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BACTERIAL SUSCEPTIBILITY PATTERNS OF PATHOGENS IN ICU IN TERTIARY CARE.

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Abstract:

Introduction: Globally antibiotic resistant pathogens are encountered in Intensive Care Unit (ICU). ICU plays important role in the management of critically ill patients and treatment of the infections. In ICU antibiotics susceptibility and resistance play an important role in the management of infection. Emergence of the antibiotic resistance is becoming increasingly difficult problem in ICU. In ICU, nosocomial infections with multi-drug resistant strains are becoming important cause of morbidity and mortality compared with an average patient. The source for multi-drug resistant 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. **Aim:** To know prevalence of the drug resistance patterns for the patients admitted in ICUs. **Material and Methods**: The study was done on 106 isolates from ICU of 40 patients. It was conducted at the Department of Medicine Grant Government Medical College and Sir JJ Group of Hospitals, Mumbai. Sample for the culture were taken from ICU patients, depending upon the infections like sepsis, ventilator associated pneumonia, respiratory tract infection and post-operative patients. Multiple samples from different sites as well as in different times 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. **Results** In vitro susceptibility data of 106 isolates from ICU were analysed. Among 106 isolates from 40 patients 25(62.5%) males and 15 (37.5%) females with age ranging from 20 years to 90 years (average 55 years) were studied. 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. 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% ,12.26%, 6.60%, 1.89% and 0.94% respectively. 25(23.58%) were ESBL producer out of all isolates and 29.07% out of total Gram negative organism. **Conclusion** This study concludes that gram negative organisms are causing more infections than gram positive organisms in ICU patients. E.coli was the most common organism isolated and shows high resistance to Amoxcillin+Clavulanic acid and Ciprofloxacin. Enterococcus was found to be resistant to Erythromycin and Penicillin. Thus, Gram negative organisms are more resistant to higher antibiotics. Antibiotics should be used carefully. Therefore, antibiotic policies should be formed for ICU and other critical care facilities.

Keywords: ICU, Antibiotics, ESBL, Staphylococcus aureus

Introduction

Intensive Care Unit (ICU) plays the important role in the management of critically ill patients and treatment of infections in patients admitted in ICU. In ICU antibiotics susceptibility and resistance play the important role in the management of infections. Emergence of the antibiotic resistance is becoming an increasingly difficult problem in ICU.

Globally antibiotic resistant pathogens are encountered in ICU. Because of this there are few therapeutic options available. [1]

Methicillin-resistant *Staphylococcus aureus* and Vancomycin-resistant *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 strains are becoming important cause of morbidity and mortality compared with an average patient.

Antibiotic resistance patterns of organisms widely vary for different countries as well as different hospitals as well as even among ICUs. Ventilator–associated pneumonias, urinary tract infection (UTI) and bloodstream infections are most common nosocominal infections. [4]

The source for multi-drug resistant 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 patterns for the patients receiving antibiotics and admitted in ICUs. This study may provide insights that might help improve the overall management of ICU infections.

Material and Methods

The study was done on 106 isolates from ICU of 40 patients. It was conducted at the Department of Medicine Grant Government Medical College and Sir JJ Group of Hospitals, Mumbai. Sample for the culture were taken from ICU patients, depending upon the infections like sepsis, ventilator associated pneumonia, respiratory tract infection and post-operative patients. Multiple samples from different sites as well as in different times 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^{o}C for 18 to 24 hours. Chocolate agar plates were incubated at 37^{o}C in 5% CO_2 for 18 to 24 hours. 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 analysed. Among 106 isolates from 40 patients 25(62.5%) males and15 (37.5%) females with age ranging from 20 years to 90 years (average 55 years) were studied.

Table 1: Microorganisms isolated from 40 patients according to the site of infection.

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

(*) Cerebrospinal fluid, Peritoneal fluid, Asitic 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% , 12.26%, 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	***Staphylococcus aureus*** (%)	***Enterococcus*** (%)
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	*E.coli* (%)	*Klebsiella spp*(%)	*Acinetobacter spp*(%)	*Proteus mirabilis*(%)	*Providencia spp*(%)	*Pseudomonas spp*(%)
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
Aztreonum	-	-	-	-	-	75.00

Note: (-) = Antibiotics not used.

Discussion

This study is based on the antimicrobial resistance and multidrug resistance of the organisms isolated from ICU. Antibiotics are among most commonly prescribed drugs in ICU.

Modern critical care is a separate speciality which requires special training 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 resistant 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 spp17 (16.03), Acinetobacter spp 17 (16.03), Staphylococcus aureus 13 (12.26), Enterococcus 7 (6.60), Proteus mirabilis2 (1.89) & Providencia Spp1 (0.94). 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 inihibitors 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. were 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 baumanni(23.6%) and Klebsiella pneumonia (13.6%.). Avery high rate of resistance (80-100%) was observed among predoment 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 high resistance to Amoxcillin+Clavulanic acid and Ciprofloxacin. *Enterococcus* shows resistance to Erythromycin and Penicillin. Thus, Gram negative organisms are more resistant to higher antibiotics. Antibiotics should be used carefully. Antibiotics policies should be formed for ICU and other critical care facilities.

References

1. Mark E Jones, Deborah C Draghi, Clyde Thornsberry *et al*. Emerging resistance among bacterial pathogens in the intensive care unit – a European and North American Surveillance study (2000–2002). Annals of Clinical Microbiology and Antimicrobials 2004, 3:14
2. Kaul S, Brahmadathan KN, Jagannati M, Sudarsanam TD, Pitchamuthu K, Abraham OC, John G. One year trends in the gram-negative bacterial antibiotic susceptibility patterns in a medical intensive care unit in South India. Indian Journal of Medical Microbiology, Vol. 25, No. 3, July-September, 2007, pp. 230-235.
3. Spellberg B, Guidos R, Gilbert D *et al*. The epidemic of antibiotic resistant infections: a call to action for the medical community from the Infectious Diseases Society of America. Infect Control Hosp Epidemiol 2008; 29:271- 74.
4. Parvin Hassanzadeh*, Mohammad Motamedifar1, and Nahal Hadi1 Prevalent Bacterial Infections in Intensive Care Units of Shiraz University Of Medical Sciences Teaching Hospitals, Shiraz, Iran. Jpn. J. Infect. Dis., 62, 249-253, 2009.
5. *www.swacm.org/annualmeeting/2012/.../WS4 GPCLSIUpdate2012.pdf*. CLSI Standards for Antimicrobial Susceptibility Testing
6. Bailey & Scott's. Diagnostic Microbiology. Twelfth Edition
7. JLIN Fernando, CP Wickramaratne and et al. Studying current status of intensive care services in Sri Lanka. International Journal of critical illiness and injury science. Vol. 2| Issue 1| Jan-Apr 2012.
8. Zaveri Jitendra R1, Patel Shirishkumar M2, Nayak Sunil N3, Desai Kanan4, Patel Parul5. A study on bacteriological profile and drug Sensitivity & resistance pattern of isolates of the patients admitted in intensive care units of a tertiary care hospital in Ahmadabad. National journal of medical research print ISSN: 2249 4995 | eissn: 2277 8810
9. Trivedi TH, Shejale SB, Yeolekar ME. Nosocomial pneumonia in medical intensive care unit. J Assoc Physicians India 2000; 48:1070-3.
10. Singh AK, Sen MR, Anupurba S, Bhattacharya P. Antibiotic sensitivity pattern of the bacteria isolated from nosocomial infections in ICU. J Commun Dis. 2002 Dec; 34(4):257-63
11. Kaul S, Brahamadathan KN, Jagannati M, Sudarasanam TD, Pitchamuthu K, Abraham OC, John G. One Year trends in gram-negative bacterial antibiotic susceptibility patterns in medical intensive care unit in South India.
12. Singh AK, Sen MR, Anupurba S, Bhattacharya P. Antibiotic sensitivity pattern of the bacteria isolated from nosocomial infections in ICU.J Commun Dis. 2002 Dec; 34(4):257-63.
13. Nidhi Goel, Uma Chaudhary, Ritu Aggarwal, Kiran Bala. Antibiotic sensitivity pattern of gram negative bacilli isolated from the lower respiratory tract of ventilated patients in intensive care unit. Indian J Crit Care Med 2009; 13: 148-51