

Review Article

Management of Infections in Neuro Intensive Care Unit: A Review

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Abstract: Infections are common in hospitalized neuro patients, among this nosocomial infections seems to be most encountered one in critically ill patients. In addition infections can develop as complications in ICU patients including post-operative neurosurgical patients. While bacterial and fungal infections are also frequently seen. Patients admitted to the neuro intensive care units are highly vulnerable to these infections because of their critical nature of illness, the frequency of associated trauma and the presence of invasive devices. Increasing incidences caused by antibiotic resistant pathogens also contributes to the seriousness of those infections, which are directly related with patient's morbidity, mortality and hospital costs and affect the quality of health care adversely. This review focuses mainly on the management of various infections in neuro intensive care unit.

Keywords: Infections, neuro intensive care unit, critically ill patients

INTRODUCTION

Central nervous system (CNS) infections are a neurological emergency requiring urgent investigation and treatment. These infections have been recognized as a critical problem especially in a developing country like India where proven preventive measures may be unobtainable, thus affecting the principal source of adverse outcome [1]. Despite recent advances in prevention and treatment, the management of these infections still poses a challenge to the neuro-ICU specialist and must consider timely diagnosis and prompt initiation of appropriate antibiotic therapy. This article reviews upon common infections in NICU including, risk factors, most prevalent causative agents, clinical features and diagnosis, therapeutical considerations and prevention.

TYPES OF INFECTIONS

These neurological infections can be differentiated to three according to the following situations in which they occur. I) Nosocomial or healthcare associated infections ii) CNS infections caused by etiological causes iii) Infectious complications in post operative neuro patients. According to centers for diseases control, Infections which do not exist in incubation period before the hospitalization but gained at the hospital are defined as

nosocomial infections [2]. The most common nosocomial infections are mainly endocarditis, bloodstream infections, pneumonia, urinary tract infections, colitis etc. These, infectious complications may arise from more 'exogenous' sources such as transmission of pathogens from ICU personnel or the ICU environment [3].

CNS infections which is caused by various etiological reasons include Viral meningoencephalitis, Bacterial infections like pyogenic meningitis's, Mycobacterial infections like tuberculosis meningitis, Protozoal infections like toxoplasmosis, Systemic infections with neurological involvement like dengue hemorrhagic fever, systemic sepsis with multiorgan system failure etc [4]. It is associated with various indications like coma. Infectious complications in neuro ICU patients like meningitis, ventriculitis, encephalitis /cerebritis, brain abscess, and subdural or epidural emphysema are frequently associated with invasive procedures such as craniotomy or placement of intracranial necessary devices like intracranial pressure (ICP) monitoring or diversion of the cerebrospinal fluid (CSF) from an obstructed ventricular system etc [5]. In addition sepsis-related neurological complications like septic encephalopathy or critical illness neuromyopathy are also seen [6].

Risk factors

Patient related factors, pathogenicity of microorganism, and extrinsic factors can affect the CNS infections in NICU. 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 [7]. Presence of the invasive procedures (surgery, endoscopy), multiple catheterizations (urinary catheter, central or peripheral catheters, shunts), or external drainage, and duration of the catheters are extrinsic factors [8]. Colonization and resistance of the pathogen is another factor related with the incidence and severity of the nosocomial infection in NICU. Frequent manipulations and contact are other risk factors.

Causative agents

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 also increasing (7%). However, every hospital has their different flora and results for every year [9]. In NICUs Staphylococci have been incriminated to be the most important and most frequent causative agents (up to 80%), whereas Gram-negative bacilli account for 10-15%. Anaerobes and fungi, primarily Candida species are rarely seen. It has also been observed that there is a parallel relation between increase in prophylactic antibiotic use in surgery and increase in MRSA and methicillin resistant coagulase negative staphylococcus infections. Patients with catheter and tracheostomy in NICU are also under the risk for MRSA colonization and infections [10].

Clinical features and diagnosis

Early indications for the presence of detection of intra cranial infections are fever, deterioration in the level of consciousness or an increase in ICP in the comatose or sedated patients [11, 12]. Any suspected intracranial infection must prompt an immediate diagnostic workup. Neuroimaging and CSF analysis is the cornerstones in the diagnosis of CNS infections. It should be emphasized that performance of such examinations must not delay initiation of anti-infective therapy. Imaging modalities like ultrasonography, computed tomography (CT), magnetic resonance imaging (MRI) can help in anatomical localization of the focus of infection. Identification of etiological cause

of neurological infection requires lumbar puncture and cerebrospinal fluid examination by biochemical, microbiological and molecular diagnostic methods; blood culture and culture of urine, pleural, ascetic and other body fluids [13]. Serodiagnostic and molecular tests for dengue fever, leptospirosis and scrub typhus infections must be carried out.

Therapeutic considerations

Patients with infections, in NICUS are treated with empirical antibiotic therapy at first by awaiting results for culture sensitivity. Empirical antimicrobial therapy of nosocomial intracranial infections must consider the most likely pathogens involved, local resistance pattern, underlying disease, and patient factors such as age, co morbidities, and immune status. Also the antibiotics selected must adequately penetrate the blood brain and blood CSF barriers [14]. This early institution of specific treatment in patients with neurological infections can be life saving. A detailed description of the various therapeutic regimens available for treatment of neurological infections is beyond the scope of this review.

Prevention

Prevention of infections in NICU is an important part in management of infections, it is because of difficulties in early diagnosis and subsequent delayed initiation of appropriate antimicrobial therapy. Preventive measures include following strict aseptic precautions during surgery, hand-hygiene, care of catheters, devices, and as well as the preventive administration of antibiotics in patients undergoing neurosurgery [15]. However, the possible induction of antimicrobial resistance, leading to major healthcare problems, is a significant concern. A relatively new option that may overcome this disadvantage is the introduction of ventriculostomy catheters impregnated with silver nano-particles other preventive techniques during neurosurgeries are strict surgical protocols (e.g. hair clipping not shaving) minimizing blood loss and tissue trauma ,avoidance of CSF leakage ,use of double layer of gloves when handling implantable devices, strict hand hygiene for catheter handling etc. Furthermore Intracranial pressure monitoring systems are directly related with CNS infections, the incidence of these infection can be decreased by using closed systems, shortening device application time period etc.[16, 17].

CONCLUSION

Infections of the central nervous system are a serious complication contributing to morbidity, prolonged length of stay in the ICU and/or hospital, and mortality of neurocritical care patients. The problem of NICU infection may be expected to escalate with the increased use of intensive care, increasingly more complex surgical procedures and the growing problem of antibiotic resistance. Since infection is related to the length of ICU stay, earlier discharge of neurosurgical patients to an appropriately staffed high dependency unit is likely to result in reduction of the infection rate. Reinforcement of infection control strategies within the ICU may be expected to further minimize the infection rate.

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