Research Article

Prospective Observational Study on Rational use of Antibiotics in ICU Patients

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ABSTRACT

Rational use of antibiotics is most essential programme in current treatment patterns as many of the microorganisms developed resistance to certain antibiotics where they no longer effective in treatment. The objective of this study is to assess rational use of antibiotics in ICU patients, determine Escalation and De-escalation criteria and to observe & monitor the use of various antibiotics in ICU patients. We included patients above 18 years of both male & female and we excluded pregnant women and patients who are not willing to participate in the study. A Prospective observational study- ongoing monitoring and feedback in the context of patient's being sensitized to antibiotics overuse and resistance. We included 130 patients into the study. Among them 48 patients were undergone Culture sensitivity tests which are 36.92% of total sample. Out of 48 cases 65% cases were de-escalated. 24 patients were kept on ventilator which is 18.46% and mortality rate is 6.15%. 19% of total sample had shown drug duplication and 76.92% rational use of antibiotics is seen in ICU patients.

Keywords: Rational use, culture sensitivity tests, mortality rate, drug-duplication, ventilator.

INTRODUCTION

Antibiotics are the substances that are produced from microorganisms which are used to kill or suppressing the growth of microorganisms at very low concentrations[1]. In 1926, Alexander Fleming discovered penicillin, a substance produced by fungi that is able to inhibit the growth of microorganisms. Rational use of antibiotics is extremely important as injudicious use can adversely affect the patient, cause emergence of antibiotic resistance and increase in cost[10]. A variety of factors must be considered to select antimicrobial therapy including the severity and acuity of the disease, host factors, factors related to the drug use and the necessity for the use of multiple agents. VAP is a type of lung infection that occurs greater than 48hrs of incubation. VAP is most frequent problem in ICU with an elevated morbidity and cost associated with it, in addition to prolong MV and hospital length of stay. VAP is different from CAP, through any microorganism that causes CAP can cause VAP.[14]Antibiotics de-escalation refers to a strategy of switching from broad spectrum antimicrobials to a narrow spectrum of antimicrobials. It is recommended to reduce the emergency of multi drug – resistant bacteria as well as to decrease the cost.[51]. In a recent meta- analysis of 9 studies involved in 1873 patients with septic shock, de-escalation of antibiotics was associated with a trend towards reduced mortality[5]. Reason for development of guidelines for rational use of antibiotics is:

a) To avoid resistance to antibiotics (book principles).

b) For correct selection, use and monitor of antibiotic therapy.

c) To reduce the incidence of ADR's.

d) To avoid unnecessary increase in the cost of treatment.

MATERIALS AND METHODS

Study Design

Prospective observational study

Study Site

This study was conducted in department of Intensive care unit Queens 'NRI Hospitals.

Study Period

The study was conducted from October 2019 – March 2020

Period for collection of data: 4 months

Period for analyzing and reporting data: 2 months

Study Population

A total of 130 random patients who were admitted in ICU would be recruited into this study.

Study Design*

A Prospective observational study- ongoing monitoring and feedback in the context of patient's being exposed to important antibiotics and their overuse**.**

Study Criteria

Inclusion criteria

- Age varying >18 yrs on treatment with antibiotics.

Exclusion criteria

- Patients who are unable to participate in the study procedure.
- Pregnant or lactating women.

RESULTS AND DISCUSSION

Gender Criteria - Patient distribution Based on Gender

Among 130 patients participated in the study, the age ranged between >18 to <85 with an average age of ± 51.5yrs. Maximum were from adulthood (30-70) years. 57% were male (n=74) and 43% were female (n=46). The details are shown as above.

Table 1: showing distributin based on gender

S.No	No of patients (%)	No of male Patients (%)	No of Female Patients (%)
1.	100 (100%)	74 (57%)	46(43%)

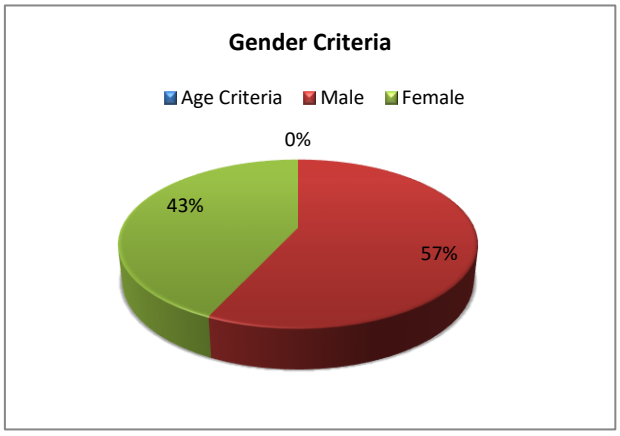

Figure 1: showing gender distribution of 130 patients

Antibiotics Used in the Study

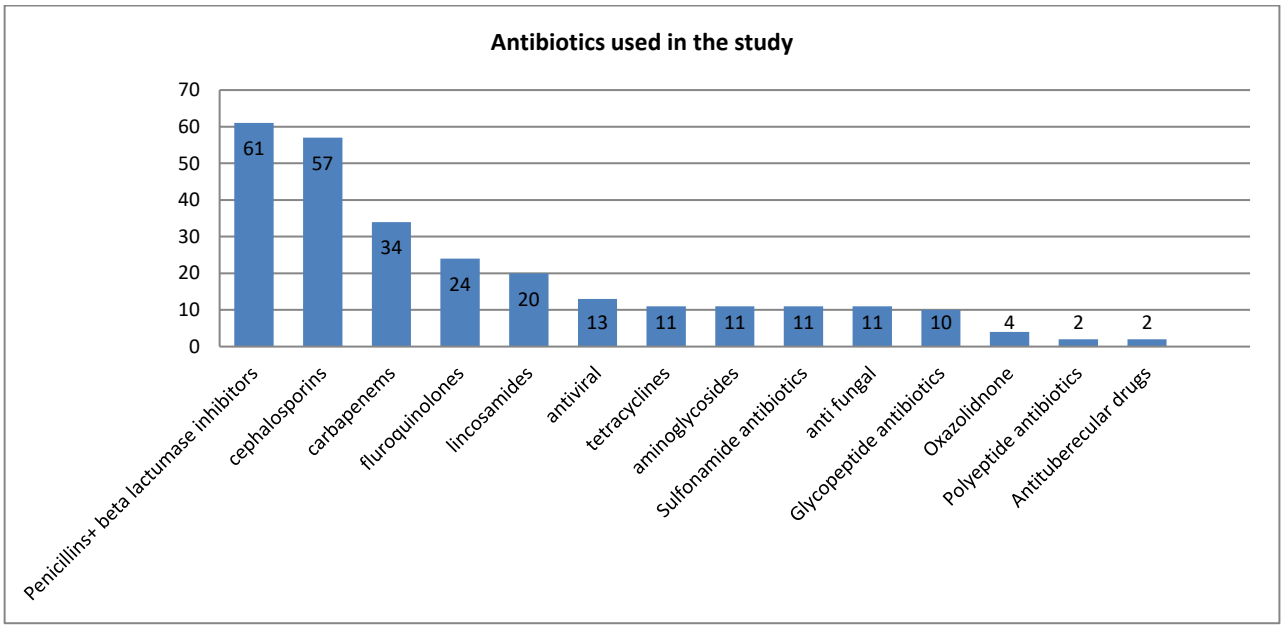

Figure 2: Analysis of antibiotics use in the study

In the following study a total of 279 antibiotics of 16 different classes were given to 130 patients. Antibiotic were given empirically i.e Penicillins 61 (n=20.46%) & Cephalosporin 57 (n=20.4%) as they have broad spectrum of activity[35].

Multiple Antibiotic Therapies

Patient Distribution based on type of Drug Regimen

Table 2: showing various drug regimens

S. No	Drug Regimen	No. Of patients (n=100)	% of patients
1.	One or two antibiotics	72	55.40%
2.	Two or three antibiotics	30	23.07%
3.	>3 antibiotics	28	21.53%

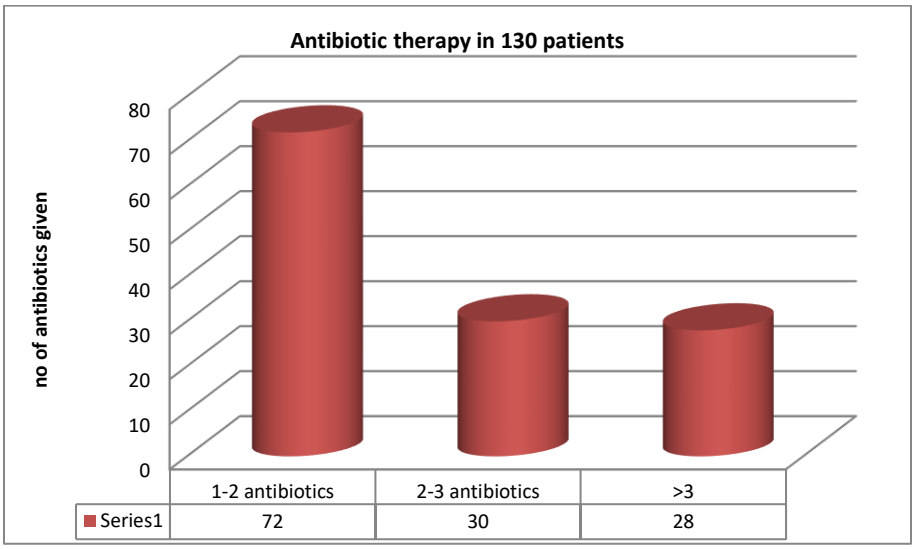

Figure 3: showing various drug regimens in total study

Antibiotic therapy was categorized into 3 groups. Depending on the patient disease severity out of 130 patients 28 patients were given with <3 antibiotics per day which means 112 antibiotics i.e n=21.53% which are combinational, narrow spectrum, antiviral and antifungal.

CST Analysis

Table 3: showing CST analysis

VARIABLES	RESULTS
Total no. of cases	130
No. of samples were sent for CST's	48
No of Blood Cultures	20
No of Pleural fluid Cultures	04
No of Pus cultures	05
No of Sputum/End tracheal cultures	29
No of urine cultures	21
No of CST shown sterile	26
Total no of cultures in 48 patients	105
Total no of organisms isolated	33
% of cultures in total sample	36.92%

Types of Microorganisms Isolated

Table 4: showing various microorganisms result

Type of organism isolated	No of organisms isolated
Gram positive bacteria	09
Gram negative bacteria	18
Fungal species	06
Total no of organism isolated	33

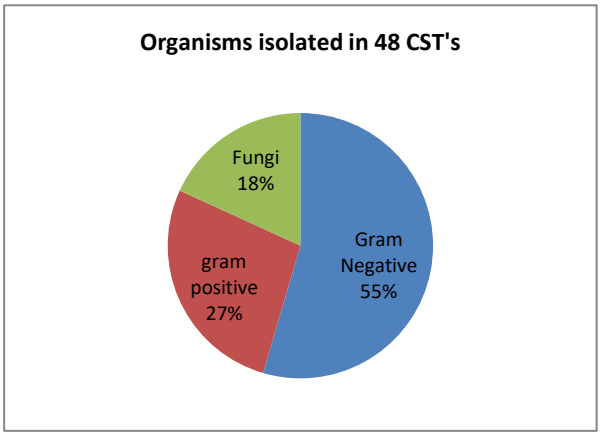

Figure 4: showing various microorganisms result

Total 33 microorganisms were isolated in the study. Gram positive bacteria 9 i.e (n=27%), gram negative bacteria 18 (n= 55%) and fungi 6 (n= 18%).

Frequency of Prescription of Narrow Spectrum of Antibiotics

Table 5: showing narrow spectrum of antibiotics

Name of the Drug	Frequency
VANCOMYCIN	10
COLISTIN	01
LINEZOLID	04
TIGECYCLINE	00
TEICOPLANIN	01

Potentially nephrotoxic drugs

Table 7: showing potentially nephron toxic drugs

Name of the drug	Frequency of drugs
Vancomycin	10
Amino glycosides	15
Colistin	01

Nephrotoxicity is common condition in ICU patients as they are given with MDT and there are few drugs that may lead to Nephrotoxicity. In our study we identified few drugs that are nephrotoxic. VANCOMYCINS, COLISTIN & AMINOGLYCOSIDES are the antibiotics that are given in 26 patients[45].

VAP: Administration of Antibiotic Therapy in Patients on Ventillator

Table 8: showing ventilator analysis

Clinical Scenario	Frequency (n)
No of patients on ventilator	24
No of organisms isolated	21
Total no of cultures in Ventilator patients	32
Gram positive bacteria	05
Gram negative bacteria	12
Fungi	01
Sterile	08
No of antibiotics used	58
Mortality rate	08

In 130 patients only 24 (n=18.46%) patients were kept on ventilator due to their respiratory severity. In 24 patients 32 CST were done and 21(n=87.5%) patients shown positive for CST and treated accordingly. 58 antibiotics of 17 varieties were used in 24 patients.

De-escalation of antibiotic therapy

Table 9: showing de-escalation of therapy

Variables	Frequency
Total no of cases	130
No of cases sent for CST	48
Change in therapy after CST	31
No change in therapy	17

In 130 patients 48 patients were sent to CST and out of them 31 patients (n=65%) were De-escalated.

Drug Duplications

In 130 patients 25 patients (n=19.23%) therapy had shown drug duplications of 9 different categories of drugs. Among these duplications Anti-platelets 9 (n=36%) were given as recommended due to high LDL level patients. Corticosteroids 9 (n=36%) were given as INH due to severe ARDS. Beta-blockers, nitrates, Alfa-1- Beta -1 adrenergic receptors, Beta- Adrenergic Receptor Agonists, PENICILLINS, NSAID's & PPI's were given according to patient requirements.

Table 10: showing list of drug duplications

S. No	Class of Drug	Generic name	No of Patients
1.	Anti-platelet agents	CLOPIDOGREL ASPIRIN TICAGRELOR TIROFIBAN	09
2.	Corticosteroids	HYDROCORTISONE BUDESONIDE	09
3.	Beta- blockers	CARVEDILOL LABETELOL	01
4.	Nitrates	ISOSORBIDE DI-NITRATE NITROGLYCERINE	01
5.	Beta- Adrenergic Receptor Agonists	LEVOLIN DUOLINQ	01
6.	Alfa-1- Beta -1 Adrenergic receptors	ADRENALINE DOPAMINE	01
7.	Penicillins	P+T Amoxicillin+clavunate	01
8.	NSAID's	NAPROXEN DICLOFENAC	01
9.	PPI's	RABEPRAZOLE PANTOPRAZOLE	01
	Total	21	25

Association of Various Clinical Outcomes with Appropriateness of Antibiotic Therapy in 130 Patients

Table 11: showing clinical outcomes of different parameters

Variables	No of Patients	No of Variables
Major drug-drug interactions	58	114
Ventilator	24	21
Drug duplications	25	09
>3 antibiotics in a single day	28	112
No of cases sent for CST's	130	48
De-escalation	48	31
ADR's	130	00
Mortality rate	130	08

In this complete study various clinical outcomes are monitored and identified. These variables include major drug-drug interactions (n=44.61%), VAP (n=18.46%), drug duplications (n=19.2%), >3 antibiotics for a individual patient (n=21.5%), de-escalation of antibiotics (64.58%), ADR (n=0.0%) and mortality rate (n=6.15%).

Rational Use of Antibiotics

Table 12: showing % of rationality in the study

Rationality	% Frequency (n)
Indication	71.54%
Dose	100%
Duration	82.30%
Frequency	100%

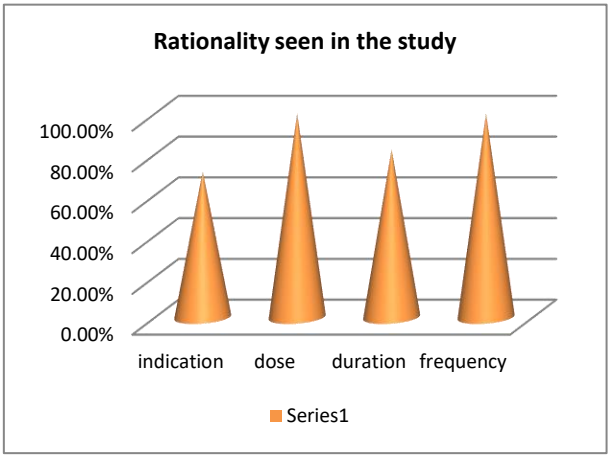

Figure 5: indication of rationality

Rational use of antibiotics is identified by considering the INDICATION n=71.54%, DOSE n=100%, DURATION n=82.30% & FREQUENCY n=100% [33].

CONCLUSION

In recent years, the studies on rational use of drug have become a potential tool to be used in the evaluation of health care systems. Prospective studies on rational use of antibiotics used to analyze the different aspects of the use of drugs and to implement ways of improving therapeutic quality.

This study accounts for the conclusion that is similar to some studies conducted on rational use of antibiotics in the context of patients sensitized to the importance of antibiotic overuse and resistance.

During the study period, we obtained data from 130 (n) individuals who were admitted into ICU with different diseases. On the basis of gender 74 (n=57%) of male and 46 (n=43%) of female patients were taken into the study where male patients have more chance for antibiotic overuse and resistance. (Table no: 1 and fig no: 1.)

A total of 279 antibiotics were given to 130 patients. Total 16 types of antibiotics were prescribed and among them Penicillins with B- Lactams combination i.e Piperacillin + tazobactum-61 (n=20.46%) and cephalosporin's 57(n= 20.4%) were given as first line of therapy as they have broad spectrum of antimicrobial activity. Whereas polypeptide antibiotics like COLISTIN & BACITRACIN was used least i.e 2 (n=0.71%) in the total study. (Table no: 2 & fig no: 2).

In 28 patients 112 antibiotics were given which indicates the increased resistance of microorganisms and decreased antibiotic sensitivity. (Table no: 4 & fig no: 4).

In the total study only 48 patients were undergone culture sensitivity tests among 130 patients i.e 36.92% of total sample. A large number of gram negative bacteria (Klebsiella species) gram positive bacteria (staphylococcus Aureus) and fungi (Candida species) were isolated which indicates its resistance to the antibiotics. (table no: 5,6,7,8,9 and fig no: 5,6,7,8,9).

There is no evidence of significant ADR which indicates the therapy and follow-up were done according to the STG-ICMR and it was appropriate. Among 48 CST cases only 15 NSA were used. (Table no: 11 & fig 11).

Nephrotoxic drugs are given in 32 patients in whom 18 patients were renally compromised and according to their severity these drugs are administered. (Table no: 12 & fig no: 12).

In 130 patients 24 patients (n=18.46%) were kept on ventilator. Mortality rate 8 (n=33.33%) was seen in patients on ventilator. (Table no: 13, 14 and fig no: 13).

In 48 CST cases only 31 cases (n= 65%) were de-escalated in their treatment and treated according to their bacterial sensitivity. (Table no: 15 & fig no: 14).

In 130 patients 25 (n=19%) patients had shown drug-duplications which are given on patient requirements. Monitoring includes LFT, KFT, CBC, albumin levels, RBS, FBS. (Table no: 16 & fig no: 15).

Mortality rate 8 (6.15%) was seen in 130 patients and all of them were on ventilator and major reason for their death was sepsis.

In 48 CST cases 31 cases were treated according to CST report which was matched to STG-ICMR i.e 64.58% rationality is seen

In 76.92% rational use of antibiotics was seen in ICU patients. (Table no: 19 & fig no: 18).

Antibiotics are an essential tool of medical use in common medical procedures, such as transplantation and chemotherapy. However, over the years, bacteria have acquired resistance to antibiotics.

Resistant bacteria can be transmitted from animals to humans through the food chain or by direct contact. Many bacterial infections are becoming resistant to the treatments most commonly prescribed antibiotics.

The resistance of pathogenic microorganisms to antibiotics not only a problem for the patient, but also for the environment as the members of the household are populated by the same pathogen and are more likely to become ill due to this.

This study indicates a vital need for the implementation of CST before treating the infections.

This study will provide a proper understanding usage pattern of antibiotics, quality and efficiency in use of antibiotics and their outcomes.

This type of study will help the physician to have better insight about prescription patterns.

The extent to which the selected antibiotic treatment had shown its effect in order to reduce the severity in ICU patients depending on the conditions.

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