

Determining the Prevalence of Nosocomial Infections in Lordegan Shohada Hospital, 21 March 2017 to 19 March 2020

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Abstract

Background and Objectives: Currently, Nosocomial Infections (NIs) or Health Care Worker Infections (HCWIs) have become one of the important health issues in many countries of the world, including Iran. This study was conducted to determine Prevalence of NIs in Shahada Lordegan Hospital from March 21, 2017 to March 19, 2020. **Methods:** In this cross-sectional descriptive study, the files of 45,830 patients who were at risk of NIs (cases that were hospitalized for at least 48 hours) were examined and cases of NIs were diagnosed based on references (definitions of the US Center for Communicable Disease Control and the surveillance system NIs of this type of infections) and the case finding form of NIs and then registered in the hospital infection care system. All stages of data analysis were performed in the hospital infection care system software version 2-2-4. **Results:** The overall incidence of NIs was equal to 0.6%, the incidence in men was 54.9% and in women 45.1%. The most common type of NIs in this center was surgical site infection (SSI) (0.2%), non-ventilation- associated pneumonia (0.17%) and ventilation-Associated (VAE) event (0.16%), and there are the highest rate of infections a hospital in intensive care. **Conclusions** NIs are a major problem for patients hospitalized in the ICU in In this center. Furthermore, according to this review and other studies conducted in Iran, It seems that the rate or NIs in is much fewer than Global rate of NIs, and the probably irrational use of antibiotics and as a result hinding these types of infections as well as underreporting are important factors of this problem.

Keywords: Nosocomial Infection, Lordegan Shohada Hospital, Health Care Worker Infections, Lordegan Shohada Hospital, 21March2017 to 19March2020

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1. Introduction

Increasing use of antibiotics and advances in invasive medical procedures put patients at risk of NIs [1]. NIs are an important public health issue and the fourth leading cause of disease in developed countries. NIs are the most common complications that affect hospitalized patients [2]. According to an estimate, 3.8% in the general sector and 15.3% in the intensive care sector in these countries are expected to have at least one Nis [3].

Nis are infections occur within 48 hours after a patient is admitted to the hospital and can cause an increase in mortality, Increased length of hospitalization, and also impose an economic burden on patients and the government [4]. Recently, a new term called “Health care worker associated infections (HCWIs) “is used instead of these types of infections in hospitals and other medical centers [5].

The history of Nis goes back to the time of Eugene Sam Lee Wise (early 19th century), He introduced a phenomenon called postpartum fever as one of the important reasons for the death of women after childbirth, which caused the death of about 25% of these women [6]. He found that by Hand hygiene before giving birth, Physicians can greatly reduce the rate of birth fever and death of mothers [7].

The most common NIs include Urinary Tract Infections (UTI), Bloodstream Infections (BSI), Surgical Site Infections (SSI), non-ventilation associated pneumonia and Ventilator Associated Events (VAE) [8]. The most common pathogens that cause hospital infections are bacteria, viruses and fungal parasites [5]. According to many studies, the most common NIs that occur in intensive care(ICU) are VAE, BSI, and urinary UTI associated catheter [9].

NIs occur in all developed, developing and underdeveloped countries [10]. The US Center for Communicable Disease Control estimated that the cost of events related to this type of infection in the United States was \$2,100 per year on average, ranging from \$680 for UTI to \$5,683 for respiratory tract infections [11]. NIs with a prevalence of 0.3% to 20.7% in different countries are a major problem for public health around the world [4], according to the World Health Organization, approximately 15% of hospitalized patients suffer from these infections, these infections are responsible for 4 to 56% of all infant deaths too [5].

The increasing use of antimicrobial agents and advanced medical methods, invasive devices such as catheters and ventilators, expose patients to the risk of hospital infections [12].

The Intensive Care Unit(ICU) is one of the most important parts of the hospital, which plays a very important role in the care and treatment of severe cases of the disease [5], NIs are one of the most important problems that occur in ICU due to more aggressive measures than in other hospital units [7].

Therefore, according to the mentioned cases, continuous monitoring, hand hygiene and other measures to control NIs are very vital to reduce and control these types of infections [13]. Considering the importance of NIs, this study was conducted to determining the prevalence of NIs in different wards of Lordegan Shohada Hospital from 21March 2017 to 19March2020.

2. Materials and Methods

This cross-sectional (descriptive-analytical) study was conducted on 45,830 patients admitted to Lordegan Shohada Hospital, who had been hospitalized for at least 48 hours 21March2017 to 19March2020

The inclusion criteria included people (both genders) who had been hospitalized for at least 48 hours and were hospitalized in Shahada Lordegan Hospital.

Exclusion criteria included people whose hospitalization was less than 48 hours.

Data collection tool

Information was collected through the NIs case finding form (form no. 1), this form includes:

- 1- **Biographical information of the patient:** which contains information: file number, name, gender and age, hospitalization department, weight (in case of children), hospitalization date and prevalence of infection, infection code, primary disease and outcome.
- 2- **Instrument-related infections:** In this section, information about the type of instrument (urinary, arterial or venous catheter, tracheal tube, etc.) is recorded.

3- **Confirming Cultures of the infectious agent:** In this part, if the positive culture has determined the infectious agent, the type of organism, the type of sample and the antibiogram (the level of sensitivity or resistance microorganism to antibiotics) are specified.

In this way, blood cultures, urine cultures, patient's secretions are sent from suspected cases of NIs and their results are recorded in the patient's file.

4- **Positive findings in favor of infection:** In this section, the patient's signs, symptoms and paraclinical results are recorded and then according to the mentioned cases and the Physician's opinion about NIs, the patient's information is recorded in the INIS.

Finally, the prevalence of NIs in the mentioned time period was calculated based on SPSS 23 software and INIS software version 2-2-4.

2. Result and Discussion

Findings

This study was conducted in order to determine the prevalence of NIs in Lordegan Shohada Hospital from 21March2017 to 19March2020, the files of 45830 patients with a duration of hospitalization of at least 48 hours were admitted to the hospital. The number of NIs among these patients was equal to 272 people (0.6%), the most common NIs in this study was SSI (0.20%), non VAE (0.17%) and VAE (0.16%) (Table No. 1).

Table No. 1. Overall prevalence and types of NIs in this study

Ward	VAE	PNEU	SSI	BSI	UTI	other	Total	Percent
ICU	64	8	2	2	6	0	82	9/97
NICU	0	28	3	1	0	0	32	1/38
Pediatric	0	5	0	2	5	2	14	0/16
Other	10	35	88	1	6	4	144	4/89
Total	74	76	93	6	17	6	272	
Percent	0/16	0/17	0/20	0/013	0/04	0/013		0/6

Among the cases of NIs, 143 were men (47.4%) and 129 were women (52.6%). (Table No. 2).

Table No. 2 Prevalence of hospital infections based on gender in this study

Gender	VAE	SSI	BSI	UTI	PNEU	other	Total
M	52	30	3	7	49	2	143
F	22	63	3	10	27	4	129
Total	74	93	6	17	76	6	272

According to the findings of this study, the most common microbial agent responsible for NIs was Klebsiella species (6.6%), Staphylococcus epidermidis, Escherichia coli were 4.04% and Enterobacter (3.67%) (Table 3).

Table No.3 Microbial epidemiology of the causes of NIs in this study

Microbial agent	VAE	SSI	BSI	UTI	PNEU	Others	Total	Percent
Staphylococcus epidermidis	5	0	1	4	1	0	11	4/04
Staphylococcus aureus	3	0	2	0	0	0	5	1/83
Staphylococcus coagulase positive	1	0	0	0	0	0	1	0/36

Staphylococcus coagulase negative	0	1	0	0	0	0	1	0/36
Streptococcus pneumoniae	0	0	0	0	1	0	1	0/36
Acinetobacter	5	1	0	0	0	0	6	2/2
Escherichia coli (Ecoli)	2	2	1	6	0	0	11	4/04
Enterobacter	7	0	1	2	0	0	10	3/67
Enterococcus	1	0	0	1	0	0	2	0/73
Other bacteria	1	0	0	0	0	0	1	0/36
Other mushrooms	3	0	0	1	0	0	4	1/47
Sarashia	1	0	0	2	0	0	3	1/1
Pseudomonas aeruginosa	1	0	1	0	1	0	3	1/1
citrobacter	0	0	0	0	1	0	1	0/36
Klebsiella	13	0	0	0	0	0	13	4/77
Klebsiella pneumoniae	5	0	0	0	0	0	5	1/83
Unknown	26	89	0	1	72	6	194	71/32
Total	74	93	6	17	76	6	272	100

Discussion

According to the results of this study, the prevalence of NIs in this center during the period under review was 0.6%, of which the most common type of NIs was SSI (34%), then Non-VAE (28%), VAE (27%), UTI (6.3%) and BSI (2.2%) were. Also, the most common microbial agents causing NIs were Klebsiella (4.8%), Staphylococcus epidermis (4.04%), Escherichia coli (4.04%), Enterobacter (3.67%). In a study conducted by Micha Scherbaum entitled "Investigation of prevalence and microbial resistance pattern of NIs in Gabon", the rate of NIs was found about 1.6%, Of this amount, 44% were surgical site infections, 26% were urinary tract infections, and 31% were other infections. In this study a high rate of NIs was observed after hysterectomy (12%) and Cesarean Section (6%). The most common pathogens were Staphylococcus aureus and Escherichia coli [14]. The results of Our study was somewhat consistent with the results of our study, so that a high rate of surgical site infections in our study was of cesarean section type (8%).

In the study conducted by Manoj Kumar Sahu with the aim of investigating the rate of nosocomial infections in patients undergoing surgery in a large cardiac surgery intensive care unit, NIs rate was 4.6%. Of this amount, lower respiratory tract infections accounted for 44.2% of the infections, followed by SSI (11.6%), BSI (7.5%), and UTI (6.9%), the most important microbial agents causing this type of infection were Acinetobacter, Klebsiella, Escherichia coli and Staphylococcus [3].

According to the results of our study, the prevalence of nosocomial infections in the ICU ward was about 9.97%, the most common type of which in this department was VAE (78%), followed by non-VAE (about 10%), BSI (4.4 2%) and SSI (2.4%). According to a study conducted by Sugata Dasgupta et al. entitled "Investigation of the prevalence of hospital infection in special care units", this rate was 11.98% in ICU. Pneumonia was the most common infection diagnosed (62.07%), followed by UTI and central venous catheter-related BSI [15]. To some extent, the results of our study are consistent with this study, and the different type of common infection is probably due to the different policy of accepting patients in different centers.

According to the results of our study, the prevalence of hospital infections in the neonatal intensive care unit was about 1.38%, of this amount 87% was related to pneumonia, followed by blood and operation site infections. In this regard, in a study conducted by F. Abdel-Wahab under the title of nosocomial infection in the neonatal intensive care unit of an Egyptian hospital, the prevalence of nosocomial infections in this unit was about 21.4%. Pneumonia was the most common infection (11.3%), followed

by bloodstream infection (8.8%). In this study, the most common microorganisms causing these infections were Klebsiella species (33.3%), followed by Escherichia coli (21.6%) [16].

Conclusion

In this cross-sectional descriptive study, NIs were observed in 0.6% of patients. The most common types of NIs during the study period was SSI and pneumonia, followed by other types of common NIs (urinary infection, blood infection). The highest rate of this type of infection was related to patients hospitalized in the ICU. The most common types of antibiotics causing hospital infections in this study were Klebsiella, Staphylococcus epidermis, Escherichia coli, Enterobacter. Considering the above and the low rate of nosocomial infections in this center and other parts of the country, the findings of this study can be used to plan for Controlling the irrational use of antibiotics, more active disease detection, better reporting of nosocomial infections, and as a first step towards a better infection control strategy.

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References

1. Bereket W, Hemalatha K, Getenet B, Wondwossen T, Solomon A, Zeynudin A, et al. Update on bacterial nosocomial infections. *European Review for Medical & Pharmacological Sciences*. 2012;16(8).
2. Alshehri M A, Bahwerth F S, Althagafi Z A, Alsolami H A, Almalki A M, Saif A, et al. Effectiveness of Gaseous Ozone as a Disinfectant for Nosocomial Pathogens in a Healthcare Emergency Room. *Arch. Pharm. Pract.* 2021;12(4):17- 24
3. Guggenbichler JP, Assadian O, Boeswald M, Kramer A. Incidence and clinical implication of nosocomial infections associated with implantable biomaterials - catheters, ventilator-associated pneumonia, urinary tract infections. *GMS Krankenhaushygiene interdisziplinär*. 2011;6(1):Doc18. PubMed PMID: 22242099. Pubmed Central PMCID: PMC3252661. Epub 2012/01/14. eng.
4. Samuel S, Kayode O, Musa O, Nwigwe G, Aboderin A, Salami T, et al. Nosocomial infections and the challenges of control in developing countries. *African journal of clinical and experimental microbiology*. 2010;11(2).
5. Khan HA, Ahmad A, Mehboob R. Nosocomial infections and their control strategies. *Asian pacific journal of tropical biomedicine*. 2015;5(7):509-14.
6. AlMogbel MS, Menezes GA, AlAjlan HH, Alkhulaifi MM, Alghassab OA, Alshammari AF, et al. Nosocomial Pathogens in Clinical Laboratory Departments of Various Hospitals in Ha'il, Saudi Arabia. *Int J Pharm Res Allied Sci*. 2021;10(4):95-104.
7. Gordis L. *Epidemiology e-book*: Elsevier Health Sciences; 2013.
8. Yousif MA, Mohammed IS, Mohammed SO, Gebreel ME, Alhaj RM, Alsier DA, et al. Nosocomial Transmission of Hepatitis B Surface Antigen and Anti-Hepatitis C Virus among Hemodialysis Patients. *Arch Pharm Pract*. 2022;13(3):5-10.
9. Edwardson S, Cairns C. Nosocomial infections in the ICU. *Anaesthesia & Intensive Care Medicine*. 2019;20(1):14-8.
10. Irina M. Farber, Maria A. Kudryashova, Lelya A. Galstyan, Svetlana I. Shatalina. Current aspects of antibacterial drug administration when treating nosocomial Pneumonia. *J Adv Pharm Edu Res* 2021;11(1):29-34.
11. Kouchak F, Askarian M. Nosocomial infections: the definition criteria. *Iranian journal of medical sciences*. 2012 Jun;37(2):72-3. PubMed PMID: 23115435. Pubmed Central PMCID: PMC3470069. Epub 2012/11/02. eng.
12. Khan HA, Baig FK, Mehboob R. Nosocomial infections: Epidemiology, prevention, control and surveillance. *Asian Pacific Journal of Tropical Biomedicine*. 2017;7(5):478-82.
13. Eskander HG, Morsy WYM, Elfeky HAA, Ali AM. Impact of pharmacovigilance educational intervention on critical care nurses' performance at cancer hospital, Egypt. *J Adv Pharm Educ Res*. 2021;11(4):15- 23.
14. cherbaum M, Kösters K, Mürbeth RE, Ngoa UA, Kremsner PG, Lell B, et al. Incidence, pathogens and resistance patterns of nosocomial infections at a rural hospital in Gabon. *BMC infectious diseases*. 2014;14(1):1-8.
15. Dasgupta S, Das S, Chawan NS, Hazra A. Nosocomial infections in the intensive care unit: Incidence, risk factors, outcome and associated pathogens in a public tertiary teaching hospital of Eastern India. *Indian journal of critical care medicine : peer-reviewed, official publication of Indian Society of Critical Care Medicine*. 2015 Jan;19(1):14-20. PubMed PMID: 25624645. Pubmed Central PMCID: PMC4296405. Epub 2015/01/28. eng.
16. Abdel-Wahab F, Ghoneim M, Khashaba M, El-Gilany A-H, Abdel-Hady D. Nosocomial infection surveillance in an Egyptian neonatal intensive care unit. *Journal of Hospital Infection*. 2013;83(3):196-9.