PREVALENCE OF HOSPITAL-ACQUIRED INFECTION IN INTENSIVE CARE UNIT: A HOSPITAL-BASED STUDY FROM A TERTIARY CARE HOSPITAL OF BIHAR

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ABSTRACT

BACKGROUND

Hospital-Acquired Infection (HAI) have taken on a new dimension with outbreaks of increasingly resistant organisms becoming common. Protocol-based infection control practices in the Intensive Care Unit (ICU) are extremely important. Moreover, baseline information of the prevalence of HAI helps in planning specific implementations of infection control program. The aim of this study was to know the prevalence of Hospital Acquired Infections (HAI) and its isolates with their antibiogram in the medical Intensive Care Unit (ICU) patients in IGIMS, Patna.

METHODS

In our study 187 pts. were suspected having HAI from whom 304 samples from different sources like respiratory samples, urine, blood and pus were collected. The specimens were cultured onto suitable culture media like MacConkey agar, Sheep blood agar, Chocolate agar and Sabouraud Dextrose Agar (SDA). Culture plates were incubated aerobically at 37°C for 24-48 hours.

RESULTS

Prevalence of HAI in the present study was found to be 18.97%. Out of 304 samples processed, 120 (75.95%) was bacterial isolates and 38 (24.05%) was fungal isolates. Out of bacterial isolates, *Escherichia coli* was 28.33%, and among fungal isolates yeast other than *Candida albicans* (YOCA) was 19%.

CONCLUSIONS

This study provides baseline information of HAIs and associated risk factors for future surveillance. Efforts are needed to strengthen infection control programs, appropriate national strategies for prevention of HAIs, antibiotic stewardship and repeated prevalence studies in our institution in order to decrease the prevalence of HAI.

KEYWORDS

Antibiotic Susceptibility, Hospital-Acquired Infections, Medical Intensive Care Unit, Prevalent Microorganisms.

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INTRODUCTION

Throughout the world, multidrug-resistant hospital-acquired infections are one of the leading causes of death and morbidity among hospitalised patients, accounting a major burden on patients and public health system of any country.^[1,2]

The National Nosocomial Infection Surveillance System (NNIS) defines Hospital-Acquired Infection (HAI) as a localised or systemic condition, 1) That results from adverse reaction to the presence of an infectious agent(s) or its toxin(s) and 2) That was not present or incubating at the time

of admission to the hospital. For most bacterial hospital-acquired infections, this means that the infection usually becomes evident 48 hours (i.e. the typical incubation period) or more after admission. However, because the incubation period varies with the type of pathogen and to some extent with the patient's underlying condition, each infection must be assessed individually for evidence that links it to the hospitalisation.^[3]

The source of HAI may be exogenous (From other patients or the members of the hospital staff or inanimate environment in the hospital) or endogenous (From patient's own flora). In either case, the infecting organism may spontaneously invade the tissues of the patients or may be introduced into them by surgical procedures, instrumental manipulation or nursing procedures. Patients in Intensive Care Units (ICUs) have a higher risk of acquiring Hospital-Acquired Infections (HAIs) than those in non-critical care areas. ICU-acquired infection rate is five to ten times higher than hospital-acquired infection rates in general ward patients.¹ Considerable increased mortality and major costs are associated with ICU-acquired infections.³⁻⁵

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Hospital-Acquired Infections (HAI) are a cause of prolonged hospital stay are inconvenient for the patient, constitute an economic burden on health care and increase the mortality of hospitalised patients.⁴ The HAI was defined according to Centres for Disease Control and Prevention Standards. Mechanical ventilation, urinary catheters or intravascular devices were independent risk factors for HAI.^{6,7}

The most common HAI category was urinary tract infection followed by respiratory tract infections and surgical site infection.⁸ Both Gram-positive and Gram-negative bacteria and *Candida* spp. have been reported as a cause of infection in these patients. Recently, Gram-negative bacilli have been reported more frequently than Gram-positives in this setting.⁹ The ICUs are an area of considerable antibiotic use, in which antibiotic-resistant organisms are prevalent. Their prevalence and rates of resistance can vary enormously depending on geographic location as well as location among ICU types.¹⁰ For proper management of ICU infections, it is important to have updated knowledge about prevalence of the causative agents and their antimicrobial susceptibility patterns in institution-specific ICUs.^{11,12}

The objective of this study was to determine hospital-acquired infection in patients admitted to medical ICU to observe microbial profile in different types of samples and to create guidelines to suggest appropriate empirical antibiotics in HAI based on antibiotic susceptibility pattern of the strain isolated.

MATERIAL AND METHODS

The present observational study was carried out in the clinical microbiological laboratory of Indira Gandhi Institute of Medical Sciences, Patna, Bihar from December 2011 to June 2013, after the approval of research and Ethics Committee, IGIMS, Patna. A total of 187 patients were studied in the described period from the patients admitted in the 8-bedded Medical Intensive Care Unit (MICU) and 6 bedded Coronary Care Unit (CCU).

Inclusion Criteria

The patients were observed for any signs of site-specific infections or fever appearing any time after 48 hours of admission into ICU.

Exclusion Criteria

Patients admitted into ICU with any signs of infections.

Clinical specimens including tracheal aspirates, sputum, urine, urine catheter tips, central venous line tips, blood, body fluids, pus and others were collected from the patients and were processed at Microbiology Laboratory of the hospital. The specimens were cultured onto suitable culture media like MacConkey agar, Sheep blood agar, Chocolate agar and Sabouraud Dextrose Agar (SDA). Culture plates were incubated aerobically at 37°C for 24-48 hours. The isolates were identified by colony morphology, gram-staining and a battery of biochemical reactions. Antimicrobial susceptibility testing was performed on Mueller Hinton agar using disc diffusion method in accordance with Clinical and Laboratory Standard Institute Guidelines (CLSI). Zone size of each antimicrobial agent were recorded and interpreted as resistant, intermediate or susceptible. Intermediately susceptible isolates were considered resistant.

RESULTS

During our study period, total admissions to our ICU were 1380. Patients admitted for more than 48 hrs. were 580. Among them 187 pts. were suspected from whom 304 specimens like urine, respiratory samples, blood and pus were collected; 110 pts. were identified to have hospital-acquired infection during their stay in the ICU. Thus, the frequency of Hospital-Acquired Infections (HAI) was 17.64%. Demographic data of patients with Hospital-Acquired infection are summarised in Table 1.

Age in Years	No.	%	Male No. (%)	Female No. (%)
Up to 20	2	1.8%	77 (70%)	33 (30%)
21-40	16	14.5%		
41-60	34	30.9%		
61-80	50	45.5%		
>80	8	7.3%		
Total	110			

Table 1: Demographic Data of Patients with HAI (N = 110)

Out of the 304 specimens processed, 158 samples of 110 patients showed growth after 24-48 hrs. of aerobic incubation are summarised in Table 2.

Samples	Isolates	%
Urine	60	38%
Respiratory sample	65	41.1%
Blood	28	17.7%
Pus	5	3.2%

Table 2: No. of Isolates in Different Samples of Different Patients (N = 110)

Out of the 110 patients, 30 pts. showed 2 isolates in same or two different samples and 4 pts. were positive for 3 isolates in same or different samples.

Isolates	No.	%
<i>Escherichia coli</i>	34	21.5%
<i>Acinetobacter</i> spp.	25	15.8%
<i>Citrobacter</i> spp.	19	12%
<i>Klebsiella pneumoniae</i>	12	7.6%
<i>Pseudomonas aeruginosa</i>	10	6.3%
Coagulase negative <i>Staphylococcus</i> spp. (CONS)	7	4.5%
<i>Staphylococcus aureus</i>	6	3.9%
<i>Proteus</i> spp.	4	2.5%
<i>Enterobacter</i> spp.	1	0.6%
<i>Enterococcus</i> spp.	1	0.6%
<i>Streptococcus</i> spp.	1	0.6%
Yeast Other than <i>Candida albicans</i> (YOCA)	30	19%
<i>Candida albicans</i>	8	5.1%

Table 3: Microbial Profile of the Isolates from Different Samples

The major pathogens which are responsible for HAI – *Escherichia coli* (21.5%), YOCA (19%), *Acinetobacter* spp. (15.8%), *Citrobacter* spp. (12%), *Klebsiella pneumoniae* (7.6%) and *Pseudomonas aeruginosa* (6.3%).

Antimicrobial susceptibility test showed all the isolates of *Acinetobacter* spp., *Klebsiella* spp., *Citrobacter* spp., *Pseudomonas aeruginosa*, *Proteus* spp., *Staphylococcus aureus* and *CONS* to be resistant to ampicillin. *Escherichia coli* showed 8.8% sensitivity to ampicillin. The sensitivity for imipenem in *Acinetobacter* spp. was 40%, while in other isolates it was 60-75%. Sensitivity for vancomycin and linezolid among *Staphylococcus aureus* and *CONS* was found 80-85%.

DISCUSSION

In this study we documented an overall HAI prevalence of 18.97%, which was in accordance with other studies particularly from developing countries (13.9%–17.9%) (Jroundi et al¹³ 2007; Allegranzi et al¹⁴ 2011, but less compared to 33.5% by Beaujean et al,¹⁵ but is higher when compared with point prevalence studies from developed countries (5.7%–6.8%) (Sartor et al,¹⁶ 2005). Disease, death and economic costs associated with HAI are increasing, especially in the last few decades. There are certain risk factors associated with high rate of HAIs like length of stay in the hospital, underlying immune compromised conditions, age of the patient, any surgical procedure during hospital stay and presence of invasive medical devices in situ (e.g. vascular catheters, urethral catheters, intubation of the respiratory tract).

Male patients were predominant in the present study and commonest age group affected among both male and female was more than 60-75 yrs. Malhotra S. et al⁵ observed that the infections was more among male than female. The increased incidence in geriatric age group may be due to their defective host defense mechanism was in accordance with other studies like Graves N. et al² and Malhotra S. et al.⁵ Similarly with respect to the role played by invasive devices in contributing to HAI, present study showed that 38% of UTI occurred in catheterised patients, 41.10% of pneumonia was associated with mechanical ventilation, 17.70% of bloodstream infections with catheter and 3.20% of local infections could be attributed to the use of invasive devices.

Gram negative organisms commonly reported include *Escherichia coli* (21.5%) followed by *Acinetobacter* spp. (15.8%), *Citrobacter* spp. (12%), *Klebsiella pneumonia* (7.6%), *Pseudomonas aeruginosa* (6.3%), *Proteus* spp. (2.5%), while Gram positive organisms were *Coagulase negative Staphylococcus* spp. (*CONS*) (4.5%), *Staphylococcus aureus* (3.9%), *Enterococcus* spp. and *Streptococcus* spp. (0.6%). Among fungal isolate, *YOCA* (19%) and *Candida albicans* (5.1%) were common isolates. In India, catheters and lung infections are believed to be the primary source of nosocomial infections and gram-negative organisms such as *Escherichia coli*, *Klebsiella*, *pseudomonas* and *enterococci* are predominant. Candidiasis is also on the rise in intensive care units.¹⁶⁻¹⁷

Generally, MRSA and multidrug resistant *Pseudomonas aeruginosa*, *Acinetobacter* species are known to cause difficulties in the treatment strategies. For the effective eradication of such pathogens can be done by specific higher antibiotics. Many studies have been done on successful elimination of resistant organisms.¹⁸ Among all other drugs colistin, vancomycin, linezolid and doripenem have given satisfactory results. Colistin therapy in cases of MDR *Acinetobacter* spp. and *P. aeruginosa* shown promising results.

In another research, it was found that linezolid is as effective as vancomycin for treating infections caused by MRSA.

Main problems in developing countries are understaffing, poor infrastructure in ICU and poor maintenance of records making situation difficult to get clarity on the incidence of these infections. Although, it is difficult to solve some problems associated with financial hardship in developing countries, most solutions are simple and not resource demanding. Infection control strategies such as hand hygiene and wearing gloves; paying attention to well established processes for decontamination and cleaning of soiled instruments and other items followed by either sterilisation or high-level disinfection and improving safety in operating rooms and other high-risk areas where the most serious and frequent injuries and exposures to infectious agents can resolve the problem to a major extent.

CONCLUSION

Efforts are needed to strengthen infection control programs, appropriate national strategies for prevention of HAIs, antibiotic stewardship in our institution in order to decrease the prevalence of HAI. Effective infection control measures must be followed in all intensive care units to prevent patients from acquiring infections in the intensive care units.

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