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POINT PREVALENCE SURVEY ON ANTIBIOTIC CONSUMPTION IN TERTIARY CARE PUBLIC HOSPITAL IN INDIA

Nilushree[1*],Aman Swami[2],Mahendra Kumar Chauhan[2],Rajesh Asija[3]

1st Research Scholar, Maharishi Arvind Institute of Pharmacy, Jaipur, India-302020
2nd Associate professor, Maharishi Arvind Institute of Pharmacy, Jaipur, India-302020
3rd Principal, Maharishi Arvind Institute of Pharmacy, Jaipur, India-302020

ABSTRACT

This study aimed to evaluate antimicrobial prescription practices at our institute, to promote responsible antimicrobial use and implement antimicrobial stewardship programs. It was conducted as a cross-sectional point-prevalence survey on antimicrobial utilization at SJHmulti-specialty Hospital in New Delhi during May 2023, spanning three days. The analysis encompassed all in-patients, except for neonates,outpatient departments, emergency room patients, and those under palliative care. Additionally, prescriptions for anti-viral, anti-fungal, anti-tubercular, and anti-parasitic medications were excluded from the study. Statistical data analysis was planned using SPSS version 13.0.

At the time of our survey, there were 1005 patients admitted, of which 737 (73.33%) were receiving antimicrobial agents (AMA). Among these, 485 patients (65.8%) received AMAs for infections,105 patients (14.20%) as prophylaxis, and 147 patients (20.00%) were receiving AMAson test-based therapy.

Notably, the burns and plastic exhibited the highest proportion of patients receiving antimicrobials, at 92.79%. Intra-abdominal infections accounted for the most common indication (32.40%), with beta-lactam antibiotics being the most frequently prescribed (60.62%). These findings underscore a notable rate of antimicrobial use and point to areas where interventions for more judicious antimicrobial utilization are essential. Additionally, we propose advocating for the initiation of a national antimicrobial stewardship program, drawing inspiration from initiatives like the Global Point Prevalence Survey, to facilitate evidence-based antimicrobial practices.

KEYWORDS

Antimicrobial utilization, Antimicrobial stewardship, Antimicrobial resistance, Point prevalence survey

INTRODUCTION

Antibiotic resistance is a pressing global concern, with a surge in antimicrobial resistance worldwide associated with increased patient morbidity and mortality. This problem is particularly pronounced in developing countries like India, which grapples with a high incidence of antimicrobial resistance. The misuse of antimicrobials, such as frequent or extended prescriptions, has been identified as a significant contributor to the development and spread of antimicrobial resistance.

A report from 2010 highlighted India as the largest consumer of antibiotics for human health, with a staggering 12.9 x 10^9 units (equivalent to 10.7 units per person). What's concerning is that nearly half of these prescriptions were deemed unnecessary. This rampant misuse of antimicrobials not only shortens the effectiveness of available drugs but also limits treatment options, creating a significant healthcare challenge. Adding to the issue is the scarcity of new antimicrobial drugs developed for human use over the last three decades_[3]

The development of resistant organisms emphasizes that misuse can harm even patients who have not been directly exposed to these drugs. Consequently, healthcare systems must adopt a conservative approach, prioritizing the preservation of currently available antimicrobial drugs. Governments, including the Ministry of Health in India, have recognized the importance of rational and judicious antimicrobial use. Recommendations have been made, encompassing the implementation of antimicrobial stewardship programs and vigilant monitoring of drug consumption within healthcare facilities. These interventions hold the potential to mitigate antimicrobial resistance, reduce adverse effects, and cut down on medical costs_[6]

In this context, a point prevalence survey, which provides a snapshot of drug utilization at a specific point in time, can offer valuable quantitative insights into patterns of antimicrobial use.

One significant challenge in developing and executing effective antimicrobial stewardship programs is the scarcity of both quantitative and qualitative data regarding antibiotic prescriptions. As a result, it is imperative to establish robust surveillance mechanisms capable of tracking and documenting antimicrobial usage trends and the potential emergence of resistance. This process should be complemented by conducting regular audits and seeking feedback on prescribing practices, which can ultimately lead to substantial improvements in key stewardship aspects, such as adhering to protocol-driven empirical treatment prescriptions.

Given this contextual foundation, the survey was structured with the primary objective of evaluating the patterns of antimicrobial utilization within our institute. This evaluation aimed to promote responsible antimicrobial use and mitigate potential drug-related complications. Additionally, the survey was designed to gauge the extent to which prescription practices align with national guidelines and to propose essential recommendations for the initiation of a tailored Antimicrobial Stewardship Program (ASP). It's worth noting that this survey represents the inaugural comprehensive comparative analysis of Point Prevalence Surveys conducted throughout India, offering insights into the nationwide landscape of antimicrobial utilization. _[4]

MATERIALS AND METHODS

Study design and setting

This study conducted a cross-sectional point prevalence survey on antimicrobial utilization within SJH Multispeciality Hospital, New Delhi. This hospital is a multidisciplinary, tertiary-care institution. It serves as a teaching hospital and boasts a bed capacity of 1430 beds, distributed across 17 clinical departments and 35 wards.

The survey was carried out over a three-day period in April 2023, following approval and authorization from the institutional ethics committee. All in-patients of varying genders and age groups who were currently undergoing systemic antimicrobial treatment on the survey day were included in the study. However, neonates, emergency room patients not formally admitted, and those under palliative care were excluded from the survey. Additionally, prescriptions for anti-viral, anti-fungal, anti-tubercular, and anti-malarial medications were omitted from the survey's scope.

Table 1: Baseline characteristics of patients surveyed under PPS study (N=1005)

Total no. patient surveyed	**1005**
No. of Male patients	**474(47.2%)**
No. of female patient	**531(52.8%)**
No. of child patient	**109 (10.9%)**
Patient on antimicrobials	**737(73.3%)**
Patient without antimicrobials	**268(26.6%)**
Patient on empirical therapy	**485(65.8%)**
patient on prophylactic treatment	**105(14.2%)**

Patient on test based therapy	**147(20%)**
Patient on 1 antimicrobials	**323 (43.9%)**
Patient on 2 antimicrobials	**272 (37%)**
Patient on >2 antimicrobials	**151 (20.5%)**

Table 2: Antimicrobial use and consumption profile across 07 departments surveyed including treatment basis.

DEPARTMENT	MEDICINE	SURGERY	PAEDS	ICU	OBG&GYNAE	ORTHO	BURNS&PLASTIC
Patient surveyed	**132**	**201**	**109**	**147**	**242**	**105**	**69**
No. (%)of patients on AM	**111 (84.1%)**	**148 (74%)**	**96 (88%)**	**120 (82%)**	**124 (51%)**	**74 (70.8%)**	**64 (92.7%)**
Patients on 1 AM	**78 (71%)**	**53 (36%)**	**15 (15.6%)**	**45 (37.5%)**	**45 (36.3%)**	**7(9.5%)**	**35 (55%)**
Patients on 2 AM	**27 (24.3%)**	**54 (37%)**	**52 (54%)**	**39 (32.5%)**	**36 (29%)**	**40(54%)**	**24 (37.5%)**
Patients on >2AM	**6 (5.4%)**	**41 (28%)**	**29(30.2%)**	**36 (30%)**	**43 (34.7%)**	**27 (36.9%)**	**5 (8%)**
Patients on empirical therapy	**80 (72.1%)**	**160 (80%)**	**52 (48%)**	**71 (48.3%)**	**230 (95%)**	**88(84%)**	**30 (43.5%)**
Patient on test based therapy	**52 (47%)**	**41(20.4%)**	**57 (53%)**	**76 (52%)**	**12(5%)**	**17 (16.2%)**	**39 (56.5%)**

Table 3: consumption of antimicrobials based on their classification across 07 departments surveyed

Class of antimicrobials	medicine	surgery	paeds	ICU	Obg&gynae	ortho	Burns & plastic
B-LACTUMS	102	163	97	112	127	93	53
AMINOGLYCOSIDES	Nil	23	46	24	36	65	20
FLUOROQUINOLONES	6	15	1	7	1	1	4
MACROLIDES	5	21	5	1	1	Nil	nil
LINCOSAMIDES	11	28	nil	6	1	4	Nil
NITROIMIDAZOLES	9	41	6	8	78	12	7
TETRACYCLINES	Nil	2	Nil	2	Nil	Nil	Nil
OXAZOLIDIONES	nil	4	5	12	1	5	3
GLYCOPEPTIDES	6	3	33	25	1	6	1
CARBAPENAM	6	17	11	20	Nil	nil	3
POLYMYXIN	1	Nil	6	15	Nil	2	2

For data analysis, the clinical departments were categorized into seven groups, facilitating a comprehensive assessment of antimicrobial utilization. These groups included the Departments of Medicine (comprising General Medicine and Respiratory Medicine), Departments of Surgery (encompassing General Surgery, Orthopedics, and pediatric surgery), Obstetrics and Gynaecology, the Department of Pediatrics, Intensive Care Units (both Medical and Surgical ICU), and Other departments like burns and plastic, orthopedics.

Study tool and validation of the study tool

A fundamental Point Prevalence Survey (PPS) tool was developed, drawing inspiration from the methodology outlined in WHO-version 1.1 for reference in antibiotic use surveys. The survey was conducted collaboratively, involving faculty members from the Department of Microbiology, Pharmacology, clinicians, and the nursing staff stationed within the hospital wards. To ensure proficiency in survey methodology, a preparatory survey skill exercise was conducted before the study, providing training to all survey team members.

The survey itself took place within a specific ward, commencing at 10:00 AM and spanning three days. Data collection employed two distinct forms: one for ward-level data, capturing denominators such as the total number of patients in the ward, and another for patient-level data. Patient-level data was meticulously collected using a well-structured case record form. This form encompassed patient characteristics, comprehensive details regarding prescribed antimicrobials, the treatment's indication, the diagnostic basis, and the rationale underpinning the choice of antimicrobial.

The survey operations were orchestrated by a team leader hailing from the Department of Pharmacology and overseen by a project monitor from the clinical team. Ensuring the integrity of the data collection process and safeguarding patient confidentiality were paramount, with supervision provided by the Head of the Department of Pharmacology and the Hospital Medical Superintendent.

Identification of study participants

Antimicrobial prescription indications were categorized into two primary classes: infection and prophylaxis. Within the infection class, further subdivisions were made, including definitive and empiric therapy. Definitive therapy denotes treatment initiated once the infection site or causative microorganism has been identified through microbiological tests, such as culture and sensitivity testing. In contrast, empiric therapy is administered to patients with suspected infections before the site or causative organism is conclusively identified.

Prophylaxis, on the other hand, refers to the preventive use of antimicrobial drugs when an active infection is not currently present. An additional category labeled 'unknown' was assigned when no discernible reason for the antimicrobial prescription could be extracted from the patient's records.

The treatment duration was defined as the number of days spanning from the commencement of antimicrobial treatment to the date of the survey. It's important to note that treatment was categorized as definitive only if it was backed by culture and sensitivity testing conducted on specimens such as blood, urine, or sputum.

Ethical considerations

The mentioned study proposal was approved by the institutional ethics committee VMMC & SJH, New Delhi. The study was conducted in adherence and compliance of Good Clinical Practice (GCP) and the declaration of Helsinki.

Statistical analysis

The analysis of the statistical data was scheduled to be performed using SPSS version 13.0. The description of the section pertaining to patients receiving antimicrobials and other observed parameters in this survey was intended to be presented using two key indicators: frequency and percentage.

Results

A total of 1005 bed patients were surveyed across six departments from our tertiary care hospital. Among these 737(73.3%) patients were on antimicrobials (table 1). The study recorded antimicrobials with an average of 2.32 antimicrobials per patient (range 1.8 to 2.3). (Tables1 and 2).

A relatively low number of patients were found to be on 2 or more antimicrobials. A total of 737(73.31%) patients were prescribed AMAs of which 485(65.80%) were prescribed empirically as indication, whereas patients 105 (14.24%) were prescribed AMAs prophylactically and 147 (20.00%) patients received AMAs for culture based.

Discussion

In India, there has been a scarcity of point prevalence surveys, and our study marks a pioneering effort in characterizing antimicrobial utilization practices within our hospital and drawing comparisons with similar surveys conducted nationwide. While antimicrobial resistance remains a global concern, it predominantly manifests within hospital settings, making these surveys pivotal in improving antimicrobial use and the quality of antibiotic prescriptions. The insights gleaned from such data can be valuable inputs for regional and national antimicrobial stewardship programs. _[3]

Our survey revealed a point prevalence of antimicrobial utilization at our hospital, with 73.3**%** of patients receiving antimicrobial agent,this figure was slightly higher compared to a multicentric point prevalence survey conducted across India, which reported that 57.4% of patients were on antimicrobials.

Infectious diseases indeed constitute an important cause of hospital admissions in Indian hospitals. 20.5% of patients received 2 or more antimicrobials. Our point prevalence survey conducted at this tertiary care center a total of 1005 patients over two weeks brought forth some important findings. Foremost, the antimicrobial use across the centers was reasonably high at 73.3 %. This relatively high use of antimicrobials is in contrast to an earlier survey conducted in India where a prevalence of around 57.4% was noted_[6] The total of 7 departments covered included general medicine, intensive care unit (ICU), surgery, Orthopedics, OBG and gynecology, burns & Plastic surgery and the Pediatric department, affiliated with the main hospital.

Globally, data collected in the 2015point prevalence survey across 53 countries indicated a 34.4% prevalence of antimicrobial use. However, it's worth noting that regional variations exist, with 2017 studies revealing higher antimicrobial use rates of 48.2% in South and East Asian hospitals compared to 29.6% in European hospitals_[2]

It's worth mentioning that these hospitals often admit patients transferred from other healthcare facilities who are already on antimicrobial regimens, leading to less efficient culture positivity rates. Moreover, for patients admitted through emergency departments, the overcrowded and resource-constrained environments frequently hinder the collection and processing of appropriate cultures. Nonetheless, this data highlights the importance of implementing strategies for sending cultures as a vital intervention for antimicrobial stewardship. _[5]

Understanding the factors contributing to the prevalence of antimicrobial use in patients is essential. Firstly, doctors often face financial incentives that may lead to an undue focus on prescribing drugs, while certain hospital business models prioritize drug sales, resulting in increased prescription rates. Secondly, the management of quality improvement projects leaves much to be desired. Data from a study conducted in China suggested that pharmacist interventions within clinical settings could positively influence healthcare providers and contribute to more judicious antimicrobial use.

Our study's data concerning the indications for antimicrobial use revealed that 85.8% of prescriptions were for treating infections, while 14.2% were for prophylactic purposes. Within the infection category, only 20.0% of prescriptions were definitive, with the majority, 65.8%, being empiric.

In our study, the most frequently utilized antibiotics were beta-lactam antibiotics, accounting for 60.62% of prescriptions, followed by aminoglycosides at 18.62% , nitroimidazoles (metrogyl) Fluoroquinolones, and macrolides shared the third position, each representing 6% of prescriptions. Among the top prescribed antibiotics were third-generation cephalosporin. Notably, Glycopeptides (vancomycin) , carbapenem, and polymixins were also prescribed in critical care units, which is an unfavorable finding. (table 3)

Comparatively, observations from another Indian study indicated that the most common antibiotic classes were third-generation cephalosporins (44%), penicillins (14.4%), and metronidazole (12%). The ESAC-2011 and the global PPS 2015, which encompassed 24.8% of the world's total antimicrobial prescriptions, suggested that penicillins, along with beta-lactamase inhibitors, were the most commonly used antibiotics_[6]

Numerous studies conducted worldwide yielded results in line with the global PPS 2015, with penicillins combined with beta-lactamase inhibitors (24%) being the most frequently prescribed antibiotics, followed by macrolides (15%) and fluoroquinolones (11%). For instance, a study in the USA in 2002-2003 identified levofloxacin, cefazolin, ceftriaxone, metronidazole, and vancomycin as the most common antibiotics in prescriptions_[2]

Point prevalence surveys have their share of significant limitations. Since they capture data at a single point in time, their results may be susceptible to external factors, including day-to-day fluctuations and seasonal variations in antibiotic usage. Additionally, this study couldn't comprehensively analyze all the quality indicators established for assessing antimicrobial prescribing, primarily due to resource constraints_[2]

However, the survey's strengths lie in its straightforward protocol, encompassing the inclusion of every admitted patient receiving antimicrobial treatment, and the involvement of experts in data collection. In resource-constrained settings, point prevalence surveys can often serve as the sole viable method to obtain a reliable assessment of antimicrobial utilization within hospitals.

Conclusion

Our point prevalence study was able to demonstrate the conducting of a point prevalence survey in high patient volume like tertiary care hospital with paper-based medical record systems and also illustrate the control parameters of intervention for inducting future action plans and policies needed for the better results of study.

The study showed that it's possible to survey a busy medical setting that still uses paper records. It also set the stage for looking at how future changes might affect things. The areas they found to work on are making surgery prevention better, cutting down on unnecessary treatments, starting a habit of testing for infections, and using fewer powerful treatments when possible. This survey should give us useful information on how well different efforts to manage medicines are working.

This survey will help generate data in evaluating the impact of various antimicrobial stewardship interventions.

Source of funding

NONE

Conflict of interest

NONE

Ethics Statement

This study was approved by the VMMC Institutional Ethics Committee, New Delhi, India.

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