Original Research Article

Point prevalence study of Hospital acquired infections in intensive care units of a tertiary care teaching hospital in Uttarakhand

Geetika Rana[1], Shantanu Aggarwal[2,*], Dimple Raina[1], V K Kataria[1]

[1]*Dept. of Microbiology, Sri Guru Ram Rai Institute of Medical and Health Sciences, Patel Nagar, Dehradun, Uttrakhand, India*
[2]*Dept. of Community Medicine, Sri Guru Ram Rai Institute of Medical and Health Sciences, Patel Nagar, Dehradun, Uttrakhand, India*

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ABSTRACT

Background: Hospital acquired infections (HAI) are one the biggest challenges that the hospitals face in patient care. The rates are even higher in patients admitted in intensive care units (ICUs). The true burden of HAI in our state of Uttarakhand is still unknown.

Materials and Methods: This study was done to determine the prevalence rate of HAI in the ICUs of a tertiary care teaching hospital in Uttarakhand. A series of two 1- day point prevalence studies was conducted in our hospital in October 2017 and February 2018 in all the ICUs of our hospital. The study comprised of 92 patients admitted for more than 48 h in the ICU. The nurses were trained to collect the data collection form according to Centers for Disease Control and Prevention definition of HAIs.

Results: Out of 92 eligible patients in ICU, 25 (27.2%) had acquired HAI. Overall a total of 37 HAIs were identified as few patients had >1 type of HAI. Respiratory tract infection (RTI) had the highest prevalence of 16.3% followed by Bloodstream infections (14.1%). Mechanical ventilation was found to have maximum association with HAI (43.6%). This association was found to be statistically significant (p = 0.002). Acinetobacter was the most common isolate (33%).

Conclusions: The highlight of this study was raising awareness about the current HAI rates in our hospital and reinforcing the importance of correct infection control practices amongst the doctors and nursing staff.

1. Introduction

Hospital acquired infections (HAI) are the infections acquired by the patient during hospital care which are not present or incubating at the time of admission. Infections occurring more than 48 hours after admission are usually nosocomial.[1] HAI rate of a hospital is a direct indicator of quality and patient care. A patient comes to the hospital with a lot of faith and hope. It is our duty to ensure that he doesn't go back with HAI.

HAIs are most commonly caused by multidrug resistant (MDR) organisms that leads to a prolonged antibiotic treatment, longer hospital stays, escalating hospital bills and ultimately increasing morbidity and mortality rates.

Though the threat of HAI is a globally recognised and prioritized phenomena but the scenario in Indian hospitals still varies. Till now, majority of hospitals in India fail to identify the threat of raising HAI rates and fail to implement any preventive measures to rectify this problem. Inadequate resources, no infection control surveillance teams, non-existent/ poorly implemented antibiotic policy, injudicious use of invasive devices and antibiotics, non – compliant staff, poor hygiene and sanitation are some of the major issues leading to high HAI rates in Indian hospitals.[2] In fact, as per a review by world health organisation (WHO), the pooled prevalence of HAI in low income countries is 10.1% which is double the prevalence in high income countries.[3] Periodic and routine surveillance of HAI is an essential first step to identify local problems and

* *Corresponding author.*
E-mail address: drshantanu.psm@gmail.com (S. Aggarwal).

priorities. It also helps to monitor the implementation and efficiency of infection control measures. This is essential to prevent the emergence and spread of multidrug resistant organisms. Routine surveillances also spread awareness on the importance of infection control measures and helps to increase the compliance of healthcare personals. Thus, reducing the HAI rates in the hospital.[4]

Prospective surveillance for HAIs are routinely done in developed countries on national level. But very scanty data is available for developing countries like India. Although, continuous prospective surveillance is the best approach but it requires comprehensive resources. The biggest advantage of point prevalence study is that it can be done on a single day with minimum resources. Along with the HAI rates, it also provides data on associated risk factors. Such data can then be used to focus any interventional programmes to reduce the burden of disease. Such a study helps to identify target areas in hospitals for quality improvement. Hence, in a resource limited country, point prevalence surveys are an efficient way for determining magnitude of HAI.[5]

Intensive care units (ICUs) are the most vulnerable sites for HAIs in a hospital. ICUs have patients with serious medical ailments, complications and pre-existing co-morbidities. They are commonly exposed to multiple invasive devices and procedures which make them an easy target for MDR organisms. Poor reflexes and low immunity favour the multiplication of pathogens thus leading to development of various HAIs.

Therefore, our study aimed to estimate the burden of various HAIs in the ICUs of our hospital and associated risk factors.

2. Materials and Methods

The point prevalence study of HAI was conducted in all the ICUs of a 1500-bedded tertiary care teaching hospital in Uttarakhand. The study was conducted in two phases: first in October 2017 and next in February 2018 in all the ICUs. Since this was the first time that such a survey was being done in our hospital, it was decided to restrict the survey to only ICUs due to restriction of human and financial resources.

All admitted ICU patients who had been in the hospital for at least 48 hours were included in the study. Ethical approval was obtained from the Institutional Ethics Committee. Nursing staff of all the ICUs was trained by the department of Microbiology in a series of lectures. They were taught about HAIs and how to identify them according to CDC definitions.[6] They were shown how to fill the data collection performa by the help of various real case examples. The data collection form included patient's demographic details, admission date, consultant speciality, ICU location, use of urinary catheter, any surgical procedure (during last 30 days), mechanical ventilation, intravascular catheter, antimicrobial therapy, presence of HAI and type of

HAI. Re-enforcement of the importance of infection control measures was also established during these sessions. On the day of the survey, a team comprising of microbiologist, respective doctors and nurses incharges of various ICUs collected data from all the eligible patients.

2.1. Statistical analysis

Data was entered and analysed in SPSS version 22.

3. Results

A total of 92 patients were included in this study (44 and 48 in each phase respectively). Males (58, 63%) were more in number than females (34, 37%). Maximum patients belonged to the > 60 years (37%) and <18 years (32.6%) age group (Table 1). 45 patients were in Surgical ICU, 17 in Neonatal ICU, 10 in Medical ICU, 10 in Paediatric ICU, 7 in Cardiac ICU and 3 in Respiratory ICU. 85.9% patients had intravascular catheter, 70.65% had urinary catheter, 42.4% had mechanical ventilator and 35 had undergone a surgical procedure.

Out of 92 eligible patients in ICU, 25 (27.2%) had acquired HAI. Overall a total of 37 HAIs were identified as few patients had >1 type of HAI. HAI prevalence was found to be highest in NICU (47.1%) followed by SICU-II (41.7%), MICU (30%), SICU-I (14.3%) and PICU (10%) (Table 2).

Mechanical ventilation was found to have maximum association with HAI (43.6%). This association was found to be statistically significant (p = 0.002) (Table 3). Respiratory tract infection (RTI) had the highest prevalence of 16.3% followed by Bloodstream infections (14.1%), line related (4.34%), others (4.34%), urinary tract infection (1%) and Surgical site infection (0%) (Table 4).

Microbiological culture results were available for 29 HAI (78.3%). Acinetobacter was the most common isolate (33%) followed by Klebsiella spp. (19%), Pseudomonas spp. (9%), E.coli (9%), Proteus (5%), S. maltophila (5%), Enterococcus spp. (5%), Enterobacter spp (5%) Serratia spp. (5%) and Candida spp. (5%).

4. Discussion

Ours was the first point prevalence study conducted in our hospital. Though there have been many similar studies reported from India and abroad but none have been reported from Uttarakhand. In our study the overall HAI prevalence in ICUs was found to be 27.2%. In a similar point prevalence study conducted in a tertiary care hospital in Pune, the HAI rates in ICU was 25%.[7] Malhotra et al in their point prevalence study of HAI in a tertiary care hospital in Delhi reported a high prevalence of 33.3% in their ICUs.[8] A study done in 7 cities of India reported HAI prevalence of 9.06 per 1000 ICU days.[9] Whereas, a study conducted by ECDC in European acute care hospitals showed a prevalence

Table 1: Age – wise and gender-wise distribution

Age Group	Gender		Total
	Male	Female	
	Number (%)	Number (%)	Number (%)
0 – 18yrs	18 (31.0)	12 (35.3)	30 (32.6)
19 – 25yrs	4 (6.9)	1 (2.9)	5 (5.4)
26 – 40yrs	3 (5.2)	5 (14.7)	8 (8.7)
41 – 60yrs	12 (20.7)	3 (8.8)	15 (16.3)
>60yrs	21 (36.2)	13 (38.2)	34 (37.0)
Total	58 (100)	34 (100)	92 (100)

Table 2: HAI prevalence by ICU type

ICU	Total Patients	Patients With Hai	HAI Prevalence (%)	Odds Ratio	95% C.I
CCU	7	0	0.0	0.00	-
MICU	10	3	30.0	0.60	0.12 – 2.91
NICU	17	8	47.1	1.24	0.36 – 4.35
PICU	10	1	10.0	0.16	0.02 – 1.43
RICU	3	0	0.0	0.00	-
SICU- I	21	3	14.3	0.23	0.05 – 1.01
SICU- II	24	10	41.7	1.00	
Total	92	25	27.2		

ICU: intensive care unit, CCU: cardiac care unit, MICU: medical intensive care unit, NICU: neonatal intensive care unit, PICU: paediatric intensive care unit, RICU: respiratory intensive care unit, SICU: surgery intensive care unit

Table 3: HAI prevalence by risk factors type

S. No	Risk Factors	No. of patients	Presence of HAI	HAI prevalence %	Odds Ratio (95% CI)	p Value
1	Surgery	35	11	31.4	1.41(0.55 – 3.58)	0.47
2	Urinary Catheter	65	16	24.6	0.65(0.24 – 1.74)	0.39
3	Mechanical Ventilator	39	17	43.6	4.35(1.63 – 11.62)	0.002
4	Intravascular Catheter	79	23	29.1	2.26(0.46 – 10.99)	0.30

Table 4: Number, percentage and prevalence of HAI, by type

HAI site	Total	% of total	Prevalence (%)
SSI	0	0	0
UTI	1	2.7	1
BSI	13	35.13	14.1
RTI	15	40.54	16.3
Line Related	4	10.8	4.34
Others	4	10.8	4.34
Total	37	100	

SSI: surgical site infection, UTI: urinary tract infection, BSI: bloodstream infection, RTI: respiratory tract infection

of 19.5% in their ICUs.[10] Aliki M et al in their point prevalence study done in three Swiss hospitals reported HAI prevalence in ICU as 26.2%.[11] Similar multicentic study done in hospitals of Ireland reported a prevalence of 23.3%.[12] While a multicentre 1-day point prevalence study in hospitals of Turkey reported a high prevalence of 48% in their ICUs.[13]

A review of literature done on similar studies showed ICUs to have the highest burden of HAIs in hospitals. This is because of many associated risk factors. Exposure to medical devices, underlying immunocompromised conditions, co morbidities, antimicrobial therapy, any surgical procedures, prolonged stay are some of the important risk factors. As a result patients in ICUs suffer from increased morbidity, mortality and financial costs.[7,9,14] Our study included all the ICUs of our hospitals including neonatal and paediatrics. Neonatal ICU was shown to have the highest HAI prevalence (47.1%) followed by surgical ICU (41.7%) but this association was not found to be significant.

In our study, respiratory tract infection (RTI) had the highest prevalence of 16.3% followed by bloodstream

infections (14.1%). Our results were corroborated by Esen S et al, in which lower respiratory tract infection (28.0%) followed by bloodstream infection (23.3%) were the most frequent types of HAI.[13] Dasgupta et al also reported Pneumonia as the most frequent type of HAI (62.07%) in their study.[15] Whereas, Nair et al in their study reported surgical-site infections (SSIs) as the most common HAI (23.94%) followed by hospital-acquired pneumonia (HAP) (18.31%).[7] Malhotra et al reported UTI to be the most common type of HAI in their study.[8] This difference could be because of the fact our study was restricted only to ICUs of our hospital whereas these studies also included the wards.

We studied common risk factors for HAIs like surgery, mechanical ventilation, urinary catheter and intravascular catheter. It was found that mechanical ventilator had a statistically significant association (p = 0.002) and the highest odds of acquiring HAI (OR = 4.35, 95% Confidence interval = 1.63 – 11.62). Our findings were also corroborated with study by Nair et al which reported mechanical ventilation having the highest odds of acquiring HAI (18.57).[7] Other similar studies also reported mechanical ventilation as a common risk factor for acquiring HAIs.[13] These results highlight the importance of following correct practices during device insertion and maintenance.

Acinetobacter spp. was found to be the most common causative agent of HAI (33%) followed by Klebsiella spp. (19%), Pseudomonas spp. (9%) and E.coli (9%). Similar results were reported in a study by Kolpa M et al in which the most common isolated microorganism was Acinetobacter baumannii (25%).[16] Acinetobacter spp is a known multi drug resistant pathogen found commonly in the hospital environment. On the other hand, Esen S et al[13] reported Pseudomonas aeruginosa (20.8%) and Dasgupta et al[15] reported Enterobacteriaceae (37.5%) as the most frequently reported isolate in their respective studies. Acinetobacter spp. isolated in our study was found to be multi drug resistant. The antibiotic resistance pattern showed 100% resistance to flouroquinolones, tetracycline and 95% resistance to carbapenems. No resistance was observed for polypeptides.

The highlight of this study was raising awareness about HAI and correct infection control practices amongst the nursing staff. Extensive training during every phase of the study helped in re-enforcing the importance of following correct infection control practices. This study provided a baseline data for monitoring the prevalence of HAIs in ICUs of our hospitals. It also highlighted the need to strengthen the infection control practices especially during device insertion and maintenance.

Ours was the first point prevalence study undertaken at our 1500 bedded teaching hospital in Dehradun. There were several limitations in our study. First, due to lack of resources, the wards were excluded from the study. Secondly, our study did not cover all risk factors leading to HAIs, such as underlying disease, previous hospitalisations, types of surgeries and admission to the emergency ward. And finally, such one day studies might not show the true rate of infections. But in resource limited set-ups, repeated point prevalence studies is a practical and cheaper option instead of continuous prospective surveillance.

In conclusion, the HAI prevalence rate in ICUs of our hospital was 27.2% and RTI being the most common type of HAI (16.3%). Mechanical ventilation was found to be the biggest risk factor in acquiring HAI. Acinetobacter spp. was the most common pathogen which was also multi drug resistant. With this baseline information of our hospital, adequate infection control methodologies can be designed to decrease the HAI rate of our hospital.

5. Source of Funding

6. Conflict of Interest

The authors declare they have no conflict of interest.

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Author biography

Geetika Rana, Assistant Professor

Shantanu Aggarwal, Assistant Professor

Dimple Raina, Associate Professor

V K Kataria, Professor and Head