

Survey of nosocomial infections and causative bacteria: A hospital-based study

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ABSTRACT

Objective: To determine the frequency of Nosocomial Infections (NI) presenting during the in-patient stay and their causative bacteria in Golestan teaching hospital, Iran.

Methodology: In a prospective cross-sectional study, all patients admitted in Golestan teaching hospital of Ahvaz from Sep 2009 to March 2010 were included in the study. NNIS questionnaire was used for data collection and essential cultures were done.

Results: From 9407 hospitalized patients, 296 cases (3.1%) proved to have NI. They consisted of 118 women (39.9%) and 178 men (60.1%) (Mean age 46.1±24.1). The rate of NI in Intensive Care Units (ICU wards) was 12% and in other wards was 1% (P=0.003). The mortality rate among patients with NI was 23.3%. The most common types of infection were: UTI (43.6%), pneumonia (35.1%), surgical wound infection (14.5%) and blood infection (6.8%). The most common infection in ICU was pneumonia (45%) and in other wards was UTI (P=0.001). The most common causative bacteria were enterobacter (59.8%) followed by Escherichia coli (34.5%) and pseudomonas aeruginosa (25.3%).

Conclusion: Nosocomial Infections (NI) rate in our study was low compared to many centers and significantly higher in ICU than other wards. Gram negative bacteria were the most common cause of Nosocomial Infections (NI).

KEY WORDS: Nosocomial Infection, Intensive Care Unit, NNIS.

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INTRODUCTION

Nosocomial infections (NI) can be defined as those occurring after 48-72 hours of hospital admission and not present or incubating when the patients are admitted in hospital.¹ They are major concern in the management of patients in hospitals because increased mortality and morbidity rates, duration of hospital admission, related costs and may cause medico legal issues. NI are frequently associated with drug-resistant micro-organisms which can pose considerable therapeutic problems and are growing in developing and developed countries.^{1,2} NI are estimated to occur in 5% of all hospitalizations in the US.³ A survey of 1576 hospitals in the UK and the Republic of Ireland showed the average prevalence of NI was 9% (range between 2-29%).⁴

In a recent study prevalence of NI in developing countries was reported 15.5%.⁵ Factors that predispose to NI are: underlying diseases and health status, invasive procedures (like endotracheal intubation, central vein or urinary catheterization, surgical drains and tracheostomy) and treatment related factors such as blood transfusion, parenteral nutrition and immunosuppressive treatments.⁶ The most common sites of NI are urinary tract, lower respiratory system, skin and surgical wounds.⁷ Intensive Care Units (ICUs) have the highest incidence of hospital infections due to use of mechanical ventilation, invasive procedures, indwelling catheters and patients immunocompromised status.⁸⁻¹⁰ Controlling and preventing NI need information about epidemiology.

This study aimed to determine the rate of NI presenting during the in-patient stay and their causative bacteria in Golestan Teaching Hospital.

METHODOLOGY

This cross-sectional prospective study was performed in Ahvaz Golestan Teaching Hospital and all patients admitted from Sep 2009 until March 2010 were included. Patients who got fever or died before 48 hours were excluded from study. NI were defined according to National Nosocomial Infections Surveillance System (NNIS).^{11,12} Data collection was done according to NNIS questionnaire. A trained nurse received daily reports from head nurses of different wards about the patients. Medical records were reviewed by the investigators.

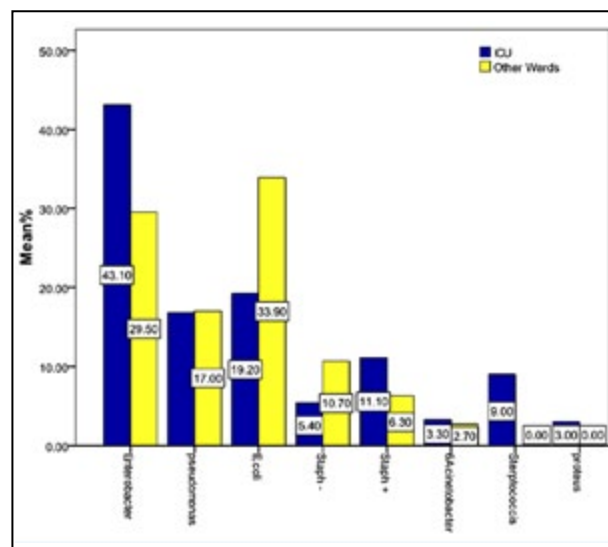


Fig.1: Frequency of nosocomial infections factors in ICU and Other wards.

Necessary tests and cultures were done for patients suspected to NI according to guidelines of NNIS and the questionnaires filled up. All cultures were done in Golestan hospital laboratory by microbiologists and identification done by standard bacteriologic methods. Data collection and analysis was achieved with SPSS software version 17. Variables were compared using Chi square test. P value <0.05 was considered significant.

RESULTS

During the study period, 9407 patients were admitted including 5700 males (60.6%) and 3707 females (39.4%). NI were documented in 296(3.1%) cases by isolation of organisms. Of those, 118 patients (39/9%) were women and 178(60/1%) men with mean age of 46/1±24/1. The rate of NI in men (3.12%) was almost the same as women (3.18%). The mortality rate of NI was 23.3%. The mean rate of NI in ICUs was 12% and in other wards was 1% (P =0.003). The most common types of NI in this study were: UTI (43.6%), respiratory system (35.1%), surgical wound infection (14.5%) and blood infection (6.8%). Frequency distribution of NI in different wards by the site of infections is showed in Figure.1. The most common infection in ICUs was pneumonia and in other wards was UTI (P= 0.001). The most common causative bacteria were enterobacter (59.8%) followed by Escherichia coli (34.5%), pseudomonas aeruginosa (25.3%) and coagulase-positive staphylococci (14.9%). The identified organisms and their frequency are listed in Table-I. Enterobacter was the most common causative organism in ICU and Escherichia coli in other wards. Enterobacter in respiratory, blood and surgical wound infections and Escherichia coli in UTI were the most common isolated organisms. Frequency distribution of identified organisms by the site of infections is showed in Table-II.

Table-I: Frequency of identified organism in Nosocomial Infection.

Organism Culture (%)	No. of Positive	No. of Patients
Enterobacter	177(59/8)	296
Pseudomonas	75(25/3)	296
E coli	102(34/5)	296
Staph-	30(10/1)	296
Staph+	44(14/9)	296
Acinetobacter	14(4/7)	296
Streptococcus	3(1)	296
Proteus	1(0/003)	296

Table-II: Frequency distribution of identified organism by site of infection.

<i>Infection Organism</i>	<i>Trachea</i>	<i>Wound</i>	<i>Blood</i>	<i>Urine</i>
Enterobacter	81(42/41%)	20(32/26%)	10(47/62%)	66(38/82%)
Pseudomonas	30(15/71%)	9(14/52%)	2(9/52%)	34(20%)
E coli	23(12/04%)	8(12/9%)	2(9/52%)	69(40/59%)
Staph-	17(8/9%)	11(17/74%)	2(9/52%)	0(0%)
Staph+	35(18/32%)	5(8/06%)	1(4/76%)	1 (0/59%)
Acinetobacter	2(1/05%)	8(12/90%)	4(19/05%)	0(0%)
Streptococcus	2(1/05%)	1(1/61%)	0(0%)	0(0%)
Proteus	1(0/52%)	0(0%)	0(0%)	0(0%)
Total	191(100%)	62(100%)	21(100%)	170(100%)

DISCUSSION

The quoted incidence of NI varies according to the setting and depends on the place of study (Hospital or ICU), study population (their ages, health status and underlying diseases) and the precise definition used.¹ The rate of documented NI in the present study was 3.1% which was low compared to some other centers. Nearly 5% of all hospitalizations in US are associated with NI.³ In a WHO study (with cooperation of 55 hospitals in 14 countries), about 8.7% of hospitalized patients had NI.¹³ In one study from UK 7.8% of hospitalizations presented with hospital-acquired infections during the in-patient period.¹⁴ A study in an Indian teaching hospital, that showed 38.8% of hospitalized patients developed NI.⁹ In a study from Saudi Arabia, the rate of NI was 8% among hospitalized patients.¹⁵

In our study like other studies, the rate of documented NI in the ICUs was much higher than other wards and the mean rate was 12%. It was close to report of Amini and her colleagues from the Tehran who reported the incidence of NI in the ICU was 10.85%.¹⁶ Other studies from different countries have quoted incidence rates of NI in ICUs between 9% and 37%.¹ Higher incidence of NI in the ICU might be related to mechanical ventilation and invasive procedures in the ICU. Our findings like some other studies showed that gender had no significant effect on the rate of NI.^{2,13,16} In a multicenter study in Northern France, NI contributed to the deaths of 14.6% of patients and reported as the fourth most frequent cause of death.¹⁷ The estimated mortality of NI in US hospitals in 2002 was 5.8%.¹⁸ Crude mortality rates of NI have been reported from 12% to 80% dependent on the population studied and the definitions used.¹ The mortality due to NI in our study was 23.3% which was moderate rate compared to other centers.

In the present study pneumonia was the most common type of infection in ICUs which is compatible with the other studies.^{1,2,6,7,16,17,19,20} In other wards UTI was the most common one. Overall, urinary tract was the most common site of NI. This is in agreement with a study conducted in the Tehran¹⁹, a survey of hospitals in the UK and the Republic of Ireland⁴ and a multi-centre prevalence survey of NI in Greek hospitals.²¹ Some studies reported that gram-positive bacteria are the commonest cause of NI with *Staphylococcus* as the predominant pathogen^{1,2,6} while in many other studies gram-negative bacteria were the most common cause of NI.^{15,19,20,22}

Recent systematic review reported gram-negative bacilli as the most common nosocomial isolates in developing countries.²³ In our study the gram-negative bacteria were the commonest causative organisms with predominance of enterobacter followed by *Escherichia coli* and *pseudomonas aeruginosa* and gram-positive bacteria (with predominance of coagulase - positive staphylococci) were involved in nearly one forth of NI. *Pseudomonas aeruginosa* was the most common agent of NI in some studies.^{15,20,22,23} It was the third most common bacteria in the present study similar to some other studies.^{2,19}

CONCLUSION

The rate of NI in our study was low compared to many centers. It was significantly higher in ICU than other wards. Gram negative bacteria were the most common cause of NI. Pneumonia in ICU and UTI in other wards were the commonest type of NI.

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