

# Detection of Nosocomial Infection during Stays of Critically Ill Patients While Admitted To the Intensive Care Units and Pattern of Pathogens

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## ABSTRACT

**Background:** The nosocomial infection is the type of infection which develops during admission to the hospital or especially in intensive care unit. There are certain pathogens involved in nosocomial infections.

**Objective:** To find the frequency of nosocomial infections among critically ill patients admitted to the intensive care units and also the most common bacterium detected in patients who developed nosocomial infection

**Material & methods:** This cross sectional survey was done at the Department of Medicine, Services Hospital, and Lahore for 6 months. Sample of 318 patients were involved in the study who got admitted in the intensive care units for critical condition. The samples of (blood, urine or pus) were taken to test the presence of pathogen and confirm the nosocomial infection. Patients were managed for nosocomial infection as per standard protocol. SPSS v. 22 was used to analyses the data.

**Results:** Mean age of the patients was  $66.13 \pm 14.89$  years. There were 205 (64.5%) male patients and 113 (35.5%) female patients. The mean duration of admission in intensive care unit was  $9.64 \pm 5.84$  days. History of smoking was positive in 131 (41.2%) patients, 157 (49.4%) patients had diabetes and 23 (7.2%) patients had previous infection. Out of 318 patients, 73 (23%) patients were found positive for nosocomial infection. The most common pathogen detected in positive nosocomial cases was Acinetobacter that was detected in 30 (40.7%) samples, Pseudomonas were detected in 23 (31.3%) samples and Klebsiella in 15 (21.1%) patients. Among patients with nosocomial infection, 24 (33%) had urinary tract infection which was the commonest.

**Conclusion:** It is concluded that among individuals who were admitted in the intensive care units, the nosocomial infection was detected in large number of patients and these patients have more hazard to attain nosocomial infections during stay.

**Keywords:** Admitted; Critical condition; Intensive care units; Nosocomial infections

## INTRODUCTION

Nosocomial infections are defined as the infections that usually develop during first 48 hours after admission of the patient in critical condition in the hospital or may develop within 48 hours after the discharge from the hospital.<sup>1</sup> The frequency of nosocomial infections is high in cases who are admitted to the "Intensive Care Unit" as compared to other sources of the health care setting.<sup>2</sup> The rate of the nosocomial infection varies in different countries and different hospital setting i.e. ranged from 6% to 26%.<sup>3-5</sup> In intensive care unit, the prevalence of the

nosocomial infections was about 45.8%. Nosocomial infections are the main source of hazard to the safety of the admitted patients in the hospital or any health care facility. A nosocomial infection increases the complications of the admitted patients. The previous surveys conducted to detect the nosocomial infections can be employed to plan the surveillance programs for nosocomial infections [1].

So we conducted this survey to get the rate of nosocomial infection in individuals admitted to the intensive care units of the hospital. So that we can get the extent of problem in local

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population and can be able to suggest alterations and modifications in the set-up of the intensive care units and improve the management protocols of patients admitted in the intensive care unit. This would also help us to detect the commonest pathogen causing or increasing the rate of nosocomial infection in admitted patients and also the most prevalent type of infection in such patients so that safe and effective protocols of empirical management are improved further while the results of culture & sensitivity are awaited[2].

## Objective

Objectives of the study were:

- To find the frequency of nosocomial infections among critically ill patients admitted in the intensive care unit
- To determine the most common pathogen detected in patients who developed nosocomial infection

## MATERIALS & METHODS

This cross sectional survey was done at the Department of Medicine, Services hospital, Lahore for 6 months. Sample of 318 patients was estimated by keeping confidence level = 95%, margin of error = 5% & taking proportion of nosocomial infection as reproved in a study conducted earlier i.e. 29.13% in critical patients admitted to the intensive care unit. The cases were included by applying non-probability, consecutive sampling. Patients were included who had age 20-80 years of both gender and who were admitted in the intensive care unit for critical condition including cardiac surgery, asthma attack, oxygen ventilation, hemodialysis or peritoneal dialysis were excluded. Informed consent was obtained from attendants. Demographic information was noted. Duration and cause of intensive care unit admission was noted. Then blood, sputum, urine, stool and/or pus samples were taken under aseptic measures in a 3 cc disposable syringe or sterile container by a staff nurse. All the sample were stored in sterile vials and were timely sent to the pathology laboratory of the hospital to assess the presence of pathogen, its type and most common site of infection. Reports were assessed and if pathogen was detected, then nosocomial infection was confirmed (Nosocomial infections are commonly defined as the development of the infection during 48 - 72 hours of hospital stay or admission in the intensive care unit). Pathogen isolate were noted and their type was noted. Patients with positive isolates were labeled as having nosocomial infection. Patients with nosocomial infection were managed as per standard protocol. All the information was entered for final analysis in predesigned preform. SPSS version 22 was applied to analyze the collected data. Presence of nosocomial infection, type of pathogen and most common site of infection were presented as frequency and percentage[3].

## RESULTS

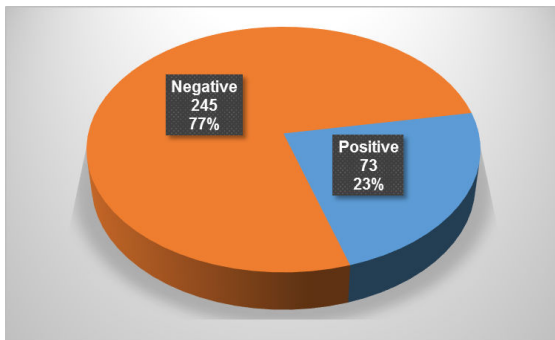
In this study, we observed the mean age of patients was 66.13 ± 14.89 years. There were 205 (64.5%) male cases and 113 (35.5%) female cases. The most common cause of admission in the intensive care unit for stroke [74 (23.3%)], followed by myocardial infarction in 61 (19.2%) cases, post-surgical in 58

(18.2%) cases, 41 (12.9%) cases were on oxygen ventilator, 23 (7.2%) cases had chronic liver disease, 18 (5.7%) cases had traumatic brain injury, 13 (4.1%) cases had severe pneumonia, 12 (3.8%) cases had asthma attack, 9 (2.8%) cases had chronic renal failure, 7 (2.2%) cases had severe chronic obstructive pulmonary disease, acute pancreatitis was observed in 2 (0.6%) cases. The mean duration of admission in the intensive care unit was 9.64 ± 5.84 days. History of smoking was positive in 131 (41.2%) patients, 157 (49.4%) patients had diabetes and 23 (7.2%) patients had previous infection. Table 1[4].

**Table 1:** Demographics and clinical findings of patients.

n	318
Age	66.13 ± 14.89
Gender	
Male	205 (64.5%)
Female	113 (35.5%)
Admitted for	
Stroke	74 (23.3%)
Myocardial infarction	61 (19.2%)
Surgery	58 (18.2%)
Oxygen ventilator	41 (12.9%)
Chronic liver disease	23 (7.2%)
Traumatic brain injury	18 (5.7%)
Pneumonia	13 (4.1%)
Asthma	12 (3.8%)
Chronic renal failure	9 (2.8%)
Chronic Obstructive Pulmonary Disease	7 (2.2%)
Acute pancreatitis	2 (0.6%)
Duration of admission	9.64 ± 5.84
h/o Smoking	131 (41.2%)
Diabetes	157 (49.4%)
Previous h/o infection(s)	23 (7.2%)

Out of 318 patients, 73 (23%) patients were found positive for nosocomial infection.



**Figure 1:** Nosocomial infection.

The commonest pathogen detected in positive nosocomial cases was Acinetobacter that was detected in 30 (40.7%) samples, Pseudomonas was detected in 23 (31.3%) samples, Klebsiella in 15 (21.1%) patients, Proteus was detected in 8 (11.4%) cases, Candida spp. was detected in 8 (11.4%) cases, E. Coli was detected in 7 (9.4%) cases, Enterococcus was isolated in 5 (6.9%) cases, Stenotrophomonas spp. was isolated in 4 (5.0%) cases, Staphylococcus was isolated in 3 (4.5%) cases and Burkholderia cepacia was isolated in 2 (2.8%) cases. Among patients with nosocomial infection, 24 (33%) had urinary tract infection, 21 (29%) had respiratory tract infection, 14 (19%) had blood stream infection, 10 (14%) had gastrointestinal tract infection while 4 (5%) had surgical site infection. Table 2 [5-9].

**Table 2:** Type of bacterium and site of infection

Bacterium	F (%)
Acinetobacter	30 (40.7%)
Pseudomonas	23 (31.3%)
Klebsiella	15 (21.1%)
Proteus	8 (11.4%)
Candida spp.	8 (11.4%)
E. Coli	7 (9.4%)
Enterococcus	5 (6.9%)
Stenotrophomonas spp.	4 (5.0%)
Staphylococcus	3 (4.5%)
Burkholderia cepacia	2 (2.8%)
Site of infection	
Urinary tract	24 (33%)
Respiratory tract	21 (29%)
Blood stream	14 (19%)
Gastrointestinal tract	10 (14%)
Surgical site infection	4 (5%)

## DISCUSSION

Worldwide speaking, nosocomial infections are among the main source of the increase in morbidity & mortality, length of hospital stay & costs. Today, the higher rate of morbidity & mortality related to the nosocomial infections that developed during stay in the intensive care unit is the matter of intense apprehension. This higher rate of nosocomial infections not only inspires the pattern of morbidity and mortality in the intensive care unit but it also causes a momentous economic burden for the patient as well as for the society [ 9].

The most commonly observed nosocomial infections were the urinary tract, respiratory tract & surgical site infections and these were more common in elderly patients during stay in the intensive care units and these also increases with the use of invasive instruments. In India, different studies reported a wide range of nosocomial infections i.e. from 11% to 60% cases that got admission to the intensive care units. This wide range and differences in the frequency of the nosocomial infections was due to the presence or absence of multiple risk factors dispersed unequally in different health care set-ups. Pena et al., reported the highest frequency of nosocomial infections was because of Klebsiella pneumoniae. This pathogen causes the nosocomial infection in about 8% cases among all the hospital acquired infection while maximum in about 14% cases of primary infections.

The epidemics of Klebsiella pneumoniae occur most frequently in the intensive care units as a consequence of the existence of most probable risk factors causing the increase in the colonization of bacterium and infections.

The risk factors like severity of the disease, advance age, prolonged duration of antibiotics use, and the high occurrence of the surgical procedures subsidize their high rate of colonization and contamination. 15-17 In a study, conducted by Choudhuri et al., about 39% individuals had multiple infections because of invasion of two or more pathogens at two or more sites. 2 It was reported that the mortality related to the infections cause by multiple pathogens was 48% which was higher than infections cause by single pathogen i.e. 25%.

Also Baviskar et al., found that the prevalence of nosocomial infection was 33.30%. Skin & soft tissue infections (36.30%), subsequently respiratory tract infections (24.46%) and genitourinary tract infections (23.40%) the most common organisms causing detected was E. coli (26.59%) and Acinetobacter species (18.08%).

The rate of mortality in the patients who developed nosocomial infections during hospital stay was 25.14% while the mortality rate was 10.57% in patients who did not develop nosocomial infections (P < 0.05). Overall mortality in intensive care unit was observed in 14.27%.

According to data provided by the Refik Saydam Hygiene Center Surveillance Center, the rate of pneumonia associated with mechanical ventilation per day was 10.9 during 2007, 11.2 during 2008 while 8.7 during 2009.19 The general weighted mean of nosocomial infection was 17.14 during 2008

which was decreased to 15.37 till 2009. The frequency of pneumonia developed after using mechanical ventilation during the stay in intensive care unit was estimated as 11.57 during 2007, which was reduced to 2.31 during 2008, but little increase as 4.32 during 2009 and later on further reduced to 2.77 during 2010. Ventilator associated pneumonia rate was above 50% in 2007. It is likely that this high rate is due to the fact that in intensive care unit had been newly created, the measures of infection control were deficient and the number of individuals having chronic lung diseases admitted to the hospitals was higher as well as the rates of secondary / nosocomial infections in these individuals.

Wang et al., observed that over the period of three years, there was not much difference in the occurrence of nosocomial infections. The overall rate of nosocomial infections reported lower in Europe (8%) while higher in 33.5% in India.

In a study by Wang et al., chronic obstructive pulmonary disease was the commonest basic diagnosis and cause of admission in many published studies. Like several previous reports of other countries, the most commonly isolated bacteria were "Staphylococcus aureus, Klebsiella pneumoniae & Pseudomonas aeruginosa" in patients admitted to the intensive care unit. The most common nosocomial infections during stay in the intensive care unit were lower respiratory tract infection, urinary tract infection and blood-stream infection, and these findings were similar as reported from the intensive care unit of different countries including China, Europe & Malaysia.

Pradhan et al., found that record of total 366 patients who were admitted to the intensive care unit were analyzed. Out of 366 patients, 32 (8.7%) cases were found positive for 35 different nosocomial infections (prevalence = 9.6%). Out of these 35 infections, respiratory tract infections were the most common (65.8%), followed by urinary tract infections (17.1%) while 17.1% had urinary as well as respiratory infection. The most frequent pathogen involved in infections of respiratory tract was Acinetobacter i.e. 40.4%; while the Pseudomonas was most common i.e. 38.4% in urinary tract infections.

Kujur et al., found that the rate of nosocomial infection was 12.7% in patients admitted in intensive care unit. They also found that age, economic status and duration of hospital stay had significant impact on the rate of nosocomial infections. Among all the infections, urinary tract infections were the most common i.e. 26.4%, while Acinetobacter was the most common pathogen detected in 30.3% isolated samples followed by pseudomonas aeruginosa (25.5%).

The influence of the nosocomial infections on the hospital morbidity and mortality of patients is debatable. Underlying patient demographics and seriousness of illness that brought the patient to intensive care unit have the major impact on the outcome of the patients. However, some recent reports supplement the theory that nosocomial infections increase morbidity and mortality in intensive care unit patients.

Baviskar et al., proposed that nosocomial infections significantly increased intensive care unit stay and mortality. 18 Several studies including some Indian studies have reported an increase

in the duration of intensive care unit stay in patients who developed nosocomial infections as compared to patients without nosocomial infections. Farzianpour et al., conducted a study and showed a low rate of nosocomial infection i.e. 12.5%. 36 However another conducted by study by Luzzati et al., detected a high frequency of nosocomial infection i.e. 30.4%. 37 Similarly, in few different studies conducted by Dereli et al., in a 3 years duration rate of nosocomial infections were 53%, 29.2%, & 16.6% respectively. 38 While Agarwal et al., conducted another study in North India also showed a high incidence rate i.e. 33.5% in patients admitted to the intensive care unit.

Mortality rates in intensive care unit patients who develop nosocomial infections vary from 10% to 40%. Baviskar et al., found that the mortality rate was 25.14% which was significantly higher as compared to patients without nosocomial infections. Hence, measures to reduce the occurrence of nosocomial infection should be undertaken zealously. It has been recommended that the appropriate nursing care, disinfection and cleansing process of the apparatuses & equipment and cautious management of surgical procedures are the finest way to prevent such life intimidating infections during hospital stay.

## CONCLUSION

It is concluded that among individuals admitted to the intensive care unit, nosocomial infection was detected in large number of patients and they have more hazard of getting nosocomial infections from different sources. Out of them the most common pathogen was Acinetobacter and mostly patients had urinary tract infection. So in future, better measures are required to decrease the rate of nosocomial infection in local setting including proper sterilization of tools, instruments and equipment used in intensive care unit as well as careful handling of surgical procedures in intensive care units. Moreover, protocols of empirical management can be improved further by looking at the most common pathogens detected and their pattern of sensitivity or resistance to multiple antibiotics, while the results of culture & sensitivity are awaited.

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