Prevalence Survey of Antimicrobial Use among Admitted Patients in Tertiary Care hospital: An observational study

Aryal S,[1] Joshi M,[1] Uprety BN,[1] Shrestha RK,[1] Gupta M,[1] Shah P,[1] Rajbhandari P,[2] Amatya R,[3] Shrestha P,[3] Ojha AR[4]

[1]Department of Pharmacology,
Patan Academy of Health Sciences,
Lagankhel, Lalitpur, Nepal.

[2]Department of Microbiology,
Patan Academy of Health Sciences,
Lagankhel, Lalitpur, Nepal.

[3]FHI 360 Nepal,
Anamika Galli, Baluwatar,
Kathmandu, Bagmati, Nepal

[4]Department of Pediatric,
Patan Academy of Health Sciences,
Lagankhel, Lalitpur, Nepal.

Corresponding Author

Sushant Aryal
Department of Pharmacology,
Patan Academy of Health Sciences,
Lagankhel, Lalitpur, Nepal.
E-mail: dr.sushantaryal@gmail.com

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ABSTRACT

Background

Monitoring the antimicrobial use is one of the key strategies to address the growing global threat of antimicrobial resistance.

Objective

To find out antimicrobial usage at tertiary care hospital of Lalitpur, Nepal.

Result

An observational cross-sectional study was carried out at the Patan Academy of Health Sciences, Lalitpur, Nepal on September 25 and 26, 2023. World Health Organization point prevalence survey methodology was used with minor modification to meet hospital's context. The data on antimicrobial usage were collected from the medical records of patients admitted at or before 08:00 am on the day of the study in the acute care ward.

Result

The study involved 324 inpatients, with females comprising 176 (54.3%) and males 148(45.7%). The mean age was 37.89 years ± 24.87. Antibiotics usage was 78.1%. A total of 471 drug was prescribed of which 312 (66.2%) was used for therapeutic purpose and 159 (33.8%) for prophylaxis. Of 312 antibiotics, 283 (90.7%) were utilized empirically. Majority of prescribed medications belonged to watch group 16 (48.5%). Ceftriaxone was the most frequently prescribed antibiotic 142 (30.1%) and was the preferred choice for surgical prophylaxis 68 (94.4%). A total of 24 (72.7%) drugs were prescribed from the National List of Essential Medicines and 432 (91.7%) prescriptions were written using generic names.

Conclusion

The use of antibiotic was high, with good adherence to essential medicines and generic prescribing. Strengthening antimicrobial stewardship and evidence-based practices can further optimize prescribing, enhance patient safety and help combat antimicrobial resistance effectively.

KEY WORDS

Antibiotic, Nepal, Point prevalence survey, Tertiary care hospital

INTRODUCTION

Antimicrobial resistance (AMR) is inherent feature of microorganism and is unavoidable. However, over exposure of microorganisms to antimicrobial agent (AMA) due to excess and improper use in agriculture, humans and animals have accelerated this process.[1,2] Globally, antibiotic consumption increased by 16.3% from 2016 to 2023.[3]

Since the discovery of first resistant bacteria, more than 70% of bacteria have developed resistance to at least one type of antibiotic.[4] The spread of resistant bacteria and development of new type of resistance along with lack of new AMA presents a global issue as treating drug-resistant infections becomes challenging, straining healthcare systems and increasing mortality risks.[5-8] In 2019, an estimated 4.95 million deaths were related to AMR. If the same trend continues, AMR would cause the economic loss of $1 trillion and a mortality of 10 million annually by 2050. 8 Situation could be more concerning in Southeast Asia because it is identified as high risk region for development and spread of AMR.[9,10] A similar patterns could be observed in Nepal due to high prevalence of AMA usage.[11]

A Global Action Plan was developed to address the issue; with one of its key strategic objectives being the optimization of antimicrobial agent utilization.[12] Point prevalence survey is cost effective and standard method recommended by World Health Organization to monitor antimicrobial use.[5]

The purpose of this study is to find out antimicrobial usage. This information helps antibiotic stewardship program to assess if antimicrobial prescriptions are appropriate and identify areas for improvement. Additionally, it can serve as the baseline to assess the impact of improvement effort.

METHODS

A observational cross sectional study was conducted in September 25 and 26, 2023 at Tertiary care, 650 bed hospital, the Patan academy of Health Sciences (PAHS) of Lalitpur, Nepal utilizing World Health Organization (WHO) point prevalence survey methodology with minor modification to meet hospital's context.[5]

All the patients of acute care ward admitted at or before 08:00 am on the day of the study were included in the study. Patients admitted to the psychiatric ward, renal dialysis ward, and those admitted for daycare were excluded. Outpatient department patients were also not included in the study. The study included antimicrobials given through oral, parenteral, rectal or inhalational route and administered before 08:00 AM. Total population sampling was done. The required data was gathered by reviewing the patients' medical record therefore consent was not taken.

Data were collected by principle investigator and co-investigator from patient's medical record in a WHO standard tool.[5] This tool was used to collect data relevant to our study. The data collected included the total number of eligible patients, their age, and gender as well as whether or not they were receiving antibiotics. It also included the name of the antibiotic prescribed as recorded in the cardex, the indication for its use, antibiotic sensitivity reports, and the type of treatment administered. The data collected did not include any directly identifiable patient's information. Patient record number was used to identify patient. In addition, each surveyed patient was given anonymous code (Patient code) that uniquely identified the patient admitted in the hospital. The collected data was entered in Excel spreadsheet 2003. The data was cleaned and transferred to Statistical Package for the Social Sciences version 16 for statistical analysis. Prevalence was calculated by dividing the number of patients receiving antibiotics by the total number of surveyed patients and then multiplying by 100. To categorize antibiotic according to Access, Watch and Reserve (AWaRe) group World Health Organization 2023 AD classification was used.[13] The National List of Essential Medicines (NLEM), 6th revision, 2021 were referred to determine how many of the prescribed drugs were part of essential medicines list.[14] Descriptive measures were presented as frequency and percentages. The ethical approval was taken from IRC-PAHS with ethical clearance Ref: bss2201181588.

Operational Definition

A. Acute care ward

• Ward that provides short-term treatment for patients needing close monitoring and urgent care but not intensive care.

B. Community-Acquired Infection

• Infection contracted outside the hospital or diagnosed within 48 hours of admission, with no previous healthcare encounter.

C. Hospital-Associated Infection

• Infection occurred on Day 3 or later of admission, or on Day 1 or Day 2 if the patient was transferred from another hospital, or if the patient was discharged from a hospital (either the same or another one) within the preceding 48 hours.

D. Surgical Prophylaxis

• Antibiotic was administered prior to surgery (with redosing if the surgery lasted more than 4 hours) and was documented in the operation record form.

E. Directed Treatment

• Antibiotic used against microorganisms identified as the cause of the infection based on the culture report.

F. Empirical Treatment

• Aantibiotic treatment used against the most likely microorganism causing the infection, as determined by the treating physician, before receiving the culture and sensitivity reports.

RESULTS

In this study, a total of 324 inpatients were enrolled, of which female patients were 176 (54.3%) and male were 148 (45.7%). The mean age was 37.89 years. Surgery was performed in 95 patients.

The prevalence of antimicrobial agent (AMA) use was 78.1%. There were 33 types of AMA prescribed and a total number of AMA used was 471 with an average of 1.82 drugs per patient encounter. Most of the prescribed drugs were from the National List of Essential Medicines 24(72.7%). According to Access, Watch and Reserve (AWaRe) group classification 2023 AD, 16 (48.5%) of prescribed drug belonged to watch group, 15 (45.5%) to access group and 2(6.1%) to reserved group as shown in table 1.

Of the 471 AMA, majority of them were prescribed in generic name 432 (91.7%) with few exception for drugs like a combination of sulfamethoxazole and trimethoprim (cotrimoxazole), piperacillin and tazobactam, and amoxicillin and clavulanic acid for which trade names were utilized. The preferred route of administration of AMA was parenteral 414 (87.9%). In terms of indication, 286 (60.7%) AMA was prescribed for community acquired infection, 150 (31.8%) for surgical prophylaxis, 26 (5.5%) for hospital acquired infection and 9 (1.9%) for medical prophylaxis. Of the 312 AMA administered for therapeutic purpose, empirical use was 283 (90.7%) and directed use was 29 (9.3%).

Out of 471 AMA, cephalosporins 177 (37.6%) were the frequently used antimicrobial followed by penicillins 118 (25.1%) and aminoglycosides 37 (7.9%). The most commonly prescribed individual drug was ceftriaxone 142 (30.1%), piperacillin-tazobactam 33 (7%) and flucloxacillin 28 (5.9%) as indicated in table 1.

Out of the 95 patients who underwent surgery, 72 were given surgical prophylaxis. Among which 12 (16.7%) patients had received only single dose preoperatively while in 60 (83.3%) patients the AMA was continued after surgery. The prophylaxis before surgery was given within 60 minutes of incision and the ceftriaxone 68 (94.4%) was predominant choice. Additionally, amikacin 2 (2.8%), cephazolin 1 (1.4%) and piperacillin-tazobactam 1 (1.4%) were also used. Regarding post surgery use of antimicrobial, a total of 84 AMA were administered. Among the 84 AMA, use of ceftriaxone was 25 (29.8%), cefixime and flucloxacillin was 12 (14.3%) each as presented in table 2.

A total of 393 microbiology specimens were sent for culture and sensitivity from 173 patients. Urine 140 (35.6%) was most commonly sent as specimen followed by blood 116 (29.5%), sputum/respiratory samples 47 (12%), sterile fluid 34 (8.7%), other 31 (7.9%), wound 14 (3.6%) and urethral/genital specimen 11 (2.8%). Out of 393 samples, a growth was detected in 66 samples.

Table 1. Distribution of Antimicrobial Agents According to Use, AWaRe Group, and NLEM

Antimicrobial agent Cephalosporins	n	%	AWaRe GROUP	NEML
Ceftriaxone	142	(30.1%)	Watch	Yes
Cefixime	24	(5.1%)	Watch	Yes
Cefuroxime	3	(0.6%)	Watch	No
Cefotaxime	5	(1.1%)	Watch	Yes
Ceftazidime	1	(0.2%)	Watch	No
Cefazolin	1	(0.2%)	Access	Yes
Cefoperazone+Salbactam	1	(0.2%)	Watch	No
Penicillins				
Piperacillin + Tazobactam	33	(7.0%)	Watch	Yes
Flucloxacillin	28	(5.9%)	Access	No
Meropenem	21	(4.5%)	Watch	Yes
Ampicillin	17	(3.6%)	Access	Yes
Cloxacillin	11	(2.3%)	Access	Yes
Amoxicillin	4	(0.8%)	Access	Yes
Amoxicillin-clavulanic acid	3	(0.6%)	Access	Yes
Penicillin-g	1	(0.2%)	Access	Yes
Aminoglycosides				
Amikacin	22	(4.7%)	Access	Yes
Gentamicin	13	(2.8%)	Access	Yes
Tobramycin	2	(0.4%)	Watch	No
Nitroimidazoles				
Ornidazole	13	(2.8%)	Access	No
Metronidazole	23	(4.9%)	Access	Yes
Macrolides				
Azithromycin	21	(4.5%)	Watch	Yes
Clarithromycin	1	(0.2%)	Watch	Yes
Fluoroquinolones				
Levofloxacin	6	(1.3%)	Watch	No
Ofloxacin	3	(0.6%)	Watch	No
Ciprofloxacin	2	(0.4%)	Watch	Yes
Tetracyclines				
Doxycycline	20	(4.2%)	Access	Yes
Others				
Colistin	12	(2.5%)	Reserve	Yes
Vancomycin	10	(2.1%)	Watch	Yes
Clindamycin	9	(1.9%)	Access	Yes
Chloramphenicol	7	(1.5%)	Access	Yes
Linezolid	6	(1.3%)	Reserve	Yes
Cotrimoxazole	4	(0.8%)	Access	Yes
Rifaximin	2	(0.4%)	Watch	No

AWaRe: Access, Watch and Reserve
NEML: NLEM: National List of Essential Medicines

Table 2. **Post surgical use of Antimicrobial agent (n=84)**

Antimicrobial agent	n (%)
Ceftriaxone	25 (29.8%)
Flucloxacillin	12 (14.3%)
Cefixime	12 (14.3%)
Ornidazole	9 (10.7%)
Gentamicin	7 (8.3%)
Metronidazole	6 (7.1%)
Cloxacillin	4 (4.8%)
Piperacillin-Tazobactam	3 (3.6%)
Clindamycin	3 (3.6%)
Colistin	2 (2.4%)
Amikacin	1 (1.2%)

DISCUSSION

The prevalence of AMA use was 78.1% in our study. This was consistent with the finding of point prevalence survey done in Nigeria 81%, Bangladesh 78% and Pakistan 75% but much higher than the study done by Versporten et al. on antimicrobial consumption and resistance among adult hospital inpatients across 53 countries, as well as with results from countries like Ghana 58.4%, India 57.4%, Brazil 52.2%, Saudi Arabia 46.9%, Canada 33.5%, and Russia 26.1%.[15-24] In comparison to studies done in Nepal, Nisha et al reported 24.9% and Karki et al. reported 69.8% use rate.[25,26] The high prevalence observed in our study may be associated with higher infection rates, empirical antibiotic use, and the administration of drugs for surgical prophylaxis.

Almost all drugs were prescribed using their generic name 91.7% except for a specific combination. Use of trade name may be partly due to long name of these combination drugs. Even though this percentage was below World Health Organization standard of 100%, it is considerably higher than that reported in several other studies conducted in Nepal, where 90-95% of medicines are prescribed by brand name in tertiary care health facilities.[27,28]

This study revealed that the percentage of AMA prescribed from NLEM was 72.7%.[14] The reason behind such finding may be insufficient awareness regarding NLEM, unavailability of NLEM drugs in the pharmacy or failure to revise National NLEM. AMA prescribed for therapeutic purpose was used empirically 91%. Research conducted across 53 nations globally, as well as specific studies in Pakistan, India and Peru have also reported high empiric use of AMA.[17-19,29] The high use of empiric antibiotics in our study could be because culture and sensitivity results were still awaited during data collection, and the rate of positive culture reports was low. The most prescribed drug in our study was ceftriaxone 30.1%, similar to findings of a worldwide point prevalence survey in 69 countries and also from hospitals in Pakistan, India, Brazil, and Nepal.[17,18,20,21,25,30] Such finding in our research was largely because of high use of ceftriaxone for surgical prophylaxis.

In our study, ceftriaxone was the preferred choice for prophylaxis. Hospitals in Eastern Europe 39.5% and southern Europe 28% and Africa 27.7% had similar report to our finding while cefazolin was preferred in hospitals of Oceania 64.5%, North America 62.4% and Western Europe 57.7%.[18] Use of ceftriaxone for prophylaxis could be attributed to lack of availability of cefazolin in the market or lack of knowledge regarding the microorganism causing surgical site infection and the AMA effective against it. Surgical patient received prophylaxis within 60 minutes of incision which was accordance to recommendation practice.[31,32] However prophylaxis continued for more than 24 hour post-surgery contrary to recommendation which suggests discontinuing its use beyond this period.[31,32] Our finding was similar to results of an internet-based global point prevalence survey conducted across 53 countries as well as of specific hospitals of Pakistan, India, Canada and Nepal.[17,18,20,23,25] The reason for use of AMA beyond 24 hour in this study could be related to substandard operation theatre as well as inadequate sterilization of reusable surgical instrument.

In our study 48.5% of prescription was from watch group, 45.5% from access group was 6% from reserve group. These findings were not according to WHO recommended prescribing 60% of access group.[13] The reason for high use of Watch group is primarily due to prescription of ceftriaxone. The usage proportion of the access group would have increased if cefazolin, classified within this category, had been used as recommended for surgical prophylaxis. Most commonly prescribed reserve drug was colistin and linezolid. In the Western and Central Asian hospitals use of Watch antibiotics was 66.1% and the Access percentage was 28.4%. Similarly, in European hospitals, access group ranged between 30.2 to 55.2%. Globally, utilization of reserve drug was 2% and the linezolid and colistin was most used.[32] According to the Global Antimicrobial Resistance and Use Surveillance System Report, 2022, the use of the Access group in Nepal was 26%, and the Watch group was 74%.[11] The primary limitation of this study is its cross-sectional nature which can only provide information of AMA use at a single point. Moreover, this research did not explore the underlying reasons behind the finding of the study.

We would like to acknowledge FHI 360 for providing training on point prevalence survey.

CONCLUSION

This study revealed important insights into antibiotic prescribing practices at this hospital. Most prescriptions followed essential medicine guidelines and used generic names. However, improvements are needed to reduce empiric prescriptions, promote the use of access group antibiotics, and align surgical prophylaxis with guidelines. Strengthening antimicrobial stewardship and implementing interventions, such as developing hospital guidelines and training healthcare professionals, will help address these issues. Regular Point Prevalence Surveys can identify gaps and monitor progress after interventions.

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