

Meningitis

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Definition

Meningitis is usually restricted to inflammation due to infective agents. Microorganisms reach the meninges either by direct extension from the ears, nasopharynx, a cranial injury or congenital meningeal defect or spread via the bloodstream. Immunocompromised patients are at an increased risk of meningitis, which may be caused by unusual organisms. Kumar (1996, p.925)

The severity of these features varies somewhat according to the causative organism, as does of the presence of other features such as skin rashes. Kumar (1996).

Acute infection of the meninges presents with the characteristic combination of pyrexia, headache and meningism. Meningism consists of stiffness of the neck and irritability of the meninges with positive Kerning's and/ or Brudzinski's signs, and can occur in other situations of meningeal irritation such as after subarachnoid haemorrhage. Haslett (1999, p. 1006).

Meningitis is an infection, which causes inflammation of the membranes covering the brain and spinal cord. Non-bacterial meningitis is often referred to as "aseptic meningitis". Bacterial meningitis may be referred to as "purulent meningitis." (Retrieved from Medline Plus).

Neurological infectious diseases. Some bacteria or virus is invaded in the dura sheet (covered the brain), which causes severe inflammation in dura. When the brain is inflamed, the patient is diagnosed as "meningoencephalitis". Sometime when bacterial forms abscess in the brain, he/she is diagnosed as "brain abscess". (Retrieved from JSAI KDD Challenge 2001)

The meninges are membranes that enclose the brain and spinal cord. Meningitis is an inflammation of the meninges, the most common cause of which is infection by viruses or bacteria that enter the meninges through the bloodstream from other parts of the body. This area of the body has no "host defenses" to fight off invading bacteria, which allows unchecked duplication of the infecting organism. (Retrieved from MediFocus MedCenter)

Bacterial meningitis is an infection caused by a virus that has entered patients' blood stream and inflamed the fluid in the spinal cord and the fluid that surrounds the brain. It is important to know what virus caused the illness because of differences in the seriousness of the illness and the treatment needed. (Retrieved from Epinions)

Viral meningitis (also called aseptic meningitis) is usually relatively mild. It clears up within a week or two without specific treatment. (Retrieved from Epinions)

Tuberculous meningitis is a chronic infection with syndromes of vague headache, lassitude, anorexia and vomiting. In Australia, when the HIV is positive with the symptoms of tuberculous infection, this can be diagnosed as AIDS.

Cause and Risk factor

The most common causes of meningitis are viral infections that usually resolve without treatment. However, bacterial infections of the meningitis are extremely serious illnesses, and may result in death or brain damage even if treated. Meningitis is also caused by fungi, chemical irritation or drug allergies, and tumors. (Retrieved from Medline Plus).

Viral infection is the most common cause of meningitis, and usually results in a benign and self-limiting illness requiring no specific therapy. It is usually a much less serious illness than bacterial meningitis unless there is associated encephalitis. Haslett (1999 p.1006).

Meningitis (inflammation of the meninges) may be caused by :
Bacteria, viruses, fungi, Other organisms, Malignant cells, drugs and contrast media and blood (following SAH)

Syphilitic aseptic meningitis is a form of meningovascular neurosyphilis, which is a progressive life-threatening complication of syphilis infection.

The disorder resembles meningitis caused by other conditions. There is inflammation of the meninges. This may cause headaches, cognitive changes, or decrease in nerve functions such as vision, movement, or sensation. Vascular symptoms, such as stroke secondary to syphilis, commonly accompany or follow syphilitic aseptic meningitis.

Risks of syphilitic aseptic meningitis include previous infection with syphilis or other sexually transmitted diseases such as gonorrhea. Syphilis infections are transmitted primarily through sexual contact with an infected person, but they may sometimes be transmitted by nonsexual contact.
(Retrieved from Medline Plus).

Cryptococcus neoformans is a yeast that is found in soil around the world. Cryptococcal meningitis most often affects people with compromised immune systems. Risk factors include AIDS, lymphoma, and diabetes. The incidence is 5 out of 1,000,000 people. (Retrieved from Medline Plus).

Bacterial meningitis causes inflammation and swelling that can result in significant consequences including hearing loss, brain damage, and even death. Bacteria that cause meningitis are carried in the nose and throat. People can be “infected” with the bacteria for days, weeks or months with no symptoms.
(Retrieved from MediFocus MedCenter)

Meningitis can cause immuno-system compression. For example, HIV is positive after the treatments of chemotherapy cancer patients, there is no help to use vaccine. In such case, I.G.(immunoglobulin) plus antibiotics injection should be used.

Types of Meningitis

There are various types of meningitis. (Kumar 1996, p. 972 ; Retrieved from Medline Plus):

Bacterial meningitis is much more serious and can cause severe disease that can result in brain damage and even death. (Retrieved from Epinions)

Acute Bacterial Meningitis. The onset is sudden, with rigors and a high fever. A petechial rash, often sparse, is strong evidence of meningococcal meningitis. Septicaemia may present with acute septicaemic shock.

Pneumococcal meningitis is an inflammation of infection of the membranes covering the brain and spinal cord caused by Streptococcus pneumococcal

Streptococcus pneumonize is the most common cause of meningitis in adults, and the second most common cause of meningitis in children older than 6.

Staphylococcal meningitis is an infection of the membranes covering the brain and spinal cord caused by staphylococcus bacteria. Meningitis caused by staphylococcus aureus or S. epidermidis usually develops as a complication of a surgical procedure, or as an infection spread by the blood from another site.

Viral Meningitis. This is almost always a benign, self-limiting condition lasting 4-10 days. Headache may follow for some weeks but there are no serious sequelae.

Tuberculous Meningitis. Tuberculosis causes a chronic meningitis commencing with vague headache, lassitude, anorexia and vomiting. Meningitic signs may appear only after some weeks. Drowsiness, focal signs and seizures may occur. A similar picture occurs in cryptococcal meningitis, the commonest fungal meningitis in Europe.

Malignant Meningitis. Malignant cells sometimes cause a subacute or chronic meningitic process. Meningitis, cranial nerve palsies, paraparesis and root lesions are seen, often in complex patterns. The CSF shows increased cells and protein and often a low glucose. Treatment is with intrathecal cytotoxic agents. The prognosis is poor.

Carinomatous/Neoplastic Meningitis – many tumors arising outside the nervous System can travel to the linings of the brain and spinal cord. Terms of the condition vary (carcinomatous meningitis, neoplastic meningitis, Leptomeningeal metastasis). Symptoms for neoplastic meningitis include pain, headaches, mental status decline, loss of sensation in the face or elsewhere on the body, or difficulties with vision, hearing or swallowing, among others.

Syphilitic aseptic meningitis is a complication of untreated syphilis infections characterized by changes in mental status and nerve functions. (Retrieved from Medline Plus).

Cryptococcal meningitis (funga infections) is an infection of the meninges caused by *Cryptococcus neoformans*. (Retrieved from Medline Plus).

Clinical and Symptom

There is intense malaise, fever, rigors, severe headache, photophobia and vomiting. The patient is irritable and often prefer to lie still. Neck stiffness and a positive Kerning's sign appear within a few hours. In Milder cases, there are few other signs, but is its most unreliable to rely on the clinical impression alone when assessing the severity of the infection. Kumar (1996, p.925).

In uncomplicated meningitis, consciousness is not impaired, although the patient may be delirious with a high fever. Papilloedema may occur. The appearance of drowsiness, lateralizing signs and cranial nerve lesions indicate a complication such as a venous sinus thrombosis, severe cerebral oedema or hydrocephalus, or an alternative diagnosis such as cerebral abscess or encephalitis. Kumar (1996, p.925).

Headache, drowsiness, fever and neck stiffness are the usual presenting features. In severe bacterial meningitis the patient may be comatose and later there maybe focal neurological signs. Meningococcal meningitis may present very rapidly. Haslett (1999, p.1008).

Other symptoms are also including :

Fever and chills, Severe headache, Nausea and vomiting, Stiff neck ("meningismus"), Sensitivity to light (photophobia) and Mental status changes

Additional symptoms that may be associated with these diseases :

Decreased Consciousness, Rapid breathing, Agitation, Opisthotonos, such as, severe neck stiffness, ultimately resulting in a characteristic arched posture-seen in infants or small children, "Bulging fontanelles" may be seen in infants and Poor feeding or irritability in children.

Meningitis is an important cause of fever in newborn children. For this reason, a lumbar puncture is often done on newborns who have a fever of uncertain origin. (Retrieved from Medline Plus).

If Children over 2 years of age, the most common symptoms are high fever, headache, and stiff neck. These symptoms usually develop over several hours but they can have been reported to appear as late as one week after it has been contracted. These happening need to watch for other symptoms such as nausea, vomiting, and sensitivity to light, confusion, and sleepiness. It is not uncommon for meningitis in viral or

bacterial form, to cause numbness of ears as well as disrupt a woman menstrual cycles. Women with viral meningitis can have a menstrual cycle lasting from 2-4 weeks. In newborns and infants, the typical symptoms of fever, headache, and neck stiffness may be hard to detect. If child is running a fever, has a small rash and is sleeping excessively, need to contact pediatrician immediately. Other signs in babies might be inactivity, irritability, vomiting and poor feeding. (Retrieved from Epinions).

Test

If the patient is drowsy with focal neurological signs it may be wise to obtain a CT to exclude a mass lesion (such as a cerebral abscess) before lumbar puncture, but this should not delay treatment of a presumptive meningitis. Haslett (1996, p.1008)

Other tests need to be carried as follows :

Lumbar puncture with CSF glucose measurement and CSF(cerebrospinal fluid) cell count need to be carried. Different infections and different presentation in CFS also need to compare. For example, bacterial infection/cell count is polymorphs (WBC) which is increasing from 1000 – 5000 and glucose is normally low and protein is normal/elevated, comparing with Viral infection, its cell count is lymphocytes, and is moderate increased from 10 – 2000 and its glucose and protein are normal. A table of comparison is listed as follow:

Cerebrospinal fluid indices in meningitis					
Condition	Cell type	Cell count	Glucose	Protein	Gram stain
Normal	Lymphocytes	< 5 per m ³	60% of blood glucose	To 0.45 g/l	-
Viral	Lymphocytes	10-2000	Normal	Normal	-
Bacterial	Polymorphs	1000-5000	Low	Normal/elevated	+
Tuberculous	Polymorphs/lymphocytes/mixed	50-5000	Low	Elevated	Often -
Fungal	Lymphocytes	50-500	Low	Elevated	+ -
Malignant	Lymphocytes	0-100	Low	Normal/elevated	-

Other tests are also needed as follow:

- Gram-stain and culture of CSF (cerebral spinal fluid)
- Chest X-ray to look for other sites of infection
- Head CT scan looking for hydrocephalus, abscess or deep swelling. (Retrieved from Medline Plus).

- EEG (electroencephalogram) if seizures are present.
- Head CT Scan
- Cerebral angiography if vascular symptoms are present
- Serum VDRL or serum RP (used as screening tests to detect syphilis infection) – if positive, requires one the following to confirm diagnosis :
- FTA-ABS

MHA-TP
CSF (cerebrospinal fluid) examination

Diagnosis

Usually, high fever and severe headache is observed. After, nausea and vomit are followed. If these symptoms and objective symptoms (neck stiffness, Kernig sign and Lasegue sign) are observed, Computer Tomography is applied and Lumbar puncture will be executed if there is no sign of brain edema.

Differential Diagnosis :

The differential diagnosis is made as follows :

- (1) Check the cell count in Cerebrospinal fluid (CSF).
- (2) If polynuclear cells are dominant, bacterial meningitis is diagnosed. If mononuclear cells are dominant, viral meningitis is diagnosed.
- (3) FOR diagnosis of brain abscess, CT will be used for confirmation of diagnosis. (Retrieved from JSAI KDD Challenge 2001)

Acute meningitis may resemble SAH, severe migraine and other causes of a sudden severe headache. Meningitis should be considered in all patients who have headache and fever. Kumar (1996, p. 926).

Treatment

Antibiotics will be prescribed for bacterial meningitis ; the type will vary depending on the infecting organism. Antibiotics are ineffective in viral meningitis. Treatment of secondary symptoms including brain swelling, shock, depending on the severity of the illness and the needed treatment. (Retrieved from Medline Plus ; JSAI KDD 2001).

Treatments of Antibiotics		
Age of onset	Common	Antibiotics
Neonate	Gram-negative bacilli (E.coli, Proteus etc., Group B streptococci	Ampicillin with cefotaxime or gentamicin
Pre-school child	Haemophilus influenzae Neisseria meningitidis Streptococcus pneumoniae	Cefotaxime
Older child and adult	Neisseria meningitidis Streptococcus pneumoniae	Penicillin G and cefotaxime

*For patients who are older than 50, Ampicillin with cefotaxime are normally applied.

The goals of treatment are to cure the infection and to reduce progression of the disorder. Treatment of the infection reduces new nerve damage and may reduce symptoms, but it does not cure existing damage.

Penicillin groups or other antibiotics, such as tetracycline or erythromycin are given to treat the infection. Treatment may be prolonged to ensure that the infection is completely cleared. Symptoms may improve dramatically after treatment of the infection. A follow-up examination of the cerebrospinal fluid is required to evaluate the effectiveness of antibiotic therapy.

Oral tetracycline is usually not prescribed for children until after all the permanent teeth have erupted. It can permanently discolor teeth that are still forming.

Symptomatic treatment is required for existing neurologic damage. Emergency treatment of seizures may be required.

Anticonvulsants such as phenytoin may be needed to control seizures.
(Retrieved from Medline Plus).

Treatment of bacterial meningitis requires antibiotics as well as medications such as steroids to reduce swelling in the brain. Close contacts of persons with meningitis are usually prescribed antibiotics to prevent further development and spread of the disease. .(Retrieved from MediFocus MedCenter)

It is often possible to distinguish between viral, pyogenic, tuberculous and other organisms from the clinical setting and immediate examination of the CSF. If bacterial meningitis is suspected, high doses of antibiotics are started immediately. There should be close liaison with a microbiologist. In children, dexamethasone should also be given as this reduces the frequency of complications particularly deafness. Kumar (1996, p.926)

In a pyogenic meningitis in an adult, intravenous benzylpenicillin 2g 2 hourly and intravenous chloramphenicol 75 mg kg have been given. Because of resistant organisms it is now recommended that immediate i.v. cefotaxime is used instead. If the diagnosis of pneumococcal or meningococcal infection has been made, penicillin alone or cefotaxime are used. Kumar (1996, p.926)

Tuberculous meningitis is treated for at least 9 months with antituberculous drugs ; rifampicin, isoniazid and pyrazinamide is the usual combination.
Kumar (1996, p.926)

Prognostic and Sequelae

Meningitis may lead to the following situation:

Hearing loss and deafness, Brain damage, Loss of vision and Hydrocephalus.

If child has any symptoms suggestive of meningitis, parents must seek emergency medical help immediately. Early treatment is key to a good outcome.
(Retrieved from Medline Plus).

If the therapy is timely, the prognosis is good. However in the case of encephalitis, a patient suffers from some symptoms even after the treatment (sequelae). A well-known sequelae is aphasia for Herpes encephalitis.

Meningitis is an emergency that has a high mortality even in countries with highly developed systems of health care. Although viral meningitis is a self-limiting condition, untreated bacterial meningitis is lethal ; in most series the death rate is round 15% even with treatment.

Other complications are including inability to care for self, inability to communicate or interact, injury caused during seizures and stroke secondary to syphilis.

References :

Haslett, C. & Chilvers, E. et (1999). *Principles and Practice of Medicine*. Sydney : Churchill Livingstone.

Kumar, P. & Clark, M. (1996). *Clinical Medicine*. NSW : Harcourt Brace & Company.

Medline Plus. *Medical Encyclopedia*. Retrieved Sept 10, 2004

<http://www.nlm.nih.gov/medlineplus/ency/article/000680.htm>

JSAI KDD Challenge (2001). *Guide to the meningoencephalitis Diagnosis Data Set*. Retrieved on Sept. 10, 2004

<http://www.ar.sanken.osaka-u.ac.jp/pub/washio/jkdd/menin.htm>

Epinions . *A very serious diseases*. Retrieved on Sept. 10, 2004

<http://www.epinions.com/kifm-review-490-84E4720-395EBC4F-prod4.htm>

MediFocus MedCenter. *Bacterial Meningitis*. Retrieved on Sept. 10, 2004

http://m_4u.tripod.com/NF001.htm