EPIDEMIOLOGICAL FEATURES OF MENINGOENCEPHALITIS IN CHILDREN: A REVIEW

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Abstract. Meningoencephalitis remains one of the most severe infectious diseases affecting the central nervous system in children and is associated with significant morbidity and mortality worldwide. Despite advances in vaccination, antimicrobial therapy, and intensive care, meningoencephalitis continues to pose a major public health challenge. The epidemiology of pediatric meningoencephalitis varies according to geographic region, age, vaccination coverage, and the prevalence of infectious agents. Viral pathogens remain the leading cause of the disease, while bacterial and less commonly fungal or parasitic agents contribute to severe clinical outcomes.

Keywords: meningoencephalitis, children, epidemiology, viral encephalitis, bacterial meningitis, central nervous system infections, risk factors, pediatric infectious diseases.

Introduction. Meningoencephalitis is an inflammatory disease involving both the meninges and brain parenchyma, resulting from various infectious and noninfectious causes. Pediatric meningoencephalitis remains a significant cause of hospitalization, neurological disability, and mortality worldwide [1]. The incidence and etiological spectrum of meningoencephalitis differ considerably across regions and age groups. Improvements in vaccination programs have significantly reduced the burden of some bacterial pathogens; however, viral agents continue to account for the majority of cases in children [2].

The global incidence of meningoencephalitis varies from 5 to 30 cases per 100,000 children annually, depending on geographical location and surveillance systems [3]. In high-income countries, vaccination against Haemophilus influenzae type b, Streptococcus pneumoniae, and Neisseria meningitidis has dramatically reduced bacterial meningoencephalitis. Consequently, viral pathogens have become the predominant etiological agents [4]. In developing countries, bacterial infections remain a major cause of severe disease because of limited vaccine coverage and delayed access to healthcare [5].

The causative agents of meningoencephalitis vary according to age and epidemiological setting.

Viral Etiology. Viruses are responsible for most pediatric meningoencephalitis cases worldwide. Common viral pathogens include: Enteroviruses, Herpes simplex virus (HSV);, Varicella-zoster virus (VZV), Epstein-Barr virus (EBV);

Human herpesvirus 6 (HHV-6), Arboviruses [2]. Herpes simplex virus type 1 remains one of the leading causes of severe sporadic encephalitis in children and is associated with substantial neurological sequelae if untreated [6].

Bacterial Etiology. The most important bacterial pathogens include: Neisseria meningitides, Streptococcus pneumoniae;, Haemophilus influenzae type b;, Listeria monocytogenes (particularly in neonates) [4]. Although bacterial causes account for a smaller proportion of cases, they are associated with higher mortality rates and long-term neurological complications.

Age-Related Epidemiological Characteristics. The epidemiological profile of meningoencephalitis differs significantly according to age.

Neonates. In newborns, the most common pathogens include: Group B streptococci, Escherichia coli, Herpes simplex virus [7].

Infants and Young Children. Enteroviruses and herpesviruses predominate among infants and preschool children, while bacterial infections remain an important cause of severe disease in unvaccinated populations [5].

School-Aged Children and Adolescents. Among older children, viral etiologies become increasingly common, particularly enteroviruses and arboviruses. Travel-related and vector-borne infections may contribute to regional outbreaks [3].

Several factors influence the risk of developing meningoencephalitis in childhood: young age. incomplete vaccination, immunodeficiency, malnutrition, chronic medical conditions, exposure to infected individuals, residence in endemic areas [1]. Environmental and socioeconomic factors also play an important role in disease transmission and outcomes.

Seasonal and Geographic Variations. The epidemiology of pediatric meningoencephalitis demonstrates significant seasonal variation. Enteroviral infections typically peak during summer and early autumn, whereas respiratory viruses associated with encephalitis are more common during winter months [6]. Geographical differences influence pathogen distribution. Arboviral encephalitis is more frequently reported in tropical and subtropical regions, while tick-borne encephalitis remains endemic in parts of Europe and Asia [2].

Public Health Importance and Prevention. Vaccination remains the most effective preventive strategy against many causes of pediatric meningoencephalitis. Immunization against Haemophilus influenzae type b, pneumococcal infection, meningococcal disease, measles, mumps, rubella, and varicella has substantially reduced disease incidence worldwide [4,8].

Additional preventive measures include: early recognition of symptoms, timely antimicrobial treatment, infection control measures, public health surveillance programs [5,9].

Conclusion. Meningoencephalitis continues to represent a significant cause of morbidity and mortality among children worldwide. The epidemiological characteristics of the disease are influenced by age, geographical location, vaccination coverage, and etiological factors. Viral pathogens currently account for the majority of cases, while bacterial infections remain associated with severe outcomes. Continued surveillance, vaccination programs, and improved diagnostic capabilities are essential for reducing the burden of pediatric meningoencephalitis and improving patient outcomes.

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