients. Multiple samples from different site as well as in different time were taken from the patient having multiple infections.

Specimens like blood, urine, pus and CSF etc. were taken depending upon the type of infection. Samples were received in the microbiology laboratory for the culture in sterile universal container. Initially strains were identified based on the morphological behaviour of the isolates on various differential media.

The specimens were inoculated on 5% sheep blood agar, MacConkey agar and incubated aerobically at 37°C for 18 to 24 hours. Chocolate agar plates were incubated at 37°C in 5% CO₂ for 18 to 24 hours. For blood culture 5-10 ml of blood for adult were collected and processed using the BACTEC 9050 blood culture system (Becton Dickinson, Maryland, USA). If growth is displayed as positive, then it is sub-cultured on appropriate media. Organism's identification was done by using routine biochemical test like catalase, Oxidase, citrate, indole, urease etc. Antibiotic susceptibility testing was done by Kirby-Bauer method using Muller Hinton Agar (MHA). Clinical Laboratory Standards (CLSI) interpretive criteria were used for susceptibility results.^[5] Quality control was performed by using reference strains of *Staphylococcus aureus* ATCC 25923, *Escherichia coli* ATCC 25922 and *Pseudomonas aeruginosa* ATCC 27853 to confirm consistency of materials, methods, and results.^[6]

RESULTS

In vitro susceptibility data of 106 isolates from ICU were analysis. Among 106 isolates from 80 patients 52(65.0%) males and 28 (35.0%) females with age ranging from 20 years to 90 years (average 55 years) were studied.

Table 1. Microorganisms isolated from 80 patients according to the site of infection.

Microorganism	Urinary tract no. (%)	Respiratory tract no. (%)	Bloodstream no. (%)	Wound no. (%)	Other sites (*) no. (%)	Total no. (%)
<i>E.coli</i>	12(41.38)	5(17.24)		5(17.24)	7(24.14)	29(27.36)
<i>Pseudomonas spp</i>	8(40)	3(15)		1(5)	8(40)	20(18.87)
<i>Klebsiella spp</i>	4(23.53)	8(47.09)		1(5.88)	4(23.53)	17(16.03)
<i>Acinetobacter spp</i>	5(29.41)	2(11.76)	1(5.88)	2(11.76)	7(41.18)	17(16.03)
<i>Staph.aureus</i>	4(30.77)	3(23.08)	1(7.7)	2(15.38)	3(23.1)	13(12.26)
<i>Enterococcus</i>	7(100)					7(6.60)
<i>Proteus mirabilis</i>				1(50)	1(50)	2(1.89)
<i>Providencia Spp</i>	1(100)					1(0.94)
Total	41	21	2	12	30	106

(*) Cerebrospinal fluid, Peritoneal fluid, Ascitic fluid, Pleural fluid, Endotracheal Secretion.

Out of 106 isolates 86(81.14%) were Gram negative organisms and 20(18.86%) were Gram positive organisms. Among all Gram positive organism 13(65%) were *Staphylococcus aureus* in which 8(61.53%) and 7.55% among all isolates respectively. The most frequent species isolated from infections in ICU was *E.coli*,

followed by *Pseudomonas spp*, *klebsiella spp*, *Acinetobacter spp*, *Enterococcus*, *Proteus mirabilis* and *Providencia spp* which were 18.87%, 16.03%, 16.03%, 6.60%, 1.89% and 0.94% respectively. 25(23.58%) were ESBL producer out of all isolate and 29.07% out of total Gram negative organism.

Table 2. Resistance pattern of common used antibiotics against commonly isolated Gram positive pathogens.

Antibiotics	<i>Staphylococcus aureus</i> (%)	<i>Enterococcus</i> (%)
Erythromycin	69.23	100.0
Penicillin	84.62	100.0
Cortimoxazole	61.54	28.57
Linezolid	15.38	00.00
Oxacillin	61.54	85.71
Vancomycin	00.00	00.00
Levofloxacin	30.77	85.71
Gentamicin	61.54	85.71
Doxycycline	30.77	71.43

Table. 3. Resistance pattern of common used antibiotics against commonly isolated Gram negative pathogens.

Antibiotics	<i>E.coli</i> (%)	<i>Klebsiella spp</i> (%)	<i>Acinetobacter spp</i> (%)	<i>Proteus mirabilis</i> (%)	<i>Providencia spp</i> (%)	<i>Pseudomonas spp</i> (%)
Amoxicillin+Clavulanic Acid	100.0	94.12	94.12	50.00	100.0	-
Gentamicin	65.52	82.35	88.24	50.00	100.0	35.29
Amikacin	37.93	52.94	70.59	50.00	100.0	50.00
Cefuroxime	100.0	88.24	88.24	50.00	100.0	-
Cefepime	96.55	82.35	88.24	50.00	100.0	65.00
Cefotaxime	96.55	70.59	94.12	50.00	100.0	-
Ciprofloxacin	100.0	70.59	82.35	00.00	100.0	70.00
Imipenem	00.00	00.00	35.29	00.00	00.00	00.00
Cotrimoxazole	93.10	82.35	88.24	00.00	100.00	-
Ceftazidime	-	-	-	-	-	60.00
Piperacillin	-	-	-	-	-	45.00
Piperacillin + Tazobactam	-	-	-	-	-	45.00
Aztreonam	-	-	-	-	-	75.00

Note: (-) = Antibiotics not used.

DISCUSSION

This study is based on the antimicrobial resistance and multidrug resistance of the organism isolated from ICU. Antibiotics are most commonly prescribing drugs in ICU which producing the strength of resistance to the organism. Modern critical care is a separate speciality which required special training for a short period in ICU. It is a part of anaesthesia, medicine, surgery or any other discipline. This study shows relationship between initial administration of antimicrobial treatment of infection and mortality rate for adult patient in ICU.^[7]

This study shows imipenem was the drug being higher antibiotics becoming resistance to Acinetobacter spp and Vancomycin has 100% sensitivity in case of gram positive organisms. Most isolates were recovered from the urine specimens followed by the respiratory specimens. The common isolates observed in this study were *E.coli*29 (27.386), *Pseudomonas spp*20 (18.87), *Klebsiella spp*17 (16.03), *Acinetobacter spp*17 (16.03), *Staphylococcus aureus*13 (12.26), *Enterococcus*7 (6.60), *Proteus mirabilis*2 (1.89) & *Providencia Spp*1 (0.89). The incidences of Gram-positive and Gram-negative bacilli in this study were 18.87% and 81.13% respectively. The *Acinetobacter spp* showed the more resistance to Imipenem (35.29%) then other organisms. The study conducted by Zaveri Jitendra et.al shows that most common multidrug resistant organism was *Citrobacter* species (66.7%) followed by *Proteus* and *Enterococcus* (33.3%, 33.3%) respectively.^[8] The another study of ICU from Mumbai found enteric gram negative organism as the commonest isolates (61.9%) followed by *Staphylococcus aureus* (29.8%).^[9] A similar study from Varanasi shows that the enteric gram negative bacilli were uniformly resistance to beta lactam-beta lactamase inhibitors combinations.^[10]

Kaul S Et al showed Cefotaxime and Ceftazidime resistance ranged from 25-50% and 14-91% respectively for *Klebsiella* while 50-70% and 50-80% respectively for

E.coli.^[10] In the study of Singh AK et al, resistance to Ciprofloxacin and Ceftriaxone ranged from 50-100% and 25-83.3% respectively. Staphylococci were 100% resistant to Penicillin and Tetracycline, 80% to Cotrimoxazole, 60% to Erythromycin and Gentamicin and 40% to Amikacin. *Acinetobacter spp.* was highly resistant to most of the antibacterial agents except Gentamicin while *Pseudomonas spp.* showed 75% resistance to it.^[12]

Nidhi Goel et. al shows a commonly isolate was *Pseudomonas aeruginosa* (35%), *Acinetobacter baumannii* (23.6%) and *Klebsiella pneumonia* (13.6%). A very high rate of resistance (80-100%) was observed among predominant GNB to ciprofloxacin, ceftazidime, co-trimoxazole and amoxycycillin /clavulanic acid combination. Least resistance was noted to meropenem and doxycycline.^[13]

CONCLUSION

This study concludes that gram negative organisms are causing more infection than gram positive organisms in ICU patients. *E.coli* was the most common organism isolated and shows highly resistance to Amoxicillin+Clavulanic acid, Ciprofloxacin whereas Erythromycin and Penicillin shows highly resistance to Enterococcus. Hence gram negative organisms are more resistance to higher antibiotics. So antibiotics are used carefully. Therefore antibiotics policies should be formed for ICU and other critical care facilities.

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