Viral meningitis and encephalitis

CNS module 3rd year
Meningitis

- Meningitis: inflammation of the meninges and underlying subarachnoid cerebrospinal fluid (CSF).

- Etiology:
  1. Bacterial (pyogenic meningitis): infectious emergency, fatal if untreated.
  2. Viral (aseptic or lymphocytic).
  4. Fungal and parasitic.
  5. Non-infectious.
Meningitis / Useful Anatomy
Clinically

- Fever
- Headache
- Photophobia
- Neck rigidity or discomfort on neck flexion
- Kernig’s sign, Brudzinski’s sign
Diagnosis

1. History and examination.

2. Radiology:
   - Chest X rays.
   - Computed tomography scan (CT scan):
     > masses and abscess > increased intracranial pressure (ICP).
Diagnosis

3. Laboratory:
- Full blood count (FBC), Liver and Kidney function tests
- Coagulation profile and serum glucose
- Blood culture and throat swabs
- *Lumbar puncture (LP)*
  - NO LP until CT scan or MRI obtained if any signs of increased ICP present
  - If suspect meningitis and awaiting neuroimaging
    - Obtain BC’s and start empiric antimicrobial treatment
Lumbar puncture
Spinal needle is inserted, usually between the 3rd and 4th lumbar vertebrae.

Cerebrospinal fluid
LP tubes

- Tube # 1 Protein & Glucose
- Tube # 2 bacterial Gram stain & Culture (acid-fast bacillus (AFB) stain and tuberculosis (TB) cultures, India ink stain and fungal cultures, and cryptococcal antigen, if indicated).
- Tube # 3 Cell count & differential
- Tube # 4 Store (PCR, viral studies if available, or for repeat cell count if needed)
# CSF findings

<table>
<thead>
<tr>
<th></th>
<th>Normal</th>
<th>Bacterial</th>
<th>Viral</th>
<th>TB</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cells</strong></td>
<td>0-5 WBC/mm³&lt;br&gt;~25 cells &lt;6 months old</td>
<td>&gt;1000/mm³</td>
<td>&lt;1000/mm³</td>
<td>25-500/mm³</td>
</tr>
<tr>
<td><strong>Polymorphs</strong></td>
<td>0</td>
<td>predominate</td>
<td>early</td>
<td>+/- increased</td>
</tr>
<tr>
<td><strong>Lymphocytes</strong></td>
<td>100%</td>
<td>late</td>
<td>predominate</td>
<td>increased</td>
</tr>
<tr>
<td><strong>Glucose</strong></td>
<td>40-80 mg/dl</td>
<td>decreased</td>
<td>normal</td>
<td>decreased</td>
</tr>
<tr>
<td></td>
<td>66%</td>
<td>&lt; 40%</td>
<td>Normal</td>
<td>&lt; 30%</td>
</tr>
<tr>
<td><strong>Protein</strong></td>
<td>15-40 mg/dl</td>
<td>increased</td>
<td>+/--increased</td>
<td>increased</td>
</tr>
<tr>
<td><strong>Culture</strong></td>
<td>negative</td>
<td>positive</td>
<td>negative</td>
<td>+TB</td>
</tr>
<tr>
<td><strong>Gram stain</strong></td>
<td>N/A</td>
<td>positive</td>
<td>N/A</td>
<td>Acid fast stain</td>
</tr>
</tbody>
</table>
viral infections of the central nervous system

• Aseptic meningitis
  = A syndrome characterized by acute onset of meningeal symptoms, fever, and cerebrospinal fluid pleocytosis, with bacteriologically sterile cultures.
  = multiple etiologies, but most cases are caused by a viral agent

• Encephalitis: brain parenchyma is involved in infectious process and inflammatory response

• Meningoencephalitis
Most common causes of viral meningitis:

- Enteroviruses (Echoviruses, coxsackievirus, enterovirus71) 80-85%
- Herpes simplex virus (HSV2 >1) varicella zoster virus 5-10%
- Mumps
- Arboviruses (West Nile virus)
- HIV and others

Most common causes of viral encephalitis:

- Herpesviruses: HSV1 commonest
- Arboviruses (West Nile virus)
- Enteroviruses
- Others e.g rabies, prions, measles..
Viral Meningitis

Presentation of viral meningitis:

- Fever, Frontal headache, signs of meningeal irritation and viral CSF profile (lymphocytosis and negative bacterial culture)
- Symptoms of the causative virus e.g:
  - Enterovirus: GIT symptoms
  - Herpessimplex virus 2: genital ulcers

Presentation of viral meningingo encephalitis:

- As above plus
  - Alteration of level of consciousness, confusion, coma, Seizures, cranial nerve involvements, or Focal weakness
Enteroviruses

- Fecal oral, respiratory routes

- Commonest cause of viral meningitis, accounting for >85% of known cases

- Patients present with sudden onset of fever; headache; nuchal rigidity; and often constitutional signs, including vomiting, anorexia, diarrhea, cough, pharyngitis, and myalgias.
Enteroviruses

- The physical examination should include a careful search for stigmata of enterovirus infection, including exanthems, herpangina, hemorrhagic conjunctivitis, AND hand-foot-and-mouth disease.

- Diagnosis: RT-PCR
- Treatment: supportive?
- New research antiviral: Pleoconaril
Herpes simplex encephalitis

- HSV, an enveloped, double-stranded DNA virus. HSV-1 and HSV-2 are both members of the human herpesvirus (also includes CMV, VZV, EBV, HHV 7 and 8).

- HSV-1 causes oral lesions (so-called fever blisters). HSV-2 causes genital lesions.

- The exact pathogenesis is unclear.
Herpes simplex encephalitis

- HSE occurs as 2 distinct entities:
  - In children older than 3 months and in adults, HSE is usually localized to the temporal and frontal lobes and is caused by HSV-1
  - In neonates, brain involvement is generalized, and the usual cause is HSV-2, which is acquired at the time of delivery
Herpes simplex encephalitis

- The most common symptoms of HSE
  - Fever (90%)
  - Alteration of consciousness (97%)
  - Headache (81%)
  - Psychiatric symptoms (71%)
  - Seizures (67%)
  - Vomiting (46%)
  - Focal weakness (33%)
  - Memory loss (24%)
  - Visual field loss (14%)
Herpes simplex encephalitis

- **Diagnosis:**
  - Oral or genital lesions?
  - Focal neurologic deficits, CSF pleocytosis, and abnormalities on CT scanning may be absent initially. Therefore, a high index of suspicion is required to make the diagnosis.
  - The diagnosis can be confirmed only by means of PCR or brain biopsy.

- **Treatment**
  - HSE Should be treated or can be fatal
  - Acyclovir
FIGURE 31-3
Coronal FLAIR magnetic resonance image from a patient with herpes simplex encephalitis. Note the area of increased signal in the right temporal lobe (*left side of image*) confined predominantly to the gray matter. This patient had predominantly unilateral disease; bilateral lesions are more common but may be quite asymmetric in their intensity.
Arboviruses: WNV

- Transmitted by Culex mosquito, blood transfusion, mother to baby, host is bird
- 4-14 d incubation period
- 80% asymptomatic
- 20% WNF and diseases: Fever, myalgia, arthralgia, maculopapular rash, generalised lymph nodes enlargement, meningoencephalitis
Arboviruses: WNV

- CSF lymphocytic pleocytosis, normal glucose concentration, and normal or mildly elevated protein concentration.
- However, 40–45% have CSF neutrophilia, which can persist for a week or more.
- The rarity of hypoglycorrhachia in WNV infection as well as the absence of positive Gram’s stains and the negative cultures help distinguish these patients from those with bacterial meningitis.
- Definitive diagnosis viral-specific IgM in CSF
Mumps
Mumps

- Paramyxovirus
- Incubation period 2-4 weeks
- Mumps vaccine reduced infection
- Occurs in Nonimmunized individuals and Rare cases (10–100:100,000 vaccinated individuals) of vaccine associated
- The presence of parotitis, orchitis, oophoritis, pancreatitis, or elevations in serum lipase and amylase is suggestive of mumps meningitis
Mumps

- Patients with meningitis have a CSF pleocytosis that can exceed 1000 cells/microL.

  Lymphocytes predominate in 75%, although CSF neutrophilia occurs in 25%.

- Hypoglycorrhachia, occurs in 10–30% of patients and may be a clue to the diagnosis when present.

- Diagnosis by detecting IgM antibodies or seroconversion.
CRYPTOCOCCUS

- Encapsulated yeast reproduce by budding
- 4 capsular serotypes A-D
- Cryptococcus gatti belongs to B and C more in immunocompetent
- Cryptococcus neoformans belongs to A and D more in immunodeficient e.g. HIV
- Found in pigeon droppings, soil and fruits
- Route of transmission: inhalation
- Common in patients with T cell defects e.g. AIDS patients, malignancies patients on steroids
CRYPTOCOCCUS

Cryptococcal meningitis/encephalitis

- Subacute presentation with fever, meningoencephalitis, visual loss and focal deficit

- Lab: 40-400 cells/µl, low glucose, positive India ink stain of the capsule

- Serum and CSF cryptococcal antigen

- Treatment: Amphotericin plus Flucytocine
Tuberculous meningitis

- Nonspecific symptoms with subacute to chronic meningeal symptoms
- CXR: in 50% of patients it shows pulmonary or miliary TB
- Suspicion: risky patients, endemic area..

Lab. Diagnosis

- Lymphocytosis 100-500 cells/microliter, increased protein and decreased sugars
- CSF ZN stain and culture
- PCR

Treatment: anti TB drugs for 1 year (4 for 2 months then 2 for 10 months)
TAKE HOME MESSAGES

- Acute Meningitis is an emergency
- Different microbiological causes
- Presentation is nearly similar but needs high index of suspicion in many cases
- A clue in the presentation or Lab. Result will help you in initiating treatment
- Some diagnostic tools will help you in management
- Immunocompetent vs immunocompromised
• Any Questions