بسم الله الرحمن الرحيم

Notes (summary) in lecture : meningitis & encephalitis

DR.ABDALLAH ALJETHAILY د/ عبدالله بن عبدالعزيز الجذيلي
(MBBS, ABP, SBCP, JBCP, IDFC, IDSA, BDIL (honors degree))

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 a bacteria, a viruses, other microorganisms, and less commonly by certain drugs.

Bacterial meningitis is considered a medical emergency as it can progress rapidly. (proximity to the brain and spinal cord)

Can lead to brain damage or even be fatal despite of the availability of the most advanced medical care.

Timely treatment with appropriate antimicrobial and supportive therapy in acute bacterial meningitis can improve prognosis.

Causes:

Bacteria that cause meningitis:

In neonatal meningitis the common causes are:

group B beta-hemolytic streptococcus, or group B strep.

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*

- Staphylococci, Pseudomonas & other gram –ve bacteria (skull trauma ,shunt , immunodeficiency).

- Mycobacterium tuberculosis (endemic, persons with immune problems, such as AIDS).

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:

(immunosuppressants Rx (organ transplantation), HIV/AIDS)

The most common fungal meningitis is cryptococcal meningitis due to Cryptococcus neoformans.

Parasitic:

The most common parasites implicated are Angiostrongylus cantonensis, Gnathostoma spinigerum, or Schistosoma.

Non-infectious causes:

- malignant or neoplastic meningitis.
- Drugs: mainly non-steroidal anti-inflammatory drugs, antibiotics (e.g. trimethoprim-sulfamethoxazole, ciprofloxacin, cephalexin, metronidazole, amoxicillin, penicillin, isoniazid) , ranitidine, carbamazepine & iv immunoglobulins (cerebral vasospasm or ischemic encephalopathy - has been reported with ivig).
- Vaccines against hepatitis B and mumps.
- Several inflammatory conditions, such as sarcoidosis(called neurosarcoidosis).
- Connective tissue disorders (SLE)

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.

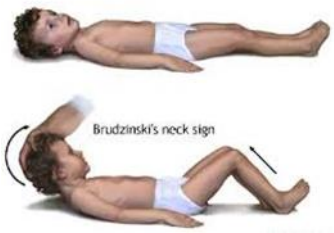
Stiff neck are common in anyone over the age of 2 years.

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

Kernig's sign:

pain limits passive extension of the knee. A positive.

Brudzinski's sign occurs when flexion of the neck causes involuntary flexion of the knee and hip.



Incubation period :

For enterovirurses: about 3 – 7 days

For bacteria , an example given down (meningococcal meningitis)

When is the person contagious?

For enteroviruses: from about 3 days after infection to 10 days after developing symptoms.

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:

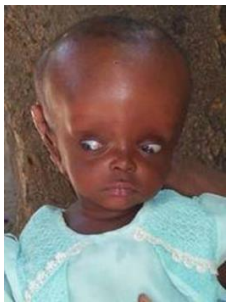
Range is 2 – 10 days (usually 3 – 4 days) from contact with an infected person to onset of fever.

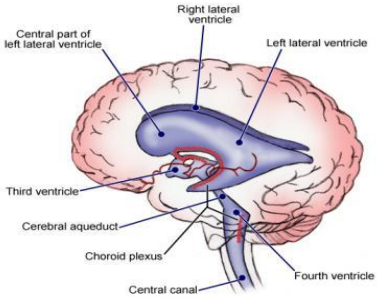
When is the person contagious?

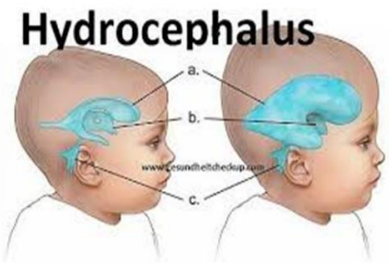
From 7 days prior to the onset of symptoms until 24 hours after antibiotics are started.

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)

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 cephalosporins such as cefotaxime or ceftriaxone.

- If resistance to cephalosporins (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.

Prognosis:

- the prognosis depends on several other factors such as age, presence of comorbidity, causative pathogen, and severity at presentation.
- Neurologic problems such as permanent mental impairment, paralysis, seizures and hearing loss occur in about 15% of children, who survive bacterial meningitis. About 20% of children may experience more subtle adverse outcomes such as cognitive, academic and behavioral problems.
- Decreased level of consciousness or an abnormally low count of white blood cells in the CSF has poorer prognosis.
- Meningitis caused by *H. influenzae* and meningococci has a better prognosis than cases caused by group B streptococci, coliforms and *S. pneumonia.*
- If the patient develops encephalitis (brain gets infected with the virus) or other complications such as pericarditis and hepatitis, prognosis becomes poor.

Antibiotic Prophylaxis Following an Exposure to Meningitis for healthcare worker:

- Preventative antibiotics are of no use following exposure to meningitis caused by Streptococcus pneumoniae, Listeria monocytogenes, Cryptococcal meningitis, viral (aseptic) meningitis.
- Antibiotics are occasionally useful following exposure to patients with Haemophilus influenzae & Neisseria meningitidis meningitis.
- Indications for antibiotics following exposure to a case of meningococcal meningitis are few, especially for healthcare workers.
- Antibiotics are of benefit to those living in households with cases. These household contacts have prolonged and more extensive contact with the affected patient than healthcare workers.
- Administration of antibiotics is occasionally of benefit to healthcare workers. It is advisable in individuals who have performed mouth-to-mouth resuscitation or endotracheal intubation on a known or suspected case of meningococcal disease. Otherwise, healthcare workers are not at increased risk of acquiring disease or of taking it home to family members.

A few facts to support this reasoning:

- Chronic asymptomatic carriage of Neisseria meningitidis in the population is common. 5-10% of people carry the germ in the nasopharynx. As such, a person is probably exposed to it all the time. Few people actually become sick.
- Antibiotics used to prevent meningitis can have serious, even fatal side-effects. Some are contraindicated in pregnancy. Some may lessen effectiveness of oral contraceptives.

Effective antibiotics regimens include:

- Rifampin orally twice daily for two days
- Ciprofloxacin orally as a single dose
- Ceftriaxone 250mg as a single intra-muscular injection

Contact prophylaxis for invasive Hib disease:

- Index case and all household contacts if household includes other children <4 years of age who are not fully immunized.
- Index case and all household contacts in households with any infants <12 months of age, regardless of immunization status.
- Index case and all household contacts in households with a child 1–5 years of age who is inadequately immunized.
- Index case and all room contacts, including staff, in a childcare group if index case attends >18 hours per week and any contacts <2 years of age who are inadequately immunised.

AND children who are not up to date with Hib should be immunized.

Effective antibiotics regimens include:

Rifampicin 20 mg/kg (max 600 mg) PO daily for 4 days , Infants <1 month: 10 mg/kg
Pregnancy/contraindication to Rifampicin: Ceftriaxone 250 mg IM daily for 2 days

Encephalitis

- It is an acute inflammation of the brain.

Signs & symptoms:

- headache, fever, confusion, drowsiness, and fatigue.

  More advanced include:

- seizures, tremors, hallucinations, and memory problems.
- Younger children or infants may present irritability, poor appetite and fever.

Causes:

Viral:

The most common causes of acute viral encephalitis are:

- Herpes simplex (most commonest cause)
- Varicella-zoster virus.
- poliovirus.
- Measles virus
- rabies virus
- John Cunningham virus.

Bacterial:

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

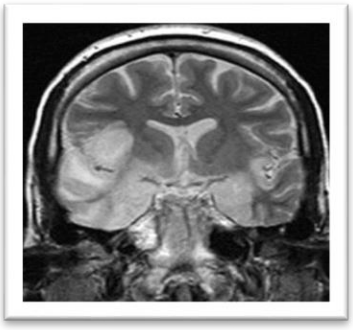
Others:

- Certain parasitic or protozoal infestations, such as toxoplasmosis, malaria, or primary amoebic meningoencephalitis (immunodeficiency).
- Fungal encephalitis like cryptococcus neoformans.
- Autoimmune 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 (EEG) 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).
- For Mycoplasma infection, parenteral tetracycline is given. Encephalitis due to Toxoplasma is treated by giving a combination of pyrimethamine and sulphadimidine.
- Corticosteroids (e.g., methylprednisolone) are used to reduce brain swelling and inflammation.