

Device-Associated Infections in the Intensive Care Units in A University Hospital in Turkey

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ABSTRACT

The aim of this study was to determine and discuss the distribution of device-associated infection rates and device utilization rates in Intensive Care Units (ICUs) after a one year period of active prospective surveillance. The subjects in this study were patients, from the ICUs of the Reanimation, Internal Diseases, Neurology, General Surgery, Neonatal and other Surgical / Internal Medicine. In the ICUs, the invasive device-related infection rates and invasive device utilization rates were calculated according to the National Nosocomial Infections Surveillance system (NNIS). In the ICU during the surveillance year; 3729 patients were hospitalized, and 14.586 invasive instrument days were recognized. The most common infections were, Ventilator-Associated Pneumonia (VAP) (22.7 %), Central Line-Associated primary Bloodstream Infections (CLABSIs) (17.3%), and Catheter-Associated Urinary Tract Infections (CAUTIs) (17.1 %). The invasive instrument-related infection rates were 47,2/1000 ventilator days for VAP, 22.6/1000 catheter days for CLABSIs and 11/1000 urinary catheter days for CAUTI. Infections in intensive care units should be monitored closely. For the prevention of infections, infection control programs should be implemented using with multidisciplinary approaches.

Key words: Infection, intensive care unit, nosocomial

Türkiye de Bir Üniversite Hastanesinde Alet İlişkili İnfeksiyonlar

ÖZET

Bu çalışmada 1 yıllık aktif prospektif süreyans ile izlenen yoğun bakım ünitelerindeki invaziv alet ilişkili infeksiyonların hızı ve alet kullanım oranlarının yoğun bakımlara dağılımı belirlenerek tartışılmıştır. Reanimasyon, İç Hastalıkları, Beyin Cerrahi, Nöroloji, Genel Cerrahi, Yenidoğan ve diğer Cerrahi-Dahili Yoğun bakım ünitelerinde belirlenen hastalar değerlendirildi. Yoğun Bakım Ünitelerinde İnvaziv alet ilişkili infeksiyon hızı ve invaziv alet kullanım oranları NNIS (National Nosocomial Infections Surveillance) sistemindeki gibi hesaplandı. Yoğun bakım ünitelerinde 1 yıllık süreyans süresince yatan hasta sayısı 3729, invaziv alet gün sayısı 14.496 idi. En sık gelişen infeksiyonlar Ventilatör ilişkili pnömoni (%22,7), santral venöz kateter ilişkili kan dolaşım infeksiyonu (%17,3) ve üriner kateter ilişkili üriner sistem infeksiyonları (%17,1) olarak saptandı. İnvaziv alet ilişkili infeksiyon hızları ; VIP 47.2/1000 ventilatör günü, SVK-KDİ 22.6/ 1000 santral venöz kateter günü ve ÜK-ÜSİ 11/ 1000 üriner kateter günü idi. Yoğun bakım ünitesi infeksiyonları yakından izlenmelidir. İnfeksiyonların önlenmesi için infeksiyon kontrol programları multidisipliner yaklaşımla uygulanmalıdır.

Anahtar kelimeler: İnfeksiyon, yoğun bakım ünitesi, nozokomiyal

Introduction

Hospital-acquired infections (HAIs) are an important cause of morbidity and mortality, and also cause significant increases in hospital stays, antibiotic utilization, and healthcare costs (1–11). Recently, HAIs have been considered medical malpractice, and as an important parameter used to judge patient safety and hospital quality management (12).

HAIs are most often seen in intensive care units (ICUs). The most important risk factor for the pathogenesis of infections in ICUs is the use of a medical device. Common infections include Ventilator-Associated Pneumonia (VAP), Central Line-Associated primary Bloodstream Infections (CLABSIs) and Catheter-Associated Urinary Tract Infections (CAUTIs) (13–16). The infection control committee of any hospital serves as a major tool for the surveillance of nosocomial infections.

The aim of this study was to determine and discuss distribution of device-associated hospital-acquired infection (DA-HAIs) rates and device utilization rates in ICUs after a one-year period of active prospective surveillance method.

Material and Methods

Setting

This study was carried out in 8 adult ICUs (AICUs), including reanimation ICU, Internal Medicine ICU, Neurosurgical ICU, Neurology ICU, General Surgery ICU, Cardiovascular Surgery ICU, Other internal medicine (a coronary ICU, a emergency ICU) and a neonatal ICU (NICU), a pediatric ICU (PICU) and pediatric surgical ICU (PSICU) in a tertiary-care teaching hospital in Turkey between January 2006 and December 2006. Surveillance On a daily basis, data were collected prospectively from each patient admitted to one of the 11 ICUs using specifically designed forms. The data were collected according to the definitions of DA-HAI declared by the CDC's National

Nosocomial Infection Surveillance System (NNIS) and National Healthcare Safety Network (NHSN) (17,18). Infection Control Professionals (ICPs) collected data on central line-associated primary bloodstream infections (CLABSIs), catheter-associated urinary tract infections (CAUTIs), and ventilator-associated pneumonias (VAPs) occurring in patients hospitalized in an ICU. Corresponding denominator data, patient days and specific device-days, were collected as well.

Definitions of DA-HAIs

VAP

VAP is indicated in a mechanically ventilated patient with a chest radiograph that shows new or progressive infiltrates, consolidation, cavitation, or pleural effusion. The patient also must meet at least one of the following criteria: new onset of purulent sputum or change in character of sputum, organism cultured from blood, or isolation of an etiologic agent from a specimen obtained by tracheal aspirate, bronchial brushing or bronchoalveolar lavage, or biopsy.

Laboratory-confirmed CLABSI

A CLABSI is laboratory confirmed when a patient with a central venous catheter in place has a recognized pathogen isolated from one or more percutaneous blood cultures obtained after 48 hours of vascular catheterization and is not related to an infection at another site. The patient also must have at least one of fever (temperature 38.8°C), chills or hypotension. With skin commensals (eg, diphtheroids, *Bacillus* spp, *Propionibacterium* spp, coagulase-negative staphylococci, or micrococci), the organism is cultured from two or more blood cultures. Clinical sepsis is suspected when a patient with a central venous catheter has at least one of the following clinical signs with no other recognized cause: fever (temperature 38.8°C), hypotension (systolic blood pressure ≤ 90 mmHg), or oliguria (≤ 20 mL/hour).

CAUTI

For a diagnosis of CAUTI, a patient with a urinary catheter in place must meet one of two criteria. (1) one or more of the following signs and symptoms with no other recognized cause: fever (temperature 38.8°C), urgency, suprapubic tenderness, and urine culture positive for 10^5 cfu/mL, with no more than two microorganisms isolated; and (2) positive dipstick analysis for leukocyte esterase or nitrate and pyuria (10 leukocytes/mL) with no other recognized cause.

Table 1. Infections in ICUs and their rates

	n	%
VAP	118	22.7
CVC-associated BSI	90	17.3
NUTI	89	17.1
Others	221	42.6

VAP: Ventilator-Associated Pneumonia, CVC-associated BSI: Central Venous Catheter-Associated Bloodstream Infection, NUTI: Nosocomial urinary tract infection.

Table 2. Distribution of device-related infections according to ICUs

	VAP (n/ device utilization day×1000)	Central Line-associated BSI (n/ device utilization day×1000)	CAUTI (n/ device utilization day×1000)
Reanimation	49	25	34
Internal Medicine	0	24	22
Neurosurgery	31	28	1
Neurology	45	34	36
General Surgery	0	0	0
Neonatal	61	26	1
Pediatrics	5	35	0
Cardiovascular surgery	32	7	0
Other internal medicine	99	40	11
Other surgery	9	9	2

n: Number of Infection, VAP: Ventilator-Associated Pneumonia, CVC-associated BSI: Central Venous Catheter-Associated Bloodstream Infection, NUTI: Nosocomial urinary tract infection.

Culture techniques

VAP; in most cases, a deep tracheal aspirate from the endotracheal tube was cultured aerobically and Gram stained. CLABSI; the central line was removed aseptically, and the distal 5 cm of the catheter was amputated and cultured using a standardized semiquantitative method (19). Concomitant blood cultures were drawn percutaneously in all cases. CAUTI; a urine sample was aseptically aspirated from the sampling port of the urinary catheter and cultured quantitatively. In all cases, standard laboratory methods were used to identify microorganisms, and a standardized susceptibility test was performed (20).

DA-HAI rate calculation

Outcomes measured during the surveillance period included the incidence density rate of VAP (number of cases per 1,000 mechanical ventilator-days), CLABSI (number of cases per 1,000 central line-days), and CAUTI (number of cases per 1,000 urinary catheter days). The rates of VAP, CLABSI, and CAUTI per 1,000 device-days were calculated by dividing the total number of DA-HAIs by the total number of specific device days and multiplying the result by 1,000 (21). Device utilization (DU) ratios were calculated by dividing the total number of device-days by the total number of patient-days. Device-days are the total number of days of exposure to the device (venti-

lator, central line, or urinary catheter) for all of the patients in the selected population during the selected time period. Patient-days are the total number of days that patients are in an ICU during the selected time period.

Results

During the study period, there were a total of 3729 inpatient admissions, 14.496 inpatient days and 14.496 invasive device-days. Of the 3729 patients who were hospitalized in ICUs and followed in this study, 263 patients developed 518 hospital-acquired infections; the observed infection rate was 13.8%. Of the infected patients, 148 (57%) were male and 115(43%) were female. Their mean age was 51.2 ± 23.7 years. The observed infections are listed in Table 1. Of the 518 hospital-acquired infections that developed; 297 were device-related infection either VAP, CLABSI, or CAUTI. The invasive device-related infection rate was 20.48/ 1000 inpatient-days. The distribution of invasive device-related infections according to ICUs is shown in Table 2. No invasive device-related infections reported this period in General Surgery ICU. The invasive device related infection rate was 47.2/ 1000 ventilator days for VAP, 22.6/1000 central venous catheter days for CLABSI and 11/1000 urinary catheter days for CAUTI. The invasive device utilization rates are shown in Table 3.

Table 1. Invasive device utilization days and rates

	Day	Rate
Mechanic Ventilator	2500	0.17
Central Venous Catheter	3976	0.27
Urinary Catheter	8020	0.54

Device utilization (DU) rates : calculated by dividing the total number of device-days by the total number of patient-days

Discussion

In developed countries, HAIs are the most important cause of complications and mortality in hospitalized patients (1-5). Such infections are particularly frequent in ICUs (22). In ICUs, the utilization of invasive devices such

as mechanical ventilators, central venous catheters and urinary catheters are accepted as the most important risk factors for the development of infections (14-16, 22-25). The CDC suggests that invasive device-related infections should be carefully monitored. A study conducted by Erdogan et al (25), CAUTI and VAP rates of 65% and 15%, respectively. Bodur et al (26) reported VAP rate of 32.1% in a reanimation unit. In our study, the VAP, CLABSI and CAUTI rates in the ICUs were found to be 22.7%, 17.3% and 17.1% respectively.

It has been suggested that infection rates and invasive device utilization rates should be monitored carefully as part of the surveillance of invasive device-related infections. Rosenthal et al (15) followed invasive device-related infections prospectively in 55 ICUs, including some in Turkey, they demonstrated that the VAP rate was 24.1, the central line-associated BSI rate was 12.5 and the CAUTI rate was 8.9. In the same study, it was reported that the ventilator utilization rate was 0.38, the central line utilization rate was 0.54 and the urinary catheter utilization rate was 0.73. Surveillance for invasive device-related infections in ICUs, according to NNIS data demonstrated that the VAP rate varied 4.1-15.9, the central line-associated BSI rate varied from 2.8-10 and the CAUTI rate varied from 3.1-10.2 (22). These data demonstrated that the ventilator utilization rate ranged from 0.25-0.56, the central line utilization rate ranged from 0.38-0.79 and the urinary catheter utilization rate ranged from 0.30-0.91. Leblebicioglu et al. (23) reported that the VAP rate was 26.5, the central line-associated BSI rate was 17.6 and the CAUTI rate was 8.3. In the same study, it was also reported that ventilator utilization rate was 0.63, the central line utilization rate was 0.61 and the urinary catheter utilization rate was 0.94. In our study, we found that the VAP rate was 47.2, the CLABSI rate was 22.6 and the CAUTI rate was 11. The ventilator, central line and urinary catheter utilization rates were found to be 0.17, 0.27 and 0.54, respectively.

According to our study data, invasive device-related infections were more common in the ICUs of the reanimation, pulmonary diseases, neurology and neonatal departments. Very few reports were found concerning the surveillance of invasive device-related infections in Turkey. As the volume of available data increases, hospitals will be able to evaluate their own data more effectively. Our results demonstrate that infection control programs should be reviewed and that infection control precautions should be taken. It can be concluded that, the surveillance of invasive device-related infection rates and invasive device utilization rates in ICUs is an effective

method to evaluate infections in these areas and to compare the results obtained with those of other studies. The data gathered through these surveillance programs will also act as a guide for the development of future infection control program and strategies.

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