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# Hospital-Acquired Infections in Internal-Surgical Intensive Care Unit Patients: A Retrospective Study

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**Abstract:** *Introduction:* Hospital-acquired infections cause the length of stay in hospital, morbidity, mortality, and increase the cost of treatment. The aim of this study was to determine the incidence of hospital-acquired infections in adult internal-surgical intensive care unit patients, distribution of infections according to the intensive care units, the types, diagnosis and causative microorganisms of infections. *Method:* In this retrospective study, the archive documents of the patients diagnosed with a hospital-acquired infection and staying in the internal-surgical intensive care units of a university hospital in Turkey between 2013 and 2014 were evaluated. From 9547 patient's documents that stayed in the adult and pediatrics intensive care units, 448 of them were diagnosed with hospital-acquired infections. From 448 patient's documents 102 pediatrics intensive care units documents were excluded. In total, 346 adult internal-surgical intensive care unit patients' files were evaluated. *Results:* The mean age of the patients was  $67,91 \pm 14,76$ , 58.9% of them were male, the mean length of stay in intensive care unit was  $27,02 \pm 25,68$  days, 60.7% of the patients stayed in internal intensive care units, and 39.3% of the patients stayed in the surgical intensive care units. The incidence of the hospital-acquired infection in the internal-surgical intensive care units was 4.16%. It was determined that 46% of the patients had a bacteremia infection, 31.8% VIP, 5.8% fungemia, and 4.9% organ-space surgical site infection. 16.8% of the causative microorganisms of the hospital-acquired infections were *Acinetobacter SPP*, 11.3% had no causative microorganism, 7.2% were *E-Coli*, 5.8% *Acinobacter Baumannii*, 5.5% *Stenotrophomonas Maltophilia*, 5.2% *Pseudomonas Spp.IBL+*, 4.3% *Candida Albicans*, 3.8% *Klebsiella Pneumoniae*, 3.5% *Pseudomonas Aeriginosa*. *Conclusion:* The incidence of the hospital-acquired infections was low, and most of the infections were associated with blood and respiration. As the rate of the hospital-acquired infections is the most important indicator in the quality of patient care, it becomes important for the intensive care nurses to use their roles as a caregiver and as an educator in the prevention of the hospital-acquired infections. Also, the determination of the agents of the hospital-acquired infections in intensive care units becomes important in the determination of the treatment process.

**Keywords:** Intensive Care Units, Hospital-Acquired Infection

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## 1. Introduction

The hospital-acquired infection (nosocomial infection) is a term used for the infections developing 48 hours or more after hospitalization, in the first 10 days after discharge, or in the first 30 days after operation. Although intensive care units (ICU) make up 5% of patient-capacity of the hospitals, they cover 25% of the hospital-acquired infections. These infections in intensive care units are seen 5-10 times more than the other units in the hospital (Kujur & Lakra, 2015; Luna et al., 2014; Özer et al. 2010; Pradhan et al., 2014; Sakr et al., 2015). It was identified that according to the study

results conducted by World Health Organization (WHO), the prevalence of the hospital-acquired infections was 9%, and the highest hospital-acquired infection frequency was 12% and 10% in the Eastern Mediterranean and in the Southeastern Asia, respectively. These rates were determined as 8% in Europe, and 9% in the West Pacific (Ertek, 2008).

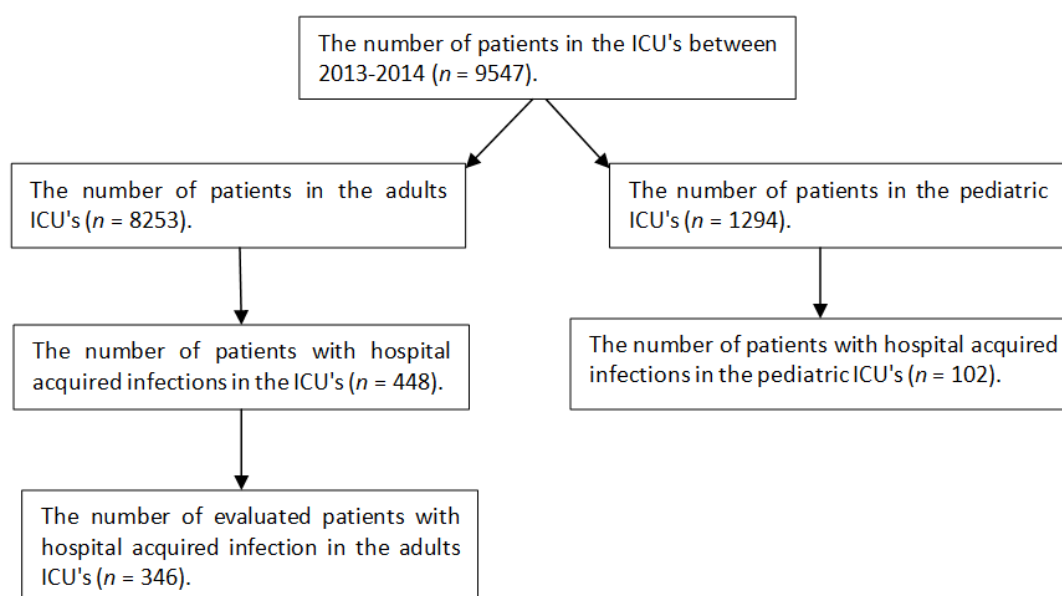
A lot of factors related to patient and institution have an influence on being the rate of the hospital-acquired infections in intensive care units high. As the intensive care units are the units where the invasive procedures such as vein-urinary catheterization, intubation, invasive monitoring, enteral parenteral nutrition etc. are performed more frequently, and multidrug-resistant microorganisms are more isolated, the

hospital-acquired infections are seen more frequently in these places compared to the other units (Luna et al., 2014; Meric et al. 2005; Oliveira et al., 2010). It was reported that of all the hospital infections, catheter-related urinary tract infections (40-45%), surgical site infection, ventilator-associated pneumonia, and catheter-related bloodstream infections were the most frequently seen infections respectively (Luna et al., 2014; Meric et al. 2005; Oliveira et al., 2010). In a study conducted in Turkey in 2001, the incidence of the hospital-acquired infections in intensive care units was determined as 25.6% (Ak et al., 2011). In a study conducted by National Nosocomial Infection Surveillance System, it was indicated that 68% of the intensive care infections were associated with respiratory system (31%), urinary system (23%), and primer bloodstream infections (14%), and 87% of the primer bloodstream infections were associated with central venous catheter, 83% of the hospital-acquired pneumonias were associated with mechanical ventilation, 97% of the urinary tract infections were associated with catheterization (Ertek, 2008). In a study conducted according to the infection types, while the most frequently seen infections were determined as the bloodstream infections and the hospital-acquired pneumonias in the internal intensive care unit, they were determined as the bloodstream infections, the hospital-acquired pneumonias, and the surgical site infection in the surgical intensive care unit. Of all the isolated agents in nosocomial infections, staphylococcus aureus, coagulase negative staphylococcus, streptococcus pneumonia, escherichia coli, enterococcus, acinetobacter spp. pseudomonas aeruginosa, klebsiella,

acinetobacter and candida spp. are the most frequently seen ones (Yenilmez ve ark. 2015). Nosocomial infections lead to prolonged hospital stay, cost increase, side effects based on antibiotic treatment, labour loss of the hospital staff, and also they cause big damages both to patients and to their families materially and morally (Dereli et al., 2013, Meric et al., 2005, Pradhan et al., 2014). The identification of the frequency, types, and isolated microorganisms of the infections in the intensive care units helps the identification of the prevention and treatment strategies. In this study, it was aimed to determine the incidence of hospital-acquired infections in adult internal-surgical intensive care unit patients, distribution of infections according to the intensive care units, the types, diagnosis and causative microorganisms of infections.

## 2. Material and Methods

This retrospective study was conducted by evaluating the documents of the patients diagnosed with hospital-acquired infection in the internal and surgical intensive care units in a university hospital in Turkey in the years 2013-2014. It was determined that 9547 patients in total stayed in the adult and pediatrics intensive care units, and 448 of these patients were diagnosed with a hospital-acquired infection. It was determined that 102 of 448 patients stayed in the pediatrics intensive care units, and the rest 346 patients stayed in the adult internal-surgical intensive care units. 346 adult internal-surgical intensive care unit patients' files in total were evaluated (Figure 1).



**Figure 1.** The Stages of Sample Selection in ICU's.

In order to be able to carry out the study, written permissions from Adnan Menderes University Faculty of Medicine Non-Invasive Ethics Committee, from Chief Physician of Adnan Menderes University Training-Research Hospital, and from the Head of the Department of Infectious

Diseases were got. From the hospital records of the patients diagnosed with hospital-acquired infection, demographic information of the patients, clinical data about hospitalization, length of stay in intensive care unit, disease diagnosis, state of consciousness, comorbid, operations the patient underwent,

operation drain, performed procedures (ERCP, bronchoscopy, LP, hemodialysis etc.) existing catheters (NG Tube, artery catheter, periphery or central venous catheter, tracheostomy, nephrostomy etc.) were obtained and analyzed. In addition to this information, the type of the hospital-acquired infection, the location of sample material collection, agents, and treatment process were obtained and analyzed.

### 3. Results

It was determined that the mean age of the patients was  $67,91 \pm 14,76$ , 58.9% of the patients were male, average length of stay in the intensive care unit was  $27,02 \pm 25,68$  days, 60.7% of the patients stayed in the internal intensive care units, and 39.3% of the patients stayed in the surgical intensive care units. It was determined that 40% of the patients staying in the internal intensive care units were in the emergency intensive care unit, and 41.1% of the patients staying in the surgical intensive care units were in the general surgery intensive care units (Table1).

**Table 1.** Demographic/ Clinical Characteristics and Distribution of Hospital-Acquired Infections Patients in the Intensive Care Units.

Sex	Male n (%)		Female n (%)	
	204 (58,9)		142(41,1)	
Age	67,91±14,76			
Hospitalization in ICU's (day)	27,02±25,68			
Patients in the ICU's	Surgery ICU's n (%)		Internal ICU's n (%)	
	136 (39,3)		210 (60,7)	
Emergency ICU	-	84 (40,0)		
General Surgery ICU	56 (41,1)		-	
Cardiovascular ICU	48 (35,2)		-	
Neurology ICU	-	29 (13,8)		
Internal ICU	-	21 (10,0)		
Nephrology-Urology ICU	3 (2,3)		20 (9,5)	
Hematology ICU	-	19 (9,0)		
Oncology ICU	1 (0,7)		18 (8,5)	
Chest ICU	11 (8,0)		6 (2,8)	
Neurosurgery ICU	9 (6,7)		-	
Anesthesia-Reanimation ICU	-	8 (3,8)		
Gastrology ICU	-	4 (1,9)		
Ortopedia ICU	5 (3,7)		-	
Burn-Plastic ICU	3 (2,3)		-	
Romatology ICU	-	1 (0,5)		
Total	346 (100)			

Table 2 shows some information about the patients staying in the intensive care units, and the diagnosis of the patients with a hospital-acquired infection. It was determined that 9% of the patients stayed in the intensive care units with the diagnosis of the acute renal failure, 6.4% of the patients stayed in the intensive care units with the diagnosis of the respiratory failure, 6.1% of the patients stayed in the intensive care units with the diagnosis of the atherosclerotic cardiovascular disease, and 5.5% of the patients stayed in the intensive care units with the diagnosis of the cerebrovascular event (Table2).

**Table 2.** Primary Diagnosis of the ICU Patients With Hospital-acquired Infections.

Diagnosis	n (%)
Acute Renal Failure	31 (9,0)
Respiratory Failure	22 (6,4)
Atherosclerotic Heart Diseases	21 (6,1)
Cerebro Vascular Attack	19 (5,5)
Car Accident (Cash)	11 (3,2)
Femur Fracture	8 (2,3)
Lung Cancer	7 (2,0)
Multiple Myeloma	7 (2,0)
Chest Pain	6 (1,7)
COPD	6 (1,7)
Malaise	6 (1,7)
Chronic Renal Failure	6 (1,7)
Pnomonia	6 (1,7)
Acute Abdomen	5 (1,4)
Dyspnea	5 (1,4)
Trauma	5 (1,4)
Etc.	175 (50,5)
Total	346 (100)

**Table 3.** Type of Diagnosis and Causative Microorganism of Hospital-acquired Infections in ICU Patients.

Infection Type	n (%)
Bacteremia	159 (46,0)
Pneumonia (VAP)	110 (31,8)
Fungemia	20 (5,8)
Organ Space Surgical Site Infection	17 (4,9)
Superficial Surgical Site Infection	8 (2,3)
Central Catheter Infection	7 (2,0)
Soft Tissue Infection	5 (1,4)
Catheter-Associated Urinary Tract Infection	4 (1,2)
Etc.	15 (4,6)
Total	346 (100)
Causative Microorganism	n (%)
Acinetobacter SPP	58 (16,8)
Unknown	39 (11,3)
E-coli	25 (7,2)
Acinetobacter Baumannii	20 (5,8)
Stenotrophomonas Maltophilia	19 (5,5)
Pseudomonas Spp. (IBL)	18 (5,2)
Candida Albicans	15 (4,3)
Klebsiella Pneumoniae	13 (3,8)
Pseudomonas Aeruginosa	12 (3,5)
E-coli ESBL+	11 (3,2)
Candida Parapsilosis	9 (2,6)
Enterococcus Faecium	7 (2,0)
MRSA	7 (2,0)
Acinetobacter Iwoffii	5 (1,4)
Klebsiella Pneumoniae ESBL	5 (1,4)
Ect.	83 (24,0)
Total	346 (100)

Table 3 shows information about the type of hospital-acquired infections. It was determined that 46% of the patients were diagnosed with a bacteremia infection, 31.8% of the patients were diagnosed with a VAP infection, 5.8% of the patients were diagnosed with a fungemia infection, and

4.9% of the patients were diagnosed with an organ-space surgical site infection. Information about the types of the causative microorganisms of the hospital-acquired infections. It was determined that 16.8% of the causative microorganisms of the hospital-acquired infections were *Acinetobacter* SPP, 11.3% had no causative microorganism, 7.2% were *e-coli*, 5.8% were *Acinnobacter Baumanii*, 5.5% were *Stenotrophomanas Maltophilia*, 5.2% were *Psedomanas Spp.IBL+*, 4.3% were *Candida Albicans*, 3.8% were *Klebsialla Pneumoniae*, 3.5% were *Psedomanas Aeriginosa* and 36.6% were other microorganisms (Table3).

## 4. Discussion

At present study, the incidence of the hospital-acquired infection in the internal-surgical intensive care units was determined as 4.16%. It was determined that the hospital-acquired infections in the general surgery and emergency intensive care units patients were found to be higher than in the other units. Besides, in patients with acute renal failure, the hospital-acquired infections were found to be higher. It was determined that of all the hospital-acquired infections, bacteremia and pneumonia were in the first place. It was determined that the most isolated microorganisms were *Acinnobacter*, *E-coli*, *Stenotrophomanas Maltophilia*, and *Psedomanas Spp.IBL+* respectively.

Farzianpour and et al. (2015) stated in their study that the rates of the hospital-acquired infections in the intensive care units between 2010 and 2012 were 15.33%, 13.17%, and 9.59% respectively. Khan and et al. (2015), and Pradhan and et al. determined these rates as 29.5% and 9.6% in their studies. Dereli and et al. (2013) stated in their study that the rates of the hospital-acquired infections between 2007 and 2010 were 53%, 29.15%, 28.85% and 16.62% respectively. Baghaei and et al. (2011), Oliveira and et al. (2010), Shaikh and et al. (2008), and Erbay and et al. (2003) determined in their studies that the rates of the hospital-acquired infections were 8.45%, 20.3%, 29.13% and 26% respectively.

Farzianpour and et al. (2015), Oliveira and et al. (2010), Özer and et al. (2010), and Shaikh and et al. (2008) stated in their studies conducted according to the sites where the hospital-acquired infections in the intensive care units were seen that the most frequently seen hospital-acquired infections in intensive care units were urinary tract infections. Khan and et al. (2015), Pradhan and et al. (2014), Baghaei and et al. (2011), Akhtar (2009), Meric and et al. (2005) and Erbay and et al. (2003) stated in their studies conducted according to the sites where the hospital-acquired infections in the intensive care units were seen that the most frequently seen hospital-acquired infections in intensive care units were respiratory tract infections (pneumonia). Dereli and et al. (2013) determined in their study conducted according to the sites where the hospital-acquired infections were seen that the most frequently seen hospital-acquired infections were bloodstream, soft tissue, and skin infections. According to the study results conducted by Alatrouny and et al. (2013) about breeding sites of the microorganisms associated with

hospital-acquired infections in intensive care units, bacterial growth was noted in sputum (41.82%) at most, in trachea secretion (20%), in central venous catheter (14.55%), in wound site (14.55%), in urine (5.45%), and in blood (3.63%).

Farzianpour and et al. (2015), and Amazian and et al. (2010) stated in their study about the hospital-acquired infections in the intensive care units that *E.coli* was the most isolated microorganism. Luna and et al. (2014), Pradhan and et al. (2014), Alatrouny and et al. (2013), Dereli and et al. (2013), and Oliveira and et al. (2010) stated in their studies about the hospital-acquired infections in the intensive care units that *Acinetobacter baumanii* was the most isolated microorganism. Khan and et al. (2015), Baghaei and et al. (2011), Akhtar (2009), and Erbay and et al. (2003) determined in their studies about the hospital-acquired infections in the intensive care units that *pseudomonas aeruginosa* was the most isolated microorganism. Kölgeliler and et al. (2012) stated in their study about the hospital-acquired infections in the intensive care units that the most isolated microorganism was MRSA. Meric and et al. (2005) stated in their study about the hospital-acquired infections in the intensive care units that the most isolated microorganism was *staphylococcus Aureus*.

## 5. Conclusion

In our study, it was determined that the rate of the hospital-acquired infections was low, and most of the infections were associated with blood and respiration. As the rate of the hospital-acquired infections is the most important indicator in the quality of patient care, it becomes important for the intensive care nurses to use their roles as a caregiver and as an educator in the prevention of the health-care associated infections. Also, the determination of the hospital-acquired infections in each intensive care unit becomes important in the determination of the treatment process.

## Authors' Contributions

HA, BT, DK, HY and HÖ were responsible for the study conception and design and drafting of the manuscript.

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