

# Key Points Review of Meningitis



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## KEYWORDS

- Bacterial meningitis • Viral meningitis • Meningitis treatment • Meningitis vaccines

## KEY POINTS

- Hospitalization is usually required for appropriate management of suspected meningitis for rapid administration of intravenous antibiotics and antivirals, diagnostic testing, and pain management.
- Diagnosis of meningitis rests on the cerebrospinal fluid examination.
- Broad-spectrum antibiotics should be narrowed if bacterial cause found or stopped if viral, fungal, or mycobacterial cause found.

## INTRODUCTION

When evaluating a patient for meningitis, it is best to prepare for the worst and hope for the best. Among lay people and patients' family members, the word meningitis can be very alarming. Certainly, *Neisseria meningitidis* is very serious with mortality between 9% and 73%, depending on serotype.<sup>1</sup> Alternatively, viral meningitis is usually self-limiting. Knowing epidemiologic risk factors and correlating patient symptoms and cerebrospinal fluid (CSF) findings with the various meningitis causes can help determine a differential diagnosis. Subsequently, the clinician will also know the appropriate management strategy. Some details of this are shared in this article. As a pretest, try answering the following questions:

1. What is the most common etiologic agent that causes meningitis in the United States?
2. What is the most common bacterium that causes meningitis in the United States?
3. What antibiotics should be initiated for suspected bacterial meningitis in the United States for adult patients with no past medical history?

Please check your answers at the end.

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The author has nothing to disclose.  
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## OVERVIEW AND EPIDEMIOLOGY

Meningitis is an inflammatory disease of the leptomeninges, the tissues surrounding the brain and spinal cord, and is defined by an abnormal number of white blood cells (WBCs) in the CSF. Most cases of meningitis in the United States are caused by a viral infection, but bacterial and fungal infections are also seen. According to reports from the Centers for Disease Control and Prevention (CDC), inpatient hospitalizations resulting from viral meningitis range from 25,000 to 50,000 each year, but the actual incidence may be as high as 75,000.<sup>2</sup> Several viruses produce aseptic (nonbacterial) meningitis, including enteroviruses, which are most common, followed by herpes simplex virus (HSV), varicella-zoster virus (VZV),<sup>3,4</sup> and then human immunodeficiency virus (HIV) and West Nile virus (WNV). According to the CDC, there were 4100 cases of bacterial meningitis, including 500 deaths, which occurred in the United States each year between 2003 and 2007.<sup>5</sup> Bacterial meningitis can be community-acquired or health care associated. The major causes of community-acquired bacterial meningitis in adults are *Streptococcus pneumoniae* (ie, Pneumococcus) with a prevalence rate of 61%, followed by *N meningitidis* (ie, Meningococcus) (11%), *Haemophilus influenzae* (7%), *Listeria monocytogenes* (2%),<sup>6</sup> Group B streptococcus (in infants) (7%),<sup>3</sup> and tick-borne illnesses.<sup>4</sup> The major causes of health care–associated bacterial meningitis are staphylococci (including methicillin-resistant *Staphylococcus aureus*) and gram-negative bacilli, such as *Pseudomonas aeruginosa*. Meningitis can also be caused by various fungi, such as Cryptococcus, and can also be caused by *Mycobacterium tuberculosis*. Aseptic meningitis can be caused by malignancies, by autoimmune disorders, or can be medication induced. It is important to know the specific cause of meningitis because the treatment differs depending on the cause (Table 1).

## CAUSE

### **Bacterial Meningitis**

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#### ***Streptococcus pneumoniae***

The leading cause of bacterial meningitis in the United States is *S pneumoniae*. This bacterium is normally found in the respiratory tract of humans. Risk factors for *S pneumoniae* meningitis include immunosuppressive conditions, basilar skull fractures, and CSF leaks. If a contiguous or distant focus of infection is found (eg, sinusitis or brain abscess), consultation with an otorhinolaryngologist should be obtained. In a CDC study, there was a 59% decline in the rates of pneumococcal meningitis in children younger than 2 years of age after licensure of the heptavalent pneumococcal conjugate vaccine.<sup>7</sup> More recently, vaccination with PCV13 in France showed a decrease in the incidence of invasive pneumococcal disease (IPD) through 2012 in children up to the age of 5 but not in older children and adults.<sup>8</sup> Although among the immunosuppressed population IPD incidence decreased from 20 to 8/100,000-population year ( $P<.004$ ) over the study period through 2014, no changes in mortality were observed. Penicillin resistance experienced a significant decline as well.<sup>9</sup>

#### ***Neisseria meningitidis***

In young adults and teens, the bacterium *N meningitidis* causes meningococcal disease, which can be fatal if treatment is not initiated immediately. This bacterium is common and also lives naturally in the posterior nasopharynx. Human beings are the only place where meningococcal bacteria can live. At any one time, 10% to 25% of us carry the bacteria for weeks or months without ever knowing they are there.<sup>10</sup> For most of us, this is harmless because we have natural resistance. It is

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