



# Patient education: Meningitis in children (Beyond the Basics)

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Literature review current through: **Jun 2024**.

This topic last updated: **Sep 27, 2022**.

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## MENINGITIS OVERVIEW

Meningitis is the medical term for inflammation of the tissues (meninges) that surround the brain and spinal cord. The inflammation is most commonly caused by a virus or a bacterium, which travels from another part of the body through the bloodstream to the meninges. The treatment and long-term outlook of meningitis differ considerably based upon the cause.

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## MENINGITIS CAUSES

There are two main types of meningitis: viral and bacterial.

**Bacterial meningitis** — There are many types of bacteria that can cause bacterial meningitis. The most likely type depends upon the child's age, history of vaccinations, and current or past medical problems. The two most common causes of bacterial meningitis in older infants and children in the United States are bacteria called *Streptococcus pneumoniae*, or pneumococcus, and *Neisseria meningitidis*, or meningococcus.

Certain factors can increase a child's risk of developing bacterial meningitis, including recent exposure to someone with bacterial meningitis, recent infection (eg, ear or sinus infection), travel to areas where bacterial meningitis is common (eg, sub-Saharan Africa), serious head

injury, problems with the immune system, cochlear implants, and certain anatomic abnormalities.

Bacterial meningitis is a medical emergency that must be treated quickly to minimize the risk of serious illness or even death. Even when treated appropriately, children who recover from bacterial meningitis sometimes have long-term complications.

**Viral meningitis** — The most common cause of viral meningitis is a family of viruses called enterovirus. In the United States, enteroviral meningitis is seen more frequently from June to October. Enteroviruses are spread by direct contact with feces during activities such as diaper changing or indirectly through contaminated water, food, and surfaces.

Other viruses that cause meningitis can be spread by airborne droplets, direct contact, during birth, or through the bite of an animal (eg, rabies) or bug (eg, mosquito, tick).

In developed countries, viral meningitis is more common than bacterial meningitis and is generally less severe. Children with viral meningitis usually recover completely with supportive treatment.

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## MENINGITIS SIGNS AND SYMPTOMS

Although bacterial meningitis is usually more severe, the signs and symptoms of bacterial and viral meningitis can be similar. It is often not possible to know whether a child has bacterial or viral meningitis based upon symptoms alone. The most common symptoms include:

- Newborns may develop a fever accompanied by nonspecific symptoms (eg, poor feeding, vomiting, diarrhea, rash). The infant may have a stiff neck or bulging fontanel (soft spot on the skull) and may be irritable, restless, or lethargic.
- Older children may develop a sudden fever, headache, nausea, vomiting, confusion, or stiff neck and may complain that light bothers their eyes.
- Meningitis can cause seizures and decreased level of awareness.
- Certain types of bacterial meningitis may be associated with petechiae ( [picture 1](#)) and purpura (red to purplish spots on the skin that do not blanch with pressure) ( [picture 2](#)).
- The symptoms of viral meningitis can resemble those of the flu, including fever, muscle aches, runny nose, and cough. One type of viral meningitis causes a slightly red to pink skin rash.

- In some cases, symptoms worsen slowly over one to two days, while in other cases, the symptoms worsen rapidly over hours.
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## MENINGITIS DIAGNOSIS

Because bacterial meningitis is a medical emergency that must be treated promptly, it is important to determine the cause of the child's symptoms as quickly as possible. The following tests are generally recommended and are usually performed in a hospital emergency department:

- **Blood culture** – A sample of blood is cultured in the laboratory to determine if there are bacteria present (normally, no bacteria should be present in the blood). The results of a blood culture are generally available within 24 to 48 hours. If the blood culture is positive, additional testing can be done to find out which antibiotic is best.
- **Lumbar puncture** – During a lumbar puncture, also known as a spinal tap, a clinician uses a needle to remove a sample of spinal fluid from the area around the spinal cord in the lower back. Several tests are done on the fluid to determine if there are signs of infection:
  - Cell count, protein, and glucose – The cell count (the number of infection-fighting cells) and the levels of protein and glucose in the spinal fluid can give clues about whether there is an infection and, if so, what type of infection (bacterial or viral). These initial results are available within a matter of hours.
  - Bacterial culture – The bacterial culture is the true test of whether a bacterial infection is present. This test usually takes 24 to 48 hours. In addition to finding out which bacteria is causing the infection, the bacterial culture can determine which antibiotic treatment is best. If the test is negative, it generally means the child does not have bacterial meningitis. However, sometimes, the result is a "false negative" and despite the negative culture result, other signs and laboratory tests strongly indicate that the child likely has bacterial meningitis. The most common cause of a false-negative bacterial culture result is that the child received antibiotics before the test was done.
  - Polymerase chain reaction (PCR) tests – If the signs, symptoms, season, or initial spinal fluid results suggest that the child may have viral meningitis, the spinal fluid may be sent for virologic testing, which is usually done using molecular tests called "PCR." PCR tests can detect enteroviruses, herpes simplex virus, and other viruses. Some PCR tests may be available quickly (even within a few hours), while others may take several days.

In some hospitals, PCR testing may be performed with a "meningitis panel," which tests for several different viruses and bacteria all at the same time.

- **CT scan** – A computed tomography (CT) scan is a radiology test that is used to take images of the brain. Most children with suspected meningitis do not need to undergo a CT scan. However, in some cases, a CT scan is performed before the lumbar puncture. The purpose of this test is to help determine if it is safe to perform the lumbar puncture and to determine if another condition may be contributing to the child's symptoms (eg, bleeding or a mass in the brain).

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## MENINGITIS TREATMENT

The treatment for meningitis depends upon whether the meningitis is caused by a virus or bacterium. However, this distinction may not be clear until the culture and polymerase chain reaction (PCR) results are available. In many cases, children are treated as if they have bacterial meningitis until bacterial meningitis is definitively excluded. The reason for this is that there is a significant risk of serious illness or even death if the child has bacterial meningitis and treatment is delayed for a prolonged period of time.

**Bacterial meningitis** — Bacterial meningitis is a life-threatening illness that requires hospitalization and treatment with intravenous antibiotics. The child will be monitored closely for signs of complications. Depending upon the severity of the illness, the child may also need supportive treatments to aid breathing, maintain blood pressure, prevent excessive bleeding, and stay hydrated.

**Antibiotics** — Antibiotic therapy is usually started immediately after the blood tests and lumbar puncture are performed. Treatment is administered intravenously. Oral antibiotic therapy is not used to treat meningitis because it does not achieve a high enough concentration of antibiotic in the spinal fluid.

**Length of treatment** — The length of antibiotic treatment depends upon the results of the bacterial cultures:

- If the cultures are negative and the child has improved, antibiotics may be discontinued after 48 to 72 hours.
- If the cultures are positive, the length of treatment depends upon the bacteria that is identified and whether there are complications. The usual treatment course is 10 to 14

days. However, treatment may be as short as five days for certain bacteria and as long as four weeks for others.

**Viral meningitis** — In most cases of viral meningitis, there is no effective antiviral therapy that will shorten the duration of symptoms. Instead, treatment is supportive, meaning that care should be provided to support the child while they recover. This generally includes rest, encouraging the child to drink an adequate amount of fluid (when alert enough to do so), providing intravenous fluids (if unable to drink enough fluid), and medications to treat fever and/or headache (eg, [acetaminophen](#) or [ibuprofen](#)). These medications should be dosed according to weight, not age.

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## MENINGITIS PROGNOSIS

A child's prognosis after an episode of meningitis depends upon the cause (type of bacterium or virus), the severity of the illness, and the age of the child.

**Bacterial meningitis** — Most children with bacterial meningitis recover completely with no long-term complications. The child should begin to improve within 24 to 36 hours after starting antibiotics. However, fever may persist for four to six days or longer.

However, even with proper treatment, meningitis can damage the brain and cause long-term complications. The most common complication is hearing loss, which occurs in approximately 5 to 10 percent of patients following bacterial meningitis. Other complications are less common and may include developmental delay or learning disabilities, spastic or paralyzed muscles, and seizures. Complications are more common in children who live in resource-limited countries.

To determine if a child's hearing was affected by the illness, hearing testing is usually performed around the time of discharge from the hospital. Young children should also be monitored closely for signs of developmental delay (eg, not walking, talking, etc at the expected time).

Bacterial meningitis is fatal in a small number of cases (<5 percent).

**Viral meningitis** — Most children with viral meningitis recover with no long-term complications. Symptoms usually begin to improve within one week, although some children will have fatigue, irritability, decreased concentration, muscle weakness and spasm, and difficulty with coordination for several weeks or more. Death is uncommon in children with viral meningitis.

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## MENINGITIS PREVENTION

Several measures can help to reduce the risk of developing bacterial and viral meningitis.

**Vaccines** — Several routine childhood vaccines reduce the risk of developing bacterial meningitis, including the pneumococcal, meningococcal, and *Haemophilus influenzae* type b (Hib) vaccines. These are discussed in detail separately. (See "[Patient education: Vaccines for infants and children age 0 to 6 years \(Beyond the Basics\)](#)" and "[Patient education: Vaccines for children age 7 to 18 years \(Beyond the Basics\)](#)".)

Vaccines are also available to prevent certain types of viral infections that may cause meningitis or other central nervous system infections, including polio, influenza, varicella-zoster (chickenpox), measles, and mumps. (See "[Patient education: Vaccines for infants and children age 0 to 6 years \(Beyond the Basics\)](#)" and "[Patient education: Influenza symptoms and treatment \(Beyond the Basics\)](#)".)

**Preventive antibiotics** — Preventive antibiotics are recommended for close contacts of anyone infected with meningococcal infection, even if the contact was previously vaccinated. Close contact is defined as a person who lives with the child or who spent  $\geq 4$  hours with the child for at least five of the seven days before the child developed symptoms.

Preventive antibiotics may also be necessary for close contacts of anyone infected with Hib bacterial infection. However, this only applies for those households in which there is a person with invasive Hib disease and at least one household member who is a child younger than 48 months of age and did not receive all of the vaccinations against Hib, or an individual who has a weakened immune system (even if that person was vaccinated against Hib).

**Infection control** — Families of children with meningitis should take care to avoid becoming infected. This includes washing hands after touching the child or changing diapers and before eating or preparing food. Utensils and cups should not be shared, the child's mouth should be covered during a cough, and the child should not be kissed on the mouth. These measures should be continued until the child no longer has symptoms (eg, fever, diarrhea, rash).

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## WHEN TO SEEK HELP

Any parent who suspects that his or her child could have meningitis should seek medical attention immediately.

Signs and symptoms of meningitis can include:

- Newborns may develop a fever accompanied by nonspecific symptoms (eg, poor feeding, vomiting, diarrhea, rash). The infant may have a stiff neck or bulging fontanel (soft spot on the skull) and may be irritable, restless, or lethargic.
- Older children may develop a fever, headache, nausea, vomiting, or stiff neck and may complain that the light bothers their eyes. The child may be confused or difficult to awaken.
- Other signs can include red to purplish spots on the skin (petechiae ( [picture 1](#)) and purpura ( [picture 2](#))), seizures, and a decreased level of awareness.

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## WHERE TO GET MORE INFORMATION

Your child's health care provider is the best source of information for questions and concerns related to your child's medical problem.

This article will be updated as needed on our website ( [www.uptodate.com/patients](http://www.uptodate.com/patients)). Related topics for patients, as well as selected articles written for healthcare professionals, are also available. Some of the most relevant are listed below.

**Patient level information** — UpToDate offers two types of patient education materials.

**The Basics** — The Basics patient education pieces answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials.

[Patient education: Meningitis in children \(The Basics\)](#)

[Patient education: Bacterial meningitis \(The Basics\)](#)

[Patient education: Viral meningitis \(The Basics\)](#)

[Patient education: Headaches in children \(The Basics\)](#)

[Patient education: Multiple sclerosis in children \(The Basics\)](#)

[Patient education: Lumbar puncture \(spinal tap\) \(The Basics\)](#)

**Beyond the Basics** — Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are best for patients who want in-depth information and are comfortable with some medical jargon.

[Patient education: Vaccines for infants and children age 0 to 6 years \(Beyond the Basics\)](#)

[Patient education: Vaccines for children age 7 to 18 years \(Beyond the Basics\)](#)

[Patient education: Influenza symptoms and treatment \(Beyond the Basics\)](#)

**Professional level information** — Professional level articles are designed to keep doctors and other health professionals up-to-date on the latest medical findings. These articles are thorough, long, and complex, and they contain multiple references to the research on which they are based. Professional level articles are best for people who are comfortable with a lot of medical terminology and who want to read the same materials their doctors are reading.

[Bacterial meningitis in the neonate: Clinical features and diagnosis](#)

[Clinical manifestations of meningococcal infection](#)

[Bacterial meningitis in children: Role of dexamethasone](#)

[Bacterial meningitis in children older than one month: Clinical features and diagnosis](#)

[Lumbar puncture in children](#)

[Meningococcal vaccination in children and adults](#)

[Bacterial meningitis in children: Neurologic complications](#)

[Bacterial meningitis in the neonate: Neurologic complications](#)

[Bacterial meningitis in the neonate: Treatment and outcome](#)

[Bacterial meningitis in children older than one month: Treatment and prognosis](#)

[Viral meningitis in children: Clinical features and diagnosis](#)

[Viral meningitis in children: Epidemiology, pathogenesis, and etiology](#)

[Viral meningitis in children: Management, prognosis, and prevention](#)

The following organizations also provide reliable health information:

- Centers for Disease Control and Prevention (CDC)

Toll-free – (800) 232-4636

( [www.cdc.gov](http://www.cdc.gov))

- United States National Library of Medicine

( [www.nlm.nih.gov/medlineplus/healthtopics.html](http://www.nlm.nih.gov/medlineplus/healthtopics.html))

- National Institute of Allergy and Infectious Diseases

( [www.niaid.nih.gov](http://www.niaid.nih.gov))

- National Foundation for Infectious Diseases

Tel – (301) 656-0003

( [www.nfid.org](http://www.nfid.org))

- Children's Hospital of Philadelphia Vaccine Education Center



( [www.chop.edu/service/vaccine-education-center/home.html](http://www.chop.edu/service/vaccine-education-center/home.html))

- KidsHealth, from Nemours

( <http://kidshealth.org/parent/infections/lung/meningitis.html>, also available in Spanish)

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## REFERENCES

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2. Tunkel AR, Hartman BJ, Kaplan SL, et al. Practice guidelines for the management of bacterial meningitis. *Clin Infect Dis* 2004; 39:1267.
3. Chávez-Bueno S, McCracken GH Jr. Bacterial meningitis in children. *Pediatr Clin North Am* 2005; 52:795.

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## GRAPHICS

### Petechiae



*Courtesy of Leslie Raffini, MD.*

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Graphic 89718 Version 1.0

## Purpura



*Courtesy of Charles V Sanders. From: The Skin and Infection: A Color Atlas and Text, Sanders CV, Nesbitt LT Jr (Eds), Williams & Wilkins, Baltimore, 1995.*

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Graphic 89719 Version 2.0

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