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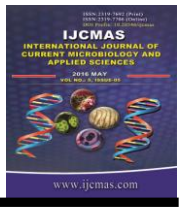

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A Study on the Prevalence and Microbiological Profile of Nosocomial Infections in the ICU of a Tertiary Care Hospital in Eastern India

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A B S T R A C T

This study was done to determine the prevalence of Nosocomial infections in the ICU and to identify the common microorganisms causing these infections and their antimicrobial sensitivity pattern. Nosocomial infection or hospital-acquired infection is a localized or a systemic condition resulting from an adverse reaction to the presence of infectious agents. Nosocomial infections are not present or incubating when the patient is admitted to hospital or other health care facility. They are caused by pathogens that easily spread through the body. Many hospitalized patients have compromised immune systems, so they are less able to fight off infections. These infections occur worldwide, both in the developed and developing countries. They are a significant burden to patients and public health. They are a major cause of death and increased morbidity in hospitalized patients, which is a matter of serious concern today. This study was done during the period of one year (2013- 2014) in the ICU of the tertiary care hospital in eastern India. Prevalence of nosocomial infection was determined; site of infection and the pattern of microorganisms were identified along with the assessment of antibiotic susceptibility profile. Patients who developed an infection after 48 hours of admission to the ICU were included in the study. A total of 324 ICU patients were analyzed, of these 79 patients were found to have developed a nosocomial infection (24.3% prevalence). Urinary tract infection was found to be more predominant followed by respiratory tract infection and soft tissue infection. The most frequently isolated microorganism was *Escherichia coli*, *Pseudomonas aeruginosa*, *Acinetobacter*, *Klebsiella pneumoniae* followed by other organisms respectively. Antibiotic susceptibility test of these isolates was done against commonly used antibiotics. Patients admitted to the ICU are especially susceptible to nosocomial infections. Despite adequate antimicrobial treatment, nosocomial ICU infections can significantly affect ICU stay and can cause an increase in patient's morbidity and mortality. Adherence to infection protocol, proper monitoring and the judicious use of antibiotics are important in preventing such infections on a regular basis.

Introduction

Nosocomial infection, also called healthcare acquired infection, is defined by the CDC as a localized or systemic condition resulting from an adverse reaction to the presence of an infectious agent(s) or toxin(s), without any evidence that the infection was present or incubating at the time of admission to the acute care setting. (Garnes *et al.,* 1988) Patients admitted to the ICU are mostly susceptible to nosocomial infections in view of significant risk factors such as central venous catheterization, urinary catheterization, mechanical ventilation, stress ulcer prophylaxis and increasing length of ICU stay. (Vincent *et al.,* (1995), Ak *et al.,* (2011), Esen *et al.,* (2004), Legras *et al.,* (1998).

Throughout the world multi-drug resistant nosocomial infections are one of the leading causes of death and morbidity amongst hospitalized patients, accounting a major burden on the patients and public health system of any country. (Shehabi *et al.,* (1996), Ducel *et al.*,(2002), Krishna *et al.*,) Critically ill Intensive care unit (ICU) patients are most vulnerable for developing these infections (Barai *et al.,* 2010). Compared with an average patient, an ICU patient has five to seven folds higher risk of nosocomial infection and ICU infections contributes to 20% to 25% of all nosocomial infections in a hospital (Günserena *et al.,* 1999). Factors like increasing use of invasive devices, immunosuppressive drugs and status as well as irrational use of antibiotic therapy in ICUs are all contributing for the same. (Zhang *et al.,*). The patterns of microorganisms causing various infections and their antibiotic resistance pattern vary widely from one country to another; as well as from one hospital to other and even among ICUs within one hospital (Barai *et al.*, 2010).

During the last few years the increase in antibiotic resistance has compromised the selection of empirical complicated treatment. Better management of patients cannot be ensured and the antibiotic policy cannot be designed if the profile of prevalent organisms along with their antimicrobial resistance pattern is known. Therefore, the present study was planned with an objective to evaluate the microbiological profile and their antimicrobial resistance pattern rate among different infections in the ICU patients in tertiary care hospital in Kolkata, India.

Material and Methods

The study was conducted in the ICU of GD Hospital & Diabetes Institute, a tertiary care hospital in Kolkata. Sample of the patient admitted in the ICU during the period of September 2013 to May 2014 were collected.

The CDC for disease control and prevention define ICU associated infection as those that occur after 48 hours of ICU admission or within 48 hour after transfer from an ICU. In the present study patients who had developed infection after 48 hour of admission to the ICU or clinically suspected of having acquired any infection were included in the study. Patient showing clinical signs of infection on or prior to admission or transfer to ICU were not included.

Few clinical signs and symptoms suggestive of infections are as follows: fever >38°C, New infiltrates on chest X-ray, Persistent Tracheal aspirates/secretions, Leukocytosis >10000/mm3, Turbid urine, Suprapubic tenderness, Thrombophlebitis, Cloudy effluent containing more than 100 Polymorphonuclear cells/mm3, Abdominal pain or tenderness, Dysuria, Burning micturition.

Various sources of clinical specimens included blood, urine, pus, cerebrospinal fluid (CSF), catheter tips, endotracheal tips, bronchial aspirates, central venous catheters (CVC) etc.

All the organisms were identified morphologically and biochemically by standard laboratory procedure. Specimens received were plated on the blood agar and Mac and incubated aerobically overnight at 37 degree centigrade. Single and mixed growth (two or more than two isolates) per specimens isolated from all the sample were identified by observing the colony characteristics on blood agar, Mac-Conkey agar plates and biochemical reactions using standard microbiological methods.

Only bacterial nosocomial infections were studied in detail in present study. Candida sp. was also identified. Samples were subjected to the testing and antibiotic sensitivity.

The following antibiotics (Hi-Media disc in mcg) were tested for sensitivity: Amikacin, Cefoperazone+Sulbactum, Ampicillin, Ampicillin+Sulbactum, Piperacillin +Tazobactum, Gatifloxacin, Cefazolin, Imipenam, Cefuroxime, Gentamycin, Cefotaxime.

Other information regarding the patient including age, gender, date of admission, was also collected from the case records of the patients.

The collected data was compiled and analysis was done using Statistical Package for Social Sciences (SPSS), version 20 (IBM, Chicago, USA). The results were expressed using appropriate statistical methods.

Results and Discussion

During the period of the study, a total of 324 medical ICU patients records were reviewed, of these 79 patients were found to develop nosocomial infection (24.3%).Out of 79 cases that developed Nosocomial Infection, urinary tract infection was the commonest 42(53.43%), followed by respiratory infection 24(30.38%) and soft tissue infection including surgical site 13(15.19%).

(Table 1). Gram-negative organisms were more common (86.67%) than the gram-positive organism (13.33%).

Urinary tract infection were frequently caused by *E.coli* (38.40%) followed by *Pseudomonas* aeruginosa (23.10%), *Acinetobacter* (14%), *Enterococcus* (13%) & *Klebsiella* (11.50%). *E.coli* isolates were sensitive to Gentamycin & Nitrofuratoin. *Pseudomonas* isolates were sensitive to Imipenem, Piperacillin, Gentamycin & Amikacin.

Respiratory Tract Infection was most frequently caused by Acinetibacter (40%) followed by *Pseudomonas* (29.80%), *Klebsiella* (21.70%) and *E.coli* (8.50%). (Table 2)

24% of *Acinetobacter* isolates were MDRO; the other were sensitive to Imipenem, Piperacillin, Polymixin, Cefoperazone, Colistin, Teteracyclin & Doxycyclin. *E.coli* isolates were sensitive to Gentamycin, Amikacin & Imipenem.

The average ICU stay of patients with and without nosocomial infection was 15.7days (4-40days) and 5.2 days (3-21days) (Table 3) .

Our study showed the prevalence of Nosocomial infection, its type, antibiotic susceptibility pattern of bacterial organism isolated from different samples from critically ill patient's after 48hours of admission to detect the Hospital acquired infection.

In this study the prevalence of Nosocomial Infection was 24.3%. The most predominant organism in our study was *E.coli* (34.6%) followed by *Pseudomonas* (32.6%), *Acinetobacter* (13.9%), *Klebsiella* (12.1%), & *Enterococcus* (5%). (Table 4)

Table.1 Prevalence of Nosocomial Infections

Nosocomial Infection (site)	Number	Percentage
Urinary Infections	42	53.43%
Respiratory Infections	24	30.38%
Soft tissue/surgical site infections	13	15.19%
Total	79	

Table.2 Patterns of Microorganisms

UTI		**RTI**		**Soft Tissue/surgical site**	
Organism	**%**	**Organism**	**%**	**Organism**	**%**
E. coli	38.4	*Acinetobacter*	40	Proteus	25.9
Pseudomonas	23.1	*Pseudomonas*	29.8	*E. coli*	24.7
Acinetobacter	14	*Klebsiella*	21.7	S.aureus	21
Enterococcus	13	*E. coli*	8.5	*Pseudomonas*	8.6
Klebsiella	11.5			*Klebsiella*	7.4

Table.3 Average Duration of ICU stay

Patient Group	**No. of days**
Study Group (Patients with Nosocomial Infections)	15.7 days
Matched Control Group	5.2days
(Patients without Nosocomial Infections)	

Table.4 Causative Organisms for Nosocomial Infections

Organism	**Percentage**
E. coli	34.60%
Pseudomonas	32.60%
Acinetobacter	13.90%
Klebsiella	12.1%
Enterococcus	5%
Candida	1.70%

Table.5 Antibiotic Sensitivity and Resistance Pattern of Different Microorganisms

Antibiotics	**Percentage (%)**			
	E. coli	***Pseudomonas***	***Acinetobacter***	***Klebsiella***
Imipenem	100	100	88	
Meropenem	100	62	88	
Polymixin B	100		100	
Amikacin	78	23	40	
Gentamicin	78	23	40	
Cepefime	40	20	20	
Levofloxacin	38	42	60	
Amp Sulbactum	18		22	
Linezolid				100
Vancomycin				96
Teicoplanin				88
Co-Trimoxazole				44
Clindamycin				44
Moxifloxacin				38
Piperacillin + Tz	40	12	18	25

A predominance of gram-positive organism was observed in our study. It was also observed that 24% *Acinetobacter* species were MDRO and ESBL production was noted in 42% isolates. In this study high level of resistance was observed in Ciprofloxacin (82.67%), Gentamycin (60.20%) and Piperacillin (52.33%) against the common isolates *E.coli* and *Pseudomonas* aeruginosa. High resistance to Cephalexin, Cephalosporin & Quinolones amongst *E.coli* and P.aeruginosa was observed, which was in concordance to other studies from the northern part of India. This shows that the isolates were resistant to the commonly used antibiotics used in the hospital & these findings may be attributed to extensive usage of Cephalosporin & Quinolones in the hospitals.

It has been observed that Amikacin, Meropenem showed good sensitivity against all bacterial isolate from the ICU. Gram positive isolates were 100% sensitive to Linezolid and Vancomycin. (Table 5)

In conclusion, a sustained coordination between the intensivist and the clinical microbiologist is essential not only for improving clinical outcome but also for optimizing resource utilization. Appropriate antibiotic utilization in ICU is crucial not only to ensure an optimal outcome, but also to prevent the emergence of multi drug resistance. Antibiotic policies, effective surveillance, and scrutiny of epidemiological trends of these infections are need of the hour for better management of ICU infections with resistant organisms. There is an evident necessity to study not only the trends in epidemiology of nosocomial infections but also the local situations for which multicenter studies need to be carried out in our country to coordinate and arrive at protocols based on certain patterns of antibiotic resistance. Alteration and rotation in antibiotic

prescribing patterns would decline the antibiotic resistance.

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