Original Article

Assessing the Nosocomial Infections' Rate and the Antibiotic Resistance Pattern among the Patient Hospitalized in Beheshti Hospital during 2013

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Abstract

Aims: Nosocomial infection is associated with increased mortality, morbidity, and length of stay. Detection of infection, identify the etiology of bacterial antibiotic resistance pattern, is necessary given the widespread use of antibiotics and antibiotic-resistant organisms. **Materials and Methods:** This cross-sectional study was done on 288 patients admitted to the Beheshti Hospitals in Kashan based on NNIS definitions according to the state of Health and Medical education. In this study infections and antibiotic resistance symptoms were found. Data analyses were performed with Chi-square test. **Results:** Among the 288 patients studied, with mean out of hospital infection was 0.80%. Most cases of infection associated were pneumonia. The highest rates of infection were in the Intensive Care Unit (ICU) with 51.7%. Nosocomial infection in ICU wards was associated with increased mortality and morbidity. The most common types were ventilator-associated pneumonia. Among the microorganisms, negative Gram was seen more. The common pathogens were including *Acinetobacter*, *Escherichia coli*, and *Klebsiella*. Antimicrobial resistance was generally increasing and had emerged from selective pressure from antibiotic use and transmission through health staff. **Conclusion**: This study showed a correlation between antibiotic use and resistance of microorganisms is significant. Hence, it seems that reducing aggressive acts and conduct hygiene education and monitoring act of antibiotics is necessary to prevent antibiotic resistance.

Keywords: Antibiotic resistance, infection control, nosocomial infection

Introduction

Hospital-acquired infections (HAIs) are among the major problems in health-care centers because they increase mortality rate and hospitalization costs. Therefore, due to the widespread use of antibiotics (a major cause of incidence of HAIs) in hospitals, it is necessary to identify infection cases, microbial etiology, and antimicrobial resistance patterns. HAIs are limited or diffuse infections caused either by pathogenic reactions of an agent or its toxins in hospitals. They develop within 48–72 h after the hospitalization of a patient. At the time of admission, the person should not show obvious symptoms of the relevant infection, and the disease should not be in the incubation period.[1]

HAIs are among the major problems in hospitals and medical centers and a significant cause of increased mortality and morbidity rates. Many types of pathogens are resistant to antibacterial agents and antiviral and this creates problems in patient treatment.[2] This is one of the most important issues in the Intensive Care Units (ICUs). Excessive use of antibiotics and immunosuppressive drugs prolongs the length of stay and increases the hospitalization costs. On the other hand, prolonged length of stay will also increase the risk of developing HAIs.[3]

Meanwhile, hospital authorities can control the number of infection cases and prevent their spread at very lower costs through observing health issues in hospitals and

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microbiological diagnosis of diseases.[4] Proper selection of antibiotics, including the correct type of antibiotic, proper dosage, sufficient time, and controlling the use of antibiotics, can prevent the incidence of resistance or reduce its increasing trend.[5]

The prevalence rate of HAI is associated with hospital conditions, the type of ward, and patient status.[6] In this regard, it is crucially important to conduct preventive planning to avoid the emergence and development of resistant organisms and to identify pathogens, and this requires performing extensive research.[7,8] At the same time, it can be controlled and spending much less and with regard to hygiene in hospitals and microbiological diagnosis of diseases. Therefore, this study aimed to raise the level of awareness of the authorities and relevant experts about HAIs and it can be a major step toward infection prevention and control.[9,10]

Materials and Methods

The study was a retrospective study in Beheshti hospital of Kashan over a 1-year period. All case records of patients admitted into the wards during the period of March 2012 to February were reviewed, and those who were identified to have developed infection from 48 h after admission up to 2 days after discharge were recruited. Accordingly, outpatients and those who were hospitalized for <48 h were excluded from the study. Data collection was designed on the basis of a questionnaire of National nosocomial infections surveillance (NNIS). According to standards of care definitions of nosocomial infections, Ministry of Health and Medical Education (NNIS) was divided, infections of urinary tract, surgical infection, blood infection, and pneumonia.[10] The study was conducted according to the Declaration of Helsinki and participants signed an informed consent form approved by the Ethics Committee of the Faculty of Medicine. Information entered in the application SPSS 19 (IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp) and was performed by Chi-square test.

Results

In this study, 288 patients with nosocomial infections were had been investigated in 2013. The incidence of hospital infections was with an average of 0.80%. The number of cases of nosocomial infection was 288 cases of patients hospitalized more than 48 h in the hospital. The total number of hospital deaths in 2013 was unknown. Pneumonia (60.42%) was the most common infection, followed by surgical site infection (22.5%), urinary tract infection (10.76%), blood infections (4.17%), and other infections (2.08%). The highest rate of infection in ICU wards (51.7%) was ventilator-associated pneumonia (VAP). The most common infections among men were pneumonia (55.17%) and among women were urinary tract infection (61.3%). Hospital-acquired pneumonia with 48 h or more after admission was one of the main causes of fatal infections. Forty-eight hours or more after ending of tracheal intubation, clinical prevalence of it diagnosed 13%–16%, although rates are much lower using stricter definitions monitoring. While the crude mortality rate was usually 20%–30% that have been reported. Infection rate was observed more in men with 53.82% [Table 1 and Figure 1].

The most dominant microorganisms in pneumonia were observed *Acinetobacter* (76.41%) and surgical site (22.63%) in urinary tract infections were *Escherichia coli* (42.85%) and in blood infections were coagulase-negative staphylococci (15.21%). The most types of microorganism had observed *Acinetobacter* [Table 2 and Figure 2]. The relationship between in two groups of men and woman in the distribution of nosocomial infections was not observed statistically ($P = 0.47$).

In this study, most patients with nosocomial infections underwent several invasive interventions during their hospitalization; however, suction and ventilator-assisted breathing were the most frequent invasive interventions, respectively [Table 3].

The study of antibiotic resistance, highest resistance, was in the group of cephalosporins and ampicillin. This table shows the susceptibility degree measured for a different antibiotic in the cases examined [Table 4].

Discussion

In this study, the prevalence of HAI or nosocomial infection was 0.80%. In other studies, the incidence of infection was different.[11,12] This may be due to the differences between methodologies and sampling tools. Ghorbanalizadegan *et al*. (2007), in their study conducted in Baqiyatallah hospital, Tehran, reported a prevalence rate of 3.9%. Pneumonia was the most common infection (60.4%) and its mortality rate was 40%–70%. In this study, *Acinetobacter* was the most dominant microorganism. In the study of Ghorbanalizadegan *et al*., the prevalence of resistant *Acinetobacter* cases was 3.1%. Most of the infection cases were observed in the ICU, and this is consistent with our study.[13]

During many studies, microorganisms have evolved evasion strategies to overcome a myriad of chemical and environmental challenges, including antimicrobial drugs.[12] In the study of Ozayar (2013) *et al*, most common HAI was blood stream infection. The rate of soft tissue and skin infection was the second most common. This is not consistent with our study. Also, the most common agents were negative Gram (56.68 %), positive Gram (31.02%). In our study observed more negative Gram. [14,15]

The most common invasive measures included suction, ventilation, and intravenous feeding. In this study, there was a significant relationship between invasive methods and the severity of infection. In addition, *Acinetobacter* was the most dominant microorganism in this study.

In Jason's study (2015), which was conducted with title nosocomial infections in the ICU; the highest prevalence infection was seen in ICU ward.

This conclusion is consistent with our study. In this study, the most microorganisms were detected *Acinetobacter*, but Jason study was seen Staphylococci and *Pseudomonas*.[16,17] In the

Table 1: Distribution cases of nosocomial infections according to the type and sex

Gender	UTI (%)	Pneumonia (%)	SSI (%)	BSI (%)	Other (%)	Total (%)
Male	12 (7.74)	96 (61.93)	36 (23.22)	7 (4.53)	4 (2.58)	155 (53.82)
Female	19 (14.28)	78 (58.64)	29 (21.83)	5 (3.75)	2 (1.50)	133 (46.18)
Total	31 (10.76)	174 (60.42)	65 (22.57)	12 (4.17)	6 (2.08)	288 (100)

UTI: Urinary tract infection, SSI: Surgical site infection, BSI: Bloodstream infection

Table 2: Distribution cases of nosocomial infections according to the agent

Type of infection microorganism	Other, *n* (%)	SSI, *n* (%)	BSI, *n* (%)	Pneumonia, *n* (%)	UTI, *n* (%)	Total, *n* (%)
Escherichia coli	3 (8.57)	5 (14.28)	-	12 (34.38)	15 (42.85)	35 (12.5)
Streptococcus	-	-	-	2 (40)	3(60)	5 (1.85)
Coagulase-positive *Staphylococcus*	-	8 (32)	-	17 (68)	-	25 (9)
Coagulase-negative *Staphylococcus*	1 (2.17)	15 (32.60)	7 (15.21)	21 (45.65)	2 (4.34)	46 (16)
Staphylococcus aureus	-	5 (100)	-	-	-	5 (0.73)
Acinetobacter	-	24 (22.63)	1 (0.94)	81 (76.41)	-	106 (36.45)
Pseudomonas	-	4 (26.66)	2 (13.33)	8 (53.33)	1 (6.66)	15 (5.2)
Citrobacter	-	-	-	3 (75)	1 (25)	4 (1.5)
Klebsiella	1 (3.12)	1 (3.12)	1 (3.14)	24 (75)	5 (16.52)	32 (11.10)
Enterobacter	-	-	-	2 (66.67)	1 (33.33)	3 (1.5)
Enterococcus	1 (12.5)	2 (25)	1 (12.5)	2 (25)	2 (25)	8 (2.77)
Proteus	-	-	-	1 (50)	1 (50)	2 (0.7)
Other	-	1 (50)	-	1 (50)	-	2 (0.7)

UTI: Urinary tract infection, SSI: Surgical site infection, BSI: Bloodstream infection

Table 3: Distribution cases of nosocomial infections according to the invasive procedures

Invasive procedures	BSI (%)	SSI (%)	Pneumonia (%)	UTI (%)	Other (%)	Total
Tracheotomy	-	-	129 (100)	-	-	129
Intra gastric tube	12 (6.25)	51 (26.56)	12 (28.50)	11 (5.72)	6 (3.13)	166
Surgery	3 (2.67)	65 (58.05)	21 (28.55)	23 (20.53)	-	112
Suction	9 (4)	51 (22.66)	136 (60.34)	23 (10.22)	6 (2.66)	225
Shunt	-	2 (100)	-	-	-	2
Urinary catheters	-	13 (16.60)	44 (56.41)	19 (24.13)	2 (2.57)	78
Artery catheters	59 (71.43)	2 (28.57)	-	-	-	61
Intravenous catheters	3 (6.13)	21 (42.80)	9 (18.36)	14 (28.75)	2 (2.57)	49
Endotracheal tube	7 (5.64)	27 (21.70)	73 (76)	12 (9.67)	5 (4.04)	124
Ventilator	-	25 (22.6)	129 (77.71)	12 (7.23)	-	192

UTI: Urinary tract infection, SSI: Surgical site infection, BSI: Bloodstream infection

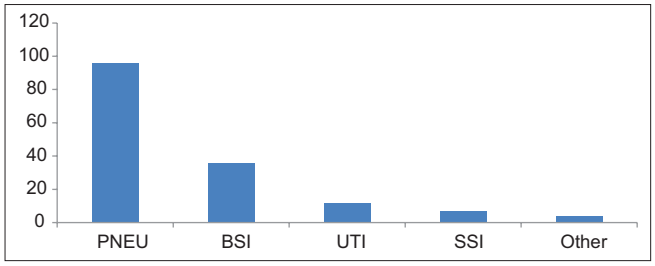

Figure 1: Nosocomial infections according to the type

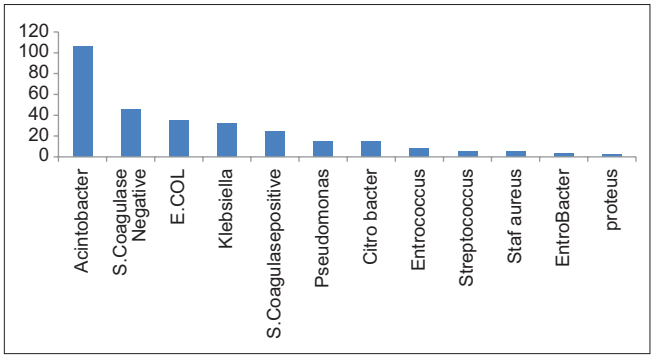

Figure 2: Nosocomial infections according to the agent

study of Mohajeri and Gholamine was carried out in 2010 in Kermanshah, the highest drug resistance to *Acinetobacter* was the third-generation cephalosporin and ampicillin.[18,19]

In this study, *Acinetobacter* had the highest resistance to cephalosporins and ceftriaxone that was in patients who were hospitalized in hospital. The high consumption of antibiotics in both studies showed that there is drug resistance of medication.[20] The study of Iliyasu *et al*. was carried out in

Table 4: Distribution cases of susceptibility degree for different antibiotics

Row	Items	High	Intermediate	Resistant (%)	Total	Not tested
1	Ampicillin	31	7	140 (78.65)	178	110
2	Amikacin	143	-	91 (38.88)	234	54
3	Azithromycin	26	24	126 (71.59)	176	112
4	Metronidazole	71	6	192 (71.37)	269	25
5	Cefepime	62	12	214 (74.30)	288	-
6	Cefotaxime	65	16	219 (78.27)	280	5
7	Ceftazidime	80	5	203 (70.48)	288	-
8	Ciprofloxacin	28	7	244 (87.45)	279	9
10	Gentamicin	18	19	198 (84.25)	235	53
11	Imipenem	64	36	108 (51.93)	208	-
12	Levofloxacin	-	-	105 (100)	105	25
13	Meropenem	68	44	171 (60.42)	283	5
14	Clindamycin	16	24	223 (84.79)	263	25
15	Trimetoprim-sulfametoxazol	5	6	28 (71.79)	39	149
16	Ceftriaxone	24	50	193 (72.28)	267	21

Nigeria in 2016 with the title of "Nosocomial infections and resistance pattern of common bacterial isolates in an Intensive Care Unit of a tertiary hospital in Nigeria: A 4-year review" that was determined antimicrobial resistance as one of the major challenges of management of infection in an ICU ward.[21,22] In Ramírez Wong study (2015) *et al.*, which was conducted with title Surgical Site Infections (SSIs) Rates in More Than 13,000 Surgical Procedures in Three Cities in Peru: Findings of the International Nosocomial Infection Control Consortium, Surgical site infections were a threat to patient safety. However, there were not available data on SSI rates stratified by surgical procedure (SP) in Peru.[23] The incidence of infection with multidrug-resistant pathogens in ICUs worldwide is high, and this has been linked to overuse of antibiotics, which invariably puts the organisms on selective pressure, this is consistent with our studies.[24,25]

Conclusion

Early detection of patients at risk for nosocomial infections is essential; this particularly important in ICUs. The necessary instructions should be implemented as key steps for the proper management of vulnerable patients. Needed policies against antibiotic resistance must be applied. The study also suggests that further attention must be paid to health-care staff training not only in ICUs but also in other care units.

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Conflicts of interest

There are no conflicts of interest.

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