CNS INFECTIONS

Classification - Aetiology

A. Aetiology
    1. Infectious
        1. Bacterial
        2. Viral
        3. Fungal
        4. Parasitic
    2. Non-infectious
        1. Malignant
        2. SAH
        3. Drugs

Classification - Aetiology

B. Duration
    1. Acute
        1. Often by typical bacteria
    2. Chronic
        1. Often by atypical causative agents

Bacterial Meningitis

Caused by:

1. *Neisseria meningitidis,*
2. *Streptococcus pneumoniae* (accounts for 70% of acute bacterial meningitis outside the neonatal period),
3. *Staphylococcus aureus*,
4. Group B Streptococcus,
5. *Listeria monocytogenes*,
6. Gram-negative bacilli e.g. E. coli,
7. *Mycobacterium tuberculosis,*
8. *Treponema pallidum,*
9. *Hemopilus influenza* B (Hib)-although case
10. *Pseudomonas aeruginosa*.

Bacterial Meningitis

- *ETIOLOGICAL AGENTS*
- The causes of bacterial meningitis vary with age:
- Infants (<1 year): *E. coli, Group B streptococcus, Listeria monocytogenes* are the commonest causative agents.
- Young children/toddler (age 1-6 years): *Haemophilus influenza, Meningococcus* account for more than 50% of cases.
- Adolescents and Adults: *Meningococcus*, *Pneumococcus* are the commonest etiologies
- Immunocompromised and cancer: *Listeria*, *Staphylococcus*, *Pseudomonas aeruginosa* etc.
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Bacterial Meningitis – Routes of entry

Micro-organisms reach the meninges either by:

- ➢ Droplet infection through the upper airways: e.g. *Neisseria meningitidis*
- ➢ Direct extension from ears (otitis media), nasopharynx (sinusitis), cranial injury or congenital meningeal defect.
- ➢ By bloodstream spread (hematogenous spread).

Bacterial Meningitis – Pathophysiology

- In acute bacterial meningitis the pia-arachnoid is congested with polymorphs. A layer of pus forms. This may organize to form adhesions causing cranial nerve palsies and hydrocephalus.
- In chronic infection (e.g. TB) the brain is covered in a viscous grey-green exudate with numerous meningeal tubercles. Adhesions are invariable.
- Cerebral edema occurs in any bacterial meningitis.

Bacterial Meningitis – Clinical features

- May develop as acute fulminant, or sub-acute over a few days
- Meningitis TRIAD:
  - Neck Stiffness
  - Headache
  - Fever
- AMS
- Photophobia
- Vomiting (projectile)
- Seizures

Bacterial Meningitis – Clinical features

- Signs:
  - Neck stiffness
  - Kerning’s sign
  - Brudzinski’s sign
  - Cranial Nerve abnormalities

Bacterial Meningitis – Clinical features

Clinical clues:

- Petechial rash- Meningococcal infection
- Skull fracture, ear disease, congenital CNS lesion- pneumococcal infection
- Immunocompromised patients- HIV opportunistic infection
- Rash or pleuritic pain- Enterovirus infection
- Recent travel- malaria

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Viral Meningitis – Aetiology

It is commonly caused by:

- Enteroviruses: Coxsackie, echovirus
- Herpes simplex, HSV (type 2 more commonly causes meningitis than HSV 1)
- Mumps
- Measles
- Poliomyelitis
- HIV
- Epstein-Barr virus (EBV)

Viral Meningitis – Clinical features

- Meningitis triad: headache, neck stiffness and fever.

Photophobia and vomiting are often present.

- In viral meningitis there are **less prominent meningitic signs.**
- It is benign, self-limiting lasting 4-10 days.
- Headache may follow for some months.

Viral Meningitis – Clinical features

 Viral meningitis is almost always benign, **self-limiting** condition lasting 4-10 days.

 Headache may follow for some months. There are no serious sequelae unless an encephalitis is present.

 In viral meningitis there is a **predominantly lymphocytic** inflammatory CSF reaction **without pus** formation, Polymorphs or adhesions. There is **little or no cerebral edema** unless encephalitis develops.

Chronic Meningitis – Aetiology

TBM

Cryptococcus

Chronic Meningitis – Aetiology

Cryptococcus

Out of 39 known Cryptococcal species only 2 cause disease C. neoformans neoformans and C. neoformans gatti

 Cryptococcus can also cause pulmonary, cutaneous and disseminated forms of illness.

The neoformans variant dominates in AIDS patients.

Acute meningitis can occur but is unusual.

 Meningitic signs often take some weeks to develop.

 Drowsiness, focal signs (e.g. diploplia, papilloedema, hemiparesis) and seizures are common.

Encephalitis

 This is acute inflammation of brain parenchyma; it is usually viral.

 In viral encephalitis **fever** (90%) and **meningism** are usual but in contrast to meningitis the clinical picture is dominated by **brain parenchyma** inflammation.

 Personality and **behavioral** change is a common early manifestation which progresses to a **reduced level of consciousness** and even coma.

 Seizure (focal and generalized) are very common and **focal neurological deficits** e.g. speech disturbance often occurs (especially in herpes simplex encephalitis).

The most common focal findings are **aphasia, ataxia, hemiparesis** (with hyperactive tendon reflexes), **involuntary movements** and **cranial nerve deficits.**

Diagnosis

 Lumbar puncture and CSF analysis

o CSF Microscopy, Culture and Sensitivity:

Stains used include **Gram Stain** (For Gram-positive intracellular diploccoci-pneumococcus, Gram-negative cocci-meningococcus), **Ziehl-Neelsen stain** (AFB stain for TB), **India ink** (for fungi)

o CSF biochemistry

o CSF PCR

 Full blood count (with differential count), Serum glucose and Blood cultures

 RPR for Syphilis and RDT for malaria

 Chest and skull X-ray

 CT scan/MRI (r/o space occupying lesion)

Diagnosis

Feature	Normal	Bacterial meningitis	Viral meningitis	Tuberculous meningitis
Pressure	50-250mm of water	Normal/increased	Normal	Normal/increased
Appearance	Crystal clear	Turbid	Clear	Cob-web appearance
Cell count/ microliter	<10 RBCs <5 WBCs	Several thousands (1000-5000 polymorphs)	Several hundreds (10-2000 lymphocytes)	Several hundreds (50-5000 lymphocytes)
Cell type	None	Granulocytes (Polymorphs)	Lymphocytes	Lymphocytes and monocytes
Glucose	2/3 to ½ blood glucose	Decreased (<30mg/dl) < ½ blood glucose	Normal > ½ blood glucose	Decreased (<30mg/dl) < ½ blood glucose
Protein	0.2-0.4 g/l	Increased (>120mg/dl) 0.5-2.0g/l	Normal (0.4-0.8g/L)	Increased (>120 mg/dl) 0.5-3.0g/l
Lactate dehydrogenase		>3.5mmol/L	<3.5 mmol/L	>3.5mmol/L

Treatment

Bacterial:

Antibiotics, eg Ceftriaxone

TB:

ATT, Steroids

Fungal;

Amphotericin B, Flucytosine,

Viral

Acyclovir