Evaluation of Device Associated Infection Rates in Intensive Care Units of Pamukkale University Hospital

H. Turgut, S. Sacar, D. Okke, S. T. Kavas, A. Asan, S. S. Kutlu

Abstract

Intensive care units (ICUs) are unfortunately the epicenters of nosocomial infections. The aim of the study was to investigate device associated infection rates in a small Turkish hospital. Device utilization ratios and device associated infection rates were calculated according to definitions of the Centers for Disease Control (CDC). During a period of 24 months 1,387 patients were surveyed in our ICUs. A total of 287 device associated infections were detected. In our study ventilator associated pneumonia was the most frequent nosocomial infection with a rate of 59.7 per 1,000 ventilator days. The most frequent pathogen of device associated infection was *Candida* spp. High rates of device associated infections in a small Turkish hospital clearly indicate the urgent need of the implementation of infection control guidelines.

Infection 2008; 36: 262–265
DOI 10.1007/s15010-008-6346-6

Introduction

Nosocomial infections predominantly occur in the intensive care units (ICUs) [1]. These infections increase mortality, morbidity, length of stay and economic costs and they are often device related [2, 3]. Only few data exists describing nosocomial infection rates of small hospitals in developing countries [2]. The aim of this study was to investigate device associated infection rates in a small hospital in Turkey.

Materials and Methods

Pamukkale University Hospital is a 250 beds tertiary care centre, situated in the city of Denizli (Turkey), with 19 beds in four different ICUs [anesthesiology and reanimation ICU (five beds), neurosurgical ICU (four beds), cardiovasculer surgical ICU (four beds) and neonatal ICU (six beds)]. The neonatal ICU was excluded from our study because daily visits were not feasible.

The present study was performed prospectively over a period of 24 months from 1 January 2004 to 31 December 2005. All patients having no infection signs at admission and being hospitalized in ICUs of our hospital longer than 48 h were included in our study. Daily monitoring and observations of urinary tract infection, blood stream infection and pneumonia were conducted according to the NNIS and CDC [4, 5]. Data collected from each infection included: demographic data, need of ventilation, use of central venous catheters, and urinary catheters, infection site, and microorganisms isolated from these sites. Device associated nosocomial infections were calculated by the method described in NNIS report [1]. Patients in three different ICUs were visited daily from a specialist of infectious diseases and an infection control nurse. Candida infections were defined as *Candida* spp. isolated in a normally sterile body site with the presence of at least one of the following criteria: fever (> 38.5°) or hypothermia (< 36 °C), unexplained prolonged hypotension (systolic blood pressure < 80 mmHg for > 2 h, unresponsive to volume challenge); or absence of response to adequate antibiotic treatment for a suspected bacterial infection. *Candida* spp. pneumonia required the recovey of 10^5 cfu/ml of *Candida* spp in the bronchoalveolar lavage, in addition to the appearance of a new infiltrate on the chest X-ray [6].

Results

Between January 2004 and December 2005, a total of 1,387 patients were hospitalized at the ICUs of Pamukkale University Hospital. During the study period we collected data of 287 patients with device associated infections. Site specific infections are shown in table 1. Among all nosocomial infections, the most frequent infections were ventilator associated pneumonias (57%), followed by catheter associated urinary tract infections (39%) and catheter associated bloodstream infections (4%).

Device days and rates of device utilization are shown in table 1. We found that central venous catheter utilization was higher in cardiac surgery ICU compared to other ICU types but mechanic ventilation and urinary catheter utilization was higher in the anaesthesiology and reanimation unit (Table 1).

H. Turgut, S. Sacar *(corresponding author)*, **D. Okke, S. T. Kavas, A. Asan, S. S. Kutlu**
Dept. of Infectious Diseases and Clinical Microbiology, Pamukkale University, Denizli, Turkey; Phone: (+90-258) 2118585-2293, Fax: 2134922, e-mail: suzansacar@yahoo.com

Received: January 7, 2007 · Revision accepted: January 29, 2008
Published online: May 3, 2008

Table 1
Patients studied device utilization and nosocomial infections in three intensive care unit.

Intensive care unit (ICU)	Anesthesiology and reanimation ICU		Neurosurgical ICU		Cardiovasculer surgical ICU	
	2004	2005	2004	2005	2004	2005
Patients studied (n)	254	340	128	187	196	282
Patients days	1,390	1,372	896	898	666	663
Ventilator days	1,110	931	385	404	335	473
Ventilator use	0.79	0.67	0.43	0.45	0.50	0.71
CVC[a] days	829	721	159	115	451	608
CVC use	0.6	0.52	0.17	0.13	0.67	0.91
Urinary catheter days	1,279	1,106	719	736	515	660
Urinary catheter use	0.92	0.8	0.8	0.81	0.77	0.99
Ventilator associated pneumonia	54	53	23	21	2	11
Rate per 100 patients	21.2	15.5	17.9	11.2	1.02	3.9
Rate per 1,000 ventilator days	48.6	56.9	59.7	51.9	5.97	23.2
CVC-associated bloodstream infections	1	3	2	1	2	1
Rate per 100 patients	0.39	0.88	1.5	0.53	1.02	0.35
Rate per 1,000 CVC days	1.2	4.1	12.5	8.6	4.4	1.6
Catheter associated UTI[b]	34	17	26	31	1	4
Rate per 100 patients	13.3	5	20.3	16.5	0.51	1.41
Rate per 1,000 catheter days	26.5	15.3	36.1	42.1	1.9	6.06

[a]CVC: Central venous catheter; [b]UTI: Urinary tract infection

The microorganisms isolated from cultures are shown in table 2. *Acinetobacter* spp. (26.1%) and *Pseudomonas* spp. (23.8%) were predominant as pathogen causing pneumonia; coagulase negative staphylococci (CNS) (50%) and *Staphylococcus aureus* (40%) for bloodstream infections and *Candida* spp. (41%) for urinary tract infections.

Discussion

To date comprehensive data about nosocomial infections in small hospitals in developing countries are still missing [2]. Therefore, we collected data of nosocomial infections in our small Turkish hospital in Pamukkale. We found high overall rates of nosocomial infections in our three ICUs ranging from 0.75% to 6.4%. All our device related

Table 2
Isolated microorganisms causing bloodstream infections, urinary tract infections or ventilator associated pneumonia.

Microorganisms	Bloodstream infection		Urinary tract infection		Ventilator associated pneumonia		Total number %	
	2004	2005	2004	2005	2004	2005		
Pseudomonas spp.	–	–	7	5	19	23	54	17.8
Acinetobacter spp.	–	–	4	2	27	19	52	17.1
Candida spp.	–	1	28	20	8	9	66	21.8
E. coli	–	–	10	16	8	12	46	15.2
Enterococcus spp.	–	–	–	1	1	2	4	1.32
KlebsIella spp.	–	–	6	3	5	10	24	7.92
KNS	3	2	–	–	4	9	18	5.94
S. aureus	2	2	1	–	6	7	18	5.94
Enterobacter spp.	–	–	1	1	1	–	3	0.99
Others	–	–	1	–	1	–	2	0.66
Polymicrobial infections	–	–	7	4	1	4	16	5.28
Total	5	5	65	52	81	95	303	100

Table 3
Comparison of device associated infection rates per 1,000 device days determined in the present study with infection rates published by NNIS and studies describing infection rates in Turkey or countries of the developing world.

Reports	Country	Number of ICUs	Number of patients studied	Study period	Ventilator associated pneumonia	Urinary tract infection	Bloodstream infection
Present study	Turkey	3	1,387	2004–2005	56.9	15.3	4.1
NNIS report	United States	632	NA	1992–2004	5.4	4.0	3.9
Moreno et al. [12]	Colombia	9	2,172	2002–2005	10	4.3	11.3
Rosenthal et al. [2]	Argentina	6	3,319	1998–1999	24.1	8.9	12.5
Velasco et al. [11]	Brazil	1	623	1993–1995	41.7	27.5	25.6
Thongpiyapoom et al. [3]	Thailand	1	1,422	2000–2002	10.8	13.8	2.6
Inan et al. [8]	Turkey	2	1,985	2002–2004	23.7	14.09	10.48
Leblebicioglu et al. [7]	Turkey	13	3,288	2002–2005	26.5	8.3	17.6

NA: not available

infection rates exceeded the 95% percentile of values determines by NNIS [1].

Ventilator associated pneumonia was the most frequent nosocomial infection with a rate of 59.7 per 1,000 ventilator days. The comparison of our data to data of other small hospitals revealed that our ventilator associated pneumonia rates was the highest whereas our catheter associated bloodstream infection rate was significantly more favorable (Table 3). Catheter related urinary tract infection rates did not significantly differ [7–12].

Interestingly, one reason for our high infection rates might be considerably higher rate of device utilization (often fourfold to eightfold). The lack of improvements of infection rates from 2004 to 2005 may be deduced to an unawareness of infection control procedures of our health-care providers. Decreasing the utilization of mechanic ventilation by increasing the use of non-invasive ventilation and the frequency of ventilator circuit changes, in addition to better implementation of infection control measures and health care educational and motivational programs, and full logistic support will be more successful in reducing our high pneumonia rate.

In the present study, *Candida* spp. were the most frequently isolated pathogens of device associated infections, followed by non-fermentative Gram-negative pathogens as were *Pseudomonas* and *Acinetobacter.* A study from Thailand university teaching hospital reported the most causative pathogens were Gram-negative microorganisms [3]. In the present study *Candida* spp. were responsible for 41% of catheter associated urinary tract infections. Another study of our country also found *Candida* spp to a high percentage (44.9%) [7]. Similar to that study, this high rate of candida infections might be possibly related to the long duration of catheterization, and to the fact that most of our patients received broad spectrum antibiotics. On the other hand, we cannot exclude an overestimation of the percentage of Candida infections that might limit our investigation; in many cases we accepted *Candida* spp. as pathogen for NI if no other organism was isolated, even if no invasive growth was confirmed by histopathological investigation.

In conclusion, high nosocomial infection rates clearly demonstrate that infection control guidelines have to be implemented immediately especially in small Turkish hospitals

References

1. National Nosocomial Infections Surveillance (NNIS) System report, data summary from January 1992 through June 2004. Am J Infect Control 2004; 32: 470–485.
2. Rosenthal VD, Guzman S, Orellano PW: Nosocomial infections in medical–surgical intensive care units in Argentina: attributable mortality and length of stay. Am J Infect Control 2003; 31: 291–295.
3. Thongpiyapoom S, Narong MN, Suwalak N, Jamulitrat S, Intaraksa P, Boonrat J, Kasatpibal N, Unahalekhaka A: Device-associated infections and patterns of antimicrobial resistance in a medical–surgical intensive care unit in a university hospital in Thailand. Med Assoc Thai 2004; 87: 819–824.
4. Perl TM: Surveillance reporting at the use of computers. In: Wenzel RP (ed). Prevention and control of nosocomial infections. 2nd edition Williams & Wilkins, Baltimore 1993, pp 139–176.
5. Horan TC, Gaynes RP: Surveillance of nosocomial infections. In: Mayhall CG (eds) Hospital epidemiology and infection control. 3rd edition Willams & Wilkins, Philadelphia 2004, pp 1659–1702.
6. Pittet D, Monod M, Suter PM, Frenk E, Auckenthaler R: Candida colonization and subsequent infections in critically ill surgical patients. Ann Surg 1994; 220: 751–758.
7. Leblebicioglu H, Rosenthal VD, Arikan OA, Ozgultekin A, Yalcin AN, Koksal I, Usluer G, Sardan YC, Ulusoy Turkish Branch of S; INICC: Device-associated hospital-acquired infection rates in Turkish intensive care units. Findings of the International Nosocomial Infection Control Consortium (INICC). J Hosp Infect 2007; 65: 251–257.
8. Inan D, Saba R, Yalcin AN, Yilmaz M, Ongut G, Ramazanoglu A, Mamikoglu L: Device-associated nosocomial infection rates in Turkish medical–surgical intensive care units. Infect Control Hosp Epidemiol 2006; 27: 343–348.
9. Rosenthal VD, Guzman S, Crnich C: Device-associated nosocomial infection rates in intensive care units of Argentina. Infect Control Hosp Epidemiol 2004; 25: 251–255.

10. Rosenthal VD, Maki DG, Salomao R, Moreno CA, Mehta Y, Higuera F, Cuellar LE, Arikan OA, Abouqal R, Leblebicioglu H: International Nosocomial Infection Control Consortium. Device-associated nosocomial infections in 55 intensive care units of 8 developing countries. Ann Intern Med 2006; 145: 582–591.
11. Velasco E, Thuler LC, Martins CA, Dias LM, Goncalves VM: Nosocomial infections in oncology intensive care unit. Am J Infect Control 1999; 27: 547–552.
12. Moreno CA, Rosenthal VD, Olarte N, Gomez WV, Sussmann O, Agudelo JG, Rojas C, Osorio L, Linares C, Valderrama A, Mercado PG, Bernate PH, Vergara GR, Pertuz AM, Mojica BE, Navarrete Mdel P, Romero AS, Henriquez D: Device-associated infection rate and mortality in intensive care units of 9 Colombian hospitals: findings of the International Nosocomial Infection Control Consortium. Infect Control Hosp Epidemiol 2006; 27: 349–356.