

Original Article**Evaluation of Drug Use Patterns in Intensive Care Unit of Tertiary Care Hospital: A Descriptive Cross-Sectional Study**Rinku Ghimire*¹, Rupesh Kumar Shreewastav²¹Department of Pharmacology, Nobel Medical College Teaching Hospital, Biratnagar, Nepal²Department of Biochemistry, Nobel Medical College Teaching Hospital, Biratnagar, NepalArticle Received: 8th April, 2021; Accepted: 15th June, 2021; Published: 30th June, 2021DOI: <http://dx.doi.org/10.3126/jonmc.v10i1.37943>**Abstract****Background**

Prescription of rational drugs is needed to save critically ill patients. This study was conducted to assess the prescription patterns of drugs in the intensive care unit.

Materials and Methods

A descriptive cross-sectional study among patients admitted in intensive care unit from March 2020 to February 2021 after approval from the Institutional Review Committee (ref no. 344 /2019). Demographic profile, prescription patterns, the average number of drugs used, route of administration, and duration of hospitalization were recorded based on the pre-structured questionnaires. Convenient sampling was chosen. Data were analyzed by SPSS, version 20.


Results

Prescription patterns of 225 were analyzed. The mean age was 55.60 ± 20.16 years with a male predominance of 131(58.2%). Cardiac disorders 57(25.3%) were the most common admitting diagnosis followed by pulmonary, neurological, and kidney disorders. The average length of hospital stay was 4.14 days (range 1-38 days). A total of 887 drugs were prescribed. The mean number of drugs prescribed per patient was 7.71 ± 1.92 . Parenteral drugs accounted for 81.39%. Antibiotics were prescribed to all patients. Intravenous fluids were given to 62.2% of patients, blood and blood products to 21.33%. Thromboprophylaxis was used in 15 (6.7%) patients. Seven hundred twenty-two (81.39%) drugs were injectables, 129(14.54%) were used by the oral or nasogastric route and 36 (4.05%) were inhaled drugs.

Conclusion

Newer generations antibiotics were the most commonly prescribed drugs. Pantoprazole, Metoclopramide, and Hydrocortisone were the top three most commonly prescribed individual drugs. There was marked underuse of thromboprophylaxis, analgesics, and sedatives.

Keywords: Drug utilization, Intensive care unit, Prescriptions

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Introduction

Chronic illnesses and life-threatening disorders are common among patients admitted to the intensive care unit (ICU). They are more likely to receive multiple drugs of different classes which may result in altered pathophysiology, drug interactions, and multi-organ failure with subsequent increased morbidity and mortality [1]. ICU utilizes higher economic resources due to the frequent use of various costly drugs and antibiotics. Moreover, ICU is considered as the important site for antibiotics resistance and it is an important factor influencing patient management and outcomes. Administration of rational drugs is needed to save critically ill patients. Periodic monitoring of drug utilization patterns in the ICU setting is necessary for the optimization of health care delivery, proper use of available resources and formulating institutional prescription policy [2].

Drug utilization has been defined by the World Health Organization (WHO) as the marketing, distribution, prescription, and use of drugs in a society with special emphasis on the resulting medical, economic and social consequences [3]. So, periodic assessments of drug prescribing patterns are the essential tools to measure the appropriate use of drugs in the health care delivery system.

The Nobel Medical College Teaching Hospital is a 990 bedded hospital in the eastern part of Nepal. The hospital has a 32 bedded medical ICU where critically ill patients from different medical specialties are admitted with limited resources. Drugs should be prescribed rationally to limit the cost of treatment and optimal use of available funds in our resource-limited settings. This study was conducted to find out the prescribing pattern of drugs in the medical ICU of tertiary care hospitals in Nepal.

Materials and Methods

This was a descriptive cross-sectional study on patients admitted to the medical ICU of Nobel Medical College Teaching Hospital from March 2020 to February 2021. A total of 225 patients of different medical sub-specialties with ages more than 12 years were enrolled based on the convenient sampling method. Patients of pediatric age groups and those admitted with surgical indications were excluded. The age and gender distribution, diagnosis, duration of hospitalization in the ICU were recorded. The number and class of drugs prescribed, route of administration were

noted. The main objectives of this study were to describe the demographic profile of patients and main illnesses requiring ICU admission, to describe the prescription patterns and different routes of administration of drugs, calculate an average number of drugs. Ethical approval was sought from the institutional review committee of Nobel Medical College (NMCTH ref. no. 344/2019) before starting the study. Convenient sampling was done. The sample size was calculated to be 138. However, a total of 225 patients were enrolled. The sample size (n) was calculated as follows, $n = Z^2 \times p \times q / e^2 = (1.96)^2 \times 0.1 \times 0.9 / (0.05)^2 = 138$, Where, $Z = 1.96$ for 95% confidence interval $p =$ Average number of patients admitted in ICU per day = 10 (Educated guess) $q = 1 - p$, $e =$ margin of error = 5%.

Data were entered in Microsoft excel 2007 and analyzed by IBM Statistical Package for the Social Sciences (SPSS) data editor, version 20. Continuous and categorical variables were presented as a mean, percentage, and standard deviation. The tabular presentation was made for different variables.

Results

The demographic profile and prescription patterns of 225 were analyzed. The mean age was 55.60 ± 20.16 years. One hundred and thirty-

Table 1: Baseline characteristics of patients admitted in ICU

Characteristics	Frequency n (%)
Age (in years): <20	10 (4.4)
21-40	45 (20)
41-60	62 (27.6)
61-80	93 (41.3)
> 80	15 (6.7)
Gender: Male	131 (58.2)
Female	94 (41.8)
Diabetes Mellitus	33 (14.7)
Hypertension	35 (15.6)
Smoker	60 (26.6)
Alcohol use	30 (13.6)
Length of ICU stay: <3 days	77 (34.2)
3-7 days	132 (58.7)
8-14 days	7 (3.1)
>14 days	9 (4)
Diagnosis by system involvement	
Cardiac disorders	57 (25.3)
Pulmonary disorders	39 (17.3)
Neurological disorders	31 (13.8)
Hepatic disorders	31 (13.8)
Poisoning	19 (8.4)
GI disorders	17 (7.6)
Kidney disorders	14 (6.2)
Endocrine disorders	9 (4.0)
Sepsis/infective etiology	7 (3.1)
Hematological disorders	1 (0.4)



one patients (58.2%) were male. The age group 61-80 years accounted for the highest number 93 (41.3%) of patients. The baseline characteristics of patients admitted to ICU are shown below (Table 1). Hypertension was present in 35 (15.6%) and diabetes in 33 (14.7%). Sixty (26.6 %) patients were a smoker and 30 (13.6%) had a history of significant alcohol consumption. Cardiac disorders 57 (25.3%) were the most common admitting diagnosis followed by pulmonary, neurological, hepatic, gastrointestinal, kidney disorders, and poisoning. The average length of ICU stay was 4.14 days (range 1-38 days).

A total of 887 drugs were prescribed to 225 patients during the study period. The mean \pm SD number of drugs prescribed was 7.71 ± 1.92 . Parenteral drugs accounted for 81.39 % of the total drugs prescribed. Antibiotics were prescribed to all patients. Intravenous fluids were given to 62.2% of patients, blood and blood products were given to 21.33%. Prescribing indicators of drugs are shown below (Table 2). Commonly prescribed antibiotics were Meropenem 38 (16.9%), Cefepime 31(13.8%), Doxycycline 27 (12%), and Cefotaxime 24 (10.7%) as illustrated below (table 3). Table 4 and 5 shows commonly prescribed injectable, oral and inhaled drugs. Among a total of 887 drugs prescribed, 722 (81.39%) drugs were injectables, 129(14.54%) were oral or administered through a nasogastric tube and 36 (4.05%) were inhaled drugs administered through nebulizer or rotahaler. The majority of the drugs (83.54%) were prescribed by brand name.

Antibiotics, diuretics (Furosemide and Mannitol), proton pump inhibitors (Pantoprazole), antiemetics (Metoclopramide), corticosteroids (Hydrocortisone), were the commonly prescribed drugs for parenteral administration and all these drugs were administered by intravenous route. Antihypertensives (Amlodipine, Losartan), hypolipidemic drugs (statins), antiplatelets (aspirin, clopidogrel), laxative (Lactulose), cough syrup (Bromhexine and Terbutaline), were the commonly prescribed oral drugs. Among the combo drugs, antibiotics (a combination of Piperacillin + Tazobactam, Cefipime + Sulbactam, Amoxicillin + Clavulanic acid), antihypertensive (Amlodipine + Losartan), bronchodilators (syrup Terbutaline + Bromhexine, inhaled Salbutamol and Ipratropium, Salmeterol + Fluticasone) were commonly prescribed drugs.

Table 2: Prescribing indicators of drugs in the intensive care unit

Indicators	Frequency
Average no. of drugs per patient	7.71 \pm 1.921
Prescription of antibiotics	100%
Prescription by generic name	16.45 %
Prescription by brand name	83.54 %
Oral or nasogastric administration	14.54 %
Parenteral drugs	81.39 %
Intravenous fluids	62.2 %
Blood and blood products	21.33%
Inhaled drugs	4.05 %

Table 3: Commonly prescribed antibiotics in the ICU.

Name	Frequency n (%)
Meropenem	38 (16.9)
Cefepime	31 (13.8)
Doxycycline	27 (12)
Cefotaxime	24 (10.7)
Piperacillin + Tazobactam	21 (9.3)
Vancomycin	20 (8.9)
Amikacin	19 (8.4)
Ceftriaxone	16 (7.1)
Metronidazole	16 (7.1)
Ceftazidime	9 (4)
Cefipime + Sulbactam	8 (3.6)
Amoxicillin + Clavulanic acid	4 (1.8)
Levofloxacin	4 (1.8)
Clindamycin	3 (1.3)

Table 4: Commonly prescribed oral and inhaled drugs in the ICU.

Class of drug	Route of administration	Frequency (%)
Diuretics		
Spironolactone	(Oral)	16 (7.1)
Hydrochlorothiazide	(Oral)	4 (1.8)
Antithrombotics		
Aspirin	(Oral)	24 (10.7)
Clopidogrel	(Oral)	13 (5.8)
Bronchodilators		
Terbutaline+ Bromhexine	(Inhaled)	21 (9.3)
Salbutamol and Ipratropium	(Inhaled)	11 (4.9)
Formoterol	(Inhaled)	4 (1.8)
Antihypertensive drugs		
Amlodipine (Tablet)	(Oral)	13 (5.8)
Amlodipine + Losartan	(Oral)	8 (3.6)
Losartan	(Oral)	4 (1.8)
Miscellaneous		
Multivitamins(Syrup)	(Oral)	11 (4.9)
Atorvastatin	(Oral)	16 (7.1)
Tranexamic acid	(Oral)	10 (4.4)
Thyroxine Sodium	(Oral)	8 (3.6)



Table 5: List of Commonly prescribed parenteral drugs in ICU.

Class of drug	Frequency (%)
Diuretics	73 (32.4)
Torsemide/Furosemide	44(19.5)
Mannitol	31(13.8)
Corticosteroids (Hydrocortisone)	59(26.22)
Antiulcer and antiemetic drugs	
Pantoprazole/Rabeprazole	99 (44)
Metoclopramide	68(30.2)
Ondansetron	3(1.3)
Antithrombotics (LMWH)	15 (6.7)
Antihyperglycemic drugs (Insulin)	16(7.1)
Analgesics	
Paracetamol	16 (7.11)
Morphine/Fentanyl	18 (8.0)
Ketorolac	10 (4.44)
Tramadol	4 (1.80)
Miscellaneous	
Terlipressin	24 (10.7)
Vitamin K	19 (8.4)
Multivitamins	19 (8.4)
Lorazepam/Midazolam	20 (8.88)
Atropine	17 (7.6)
Pralidoxime	17 (7.6)
Dopamine/Dobutamine/Noradrenaline	13 (5.8)
Haloperidol	13 (5.8)
Albumin	6 (2.7)
Levetiracetam	6 (2.7)
Octreotide	6 (2.7)

Discussion

The medical ICU is known as a resource-intensive area of the health care delivery system with an increased economic burden. It is important to evaluate the utilization pattern of drugs in the ICU to look for their rationale use. In this study, we described the prescription patterns of 225 patients admitted to the medical ICU of tertiary care hospital.

The mean age of patients was 55.60 ± 20.16 years with male predominance. This is similar to a study done by Shankar PR et al [2] which showed that the majority were aged above 49 years with males representing 64% of the patients. The average duration of hospital stay was 4.14 days that is similar to a previous study done in Nepal where individuals were hospitalized for sometime less than 4 days and financial constraints being the major reason for early discharge.² In a similar study done in South India, [4] average duration of medical ICU stay was 5.5 ± 2.4 days.

The average number of prescribed drugs was 7.71 ± 1.92 . The number of drugs used was higher when compared to a previous study done in Nepal where the average number of drugs prescribed in the ICU was 5.15 ± 2.67 and less compared to a study done in India (13.54 ± 1.6) [5] The average number of drugs should be kept

minimum to decrease the risk of drug interactions, drug resistance, and financial burden [6].

In this study, the most frequent route of administration was the parenteral route accounting for 81.39 % of the total drugs prescribed followed by the oral or nasogastric route (14.54 %). Results of other studies conducted in Nepal and India also showed that parenteral routes were the most frequent routes of administration (87%, 51.12%, and 62 % respectively) [2, 4, 7].

ICU patients are at increased risk of nosocomial infections due to various factors like invasive procedures, prolonged hospital stay, multiple antibiotics use, cross-contamination, etc. [8]. The emergence and spread of antibiotics resistance due to the different mechanisms require the continuous monitoring of resistance and rapid identification of resistant organisms [9]. This will help to reduce antibiotics resistance and to find the most effective drugs with minimal cost. In this study, commonly used empirical antibiotics were Meropenem, Cefipime, Doxycycline, and Cefotaxime. These were of a newer class of empirical antibiotics compared to a study conducted at a tertiary care hospital in Pokhara, Nepal where commonly prescribed antibiotics were Ampicillin, Metronidazole, Crystalline penicillin, Cloxacillin, Ceftriaxone, etc. [3]. In a study done in an ICU setting at Kathmandu [9], the most common bacterial isolates were *Acinetobacter* spp. and *Staphylococcus aureus* with the majority being multidrug-resistant thus warranting the routine testing in clinical isolates rather than using the newer generations antibiotics empirically. Strategies that can be used to reduce the prevalence of antimicrobial resistance are the prescription of antibiotics for a shorter duration as required and in cyclical rotations [10].

In the present study, the most frequently used drugs other than antibiotics were Pantoprazole, Metoclopramide, and Hydrocortisone in contrast to a study done by Patel MK et al [11] in India where Ranitidine, Atropine, Inotropes and Furosemide were among the most commonly used drugs. Corticosteroids are used in ICU for a variety of indications like severe sepsis, airway diseases, anaphylaxis, etc. Its use is associated with increased infection rate, ICU stay, and mortality [12]. In this study, Hydrocortisone was one of the commonly used drugs (26.4%). This emphasizes the need for its cautious use while considering the risks and benefits. Deep vein thrombosis and thromboembolism (VTE) is a major complication in ICU settings due to additional risk factors such as immobilization, mechanical ventilation, and the use of central



intravenous catheters. Pharmacologic thromboprophylaxis with the use of heparins has been proven to markedly reduce VTE and mortality in ICU [13]. In this study, only 6.7% of total patients were receiving thromboprophylaxis. This reinforces the proper use of anticoagulants in ICU patients to reduce the incidence of VTE.

Different inotropes like noradrenaline, dopamine, and dobutamine are used alone or in combination with volume expansion in patients with sepsis and cardiogenic shock. They help to restore cardiac output and tissue perfusion [14]. In our study, only 5.8% of patients were prescribed dopamine, dobutamine, or noradrenaline showing the marked underuse of inotropes.

The use of analgesics and sedatives plays an important role in easing the patient's comfort and improving patient outcomes in ICU. They are more commonly used in mechanically ventilated patients [15]. In our study, 14.2% of patients were prescribed analgesics (Morphine, Tramadol, or Ketorolac), and 8.8% of patients were receiving sedatives (Lorazepam or Midazolam). There was a trend towards the underuse of analgesics and sedatives in our ICU patients. This underlies the need for institutional guidelines and policies for rational prescriptions of drugs and to promote the appropriate use of antibiotics according to the culture and sensitivity pattern.

Limitations

We enrolled a limited number of patients at a point of time without knowing the outcome of patients. Moreover, we don't have local guidelines on the rational use of drugs in ICU settings. In the absence of such guidelines, the rationality of drug used could not be ascertained. Moreover, we did not look at the outcomes associated with the use of the different categories of drugs. Prescription patterns and selection of drugs differed by the physicians of different medical specialties.

Conclusion

This study helps to provide feedback to the treating physicians and other medical professionals on the uses and prescription pattern of drugs in ICU settings. Empirical use of newer generations' antibiotics like Meropenem, Cefepime, etc was common. Antiulcer drugs (pantoprazole), antiemetic (Metoclopramide), and corticosteroid (hydrocortisone) were the top three most commonly prescribed individual drugs. There was marked underuse of thromboprophylaxis, analgesics, and sedatives.

Conflicts of interests: None

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