

Project: Ghana Emergency Medicine Collaborative

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Meningitis

and other CNS infections

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BACKGROUND

history

- first described by Viesseux in 1805
- Flexner developed antiserum in 1913
- antibiotic use began in 1930s-40s
- high morbidity and mortality to this day
 - 20-40% depending on organism
 - 30% with residual deficits
- changing landscape of causative organisms based on vaccination patterns

definitions

- *meningitis* – inflammation of the meninges
- *encephalitis* – inflammation of brain parenchymaa
- *myelitis* – inflammation of spinal cord

epidemiology

- meningitis endemic in parts of Africa
- occurs in epidemics in US
 - incidence is 5-10/100,000 per year, winter
 - 80% are Neisseria and Strep pneumo
 - viral meningitis twice as common, summer
- encephalitis less common but incidence rising due to West Nile Virus
- rare brain abscesses due to sinusitis, otitis media, immunocompromised

MENINGITIS

etiology

- streptococcus pneumoniae
- neisseria meningitidis (<45 yo)
- listeria monocytogenes
- aseptic

viral – HSV, enteroviruses, etc.

fungal – crypto, histo, blasto, coccidioides

parasites – toxo, neurocyster. trichinosis

rickettsiae – RMSF, typhus

non-infectious – post inf, drugs, systemic dz

pathophysiology

- nasopharyngeal colonization → mucosal invasion → enter blood stream → evade immune destruction → cross blood brain barrier into CSF
- meningeal inflammation → increased permeability of BBB, vasculitis, edema, increased ICP
- decreased cerebral perfusion, decreased CSF glucose, increased CSF protein

risk factors

- age <5 or >60
- male
- african descent
- crowding
- sickle cell disease
- malignancy
- etoh, DM
- recent ENT surgery or head injury

clinical presentation

- headache
- fever
- nausea/vomiting
- seizures
- altered mental status
- nuchal rigidity
- photophobia
- many present atypically (old, young, immune compromised, aseptic)

clinical presentation

- often have a primary source of infection on exam (PNA, UTI, sinusitis, OM, etc.)
- purpuric rash with meningococemia
- Kernig Sign – can't extend knee to 180 while laying supine with hip in flexion
- Brudzinski Sign – 5 described, 2 used now
 - contralateral – flexion of one hip causes flexion of the other hip
 - neck – flexion of neck causes hip flexion
- jolt acceleration of headache

complications

- acute – coma, seizure, loss of airway reflexes, respiratory arrest, cerebral edema, DIC, dehydration, death
- delayed – seizures, paralysis, cognitive deficits, hydrocephalus, hearing loss, ataxia, blindness, death
- complications from viral meningitis are rare

ENCEPHALITIS

etiology

- usually viral – HSV, HHV, west nile virus, arbovirus, VZV, EBV
- occasionally idiopathic, post infectious, or bacterial (mycoplasma pneumoniae)

pathophysiology

- inoculation occurs via various mechanisms depending on the virus
- viremia, proliferation within neurons, or invasion via nasal mucosa
- CSF invasion similar to meningitis but less of an immune response if viral → fewer neurologic sequelae in most patients

clinical presentation

- symptoms similar to meningitis, except:
- almost all have AMS
- personality changes
- focal neurologic signs
- higher incidence of seizure
- hallucinations, bizarre behavior

may precede other signs → psych dx

complications

- dependent on etiologic agent
- Japanese, Eastern equine, and St. Louis encephalitis have high M&M
- West Nile Virus infects few but has significant mortality
- HSV mortality dropped from 70% to 30% with acyclovir
 - survivors: seizure, motor/cognitive deficits
- TB M&M vary based on duration
- fungal mortality high, morbidity low

CNS ABSCESS

etiology

- usually invasion from more common ENT infections (otitis media, sinusitis, dental infections, etc.)
- streptococcus milleri most common
- also bacterioides, staph aureus, propionbacterium, enterobacteriae

clinical presentation

- similar to encephalitis, often difficult to differentiate clinically
- usually subacute (>2 weeks onset) course of illness
- often have papilledema
- acute worsening can occur with rupture of abscess into ventricles or with uncal herniation
- can mimic intracranial hemorrhage

complications

- mortality >50% without aggressive care
 <20% with surgical aspiration + abx
- 80% develop seizure disorder
- cognitive deficits, focal neuro deficits common
- epidural abscess → paralysis, motor & sensory deficits, bowel/bladder dysfunction

DIAGNOSIS

CT before LP?

- unnecessary in most patients with suspected meningitis, except:

focal neuro deficits

altered mental status/coma

papilledema

seizures

trauma

- CT and LP should not delay treatment
- abx → CT if needed → LP

lumbar puncture

- collect at least 3 tubes of 1 mL each
- opening pressure = 5-20 cm H₂O
- cell count <5 WBC/mm³
- differential <1 PMN/mm³
- protein = 15-45 mg/dL
- glucose = 60% blood glucose
- gram stain/AFB
- culture, specific antigen tests

adjuncts to LP

- blood cultures
 - often have higher yields for bacteria
- CBC w/diff
 - don't let it talk you out of an LP
- chemistry panel
 - compare glucose to CSF, renal function
- CXR
 - 50% w/strep pneumo meningitis have PNA
- EEG – encephalitis (HSV)

MANAGEMENT

resuscitation

- fulminant presentation
 - septic shock
 - seizures
 - cerebral edema
 - hypoxia
 - loss of airway reflexes
- standard supportive measures
 - mannitol for cerebral edema
 - empiric antibiotics as soon as possible

antibiotic regimen

- vancomycin plus
 - ceftriaxone or
 - cefotaxime or
 - meropenem or
 - chloramphenicol
- add ampicillin if >50 yrs
- neonates: cefotaxime + ampicillin
- special cases: penetrating trauma, post neurosurgery, VP shunt

other medications

- acyclovir for suspected HSV
 - INH, rifampin, etc. for TB
 - amphotericin B for fungal (not in ED)
 - flagyl for CNS abscess
- also early neurosurgical consultation

steroids in meningitis

- dexamethasone has been shown to reduce cerebral edema, ICP, CSF lactate
- past studies with variable results
- randomized controlled study in sub-Saharan Africa showed no benefit in children
- randomized controlled study in Vietnam showed reduction of long-term neurologic sequelae with dexamethasone >14 yo

dexamethasone for strep pneumoniae

chemoprophylaxis

- rifampin 600 mg x4 doses in household contacts
- ciprofloxacin 500 mg x1 dose in HCW with direct contact (intubation, suctioning)

disposition

- admit
- can consider d/c if symptoms are classic for viral meningitis and follow up within 24 hours can be ensured

often viral meningitis is admitted on abx until bacterial causes can be excluded

SUMMARY

in conclusion...

- suspicion of CNS infection mandates LP unless contraindications to blind LP exist
 - in which case, perform HCT first
- do not delay abx for HCT or LP
- evaluation for CNS infection in a patient with the right symptoms should not stop if another infection is found
 - many have hematogenous spread from PNA or UTI

QUESTIONS