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CONSUMPTION OF HIGH-END ANTIBIOTICS IN AN INTENSIVE CARE UNIT OF A TERTIARY CARE HOSPITAL: A RETROSPECTIVE COMPARATIVE STUDY

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ABSTRACT

Background: High utilization and inappropriate usage of antimicrobial agents (AMAs) in an Intensive Care Unit increases resistant-organisms, morbidity, mortality and treatment cost. Evaluating drug utilization plays a key role in managing health care system to understand, interpret, evaluate and improve the prescribing, administration and use of medication. The Parameter: Defined Daily Dose/100 beds, as proposed by WHO, provides an estimate of consumption of drugs within the hospital in-patients. **Methodology:** A retrospective comparative study was conducted in the Medical ICU of a tertiary care hospital every 6-months for 1.5 years (January 1 2017 to June 30 2018). The demographic data, disease data and utilization of different classes of High-End AMAs were recorded. Data were sorted in Microsoft Excel using Restricted Antibiotic Form. By using WHO-AMC tool. **Results:** 3121 patients were admitted for the entire study period, in which 1682 patients received at least one high end AMAs. During consecutive 6-months 722, 833 & 745 high-end prescriptions were obtained respectively. Piperacillin-Tazobactum was the most commonly prescribed antibiotic, followed by Meropenem, Linezolid and Vancomycin. The DDD/100 bed days for restricted antibiotics in consecutive 6 months was found to be 30.854, 35.047, and 31.821 respectively. **Conclusion:** High utilization of AMAs was observed, which was then compared between each 6-months as well as other published data. The programmed implementation of Antibiotic Stewardship strategies helped to reduce the increasing antimicrobial usage and inappropriate prescription of High-end antibiotics within the ICU-settings.

KEYWORDS: Antimicrobial Consumption, Defined Daily Dose, Retrospective, Restricted Antibiotic, Stewardship.

INTRODUCTION

Antimicrobial medications are considered as the greatest discovery of the twentieth century. The emergence of antibiotic resistant bacteria is a major problem throughout the world and a rational use of antibiotics is therefore very important.[1] Drug utilization research facilitates the rational use of drugs and suggests a way to improve prescribing habits. Use of antibacterial in non-bacterial infections, result in the devastation of susceptible bacteria and careful production of resistant strain bacteria, accordingly aiding the broadcasting of bacterial drug resistance.[2] Antibiotics are the most imperative weapons in our hands which should be used safeguarded for the future generations to use for that it is important to initiate antibiotic stewardship programs which include a team effort to minimize the antibiotic use the impact of antibiotic stewardship should be monitored Periodically Hence, evaluation can be done by making audit of prescribing dispensing indicators and irrational use, so that strategies can be beleaguered in the direction of changing specific problems and the extent of irrational use, so that amount of the problem is known, which can be monitor further.

There are numerous well-distinguished methods to determine the degree of irrational use, comprehensive medicine (drug) consumption data can be used to spot out expensive medicines of lower efficacy, Anatomical Therapeutic Classification system (ATC)/Defined Daily Dose (DDD) to measure up the drug consumption among institutions or regions and lastly WHO drug use indicators such as prescribing indicators, patient care indicators, facility indicators, complementary drug use indicators. Hence, our study was designed to analyze the prescribing pattern and appropriateness use of antibiotics in a secondary care referral hospital of India[2]. The main objective of the study is to evaluate the antibiotic stewardship strategies which are used to minimize the antibiotic use. Drug utilization evaluation is conducted in terms of Utilization of AMAs in ICU presented as DDD/100bed days (WHO/DDD).

Formula for calculating DDD per 100 bed days

Is=DDD/100 bed days

$$\frac{\text{Number of unitsadministered in a given period (mg)}}{\text{DDD (mg)} \times \text{number of days in the period} \times \text{number of beds} \times \text{occupancy index}} \times 100$$

- Number of beds in ICU = 20
- Occupancy index for that period in our ICU was

0.60,0.62,0.65 respectively.

MATERIALS AND METHODOLOGY

A Retrospective observational comparative study was conducted in the Medical ICU of a tertiary care hospital every 6-months for a period of 1 ½ years (January 2017- June 2018).

SAMPLE SIZE : Patients admitted in consecutive 6-months for 1 ½ years

SAMPLE SITE : Medical Intensive Care Unit

STUDY TOOLS : Restricted Antibiotic Indent Form

WHO-AMC(Anti-microbial Consumption)Tool

INCLUSION CRITERIA

- Patients admitted to the Medical ICU
- Patients prescribed with atleast 1 injectable restricted antibiotic

EXCLUSION CRITERIA

- Patients who were transferred to other speciality ICUs or wards within 24 hrs of admission were excluded from the study.
- Paediatric Population.

DATA COLLECTION

Data were collected from patient's restricted antibiotic forms. The following parameters were recorded

- Patients demographic details
- Distribution of pattern of Illness based on the diagnosis
- Associated Co-morbidities
- Prescription frequency of Individual Restricted Antibiotics
- Utilization of Restricted antibiotics in ICU presented a DDD/ 100 bed-days using WHO-AMC Tool 2015 version 1.5.0

RESULT

3121 patients were admitted for the entire study period, in which 1682 patients received at least one high end AMAs. During consecutive 6-months 722, 833 & 745 high-end prescriptions were obtained respectively. Of the total, 2008 (64.33%) were males and 1113(35.66%) were females and 2212(70.8%) patients were above 60 years of age and 909 (29.1%) patients were below 60 years of age. patients were in icu for an average of 3.32 days

. 2155 (69.04%) of the total MICU admitted patients were having comorbidities. Piperacillin-Tazobactum was the most commonly prescribed antibiotic, followed by Meropenem, Linezolid and Vancomycin. The occupancy index of 1.5 years for each 6 months was 0.60, 0.62, 0.65 respectively. The DDD/100 bed days for restricted antibiotics in consecutive 6 months was found to be 44.669, 48.625, and 41.621 respectively. Implementation of Antibiotic Stewardship Strategies like antibiotic restriction and antibiotic awareness campaigns reduced the overall AMAs consumption during the last 6-months of the study.

Table 1: Distribution of patients according to gender.

Gender	Patients
Male	2008 (64.33%)
Female	1113(35.66%)

Table 2: Distribution of patients according to age.

Age	Patients
≥60	2212 (70.8%)
<60	909 (29%)

Table 3: Number of patients admitted in medical icu for each 6 months.

duration	Number of patients
2017 januvary 1 –2017 june 30 (181 days)	935
2017 july 1 –2017 december 31 (184 days)	1092
2018 januvary1 –2018 june30	1094

Table 4: Number of patients received at least one restricted antibiotics in medical icu for each 6 months.

duration	Number of patients
2017 januvary 1 –2017 june 30 (181 days)	527
2017 july 1 –2017 december 31 (184 days)	613
2018 januvary1 –2018 june30	542

Table 5: List of Restricted Antibiotics With Atc and Who Ddd.

Antibiotic name	ATC	DDD
meropenem	J01DH02	2g
colistin	J01XB01	3mu
Doripenem	J01DH04	1.5g
Imipenenm	J01DH51	2g
tigecycline	J0IAA12	0.1g
Aztreonam	J01DF01	4g
Teicoplanin	J01XA02	0.4g
linezolid	J01XX08	1.2g
Piptaz	J01CR05	14g

ertapenem	J01DH02	1g
vancomycin	J01XA01	2g

Table 6: Number of Units of Restricted Antibiotics In Medical Icu.

Drug	2017 Januvary 1 – June 30	2017 July 1 – December 31	2018 Januvary1 – June30
meropenem	455	509	455
colistin	28	39	30
Doripenem	02	10	14
Imipenenm	63	106	96
tigecycline	26	28	22
Aztreonam	12	17	15
Teicoplanin	03	09	07
linezolid	208	288	264
Piptaz	1536	1564	1452
ertapenem	2	4	5
vancomycin	110	108	94
	1944	2180	1981

Table 7: Utilization of restricted antimicrobial agent in medical ICU presented as DDD/100 bed days.

Drug	Jan	june	Jan	total
meropenem	10.303	11.526	9.669	31.498
colistin	1.275	1.776	1.282	4.333
Doripenem	0.030	0.152	0.199	0.381
Imipenenm	1.43	2.413	1.346	5.189
tigecycline	1.184	1.275	0.94	3.399
Aztreonam	0.137	0.194	0.160	0.491
Teicoplanin	0.139	0.403	0.34	0.882
linezolid	4.815	6.311	5.641	16.767
Piptaz	22.731	22.033	19.835	64.599
ertapenem	0.093	0.175	0.212	0.48
vancomycin	2.532	2.367	1.997	6.896
Total	44.669	48.625	41.621	134.915

Table 8: List of diseases in ach segments.

Disease	1	2	3	Total
sepsis	152	163	171	486
Respiratory infection	87	92	95	274
Intraabdominal infection	78	96	80	254
Skin and soft tissue infection	27	34	26	87
Febrile neutropenia	21	24	19	64
Urinary tract infection	32	44	20	96
CNS infection	7	11	13	31
Others	39	31	33	103
Total	443	495	457	1395

DISCUSSION

DUE is an inexpensive, flexible and simple method to assess the utilization pattern of drugs. The present study was performed to evaluate and improve the hospital antibiotic use, using the data from the antibiotic prescribing area like medical ICU. The antimicrobial utilization data from medical ICU could be used as a comparative tool to distinguish the usage trend variation in different seasons. For the study we used hospital restricted antibiotic form as data collection tool.

The study was conducted in 3 consecutive 6 months and the utilization of restricted antibiotic is compared. Medical ICU (MICU) is a unit in which acute care for critically ill adult and geriatric patients are given. The demographic parameters of the patients revealed that 28.67 % of male patient is admitted than the female patients. This was nearly same as in the study done in Bangalore in 2006, Mangalore 2016. In the total of patients, 70.8% of patients were more than or equal to 60 years of age. Average length of stay in ICU was 4.2 day which is nearly equal to the study done Mangalore and less than of study done in North India and South India. The difference may be due to the epidemiological and illness pattern difference among population.

A total of 11 injectable antibiotics were listed in restricted antibiotics list which is monitored for consecutive 6 months. The drug utilization data revealed that more than 54% of the total 3121 patients were treated with at least one group of restricted antibiotics. Major Indication for restricted antibiotic usage was sepsis followed by respiratory tract infection and intraabdominal infections. 61.9% of the total admitted patients were having co morbidities. Among them major encountered co morbidities were hypertension and diabetes mellitus.

Utilization of antibiotics in DDD/100 days is the assumed average maintenance dose per day for a drug use for its main indication.[1] Studies based on ATC DDD are superior for comparing the use of drugs between hospitals or regional levels.[2] In our study, we analyzed restricted antibiotic use in DDD/100 bed days. The utilization of restricted antibiotic in MICU is 44.669 DDD/100 bed days, 48.625 DDD/100 bed days, 41.621 DDD/100 bed days in 3 consecutive 6 months of our study period. Our result of first 6 months is nearly equal to the study done in Bangalore[3], New Delhi[4] while DDD obtained during second 6 months was slightly higher. In the study, calculated DDD/100 bed days were higher than study done in Pokhara. Highly utilized restricted antibiotic in our study was piperacillin/tazobactam followed by meropenem, linezolid, vancomycin where as in a study done in Bangalore,

Andhra Pradesh[5], Gujarat[6] which showed piperacillin /tazobactum, linezolid followed by meropenem.[2]

In our study, the utilization of restricted antibiotic in MICU is 44.669 DDD/100 bed days, 48.625 DDD/100 bed days in first 2 consecutive 6 months. There was a significant increase in restricted antibiotic utilization in second half of 2017 which was an alarming indicator. The reason for this increase is due to isolation of resistant organisms in culture reports. Studies from Europe and significant increase in antibiotic utilization from 162.9 to 101.2 DDD/100 patient days after introducing antibiotic stewardship strategies and antibiotic policy.[7] This observation highlights the importance of antibiotic policy and also points out the need for regular scrutiny of antibiotic surveillance. To minimize the drug utilization we have implemented up-to-date hospital antibiogram, antibiotic resistance campaign such as continuous quality improvement classes on optimization of antibiotic use and strict restricted antibiotic surveillance with feedback. Other than these strategies antibiotic rotation, de-escalation protocol, serum drug concentration were evaluated in Washington University of medicine, USA.[8,9] area specific antibiotic therapy protocol were implemented in study conducted in spain.[10,11]

During the last 6 months of the study, utilization of antibiotics was reduced (41.621 DDD/100 bed days) even though there were drug resistant organisms in culture reports which could be due to the patient specific and symptomatic treatment other than considering only on culture reports. Comparing the drug utilization in 3 consecutive 6 months, highly prescribed antibiotics were piperacillin/tazobactam and lowest prescribed was doripenem. There was a slight increase in utilization of ertapenem and doripenem in the last 6 months whereas utilization of other drugs reduced.

CONCLUSION

The aim of the study is to evaluate the impact of the antibiotic stewardship program which is conducted to minimize the antibiotic therapy. the result of the study showed that the implementation of antibiotic stewardship have significance role in reduction antibiotic use there by in reduction of antibiotic resistance.

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