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A Clinical-Based Study to Evaluate the Extent of Microbial Sensitivity Tests Performed Among ICU Patients Prescribed with Antibiotics in a Tertiary Care Hospital

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ABSTRACT

Antibiotic resistance is recognized as a global threat to human health. ICUs are generally considered as the main source of outbreaks of multi-drug resistant bacteria. Infectious complications are one of the dominant causes of morbidity and mortality among elderly and geriatric patients, especially in the ICU. The impact of microbial resistance on them is more due to immune senescence. This can be overcome by strengthening antibiotic resistance monitoring and surveillance systems. Antibacterial sensitivity analysis prior to antibiotic therapy is one of the tools in practicing rationality of antibiotic use as it helps to choose the most effective antibiotic. This study evaluates the extent of microbial sensitivity tests performed among ICU patients prescribed with antibiotics. A prospective observational study was conducted on a total of 60 ICU patients at Srinivas Institute of Medical Science and Research Centre, Mangalore, for a period of six months. ICU patients diagnosed with infectious diseases and prescribed with antibiotics are included in the study. Data were collected using an antimicrobial stewardship form and were analyzed using MS Excel 2016. Majority of the 60 people involved in the study were adults (36-65 yrs old) and geriatrics (65 yrs and older). Sensitivity test of pathogen toward various antibiotics were performed among 68.33% (N=41) of the patients, where most of the patients were Geriatrics (25%) and Adults (38.3%). Although the sensitivity test was performed on the majority of the patients in the study, it is critical to follow this test with antimicrobial therapy in each patient. It is important to evaluate the sensitivity of pathogen before therapy and at ongoing times of therapy which avoids complications due to resistance issues by enabling the selection of appropriate antimicrobial treatment and helps in overall clinical management.

Keywords: Resistance, Sensitivity, Antibiotic, Geriatrics, ICU.

INTRODUCTION

Antibiotic resistance is the condition in which the pathogens lose their sensitivity towards antimicrobials and hence the drug becomes ineffective against the infection. Antimicrobial resistance is rising to dangerously high levels globally, which leads to prolonged hospital stays, higher medical costs and increased mortality. Antibiotic resistance makes the treatment of patients difficult mostly, and sometimes impossible. The emergence of antibiotic resistance in pathogens has become a matter of great public health concern. Antibiotic resistance is well recognized as a global threat to human health.[(1)]

The U.S. Centers for Disease Control and Prevention estimate that antibiotic resistance is responsible for more than 2 million infections and 23,000 deaths each year in

the United States. The promotion of rational antibiotic use is an absolute necessary for preventing the major threat of resistance. Modern medicine is at risk due to antibiotic resistance. Organ transplantation, chemotherapy and surgeries such as caesarean sections become dangerous without effective antibiotics for prevention and treatment of infections. The geriatric population is particularly susceptible to nosocomial infections because of multimorbidity, immune senescence, greater severity of illness, functional impairment, incontinence and the presence of frequent short term and long term indwelling devices such as urinary catheters and feeding tubes.[(2)]

Intensive care units (ICU) are generally considered as the main source of outbreak of multi drug resistant bacteria.[(3)] Antimicrobial resistance increases in the ICU by patient to patient transmission, importation, horizontal gene transfer within and between bacterial species and induction of new resistance. Most countries are reporting gradual increase in antimicrobial resistance among common pathogens found in ICU. Trends of raising antimicrobial resistance, especially to gram negative bacterial are problematic in ICU.[(4)] The international study of infection in ICU which was conducted in 2007, and involved with 1 265 ICUs from 75 countries, demonstrated that patients who had longer ICU stays had higher rates of infection, especially infections due to resistant *Staphylococci*, *Acinetobacter*, *Pseudomonas* species, and *Candida* species. Moreover, the ICU mortality of infected patients was more than twice that of non-infected patients.[(4)] The emergence of antibiotic resistance is directly correlated with the inappropriate use of the antibiotics.[(5)] A study results shows 30%-60% of antibiotics prescribed in ICUs are inappropriate and unnecessary.[(6)] The irrational use of antibiotics can lead to the antibiotic resistance. A study shows that around 51.9% of mortality rate was found among patients who found resistance to the antibiotics in ICU.[(7)] And its impacts on geriatric patients are more due to immune senescence. Infectious complications are amongst the dominant causes of morbidity and mortality in geriatric patients and especially in the Intensive Care Unit (ICU) setting.

Risk factors for multidrug-resistant (MDR) organisms include age >65 years, antimicrobial therapy in the preceding 3 months, high frequency of antibiotic resistance in the community, hospitalization for ≥48 hours in the preceding 3 months, home infusion therapy including antibiotics, home wound care, chronic dialysis within 1 month, family member with MDR pathogen and ongoing immunosuppressive treatment. Although antibiotics represent one of the most frequently prescribed classes of drugs among all hospitalized patients, total antibiotic consumption is approximately 10 times greater in the ICU than in general hospital wards. The WHO advocates that the use of antibiotics should be strictly monitored. This can be achieved through strengthening antibiotic resistance monitoring and surveillance systems and introducing evidence-based treatment guidelines.

Use of antibiotic stewardship in ICUs helps in rapid identification, optimal treatment of bacterial infections in critically ill patients, reducing use of unnecessary broad spectrum antibiotics, shortening the duration, and reduces undue antibiotic therapy.[(6)] The guideline 'The antibiotic stewardship in Intensive Care Unit' recommends performing culture and sensitivity test along with prescribing broad spectrum antibiotics immediately. It is given to reduce the further risk of patient's health and advised to de-escalate its dose if patient shows positive results for the antibiotic given until the prescriber gets culture and sensitivity test reports from the laboratory. It is then followed by starting the course of antibiotic therapy appropriate to the pathogen found and sensitivity reports. Sensitivity analysis prior to course of antibiotic therapy is one of the tool in practicing rationality of antibiotic use as it helps to choose the most effective

antibiotic and reduces the rate of its inappropriate use. Rational and optimal use of existing antimicrobial agents is one of the three pillars in combating antimicrobial resistance.[8] Antimicrobial stewardship (AS) which involves careful and responsible management of antimicrobial use is one of the key strategies to overcome resistance.

MATERIALS AND METHODS

STUDY SITE: A prospective observational study was carried out at Srinivas Institute of Medical Science and Research Centre, Mukka-574146, a multi-speciality tertiary care teaching hospital in Mangaluru from October 2020 to March 2021.

STUDY DESIGN: Prospective Observational study

STUDY DURATION: The study was conducted for a duration of 6 months from October 2020 to March 2021.

ETHICAL CLEARANCE: The study protocol was approved by Institutional Ethics Committee (IEC) of Srinivas Institute of Medical Science and Research Centre, Mukka-574146. (Ref No: SIEC/SIMS & RC/2021/03/08)

STUDY CRITERIA:

- **Inclusion criteria**
- Patients undergoing antibiotic treatment for any illness in ICU

- **Exclusion criteria**
- Out-patients
- In patients in other wards

SOURCE OF DATA: The data collected for study was taken from the case files of patients in the ICU of Srinivas Institute of Medical Science and Research Centre, and it included demographic details, medical and medication history, suspected infection/source, MDRO risk, diagnosis, treatment and microbiology test reports.

SAMPLE SIZE: Based on the inclusion and exclusion criteria case files of patients admitted to the ICU were obtained. A total of 60 ICU patients met the selection criteria.

STUDY METHOD: A structured stewardship form was used to collect the data from case files of ICU patients. Stewardship form was designed with the help of resources and is validated by the Department of Microbiology, SIMS&RC, Mukka. The data was collected from the case files of ICU patients which are filled by doctors, nurses, pharmacist and other health-care professionals. Data collected includes demographic details, medical and medication history, suspected infection/source, MDRO risk, diagnosis, treatment and microbiology test reports and all the details will be kept confidential.

DATA ANALYSIS: The collected data were analyzed by using Microsoft Excel 2016. The extent of sensitivity test performed among ICU patients with antibiotics therapy has been observed and concluded on the basis of case files of ICU patients.

OPERATIONAL MODALITY:

Ethical Committee approval was obtained before starting of this study.

Antimicrobial stewardship form has been designed as per need of the study.

Case files of ICU patients prescribed with antibiotics are reviewed.

Antibacterial sensitivity test reports were collected along with other required information from the case files into the prepared stewardship form.

The extent of microbial sensitivity test performed is assessed along with its percentage among various age

RESULT

DEMOGRAPHIC CHARECTERISTICS OF THE PATIENTS

In the present study, data of 60 ICU patients prescribed with antibiotics were collected from the case files of Srinivas Institute of Medical Science and Research Centre, Mukka, Mangaluru, who met the inclusion and exclusion criteria for the study. Out of 60 patients, 35 (58.33%) were males and 25 (41.66%) were females(Figure 1). 2 (3.33%) patients belonged to the age group of 0-18yrs, 4(6.66%) patients belonged to the age group of 19-35yrs, 36 (60%) patients in the age group of 36-65yrs and 19 patients (31.6%) belonged to the age group above 65yrs(Figure 2).

Table 1. Demographic characteristics of patients in the study:

Age groups	Male	Female	Total no. Of patients
Paediatrics (0-18yrs)	0	2	2
Young adults (19-35yrs)	4	0	4
Adults (36-65yrs)	24	12	36
Geriatrics (65yrs<)	7	11	18

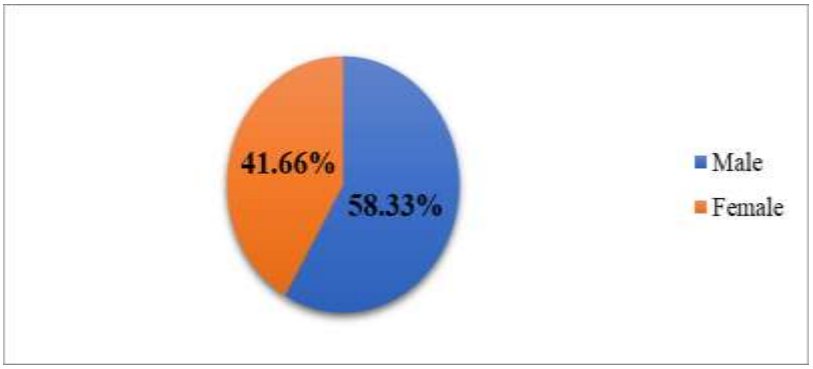

Figure1. Gender wise distribution among the study population.

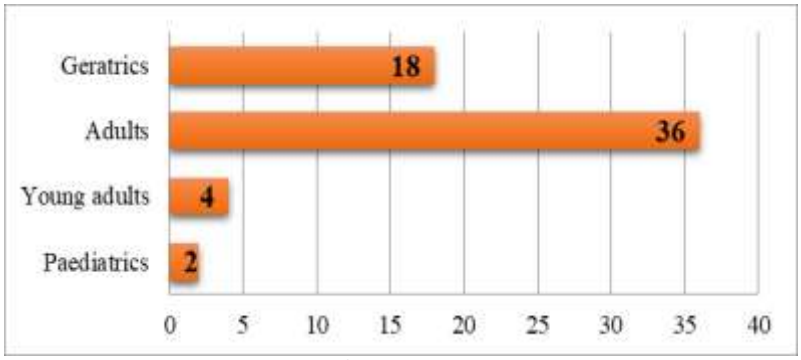

Figure2. Distribution of study population as per Age group

LENGTH OF STAY IN ICU

Among 60 ICU patients who survived to hospital discharge, the length of stay of 21 samples were 1-5 days and 39 samples were more than 5 days (≥5). 35% of patients were in ICU for 1–5 days, 65% of patients were in the ICU for ≥5 days representing the length of stay in ICU bed-days.

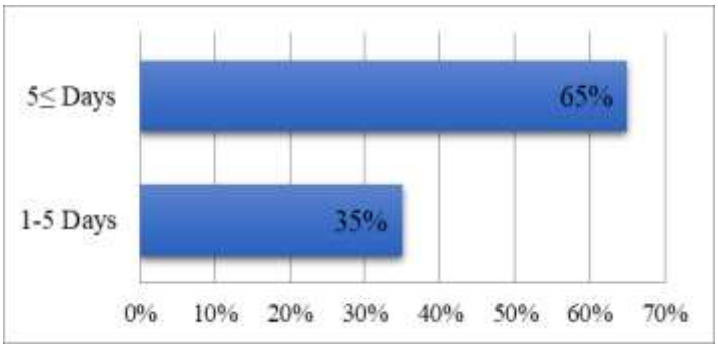

Figure3. Length of stay in ICU by the patients

CULTURE TEST PERFORMED AMONG PATIENTS

The sample from infected site was cultured on specialized culture media to recover the pathogen that is causing the infection. Sample collected were depended on the type of culture performed and the type of patients' infection and they were urine, blood, sputum, pus, bronchoalveolar lavage, CSF and pericardial fluid. Among the study subjects prescribed with antibiotics, culture test was performed in 55 patients (91.66%) and was not performed in 5 patients (8.34%).

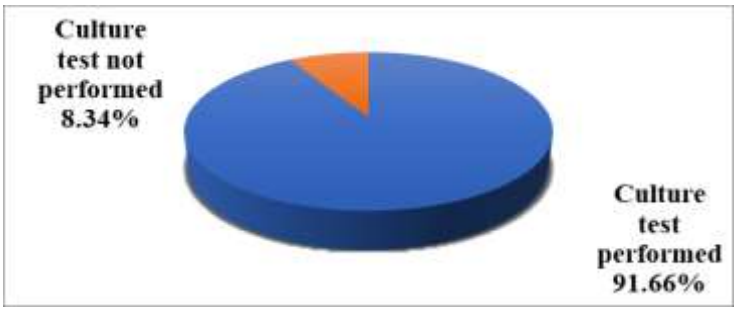

Figure4. Percentage of subjects with culture test

ORGANISMS ISOLATED

Culture test was performed among 55 patients and the obtained pathogens were identified and categorized as gram-positive and gram-negative organisms. Gram-positive organisms comprised of 20 (20/55, 36.36%) and gram-negative organisms were 35 (35/55, 63.63%). *Enterococcus faecalis*, *Staphylococcus aureus*, *Staphylococcus haemolytics*, *Staphylococcus saprophyticus*

and *Streptococcus agalactiae* were the isolated gram positive strains of bacteria and isolated gram negative strains were *Acinetobacter spp., Citrobacter spp., Escherichia coli, Klebsiella pneumonia, Klebsiella spp., Pseudomonas aeruginosa* (Table2).

Table 2. Organisms identified:

	Pathogen	Total Number and %
Gram positive bacteria	*Enterococcus faecalis* *Staphylococcus aureus* *Staphylococcus haemolytics* *Staphylococcus saprophyticus* *Streptococcus agalactiae*	20(20/55, 36.36%)
Gram negative bacteria	*Acinetobacter spp.* *Citrobacter spp.* *Escherichia coli* *Klebsiella pneumonia* *Klebsiella spp.* *Pseudomonas aeruginosa*	35(35/55, 63.63%)

FREQUENCY OF ORGANISMS ISOLATED

Escherichia coli was isolated in 15 subjects (27.27%) which is found to be the highest reported pathogen followed by *Staphylococcus aureus* in 12subjects (21.8%), *Acinetobacter* species in 3 subjects (5.4%), *Citrobacter* species in 3 subjects (5.4%),*Enterococcus faecal* in 3 (5.4%), *Klebsiella pneumoniae* in 5 (9%), *Klebsiella* species in 1 (1.8%), *Pseudomonas aeruginosa* in 8 (14.5%), *Staphylococcus haemolytics* in 1 (1.8%), *Staphylococcus saprophyticus* in 2 (3.6%) and *Streptococcus agalactiae* in 2(3.6%).

Table 3. Frequency of organisms isolated:

Sl. no	Organisms	Frequency	Percentage (%)
1.	*Acinetobacter species*	3	5.4
2.	*Citrobacter species*	3	5.4
3.	*Escherichia coli*	15	27.27
4.	*Enterococcus faecalis*	3	5.4
5.	*Klebsiella pneumonia*	5	9
6.	*Klebsiella species*	1	1.8
7.	*Pseudomonas aeruginosa*	8	14.5
8.	*Staphylococcus aureus*	12	21.8
9.	*Staphylococcus haemolytics*	1	1.8
10.	*Staphylococcus saprophyticus*	2	3.6
11.	*Streptococcus agalactiae*	2	3.6

SENSITIVITY TEST PERFORMED

Sensitivity analysis determines the effectiveness of antibiotics against pathogens that have been isolated from cultures. Among 55 subjects with isolated pathogen, 41 were found to be tested for its sensitivity against antibacterial drugs. Hence the study shows that the microbial sensitivity test performed among the patients with antibiotics prescription were 68.33% (41 patients) and 31.66% (19 patients) without microbial sensitivity test (Figure 5). Out of 68.33% of subjects with microbial sensitivity test 1(1.66%) subject belong to the age group of 0-18 yrs, 2 (3.33%) subjects belong to the age group of 19-35yrs, 23 (38.3%) subjects belonged to the age group of 36-65yrs and 15 (25%) subjects belonged to the age group of 65<yrs. They are specified in the Table 4.

Figure 5. Sensitivity test performed among the patients

Table 4. Percentage of sensitivity test performed among different age groups:

Age Groups	Microbial Sensitivity test performed	Percentage (%)
Paediatrics (0-18yrs)	1	1.66%
Young adults(19-35yrs)	2	3.33%
Adults(36-65yrs)	23	38.3%
Geriatrics(65yrs<)	15	25%

PERCENTAGE OF SAMPLES WITH MDRO RISK AND ANTI-BACTERIAL RESISTANCE

From the data collected by using antimicrobial stewardship form, it was found that 25 patients (41.66%) were with the risk of MDRO. The MDRO risk was analysed using the factors such as antimicrobial therapy in preceding 90 days, hospitalization for 2 days or more in preceding 90 days, current hospitalization of more than 5 days, chronic dialysis within 30 days, home wound care, family member with MRDO risk, colonization or repeated infection with MDRO, immunosuppressive therapy or disease and nursing home residence. The sensitivity test report shows that from 25 patients with MDRO risk, 11 patients (18.33%) already developed resistance towards multiple antibacterial drugs (Figure.8). Among paediatrics 1.66% of the subject had the risk of MDRO. 13.33% of subjects with MDRO risk from the age group of young adults with the resistance of 3.33%. 23.33% of the adults had the risk of MDRO and 10% of them found to be having resistance. From geriatrics, 16.66% had the risk of MDRO and 3.33% of were reported to be having resistance (Table 5).

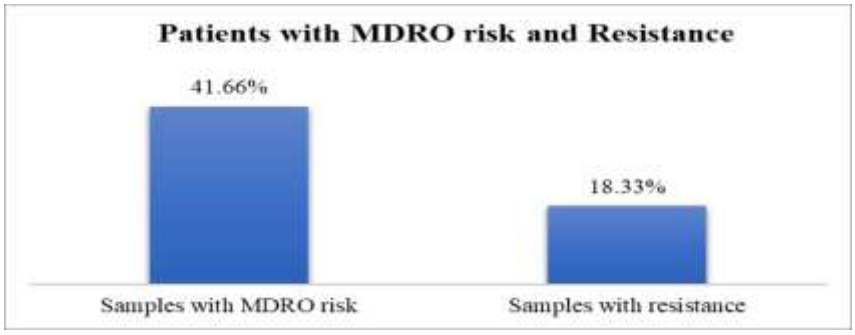

Figure 6. Patients with MDRO risk and Resistance

Table 5. Percentage of patients with MDRO risk and resistance

Age Groups	No. Of subjects with MDRO risk	No. Of subjects with resistance to antibiotics
Paediatrics (0-18yrs)	1(1.66%)	0
Young adults(19-35yrs)	8(13.33%)	2(3.33%)
Adults(36-65yrs)	14(23.33%)	6(10%)
Geriatrics(65yrs<)	10(16.66%)	2(3.33%)

The table 6. describes the overall results of the study in brief. From the study of 60 patients in ICU, 91.66% of the subjects have underwent culture test for pathogen before starting definitive therapy with antimicrobials. 68.33% of the samples underwent microbial sensitivity test and 18.33% of the subjects were reported with developed resistance with the use of multiple antibacterial drugs. As per the Antimicrobial Stewardship Form the study also showed that 41.66% of the subjects were with risk of multi-drug resistance organisms (MDRO).

Table 6. Overall result of the study

	Yes	No
Culture test performed	55(91.66%)	5(8.34%)
Antimicrobial sensitivity test performed	41(68.33%)	19(31.66%)
MDRO risk	25(41.66%)	35(58.33%)
Subjects with antimicrobial resistance	11(18.33%)	49(81.66%)

The 60 ICU patients in the study were diagnosed with multiple disorders along with infectious disease which needed intensive care and antibiotic therapy. 3 samples were with the diagnosis of pulmonary TB, 9 with UTI, 4 with surgical site infection, 8 with LRTI, 8 with sepsis, 1 with pericarditis, 6 with abscess, 5 with cellulitis, 6 with pneumonia, 1 with endocarditis, 1 with meningitis, 5 with bacteraemia, 2 with GI infection and 2 with glomerulonephritis.

Table 7. Diseases with frequency

Sl no	Diagnosis for which antibiotics given	No. of cases
1.	Pulmonary TB	3
2.	UTI	9
3.	Surgical site infection	4
4.	LRTI	8
5.	Sepsis	8
6.	Pericarditis	1
7.	Abscess	6
8.	Cellulitis	5
9.	Pneumonia	6
10	Endocarditis	1
11.	Meningitis	1
12.	Bacteraemia	5
13.	GI Infection	2
14.	Glomerulonephritis	2

ANTIBIOTIC SENSITIVITY PATTERN

In the study, analysis of culture test and sensitivity test results were done in which 8 type of obtained organisms were analyzed to 32 antibiotics. *Staphylococcus* spp., *Klebsiella* spp., *E. coli, Acinetobacter, P. aeruginosa*., *Citrobacter* spp., *Enterococcus* spp., and *Streptococcus* spp., were the organisms isolated. The tables 8.1,8.2 and 8.3 describes the details of the antibacterial's susceptibility and resistance towards the pathogen isolated from the patients.

Table 8.1Antibiotic sensitivity pattern

Organism	***E.Coli***		***Acinetobacter spp.***		***Citrobacter spp.***		***Enterococcus faecalis***		***Klebsiella spp.***	***P. aeruginosa***			***Staphylococcus spp.***		***Streptococcus agalactiae***	
Antibiotics	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
AMX/CL	2	0	0	1	0	0	0	1	0	2	0	0	1	1	0	0
Cefazolin	1	2	0	0	0	0	0	0	0	2	1	1	1	0	0	0
Cefotaxime	0	1	0	0	0	0	0	0	0	2	0	0	1	0	0	0
Co-trimoxazole	1	2	0	1	0	1	0	1	1	2	1	1	2	0	0	0
Gentamicin	2	2	0	1	0	1	1	0	1	2	0	1	2	0	1	0
AMK	0	0	1	0	0	1	0	0	1	2	0	0	2	0	0	0
Ciprofloxacin	0	2	0	1	0	1	0	1	1	2	1	0	2	0	0	0
Levofloxacin	1	2	0	0	0	0	0	0	0	2	0	1	1	0	1	0
Azithromycin	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Clindamycin	0	0	0	0	0	0	0	1	0	0	0	0	2	0	0	0
Tigecycline	1	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0

Table 8.2Antibiotic sensitivity pattern

Organism	***E.Coli***		***Acinetobacter spp.***		***Citrobacter spp.***		***Enterococcus faecalis***		***Klebsiella spp.***		***P. aeruginosa***		***Staphylococcus spp.***		***Streptococcus agalactiae***	
Antibiotics	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Cefoperazone	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0
Meropenem	4	1	0	1	1	0	0	0	1	2	1	0	0	0	0	0

PIP/TZ	2	1	0	1	1	0	0	0	1	2	1	1	0	0	0	0
Imipenem	2	1	0	0	0	0	0	0	0	2	1	1	0	0	0	0
Aztreonam	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Colistin	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Nitrofurantoin	3	0	0	0	1	0	0	0	0	0	0	1	0	0	1	0
Ceftriaxone	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Vancomycin	0	0	0	0	0	0	1	0	0	0	0	0	1	0	1	0
Teicoplanin	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0
Linezolid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Table 8.3. Antibiotic sensitivity pattern

Organism	***E.Coli***		***Acinetobacter spp.***		***Citrobacter spp.***		***Enterococcus faecalis***		***Klebsiella spp.***		***P. aeruginosa***		***Staphylococcus spp.***		***Streptococcus agalactiae***	
Antibiotics	S	R	S	R	S	R	S	R	S	R	S	R	S	R	S	R
Cefuroxime	0	1	0	0	0	0	0	0	0	2	0	1	0	0	0	0
Netilmicin	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
SCF	2	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0
Polymyxin B	1	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0
Erythromycin	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
Tetracycline	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Ceftazidime	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
Ampicillin	0	2	0	1	0	1	0	1	0	0	0	1	0	1	0	0
Chloramphenicol	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Morfloxacin	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0

Among the various antibiotics tested for the sensitivity with the pathogen, it was found that Gentamicin, Co-trimoxazole, Ciprofloxacin and Ampicillin were resistant towards most of the microorganisms.

Table 9. Antibiotic Resistance pattern

Antibacterials	**No. Of samples with resistance**
AMX/CL	5
Cefazolin	5
Cefotaxime	3
Co-trimoxazole	8
Gentamicin	7
AMK	3
Ciprofloxacin	7
Levofloxacin	5
Nitrofurantoin	1
Clindamycin	1
PIP/TZ	5
Imipenem	4
Meropenem	4
Cefuroxime	4
Netilmicin	1
SCF	4
Ceftazidime	3
Ampicillin	7
Chloramphenicol	1
Morfloxacin	1
Erythromycin	1

DISCUSSION

Antimicrobial resistance is one of the major clinical problems in intensive care units (ICUs).[9] The emergence of antibiotic resistance is directly correlated with the inappropriate use of antibiotics.[10] Although antibiotics represent one of the most frequently prescribed classes of drugs among all hospitalized patients, total antibiotic consumption is approximately 10 times greater in the ICU than in general hospital wards. The promotion of rational use of antibiotic is absolute necessary for preventing the major threat of resistance. Antimicrobial resistance in ICUs is of great concern as it increases the likelihood of drug interactions/side effects and cost of therapy due to use of newer antibiotics. Resistance may also be responsible for prolonged hospital stays and can affect prognosis. Performing antibacterial sensitivity test prior to giving the definitive therapy can help in choosing the appropriate antibiotics for individual patients, along with reducing the possibility of administering resistant antibacterial drugs to the patients which turn out to be the additional risk for the patients in the ICU.

A prospective analysis was performed using the case files of 60 ICU patients prescribed with antibiotics for the demographic details and performance of antibacterial sensitivity test. The demographic data of the patients shows that the number of males (58.33%) were more than number of females (41.66%) which is similar to the study conducted by *Peter Dodek et al.,* [11] *that* the

more males were admitted in ICU than females.

In the present study, it was found that most of the patient belonged to the age group of 36-65yrs (Adults) and >65yrs (Geriatrics) in the percentage of 60% and 30% respectively which is similar to the study conducted by *Narayan Prasad Parajuli et al.,*[12] and *Giang M. Tran et al.,*[13] that the admission rate of older patients is more in ICU compared to the younger patients. This could be due to comorbidities associated with increasing age and vulnerability to infections as the process of aging is associated with physiological and functional alterations of the body.

In this study, it was observed that most of the patients (65%) had the stay at ICU for 5 or more than 5 days which is similar to the study conducted by *Vivek K Moitra et al.,*[14] where the mean ICU length of the stay was ±4.5days.

The study showed that out of 60 ICU subjects with antibiotics, most of them were performed culture test (91.66%) similar to the study of *P.Cornejo-Juarez et al.,*[15] and continued with definitive antibiotic therapy based on the pathogen isolated. Among them Gram negative bacteria(63.63%) were the predominant cause of infection while patients with Gram positive bacterial infection were 36.36%. It is similar to the studies conducted by *Narayan Prasad Parajuli et al.,*[12] and *Tsegaye Alemayehu et al.,* [16] that Gram negative bacterial pathogens are major culprits associated with the infection in ICU and its alarming state of drug resistance.

Pathogens were further categorized according to their species. Among the isolates *Escherichia coli* (27.27%) was the predominant cause of infection among the patients followed by *Staphylococcus aureus* (21.8%). The studies conducted by *W R Jarvis et al.,*[17] and *Lei Tian et al.,*[18] shows similar result that *Escherichia coli* as the most common cause of infection followed by *Staphylococcus aureus*.

The current study shows that out of 60 patients with antibiotic therapy, antibacterial sensitivity test is performed among most of the subjects (68.33%). Specifically adults (N=23) are dominant in the sensitivity test followed by Geriatric(N=15) patients which is more compared to the study results conducted by *Asha K Rajan et al.,*[19]

The patients in the study were assessed for MDRO risk using antimicrobial stewardship form. The results showed that out of the 41.66% of subjects with MDRO risk 18.33% were found to be resistant to various antibacterials. Among the patients with resistance majority of patients were Adults(10%) followed by Geriatrics(3.33%) and Young adults(3.33%). Similar result was found in a study performed in an Oncology ICU by *P.Cornejo-Juarez et al.,*[15]

In the present study, the sensitivity analysis of the pathogen is performed with various antibacterials which shows that antibacterials such as Co-trimoxazole(N=8) ,Gentamicin(N=7), Ciprofloxacin(N=7) and Ampicillin(N=7) were resistant to most of the isolated pathogens. Similar results were found in the study done by *Tsegaye Alemayehu et al.,*[16] and *Giang M. Tran et al.,*[13] where organisms are shown to be resistant to antibiotics like Ciprofloxacin, Gentamicin, Cefoperazone, Levofloxacin, Co- trimoxazole, Ampicillin etc leaving them to be the antibiotics with more resistance by various pathogens.

CONCLUSION

The resistance of pathogens to antibiotics is emerging in higher rates in ICU and it is important to perform sensitivity test to check the susceptibility of antibiotics prior to the prescription to maintain rationality and reduce the risk of patients' condition by prescribing inappropriate antibiotics.

Our findings indicated that majority of the patients with antibiotics therapy in the ICU have underwent sensitivity test prior to the definitive therapy. Highest percentage of the patient with the sensitivity test was from the age group of adults followed by geriatrics. This could be due to higher risk possibilities

for older patients than youngsters with inappropriate antibiotics.

Hence it was concluded that sensitivity test is performed in majority of patients but not in all the ICU patients receiving antibiotic therapy. It is important to evaluate the sensitivity of pathogen of each patient with antibiotic therapy to provide appropriate antibiotic regimen and maintain rationality. Antimicrobial sensitivity test before therapy and at ongoing times of therapy avoids complications due to resistance issues by enabling selection of appropriate antimicrobial treatment and overall clinical management which ultimately will optimize patient's outcome.

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