

CLINICAL PROFILE AND DRUG UTILIZATION PATTERN IN AN INTENSIVE CARE UNIT OF A TEACHING HOSPITAL IN WESTERN NEPAL

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Summary

Irrational use of drug is a common problem worldwide. The intensive care unit (ICU) is a common place for irrational drug use. Previous studies carried out in the ICU of Manipal Teaching Hospital (MTH), Pokhara, Nepal have identified discrepancies in drug use and recommended improvements. The objectives of the present study are to study the clinical profile of patients admitted to the intensive care unit, identify the commonly used drugs, drug categories and dosage forms, study the commonly used antimicrobials, sensitivity pattern and the treatment outcomes of the admitted patients. The researchers studied the case records of all the patients admitted in the ICU during the time period from 1st August to 30th September, 2007 and entered the details in the patient profile form. The filled patient profile forms were analyzed as per the study objectives. Altogether 201 patients were admitted in the ICU and were included in the study. There were 101 (50.25%) males and 100 (49.75%) females (the total is 201). More than 50% of the patients were above the age 60 years. The most common diagnosis of the patients was Myocardial Infarction /Ischemic heard disease (MI/IHD) accounting for 13.96 % (n=62) of the total cases followed by infections 10.81% (n=48)]. The median and interquartile range of the duration of the hospital stay was 3 (2-4) days. All together 2401 drugs were prescribed to the 201 patients. The most commonly used dosage form was tablets [47.81% (n=1148)] followed by injections [33.11% (n=795)]. The most commonly used drugs belonged to the class of cardiovascular drugs [31.7% (n=761) followed by antimicrobials [14.7% (n= 351)] and the drugs acting on the gastrointestinal tract [14.08% (n=338)]. Among the antimicrobials, metronidazole was most commonly prescribed followed by ceftriaxone. The morality rate in the ICU was 17.41 % and the major causes of mortality were cardiovascular and respiratory diseases such as myocardial infarction and chronic obstructive pulmonary disease respectively. Antimicrobials was the most common class of drugs used in the ICU. Pantoprazole was the most commonly prescribed individual drug. Cardiovascular and respiratory diseases were major causes of death in the ICU.

Key words: Drug Utilization, Intensive Care Unit, Nepal.

Introduction

Irrational use of drug is a common problem worldwide.^{1,2,3,4} Studies from Nepal have acknowledged irrational use of medicines.^{5,6,7,8} One of the places where irrational drug use is common is the intensive care unit (ICU). Since most of the patients in the ICUs are critically ill and often suffer from multiple complications, polypharmacy becomes unavoidable. Studies from different countries have acknowledged irrational drug use in the ICUs and recommended interventions to improve the drug use pattern.^{9,10,11} Previous studies carried out in the ICU of Manipal Teaching Hospital (MTH), Pokhara, Nepal have identified discrepancies in drug use and recommended improvements.^{12,13} From the year 2004 onwards several initiatives were taken in MTH to improve the drug use pattern in the hospital.^{14,15} Some of these include establishment of drug information center, strengthening of hospital drug and therapeutics committee, banning of certain irrational drug combinations etc. Moreover several initiatives were also taken to improve the functioning of the ICU.

Periodic studies on drug utilization can be useful to know the use pattern, early signals of irrational use of drugs, help to carry out interventions to improve drug use, increase the quality control cycle and continuous quality improvement.¹⁶ Similarly periodic evaluation of the clinical profile of the patients gives an idea regarding the morbidity and mortality profile and also provides room for improvements. A previous study from MTH has provided some data regarding the drug use pattern in ICU. But that study was focused mainly on utilization pattern of antimicrobials.¹³ The present study in addition to the utilization of antimicrobials also studied parameters like clinical profile of the patients, treatment outcomes etc. Moreover the previous study was more than five years old. With this background the present study was carried out.

Objectives: the objectives of the present study are as follows:

1. To study the demographic details of patients admitted in the intensive care unit
2. To identify the commonly used drug classes, individual drugs and dosage forms used in the intensive care unit and
3. To study the commonly used antimicrobials and their sensitivity pattern
4. To study the treatment outcomes of the admitted patients

Methodology: The study methodology is mentioned below.

Study type: Cross sectional, descriptive study. The patients' files were checked at the time of discharge from the ICU.

Study site: ICU of MTH, a 750 bedded tertiary care teaching hospital located in Pokhara, western Nepal. The hospital has got several clinical and paraclinical departments. The hospital has an eleven bedded ICU. Since there is no separate cardiac care unit, even cardiac patients are admitted in the ICU.

Study duration: Two months (from 1st August till 30th September, 2007).

Tools used: A patient profile form was used to collect the data as per the study objectives.

Operational modality: The researchers prospectively collected the patient case records and collected the details and entered in the patient profile form. The filled patient profile forms were analyzed as per the study objectives. The parameters analyzed were the age and sex distribution of the study patients, diagnosis, duration of ICU stay, therapeutic category of the drugs used, most commonly prescribed drugs, commonly used antimicrobials, dosage forms of the drugs used and the treatment outcomes.

Result analysis: The data was entered in the Microsoft excel spread sheet and analyzed descriptively. The SPSS version 9.0 was used to carry out the descriptive statistics.

Results

All together 201 patients were admitted in the ICU during the study period. All the patients were included in the study. The age and the sex details of the patients are listed in Table 1.

Table 1. Demographic details of the patients

Demography	Parameters	Number	Percentage
Sex	Male	101	50.25
	Female	100	49.75
Age (in years)	Up to 20	10	4.98
	21-40	25	12.44
	41-60	50	24.88
	> 60	112	55.72
	Unknown	4	1.99

Diagnosis of the patients: The most common diagnosis of the patients admitted in the ICU was MI/IHD accounting for 13.96 % of the total cases. The details regarding the diagnoses are listed in Table 2.

Duration of stay in the intensive care unit (n=201): The median interquartile range of the duration of the hospital stay was 3 (2-4) days. A total of 42.29% (n=85) patients stayed for 1-2 days, 34.22% (n=69) for 3-4 days, 15.42% (n=31) for 5-6 days, 1.99 % (n=4) for 7-8 days and 1.99% (n=4) for more than 8 days. The duration of stay of 3.98% (n=8) patients were not known.

Therapeutic category of the drugs used: Altogether 2401 drugs were prescribed with an average of 11. 94 drugs per patients. The most commonly used drugs were cardiovascular drugs accounting for 31.7% (n=761). The details are listed in Table 3.

Table 2. Diagnosis of the patients (444)

Diagnosis	Number	Percentage
Myocardial infarction/Ischemic heart disease	62	13.96
Infections	48	10.81
Cerebrovascular accident	40	9.01
Hypertension (Uncontrolled /emergency/urgency)	29	6.53
Arrhythmia/ conduction disturbances	27	6.08
Alcoholic liver disease /other liver diseases	23	5.18
Acute exacerbation of COPD / respiratory failure	18	4.05
Congestive cardiac failure/ dilated cardiomyopathy	18	4.05
Renal failure/ dyselectrolytemia	18	4.05
Diabetes mellitus/diabetic ketoacidosis	17	3.83
Primary central nervous system disease	11	2.48
Poisoning/snake bite	9	2.03
Malignancy	7	1.58
Bleeding/shock	7	1.58
Anemia	6	1.35
Head injury	3	0.68
Psychosis	2	0.45
Miscellaneous	99	22.30

Note: One patient might have had more than one diagnosis

Table 3. Therapeutic category of the drugs used (n=2401)

Therapeutic classification	No. of drugs	Percentage
Cardiovascular drugs	761	31.7
Antimicrobials	353	14.7
Drugs acting on the gastrointestinal tract	338	14.08
Drugs acting on the central nervous system	179	7.46
Intravenous fluids	179	7.46
Antiasthmatics	100	4.16
Vitamins, minerals and dietary supplements	95	3.96
Diuretics	95	3.96
Analgesics and anti-inflammatory	68	2.83
Electrolytes	40	1.67
Antihistamines	38	1.58
Antidiabetics	29	1.21
Unknown	6	0.25
Miscellaneous	120	5

Top ten antimicrobials: The top ten commonly used antimicrobials were analyzed and the details are listed in Table 4.

Table 4. Top ten commonly used antimicrobials

Antimicrobials	No. of drugs
Metronidazole	91
Ceftriaxone	36
Amoxicillin+ Clavulanic acid	32
Ampicillin	29
Ciprofloxacin	22
Ceftazidime	19
Cefotaxime	18
Azithromicin	12
Amikacin	8
Cefpodoxime	8
Ofloxacin	8

Antibiogram of the isolates from ICU: During the study period a total of 30 sputum samples, 17 urine samples and 11 blood samples were sent for culture sensitivity. Out of which organisms were isolated from 21 sputum samples, 7 urine samples and 2 blood samples. The antimicrobial sensitivity of the pathogens in the ICU was studied and the details are listed in Table 5.

Table 5. Antibiogram of the isolates

Specimen	Organisms	Sensitivity pattern
Sputum (21/30)	<i>P. aeruginosa</i> (14)	Ciprofloxacin (8/14) Aminoglycosides (11/14) Carbenicillin (14/14) Imipenem (14/14)
	<i>Acinetobacter Sp</i> (4)	Aminoglycosides (2/4) Carbenicillin (2/4) Imipenem (4/4)
	<i>Kleibsella Sp</i> (2)	-
	<i>H. influenza</i> (1)	-
Urine (7/17)	<i>E.coli</i> (5)	Ciprofloxacin (4/5) Aminoglycoside (5/5) Nitrofurantoin (5/5)
	<i>Kleibsella Sp</i> (1)	-
	<i>Acinetobacter Sp</i> (1)	-
Blood (2/11)	<i>P. aeruginosa</i> (2)	Only sensitive to Imipenem

Dosage form of the drugs used (n=2401): The most commonly used dosage form was tablets 47.81% (n=1148) followed by injections 33.11% (n=795), intravenous fluids 7.755% (n=186), syrups 5.50% (n=132), nebulized solutions 2.21% (n=53), capsules 1.54% (n=53), eye/ear drops 0.54% (n=13), powders 0.46% (n=11), dry powder inhalers 0.29% (n=7), ointments 0.17% (n=4), metered dose inhalers 0.12% (n=3), cream/gargles/gels 0.20% (n=5) and the dosage forms of 0.29% (n=7) preparations were unknown.

Top twenty drugs used in the ICU: Pantoprazole was the most commonly prescribed drugs. The details regarding the top twenty commonly used drugs are listed in Table 6.

Table 6. Top twenty drugs used in the ICU

Name of drug	Number	ATC code
Pantoprazole	173	BO1AC06
Clopidogrel	112	-
Aspirin	110	A12CAO1/ BO5CBO1/ BO5XAO3
Normal saline	97	BO1AC06/ NO2BA01
Metronidazole	91	CO9BAA02
Enalapril	80	RO1AXO3/ RO3BB01
Atorvastatin	67	C10AA05
Frusemide	61	AO1AB17/ DO6BXO1/ GO1AFO1/ JO1XDO1/ PO1ABO1
Isosorbide mononitrate	60	C01DA14
Dextrose + normal saline	55	CO3CAO1
Metoprolol	45	C07AB02
Enoxaparin	44	B01AB05
Alprazolam	42	N05BA12
Lactulose	40	A06AD11
Cremaffin	39	-
Ipratropium	39	AO2BCO2
Isosorbide dinitrate	37	C01DA08/ CO5AE02
Ceftriaxone	36	J01DD04
Vitamin K	31	-
Ranitidine	30	A02BA02

Treatment outcomes: The mortality rate in the ICU was 17.41 % (n=35). A total of 56.22 % (n=113) patients improved, 4.98% (n=10) patient did not improve or were static in their progress and 9.45% (n=19) patients left against medical advice. The details regarding the outcome of 11.94% (n=24) of the patients were not known.

Causes of death in the ICU: Altogether 35 patients expired in the ICU. The most common cause of mortality in the ICU was cardiovascular diseases 22.86 % (n= 8) and respiratory diseases (22.86% (n=8) followed by neurological disorders 17.14% (n=6), alcoholic liver disease 14.29% (n=5), septicemia 8.57% (n=3), renal diseases 5.71 % (n=2), poisoning 2.86 % (n=1) and other 5.71 % (n=2).

Discussion

The present study evaluated the utilization of drugs in the ICU of MTH. ICU is a special setting wherein patients with serious complications and multiple complications get treated. The use of drugs is thus expected to be high. Altogether 201 patients were admitted in the ICU during the study period with an almost equal sex distribution. We found more than fifty percent of the patients to be aged more than 60 years. The previous studies from our ICU also documented a high percentage of elderly patients.^{12,13} It is because the common diseases managed in the ICU like myocardial infarction, ischemic heart disease etc occur in the elderly patients. It is because the hospital do not have a separate CCU and hence patients with cardiac complications are also managed in the ICU. However, a CCU is expected to come up in the near future.

The average number of drugs used in the ICU per patient was 11.94. It is well known that elderly patients are suffering from multiple diseases and are prescribed a large number of drugs.^{17,18} Polypharmacy increases the risk of drug-drug interactions.^{19,20} A previous study from the internal medicine wards and ICU of our hospital identified a high risk for potential DDIs.²¹ Added to these, the average number of drugs use din the ICU has also increased dramatically to 11.94 in the present study from the previous value of 5.15 ± 2.67 suggesting an increase.¹² In general it is better to keep the number of drugs as low as possible to minimize the risk for DDIs and also to minimize the economic burden on the patient.

The most common condition managed in our ICU was MI/IHD followed by infections. Due to urbanization and rapid lifestyle changes there has been an increase in the incidence of cardiovascular diseases in developing countries. Lifestyle modifications can play an important role in preventing and managing these cardiovascular diseases. However, in our previous study the most common disease managed was COPD.¹³ In general patients with cardiovascular diseases are prescribed a higher number of drugs. This might be one of the reasons for the increase in the number of drugs prescribed. The recent national mortality report also suggests respiratory diseases as the major cause of death in the country.²² In our ICU there is less number of patients with respiratory diseases because most of the COPD cases are managed in a semi ICU/COPD block with facility for central oxygen supply and monitoring by the nurses and doctors. Though the number of respiratory cases managed in the ICU has decreased compared to that reported in previous studies it still was the major cause of mortality in the ICU suggesting a significant burden. It may be because out hospital is a tertiary care center due to which many terminal COPD cases are being referred and managed in ICU.

The most common class of drugs prescribed was antibiotics/antibacterials. Among this class the most commonly prescribed drug was metronidazole. Metronidazole is used in most of the cases of suspected aspiration pneumonia as most of the unconscious patients when brought to the hospital have a history of aspiration, especially in stroke patients. Antimicrobial resistance is a common problem worldwide.^{23,24,25} The culture and sensitivity reports of our ICU reports a high number of *Pseudomonas* species suggesting the need for antipseudomonal drugs like ceftazidime. Amoxicillin/clavulanic acid combination is used widely in the ICU in cases of acute exacerbation of COPD since the conventional antimicrobials like ampicillin, amoxicillin etc are insensitive against the

betalactamase producing species of *Streptococcus pneumoniae*. However, one should look for cheaper alternatives such as aminoglycosides with ampicillin etc considering the cost and sensitivity pattern) Some of the strategies that can be used to minimize the occurrence of antimicrobial resistance are prescribing the antimicrobials for the correct duration, at the correct dose and by cycling of antibiotics.²⁶ In our ICU some of the strategies followed are regular fumigation of the ICU, empirical therapy till confirmation of the organism by the culture sensitivity reports. However, there is a need for improvement in terms of regular hand washing by the healthcare professionals and the need for an antibiotic policy. For the past two years the Drug Information Bulletin (DIB) of our hospital publishes the microbial sensitivity pattern of the commonly isolated organisms in the hospital.²⁷ This initiative may be useful in knowing about the sensitivity pattern of the organisms and prescribing antimicrobials accordingly.

The top ten drugs used in the ICU were studied and it was found that pantoprazole was most commonly prescribed. In the previous study ranitidine was one among the top ten drugs used.¹³ At present ranitidine is being replaced by pantoprazole. A recent study from the United States assessed intermittent IV pantoprazole for control of gastric acid and the possible prevention of upper gastrointestinal (UGI) bleeding in ICU patients. The study concluded that intermittent IV pantoprazole effectively controls gastric pH and may protect against UGI bleeding in high risk ICU patients without the development of tolerance.²⁸ Preliminary findings have shown that intermittent administration of intravenous pantoprazole, is as effective in raising intragastric pH on the first day as a continuous infusion of a histamine-2-receptor antagonist in clinical trials conducted within an ICU setting.²⁹ Another study compared the efficacy, safety, and cost of using cimetidine, famotidine, and lansoprazole (proton pump inhibitor) for stress ulcer prophylaxis. The study found lansoprazole to be the most cost-effective therapy.³⁰ However, one should keep in mind the cost of PPIs in comparison with ranitidine. In general, therapy with PPIs is much costlier than with H1-blockers.

The mortality rate in our ICU was found to be 17.41%. The major causes of death on our ICU were cardiovascular diseases and respiratory diseases followed by neurological disorders. In the previous study from our ICU, the mortality rate was 15.4%.¹³ Since the duration of the study is low it is difficult to compare our value with the previous study.

Limitations: Our study had a few limitations. The study duration was low (2 months). We also did not follow up of the patients once they are discharged from the ICU. In the absence of established treatment guidelines the rationality of use of particular drugs could not be determined.

Conclusions

The study was successful in identifying the pattern of drug use in the ICU. Antimicrobials were the most common class of drugs used. Pantoprazole was the most commonly prescribed individual drug. The most common diseases managed were cardiovascular problems followed by infections. Cardiovascular and respiratory diseases were the major causes of mortality. The average number of drugs per prescription has increased considerably compared to the past. The overall use of antimicrobials in the ICU is justifiable as most of the economic and older drugs are still prescribed. The use of PPIs needs to be looked upon and interventions may be needed.

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