Nosocomial Infections: Multicenter Surveillance of Antimicrobial Resistance in Tehran During 2015 - 2017

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Abstract

Background: Rapid increase in nosocomial infections (NIs) due to antibiotic resistant organisms is a global issue, which causes significant morbidity in both patients and healthcare professionals ultimately leading to an extra cost on health care systems. Thus, studying NIs is a public health priority.

Methods: The study was designed as a cross-sectional investigation between 2015 - 2017. Inpatient cases of selected hospitals with nosocomial infections were included. Demographics, source of infections, causative agents, and their antibiotic susceptibility through E-test method were collected. All data were analyzed using SPSS statistical software (version 19).

Results: A total of 168 patients with NIs were identified. Of the patients, 100 (59.5%) cases were male. The intensive care unit had the highest infection rate (N = 100 (59.5%)) and bronchoalveolar lavage (BAL) (N = 58 (34.5%)) and *Acinetobacter* (N = 76 (47.5%)) were the most common source and organism of NI.

Conclusions: Results of this study showed the dangerously high nosocomial infection rates, which necessitates considering surveillance of antibiotic usage and restriction of using broad spectrum antibiotics in infections.

Keywords: Nosocomial Infection, Bacterial Agent, Resistance, Susceptibility

1. Background

The problem of hospital acquired infection, in spite of vast advances in the treatment of infectious diseases during past decades, remains a vital issue and the importance of this issue is increasing every day. According to different studies, 8.7% of hospitalized patients acquire this infection worldwide, in both developed and developing countries. This kind of infection leads to an increasing rate of deaths, organ rejection, and surgeries failure (1). Nosocomial infection definition is an infection in those occurring in 72 hours of hospital admission, 3 days of discharge, or 30 days after surgery. Bacteria, viruses, fungi, and parasites can cause nosocomial infections (2, 3). The main gram-negative agent bacilli are including *E. coli*, *Klebsiella pneumonia*, and *Pseudomonas aeruginosa* (4). The estimated rate of nosocomial pneumonia is 5 - 10 episodes per 1000 hospitalizations. The length of mechanical ventilation is directly related to the rate of ventilator associated pneumonia (5). Gram negatives bacilli like *Pseudomonas aeruginosa*, *Klebsiella pneumonia*, *Acintobacter* species, and staphylococci are the main etiological factors. Increasing frequency of antibiotic resistant organisms is a common problem in the treatment of NIs. Studies regarding antimicrobial drug resistance effective for the control of bacterial pathogens and vital in any region, hospital epidemiologic plans, and antibiotic susceptibility patterns in hospitals should be monitored regularly (6).

2. Objectives

The aim of this study was to evaluate the frequency of nosocomial infections and antibiotic susceptibility patterns of selected hospitals in Tehran, Iran, to help the physician in choosing better antibiotics for initial empiric therapy, which is due to the fact that there is a significant knowledge gap regarding the Nis due to the fact that lack of enough data from epidemiological studies and reports coming from Iran are not enough.

3. Methods

This cross sectional study survey was conducted from June 2015 to June 2017 in selected referral hospital in Iran,

located in Tehran. In the first step, a questionnaire that included the demographic and clinical characteristics, type of nosocomial infection, and sort of culture was provided. The antibiotic susceptibility was determined by the E-test method. Next, we took out the list of patients with nosocomial infection that was provided by the hospital infection control nurse and then we went to the archive file of the patients one by one. We extracted our required patient data and entered them in the information form. Finally, the collected data were analyzed using the SPSS Version 19 (7).

4. Results

A total 168 patients were infected. Of these patients, 100 were males and 68 were females. The average age was 71.64 years. The most of nosocomial infection was seen in the ICU with 100 patients. BAL (58) and sputum (37) were the most sources of infection. The most common organisms were *Acintobacter* and *Klebsiella* (76 and 30 cases, respectively). The prevalence of NIs in various wards is shown in Table 1. The prevalence of various causative agents and source of infection is listed in Table 2. Antibiotic sensitivity patterns of the bacteria that cause NIs are listed in Tables 3 and 4.

5. Discussion

In the current study, detection of NIs in most of cases was based on the clinical grounds; therefore, it is increasing the possibility of missing patients with subclinical infections. In addition, due to the fact that the laboratory reports might contain false negative results, the average age of our cases was 71.64 years. The average of over 50 years old has a higher risk of infections (8). Furthermore, it was mentioned that people over 50 years are the most resistance antibiotics (9).

In this study most of our patients were hospitalized in the ICU and the most common source of infection was BAL. The most common bacteria isolated from patients was *Acinetobacter* spp. In Javanbakht et al. (10), study in Mashhad the highest frequency of pathogen was *Acinetobacter* spp., which is similar to our result. In a study, which was conducted by Kazemi et al. (11), *A. baumannii* isolates from ICU wards of hospital was very high and antibiotic resistance against meropenem, piperacilin, and ceftazidin had a rate of 100%, 98%, and 96%, respectively, which is consistent with our results. In another study, most of the *Acinetobacter* samples were isolated from the ICU (12). In the Atlantic region, prevalence of the multi-drug resistance of

Acinetobacter spp. has been reported to 29.3%. Unfortunately, due to increasing multi-drug resistant strains, treatment of infectious diseases, which coursed by *Acinetobacter* spp. is difficult (13, 14). According to different studies, the rate of mortality from NIs caused by *Acinetobacter* spp. is around 7.8% to 23% (14).

In our study, resistance to amikacin was low in gram negative bacteria except *Pseudomans* spp. in Hosain Zadegan's study, which was done in the Baghiattalah hospital; the most common germ in bronchial samples was *Pseudomans* spp. (15). In another study, Nan et al. (16), reported that the prevalence of *Pseudomans* spp. in nosocomial infection was 20%. In our study, the prevalence is 10%. These differences could be due to hospital environment and health (17).

S. aurous had a very high rate of resistance. Molaabbaszadeh et al. , studied the rate of resistance in *S. aurous* to ciproflaxin, clindamycin, and cotrimoxazol and observed that the resistance was low, and similar to our study, cotrimaxazol was 100% sensitive (18). In the study of Yadegarynia et al., *S. aurous* resistance was low in linozolind and vancomycine. In our study, resistance to vancomycin and cotrimaxozol were not observed (19).

Although *Acinetobacter* spp. and *Klebsiella* spp. is the most common cause of NIs in the ICU, with source of BAL in the current study, they are resistance to a wide range of antibiotics. Furthermore, in many studies in nosocomial infection the main infection was UTI infected by *E. coli* (20).

In our study, the second common microorganism that was isolated in culture was *Klebsiella* spp. (30 patients, 17%). Yedagarynia et al. studied the rate of *Klebsiella* spp. infection and antimicrobial resistance by E-test in Khatam-ol-Anbiya Hospital (21). In that study, the most resistance was observed in ciprofloxacin, ceftriaxone, and gentamicin. In the current study ceftazidim had the highest resistance.

Since our study design, as a respective study and test of susceptibility, was limited, we had some limitations.

5.1. Conclusions

In conclusion, our study showed the antibiotic resistance of bacteria isolated in selected hospitals during 2015 - 2017. It seems that we are facing the increasing rate of antibiotic resistance in our hospitals and region. The result confirms that it is necessary to evaluate precise reporting and improving control of infection procedure in hospitals. We must gain sufficient knowledge about antimicrobial resistance in our country; therefore, we can monitor the prevalence and antimicrobial resistance of bacteria by administrating appropriate treatments.

Table 1. Distribution of Patients According the Ward Type[a]

	ICU	CCU	Cardiovascular	General	Surgery	Neurology
Acinetobacter	48 (63.2)	16 (21.1)	2 (2.6)	4 (5.3)	2 (2.6)	4 (5.3)
Klebsiella	24 (80)	3 (10)	3 (10)			
Enterococcus	4 (28.6)	2 (14.3)	2 (14.3)	4 (28.6)	2 (14.3)	
Pseudomonas	8 (44.4)		2 (11.1)	8 (44.4)		
Staphylococcus aureus	16 (72.7)			6 (27.3)		

[a]Values are presented as No. (%).

Table 2. Causative Agent and Source of Infection[a]

	BAL	CSF	Foley Catheter	Pleural	Sputum	Trachea Sample	Wound	Blood	Total
Acinetobacter	28 (36.8)	10 (13.2)	2 (2.6)	2 (2.6)	22 (28.9)	2 (2.6)	10 (13.2)		76
Klebsiella	15 (50)	6 (20)			3 (10)			6 (20)	30
Enterococcus		4 (28.6)					4 (28.6)	2 (14.3)	14
Pseudomonas	3 (16.7)				6 (33.3)		6 (33.3)	3 (16.7)	18
Staphylococcus aureus	12 (54.4)				6 (27.3)		2 (9.1)	2 (9.1)	22

[a]Values are presented as No. (%).

Table 3. Antibiotic Susceptibility of Gram Negative Bacterial Isolated from Infection Sites

	Acinetobacter spp.		*Pseudomans* spp.		*Klebsiella* spp.	
	R	I	R	I	R	I
Amikacin	28.9	68.4	50	-	30	3.3
Piperacillin	100	-	-	-	30	-
Cefepime	100	-	100		50	40
Rifampicin	7.1	57.1	-			
Gentamicin	94	2	50		30	
Meropenem	63	-	100		20	10
Colistin	0		66.66		10	10
Ceftazidim	92		16.7		90	
Imipenem	0				20	70
Co-trimoxazol					40	50

Table 4. Antibiotic Susceptibility of Gram Positive Bacteria Isolated from Infection Site

	S. aureus		*Entrococcus*	
	R	I	R	I
Rifampicin	85.7		85	
linozolid	10		90	
Amikacin	100			
Vancomycine	0			9.1
Piperacillin	100		100	
Co-trimaxozol	0		0	

Footnotes

Authors' Contribution: The core idea and work came from Davood Yadegarynia and Saman Droodgar.

Conflict of Interests: The authors declare that they have no conflict of interest.

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