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AN OVERVIEW RISK FACTORS, AND MOST COMMON ORGANISMS IN MENINGITIS

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Abstract:
Meningitis caused by bacteria is a medical emergency. All doctors who offer acute medical treatment must have a thorough awareness of the management priorities for a patient suspected of having meningitis during the first hour. These include getting blood cultures, doing a lumbar puncture, and commencing appropriate therapy while minimizing potentially hazardous delays, such as those caused by delaying treatment until after neuroimaging is conducted. And to recognize the most common pathogen which will help to start empirical therapy, we have conducted a search through biomedical database for all relevant studies that were published till the middle of 2022.

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INTRODUCTION:

Meningitis is a life-threatening illness of the central nervous system caused by bacteria. The primary causal organisms are Streptococcus pneumoniae and Neisseria meningitidis, with the former responsible for two-thirds of cases in Western Europe and the United States [1,2]. Despite the availability of antibiotics and dexamethasone, mortality rates in low-income nations are several times greater than in high-income countries [3,4]. Approximately fifty percent of survivors have neurological complications such as hearing loss, focal motor impairments, or cognitive impairment [5]. Pneumococcal and meningococcal invasive illness is preceded by nasopharyngeal colonization. Pneumococci and meningococci can colonize up to one hundred percent and eighteen percent, respectively, of the typical population [6]. In some individuals, these frequent colonizers can breach the mucosal barrier, survive in the bloodstream, and pass the blood-brain barrier, resulting in meningitis. Several risk factors for bacterial meningitis susceptibility have been discovered. These can include specific age groups, medical diseases that produce immunodeficiency, host genetic variables, and anatomical anomalies of the central nervous system's natural barriers [2,6].

Bacterial meningitis is one of the most severe children's illnesses, with high morbidity and fatality rates. It may potentially result in long-term complications. 20 to 30 percent of affected patients have been observed to suffer seizures before hospital admission or within the first two days of hospitalization [7]. Meningitis is prevalent in 5% of children with febrile convulsions, according to one report [8].

Meningitis was typically caused by H. influenzae, meningococci, and pneumococci. Infection with H. influenzae accounted for the majority of cases of bacterial meningitis in children aged 1 to 24 months. According to earlier research from Saudi Arabia [9,10], the primary causative organisms of meningitis in children older than the newborn period are comparable.

DISCUSSION:

Clinical characteristics and indicators of the causative pathogen Most doctors would investigate the likelihood of meningitis if a patient presented with a recent onset of headache, fever, neck stiffness, or altered mental state. At least two of these four symptoms will be present in 95% of individuals with bacterial meningitis, necessitating immediate diagnostic testing [10]. The conventional trio of bacterial meningitis comprises of fever, neck stiffness, and altered mental state; however, relying on all three of these indications will result in the missed diagnosis of almost fifty percent of cases [10]. Some clinical symptoms and patient characteristics may provide hints regarding the causative pathogen. Meningitis caused by Neisseria meningitidis may begin with influenza-like symptoms, including fever, muscle pains, and vomiting, before becoming clinically apparent. Rapid onset and progression of symptoms over the course of hours is typical of this illness and can be used to distinguish it from self-limiting viral infections. A patient with meningitis and a petechial or purpuric rash that does not blanch strongly supports meningococcal illness, however the rash may also be maculopapular or absent. Patients coming in the midst of a known meningococcal outbreak must be viewed with a heightened degree of suspicion [11]. Streptococcus pneumoniae meningitis should be suspected in patients with predisposing conditions, such as middle ear infection, sinusitis, mastoiditis, cerebrospinal fluid (CSF) leak, cochlear implants, asplenia, human immunodeficiency virus (HIV) infection, or other immunosuppressive conditions or medications [12]. 50-year-old patients, those on long-term glucocorticoids or other immunosuppressive treatments, and those with diabetes, alcoholism, cirrhosis, end-stage renal failure, cancer, HIV infection, or organ transplantation are at risk for Listeria monocytogenes meningitis [13].

Generally speaking, patients with underlying diseases have a higher chance of a poor outcome; consequently, identification of these groups and preventive actions such as vaccination are of the utmost importance (TABLE 1). Pneumococcal illness, including meningitis, is most prevalent in children younger than 2 years old and adults older than 50. In addition, persons with underlying illnesses such as splenectomy or asplenic states and children with cochlear implants are particularly susceptible. 20% of people with pneumococcal meningitis exhibit the use of immunosuppressive medicines, the presence of diabetes mellitus, a history of splenectomy, infection with HIV, or alcoholism [4]. HIV infection has a significant impact on the etiology of acute meningitis in low-income countries [13]. Meningococcus is the major cause of meningitis in young infants and young adults beyond the neonatal period. Meningococcal disease has been linked to smoking, living in the same household as a patient (including students), and proxies with meningococcal disease [11].

TABLE 1: Acquired risk factors for bacterial meningitis and most common causative organisms

Risk factor	Prevalence or incidencein Dutch population	Relative frequency[a]	Most common causative organism	Mortality
Elderly > 65 years	Prevalence 1,108,000[61]	37%[14]	*S. pneumoniae* *L. monocytogenes*	34%[14]
Splenectomy / hyposplenic state	Incidence 1000 spleen removalsper year[62] Functional asplenia unknown	3%[39]	*S. pneumoniae*	25%[39]
Alcoholism	Prevalence 78,400 (adults between 18-65 year)[63]	4%-18%[22,26]	*S. pneumoniae* *L. monocytogenes*	33%[26]
HIV/AIDS	Prevalence 22,231[64]	In Western world: 1%[3]	*S. pneumoniae, Salmonella* spp.	24%[43]
Diabetes mellitus	Prevalence 110,880[65]	7-10%[22,23]	*S. pneumoniae, L. monocytogenes*	Unknown
Cancer	Incidence 101,000 per year[66]	Unknown	*S. pneumoniae, L. monocytogenes*	Unknown
Anatomical defect	Unknown	5%[22,56]	*S. pneumoniae*	Prone to recurrent meningitis, mortality in case of recurrent meningitis 15%[56]
Organ transplant recipients	Incidence 1200 per year[67]	5-10% of the patients CNS infections 38	*S. pneumonia, L. monocytogenes, Nocardia*	Unknown

[a]Frequency: Percent of cases in adult patients with community-acquired bacterial meningitis.

Age as risk factor:

Meningitis is more prevalent in young children and the elderly [12]. Infants are more susceptible to bacterial infections as a result of their decreasing passive immunity inherited from their mothers and undeveloped immune systems. Due to the advent of conjugated vaccines against Haemophilus influenzae type B and S. pneumonia, infants are now protected against these diseases; thus, the age distribution of individuals with bacterial meningitis has changed. Historically, bacterial meningitis was primarily a disease of children and adolescents; however, the majority of patients are now over the age of 50 [5]. Vaccinations have altered the common causative organisms in children, but not the clinical characteristics. Young infants with bacterial meningitis may exhibit nonspecific symptoms like lethargy, poor feeding, and irritability. Children of a greater age are more prone to exhibit the classic signs and symptoms of bacterial meningitis. In the Netherlands, 80 percent of cases are caused by S. pneumoniae and N. meningitidis in infants older than one month. 10 Group B streptococci, E. coli, H. influenzae, various Gram-negative bacilli, L. monocytogenes, and group A streptococci are responsible for the remaining instances. The recommended treatment is a cephalosporin of the third generation (cefotaxime or ceftriaxone) [13]. A meta-analysis of randomized trials revealed a positive impact of dexamethasone on hearing loss in children in high-income countries; this was not proven in low-income countries [4].

Immunodeficiency:

Due to developments in medical research and technology, life expectancy has grown, and diseases that were once universally fatal have become chronic [14]. Consequently, the number of immunocompromised people has increased during the past few decades. One-third of bacterial meningitis

patients are immunocompromised. Meningitis risk factors include splenectomy, drinking, HIV, diabetes, cancer, and immunosuppressive drug use. Although S. pneumoniae is the most prevalent causative organism of bacterial meningitis in immunocompromised patients, other causative species may be detected in patients with specific risk factors [15,16].

Organ transplant recipients:

In organ transplant recipients, invasive pneumococcal infections are more prevalent due to immunosuppressive medicine used to prevent and treat graft rejection [17]. The highest incidence (354 per 100,000 people per year) occurs among liver transplant recipients, presumably because to a higher frequency of spleen dysfunction. Variability exists in the start of invasive pneumococcal illness following organ transplant, and the risk continues over time [18]. Nocardia (particularly in cases of multiple brain abscesses) and Listeria monocytogenes are additional causal pathogens [19]. In organ transplant recipients with suspected bacterial meningitis, the differential diagnosis may include cryptococcal, tuberculous, or other unusual kinds of meningitis in which supplemental dexamethasone may be hazardous in the absence of adequate antibiotic treatment. Therefore, when bacterial meningitis is suspected in transplant patients, the potential benefit of supplementary dexamethasone must be balanced against the danger of worsening when caused by rare pathogens. Prior to transplantation, vaccination against pneumococcal disease can reduce the risk of invasive pneumococcal disease. Administration of preventive antibiotics to these individuals remains controversial, as there is a risk of antibiotic resistance and current guidelines differ in their recommendations [18].

Splenectomy or hyposplenic state:

Infections with encapsulated bacteria such as S. pneumoniae and Haemophilus influenzae are more likely in individuals with a dysfunctional or absent spleen [20]. Hyposplenism may be congenital or the result of surgical excision of the spleen (splenectomy). In addition, 15-40% of patients who have allogeneic bone marrow transplantation develop acquired functional hyposplenism. Other causes of hyposplenism include graft-versus-host disease, sickle-cell anemia, celiac disease, and HIV infection [21]. The spleen is the only organ in the human body where inadequately opsonised microorganisms, such as S. pneumoniae, can be removed from the bloodstream; hence, hyposplenic patients are at risk for severe sepsis caused by these germs [20]. Despite the fact that this danger has been recognized for nearly a century, individuals still do not obtain enough vaccination or information from their physicians regarding their risk of infection and when to seek medical attention [20,22].

CONCLUSION:

Bacterial meningitis is a potentially fatal disease, and numerous susceptibility-increasing factors have been found. Awareness of meningitis risk factors may aid early diagnosis and treatment of the condition, and immunizations can prevent bacterial meningitis in various risk groups. In select groups of individuals at increased risk for bacterial meningitis, adequate preventative actions may minimize the incidence rate.

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