

Infections of the Central Nervous System



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INTRODUCTION

Infections of the central nervous system (CNS) are associated with significant morbidity and mortality. This chapter focuses on meningitis, encephalitis, and brain abscesses in the parenchyma and parameningeal areas.

MENINGITIS AND ENCEPHALITIS

Contact with offending infectious agents such as viruses, bacteria, fungi, protozoa, and helminths can cause inflammation of the meninges covering the brain and spinal cord (i.e., meningitis) or lead to inflammation of the brain parenchyma (i.e., encephalitis). These infectious agents can penetrate the CNS by direct seeding or hematogenous spread and cause a constellation of symptoms. The clinician must rapidly initiate a diagnostic evaluation and begin appropriate management.

Meningitis

Definition

Meningitis is defined as inflammation of the leptomeninges that cover the brain and spinal cord. It is identified by an abnormal increase in the number of white blood cells in cerebrospinal fluid (CSF). Inflammation can be caused by many infectious agents (i.e., bacteria, viruses, fungi, and parasites) and also can occur as a result of noninfectious conditions, including tumors or cysts, medications (e.g., nonsteroidal anti-inflammatory drugs, antimicrobial agents), systemic illnesses (e.g., systemic lupus erythematosus, Behçet's disease, sarcoidosis), or neurologic procedures (e.g., neurosurgery, spinal anesthesia, intrathecal injections).

The clinical presentation can be acute, subacute, or chronic based on the virulence of the organism. Acute meningitis is a syndrome characterized by the onset of symptoms within hours to several days, whereas chronic meningitis characterized by clinical and CSF findings that remain abnormal for at least 4 weeks. Acute meningitis is most often caused by bacteria and viruses, whereas chronic meningitis is most often caused by spirochetes, mycobacteria, and fungi.

Epidemiology and Etiology

Bacterial Meningitis

In the United States, the epidemiology of bacterial meningitis has changed significantly over the past several decades with the introduction of conjugate vaccines against *Haemophilus influenzae* and *Streptococcus pneumoniae*. A surveillance study found that about 4000 cases of bacterial meningitis and 500 deaths

occurred annually between 2003 and 2007. The leading causes of bacterial meningitis were *S. pneumoniae* (58% of cases), *Streptococcus agalactiae* (18% of cases), *Neisseria meningitidis* (14% of cases), *H. influenzae* (7% of cases), and *Listeria monocytogenes* (3% of cases).

Specific etiologic agents may be more likely based on the patient's age and various risk factors (Table 90-1). In one study of 352 episodes of community-acquired pneumococcal meningitis, 70% of cases were associated with an underlying disorder. Conditions associated with pneumococcal meningitis include splenectomy or asplenic states, multiple myeloma, hypogammaglobulinemia, alcoholism, malnutrition, chronic liver or kidney disease, and diabetes mellitus. Patients often have contiguous or distant foci of infection such as pneumonia, otitis media, mastoiditis, sinusitis, endocarditis, and head trauma with a CSF leak.

The group B streptococcus (i.e., *S. agalactiae*) is a common etiologic agent of meningitis in neonates, with 52% of cases occurring during the first year of life. Risk factors for *S. agalactiae* meningitis in adults include age older than 60 years, pregnancy or the postpartum state, diabetes mellitus, and other chronic diseases and immunosuppressed states.

N. meningitidis usually causes meningitis in children and adults. Most cases in the United States are caused by serogroups B, C, and Y; serogroups A and W135 usually cause disease outside of the United States. Because of *N. meningitidis* in the upper

TABLE 90-1 COMMON BACTERIAL PATHOGENS AND FACTORS PREDISPOSING TO MENINGITIS

PREDISPOSING FACTOR	BACTERIAL PATHOGENS
Age	
<1 mo	<i>Streptococcus agalactiae</i> , <i>Escherichia coli</i> , <i>Listeria monocytogenes</i>
1-23 mo	<i>S. agalactiae</i> , <i>E. coli</i> , <i>Haemophilus influenzae</i> , <i>Streptococcus pneumoniae</i> , <i>Neisseria meningitidis</i>
2-50 yr	<i>S. pneumoniae</i> , <i>N. meningitidis</i>
>50 yr	<i>S. pneumoniae</i> , <i>N. meningitidis</i> , <i>L. monocytogenes</i> , aerobic gram-negative bacilli
Immunocompromised state	<i>S. pneumoniae</i> , <i>N. meningitidis</i> , <i>L. monocytogenes</i> , aerobic gram-negative bacilli (including <i>Pseudomonas aeruginosa</i>)
Basilar skull fracture	<i>S. pneumoniae</i> , <i>H. influenzae</i> , group A β -hemolytic streptococci
Head trauma; post neurosurgery	<i>Staphylococcus aureus</i> , coagulase-negative staphylococci (especially <i>Staphylococcus epidermidis</i>), aerobic gram-negative bacilli (including <i>P. aeruginosa</i>)

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