Research Article

Prescribing Patterns of Antimicrobial Agents in Intensive Care Unit at Tertiary Care Teaching Hospital in Bhairahawa, Nepal

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ABSTRACT

Antibiotics tend to be usually used in critically ill patients and comprise a large proportion of the total medications taken in the Intensive Care Unit (ICU). This prospective observational work was carried out to determine the prescription trend of antimicrobial agents in the ICU of a Universal College of Medical Sciences (UCMS), a tertiary care teaching hospital, Bhairahawa, Nepal and to propose possible changes in the prescription of drugs to achieve appropriate clinical activities. A prospective, observational research was performed in UCMS' Intensive Care Unit over two months from September to November 2016. The study contained 100 consecutive inpatient reports of ICU-admitted patients and analyzed data using statistical tools SPSS (Ver 16.0, IBM SPSS, Inc., NY, USA). Result showed 56 (56%) of 100 patients were female and 44 (44%) were male where the mean age was found to be 50.8 ±19.91 years. The average stay-length was 3.02±1.41 days. Sepsis, Clinical Malaria, Pneumonia, COPD, MODS, AKI were the six most common causes of admission at ICU. The overall number of patients moved was 35%, the mortality rate was 33% and rests were on LAMA. A total of 270 Anti-microbial Agents (AMA's) were administered in 100 patients. The total antibiotic count prescribed for each patient was 2.7. At 28.88 per cent, metronidazole was the most frequently used AMA. Antibiotics are typically administered at the admission of most ICU patients and add greatly to the overall cost of the treatment. Antibiotic resistance is increasing at an alarming rate leading to increased morbidity, mortality and treatment cost thus antibiotic restriction policies and a multidisciplinary initiative are urgently required to minimize usage.

Keywords: Antimicrobial Agents, Intensive Care Unit, Rational Prescribing, Prescribing Pattern.

INTRODUCTION

Antimicrobials are the most usually endorsed medicines among hospitalized patients, particularly in the ICU department.[1] Patients with basic diseases are at higher danger of mounting nosocomial infection and anti-infection agents are the most impressive and valuable gears to deal with these contaminations. Broad and undiscerning utilization of antimicrobial agents has been recorded in ICUs in past distributed reports.[2, 3] In ICU huge number of medications are installed to patients and the expenses of hospitalization and medication treatment are high.[4] The widespread utilization of wide range anti-microbial prompts obstruction of specific strains of microorganism. In this way improving the prescribing pattern example can control the advancement of resistance.[2, 3] An ICU of a developing nation where health costs are endured by the patients and somewhat by the hospital, it is causing a colossal monetary burden.[5]

At admission, patients admitted to intensive care units (ICUs) are sometimes given several wide-spectrum antibiotics because they become more ill, subjected to numerous intrusive treatments and susceptible to multidrug-resistant infections.[6] Prescription of medications in a sick patient is convoluted. The prudent utilization of prescriptions can be lifesaving. The normal utilization of conventional medication dosage regimens may open ICU patients to tranquillize related issues, for example, treatment dissatisfaction, high risk of adverse drug reactions and drug interaction. Cautious titration and checking of dosage regimens get basic to guarantee the perfect treatment outcome.[7]

About 5000 antimicrobial agents (AMAs) have been found to date, of which only around 100 are currently used to treat an infection.[8] Unfortunately, with the need for new AMA growing over time, the development of novel drugs in recent years has been slow. It seems likely we will have to rely on the currently available class of drugs in the coming decade. Because of the continuing emergence of resistant pathogens, considerable effort will be needed to contain resistance development to uphold the effectiveness of available AMAs.[9]

Critically ill patients who are admitted to ICU have recurrent infection and are more likely to develop new infections.[10] Consequently, the overall intake of AMA in

ICU is around ten times higher than the general hospital wards.[11] As a result, AMAs used in ICU constitute a significant part of the overall consumption and expense of AMA hospitals.[12]

The medically unnecessary, ineffective and economically wasteful use of antimicrobials is widely observed worldwide, particularly in developing countries, in the health care system.[13] The quality of life in developing countries can be improved by enhancing the standards of medical treatment at all levels of the health care delivery system.[14] Developing nations have minimal resources available for healthcare and medications, so it is extremely necessary to rationally prescribe medicines so that the available funds can be optimally used. Studies from different countries have acknowledged irrational drug use in the ICUs and recommended interventions to improve the drug use pattern. Hence, this study is planned with the objectives of finding out the prescribing pattern and rationality of antimicrobial dugs use in ICU department at tertiary care teaching hospital at UCMS, Bhairahawa, Rupandehi District, Nepal.

MATERIALS AND METHODS

A prospective, observational study was carried out in the general ICU of a Tertiary Care Teaching Hospital, UCMS by assessing patient's records and prescription from the Intensive Care unit department.

In the study time, all patients admitted to the general ICU and who gave consent were included as the sample population. Patients who had been moved from general ICU to other specialty ICUs or discharged / death within 24 h of admission were removed from the study.

Data were collected from patient's records. The following parameters were recorded:

- Socio-demographic data of patients
- Frequency of comorbidities at the time of admission in ICU
- Major cases for admission in ICU
- The average length of stay (LOS) in ICU
- Percentage of oral/parenteral route of administration
- Prescription frequency of class of AMAs

The collected data was analyzed and was filled using MS Excel. Descriptive values were presented as mean values and percentages using statistical tools SPSS (Ver 16.0, IBM SPSS, Inc., NY, USA) for Windows.

RESULTS

Out of 100 patients, 56 (56%) were female and 44 (44%) were male. Age of patients ranging from 20 years and 105 years and the mean age was found to be 50.08 ±19.91 years (Table-1). Most of the patients were from Lumbini and Rapti regions of Nepal. The observed length of stay (LOS) was 3.02±1.41 days in our study.

Table 1: Socio-demographic data

Variable	Number of Patients (n=100)	Percentage
Male	44	44
Female	56	56
Age-wise distribution of patients.		
20-30 years	21	21
30-40 years	17	17
40-50 years	16	16
50-60 years	16	16
60-70 years	12	12
70-80 years	12	12
80-90 years	5	5
90-100 years	0	0
>100 years	1	1

The frequency of comorbidities was shown in table 2. The most five common cases of admission in ICU was Sepsis (30 patients) followed by Pneumonia (16 patients), Clinical Malaria (16 patients), COPD (14 patients) and MODS (13 patients) as shown in table 3. Out of admitted patients, 35% of patients were shifted to other departments, 33% patients were expired and 32% of the patients were on LAMA (Leave Against Medical Advice) as shown in table 4.

Table 2: Frequency of comorbidity found in patients.

Patients with a number of comorbidities	Number of patients	Percentage
Single comorbidity	30	30
Two comorbidities	41	41
Three comorbidities	25	25
Four or more comorbidities	4	4

Table 3: Major Cases for Admission in ICU Department.

S.N.	Comorbidity for Admission	Total Number of patients
1.	Sepsis	30
2.	Clinical Malaria	16
3.	Pneumonia	16
4.	Chronic Obstructive Pulmonary Diseases	14
5.	Multiple Organ Dysfunction Syndrome (MODS)	13
6.	Acute Kidney Injury (AKI)	12
7.	Poisoning	10

8.	GI Bleeding	6
9.	Diabetes Mellitus	5
10.	Renal Tubular Acidosis (RTA)	4
11.	Viral Hepatitis	3
12.	Pulmonary Tuberculosis	4
13.	Hypertension	3
14.	Jaundice	3
15.	Others	54

Table 4: Outcome of patients

S.N.	Outcome	Number of patients (n=100)	Percentage
1.	Transferred to other department	35	35
2.	Expired	33	33
3.	LAMA	32	32

A total of 270 AMA were prescribed in 100 patients demonstrating that about 3 AMAs were prescribed per patient. Table-5 shows that in the ICU metronidazole was the most commonly used AMA (28.88%) followed by ceftriaxone (17.77%), levofloxacin 17.03% and least prescribed drug was dapsone (0.36%). In ICU, Nitroimidazole was the most commonly prescribed group of antibiotics by 28.88% followed by cephalosporin 21.11% and whereas, sulphonamide is prescribed in the least (<1%) (Table-6). Percentage of patients receiving several AMA was shown in table-7, where the highest percentage (44%) of patients received 2 AMA and least, only 1% received more than 6 AMA.

Table 5: Prescription frequency of individual antimicrobial agents

Drugs	No of drugs (n=270)	Percentage
Ceftriaxone	48	17.77
Metronidazole	78	28.88
Levofloxacin	46	17.03
Maxifloxacin	2	0.74
Vancomycin	24	8.88
Piperacillin+tazobactum	32	11.85
Ceftriaxone+sulbactum	9	3.33
Doxycycline	13	4.81
Meropenem	17	6.29
Dapsone	1	0.36
Total	270	100

Table 6: Prescription frequency of groups of antimicrobial agents

Group of AMA	No of drugs (n=270)	Percentage
Nitroimidazole	78	28.88
Cephalosporin	57	21.11
Fluoroquinolone	48	17.77
Penicillin	32	11.85
Glycopeptides	24	8.88
Carbepenam	17	6.29
Tetracycline	13	4.81
Sulphonamide	1	0.36
Total	270	100

Table 7: Number of patients receiving AMA in ICU

S.N	No. of AMAs Prescribed	Total Number of patients (n=100)	Percentage
1.	Single AMA	7	7
2.	2 AMAs	44	44
3.	3 AMAs	29	29
4.	4 AMAs	13	13
5.	5 AMAs	6	6
6.	6 AMAs	1	1
Total Patients Receiving AMA		100	100
Total Patients without AMA Prescription, i.e. AMA=0		0	0

The prescription followed both generic and brand names of prescribed drugs, in which most of the drugs are prescribed by brand names which account 95% and 5% by generic name. Both single and fixed-dose combinations are administered in ICU where single-dose accounts for 84.81% and the fixed-dose combination was 15.19%. In ICU the most common route of administration was intravenous which accounts for 94.81% and oral route accounts 5.18%.

DISCUSSION

The present study was a prospective observational analysis in the intensive care unit to check the prescribing patterns of antimicrobial agents. All out 100 prescriptions were examined during the investigation time frames among them 56 were female and 44 were male, the mean age was seen as 50.8 ±19.91 years. Studies are done beforehand in Bengaluru in 2006,[15] Dehradun in 2012[5] and Pokhara, Nepal, in 2002[4] had indicated a comparative mean age of patients of around 50 years with insignificant distinction in the mean age of males and females. Interestingly, an examination is done by Smythe *et al.* (2006) in Detroit

demonstrated an equivalent extent of male and female admitted to the ICU with a mean age of 65 years.[15] These findings suggest that in Nepali settings more females are admitted to the ICU. A maximum of patients has a place with the age group of 20-30 years in our investigation which establishes 21%. Forty-six per cent of patients were over 50 years old (table-1). This finding is similar to the results of studies done in Pokhara, Nepal[4] and Nagpur.[16]

Normal LOS in ICU was 3.02±1.41 days in our investigation whereas, different investigations done in ICUs of North India, South India, and the USA showed the normal LOS in ICU was 5.75, 6.22, and 5.2 days respectively.[5, 17, 18] The distinction found in the mean LOS could be because of the distinction in disease design among the population and because of low financial aspects condition.

Patients with a wide spectrum of clinical conditions were admitted, multiple, and complex diagnosis often observed. Sepsis, Clinical malaria, Pneumonia, COPD, MODS, AKI and poisoning were the most common causes for admission in ICU (figure-7). Debilitating condition of the patients due to underlying disease, invasive diagnostic and therapeutic procedures and prolonged utilization of life support equipment predispose these patients to infections. Nina et al had reported that ICU contributes 20-30% of the nosocomial infection in hospitals.[19]

In respect of comorbidities, seventy per cent of patients had more than one comorbidity, as per table-2. Sepsis was the most commonly found comorbidity followed by clinical malaria, pneumonia and COPD as shown in table-3. Respiratory infections, cerebrovascular injuries, septicemia, cardiovascular disorders and febrile illness were among the most frequently observed medical conditions to be admitted to ICU in a report at Manglore (2016), South India.[9]

A key indicator is the total number (mean) of medications per prescription. This is advised that the number of medications per prescription should be kept small for reducing the risk of medication interactions. This would also reduce healthcare costs and improve bacterial resistance.[20] A total of 270 AMA were prescribed in 100 patients. The average number of antibiotic prescribed per patients was 2.7. Other studies support our finding with an average of 2.09 AMA per patient prescription.[21]

The most common AMA prescribed was metronidazole 28.88%. In the studies similar to Biswal S *et al.* reported that metronidazole was the most widely prescribed AMA, preceded in their studies by cefotaxime, amoxicillin / clavulanic acid, cefepime, and ciprofloxacin[18] but in contrast with similar study done by Anand *et al*. cephalosporins are commonly prescribed due to their relatively lower toxicity and broader spectrum activity.[9] Another study done on India revealed that piperacillin/tazobactam or cefoperazone/sulbactam were the most frequently prescribed antibiotics at admission.[22] Whereas in a Brazilian study it was found that cephalosporins, aminoglycosides and fluoroquinolones are

most widely administered in ICU.[23] The most frequently prescribed groups in UCMS hospital was nitroimidazole, cephalosporins, penicillin, fluoroquinolone glycopeptides. The rationale behind prescribing metronidazole is that it covers the anaerobic infection[24] which is quite common in hospital-acquired infections. The combinations of antimicrobials (ceftriaxone+ metronidazole, and piperacillin/ tazobactum+ metronidazole) used in our study was rationale as it covered gram-positive, gram-negative, aerobic and anaerobic organisms.

In our study, prescribing of newer antimicrobial drugs was noticed such as meropenem (carbapenems) 6.29%, levofloxacin (quinolones)-17.03%, and vancomycin (glycopeptides)-8.88%. Similarly, the utilization of newer AMAs was reported in the Bengaluru study.[17] Similarly in Manglore, South India (2016) study, newer AMAs were utilized fairly which include linezolid (oxazolidinones), clindamycin (lincosamides), meropenem and imipenem (carbapenems), doxycycline (tetracycline), levofloxacin (quinolones), and vancomycin (glycopeptides).[9]

In our study, 94.81% of prescribed AMAs were given parenterally and 5.18% by orally. Parenteral route of administration is preferred over oral because of better drug monitoring, quicker onset of action and better bioavailability.[9] In our study improvement was seen in 35% so they are transferred to the general ward, mortality was 33% which is similar to the study done by Smythe *et al.* [15], and 32% were discharged without medical advice. It was noticed that most of the antimicrobial agents were prescribed by the brand name which requires the revision of current prescribing practice which is helpful to decrease the cost of patients.

CONCLUSION

Based on the results, we conclude the number of drugs prescribed by generic names was low in the ICU and effort must be made to encourage prescribing by generic names. AMA prescriptions were reasonable about their period of administration, route, and indication, but were not accompanied by evidence of culture and sensitivity. The analysis offers a basis for the ongoing audit of AMA's prescribing behaviour in the ICU. Antibiotic resistance is increasing at an alarming rate leading to increased morbidity, mortality and treatment cost thus the high consumption rates and antibiotic costs administered at ICU entry are being of significant concern and need to be tackled immediately by the use of recommendations, procedures, training programs, monitoring and antibiotic control policies at all levels of health care. The appropriate use of antimicrobial agents in ICU should be promoted by adopting strict protocols and regulations on antibiotics in hospitals.

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