

CNS Infections in the Pediatric Age Group

Introduction

- CNS infections are frequently life-threatening
 - In the Philippines, bacterial meningitis is one of the top leading causes of mortality in children 0-4 years old
 - Overall goal: to minimize the mortality rate and long-term morbidity through:
 - Earlier recognition of patients*
 - Prompt initiation of appropriate therapy*
 - Rapid determination of etiologic agents*
 - Enhanced management of complications*
- CNS Infections

Forms:

- Meningitis
 - Encephalitis
 - Brain Abscess
- Bacterial Meningitis
- Acute
 - Route of Infection
 - Hematogenous
 - Contiguous focus of infection
 - CSF leak (trauma, congenital defect)
 - Neurosurgical procedure

Clinical Features

Laboratory Diagnosis

- Lumbar Puncture
- Contraindications
 - Skin infection over site
 - Increased ICP with papilledema
 - Focal neurologic deficits
 - Suspected mass lesion
 - Hematologic problems
 - Significant cardiopulmonary compromise and shock

Routine Tests:

- Color and clarity*
- Cell count and differential*
- Chemistries (protein, glucose)*
- Stains/smears (Gram, AFB, KOH)*

Culture and sensitivities
Serologies and antigen determination

•Brain Imaging (cranial CT scan or MRI)

Indications:

- prolonged depressed consciousness
- persistent full fontanel
- prolonged fever
- focal neurologic deficits
- seizures
- failure to display clinical improvement
- sudden unexplained clinical deterioration

•Brain Imaging (cranial CT scan or MRI)

•Other Useful Laboratory Tests

•Culture of other normally sterile fluids

Blood

Middle ear fluid

•Cranial ultrasound

Treatment

- Bacterial meningitis is a medical emergency, delay in treatment may lead to increased sequelae or death
- Drug of choice must be bactericidal for pathogen involved
- Must achieve adequate levels in the CSF
- Initial regimen should cover most likely pathogens for specific age groups, and reach bactericidal levels in the CSF
- Knowledge of local susceptibility patterns is essential

Empiric Therapy for Bacterial Meningitis

Specific Antimicrobial Therapy for Bacterial Meningitis

Dexamethasone:

- in cases where the causative organism can be reliably diagnosed, particularly those with *H. influenzae* meningitis
- b. in patients with markedly increased ICP
 - 0.15 mg/kg/dose IV q 6 hrs for 2 days
 - 1st dose of dexamethasone should be given prior to or with the 1st dose of antibiotics
 - give with an H2 antagonist

Supportive Management:

- IV fluids and hydration

- Maintain normal blood pressure
 - Watch out for SIADH
- Control of increased intracranial pressure
- Nutritional support
- Prevention
 - Chemoprophylaxis
 - Immunizations
 - Infection control

Acute Complications

Common

- Increased intracranial pressure
- SIADH
- Ventriculomegaly
- Seizures
- Extra-axial fluid collection (subdural effusion)
- Infarction and necrosis
- Cranial nerve involvement (VIII)
- Disseminated intravascular coagulation

Uncommon

- Subdural empyema
- Brain abscess
- Cranial nerve deficits other than VIII

Acute Complications

Acute Complications

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Acute Complications

Late Neurologic Sequelae

- Visual impairment
- Strabismus
- Hearing loss or impairment
- Locomotion/neuromotor deficits
- Epilepsy
- Mental or psychomotor retardation
- Hydrocephalus
- Microcephaly

Late Neurologic Sequelae

Other Consulting Services:
Hydrocephalus

Tuberculous Meningitis

- Subacute to chronic
- Staging of symptoms
- Stage I: early nonspecific
- Stage II: altered consciousness, minor focal signs, meningism, abnormal involuntary movements
- Stage III: stupor or coma, seizures, severe neurologic deficits and/or abnormal movements
- Prognosis is related directly to the clinical stage of diagnosis

Diagnosis

- Clinical picture
- History of exposure
- Positive skin test result
- CSF changes

Ancillary Laboratory Procedures

1. Imaging Studies

- Chest x-ray:
- Hilar adenopathy
- Simple pneumonia
- Infiltrate
- Fibronodular infiltrate/cavitation
- Pleural effusion/pleural scan
- CT scan and MRI:
- Basilar meningeal thickening
- Infarction
- Hydrocephalus

Laboratory Diagnosis

2. Other Tests:

- Complete blood count
- ESR
- Electrolytes

Treatment

- Medical Care

Anti-TB Agents

- First 1 or 2 months:
Isoniazid

Rifampicin
Pyrazinamide and
Ethambutol or Streptomycin (or another
aminoglycoside) or Ethionamide
–Next 9 – 12 months:
Isoniazid
Rifampicin

Treatment

•Medical Care

Steroids

–Prednisone = 1 to 2 mg/kg or its equivalent given for 6 to 8 weeks

–Dexamethasone = short course of 6 mg/m² every 4 to 6 hours

2. Surgical Care

External drainage

Ventriculoperitoneal shunt

Fungal Meningitis

•Subacute to chronic granulomatous

•Primary or secondary

•Etiology:

–Cryptococcus

–Coccidioides

–Mucor

–Candida

–Actinomyces

–Histoplasma

–Aspergillus sp

Treatment

•Candida:

Amphotericin B and 5-flucytosine

Fluconazole if immunocompromised

•Cryptococcus:

Amphotericin B and 5-flucytosine

Fluconazole if immunocompromised

Viral Meningitis

•Majority due to enteroviruses

•Higher incidence during summer to fall months

•Other viruses associated with meningitis in children:

•HSV types 1 and 2

- Mumps
- Adenoviruses
- Polioviruses
- Lymphocytic choriomeningitis virus
- Epstein-Barr virus
- HIV
- St. Louis encephalitis virus
- Tick-borne encephalitis virus

- No specific antiviral therapy necessary
- Treatment is supportive with IV fluids
- Outcome is usually a full recovery

Encephalitis

- Distinguished from aseptic meningitis by the extent and severity of cerebral dysfunction, independent of signs of meningeal inflammation
- Two clinicopathologic presentations:
 - Acute (Primary) Viral Encephalitis
 - Postinfectious (Secondary) Encephalitis

•Primary Encephalitis

Epidemic

- Arbovirus
- Poliovirus
- Echovirus
- Coxsackie virus

Sporadic

- Herpes simplex
- Varicella-Zoster
- Mumps

•Secondary Encephalitis

(Parainfectious / Postinfectious / ADEM)

- Measles
- Varicella
- Rubella
- Slow Viral Infections
- SSPE
- Progressive Rubella Panencephalitis
- Creutzfeldt-Jakob Disease

Systemic Physical Findings Suggesting Causes of Acute Encephalitis

Clinical Presentations:

—Fever and malaise without meningeal signs

—With meningeal signs plus cerebral dysfunction (altered consciousness, personality changes, seizures, and paresis) and cranial nerve abnormalities

•Other ancillary procedures:

- Cranial MRI
- Biopsy

Treatment:

Acyclovir 10 mg/kg IV infusion every 8 hours for at least 10 days
Supportive therapy

Prognosis:

Mortality rate varies with etiology
Permanent cerebral sequelae more likely in infants
Brain Abscess

•Mechanisms:

Direct extension of contiguous infection
Penetrating head wounds
Hematogenous spread

•Clinical Features:

Signs of raised intracranial pressure
Focal neurologic deficits
(+) antecedent infection or risk factor

Treatment:

—Search for the source of infection

—Medical

- Penicillin
- Chloramphenicol
- Metronidazole
- Oxacillin or Methicillin

—Surgical

CONCLUSION

- CNS infection, especially bacterial, is a medical emergency and requires early recognition, prompt initiation of treatment and enhanced management of complications to avoid devastating sequelae
- Management of pediatric CNS infections and their complications is multidisciplinary
- Mutual communication between the primary care team and the specialty team is a must
- Most importantly, the family should provide input and exhibits understanding of, and agreement with, the content of comprehensive management plan for the patient