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Neurosurgery Intensive Care Unit Infections; Single Center Retrospective Study

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ABSTRACT

Aim: Nasocomial infections are the most important cause of mortality and morbidity of the intensive care units. In this study, we evaluated that developed infections in neurosurgery care unit.

Patients and methods: 277 cases with the diagnosis of nosocomial infection out of 2381 patients followed up in the neurosurgical intensive care units of our center between 2008 and 2013 were retrospectively evaluated.

Results: In our clinic, infection rate was 11.6%, its incidence density was detected as 22.2/1000 patient-days. Pneumonia was the most frequently seen type of infection. Most frequently Staphylococcus aureus (20.15%) and Pseudomonas aeruginosa (14.83%) were detected. Overall mortality rate of the patients who became infected was 12.7 percent. However mortality rate of the patients without infection was 2.6 percent. In 28 patients more than one episode of infection developed which resulted in death of 21 (75%) cases.

Conclusion: During monitorization in the intensive care unit, one of the important factors which effect morbidity and mortality is nosocomial infections. In order to be able to prevent infections, routine surveillance studies should be performed and infection control measures should be evolved.

KEYWORDS Infection, intensive care unit, mortality, morbidity, neurosurgery.

INTRODUCTION

Infections which don't develop during hospitalization of the patient or incubation period of the disease or those emerge 48-72 hours after hospital admission of the patient or within the first 10 days after discharge are described as nosocomial infections (NE) [15]. Development of infection increases treatment period and costs, delays patient's return to daily activities and work with resultant important socioeconomical losses. Clinical manifestations of the patients hospitalized in the neurosurgical intensive care unit (ICU) invasive interventions performed in ICU, alimentation of the patients, frequent contacts of hospital staff with the patients and widespread use of broad-spectrum antibiotics cause more frequent emergence of infections in these units [13].

In the present study, infections developed in the neurosurgical ICU were retrospectively analyzed. Frequency, types, responsible factors of nosocomial infections, length of neurosurgical ICU stay and their contribution to morbidity and mortality were discussed in the light of literature findings.

MATERIAL AND METHOD

Two hundred and seventy-seven (11.63%) cases with the diagnosis of nosocomial infection out of 2381 patients followed up in the neurosurgical intensive care units of our center between January 2008 and July 2013 were retrospectively eval-

uated in compliance with the approval of the local ethics committee (41340010/42877-315). The definition of hospital-acquired infections was based on the criteria of "Centers of Disease Control and Prevention (CDC)" [6]. In our study the effects of age, gender, invasive interventions applied (urinary catheters, nasogastric catheter, intubation, mechanical ventilation, shunt catheter and extraventricular drainage) and length of hospital stay on the development of nosocomial infection and their contribution to morbidity and mortality were evaluated. A total of 327 infection foci were detected in 277 cases who developed nosocomial infections. All patients were followed up during their stay in neurosurgical ICU and the patients who were transferred from ICU to the ward were monitorized till they were discharged from the hospital. All culture-positive patients who were suspected of contracting infection at least 48 hours after their admission and culture-positive cases presented with manifestations of infection within the first 10 days after discharge were included in the study. Infections developed before and later than the first 48 hours after hospital admission and more than 10 days after patient's discharge were not included in the study. The patients with no evidence of ICU stay who developed infection in the ward were not included in the study. During daily visits, febrile state, physical examination and laboratory results, the treatment and invasive interventions applied were evaluated. In patient monitorization, during febrile periods (≥38oC), on a routine basis, urine and blood cultures, in the presence of pressure sores and wound discharges, wound site cultures and if deemed necessary, cultures from aspirates and catheters were obtained. Data about infectious agents isolated from samples sent to the central laboratory and laboratory of clinical microbiology and infectious diseases were classified. The Clinics of Infectious Diseases were consulted and appropriate antibiotherapy based on antibiotic susceptibility tests results was recorded. As criteria for pulmonary infections, detection of new foci of infiltration in the chest X-ray and for catheter sepsis, isolation of the same infectious agent from both blood sample and catheter specimen were taken into consideration. Infection control nurses visited the patients every day. Development of a nosocomial infection was assessed by a specialist of infectious diseases who was a member of the Infection Control Committee. The data obtained and clinical manifestations were interpreted by the specialist of infectious diseases and clinical microbiology and the patients meeting the criteria of hospital-acquired infections were recorded. In patients who developed nosocomial infections, focus (foci) of infection, the most responsible microorganisms, prophylactic antibiotic use and their effects on prognosis were evaluated.

Results;

During a predetermined period in a total of 277 (11.6%) (159 male, 118 female cases) out of 2381 patients, nosocomial infection was detected. Mean age of the patients was 51.7 (24-89) days. Patients with and without detected infections were compared based on number of days of hospital stay. Total duration of hospitalization in patients who developed infection was 12463 (median: 44.99; range: 4-291 days) days, while those without nosocomial infections hospitalized for an average of 7.4 days. In our clinic, infection rate was 11.6%, its incidence density was detected as 22.2/1000 patient-days. The most frequent reason for hospitalization of the patients in the intensive care unit was subarachnoidal bleeding (SAB) (35.6%) followed by intracranial space occupying mass lesion (29.1%) and intracerebral hematoma (16.7%) (Figure 1).

Mechanical ventilation was applied in 186 (67%) and urinary catheterization in 98 % of the cases. All patients had undergone intravenous and intraarterial catheterization.

Pneumonia was the most frequently seen type of infection. A total of 193 (59%) cases with pneumonia which were related (n=67; 20%) or unrelated (n=129; 39%) to mechanical ventilation were detected. Cases with pneumonia consisted frequently of patients monitored for SAB and intracerebral hematoma. Circulatory system infections associated with central catheterization (n=73; 22%), surgical field infection (meningitis, wound site infection: n=31; 9%) and catheter-related urinary system infection (n=27; 8%) were detected (Figure 2).

Median Glasgow coma scale (GKS) scores in patients who developed or did not develop infection were 6.3 and 11.1, respectively. In patients who did not develop infection and monitored in the intensive care unit for less than 48 hours were not included in the GKS analysis. During this time frame overall mortality rate of the patients who became infected was 12.7 percent. However mortality rate of the patients without infection was 2.6 percent. In 28 patients more than one episode of infection developed which resulted in death of 21 (75%) cases. These patients had been followed up with the diagnosis of intracerebral hematoma (n=9; 43%) and SAB (n=8; 29%). Most frequently Staphylococcus aureus (20.15%) and Pseudomonas aeruginosa (14.83%) were detected (Table 1).

DISCUSSION

During monitorization in the intensive care unit one of the important factors which effect morbidity and mortality are nosocomial infections. Increase in the rate of nosocomial infections results in the development of septic shock, multiple organ failure and higher mortality rates [12]. Host-related factors which facilitate development of infections include underlying factors as age, gender, ASA score, diabetes mellitus and malnutrition [4]. Surgical factors include emergency or elective surgery, preoperative antibiotherapy, type and duration of the operation and characteristics of the surgical field [5]. Gender dominancy was not seen in patients who developed infections, while higher ASA scores and lower preoperative GCS scores were detected as facilitating factors.

In general intensive care units median mortality rate is 18.9 percent [3]. Hospital-acquired infections reportedly increase mortality at a rate of 30 percent [16]. In patients who developed nosocomial infections, mortality rate is 33.8 percent. Our mortality rates were observed to be lower than those reported in the literature. We attributed these lower rates of mortality to avoidance from operating on cases who required referral to a multidisciplinary center because of additional pathologies detected preoperatively and referral of the patients who need to be consulted to a multidisciplinary center because of indications unrelated to neurosurgical pathologies postoperatively.

It has been indicated that the risk of nosocomial infection increases with prolongation of hospital stay beyond 2 weeks [1]. In their study on neurosurgical ICU, Taşbakan et al. estimated incidence rate of infections as 63% and incidence density as 43.2/1000 patient-days [14]. In our clinic, comparatively lower rates were detected (infection rate, 11.6% and incidence density 22.2/1000 patient-days).

In study on nosocomial infections seen in ICUs of neurology and neurosurgery, development of nosocomial infection was detected in 206 (19.3%) of 1066 patients. In order of decreasing frequency, urinary system infection (44.3%), cardiovascular infections (22.1%) and lower respiratory tract infections (20.6%) were detected. While as the most frequently isolated microorganisms Escherichia coli (16.2%), Acinetobacter spp. (20.4%), Enterococcus spp. (18.5%) were reported [2]. Taşbakan et al. evaluated nosocomial infections seen in neurosurgical ICUs. They observed most frequently urinary system infections, followed by pneumonia and catheter infection [14]. Laborde et al. determined development of nosocomial infections in 114 of 314 patients whom they followed up in the neurosurgical ICU for more than 48 hours within a period of 4 years. Among these infections urinary tract infection and as a pathogenic agent E. coli (29.8%) was detected. They reported respiratory tract infection as the second most frequently developed infection and they mostly isolated gram-positive S. aureus in 56.3% of the cases [9]. Zolldann et al. studied 84 NICU patients and detected urinary infection in 24.7% and pneumonia in 23.6% of the cases [17]. In our series, most frequently pneumonia was detected, while in the literature urinary system infection ranked fourth among the most fre-

quently observed infections. We attribute this finding to our routine and periodic urinary care procedure. It has been understood that frequency of pneumonia which was higher than that reported in the literature, appears to be relatively higher due to our considerably lowered incidence of urinary infection.

Hospital-acquired meningitis are rarely seen among nosocomial infections. Hospital-acquired meningitis emerges especially following neurosurgical interventions and progresses with a considerably higher mortality rates. Although, nearly 0.4 % of nosocomial infections consist of hospital- acquired meningitis, in neurosurgical clinics, its incidence is around 7 percent [10]. In a study conducted in Hacettepe University where cases with nosocomial bacterial meningitis were analyzed. Acinetobacter spp., coagulase-negative staphylococci and E. coli were determined as the most frequently seen pathogenic agents [8]. Generally nosocomial meningitis develops following neurosurgical operations and external drainage has been implicated as the most important predisposing factor [7]. Besides, operative times, CSF leakage and premature re-operation are another known risk factors [11]. In our series pathogenic agents were consistent with literature findings and consisted of in order of decreasing frequency as coagulase (-) staphylococci (n=8; 42.11%), A. baumannii (n=6; 31.58%) and S. aureus (n=1; 10.53%). In 17 cases (65%) EVD was detected.

Conclussion;

Nosocomial infection is an important problem all over the world and in our country as well. As preventable infections, nosocomial infections which incur higher costs and increase mortality rates have gradually gained increasing importance in recent years. As is the case in our hospital, infection control committees have been established to monitor and analyze incidence rates of infections. We think that neurosurgical intensive care units should establish their own procedures based on the microbial flora of their hospital. This approach will dramatically decrease rates of nosocomial infection. In order to be able to prevent infections secondary to health care services, routine surveillance studies should be performed and infection control measures should be evolved. Surveillance studies will determine distribution and resistance of microorganisms prevalent in every center and accordingly emphasize the importance of rational antibiotic use with resultant success in the fight against resistant microorganisms. While awaiting for the result of an antibiogram, treatment should be directed at the most frequently isolated microorganism in that clinic. After identification of the responsible pathogen, specific antibiotherapy, rather than broad-spectrum antibiotics should be initiated.

FIGURE LEGENDS

Figure 1. Reasons for hospitalization of the patients in the neurosurgery intensive care unit.

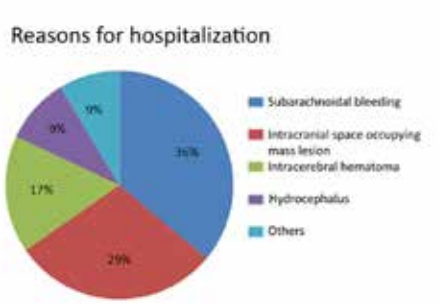
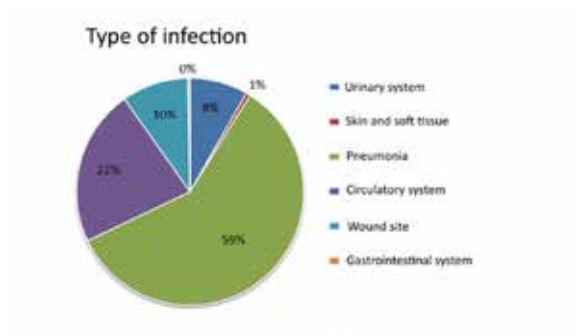


Figure 2. Type of infection in patients hospitalized in the neurosurgery intensive care unit.



TABLES

Table 1. Isolated microorganisms in patients hospitalized in the intensive care unit.

Isolated microorganisms	Percentage (%)
Acinetobacter baumannii	13.69%
Candida albicans	3.8%
Citrobacter sp.	1.9%
Others	3.42%
Enterobacter sp.	2.28%
Enterococcus faecalis	3.8%
Escherichia coli	8.37%
Gram-negative bacillus	2.28%
Klebsiella sp.	6.84%
Coagulase-negative staphylococci	15.59%
Proteus mirabilis	3.04%
Pseudomonas aeruginosa	14.83%
Staphylococcus aureus	20.15%

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