Notes (summary) in lecture: meningitis & encephalitis

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Meningitis

What is it?
Meningitis is an inflammation of the protective membranes covering the brain and spinal cord, known collectively as the meninges.

Meningitis can be caused by bacteria, viruses, other microorganisms, and less commonly by certain drugs.

Bacteria that cause meningitis:
In neonatal meningitis the common causes are:
- group B beta-hemolytic streptococcus, or group B strep.
- It can also be caused by Escherichia coli (E. coli),
- and in rare cases, listeria monocytogenes (listeria).

In children:
- Haemophilus influenzae type B (Hib)
- Neisseria meningitides
- Streptococcus pneumoniae
- Group B Streptococcus

Viral causes:
About 90% of cases of viral meningitis are caused by members of a group of viruses known as enteroviruses, such as coxsackieviruses and echoviruses.
- Polioviruses, mumps virus, herpes simplex virus, and varicella zoster virus can also cause viral meningitis.

Fungal

Parasitic
**Signs and symptoms:**

- High fever, headache.
- Infants < 2 years of age may appear slow or inactive, vomit, or feeding poorly.
- Other symptoms may include:
  - Nausea, vomiting,
  - Discomfort looking into bright lights (photophobia)
  - Loud noises (phonophobia)
  - Confusion, and sleepiness.
- Seizures may occur as illness progresses.

Small children often do not exhibit the above symptoms, and may only be irritable and look unwell.

If a rash is present, it may indicate a particular cause of meningitis; for instance, meningitis caused by meningococcal bacteria may be accompanied by a characteristic rash.

Stiff neck are common in anyone over the age of 2 years

Other signs of meningism include the presence of positive Kernig's sign or Brudziński sign.

**How is it spread?**

- Viral meningitis is spread through direct contact with the nose and throat secretions of an infected person.

**Incubation period:**
For enteroviruses: about 3 – 7 days

**When is the person contagious?**
For enteroviruses: from about 3 days after infection to 10 days after developing symptoms

**How to prevent spread of the illness to other children?**
Child can attend school or child care facility if they feel well enough to take part in activities.
**Diagnosis:**

Complete blood count
C-reactive protein
Blood cultures
Analysis of the cerebrospinal fluid through lumbar puncture (LP, spinal tap).

( high wbc , low glucose in bacterial)

However, lumbar puncture is contraindicated if there is a mass in the brain (tumor or abscess) or the intracranial pressure (ICP) is elevated, as it may lead to brain herniation.

If there is evidence on examination of a raised ICP, a CT or MRI scan is recommended prior to the lumbar puncture.

If a CT or MRI is required before LP, or if LP proves difficult, it is recommended that antibiotics should be administered first to prevent delay in treatment.

Monitoring of blood electrolytes may be important; for example, hyponatremia is common in bacterial meningitis, due to a combination of factors, including dehydration, the inappropriate excretion of the antidiuretic hormone (SIADH), or overly aggressive intravenous fluid administration.

**Meningococcal Meningitis**

**What is it?**

Meningococcal meningitis is an infection of the lining of the brain caused by the bacteria, *Neisseria meningitidis*. It can cause serious illness and death. The case fatality rate is 8 – 15%.

The bacteria that cause meningitis can be found in the nose and throat of 5% to 10% of people at any time.

Meningococcal bacteria also cause septicemia, pneumonia, and conjunctivitis. Symptoms of meningococcal meningitis occur suddenly and may include:

- ☐ Fever
- ☐ Intense headache
- ☐ Nausea and often vomiting
- ☐ Bulging fontanelle (soft spot) in infants
- ☐ Stiff neck
- ☐ Stiff back in older children
- ☐ Pinpoint rash

Diagnosis is confirmed with a test of blood and cerebrospinal fluid (CSF).
Incubation period:
Range is 2 – 10 days (usually 3 – 4 days) from contact with an infected person to onset of fever.

When is the person contagious?
From 7 days prior to the onset of symptoms until 24 hours after antibiotics are started.

Complications of meningitis (generally):
The brain tissue may swell, pressure inside the skull may increase and the swollen brain may herniate through the skull base.
This may be noticed by a decreasing level of consciousness, loss of the pupillary light reflex, and abnormal posturing.
The inflammation of the brain tissue may also obstruct the normal flow of CSF around the brain (hydrocephalus).
Seizures may occur for various reasons;
- In children, seizures are common in the early stages of meningitis (in 30% of cases) and do not necessarily indicate an underlying cause.
- Seizures may result from increased pressure and from areas of inflammation in the brain tissue.
- Focal seizures (seizures that involve one limb or part of the body), persistent seizures, late-onset seizures and those that are difficult to control with medication indicate a poorer long-term outcome.

Meninges may lead to abnormalities of the cranial nerves.
Visual symptoms and hearing loss may persist after an episode of meningitis.
Inflammation of the brain (encephalitis) or its blood vessels (cerebral vasculitis), as well as the formation of blood clots in the veins (cerebral venous thrombosis)
May all lead to weakness, loss of sensation, or abnormal movement or function of the part of the body supplied by the affected area of the brain.
Treatment:

Meningitis is potentially life-threatening and has a high mortality rate if untreated; delay in treatment has been associated with a poorer outcome. Thus, treatment with wide-spectrum antibiotics should not be delayed while confirmatory tests are being conducted even before the results of the lumbar puncture and CSF analysis are known.

The choice of initial treatment depends largely on the kind of bacteria that cause meningitis in a particular place and population. Third-generation cefalosporin such as cefotaxime or ceftriaxone.

If resistance to cefalosporins (found in streptococci), addition of vancomycin to the initial treatment is recommended.

In young children, as well as those who are immunocompromised, the addition of ampicillin is recommended to cover Listeria monocytogenes.

Once the Gram stain results become available, and the broad type of bacterial cause is known, it may be possible to change the antibiotics to those likely to deal with the presumed group of pathogens.

For an antibiotic to be effective in meningitis it must not only be active against the pathogenic bacterium but also reach the meninges in adequate quantities; some antibiotics have inadequate penetrance and therefore have little use in meningitis.

Steroids:

Adjuvant treatment with corticosteroids (usually dexamethasone) has shown some benefits, such as a reduction of hearing loss, and better short term neurological outcomes.

Corticosteroid just before the first dose of antibiotics is given, and continued for four days.

Corticosteroids are recommended in the treatment of pediatric meningitis if the cause is H. influenzae, and only if given prior to the first dose of antibiotics; other uses are controversial, like pneumococcal meningitis.

They also appear to be beneficial in those with tuberculosis meningitis.

Viral meningitis typically only requires supportive therapy; most viruses responsible for causing meningitis are not amenable to specific treatment.

Herpes simplex virus and varicella zoster virus may respond to treatment with antiviral drugs such as acyclovir, but there are no clinical trials that have specifically addressed whether this treatment is effective.
Encephalitis

It is an acute inflammation of the brain.

Symptoms include:

headache, fever, confusion, drowsiness, and fatigue.

More advanced and serious symptoms include seizures or convulsions, tremors, hallucinations, and memory problems.

Causes:

Viral:

The most common causes of acute viral encephalitis are rabies virus, Herpes simplex, poliovirus, measles virus, and JC virus.

Bacterial and others:

bacterial meningitis, spreading directly to the brain (primary encephalitis), or may be a complication of a current infectious disease syphilis (secondary encephalitis).

Diagnosis:

Neurological examinations usually reveal a drowsy or confused patient. Stiff neck, due to the irritation of the meninges covering the brain, indicates that the patient has either meningitis or meningoencephalitis.

Examination of the cerebrospinal fluid obtained by a lumbar puncture procedure usually reveals increased amounts of protein and white blood cells with normal glucose.

CT scan often is not helpful. Magnetic resonance imaging offers better resolution. In patients with herpes simplex encephalitis, electroencephalograph may show sharp waves in one or both of the temporal lobes.

Diagnosis is often made with detection of antibodies in the cerebrospinal fluid against a specific viral agent (such as herpes simplex virus) or by polymerase chain reaction.

Treatment:

Treatment is usually symptomatic. Reliably tested specific antiviral agents are few in number (e.g. acyclovir for herpes simplex virus)

Corticosteroids (e.g., methylprednisolone) are used to reduce brain swelling and inflammation.