Original Research Article

An investigation of the incidence of Nosocomial infections among the patients admitted in the intensive care unit of a tertiary care hospital in Rajasthan, India

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A B S T R A C T

Keywords

Intensive care unit;
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The present study aimed to investigate the incidence of nosocomial infections (NI) among the patients admitted in the intensive care unit (ICU) in the medical ward of a tertiary care hospital. This was a cross-sectional hospital based study. The patients admitted in the ICU, without evidence of initial infection, were included in the study. Bacterial strains were identified with the help of gram staining and biochemical tests. Mainly, facultative anaerobes and aerobic bacteria such as *Staphylococcus aureus, E. coli, Klebsiella, Pseudomonas* species etc. were taken into consideration. More than half (57.3%) of the patients were $\geq$40 years and 53% were males. The incidence of NI was 24.9% (95%CI=18.6-31.1%). Age, sex, education, occupation and SES were significantly associated with the incidence of NI. The *Acinetobacter baumanii* (83.2%) was the most common organism found followed by *Pseudomonous aeruginosa* (73.5%) *Escherichia coli* (72.5%), *Staphylococcus aureus* (53.3%), *Klebsiella pneumoniae* (41.3%), *Coagulase-negative staphylococcus* (33.4%) and *Enterococcus faecalis* (22.2%). The nosocomial infection is one of major problems in the ICUs in the hospitals. We suggest large scale studies to be carried out among Indian population for prevention and management of nosocomial infections as this was small sample size study. The study on the community acquired infections should also be conducted

Introduction

Nosocomial infections (NI) are frequent complications of hospitalizations (Inan *et al.,* 2005). The issue has been recognized for more than a century as a critical problem affecting the quality of health care and a principal source of adverse outcomes. Today NI affects more than 2 million patients annually, at a cost of US 4.5 billion (Apostolopoulou and Veldekis, 2005).

Studies throughout the world document that NIs are a major cause of morbidity and mortality (Mayon-White *et al.,*1988;

Emmerson *et al.,*1996). A high frequency of NI is evidence of a poor quality of health service delivery, and leads to avoidable costs. Many factors contribute to the frequency of nosocomial infections, hospitalized patients are often immunocompromised, they undergo invasive examinations and treatments, and patient care practices and the hospital environment may facilitate the transmission of microorganisms among patients. The selective pressure of intense antibiotic use promotes antibiotic resistance, while progress in the prevention of nosocomial infections has been made; changes in medical practice continually present new opportunities for development of infection.

Over 80 percent of NIs are related to device utilization needed for patient life support but responsible for such complications as ventilator-associated pneumonia (VAP), catheter associated bloodstream infections (CABSI), surgical site infection (SSI) and urinary tract infection (UTI) (Corona and Raimondi, 2004). Intensive care units (ICUs) are where the most severely ill patients are treated and where the highest mortality rates occur.

NI and mortality in ICUs are more prevalent than in other wards of the hospital. For ICU patients, the risk is as much as 5 to 10 times greater. Underlying diseases, multiple illnesses, malnutrition, extremes of age, impaired host defenses, invasive devices, immunosuppressive therapy, use of antibiotics and colonization with resistant micro organisms render patients highly susceptible to NIs in ICUs (Weber *et al.,*1999). According to the European Prevalence of Infection in Intensive Care study (EPIC), involving over 4500 patients, the NI prevalence rate

in ICU was 20.6 percent. On an average, a patient with hospital-acquired infection spends 2.5 times longer in hospital resulting in additional cost of 3000 Pounds more than an uninfected patient. The frequency of nosocomial infection was 39.7 percent. UTI developed in 44.6 percent, while 27 percent had blood stream infection, and 21 percent had pneumonia. Each of the three major sites of infection was strongly associated with the use of invasive devices (Rizvi *et al.,*2007).

The present study aimed to investigate the prevalence of nosocomial infections among the patients admitted in the intensive care unit (ICU) in the medical ward of a tertiary care hospital in north India.

Materials and Methods

Study design

Cross-sectional hospital based.

Study site:

A tertiary care hospital in north India.

Patients:

The patients admitted in the ICU, without evidence of initial infection, were included in the study.

Nosocomial Infection

Patients who had no infection or they had not been in incubation period at the admission time and had positive culture after third day of admission, were defined as patients with nosocomial infections in the present study (Guidelines of CDC 2008) (CLSI, 2008).

Data Collection

Blood and urine specimen among study patients was taken after 48 hours of admission who developed fever after 48 hours of admission and followed till discharge from the hospital.

Strain identification

Bacterial strains were identified with the help of gram staining and biochemical tests. Mainly, facultative anaerobes and aerobic bacteria such as *Staphylococcus aureus, E-coli, Klebsiella, Pseudomonas* species etc. were taken into consideration as per guidelines of CLSI, (2008).

Analysis

The data collected was entered in the Microsoft Excel computer program and checked for any inconsistency. The results are presented in proportions/percentages with its 95% confidence interval (CI). The Chi-square test was used to compare dichotomous/categorical variables. The p-value <0.05 was considered as significant. All the analysis was carried out by using SPSS 15.0 version.

Ethical consideration

Ethical clearance was taken from Institutional Ethical Committee of the institute. Consent was taken from each patient included in the study.

Result and Discussion

The bio-social characteristics of the patient is depicted in the Table-1. More than half (57.3%) of the patients were ≥40 years and 53% were males. Majority (90.3%) of the patients belonged to Hindu community and about 35.7% were scheduled caste.

More than half (63.8%) of the patients were illiterates and around half (48.1%) were in SES V.

Out of the total 185 patients enrolled, 89 (48.1%) patients had fever. Thus, 89 blood and urine specimen were collected. A total of 46 patients were found to be positive for NI by any of the two specimens. Hence, incidence of NI was 24.9% (95%CI=18.6-31.1%) (Table not shown).

The incidence of NI was significantly higher (p=0.04) among the patients of age ≥40 years (30.2%, 95%CI=21.4-38.9) than <40 (17.7%, 95%CI=9.3-26.1). Females (28.7%, 95%CI=19.2-38.2) were found to be significantly (p=0.03) more infected as compared to males (19.4%, 95%CI=11.6-27.2). There was no significant difference (p>0.05) in the incidence of NI among the patients of Hindu (24.6%, 95%CI=18.0-31.2) and Muslim (27.8%, 95%CI=7.1-48.5) community.

The incidence of was significantly higher among scheduled (36.4%, 95%CI=24.8-48.0) and backward (20.6%, 95%CI=10.6-30.6) castes as compared to general caste (16.1%, 95%CI=6.5-25.7). The incidence of NI was significantly higher among illiterates than literates (p=0.02). A significant association was observed between incidence of NI and occupation as well as SES of the patients (Table-2).

The *Acinetobacter baumanii* (83.2%) was the most common organism found followed by *Pseudomonous aeruginosa* (73.5%) *Escherichia coli* (72.5%), *Staphylococcus aureus* (53.3%), *Klebsiella pneumoniae* (41.3%), *Coagulase-negative staphylococcus* (33.4%) and *Eterococcus faecalis* (22.2%) (Fig.1).

**Table.1** Distribution of patients by bio-social characteristics

Parameters	No. (n=185)	%
Age in years		
<40	79	42.7
≥40	106	57.3
Sex		
Male	98	53.0
Female	87	47.0
Religion		0.0
Hindu	167	90.3
Muslim	18	9.7
Caste		
General	56	30.3
Backward	63	34.1
Scheduled	66	35.7
Education		
Illiterate	118	63.8
Literate	67	36.2
Occupation		
Service	28	15.1
Professional	17	9.2
Agriculture	46	24.9
Housewife	24	13.0
Unemployed	46	24.9
Labor	24	13.0
SES		
II	13	7.0
III	27	14.6
IV	56	30.3
V	89	48.1

Table.2 Association of Nosocomial infection with bio-social characteristics

Bio-social characteristics	No. screened	Prevalence of NI		95%CI	p-value[1]
		No. with fever after 48 hrs	%		
Age in years					
<40	79	14	17.7	9.3 - 26.1	0.04*
≥40	106	32	30.2	21.4 - 38.9	
Sex					
Male	98	19	19.4	11.6 - 27.2	0.03*
Female	87	25	28.7	19.2 - 38.2	
Religion					
Hindu	167	41	24.6	18.0 - 31.2	0.11
Muslim	18	5	27.8	7.1 - 48.5	
Caste					
General	56	9	16.1	6.5 - 25.7	0.01*
Backward	63	13	20.6	10.6 - 30.6	
Scheduled	66	24	36.4	24.8 - 48.0	
Education					
Illiterate	118	34	28.8	20.6 - 37.0	0.02*
< High school	67	12	17.9	8.7 - 27.1	
Occupation					
Service	28	2	7.1	-2.4 - 16.7	0.001*
Professional	17	2	11.8	-3.6 - 27.1	
Agriculture	46	8	17.4	6.4 - 28.3	
Housewife	24	6	25.0	7.7 - 42.3	
Unemployed	46	12	26.1	13.4 - 38.8	
Labor	24	7	29.2	11.0 – 47.4	
SES					
II	13	2	15.4	-4.2 – 35.0	0.01*
III	27	5	18.5	3.9 – 33.2	
IV	56	14	25.0	13.7 – 36.3	
V	89	25	28.1	18.8-37.4	

CI=Confidence Interval, [1]Chi-square test, *Significant

Figure.1 Different types of organisms in blood and urine specimen (multiple response)
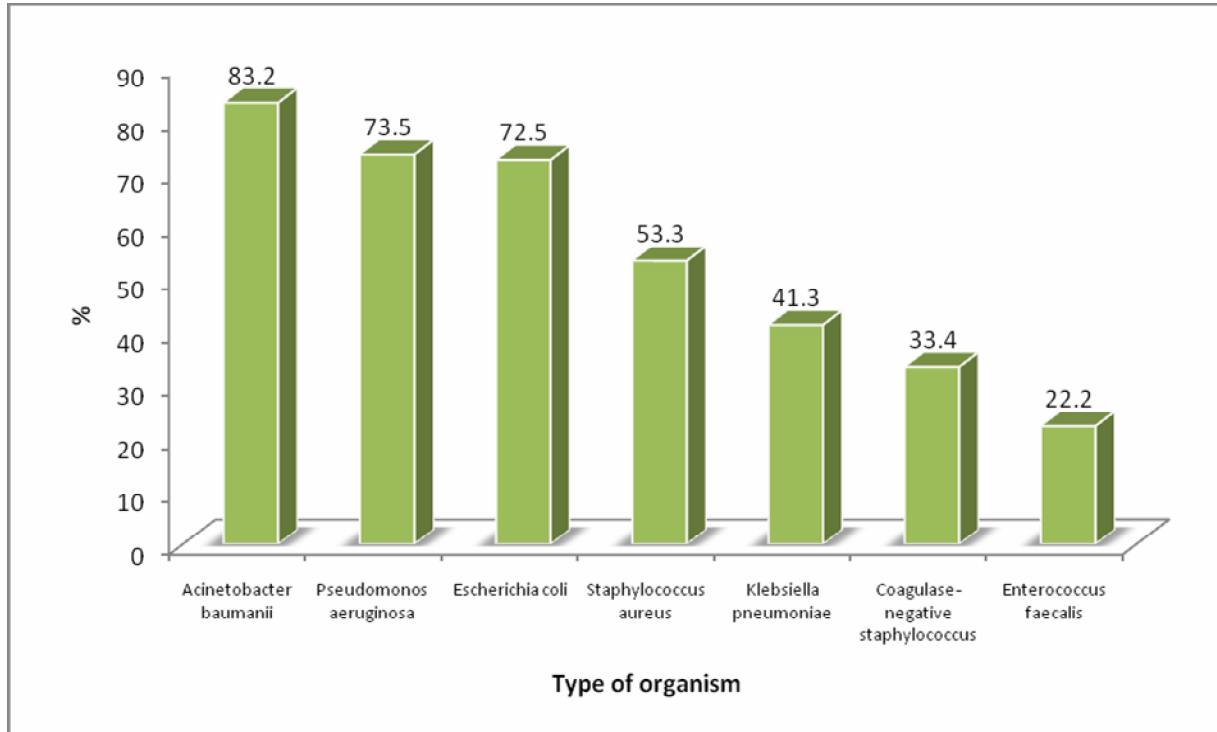
Infections in the Intensive Care Units (ICUs) result in increased morbidity, mortality, length of ICU and hospital stay (Weinstein, 1998). Furthermore ICUs act as epicenters for Hospital Acquired Infections (HAI) and the development of Multidrug-Resistant Organisms (MDROs) due to prolonged hospitalization, serious illnesses, compromised hosts and the higher rates and longer duration of antibiotic usage (Kollef and V.J, 2001). Early and appropriate empiric antibiotic use improves survival in critically ill

patients, especially with shock. While routinely choosing broader antibiotics may increase the appropriateness of antibiotic choice, it may induce further resistance and lead to extreme drug resistance. Hence the clinician has to choose empiric antibiotics aiming to both maximizing outcomes and minimizing emergence of resistance.

In this study, the incidence of NI in ICU patients was 24.9% . This rate was comparable to previous studies conducted in the developed settings (12-45%) (Vincent *et al.,*1995; Richards *et al.,*1999; Trilla, 1994). In our study, we found a significant relationship between the age of the patients and occurrence of nosocomial infections. This was in agreement with the results of the study conducted in Rasul-e-Akram Hospital of Teheran (Mir, 2002) and the studies done by Ganguly et al (1995) and Michael et al (1992) who reported a significant relationship between the age of the patients and occurrence of nosocomial infections. Our study also showed significant higher infection rate among females than males which also in agreement with the study by Ganguly et al (1995). Education, occupation and SES were also significantly associated with the infection rate in the present study.

Species of gram-negative bacteria such as *E.coli*, *Pseudomonas* and *Acinetobacter* were the most prevalent pathogens recovered from ICU patients in this study; this finding was similar to previous non-ICU studies conducted in India and in ICU studies conducted in other developing countries (Gopalakrishnan and D. Sureshkumar, 2010; Shehabi and L. Baadran, 1996; Dai *et al.,*2006).

One of the limitation of this study was that we did not differentiate between community acquired infections and nosocomial infections, since we wanted to capture the day to day patterns of resistance and antibiotic practices during patients' initial presentation to our ICU.

The nosocomial infection is one of major problems in the ICUs in the hospitals. We suggest large scale studies to be carried out among Indian population for prevention and management of nosocomial infections as this was small sample size study. The study on the community acquired infections should also be conducted.

Acknowledgement

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