

NOSOCOMIAL INFECTIONS IN NEUROINTENSIVE CARE UNIT

Review Article

NÖROLOJİK YOĞUN BAKIMDA HASTANE ENFEKSİYONLARI

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SUMMARY

Nosocomial infections are commonly encountered problems for all hospitalized patients. Patients admitted to the neuro intensive care unit (NICU) are at higher risk of developing life-threatening nosocomial infections. These patients are particularly vulnerable because of the serious nature of their illness, the frequency of associated trauma and the presence of invasive devices. In this study, the definition of neuro-intensive care unit nosocomial infections, affecting factors, pathogens, type of the nosocomial infections, and prevention of infection were reviewed.

Key words: neurointensive care; nosocomial infection.

ÖZET

Hastane enfeksiyonu tüm hastalar için yaygın olarak karşılaşılan bir sorundur. Nöro-yoğun bakım ünitesine kabul edilen hastalar gelişmekte olan yaşamı tehdit eden hastane enfeksiyonları açısından yüksek risk altındadırlar. Bu hastalar tanıları, ilişkili travma ve invaziv cihazlar nedeniyle enfeksiyonlara hassastırlar. Bu çalışmada; nöro-yoğun bakım ünitesinde nosocomial enfeksiyonların tanımı, etkileyen faktörler, etken patojenler, enfeksiyon tipleri ve alınacak önlemler derlenmiştir.

Anahtar Sözcükler: Nöro-yoğun bakım; hastane enfeksiyonu.

INTRODUCTION

Patients admitted to the intensive care unit are at risk of developing life-threatening nosocomial infections (NI), especially with organisms resistant to commonly used antibiotics (1). Neurosurgical patients are particularly vulnerable because of the serious nature of their illness, the frequency of associated trauma and the presence of invasive devices. Generally, definition of NI is same for all hospital units; however the incidence, severity, risk factors, pathogens and type of the infection can be different (2-4).

Nosocomial infections are directly related with the patient's morbidity and mortality and hospital costs. This review focuses on the definition, clinical features, and prevention to this distinct complication of neurocritical care.

1. Definition

Infections which do not exist in incubation period before the hospitalization but gained at the hospital are defined as nosocomial infection by Centers for Diseases Control (CDC) (1). Symptoms of the disease can either appear 48-72 hours after hospitalization or within 10 days after coming out of hospital. However, diseases having long incubation period are not included in this definition (6, 7).

Incidence:

The incidence of the nosocomial infection is 5-10 times higher than the other services in NICU. Neuro problems are life threatening pathologies, invasive manipulations are often in NICU, cross infections are often in neurosystems, and antibiotic usage are common for trauma and surgical patients, and for these type of reasons neurointensive care patients have relatively higher incidence and severity of the nosocomial infection (8, 9).

European Prevalence of Infection in Intensive Care" (EPIIC) reported that the 45 percent of the ICU patients infected with the pathogens for once or more time, and these percentage is increasing to 63% if the duration of the ICU period longer than 3 days. However, these data are change depends to the clinic and years. Mean incidence of nosocomial infection are 5-15% in literature(10, 11) . No standard data was found for neuro intensive care.

Type of the Infections

Ninety percent of the NI are urinary system infection, pneumonia, surgical wound infection and catheter related infection respectively (12). The most common causes are ventriculitis, shunt infections, meningitis, surgical wound infections, urinary tract infections, pneumonia, intravascular catheter related to infections and gastrointestinal infections (7). For NICU, there are some studies in our country. Tun et al, reported that the bacteriemia (27%), surgical wound infection (23%), and pneumonia (20%) are most common in their NICU respectively (2). Despite to this report, Ornett et al. found that urinary infection has higher incidence in NICU (13). Result of the different studies showed that the urinary tract infection, pneumonia, meningitis, and surgical wound infection are common in NICU patients.

Since either development of post traumatic rhinorrhea, otorrhea due to patient diversity or contamination of cerebrospinal fluid as a result of craniotomy, external ventricular drainage tube and shunt applications, neuro intensive care patients face the risk of meningitis more often than the other intensive care patients and the results are more mortal (7). The incidence of nosocomial meningitis (NM) is 0.5-1.7 % in postoperative patients. However, the incidence of ventriculostomy-related meningitis or ventriculitis is reported as approximately 8% (ref). For this type of

infections "device related infection" term is common (14).

Yılmaz et al, reported that the 69 of the 190 patients who have infection in NICU are the nosocomial infection, and most common infections are urinary infection (43%), and pneumonia (26%) in their NICU (15).

Bulut et al, researched 1066 patients in NICU and 206 of these patients have nosocomial infection (19%). The urinary infection(44%), sepsis (22%), and respiratory infections (20%) are most common (16). Taşbakan et al. reported that the different incidence for nosocomial infections as urinary infection, pneumonia and catheter related infection (17).

Risk Factors

Neuro patients are require NICU following the trauma, surgery or other for diagnosis and treatment and these patients who have been taken to intensive care units due to breathing deficiency, trauma and major surgical attempts, and have been defined as an infection acquired during or a result of hospitalization.

These patients can either be patients having bad general medical condition and life threatening additional diseases in older ages or they can be patients who have had vertebral or cranial operations and are in the ASA (American Society of Anesthesiology) group 1 with no additional pathologies but who are hospitalized for post operational follow up in case of intervention in elective or emergent conditions (18, 19).

Patient related factors, pathogenity of microorganism, and extrinsic factors can be affected the nosocomial infections. Age (<1yr, >60yr), majority of trauma and burning, immune deficiency, presence and severity of systemic diseases, radiotherapy and chemotherapy, long duration of the ICU period, immobilization cause of the neurological deficit are patient related factors (18, 19). Presence of the invasive procedures (surgery,

endoscopy or angiography), multiple catheterizations (urinary catheter, central or peripheral catheters, shunts), or external dranaige, and duration of the catheters are extrinsic factors (20). Colonization and resistans of the pathogen is aother factor related with the incidence and severity of the nosocomial infection in NICU. Also frequent manipulations and contact are other factors.

O'shea et al reported that, the nosocomial infection is significantly related to length of hospital stay, length of ICU stay, duration of intubation, duration of ventilation, and the presence of diabetes mellitus in NICU (10).

External ventricular drainage related infections, Presence of shunt, or external ventricular dranaige are important entrance for pathogens. Duration of this type of devices and cerebrospinal fluid sampling are the main reasons. Short duration of external ventricular dranaige (2-6 days)is results less infection than the long term duration (11 days)of the external ventricular drainage (21). Following the 11 days the incidence of the are very high. Hoefnagel et al. reported that if sampling are doing infection incidence are high (21).

Intravenous agent infusions can also lead to contamination in long term infusion applied case as a result of both long immobilization period and long recovery period of existing pathologies. Propofol is a widely used drug in neuro practice and needs pay attention. This injectable emulsion is used in patients with increased intracranial pressure or impaired cerebral circulation, however propofol contains no antimicrobial preservatives. Strict aseptic techniques must always be maintained during handling since the vehicle is capable of supporting the rapid growth of microorganisms. Failure to follow aseptic handling procedures may result in microbial contamination Once propofol has been opened, vial contents should be drawn into sterile syringes; each syringe

should be prepared for single patient use only. Unused product should be discarded within 6 hours.

The nutritional factor is another factor for nosocomial infection. The patients who has cranial pathologies and low Glasgow coma scale, required longer treatment or mechanical ventilatory support are require the enteral or parenteral nutrition. Parenteral nutrition has their own risk for contamination with pathogens.

In the cases which patients cannot be fed enterally, risk of infection increases due to intestinal mucosa atrophy and increase in permeability for bacteria and endotoxine leads to serious metabolic disorders, hypercatabolism, decrease in endogenous protein sources and weakness in immune response results in increase in tendency for nosocomial infections and length of staying in intensive care units.

Pathogens:

National nosocomial infections surveillance reported that the most common pathogens are E.coli, Enterococcus spp., P. aeruginosa, S. aureus, coagulase-negative staphylococci, and Enterobacteria in intensive care units. These pathogens can be classified as aerobic (80-90%), or anaerobic (2-5%) bacteria, virus or parasite (5%) infections, recently fungal infections are increasing (7%). The resistant pathogens can be identified from hospital flora as methicillin resistant Staphylococcus aureus, Enterococcus, or Gram negative bacilli. However, every clinic has their different flora and results for every year. Yilmaz et al. reported that the Klebsiella pneumoniae (%20.6), Enterococcus spp. (%15.3) and Candida (%13.7) are the most common pathogens in their NICU (15). Önen et al., reported that the Gram-positive (% 46), Gram-negative (%52) and Candida (%1) are the main (20). In other study, Bulut et al., reported that the methicillin resistant Staphylococcus aureus (MRSA), gram-negative Pseudomonas aeruginosa are mostly

identified from NICU (16). Especially Escherichia coli (%16.2), Acinetobacter spp. (%20.4), and Enterococcus (%18.5) need pay attention in their report. Staphylococcus aureus and Pseudomonas aeruginosa are isolated from the cultures as nosocomial infection cause (17).

While Escherichia coli and Klebsiella origin infections have decreased in recent years due to prevalent contact isolation and education of staff (there are conflict data), nosocomial infections caused by candida and coagulase negative staphylococcus due to widespread use of antibiotics have increased. Use of antibiotics in intensive care units for prophylaxis and the medical therapy purpose may result in aerobic gram-negative bacillus, MRSA and vancomycin resistant enterococcus (VRE) colonization. It has been observed that there is a parallelism between increase in prophylactic antibiotic use in surgery and increase in MRSA and methicillin resistant coagulase negative staphylococcus infections. Patients with catheter and tracheostomy are under the risk for MRSA colonization and infections.

Prevention:

Nosocomial infections control for both all hospitalized patients and those who are in NICU depend on the same general principles.

Washing hands is the first and the basic application. In the guidebooks, it is stated that washing hands with soap would be enough in most cases but in high risk places such as intensive care units, it would be more efficient to use disinfectants. Besides washing hand, wearing gloves will help prevent getting infected possibility. A member of CDC, Hospital Infection Control Practices Advisory Committee in its guidebook for hospitalized patients' isolation measures states that routine use of gloves and washing hands after taking off the gloves is required when contacted with blood, body fluids, secretions and contaminated

particules (1). Moreover, it suggests wearing gowns against the spread of methicillin resistant *S. aureus* in contact isolation.

Follow up of infected patients in intensive care room is also determinant for to control the infection. Intracranial pressure monitoring systems are directly related with nosocomial infections, the incidence of infection can be decrease using by the closed systems. Furthermore, intracranial device application periods should as short as possible and antisepsis should be carefully watched over during the application, and use of intraventricular antibiotic when needed is critical. Avoiding redundant use of antibiotics is as important as regular use of preoperative antibiotic prophylaxis with the patients who will go under surgical operations. Despite all the measures taken and treatments, neuro intensive care nosocomial infections are still one of the most important determinants in morbidity and mortality (22). Besides, when there exists flora in a NICU, frequency of nosocomial infections can be reduced but cannot be eliminated even if all of the rules are followed.

Despite recent advances in prevention and treatment, the management of nosocomial infection still poses a challenge to the specialist cause of the more complexity of the neuro intensive care patients.

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