THE CONTRIBUTION OF STREPTOCOCCUS PNEUMONIAE TO BACTERIAL MENINGITIS IN ADULTS

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Abstract. Bacterial meningitis remains a life-threatening condition worldwide, with significant morbidity and mortality among adults. Streptococcus pneumoniae is one of the leading causative agents of bacterial meningitis in adults. This review summarizes current knowledge on the epidemiology, pathogenesis, clinical manifestations, diagnostic methods, and preventive strategies for pneumococcal meningitis. Despite advances in vaccination and antimicrobial therapy, S. Pneumoniae continues to account for a substantial proportion of adult meningitis cases, particularly in individuals with comorbidities or immunosuppression. Early diagnosis using cerebrospinal fluid analysis and culture, complemented by molecular methods, is critical for effective management. The review highlights the importance of vaccination programs, antimicrobial stewardship, and surveillance systems to reduce the burden of pneumococcal meningitis in adults.

Keywords: Streptococcus pneumoniae, bacterial meningitis, adults, epidemiology, vaccination, cerebrospinal fluid, diagnosis.

Introduction. Bacterial meningitis is an acute inflammation of the meninges caused by bacterial infection, and it remains a major public health concern due to high rates of morbidity and mortality [1,3]. Among adults, Streptococcus pneumoniae is the most common causative agent, responsible for severe

neurological complications if diagnosis or treatment is delayed [2,4,5]. Understanding the epidemiology and clinical characteristics of pneumococcal meningitis is essential for optimizing prevention and management strategies.

Epidemiology. Global studies indicate that S. Pneumoniae accounts for approximately 50–60% of bacterial meningitis cases in adults in developed and developing countries [6,7]. Risk factors include older age, chronic diseases (e.g., diabetes, renal insufficiency), immunodeficiency, and previous respiratory infections. Pneumococcal meningitis often follows invasive pneumococcal infections such as pneumonia or sinusitis.

Pathogenesis. The pathogenesis of pneumococcal meningitis involves colonization of the nasopharynx, followed by invasion into the bloodstream and crossing of the blood–brain barrier. Capsular polysaccharides of S. Pneumoniae play a key role in evading host immune defenses, leading to inflammation and neuronal damage [8,9].

Clinical Manifestations. Adult patients typically present with the classic triad of fever, neck stiffness, and altered mental status. Other symptoms may include headache, photophobia, nausea, and vomiting. Severe cases can progress rapidly to septic shock, cerebral edema, and neurological sequelae.

Diagnosis. Definitive diagnosis relies on cerebrospinal fluid (CSF) analysis obtained via lumbar puncture. CSF findings include elevated white blood cell counts, elevated protein, and decreased glucose levels. Culture and Gram staining allow identification of S. Pneumoniae, while polymerase chain reaction (PCR) enhances sensitivity, especially in patients pretreated with antibiotics [10,11].

Prevention and Treatment. Vaccination with pneumococcal conjugate and polysaccharide vaccines is the most effective preventive measure, particularly for high-risk adults. Early empiric antibiotic therapy, adjusted based on

susceptibility, is critical for reducing mortality. Supportive care and monitoring for complications are also essential [12,13].

Conclusion. Streptococcus pneumoniae remains a major contributor to bacterial meningitis in adults, causing significant morbidity and mortality. Timely diagnosis, appropriate antimicrobial therapy, and preventive vaccination are crucial for reducing disease burden. Continued surveillance and research are necessary to optimize management strategies and implement effective public health interventions.

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