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**DETERMINING OF THE PREVALENCE OF NOSOCOMIAL INFECTIONS  
AND CAUSATIVE GRAM NEGATIVE BACILLI IN THE INTENSIVE CARE  
UNIT**

**Yoğun Bakım Ünitesinde Nozokomial Enfeksiyon Prevalansı ve  
Etken Gram Negatif Basillerin Belirlenmesi**

**ABSTRACT**

**Purpose:** Nosocomial infections develop after 48-72 hours of hospitalization. Gram negative bacilli are generally the causative agent. 25% of all nosocomial infections develop in the intensive care units. Therefore, patients in the intensive care units are at high risk. This study aimed to determine the prevalence of nosocomial infections and causative gram negative bacilli in the Intensive Care Unit (ICU).

**Materials and Methods:** 269 patients who were hospitalized in internal medicine intensive care unit (IMICU) of Dicle University Faculty of Medicine between June 2010- December 2010 were included in this study. Culture samples were taken from all of the patients who develops fever ( $\geq 38.5$  C) after the hospitalization to the IMICU. Culture of blood, urine, sputum, central venous catheters, open wounds and deep tracheal aspirate were taken. Source and the prevalence of infection and distribution of the isolated causative pathogens were determined in the patients with gram negative bacilli reproduction.

**Results:** 158 of the patients were male ( 58.7%) and 111 of the patients were female ( 41.3%). The mean ages of men and female were  $58.81 \pm 16.91$  and  $56.44 \pm 19.16$  years, respectively ( $p=0.286$ ). Culture samples were taken from blood (16%), urine ( 8.6%), central venous catheter tips ( 6.3%), deep tracheal aspirates (10%), sputum (2.2%) and wound swabs (2.2%). Nosocomial infections were detected in 109 patients ( 40.5%). Pneumonia, urinary tract infections and gastrointestinal system infections were the most frequent infections respectively. Microorganisms were isolated from one sample in 97 patients, while 12 patients had more than focus. The most commonly isolated organisms were E.Coli (13.8%) and Pseudomonas Aeruginosa (7.4%), followed by Acinetobacter Baumanni (6.3%) and Stenotrophomonas Maltophilia (3.3%).

**Conclusion:** Nosocomial infections in intensive care units have proved to be a serious problem. Surveillance studies should be performed for the isolated causative pathogens and measures should be taken to prevent the development of the ICU infections.

**Key words:** intensive care unit, nosocomial infections, gram negative bacilli.

**ÖZET**

**Amaç:** Nozokomial enfeksiyonlar hastaneye yatıktan 48-72 saat sonra gelişir. Etken genelde gram negatif basillerdir. Tüm nozokomial enfeksiyonların %25'i yoğun bakım ünitelerinde gelişir. Bu nedenle yoğun bakım ünitesindeki hastalar yüksek risklidir. Bu çalışmada amacımız Yoğun Bakım Ünitesinde nozokomial enfeksiyon prevalansını ve etken gram negatif basilleri belirlemektir.

**Materyal ve metod:** Çalışmaya Dicle Üniversitesi Tıp Fakültesi Genel Dahiliye Yoğun Bakım Ünitemizde (GDYBÜ) 2010 yılı Haziran – Aralık ayları arasında yatan 269 hasta dahil edildi. GDYBÜ'ne yattıktan sonra ateş ( $\geq 38.5^{\circ}\text{C}$ ) gelişen tüm hastalardan kültür için örnekler alındı. Kültür için kan, idrar, balgam, santral venöz kateter ucu, açık yara ve derin trakeal aspirattan örnekler alındı. Alınan örneklerde gram negatif basil üreyen hastalarda enfeksiyon kaynağı, prevalansı ve izole edilen ajan-patojenlerin dağılımı belirlendi.

**Bulgular:** Hastaların 158'i erkek (%58.7) ve 111'i kadın (%41.3) idi. Erkeklerin yaş ortalaması  $58,81 \pm 16,91$ , kadınların yaş ortalaması  $56,44 \pm 19,16$  yıl ( $p: 0,286$ ) idi. Kültür için alınan örneklerin %16'sını kan, %8,6'sını idrar, %6,3'ünü santral venöz kateter ucu, %10'nu derin trakeal aspirat, %2,2'sini balgam ve %2,2'sini yara sürüntüsü oluşturdu. 109 (%40.5) hasta nozokomial enfeksiyon tespit edildi. İlk üç sırada pnömoni, üriner sistem enfeksiyonu ve gastrointestinal yol enfeksiyonu olduğu saptandı. Hastaların 97'sinde bir örnekten mikroorganizma izole edilirken, 12 hastada birden çok odakta gram negatif basil izole edildi.

En sık izole edilen mikroorganizmalar % 13,8 E.Coli ve % 7,4 Psödomonas Aeruginosanın olduğu, bunları % 6,3 ile Acinetobacter Baumannii ve % 3,3 ile Stenotrophomonas maltophilia'nın izlediği görüldü.

**Sonuç:** Genel Dahiliye Yoğun Bakım Ünitesinde nozokomial enfeksiyonun ciddi bir sorun olduğu görüldü. Enfeksiyon etkeni olarak izole edilen ajan patojenlere yönelik sürveyans çalışmaları yapılmalı ve yoğun bakım enfeksiyonu gelişimini önleyecek tedbirler alınmalıdır.

**Anahtar kelimeler:** Yoğun Bakım Ünitesi, Nozokomial Enfeksiyon, Gram Negatif Basiller.

## INTRODUCTION

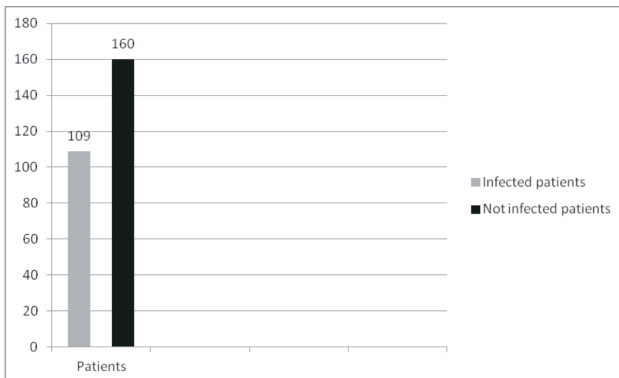
Nosocomial infections are infections that are not in the incubation period at the time of hospital admission but develop later. It has been reported that they develop in 3.1-4.1% of patients (1,2). The risk for nosocomial infections is substantially higher in patients admitted to intensive care units compared to other departments (3). Although only 5-10% of admitted patients are followed at intensive care units, about 25% of all nosocomial infections are observed at these units. Approximately 45% of all nosocomial pneumonia and bacteremia cases are diagnosed in intensive care unit patients (4). Also, B.D. Salah et al showed that ICU patients represented 34% of all hospital gram-negative bacteremias in an epidemiologic study (5). The most common nosocomial infections in ICU patients are respiratory tract infections (RTIs), urinary tract infections (UTIs) and bloodstream infections (BSIs) and are most often associated with the use of invasive devices (6). Gram-negative bacilli have been reported more frequently than Gram-positives in this setting (7).

The physiological flora of patients admitted to hospital is replaced within 48-72 hours by the local endemic flora that usually consists of multi-resistant gram negative bacilli. Patients with Gram-negative bacteremia have a high mortality rate. In a study from a large Swiss university hospital, there was a 7-fold higher death rate compared to hospitalized patients without Gram-negative bacteremia (8). Furthermore, Gram-negative bacteremias have been associated with higher case fatality rates when compared to Gram-positive bacteremias (44% vs. 30%) (9).

In the present study, we aimed to determine the prevalence of nosocomial infections and causative gram negative bacilli in Intensive Care Unit (ICU).

## MATERIALS AND METHODS

This study included 269 patients admitted to Dicle University Faculty of Medicine, General Medicine Intensive Care Unit(ICU) between June and December 2010 years. Patients who were 18 years old and over age group were enrolled to the study. The study



**Figure 1:** The prevalence of nosocomial infections in intensive care unit.

**Table 1:** The distribution of the samples taken at ICU .

Samples	Number (n)	Percentage (%)
Blood	43	16
Urine	23	8.6
Catheter	17	6.3
Deep Tracheal Aspirate	10	3.7
Sputum	6	2.2
Wound swab	6	2.2
Total	105	39

was designed as retrospective and observational. Cohort of the patients admitted to our intensive care unit were composed of the patients from internal medicine branches, as well as cardiology, infectious diseases and clinical microbiology, neurology, and pulmonology departments. Patients demographic data were obtained from patient records. Culture samples were taken all of the patients who develops fever ( $>38.5$  C) at a single measurement in 48 hours after the hospitalization into the ICU. Empirical antibiotic therapy was started after the samples were taken. Antibiotic therapies were revised according to culture results. culture samples were taken from blood (16%), urine (8.6%), central venous catheter tips (6.3%), deep tracheal aspirates (10%), sputum (2.2%) and wound stabs (2.2%). The diagnoses of patients were clarified and documented according to clinical and laboratory characteristics of patients and culture results.

## RESULTS

158 (%58.7) patients were male and 111 (%41.3) were female. The mean ages of men and female were  $58.81 \pm 16.91$  and  $56.44 \pm 19.16$  years, respectively ( $p=0.286$ ). The prevalence of nosocomial infections at ICU was 40.5% ( $n=109$ ). It is shown in Figure 1.

16% of the samples were from blood, 8.6% from urine, 6.3% from central venous catheter tip, 10% from deep tracheal aspirate, 2.2% from sputum, and 2.2% from wound swabs. The distribution of samples from blood, urine, sputum, central venous catheter tip, open wound, and deep tracheal aspirates are summarized in Table 1.

The most commonly isolated organisms were E.Coli (13.8%) and Pseudomonas Aeruginosa (7.4%), followed by Acinetobacter Baumannii (6.3%) and Stenotrophomonas Maltophilia (3.3%). The distribution of the isolated organisms are shown in Table 2.

Distributon of the diseases which caused by gram negative bacilli were pneumonia ( $n=32$ , 11.9%), urinary tract infections ( $n=29$ , 10.8%), gastrointestinal system infections ( $n=26$ , 9.7%), catheter infections ( $n=17$ , 6.3%), wound infections ( $n=3$ , 1.1%) and central nervous system infections ( $n=2$ , 0.7%). The distribution of nosocomial infections are shown in figure 2. Microorganisms were isolated from one sample in 97 patients, while 12 patients had more than focus.

## DISCUSSION

Intensive care units are places where patients with poorest general status are admitted, many diagnostic and therapeutic invasive procedures impairing the defense mechanisms of the host are performed, and extended spectrum antimicrobial drugs are widely utilized. Thus, nosocomial infections are 5-10 times more common at these units compared to other departments (10). Patients admitted to intensive care units have a severe clinical course owing to concomitant diseases.

Many studies have been performed on nosocomial infections in our country. In a prospective study conducted at internal intensive care units (39 of 203 patients were admitted less than 6 days) Akkuş et al. reported that 114 nosocomial infections developed in 75 patients (11). Arslan et al. conducted a retrospective study of

**Table 2:** The distribution of the isolated microorganisms.

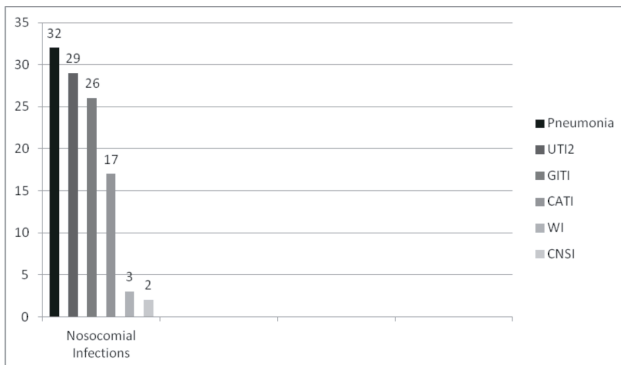
Microorganisms	Number (n)	Percentage (%)
Escherichia Coli	37	13,8
Pseudomonas Aeruginosa	20	7,4
Acinetobacter Baumannii	17	6,3
Stenotrophomonas Maltophilia	9	3,3
Klebsiella Spp	9	3,3
Candida Spp	5	1,9
Enterobacter spp	3	1,1
MRSA	2	0,7
Proteus Mirabilis	2	0,7
VRE	0	0
Total	105	39

MRSA: meticillin resistant staphylococcus aureus

nosocomial infections at intensive care units (general surgery, neurosurgery, cardiovascular surgery, internal medicine, and transplantation) at Başkent University and reported a low nosocomial infection rate as 5.3% (12). We, on the other hand, found a nosocomial infection rate of 40.5% (n=109). Literature data suggest that the risk of nosocomial infections is higher in patients of advanced age (13,14). In our study the mean ages of men and women were 58.81±16.91 and 56.44±19.16 years, respectively (p=0.286). However, advanced age cannot be identified as a definitive risk factor since risk factors for infections at intensive care units are diverse and patients of advanced age have a higher death rate.

Nearly half of nosocomial infections are related with invasive procedures. As these procedures are carried out more commonly at intensive care units, rates of infection are higher compared to other departments (15,16,17). Nosocomial bacteriurias are caused by urethral catheters in 70-80% of patients (18). Bacteriuria develops in 10-30% of patients who undergo urinary catheterization for one time as compared to only 1% in those who never received urinary catheters (19). Mechanical ventilation is a serious risk factor for pneumonia at ICUs and causes pneumonia at a rate of 7-40% (20,21). Nosocomial pneumonia can also develop as a result of increased gastric bacterial colonization resulting in tracheal colonization and aspiration in patients undergoing enteral feeding via nasogastric catheters. Therefore, orogastric intubation and catheterization are recommended. It has also been demonstrated that the rate of nosocomial sinusitis is reduced in this way. In addition, contamination of enteral nutrition solutions by especially gram negative bacteria may increase infection risk (22).

Rates and distributions of gram negative bacteria responsible from nosocomial infections vary by hospitals. Among nosocomial infectious microorganisms, P. Aeruginosa is the most common microbiological agent (23). Studies on agents responsible from nosocomial infections in Turkey have shown that among gram negative agents the Pseudomonas species are responsible from

**Figure 2:** The distribution of nosocomial infections in intensive care unit

UTI:urinary tract infections, GITI:gastrointestinal tract infections, CATI:catheters infections, WI: Wound infections, CNSI: central nerve system infections.

25.8 % to 56% of nosocomial infections (24,25,26). Gür et al., in a multicenter study including 9 centers, isolated Pseudomonas species at a rate of 30%, Klebsiella species at 25%, E. coli at 18%, Enterobacter species at 9%, and Acinetobacter species at 9% in nosocomial infections at intensive care units. In that study, P. Aeruginosa, E. coli, Acinetobacter species, and Klebsiella species were the most commonly isolated bacterial agents. Stenotrophomonas maltophilia, on the other hand, is less common although they may lead to serious nosocomial infections. In that study three of 94 agents were maltophilia species (27). In our study the most commonly isolated agents were E. Coli (13.8%) and Pseudomonas Aeruginosa (7.4%), followed by Acinetobacter Baumannii (6.3%) and stenotrophomonas maltophilia (3.3%).

In conclusion, data from domestic and foreign studies indicate that gram negative bacteria are the most common agents isolated from nosocomial infections at intensive care units. We observed that, among gram negative bacilli, resistance rates of Pseudomonas, Acinetobacter, and Klebsiella species have reached worrisome levels. It is clear that knowledge of risk factors for infections caused by more resistant bacteria will help critical patients survive.

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