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## RESEARCH ARTICLE

# TO STUDY INCIDANCE OF NOSOCOMIAL INFECTIONS IN SURGICAL INTENSIVE CARE UNIT OF A LARGE TEACHING HOSPITAL IN NORTH INDIA

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**ABSTRACT**

**Background:** Nosocomial infections (NIs) constitute an important worldwide health problem with high morbidity and mortality rate as well as economic consequences. We aimed to determine incidence of nosocomial infection in surgical intensive care unit (SICU).
**Aims & Objectives:** To find out incidence of nosocomial infection in surgical intensive care unit (SICU) at a large teaching hospital in North India.
**Methods:** A prospective cohort study was conducted during a period of one year from 1st Oct 2013 to 30th Sep 2014 in SICU of SKIMS. The researcher visited the SICU on daily basis at 10 am in the morning to note down presence or absence of signs and symptoms of nosocomial infection as per the laid down criteria. The researcher used inpatient records, interacted with clinical staff to establish absence or presence of nosocomial infection. Criteria for establishment of nosocomial infections were adopted in accordance with the simplified definition derived from the Centre for disease control, USA.
**Results:** During this period a total of 600 patients were admitted in SICU of SKIMS for more than 48 hours and were included in the study. Of 600 patients, 190 (31.7%) were confirmed and documented with nosocomial infection. Respiratory tract infection was the most common nosocomial infection present in 74.7 % patients (n=142) among the total 190 documented cases of nosocomial infection, followed by septicemia in 26.8%, (n=51) and then surgical site infection in 11.05%, (n=21). Vascular catheter associated infection was found in 5.8% (n=11) while urinary tract infection was found only in 2.6% (n=5). It is pertinent to mention that some cases were infected with more than one type of nosocomial infection such that 190 patients developed a total of 230 infections.
**Conclusion:** Nosocomial infections are an important healthcare adverse events and need to be reduced.



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## INTRODUCTION

Nosocomial comes from the Greek word NOSOKOMEION meaning (no =disease, soskomeo=to take care) (Devrajani, 2009). The word nosocomial was first used in 1940 by Joyce Wright in a paper discussing streptococcal infection in children's ward in London (Wright, 1940). Nosocomial infections, also called 'hospital-acquired infections' are infections acquired during hospital care which are not present or incubating at admission. Infections occurring more than 48 hrs after admission are usually considered nosocomial (Prevention of Hospital acquired infection a practical guide, 2002). Infections incubating at the time of patients admission to hospital are not nosocomial, they are community acquired (Sirram Lata).

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Infection may present also after patient discharge. In these cases, the patient has become colonized or infected while in hospital, but the pathogen incubation period exceeds the patient's hospital stay. For instance, several studies report that over 50% of surgical site infections (SSI) manifest post discharge (worldwide. whqlibdoc.who.int/publications/2011/ 9789241501507_eng.pdf). John Bell in 1801, remarked that hospital infection exists in every type of hospital. Hospital acquired infections add to functional disability and emotional stress of patient and may in some cases lead to disabling conditions that reduce quality of life. These are also one of the leading cause of death (Brachmann, 1998). The highest rate of nosocomial infections are observed in intensive care units, which are also the units in which the most severely ill patients are treated and in which highest mortality rates are observed (François Stéphan, 2001). Intensive care unit is a highly specified and sophisticated area of a hospital which is

specifically designed, staffed, located furnished and equipped, dedicated to management of critically sick patient, injuries or complications (Patel Kiran, 2014). ICU patients are at risk of both acquiring nosocomial infection and for dying (Girou, 1988). Patients in intensive care units (ICUs) are a significant subgroup of all hospitalized patients, accounting for about 25% of all hospital infections (Adamu Sadiq Abubakar, 2014). Healthcare associated infection (HCAI) is acknowledged as the most frequent adverse event in health care, but the global burden remains unknown because of the difficulty of gathering reliable data. This is mainly due to the complexity and lack of uniformity of diagnostic criteria and to the fact that surveillance systems for HCAI are virtually nonexistent in most countries. The burden of HAI is already substantial in developed countries, where it affects from 5% to 15% of hospitalized patients in regular wards and so many as 50% or more of patients in intensive care units (ICU). In developing countries, the magnitude of the problem remains underestimated or even unknown largely because HAI diagnosis is complex and surveillance activities to guide interventions requires expertise and resources. The prevalence of ICU-acquired infections is significantly higher in developing countries than in industrialized countries, varying between 4.4% and 88.9% (Adamu Sadiq Abubakar, 2014). Nosocomial infection rates in adult and pediatric ICUs are approx three times higher than elsewhere in hospital. The site of infection and the pathogen involved are directly related to treatment in ICUs (Weinstein, 1998). Health care associated infection (HCAI) may be caused by infectious agents from endogenous or exogenous sources. Endogenous sources are body sites, such as the skin, nose, mouth, gastrointestinal tract, or vagina that are normally colonized by local microbial flora. Exogenous sources are those external to the patient, such as health-care workers, visitors, patient care equipment, medical devices, or the health-care environment (http://whqlibdoc.who.int/publications/2011/9789241501507_eng.pdf). The present study was undertaken at Sher-I-Kashmir Institute of Medical Sciences [SKIMS], Srinagar which is a super-specialty hospital commissioned in 1982 with a present bed complement of 689. The aim of the study was to generate more representative data, so as to improve surveillance of nosocomial infection at surgical intensive care unit of SKIMS.

## MATERIALS AND METHODS

To study the incidence of nosocomial infection at SKIMS a prospective study for a period of one year was conducted. Patients who were admitted in the SICU were studied during that period.

**Area of Study:** 12 bedded Surgical Intensive Care Unit (SICU) of SKIMS.

**Duration of study:** 1 year from October2013 to 30$^{th}$ September 2014.

**Study population**: All patients admitted in surgical intensive care unit (SICU), SKIMS.

**Sample size:** 100%

**Study tool:** Predesigned proforma was developed to assess the incidence of nosocomial infection in surgical ICU. The proforma was designed in two parts.

**Part A:** The proforma enlisted demographic details of the patient including age, sex, geographic details and diagnosis.

**Part B:** It was used to establish presence or absence of nosocomial infection in the study subject. Criteria for establishment of nosocomial infection were adopted in accordance with the simplified definition derived from the Centre for disease control, USA. The selected criteria to establish the presence or absence of nosocomial infection was as under

- Surgical site infection: Any purulent discharge, abscess or spreading cellulitis at the surgical site during the month after the operation.
- Urinary tract infection: Positive urine culture (1 or 2 species) with at least $10^5$ bacteria/ ml, with or without clinical symptoms.
- Respiratory tract infection: Respiratory symptoms with at least two of the following signs appearing during hospitalization.
  - Cough
  - Prulent sputum
  - New infiltrates on chest radiograph consistent with infection

**Septicemia:** Fever or rigors and at least one positive blood culture.

**Vascular catheter associated infection:** Inflammation, lymphangitis or purulent discharge at the insertion site of catheter. The proforma developed was subjected to validation by carrying out pilot study for a period of 15 days to access the deficiency if any present in the research tool. After the validation the refined tool was put to study. The researcher visited the SICU on daily basis at 10 am in the morning to note down presence or absence of sign's and symptoms of nosocomial infection as per the laid down criteria. The researcher used inpatient records, interacted with clinical staff to establish absence or presence of nosocomial infection. This finding was enlisted on the pre designed performa.

Incidence was calculated as per below given formula:

Number of new cases of nosocomial

$$\text{Incidence of nosocomial infection} = \frac{\text{Infection during a given time period}}{\text{Study population at risk during that period}} \times 1000$$

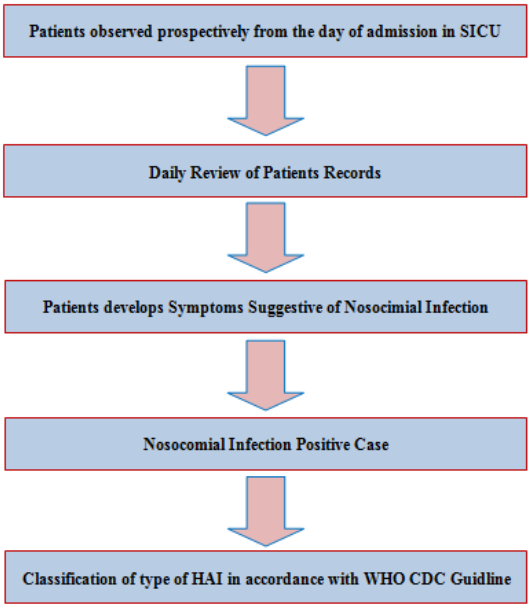



**Diagram 1. Flow diagram depicting the follow up of the patients admitted in Surgical ICU**

## RESULTS

Nosocomial infections (NIs) constitute an important worldwide health problem with high morbidity and mortality rate as well as economic consequences. Nosocomial infections have become especially prominent in intensive care units (ICUs), where the incidence is two to five times greater than in the general inpatient population.

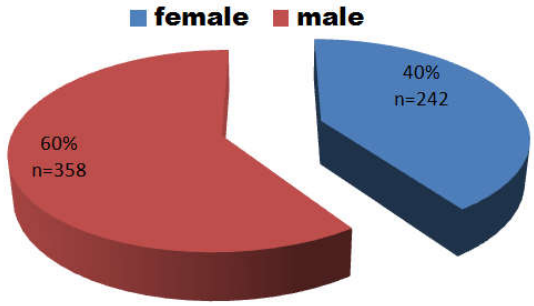



**Fig. 1. shows majority, 59.7% (n=358) were males and 40.3% (n=242) were females**

Minimum age group admitted in SICU during the study period was 4 months old while maximum age group was reported to be 75 years. Mean age group calculated was 37.8 years. (Table 1).

**Table 1. Age wise variation in patient population**

| Age (years) | Minimum age(years) | Maximum age(years) | Mean Age |
|---|---|---|---|
| n=600 | 4/12 years | 75 years | 37.8 years |

Observation revealed that majority i.e 44.8% ( n=269) were in the age group of 30-60 years followed by < 30 years group which constituted 35%(n=210) of the study population. 20.2% (n=121) of admissions were in the age group of > 60 years. (Table 2).

**Table 2. Variation of Patient in Different Age Category**

| Age Category | Frequency | Percent |
|---|---|---|
| <30 years | 210 | 35.0 |
| 30-60 years | 269 | 44.8 |
| >60 years | 121 | 20.2 |
| Total | 600 | 100.0 |

The patients were followed till they were transferred out of SICU. The outcome of patients were categorized as discharged, shifted or expired . Out of 600 patients majority i.e 57.3 % (n=344), were discharged /shifted to other areas of hospital , 42.7%, (n=256) expired in SICU during the period of study.(Fig 2)

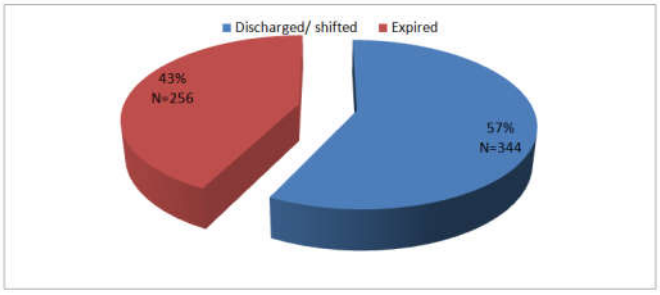


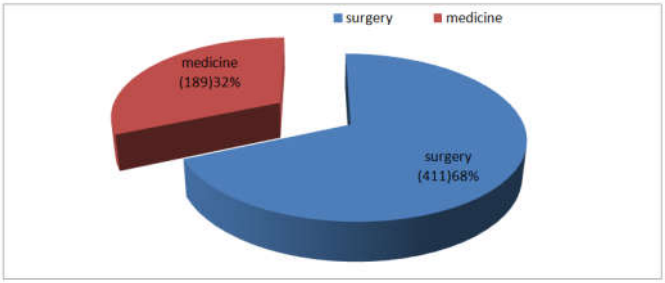

**Figure 2. Categorization of patients according to outcome of stay in SICU**

Out of 600 patients in study population the majority i.e 67.2% (n=403) were from rural area while 32.8% (n=197) were from urban areas (Table 3).

**Table 3. Categorization of patients according to their residence**

| Residence | Frequency | Percent |
|---|---|---|
| Rural | 403 | 67.2 |
| Urban | 197 | 32.8 |

Observation from primary diagnosis of admissions (figure 3) in SICU revealed that the majority i.e 68.5% (n=411) were admitted with surgical diagnosis while 31.5% (n=189) were admitted under medical diagnosis.




Clinically the diagnosis of patients were broadly classified under the categories

- Tumors
- Trauma
- Others

Observations from the clinical diagnosis revealed that 50.8% (n=305) were having trauma while 10% (n=60) were having different types of tumors both benign and malignant. 39.2% (n=235) of patients were having varied type of diagnosis other than tumor and trauma so were grouped in others category. Of the 600 patients included in the study the majority had length of stay ( LOS) less than 5 days as was seen with 302 patients(50.3% ), followed by LOS of 5-10 days in 229 cases(38.2%) and only few had LOS more than 10 days i.e 69 (11.5%).

The SICU admissions were followed during the study period for the development of nosocomial infection. The diagnosis was confirmed and documented after being ratified by the attending physician, endorsed by lab reports and / or x-rays. Of 600 patients, 190 (31.7%) were confirmed and documented with nosocomial infection.

Nosocomial infection were broadly classified into following categories

- Respiratory tract infection
- Septicemia
- Surgical site infection
- Vascular catheter associated infection
- Urinary tract infection

Of 600 patients, 190 (31.7%) were confirmed and documented with nosocomial infection (Table 4). Respiratory tract infection was the most common nosocomial infection present in 74.7 % patients (n=142) among the total 190 documented cases of nosocomial infection, followed by septicemia in 26.8%, (n=51) and then surgical site infection in 11.05%, (n=21). Vascular

catheter associated infection was found in 5.8% (n=11) while urinary tract infection was found only in 2.6% (n=5). (Table 5)

**Table 4. Incidence of nosocomial infection**

| Nosocomial Infection | Frequency | Percent |
|---|---|---|
| Absent | 410 | 68.3 |
| Present | 190 | 31.7 |

**Table 5. Classification of Nosocomial Infection Recorded**

| Type of nosocomial infection | Frequency | Percent |
|---|---|---|
| Respiratory tract infection | 142 | 74.70% |
| Septicemia | 51 | 26.80% |
| Surgical site infection | 21 | 11.05% |
| Vascular catheter associated infection | 11 | 5.80% |
| Urinary tract infection | 5 | 2.60% |

Gender wise distribution of study population who were confirmed with the diagnosis of nosocomial infection revealed (table 6) that 62.1% ( n=118) were males while 37.9% (n=72) were females among the total 190 documented cases as nosocomial infection.

**Table 6. Distribution of nosocomial infection among males vs females**

| Nosocomial Infection | Female | Male | Total |
|---|---|---|---|
| Absent | 41.5% n=170 | 58.5% n=240 | 100% n=410 |
| Present | 37.9% n=72 | 62.1% n=118 | 100% n=190 |

It is found that among the 190 patients found positive for nosocomial infection, 65.8 % (n=125) patients (figure 4) were from surgical specialty and 34.2% (n= 65) patients were from medical specialty.

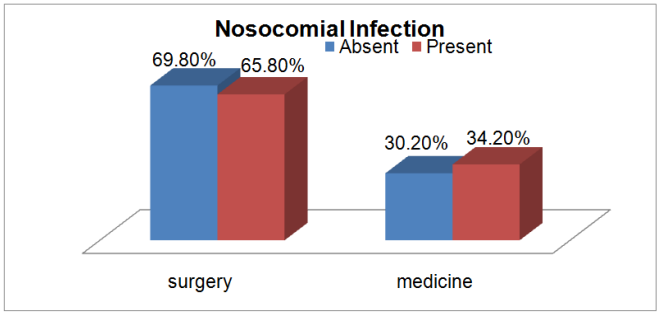



**Figure 4. Nosocomial Infection In Different Specialties**

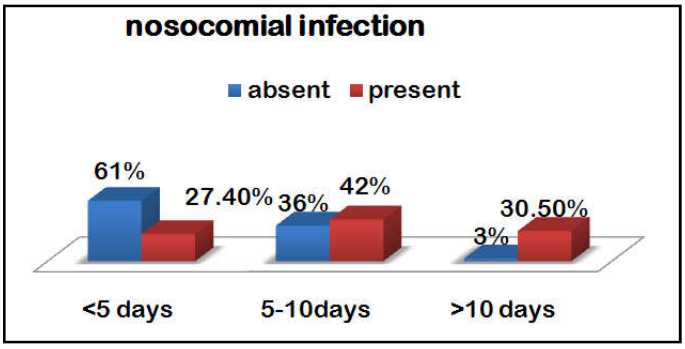



**Figure 5. length of stay for patients having nosocomial infection**

190 patients were documented with nosocomial infection of which the incidence was higher for patients with length of stay (LOS) 5-10 days i.e 42.10%(n=80). 30.50% of patients n= 58 with length of stay (LOS) of more than ten days had nosocomial infection while only 27.40% patients (n=52) with LOS less than 5 days had nosocomial infection. (Figure 5).

## DISCUSSION

Healthcare-associated infections (HAIs) are a major global problem for patient safety, and are related to significantly increased morbidity, mortality, hospital stays, and costs. The HAIs account for an estimated 1.7 million infections and 99,000 deaths annually in the US. Along with hand hygiene and isolation practices, surveillance is one of the most important steps in controlling HAIs (Emin). Patients admitted to the ICU have been shown to be at particular risk of acquiring nosocomial infection with a prevalence rate as high as 30%. The risk of nosocomial infection in ICU is 5–10 times greater than those acquired in general medical and surgical wards (Shaikh, 2008). A total of 600 patients admitted in SICU of SKIMS for more than 48 hours were included in the study. Among these majority i.e 59.7% (n=358) were males and 40.3% (n=242) were females. This finding was in agreement with the study conducted by Eleni Apostolopoulou *et al* (Apostolopoulou, 2013) in which 294 patients were included in the study population of which 164 were males (55.8%) and 130 were females(44.2%). Variation of admitted subjects viz-a-viz age in our study revealed that minimum age group admitted in SICU during the study period was 4 months while maximum age group was reported to be 75 years. Mean age group calculated was 37.8 years. This was complimenting the research by Jan Mohammad *et al* (Shaikh, 2014) which revealed that total admissions to ICU were 964 with mean age of 30.05±15.81 SD years. Observation viz-a-viz stratified age group revealed that majority i.e 44.8% (n=269) were in the age group of 30-60 years followed by < 30 years group which constituted 35% (n=210) of the study population. 20.2% (n=121) of admissions were in the age group of > 60 years. A study by Oznur A K *et al* (Oznur, 2011), revealed that 115 patients had nosocomial infection of which 14.8% were aged <20 years , 20.8% were in age group of 20-40 years, 28.7 % were in age group of 40-60 years while 35.7 % patients infected were in age group of > 60 years.

The patients were followed till they were transferred out of SICU of SKIMS. The outcome of patients was categorized as discharged, shifted or expired. Out of 600 patients majority i.e 57.3% (n=344), were discharged /shifted to other areas of hospital, 42.7%, (n=256) expired in SICU during the period of study. These findings were in agreement with the previous study conducted by Meliha Merci *et al* (Meliha Meric, 2005) in which the difference between the ICU mortality rates for patients with or without ICU acquired infection was not statistically significant (p>0.05) (mortality rates: 42.3 and 45.6% respectively. It was observed that 411 were admitted under surgical specialty out of which 42.1% (n= 173) were females and 57.9% (n= 238) were males. Total of 189 patients were admitted under medical specialty out of which 36.5% (n=69) were females and 63.5% (n=120) were males. Clinically the diagnosis of patients was broadly classified under the categories tumor, trauma and others. Observations from the clinical diagnosis revealed that 50.8% (n=305) were having trauma while 10 % (n=60) were having different types of tumors both benign and malignant. 39.2% (n=235) of patients were having varied type of diagnosis other than tumor and trauma so were grouped in others category.

In our study the majority had length of stay ( LOS) less than 5 days as was seen with 302 patients(50.3% ), followed by LOS of 5-10 days in 229 cases(38.2% ) and only few had LOS more than 10 days i.e 69 (11.5%). Similar study conducted by Meliha merci (Meliha Meric, 2005), revealed that the median length of stay in ICU with or without ICU acquired infection as 20 and 7 days respectively ($p<0.0001$). Of 600 patients in our study population, 190 (31.7%) were confirmed and documented with nosocomial infection in our study. This finding was in agreement with the previous studies done by Jan Mohammad *et al* (Shaikh, 2008), which revealed that ninety-seven (97) out of three hundred thirty three (333) patients were identified to acquire infection during their stay in the ICU with frequency of nosocomial infection as 29.13%. Another study by Meliha Merci *et al* (Meliha Meric, 2005) in which the infection rate were 56.2 in 1000 patient days and 70.9 in 100 patients nursed >48 hrs. In general, ICU acquired infection constitute 20-25% of all hospital acquired infection (Oznur, 2011). There may be variation in the incidence of ICU infections between centers, depending on the characteristics of patients and ICUs . In a point prevalence study including 1417 centers in 17 European countries, the infection rate in ICUs was reported to be 20.6 % (Vincent, 1995). The infection rates in ICUs in several other studies reported are as follows: Legras *et al* (Legras, 1998): 21.6%, Appelgren *et al* (2001) and Urli *et al*. (Urli, 2002). 79%, Emin E *et al* (Prevention of Hospital acquired infection a practical guide): 16.1% Ji-Guang Ding (2009) 26.8%, Oznur A K *et al* (Oznur, 2011) found that out of 1134 patients hospitalized in the ICU for a period of 6257 days, 115 patients acquired a total of 135 nosocomial infections and the rate of nosocomial infection was 25.6%. The critically ill patient is at particular risk of developing intensive care unit acquired infection, with the lungs being especially vulnerable. Nosocomial bacterial pneumonia occurring after two days of mechanical ventilation is referred to as ventilator associated pneumonia, and is the most common nosocomial infection seen in the intensive care unit (Sirram Lata). This was depicted in our study as respiratory tract infection was the most common nosocomial infection present accounting for 74.7 % (n=142) among the total 190 documented cases of nosocomial infection, followed by septicemia in 26.8%, (n=51) and then surgical site infection in 11.05%, (n=21). Vascular catheter associated infection was found in 5.8% (n=11) while urinary tract infection was found only in 2.6% (n=5). It is pertinent to mention that some cases were infected with more than type of nosocomial infection such that 190 patients developed a total of 230 infections.

Our findings were in agreement with the research work of Kallel *et al* (Kallel, 2005) who revealed in his study that pneumonia was present in 58.2%, followed by blood stream infection in 18.2% and urinary tract infection in 14.5%. Vincent J L *et al* (Vincent,1995), who found that pneumonia was present in 46.9%, lower respiratory tract infection (17.8%), urinary tract infection (17.6%), and bloodstream infection (12%) similarly. In another study Erbay *et al* (Erbay, 2003), revealed that pneumonia was present in 40.9%, followed by blood stream infection in 30.2% and urinary tract infection in 23.6. In general, the most common type of infection in ICU is pneumonia, although Oznur AK *et al* (Oznur, 2011) reported bacteremia as the most commonly encountered ICU infection in 36.3% followed by respiratory tract in 30.4%, urinary tract in 18.5%,7.4% central line infection, 5.9% cutaneous infection and 1.3% meningitis.

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