A Clinical Based Study to Assess Whether Antibiotic Sensitivity Tests Are Performed Among the Patients with Antibiotics in a Tertiary Care Hospital

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ABSTRACT
The issue of antibiotic resistance to human health is widely acknowledged. ICUs are typically regarded as the primary source of multi-drug resistance bacterial outbreaks. One of the most common causes of morbidity and mortality in elderly and geriatric patients, particularly in the ICU, is infectious complications. The Antibacterial sensitivity analysis prior to antibiotic therapy is one of the tool in practicing rationality of antibiotic use as it helps to choose the most effective antibiotic therapy. This study assesses whether antibiotic sensitivity tests has been performed among the patients with antibiotics. A prospective observational study was conducted in 60 ICU patients at Srinivas Institute of Medical Science and Research Centre, Mangalore, for a period of six months. ICU patients diagnosed with infectious disease and prescribed with antibiotic were included in the study. Data were collected using an antimicrobial stewardship form and was analyzed using MS Excel 2016. From a total of 60 ICU patients involved in the study, majority were from age group adults(36-65yrs) and Geriatrics(65yrs<). Sensitivity test of pathogen toward various antibiotics were performed among 68.33% of the patients, where most of them were Adults(38.3%) and Geraitrics(25%).
Although, the sensitivity test were performed among most of the patients in the study, it is crucial to follow this test in each patient with antimicrobial therapy. 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 selection of appropriate antimicrobial treatment and helps in overall clinical management.
Keywords: Antibiotics, Sensitivity, Resistance

I. INTRODUCTION
There are many classes of antibiotics like penicillins, cephalosporins, fluoroquinolones, aminoglycosides, macrolides, monobactams and carbapenems. Increased life expectancy and safe surgeries have become normal after the discovery of antibiotics and people could survive the infections which used to be deadly before. Antibiotics are currently the most commonly prescribed medication in hospitals, worldwide. Moreover, excessive and inappropriate use of antibiotics has rendered increased drug resistance.[1]

Antibiotic resistance is a condition in which the pathogen loses its sensitivity towards antimicrobials and hence the drug becomes ineffective towards the infection. Antimicrobial resistance is rising to dangerously all over the globe, which leads to prolonged hospital stays, higher medical costs and increased mortality. The U.S. Centers for Disease Control and Prevention estimated that antibiotic resistance is responsible for more than 2 million infections and 23,000 deaths every year in the United States.[2]

Promotion of rational use of antibiotic is of major need for preventing the threat of resistance. Growing infections such as pneumonia, tuberculosis, food borne disease, blood poisoning and gonorrhea are becoming harder to treat as antibiotics become less effective.[3]

The geriatric population are particularly susceptible to most 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.[4]

Intensive care units (ICU) in the hospitals are specialized for critically ill patients to get specialized and individualized medical treatment and monitoring. They are generally considered as the major source of outbreak of multi drug resistant bacteria further acts as the life threatening factor for critically ill patients. Antimicrobial resistance increases in the ICUs by patient to patient transmission, importation, horizontal gene transfer within and between bacterial species and induction of new resistance. WHO identifies antimicrobial resistance as a major threat due to lack of development of new antibiotic for the treatment of infections caused by MDR pathogens.[5]

Most countries are reporting gradual increase in antimicrobial resistance among common pathogens

found in intensive care units. Trends of raising antimicrobial resistance, especially to gram negative bacterial are nowadays common in ICU. An international study of infection in ICU which was conducted in 2007, involved with 1265 ICUs from 75 countries, demonstrated that patients having longer ICU stays had higher rates of infection, mainly infections due to resistant Staphylococci, Acinetobacter, Pseudomonas species, and Candida species. Moreover, the ICU mortality of infected patients were more than twice that of non-infected patients.[6]

METHODOLOGYANDOPERATIONALMODALITY

**Studydesign:** Prospective Observational study.

Study site: Srinivas Institute of Medical Science and Research Centre, Mukka-574146, a multi-speciality tertiary care teaching hospital in Mangaluru.

Study duration: The study was conducted for a duration of 6 months from January 2021 to June 2021.

Sample size: The study was limited for a sample of 60 based on the time schedule allotted for the project including other circumstances.

Ethical clearance: The study protocol was approved by the Institutional Ethics Committee (IEC) Reference number: SIEC/SIMS & RC/2021/03/08

Operational modality
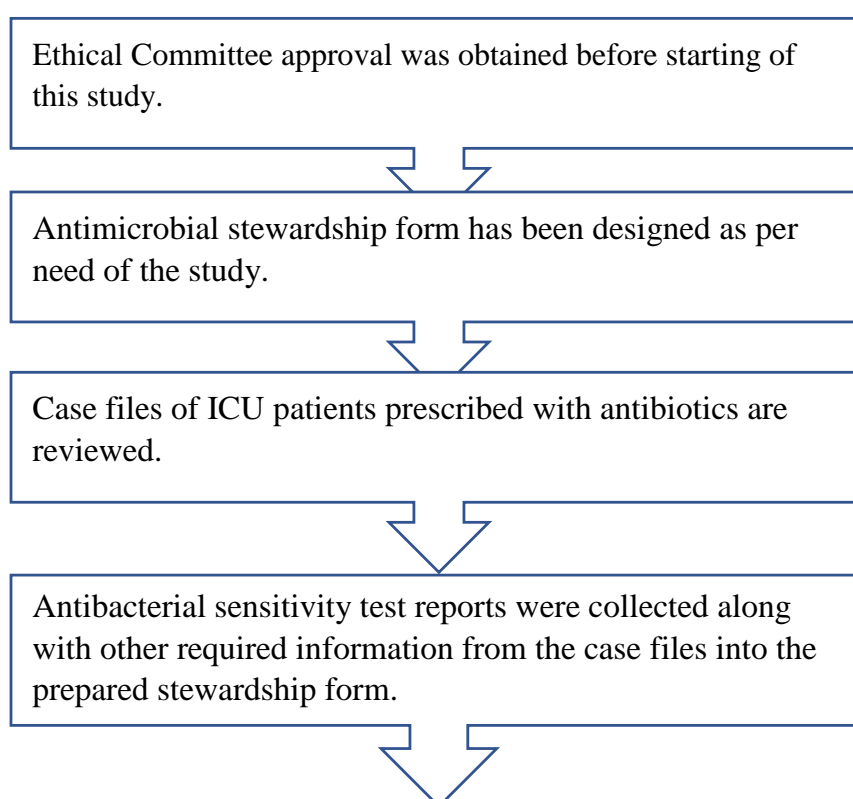
Study criteria
Inclusioncriteria
•   Patients undergoing antibiotic treatment for any illness in
Exclusioncriteria
•   Out-patients
•   In patients in other wards

Source of data: The data collected for study was taken from the case files of patients admitted in 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..

Datacollectionprocedure: A structured antibiotic stewardship form was used to collect the data from case files of ICU patients. Stewardship form was designed with the help of resources and were validated from the Department of Microbiology, SIMS&RC, Mukka. The data were collected from the case files of ICU patients which are filled by doctors, nurses, pharmacist and other health-care professionals.

II.   DATAANALYSIS

Dataanalysisinvolvedcollectingandscrutinizingeverydataand were analyzedusing MicrosoftExcel. 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 patient

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 isassessed along with its percentage among various age groups

III.   RESULT
DEMOGRAPHIC CHARECTERISTICS OF THE PATIENTS

In the present study, data from 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. 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 belonged to the age group of 36-65yrs and 19 patients(31.6%) belonged to the age group above 65yrs.

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

Table 1. Demographic characteristics

CULTURE TEST PERFORMED AMONG PATIENTS

The sample was collected from infected site was cultured on specialized culture media to recover the pathogen that is causing the infection. It depended on the type of culture performed and the type of patients infection and they were sputum, urine, blood, 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%).

CULTURE TEST PERFORMED AMONG PATIENTS
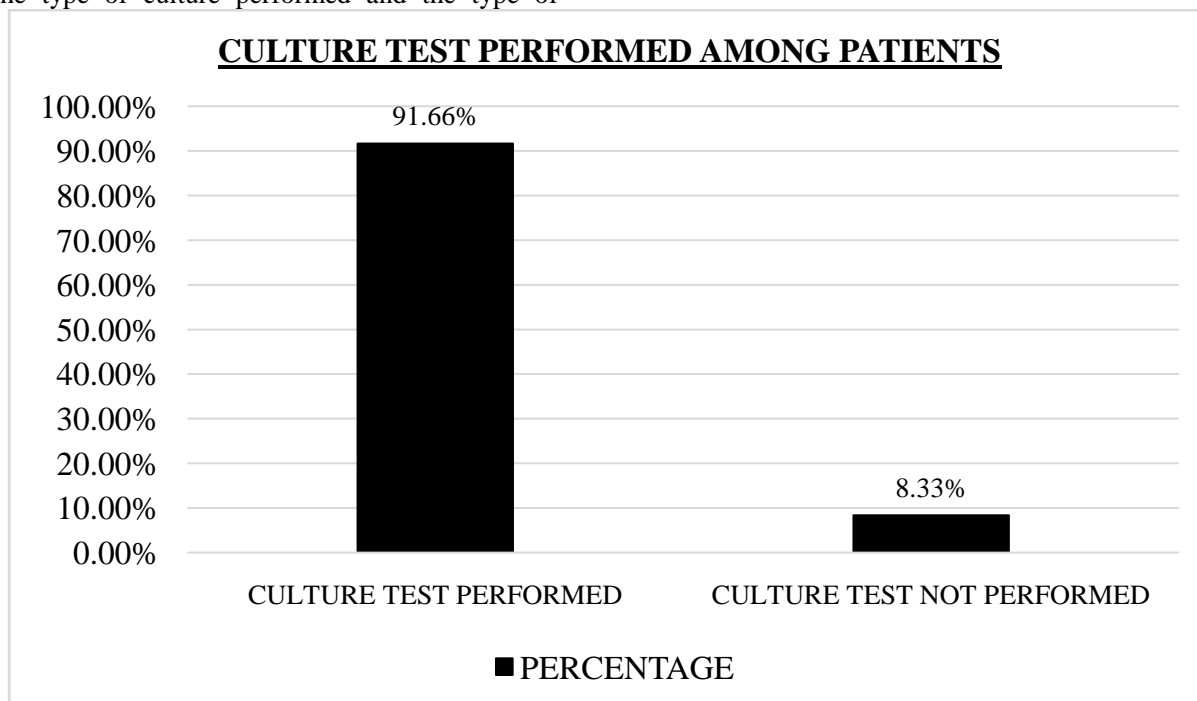
ORGANISMS ISOLATED

Culture test were performed among 55 patients and the obtained pathogens were identified and categorized as gram-negative and gram-positive organisms. Gram-positive organisms isolated comprised of 20 (20/55, 36.36%) and gram-negative organisms were 35 (35/55, 63.63%). Enterococcus faecalis, Staphylococcus haemolytics, Staphylococcus aureus, Staphylococcus saprophyticus and Streptococcus agalactiae were the isolated gram positive strains of bacteria and gram negative strains isolated were Acinetobacter spp., Klebsiella pneumonia, Citrobacter spp., Escherichia coli, Klebsiella spp., Pseudomonas aeruginosa.

	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%)

Table 2. Organisms identified

SENSITIVITY TEST PERFORMED

Sensitivity test performed determines the effectiveness of antibiotics against pathogens that have been isolated from cultures. Among subjects with isolated pathogen(55), 41 were found to be tested for its sensitivity against antibacterial drugs. So, 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. Among 68.33% of subjects with microbial sensitivity test 1(1.66%) subject belong to the age group of 0-18 years, 2 (3.33%) subjects belong to the age group of 19-35years, 23 (38.3%) subjects belonged to the age group of 36-65years and 15 (25%) subjects belonged to the age group more than 65years.
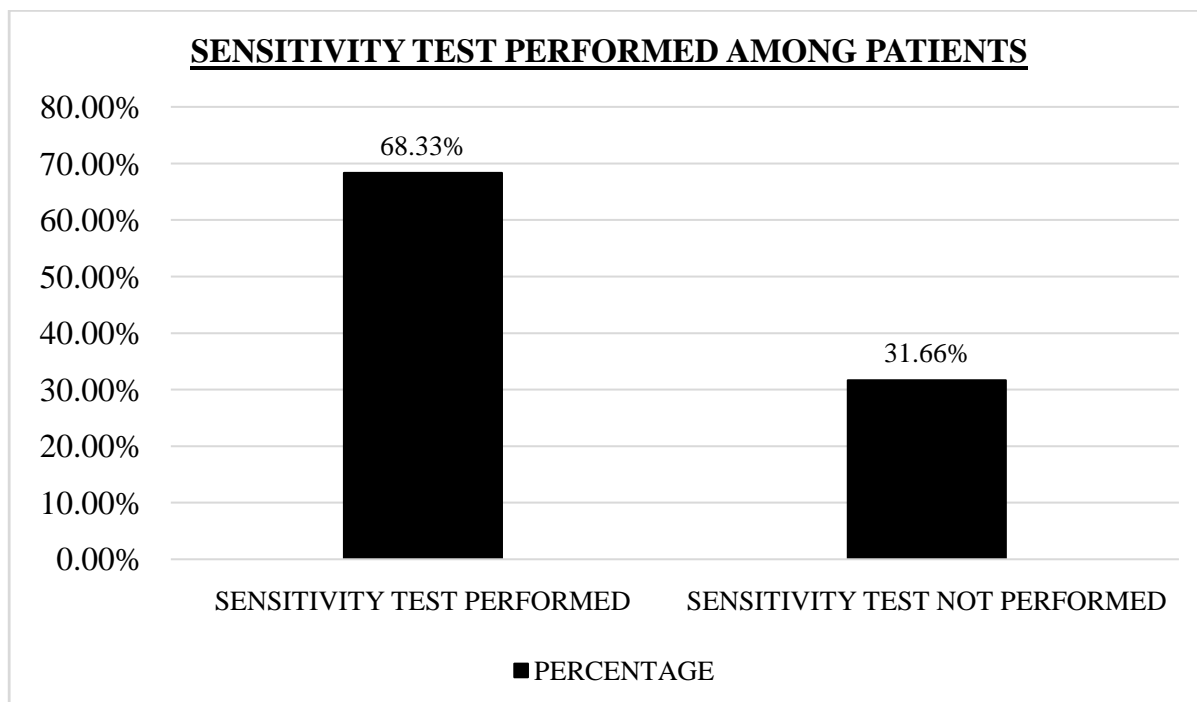
Age Groups	Microbial Sensitivity test performed	Percentage (%)
Paediatrics (0-18yrs)	1	1.66%
Young adults(19-35yrs)	2	3.33%
Adults(36-65yrs)	23	38.3%
Geriatrics(65yrs<)	15	25%

Table 3. Percentage of sensitivity test performed among different age groups

PERCENTAGE OF SAMPLES WITH MDRO RISK AND ANTI-BACTERIAL RESISTANCE

Among the data collected by using antimicrobial stewardship form, it was found that 25 patients (41.66%) were with the risk of multidrug resistant organism(MDRO). The MDRO risk was analysed using the factors like antimicrobial therapy in preceding 90 days, hospitalization for 2 days or more in preceding 90 days, current hospitalization of more than 5 days, family member with MRDO risk, chronic dialysis within 30 days, home wound care, colonization or repeated infection with MDRO, immunosuppressive therapy or disease and nursing home residence. The sensitivity analysis report shows that from 25 patients with MDRO risk, 11 patients (18.33%) already developed resistance towards multiple antibacterial drugs. Among paediatrics patients 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. Among geriatrics, 16.66% had the risk of MDRO and 3.33% of were reported to be having resistance.
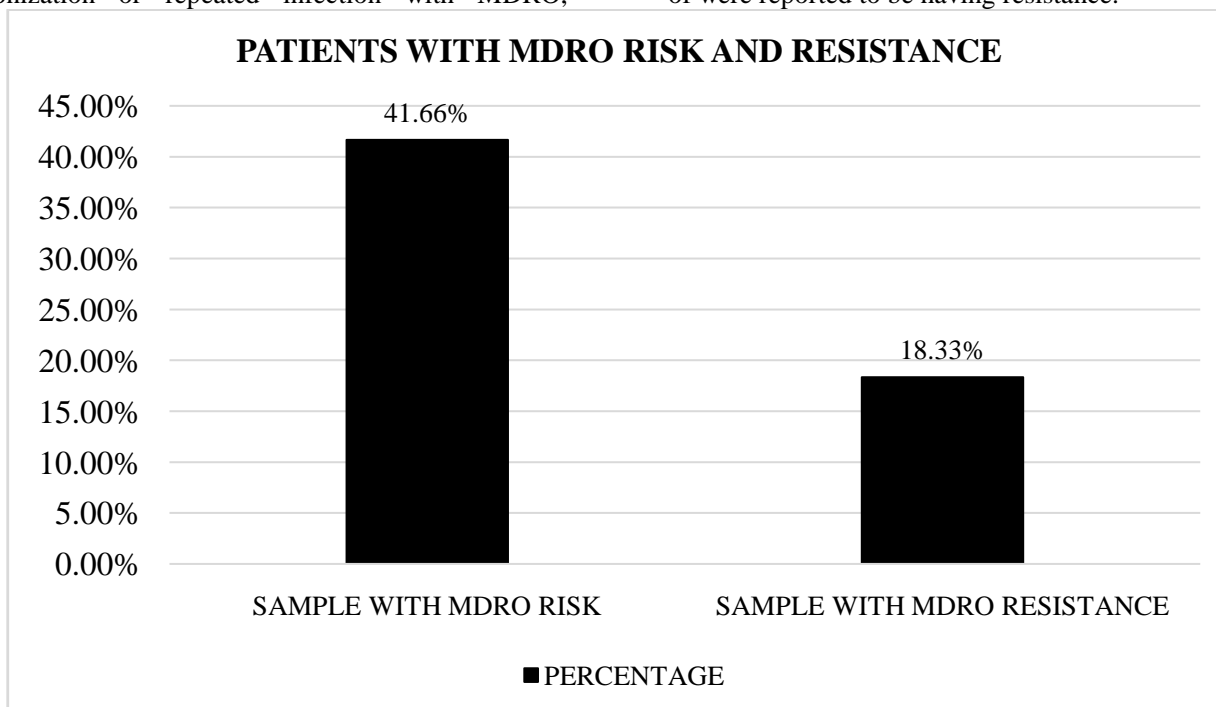
Age Groups	No. Of subjects with MDRO risk	No. Of subjects with resistance to antibiotics
Paediatrics (0-18yrs)	1(1.66%)	0
Young adults(19-35yrs)	8(13.33%)	2(3.33%)
Adults(36-65yrs)	14(23.33%)	6(10%)
Geriatrics(65yrs<)	10(16.66%)	2(3.33%)

Table 4. Percentage of patients with MDRO risk and resistance

IV. DISCUSSION

Antimicrobial resistance is one of the major clinical crisis in intensive care units (ICUs).[7]The emergence of antibiotic resistance is directly correlated with the inappropriate use of the antibiotics.[3]Antimicrobial stewardship that involves careful and responsible management of antimicrobial use is one of the key strategies to overcome resistance.

In the present study, it was found that majority of the patient belonged to the age group of 36-65yrs and >65yrs in the percentage of 60% and 30% respectively which is similar to the study conducted by **Narayan Prasad Parajuli et al.,** and **Giang M. Tran et al.,** that the admission rate of older patients is more in ICU compared to the younger patients. This may 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.

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

The current study also showed that out of 60 patients with antibiotic therapy, antibacterial sensitivity test was performed among most of the subjects (68.33%). Specifically adults were dominant in the sensitivity test followed by Geriatric patients which is more compared to the study results conducted by **Asha K Rajan et al.,**

V. CONCLUSION

The resistance of various pathogens towards antibiotics is emerging at higher rates in ICU and it is important to perform sensitivity test to check the susceptibility of antibiotics prior to the prescription of antibiotics to maintain rationality and reduce the risk of resistance due to inappropriate antibiotics.

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