



Point-Prevalence Survey for the Hospital-Acquired Infections in Intensive Care Units of Trauma Center in a Tertiary Care Hospital of Northern India

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J Lab Physicians 2022;14:115–118.

Abstract

Background The burden of hospital-acquired infections (HAIs) is all assumption based, and the true burden remains unknown in most countries, particularly in the developing countries where healthcare facilities are suboptimal and knowledge is limited.

Methodology This cross-sectional study was conducted at the trauma center of a tertiary care institute from August to September 2019, to assess the burden of HAI and antibiotic resistance pattern of HAI. The total sample size in our study was 105. Our objective was to estimate the point prevalence of HAI and study the associated factors in a tertiary care hospital.

Result In this study, the point prevalence of HAI was five to six times higher when compared with that of developed countries. Gram-negative organisms were the predominant bacteria; with *Acinetobacter baumannii* the most common among them.

Conclusion Point-prevalence survey is an important objective of the antimicrobial stewardship program; it will be helpful in controlling antimicrobial resistance and this tool plays a significant role in hospital settings. Our study is quite pertinent to assess the point prevalence of HAI. It will help in knowing the current prevalence and pattern of the HAI. Therefore, as healthcare administrators, we can further decrease the HAI for better patient outcomes in the future.

Keywords

- ▶ hospital-acquired infection
- ▶ point prevalence
- ▶ *Acinetobacter baumannii*

Introduction

Hospital-acquired infections (HAI) are defined as “infections occurring in a patient or in a hospital or another healthcare facility in whom the infection was not present or incubating at the time of admission.”¹

HAIs are associated with increased mortality and morbidity and pose a tremendous strain to the health system and it is considered as a major public health problem in developed as well as developing countries. It is also responsible for an

increase in the average length of stay in hospital and increased healthcare expenditure. As per the estimates, in the United States, HAIs are associated with 88,000 deaths and an economic burden of \$4.5 billion per year.^{2–5}

To check this problem, effective surveillance of HAIs is an important step for every healthcare facility. The surveillance mechanism not only helps in reducing the HAIs but also helps in quality improvement by identifying and rectifying the problem in the hospitals. The increasing trend in HAIs is a universal problem and every health system has a dedicated

published online
July 9, 2021

DOI <https://doi.org/10.1055/s-0041-1731946>.
ISSN 0974-2727.

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surveillance team/mechanism to control the HAI. The surveillance mechanism can be prospective or retrospective and each method has its advantages and disadvantages.⁶

As per the Centers for Disease Control and Prevention (CDC), "The gold standard for HAI surveillance is a large, prospective, continuous, hospital-wide, incidence survey. However, few hospitals opt for this approach because incidence surveys require a significant amount of manpower, material resources and a greater number of trained personnel."⁶⁻⁹

In world history, there have been many diseases that humans have had to fight. We have used natural remedies, antibiotics, surgical procedures, and vaccines to treat and prevent the disease from occurring or spreading. Our focus on medicine and treatment of disease from history to today is due to our burning desire to keep human beings alive and well for as long as we can. To study our progression with the treatment of disease, we must use point prevalence.

Point prevalence is defined as "the number of people who have a disease over the total amount of people in the population at a particular point in time. If we can pinpoint how many people are suffering from a disease at one time, then we can see if that number has increased or decreased the next time that is how, we find the point prevalence. We can also see the need for further research or funding to treat a disease."⁶

Point-prevalence surveys are simple, fast, and relatively inexpensive compared with incidence surveys.⁹ The prevalence of HAIs varies with the socioeconomic level, the type of medical facilities, ethnicity, dietary habits, lifestyle, and behaviors.^{10,11} It's an important objective of antimicrobial stewardship program and will help in controlling antimicrobial resistance (AMR).

In most of the countries, the surveillance criteria have been incorporated with the definitions and diagnostic criteria for "healthcare-associated surveillance" established by the CDC. Despite difference in the diagnostic criteria of HAI, it is observed from various studies that the prevalence of HAI is inversely related to national prosperity.^{2,3}

AMR is another challenge that is closely related to HAIs. Inappropriate use of antimicrobials is the most important cause of the emergence and spread of resistant microorganisms at the community and hospitals.

Conducting continuous active surveillance helps to identify the root causes of HAIs, patterns of microorganisms, and types of antibiotic resistance that help the infection control team of a hospital to improve their management protocols. Additionally, point-prevalence surveys of HAIs are an important tool for comparison among the healthcare facilities at national as well as at the international level.¹

Need of the Study

In most of the cases, the burden of HAIs is all assumption based, and the true burden remains unknown in most of the countries, particularly in the poor countries where healthcare facilities are suboptimal. Addition to this, limited data are available from India. Developing nations like India, where advance technology to monitor adherence may not be

available, direct observation remains the choice. Continuous training, performance feedback, verbal reminders and effective surveillance will be needed to sustain adherence to prevent and control HAI. So, our study is quite pertinent to assess the point prevalence of HAI; it will help to know the current prevalence and pattern of the HAI. Therefore, as a healthcare administrator, we can further decrease the HAI for better patient outcomes in the future.

Methodology

This cross-sectional study was conducted on the trauma center, of a tertiary care institute from August to September 2019, to assess the burden of HAI and antibiotic resistance pattern of HAI. For the data collection, by using a convenient sampling method, the existing HAI checklist was used by the investigator. Our study population includes all the patients of polytrauma intensive care unit (ICU) who were initiated on parenteral antibiotics during the study period of 24 hours. The case sheets of these patients are obtained from the ICUs to determine if appropriate cultures (blood, respiratory secretions, urine, pus, or cerebrospinal fluid) have been sent for these patients, before initiating or changing antibiotics, for dosage adjustments. Total sample in our study was 105. Data were analyzed for frequencies, percentages, and mean value that were calculated using the Statistical Package of Social Sciences (SPSS), Version-22. The aim of our study was to estimate the point prevalence of HAI and study the associated factors in a tertiary care hospital.

Results

Total sample size was 105. Mean age of the patients was 38.70 ± 20.51 years. Majority of patients were male 82 (78.1%). Our study revealed that most of the admitted patients were suffering from polytrauma (43; 41%), followed by abdominal injury (22; 21%), long bone injury (22; 21%), chest injury (13; 12.4%), spinal injury (3; 12.4%), and neck and vascular injury (1 each; 1%). It was observed that empirical treatment was started for 64 (61%) patients. Additionally, for the rest of the patients, the sample was taken for microbiological culture and sensitivity test. No growth was observed in 73 patients. The prevalence of HAI was observed at 30.4%. The most common sample taken was bronchoalveolar lavage (BAL) 15 (14.3%) and blood 15 (14.3%), followed by pus 6 (5.7%), tissue 3 (2.9%), wound swab 1 (1%), and others body fluids 1 (1%). After getting the culture report, we found that *Acinetobacter baumannii* was the most common organism (9; 8.6%), followed by *Escherichia coli* (6; 6.2%) and *Klebsiella spp.* (5; 5.2%). However, *Pseudomonas spp.*, *Proteus spp.*, *Stenotrophomonas maltophilia*, and *Enterococcus spp.* constitute 1% each from the culture. Initially, most 44 (41.9%) of the patients were put into two antibiotics, followed by 23 patients (21.9%) who were put on three antibiotics, 17 (16.2%) on four antibiotics, and 16 (15.2%) into one antibiotic. However, it was noted that only one patient was put on seven antibiotic combinations. It was also observed that

Table 1 Variables pertaining to the point-prevalence study

Variables	n	%
Sex		
Female	23	21.9
Male	82	78.1
Types of trauma		
Polytrauma	43	41
Abdomen injury	22	21
Chest injury	13	12.4
Spinal injury	3	2.9
Neck injury	1	1
Vascular injury	1	1
Microorganisms		
<i>Acinetobacter baumannii</i>	9	8.6
<i>Escherichia coli</i>	6	6.2
<i>Klebsiella</i> spp.	5	5.2
<i>Enterococcus</i> spp.	1	1
<i>Enterobacter</i> spp.	1	1
<i>Proteus</i> spp.	1	1
<i>Pseudomonas</i> spp.	1	1
<i>Stenotrophomonas maltophilia</i>	1	1
<i>Providencia</i> spp.	1	1
Samples		
Bronchoalveolar lavage	15	14.3
Blood	15	14.3
Pus	6	5.7
Tissue	3	2.9
Wound swab	1	1.0
Fluid	1	1.0
Total number of antibiotics used		
1.00	16	15.2
2.00	44	41.9
3.00	23	21.9
4.00	17	16.2
5.00	4	3.8
7.00	1	1.0
Drugs/drug combinations given against		
Gram negative	60	63.2
Gram-negative and gram-positive agents	15	15.8
Gram negative and antifungal agents	6	6.3
Gram negative, gram positive, and antifungal agents	6	6.3
Gram positive agents	5	5.3
Gram positive and antifungal agents	2	2.1
Antifungal agents	1	1.1

initially, a drug against gram-negative bacteria was most commonly used (60; 63.2%), followed by gram-positive and gram-negative combination 15 (15.8%); gram-positive, gram-negative, and antifungals were used in combination among six (6.3%) patients. Only gram-positive drug was administered for five patients (5.3%, ► **Table 1**).

Discussion

Our pilot study was aimed to estimate the point prevalence of HAI and study the associated risk factors in a tertiary care hospital. The point prevalence came around 30.4%, which is quite high as compared with mean HAI prevalence of 7.1%

reported by the European Centre for Disease Prevention and Control and 6.4% reported by the English National Point Prevalence Survey on HAI. However, a similar finding was observed in a study conducted by Shin et al where point prevalence came around 33.5%.¹² In our study, it was observed that most of our patients were male; similar findings were observed in a study conducted by Hassan and El-Gilany in Egypt.¹³ This may be because we conducted this study in a trauma center and men are involved more in outdoor activities; so they are more prone to accidents. A similar finding was observed from the Global Burden of Disease Study¹⁴ in which patients were mostly middle-aged. The most common sample taken was BAL and blood, followed by pus, tissue, wound swab, and other body fluids. This may be because most of our patients suffered from multiple traumas and, due to technical feasibility, the most common samples were blood and BAL.

Regarding culture results, the predominant organisms were gram-negative and similar findings were observed in a study conducted by Shin et al.¹² Among gram-negative organisms, *A. baumannii* (a gram-negative rod) was the most common organism found among the patients, followed by *E. coli* and *Klebsiella spp.* Similar findings were observed in a study in India conducted by Choudhuri et al.¹⁵ Our study also revealed that most offered initial modality of treatment for the trauma patients was a combination of two antibiotics, followed by three and four antibiotics, respectively.

It was also observed that after the culture report, a drug against gram-negative bacteria were mostly used, followed by gram-positive and gram-negative combination. This finding suggests that HAI awareness and education are well covered in our ICU settings and use of antibiotics among trauma patients providing them prompt gram-negative coverage based on culture reports is prescribed.

To summarize, our study indicated that polytrauma patients were more commonly admitted in the trauma center; they are more prone to HAI by gram-negative organisms. The prevalence of HAI in our study was five to six times higher compared with the developed countries as they have fewer chances of infections. As a hospital administrator, there is an urgent need to reduce the point prevalence of HAI by proper training and interdepartmental collaboration, where the Hospital Infection Control Committee should play a leadership role.

Limitation of the Study

We conducted this study in a small period with a single area of a trauma center, so we have less sample size. Therefore, it is not possible to generalize our findings. To do that in future, we need a larger sample size with a longer period.

We also need to consider the associated risk factors that we did not take into the account in our study due to feasibility issues.

Conclusion

The point prevalence of HAI in our study was five to six times higher compared with the developed countries. It has been

observed that gram-negative organisms were predominant for causing HAI. Among them *A. baumannii* was the most common gram-negative organism that was reported to cause infections. Drugs targeted on gram-negative organisms are most used antibacterial agents among the HAI patients based on the culture reports. Therefore, carrying out culture of cultures will be helpful in antimicrobial stewardship programs and controlling AMR.

Conflict of Interest

None reported.

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