

Nosocomial Infections and Associated Risk Factors in Geriatric Patients in the Intensive Care Unit

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Abstract

Aim: The elderly population increases worldwide. The purpose of this study was to evaluate nosocomial infections (NI) detected in geriatric patients and to determine the risk factors leading to their development.

Materials and Methods: Patients monitored in our hospital's Intensive Care Unit (ICU) were evaluated daily by intensive care and infectious disease specialists, including surveillance by our Infection Control Committee. We included the patients aged ≥ 65 years who were monitored in the adult ICU between January and December 2014, using the methods of retrospective file screening and computer record review. Patients were classified into two groups: patients with and without NI.

Results: In total, 222 (38.07%) patients were ≥ 65 years old. 44 NI events were detected in 27 patients. Groups were compared with respect to age; sex; presence of mechanic ventilation (MV), central venous catheterization (CVC), cerebrovascular disease, chronic obstructive disease, diabetes mellitus; and mortality. The presence of MV, CVC, and mortality were seen to be significantly higher in patients with NI compared with those without. The most common NIs found were sepsis and pneumonia. The most common infectious agent was *Acinetobacter*.

Conclusion: NIs observed in hospital ICUs are common, but largely preventable, conditions. A systematic approach and well-disciplined empiric therapy are very important. Our study revealed that the mortality rate is high in elderly patients who develop NI, and NI is more commonly seen in patients who undergo invasive interventions. We believe that using invasive interventions as little as possible in this group may improve their treatment success and outcome.

Keywords: Nosocomial infections, risk factors, geriatric patients

Introduction

As the elderly population increases worldwide, the evaluation and care of elderly patients becomes very important. With increases in the geriatric population, the number of elderly patients admitted to intensive care units (ICUs) has also increased (1, 2).

The courses of elderly patients in ICUs may differ. Elderly patients in ICUs represent a complex patient group; they may have acute exacerbations of underlying chronic diseases or problems involving many organ systems. Acute exacerbations of a chronic disease can become more complex because of the general decline in physiological reserves that comes with advanced age. Patients over 65 years of age account for 42%-52% of those in ICUs in the USA (3-5).

Nosocomial infections (NI) are an important health issue, both globally and in Turkey, because of their economic burden and high mortality rates. A decrease in the rates of NI has been achieved in developed countries as a result of infection control studies initiated earlier by these countries. Detection of problems has been delayed in developing countries because of their lag in initiating such studies. Developing countries have a 2-20-fold higher risk of NIs compared with developed countries (6, 7).

Despite the fact that elderly patients are at higher risk for developing NIs, the frequency, risk factors, and types of hospital-acquired infections in geriatric patients are not well known (8, 9).

The purpose of this study was to evaluate NIs detected in geriatric patients and to determine the risk factors leading to their development.

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Materials and methods

This study was conducted between January 1 and December 1, 2014, with the approval of the hospital ethics committee (Kanuni Sultan Suleyman Training and Research Hospital, Ethics Committee Decision No. 164/32, dated November 24, 2014).

Patients monitored in our hospital's ICU were evaluated daily by intensive care and infectious disease specialists, including surveillance by our Infection Control Committee. In this study, we examined the patients aged ≥ 18 years who were monitored in the adult ICU between January 2014 and December 2014, using the methods of retrospective file screening and computer record review. We focused on the patients aged ≥ 65 years.

Subjects were classified into two groups: patients with and without NI. Both groups were then compared with respect to the use of mechanical ventilators (MV) and central venous catheters (CVC); the presence of selected types of underlying disease (such as cerebrovascular disease (CVD), chronic obstructive pulmonary disease (COPD), diabetes mellitus (DM); and mortality.

NIs were diagnosed according to the criteria of Centers for Disease Control and Prevention (CDC) in patients who were being monitored by our hospital-based and laboratory-based active surveillance methods.

Cultures of elderly patients detected to have NI were collected from their blood, urine, and site of infection on the day they developed the infection. The number of infections in these patients and the distribution of their infections by body system and causal agents (microorganisms) were recorded.

Identification of the growing microorganisms and antibiotic sensitivity testing of blood cultures were performed using an automated system. The Statistical Package for the Social Sciences version 15.0 (SPSS Inc.; Chicago, IL, USA) program was used for statistical evaluation: mean \pm standard deviation, Chi-square tests, and Mann-Whitney U tests were calculated for descriptive statistics and tests of statistical significance. A p-value < 0.05 was considered statistically significant.

Results

In our study, 583 patients were admitted to the adult ICU, 222 (38.1%) were ≥ 65 years old. 44 NI events were detected in 27 patients.

When patients with and without NI were compared with respect to age; sex; presence of MV, CVC, CVD, COPD, DM, and mortality, the presence of MV and CVC and mortality were seen to be significantly higher in patients with NI compared with those without. No differences between study groups were detected in the other examined parameters (Table 1). The most common NIs found were sepsis and pneumonia. The most common infectious agent was *Acinetobacter* (Table 2).

Discussion

Patients monitored in ICUs are characterized by impaired general health status, frequent exposure to invasive interventions, use of broad-spectrum antibiotics, and longer duration of hospital stays. Infection is one of the most important causes of morbidity and mortality in this setting. Despite the fact that only 5%-10% of hospitalized patients are treated in ICUs, 20%-25% of all NIs occur in these units (10-12).

Table 1. Comparison of characteristics of geriatric patients with and without NI (n/%)

	Patients with NI N=27 (12.2%)	Patients without NI N=195 (87.8%)	P value
Mean age	74.85 \pm 9.73 years	76.64 \pm 6.86 years	0.113
Sex: M/F	15/12 (55.6/44.4)	75/120 (38.5/61.5)	0.09
Presence of CVC	27 (100)	87 (44.6)	<0.001
Presence of MV	27 (100)	72 (36.9)	<0.001
Presence of COPD	8 (29.6)	58 (29.7)	0.99
Presence of DM	6 (22.2)	60 (30.8)	0.36
Presence of CVD	2 (7.4)	34 (17.4)	0.18
Mortality rate	23 (85.2)	28 (14.4)	<0.001

CVD: cerebrovascular disease; MV: mechanical ventilators; COPD: chronic obstructive pulmonary disease; DM: diabetes mellitus; CVA: central venous catheters; CVC: central venous catheterization; NI: nosocomial infections

Table 2. Number and percent of NIs developed by microorganism (n/%)

	N (%)
<i>Acinetobacter baumannii</i>	16 (36.4)
<i>Pseudomonas</i> species	11 (25)
MRSA + MRCNS	8 (18.2)
<i>Klebsiella pneumoniae</i>	24 (4.6)
<i>Candida albicans</i>	3 (6.8)
<i>Escherichia coli</i>	3 (6.8)
<i>Serratia marcescens</i>	1 (2.3)
Factors	44 (100)

MRSA: methicillin-resistant *Staphylococcus aureus*; MRCNS: methicillin-resistant coagulase-negative staphylococ; NI: nosocomial infections

In our study, the rate of elderly patients being admitted to the adult ICU was 38.1%. This rate was determined to be 49.8% in a study by Ozdemir et al. (2) and 48.6% in another study (13).

The human lifespan is being extended by new developments, and interventions to extend the lifespan may lead to infections. Hospitalized elderly patients are at high risk of NIs because of the predisposition of underlying chronic diseases, physiological changes of aging, and invasive interventions (14, 15).

Our study revealed that the presence of CVC and MV was significantly higher in patients with NI than in those without; but no difference was detected in other examined parameters. Our study also revealed that the mortality rate was statistically significant and higher in patients who developed NI compared with those who did not.

In another Turkish study conducted with 433 patients, of whom 288 were > 65 years of age, the presence of MV and CVC and the use of broad-spectrum antibiotics were found to be higher in elderly patients who developed NI compared with those who did not. No associations were detected between the presence of DM, malignancy, or COPD and the development of NI (2).

Similar to our findings, a study by Ribas and Gontijo Filho (9) also reported that the presence of CVC and MV was higher in elderly pa-

Table 3. The most common infections and microorganisms observed in selected studies on NI (%)

Study	Year	Age group	Most common infection	Most common microorganisms
Beaujean et al. (19)	1997	Geriatric	UTI	-
Stéphan et al. (17)	2001	>75 years	Pneumonia	-
Ribas et al. (9)	2003	≥65 years	Surgical site	-
Erbay et al. (16)	2003	Adults	Pneumonia	<i>Pseudomonas aeruginosa</i>
Ellidokuz et al. (20)	2003	≥65 years	Surgical site	-
Ozdemir et al. (2)	2012	≥65 years	Pneumonia	-
Oberoi et al. (21)	2012	≥65 years	UTI	<i>Escherichia coli</i>
Mythri et al. (15)	2014	43–72 years	UTI	-
Erdem et al. (18)	2014	Adults	Pneumonia	Acinetobacter species
Present study	2014	≥65 years	Pneumonia	Acinetobacter species

UTI: urinary tract infection; NI: nosocomial infections

tients who developed NI. A study by Mythri et al. (15) revealed that NIs in elderly patients were associated with invasive interventions.

A study by Erbay et al. (16) reported a mortality rate of 60.9% for patients with NI and 22.1% for those without, which was a statistically significant finding (16). However, a study by Stéphan et al. (17) reported that patients over 75 years of age were not at an increased risk of NI development or death.

According to the literature, NI in elderly patients commonly involves pneumonia and Acinetobacter. Summary findings of selected studies related to this issue are listed in Table 3.

A study by Aydemir et al. (22), which was also conducted in Turkey, examined infection consultations for elderly patients and reported the most common diagnoses as community-acquired pneumonia, nosocomial pneumonia, and urinary tract infection.

Nosocomial pneumonia developed in an ICU setting increases morbidity and mortality (2). In a study by Alp et al. (23), the mortality rate was reported to be 65% for the nosocomial pneumonia group and 26% for the control group; whereas the study of Pancharti et al. (24) reported the mortality rate for the nosocomial pneumonia group to be 42%

A study by Cevik et al. (25), conducted in a neurological ICU, reported a mortality rate of 69% for NI and demonstrated that MV, use of steroids, parenteral nutrition, and a low score on the Glasgow Coma Scale heightened mortality.

We believe that the high mortality rate of 85% in our study may be attributed to the fact that all NIs occurring in our geriatric patients were pneumonia and sepsis, and the rates of MV and CVC were very high.

Conclusion

NIs observed in hospital ICUs are common, but largely preventable, conditions. A systematic approach and well-disciplined empiric therapy are very important. Our study revealed that the mortality rate is high in elderly patients who develop NI, and NI is more commonly seen in patients who undergo invasive interventions. We believe that using invasive interventions as little as possible in this group may improve their treatment success and outcome.

Ethics Committee Approval: Ethics committee approval was received for this study from the Ethics Committee of Kanuni Sultan Süleyman Training and Research Hospital (24.11.2014, Decision No: 164/32).

Informed Consent: Informed consent was not received due to the retrospective nature of the study.

Peer-review: Externally peer-reviewed.

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