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Prevalence of Hospital Acquired Infections in Anesthesiology Intensive Care Unit

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ABSTRACT

Objectives: To determine the prevalence of infections, predominant organisms and their resistance pattern.

Materials and Methods: Prospective cohort study. All patients over 16 years old were occupying an intensive care unit bed over a 24-hour period. All patients admitted to the unit were evaluated on a daily basis for nosocomial infections in compliance with National Nosocomial Infections Surveillance System (NNISS) methodology. Infection site definitions were in agreement with Center for Diseases Control and Prevention (CDC) definitions.

Results: The NI incidence was 72%; ventilator associated pneumonia was the most common NI (41.2%), followed by urinary tract catheter-associated infection (28.2%), bloodstream infections (13.7%), and sepsis (6.9%), surgical site infection (4.6%). *Pseudomonas* spp. was the most common pathogen identified in the NIs (31.3%), followed by (%), and yeasts. The most frequent isolated microorganisms from patients were as follows: *Pseudomonas* aeruginosa (31.3%), Staphylococcus aureus (11.5%), Coagulase negative staphylococci (CoNS) (10.7%), *Acinetobacter baumanii* (9.2%), *Candida* spp. (8.4%), *Escherichia coli* (8.4%), *Enterobacter* spp. (4.6%), *Enterococcus* spp. (3.1%) and others (12.8%). Methicillin resistance was 96% at staphylococci. It was observed Gram-negative microorganisms had multi-resistant pattern.

Conclusion: The rate of nosocomial infection is high in intensive care unit patient, especially for respiratory infections. The predominant bacteria were *P. aeruginosa* and *S. aureus*, CoNS and *A. baumanii* (resistant organisms). This study documents the clinical impression that prevalence rates of intensive care unit-acquired infections are high and suggests that preventive measures are important for reducing the occurrence of infection in critically ill patients.

Key words: *Intensive care unit, hospital acquired infections, prevalence, antibiotic susceptibility*

ÖZET

Yoğun Bakım Ünitesi, Hastane İnfeksiyonları, Prevalans, Antibiyotik Duyarlılığı

Amaç: Anestezi ve Reanimasyon yoğun bakım ünitesinde gelişen hastane infeksiyonlarını (Hİ), bu infeksiyonlarda saptanan etkenleri ve antibiyotik duyarlılıklarını prospektif olarak incelemek.

Gereç ve Yöntem: Prospektif sürveyans çalışması. 01 Kasım 2004–28 Şubat 2005 tarihleri arasında (4 ay) Fırat Üniversitesi Fırat Tıp Merkezi Anestezi ve Reanimasyon YBÜ'de en az 24 saat yatan hastalar çalışmaya dahil edilmiştir. Çalışma kapsamına alınan hastalar, National Nosocomial Infections Surveillance System (NNISS) önerilerine göre hasta ve laboratuar verilerine dayalı sürveyans yöntemleri bir arada kullanılarak izlenmiş, tanımlamalar "Centers for Disease Control and Prevention (CDC)" ölçütlerine göre yapılmıştır. Mikroorganizma tanımlamasında konvansiyonel yöntemler ve API 20E testi kullanılmış, antibiyotik duyarlılıkları disk difüzyon yöntemi ile çalışılmıştır.

Sonuçlar: YBÜ'ne yatırılan 182 hastadan 60'ında 131 Hİ gelişti. YBÜ'de Hİ hızı %72 olarak saptandı. YBÜ'de en sık görülen infeksiyon türleri; ventilatör ilişkili pnömoni (%41.2), üriner sistem infeksiyonu (%28.2), laboratuar olarak tanımlanmış kan dolaşımı infeksiyonu (%13.7), klinik sepsis (%6.9), cerrahi alan infeksiyonları (%4.6) ve diğer nozokomiyal infeksiyonlar idi. Hastalardan en sık izole edilen patojenler; *Pseudomonas* spp. (%31.3), *Staphylococcus aureus* (%11.5), koagülaz negatif stafilokoklar (%10.7), *Acinetobacter* spp. (%9.2), *Candida* spp. (%8.4), *Escherichia coli* (%8.4), *Enterobacter* spp. (%4.6), *Enterococcus* spp. (%3.1) ve diğerleri (%12.8) idi. Stafilokoklardaki metisilin direnci %96 olarak saptandı. Gram-negatif mikroorganizmaların büyük kısmının çoklu antibiyotik direnci taşıdığı görüldü.

Sonuç: YBÜ'de hastane infeksiyonları en önemli sorunlardan biri olarak karşımıza çıkmaktadır. Bu infeksiyonların kontrol altına alınması ya da önlenmesi için YBÜ'lerine yönelik sürveyans çalışmalarının süreklilik göstermesi ve özellikle infeksiyon kontrol önlemlerine titizlikle uyulması konusunda azami çaba gösterilmelidir.

Anahtar kelimeler: *Yoğun bakım ünitesi, hastane infeksiyonları, prevalans, antibiyotik duyarlılığı*

Intensive care units (ICUs) are where the most severely ill patients are treated and where the highest mortality rates occur. Nosocomial infection and mortality in ICUs are more prevalent than in other wards of the hospital (1, 2) Underlying diseases, impaired host defenses, invasive devices, immunosuppressive therapy, use of antibiotics, and colonization with resistant microorganisms render patients highly susceptible to nosocomial infections in ICUs (1, 2).

Nosocomial infection is associated with a considerable increase in morbidity and mortality of patients at a hospital as well as to significant increases in costs (3). Nosocomial infections occur in 5% to 17% of hospitalized patients (4). In ICUs, where the frequent use of invasive procedures and multiple therapies expose patients to an increased risk, prevalence rates are even higher (3-6).

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In view of the relevance and impact of such observations, it is crucial to know the prevalence rates and nature of nosocomial infections to achieve satisfactory results in controlling this important phenomenon. The present study was undertaken to determine the prevalence rates of infection for Anesthesiology and Reanimation ICU (AR-ICU) patients in our hospital, identify the most common infectious agents and their resistance patterns, and establish the prevalence rates of ICU-acquired infections.

MATERIALS AND METHODS

Patients and setting: An observational prospective study was conducted in the Anesthesiology and Reanimation ICU of "Firat Tıp Merkezi" from November 1, 2004 to February 28, 2005.

All patients over 16 yrs of age who had been hospitalized in a participating ICU over the 24-hr period were eligible. Information regarding demographics (age and gender), operative status during the preceding month, underlying and/or concomitant diseases, clinical status at admission to the ICU including the nature and number of organ and system failures, as well as the Acute Physiology and Chronic Health Evaluation II (APACHE II) (9) score was collected. Diagnostic, therapeutic, and prophylactic interventions performed during the week preceding the study day (from November 1, 2004, to February 28, 2005) were recorded. The presence or absence of intravascular and urinary catheters, tracheal intubation, tracheostomy, mechanical ventilation, wounds and chest and intracranial drains, peritoneal dialysis, hemodialysis/hemofiltration, central parenteral nutrition, peripherally administered infusion of hyperosmolar solutions, administration of immunosuppressive drugs, prophylactic agents for stress ulcer, and prophylactic antibiotics was also recorded.

Surveillance procedures and definitions: Up to two days following discharge, all patients admitted to the unit were evaluated on a daily basis for NI, in compliance with NNISS (National Nosocomial Infection Surveillance System) methodology, by the same professional, an infectious diseases physician. NI was defined based on standard definitions, taking into consideration if it was acquired in the unit, regardless of length of stay, provided there was no evidence of the infection being in incubation or a continuation of the disease that led to the hospitalization, or up to two days following discharge from the unit. Infection site definitions were in agreement with CDC definitions (7) Death occurring up to one week after diagnosis, with no further justifying causes, was considered associated mortality.

Cultures: The cultures employed were: cultures of blood (more than 2 positive pairs of culture for the same pathogen), urine (> 10,000 CFU when collected from urinary catheter and 100,000 CFU when not), endotracheal aspirate (≥10,000 CFU for a single pathogen), and catheters (≥ 10,000 CFU for a single pathogen) and surgical wounds. Identification of bacteria isolated from ICU-acquired infections were performed using conventional methods and API 20E (8) and antimicrobial susceptibility tests were performed with Kirby-Bauer disk diffusion method according to the suggestions of Clinical and Laboratory Standards Institute (CLSI) (9).

Statistical analysis: Fischer exact and Chi-squared tests were used; $P < 0.05$ was considered significant.

RESULTS

A total of 182 patients who admitted to ICU, 60 patients developed 131 NI. The NI incidence was 72%; ventilator associated pneumonia (VAP) was the most common NI (41.2%), followed by urinary tract catheter-associated infection (UTI) (28.2%), bloodstream infections (BSI) (13.7%), sepsis (6.9%), and surgical site infection (SSI) (4.6%). *Pseudomonas* spp. was the most common pathogen identified in the NIs (31.3%), followed by (%), and yeasts (Table 1).

Table 1. *Distribution of hospital acquired infections*

Hospital acquired infections	Count (n=131)	(%)
Ventilator associated pneumonia	54	41.2
Urinary tract infection	37	28.2
Bloodstream infection	18	13.7
Sepsis	9	6.9
Surgical site infection	6	4.6
Others	7	5.4

The most frequent isolated microorganisms from patients were as follows: *Pseudomonas aeruginosa* (31.3%), Staphylococcus aureus (11.5%), Coagulase negative staphylococci (CoNS) (10.7%), *Acinetobacter baumanii* (9.2%), *Candida* spp. (8.4%), *Escherichia coli* (8.4%), *Enterobacter* spp. (4.6%), *Enterococcus* spp. (3.1%) and others (12.8%). Methicillin resistance was 96% at staphylococci. It was observed Gram-negative microorganisms had multi-resistant pattern. When investigated to antibiotic susceptibility; the most effective antibiotics to *Pseudomonas* spp. were piperacillin-tazobactam (89.7%), imipenem (81.6%), meropenem (53.8%) and cefoperazone-sulbactam (48.6%), while affectivity of antibiotics to Acinetobacter spp. were imipenem (100%), sefoperazon-sulbactam (100%), meropenem (85.7%) and piperacillin-tazobactam (54.5%) (Table 2).

Table 2. *Distribution of isolated microorganisms*

Microorganisms	Count (131)	(%)
Pseudomonas spp.	41	31.3
Staphylococcus aureus	15	11.5
Coagulase negative Staphylococci	14	10.7
Acinetobacter spp.	12	9.2
Candida spp.	11	8.4
Escherichia coli	11	8.4
Enterobacter spp.	6	4.6
Enterococcus spp.	4	3.1
Others	17	12.8

The most responsible agents isolated from endotracheal aspirate specimens for VAP and pneumonia were *P. aeruginosa* (%25.9), *Pseudomonas* spp. (%22.2), MRSA (%16.7), methicillin resistant CoNS (%9.3), *E. coli* (%7.4), Acinetobacter spp (%7.2), and others, respectively. *Candida* spp. (%29.7), E. coli (%18.9), *P. aeruginosa* (%18.9), *Pseudomonas* spp. (%8.1) and *Enterobacter* spp. (%8.1) were the most responsible microorganisms' isolated urine. Methicillin resistant CoNS (%22.2), *Acinetobacter* spp. (%22.2), *A. baumanii* (%11.1), *P. aeruginosa* (%11.1), *Pseudomonas* spp. (%11.1) were the most responsible agents for laboratory diagnosed BSIs.

DISCUSSION

Rates of nosocomial infection in patients requiring more than 1 week of advanced life support within an ICU in the United States are 3 to 5 times higher than in patients who are hospitalized but do not require ICU care (3, 10, 11). Nosocomial infections are emerging as an important problem in many developing countries as well although data on epidemiology of nosocomial infections in developing countries is limited (12). Nosocomial infections are associated with high morbidity, mortality, and hospital costs. A key aspect of nosocomial infections control is surveillance, as shown by the Study on the Efficacy of Nosocomial Infection Control Programs, which reported that surveillance combined with an infection control program reduces nosocomial infections by approximately 30% (13)

We found high overall rates of nosocomial infection in our ICU as 72%. In a study performed at Erciyes University at 1997, ICU acquired infections (ICU-AIs) rates were declared as 25.8% (14), in an another study performed at Selcuk University, ICU-AIs rates were informed as 84.9% on year 1999-2000 (15). From the point view of ICU-AIs, comparisons between hospitals can not be appropriate for the reason of different conditions of ICUs and surveillance methods applied.

Regarding the site of infection, the most prevalent infection site was pneumonia with the rates of 20-40%, and followed by UTI, bacteremia, SSI and others, respectively (16). A study performed at Kocaeli University, the most prevalent infection sites at the first fifth month of 1999 were declared as bloodstream infections (32%), UTI (16%) and SSI (13%) (17). Esen and Leblebicioglu (18) performed a one-day point prevalence study in Turkey ICUs, they observed pneumonia and lower respiratory tract infection (28.0%), laboratory confirmed blood stream infection (23.3%) and urinary tract infection (15.7%) were the most frequent types. In the present study, ventilator associated pneumonia was the most common NI (41.2%), followed by urinary tract catheter-associated infection (28.2%), bloodstream infections (13.7%), sepsis (6.9%), and surgical site infection (4.6%).

Gram-negative bacteriae were the most isolated agents from ICUs and *Pseudomonas* spp. takes part first in these microorganisms. The most isolated Gram-positive agent is *S. aureus* (2-4). In a study done by Erbay et al. (19) P. aeruginosa (22.6%), *Staphylococcus aureus* (22.2%) and *Acinetobacter* spp. (11.9%) were found the most responsible agents in ICUs acquired infections, and, Esen and Leblebicioğlu (18) declared The most frequently reported isolates were *P. aeruginosa* (20.8%), *S. aureus* (18.2%), *Acinetobacter* spp. (18.2%) and *Klebsiella* spp. (16.1%). In our ICU, the most isolated agent were *Pseudomonas* spp. (31.3%), *S. aureus* (11.5%), CoNS (10.7%), *Acinetobacter* spp. (9.2%), *Candida* spp. (8.4%) and *Escherichia coli* (8.4%). It was attracted to attention that the role of *Candida* spp. is increasing in our ICU. This can be due to excessive use of antibiotics. To evaluate the antimicrobial susceptibility, it was observed the microorganisms were multi-drug resistant. The least resistance showed by Gram-negative bacteriae in our ICU was found as imipenem, meropenem, piperasilin-tazobactam ve cefoperazone-sulbactam. Among the 29 *S. aureus* isolates, 28 (96%) of them were methicillin-resistant strains (MRSAs), and all were sensitive to vancomycin. This problem reaches the great extents in our ICU. Circulation of multidrug resistant MRSA in hospital should lead to surveillance. Improved compliance with handwashing is needed to prevent MRSA spread out.

In conclusion, the prevalence data that we obtained are consistent with results as reported from many other regions of our country. Surveillance should be focused on patients in intensive care units. Every hospital have to be make a continuous surveillance in ICUs to detect the infection sites, antimicrobial susceptibility, risk factors to prevent and treatment for these infections successfully and make effort to carry out infection control policies.

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