



# International Journal of Pharmacy and Natural Medicines

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Review Article

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## A Review on Meningitis Associated Health Complications and its Management

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### ABSTRACT

Meningitis is a chronic inflammatory condition of the cerebrum. The brain protected with distinguishes three layers dura matter, pia matter, and arachnoid matter. The meningitis condition can happened due to the inflammation between pia and arachnoid matter. The infection in meninges caused by various species like bacteria, fungal, virus, protozoal species. The person with previous history of infections he is high risk compare with others. In the last 20 years (1991–2010) close to one million suspected meningitis cases were reported among countries of the African approximately 100 000 deaths. 80 000 of these cases, including over 4000 deaths, occurred in 2009 country alone. the meningitis patients have headache, vomiting, diarrhea, encephalitis, neck stiffness, Photophobia. The diagnosis of case through MRI and CT-Scanning, CSF fluid examination. the meningitis complications includes CNS, kidney, liver, joint, behavioural abnormalities. The Prevention of the meningitis through maintaining healthy practices and medication adherence towards treatment plays a key role in vanishing infection origin in the body and promotes better prognosis to the patient.

**Keywords:** Inflammation, cerebrum, infection

### ARTICLE INFO

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**Article History:** Received 19 March 2016, Accepted 21 April 2016, Available Online 15 June 2016

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PAPER-QR CODE

**Citation:** A. Bharath Kumar, et al. A Review on Meningitis Associated Health Complications and its Management. *Int. J. Pharm. Natural Med.*, 2016, 4(1): 39-43.

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### 1. Introduction

Meningitis is a disease caused by the inflammation of the protective membranes covering the brain and spinal cord International Journal of Pharmacy and Natural Medicines

known as the meninges. The inflammation is usually caused by an infection of the fluid surrounding the brain and spinal

cord. Meningitis may develop in response to a number of causes, usually bacteria or viruses, but meningitis can also be caused by physical injury, cancer or certain drugs towards cerebrum. Meningitis caused by the bacterium *Neisseria meningitidis* (known as "meningococcal meningitis") can be differentiated from meningitis with other causes by a rapidly spreading petechial rash, which may precede other symptoms.

The rash consists of numerous small, irregular purple or red spots ("petechiae") on the trunk, lower extremities mucous membranes, conjunctiva [1], and (occasionally) the palms of the hands or soles of the feet. The rash is typically non-blanching; the redness does not disappear when pressed with a finger or a glass tumbler. Although this rash is not necessarily present in meningococcal meningitis, it is relatively specific for the disease; it does, however, occasionally occur in meningitis due to other bacteria.

**Bacterial meningitis:** There are several pathogens (types of germs) that can cause bacterial meningitis. Some of the leading causes of bacterial meningitis in the United States include *Haemophilus influenzae* (most often caused by type b, Hib), *Streptococcus pneumoniae*, group B *Streptococcus*, *Listeria monocytogenes*, and *Neisseria meningitidis*.

#### **Viral Meningitis**

Meningitis is an inflammation of the tissue that covers the brain and spinal cord. Viral meningitis is the most common type of meningitis. It is often less severe than bacterial meningitis, and most people usually get better on their own (without treatment). However, infants younger than 1 month old and people with weakened immune systems are more likely to have severe illness [2].

**Risk Factors:** Factors that can increase your risk of bacterial meningitis include:

- Age
- Infants are at higher risk for bacterial meningitis than people in other age groups.
- Community setting
- Infectious diseases tend to spread more quickly where larger groups of people gather together.
- Persons with weakened immune system or increase risk of meningitis in other ways.

**Causes:** Non-polio enter viruses are the most common cause of viral meningitis includes

#### **Mumps virus**

- Herpes viruses, including , herpes simplex viruses, and varicella-zoster virus (which causes chickenpox and shingles)
- Measles virus
- Influenza virus
- Arboviruses, such as West Nile virus
- Lymphocytic choriomeningitis virus[3]

#### **Fungal Meningitis**

**Causes:** Fungal meningitis is rare and usually the result of spread of a fungus through blood to the spinal cord. The most common cause of fungal meningitis for people with weakened immune systems is *Cryptococcus*. Fungal meningitis is not contagious, which means it is not transmitted from person to person. Fungal meningitis can

develop after a fungus spreads through the bloodstream from somewhere else in the body, as a result of the fungus being introduced directly into the central nervous system, or from an infected body site infection next to the central nervous system [4].

#### **Signs and Symptoms of fungal infection patients**

Signs and symptoms of fungal meningitis may include the following:

- Fever
- Headache
- Stiff neck
- Nausea and vomiting
- Photophobia (sensitivity to light)
- Altered mental status (confusion)

#### **Parasitic Meningitis**

##### **Causes**

Primary amebic meningoencephalitis (PAM) is a very rare form of parasitic meningitis that causes a brain infection that is usually fatal. The parasite enters the body through the nose and is caused by the microscopic amoeba (a single-celled living organism) *Naegleria fowleri*.

##### **Transmission**

*Naegleria fowleri* infects people by entering the body through the nose. This typically occurs when people go swimming or diving in warm freshwater places, like lakes and rivers. The *Naegleria fowleri* amoeba travels up the nose to the brain where it destroys the brain tissue.

##### **Causes**

Meningitis is typically caused by an infection with microorganisms. Most infections are due to viruses, with bacteria, fungi and protozoa being the next most common causes. It may also result from various non-infectious causes. The term *aseptic meningitis* refers to cases of meningitis in which no bacterial infection can be demonstrated. This type of meningitis is usually caused by viruses but it may be due to bacterial infection that has already been partially treated, when bacteria disappear from the meninges, or pathogens infect a space adjacent to the meninges (e.g. sinusitis). Endocarditis (an infection of the heart valves which spreads small clusters of bacteria through the bloodstream) may cause aseptic meningitis. Aseptic meningitis may also result from infection with spirochetes, a type of bacteria that includes *Treponema pallidum* (the cause of syphilis) and *Borrelia burgdorferi* (known for causing Lyme disease).

##### **Bacterial**

The types of bacteria that cause bacterial meningitis vary according to the infected individual's age group.

- In premature babies and newborns up to three months old, common causes are *group streptococci* (subtypes III which normally inhabit the vagina and are mainly a cause during the first week of life) and bacteria that normally inhabit the digestive tract such as *Escherichia coli* (carrying the K1 antigen). *Listeria monocytogenes* (serotype IVb) is transmitted by the mother before birth and may cause meningitis in the newborn [5].
- Older children are more commonly affected by *Neisseria meningitidis* (meningococcus) and *Streptococcus pneumoniae* (serotypes 6, 9, 14, 18

and 23) and those under five by *Haemophilus influenzae* type B (in countries that do not offer vaccination).

- In adults, *Neisseria meningitidis* and *Streptococcus pneumoniae* together cause 80% of bacterial meningitis cases. Risk of infection with *Listeria monocytogenes* is increased in persons over 50 years old. The introduction of pneumococcal vaccine has lowered rates of pneumococcal meningitis in both children and adults.

### Viral

Viruses that cause meningitis include enteroviruses, herpes simplex virus, varicella zoster virus, mumps virus, HIV.

### Fungal

There are a number of risk factors for fungal meningitis, including the use of immunosuppressants (such as after organ transplantation), HIV/AIDS and the loss of immunity associated with aging. It is uncommon in those with a normal immune system but has occurred with medication contamination. Symptom onset is typically more gradual, with headaches and fever being present for at least a couple of weeks before diagnosis. The most common fungal meningitis is cryptococcal meningitis due to *Cryptococcus neoformans*.

### Parasitic

A parasitic cause is often assumed when there is a predominance of eosinophils (a type of white blood cell) in the CSF. The most common parasites implicated are *Angiostrongylus cantonensis*, *Gnathostoma spinigerum*, *Schistosoma*, as well as the conditions *cysticercosis*, *toxocariasis*, *baylisascariasis*, *paragonimiasis* and a number of rarer infections and non-infective conditions [6].

### Prevention

Protection can be provided in the long term through vaccination or in the short term with antibiotics, behavioural therapy.

### Behavioural

Bacterial and viral meningitis are contagious; however, neither is as contagious as the common cold or flu. Both can be transmitted through droplets of respiratory secretions during close contact such as kissing, sneezing or coughing on someone, but cannot be spread by only breathing the air where a person with meningitis has been. Viral meningitis is typically caused by enteroviruses and is most commonly spread through fecal contamination.

### Vaccination

*Streptococcus pneumoniae* with the pneumococcal conjugate vaccine (PCV), which is active against seven common serotypes of this pathogen, significantly reduces the incidence of pneumococcal meningitis.

### Antibiotics

Short-term antibiotic prophylaxis is another method of prevention, particularly of meningococcal meningitis. In cases of meningococcal meningitis, preventative treatment in close contacts with antibiotics (e.g. rifampicin, ciprofloxacin or ceftriaxone) can reduce their risk of contracting the conditions.

### Epidemiology

Although meningitis is a notifiable disease in many countries, the exact incidence rate is unknown. In 2013

meningitis resulted in 303,000 deaths – down from 464,000 deaths in 1990. In 2010, it was estimated that meningitis resulted in 420,000 deaths, excluding cryptococcal meningitis. Bacterial meningitis occurs in about 3 people per 100,000 annually in Western countries. Population-wide studies have shown that viral meningitis is more common, at 10.9 per 100,000, and occurs more often in the summer. In Brazil, the rate of bacterial meningitis is higher, at 45.8 per 100,000 annually.

### Diagnostic Tests for Meningitis:

- **Blood cultures:**

Blood samples are placed in a special dish to see if it grows microorganisms, particularly bacteria. A sample may also be placed on a slide and stained (Gram's stain), then studied under a microscope for bacteria.

- **Imaging:**

- Computerized tomography (CT) or magnetic resonance (MR) scans of the head may show swelling or inflammation. X-rays or CT scans of the chest or sinuses may also show infection in other areas that may be associated with meningitis.

- **Spinal tap (lumbar puncture):**

For a definitive diagnosis of meningitis, you'll need a spinal tap to collect cerebrospinal fluid (CSF). In people with meningitis, the CSF often shows a low sugar (glucose) level along with an increased white blood cell count and increased protein.

## 2. Pathophysiology

### Bacterial invasion

The current assumption is that high-grade bacteremia precedes meningitis and that bacteria invade from the blood stream to the central nervous system (CNS). Alternatively, direct accesses to the CNS through dural defects or local infections are potential entrance routes.

### Inflammatory response

Inflammatory activation of endothelial cells seems to be a prerequisite for bacterial invasion but also results in the regulation of adhesion molecules as ICAM-1. Subsequently, these molecules promote the multistep process of leukocyte invasion. Leukocytes, in particular the presence of granulocytes in the CSF, are the diagnostic hallmark of meningitis. Early inflammatory response and bacterial invasion seem to progress in parallel and products of activated leukocytes such as MMPs and NO and others contribute to early damage of the blood-brain and blood-CSF barrier. Once bacteria have entered the subarachnoid space, they replicate, undergo autolysis and cause further inflammation [6].

### Neuronal damage

Neuronal loss translates into hippocampal atrophy and has been reported on MRI scans in survivors of bacterial meningitis. The predisposition of the hippocampus for neuronal damage remains unclear. The extracellular fluid around brain cells is contiguous with the CSF and the proximity to the ventricular system allows diffusion between these compartments that could deliver soluble bacterial and inflammatory toxic mediators.

Neuronal damage in meningitis is clearly multi-factorial, involving bacterial toxins, cytotoxic products of immune competent cells, and indirect pathology secondary to intracranial complications. The *S. pneumoniae*, the pathogen associated with the highest frequency of neuronal damage, two major toxins have been identified,  $H_2O_2$  and pneumolysin, a pore-forming cytolysin. The direct bacterial toxicity underlines the critical importance of rapid antibiotic elimination of living bacteria and their metabolism. In insufficiently treated patients or resistant bacteria toxic activity may be significantly prolonged and harm neuronal functions. Mechanistically, these toxins seem to cause programmed death of neurons and microglia by inducing rapid mitochondrial damage.

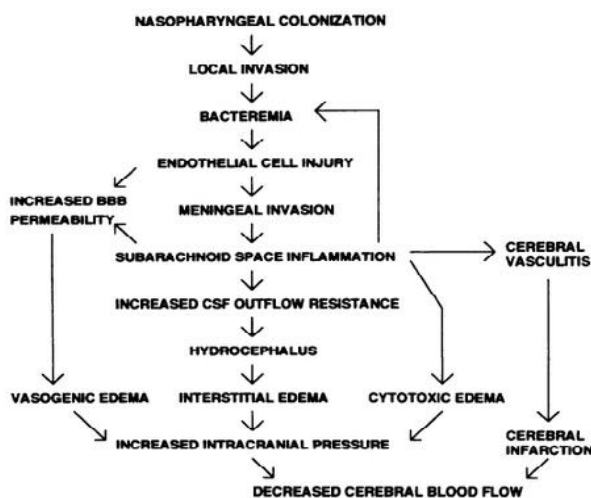


Figure 1: Pathophysiology of Meningitis

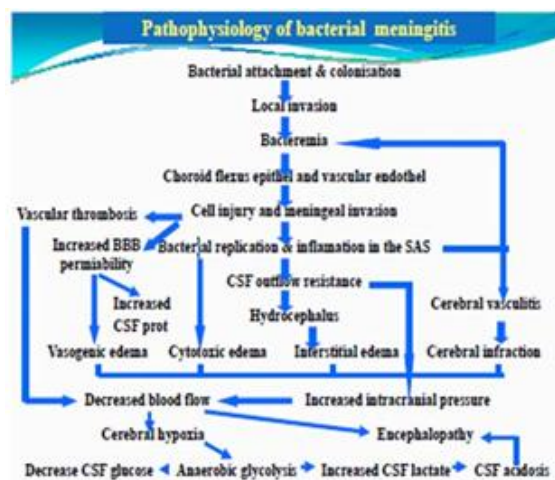


Figure 2: Pathophysiology of Meningitis

### 3. Management of meningitis

**Steroids:** Additional treatment with corticosteroids (usually dexamethasone) has shown some benefits, such as a reduction of hearing loss and better short term neurological outcomes in adolescents and adults from high-income countries with low rates of HIV [7].

#### Viral meningitis

Herpes simplex virus and varicella zoster virus may respond to treatment with antiviral drugs such as acyclovir

#### Fungal meningitis

Fungal meningitis, such as cryptococcal meningitis, is treated with long courses of high dose antifungals such as amphotericin B and flucytosine.

#### Prevention of meningitis

These measurements can help in prevention of meningitis includes:

- Washing hands
- Maintain and Practice good hygiene.
- Stay healthy.
- Covering mouth with neat protective.

#### Immunizations

##### Haemophilus influenzae type b (Hib) vaccine

These vaccine as part of the recommended schedule of vaccines, starting at about 2 months of age.

**Pneumococcal conjugate vaccine (PCV13).** This vaccine also is part of the regular immunization schedule for children younger than 2 years in the United States.

##### Pneumococcal polysaccharide vaccine (PPSV23)

It should be used in older children and adults who need protection from pneumococcal bacteria may receive this vaccine [8].

##### Meningococcal conjugate vaccine

A single dose be given to children ages 11 to 12, with a booster shot given at age 16. If the vaccine is first given between ages 13 and 15, the booster shot is recommended between ages 16 and 18.

This vaccine can also be given to younger children who are at high risk of bacterial meningitis or who have been exposed to someone with the disease. It is approved for use in children as young as 9 months old.

##### Other Vaccines to Prevent Meningitis

Vaccines can prevent many of the diseases that could lead to meningitis. Most of these shots are routinely given to young children.

**MMR (measles-mumps-rubella) vaccine**, which is routinely given to children, protects against meningitis that can develop from measles and mumps.

- Varicella (chickenpox) vaccine and shingles vaccine target the varicella virus, which can potentially lead to viral meningitis.

##### Meningitis Associated complications

The most common complications associated with meningitis are:

- hearing loss
- Recurrent seizures (epilepsy)
- problems with memory and concentration
- co-ordination, movement and balance problems
- learning difficulties and behavioural problems
- vision loss, which may be partial or total
- loss of limbs – amputation is sometimes necessary to stop the infection spreading through the body and remove damaged tissue
- bone and joint problems
- kidney problems
- Disseminated intravascular coagulation (DIC; blood-clotting disorder)
- Encephalitis
- Persistent fever

- Seizures
- Syndrome of inappropriate antidiuretic hormone
- Behavioral and personality changes
- Vision loss (partial or total)
- Cerebral palsy Hearing loss (partial or total)
- Learning disabilities or mental retardation
- Paralysis (partial or total)
- Speech loss (Partial or total)

#### 4. Conclusion

We conclude that meningitis is an inflammation of the meninges that lasts for more than 4 weeks of duration. Maintaining healthy practices regular adherence to medication therapy can play a role in minimizing the infection complications. It is a serious life threatening condition so we need to promote several awareness programmes towards meningitis in the community will minimize the infection related burden.

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