CNS infections in pediatrics

Learning objectives:

1. Demonstrate knowledge of the possible presenting symptoms of meningitis and the immediate steps in management.
2. Students will recognize the differences between aseptic meningitis, acute bacterial meningitis, and viral encephalitis in pediatric patients.
3. Demonstrate the ability to interpret CSF results and understand the typical findings in viral vs. Bacterial meningitis.
4. Understand the possible complications of meningitis in children.
5. Review the treatment and prevention of bacterial meningitis.

Meningitis is an acute inflammation of the protective membranes covering the brain and spinal cord (meninges). Meningitis is a potentially life-threatening condition that can rapidly progress to permanent brain damage, neurologic problems, and even death.
Causes:

1. Viral (aseptic): is the most common cause, usually mild and resolve without treatment (common viruses are the enteroviruses like coxackie, polio, and echoviruses)
2. Bacterial type are extremely serious illnesses, and may result in death or brain damage even if treated.
3. Meningitis is also caused by fungi, TB, syphilis, chemical irritation, drug allergies, and tumors.

Bacterial meningitis:

The commonest organisms between 2mo-12 yr. Are:
(H. Influenza type B, Streptococcal pneumonia, Neisseria meningitides)
Epidemiology:

1. More in male
2. Usually occur between 2-24 months
3. Most common in winter and spring
4. Close contact with nasopharyngeal carrier, or an ill patient with type B H. Influenza infection, or meningococcal disease is of increased risk.

Pathogenesis

Acute bacterial meningitis are usually the result of hematogenous spread from a distant focus of infection, or sometime may result from direct spread of the microorganism from the contagious site of infection like: chronic sinusitis, otitis media, and mastoids, and common in patients with head injury, sickle cell anemia, or following splenectomy.

Clinical presentation:

Depends on the age of the child

Can be subtle in neonates

- **Poor feeding**
- **Increased sleep**
- **Respiratory distress**

- **Fever or hypothermia**
- **Convulsions.**

Children under one year of age outside the neonatal period may exhibit nuchal rigidity

- **Fever**
- **Lethargy**
- **Poor feeding**
- **Irritability**
- **Altered sensorium**
- **Vomiting**
- **Convulsions.**

Symptoms more specific as the age increase beyond one year

- **Fever**
- **Headache**
- **Nuchal rigidity**
- **Altered sensorium**
- **Vomiting**
- **Photophobia**
- **Convulsions**

The classical signs of meningeal irritation are

Kernigs, Brudziniski **are usually present in older children, enlargement and bulging anterior fontanelle, and in complicated cases there are signs of increased intracranial pressure (severe headache, projectile vomiting, ptosis, 6 cranial nerve palsy, unequal size of the pupils bradycardia, hypertension. Signs of shock.**

Diagnostic studies:

1. **Blood culture is essential, positive in 50-90%.**
2. **CBC, electrolytes, blood urea and sugar.**
3. **LP**
4. **Chest radiograph if respiratory symptoms**
5. **Nasopharyngeal swab for culture.**

TABLE 602-1 -- Cerebro-spinal Fluid Findings in Central Nervous System Disorders

CONDITION	PRESSURE (MM H_2O)	LEUKOCYTES (MM^3)	PROTEIN (MG/DL)	GLUCOSE (MG/DL)	COMMENTS
Normal	**50–80**	**<5, ≥75% lymphocytes**	**20–45**	**>50 (or 75% serum glucose)**	
COMMON FORMS OF MENINGITIS					
Acute bacterial meningitis	Usually elevated (100–300)	100–10,000 or more; usually 300–2,000; PMNs predominate	Usually 100–500	Decreased, usually <40 (or <50% serum glucose)	Organisms usually seen on Gram stain and recovered by culture.

CONDITION	PRESSURE (MM H_2O)	LEUKOCYTES (MM^3)	PROTEIN (MG/DL)	GLUCOSE (MG/DL)	COMMENTS
Partially treated bacterial meningitis	Normal or elevated	5–10,000; PMNs usual, but mononuclear cells may predominate if pretreated for an extended period of time	Usually 100–500	Normal or decreased	Organisms may be seen on Gram stain. Pretreatment may render CSF sterile. The antigen may be detected by agglutination test
Viral meningitis or meningoencephalitis	Normal or slightly elevated (80–150)	Rarely >1,000 cells. Eastern equine encephalitis and lymphocytic choriomeningitis (LCM) may have cell counts of several thousand. PMNs early, but mononuclear cells predominate through most of the course	Usually 50–200	Generally, normal; may be decreased to <40 in some viral diseases, particularly mumps (15–20% of cases)	HSV encephalitis are suggested by focal seizures or by focal findings on CT or MRI scans or EEG. Enteroviruses and HSV infrequently recovered from CSF. HSV and enteroviruses may be detected by PCR of CSF

Treatment:

- **Supportive**
  1. **Shock**
  2. **DIC**
  3. **Anemia**
  4. **Convulsion**
  5. **Subdural effusion**
  6. **Fever and dehydration**
  7. **Raised intracranial pressure**

- **Specific treatment:**

Based on the substantial rate of resistance of *S. Pneumonia* to β-lactam drugs recommended empirical therapy is vancomycin (60 mg/kg/24 HR, given every 6 HR) in combination with either of the third-generation cephalosporin, cefotaxime (200 mg/kg/24 HR, given every 6 hour) or ceftriaxone (100 mg/kg/24

HR administered once per day or 50 mg/kg/dose, given every 12 hours). Patients allergic to β-lactam antibiotics can be treated with chloramphenicol, 100 mg/kg/24 HR, given every 6 hour.
3. Dexamethasone is given in a dose of 0.6 mg/kg/day just before antibiotics, the duration of dexamethasone treatment is 2 days.

Prognosis:
The mortality rate is reduced by adequate early treatment, but the 40-50% of survivors develop complications:

1. **Hydrocephalus**
2. **Deafness**
3. **Blindness**
4. **Different types of paralysis**
5. **Learning disabilities**
6. **Epilepsy**
7. **Subdural effusion**

Prevention:
1. Treatment of family contacts, index case and other close contacts with H. Influenza or meningococcal meningitis with rifampicin
10mg/kg/day divided every 12 HR. For 2 days in meningococcal meningitis
20mg/kg/day for 4 days in H. Influenza meningitis.
2. Vaccinations for H influenza type b and S. Pneumonia.

Encephalitis:

- **Is an acute inflammation of the brain tissue and almost always associated with inflammation of the adjacent meninges (meningoencephalitis).**
- **Causes: the disease most commonly caused by**
  - Viral infection usually enteroviruses (echo and Coxsackie), herpes and arboviruses.
  - Autoimmune.
- **Clinical features: headache, lethargy, irritability, malaise, fever, nausea, vomiting, neck pain, photosensitivity, alteration of level of consciousness, focal or generalized neurological signs, convulsions are common,**

- **Diagnosis: LP, MRI, CT scan, EEG.**
- **TREATMENT: is supportive, and acyclovir 30 mg/kg/day for 14 days after HSV infection.**
- **Prognosis: is poor in HSV infection.**

References

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