

Clinical features

- The classic clinical triad of meningitis is fever, headache, and nuchal rigidity (“stiff neck”).
- Altered consciousness
- headache
- photophobia
- irritability
- Lethargy
- poor feeding /weak sucking
- high-pitched cry
- skin rashes

Signs & symptoms

- Brudzinski sign
- Kernig sign
- Apnea
- Abnormal temperature (hypo/hyperthermia)
- bulging fontanelles
- Poor reflexes

Neonates

- Suspect meningitis with temperature more than 100.7° F (38.2°C).

Risk factors:

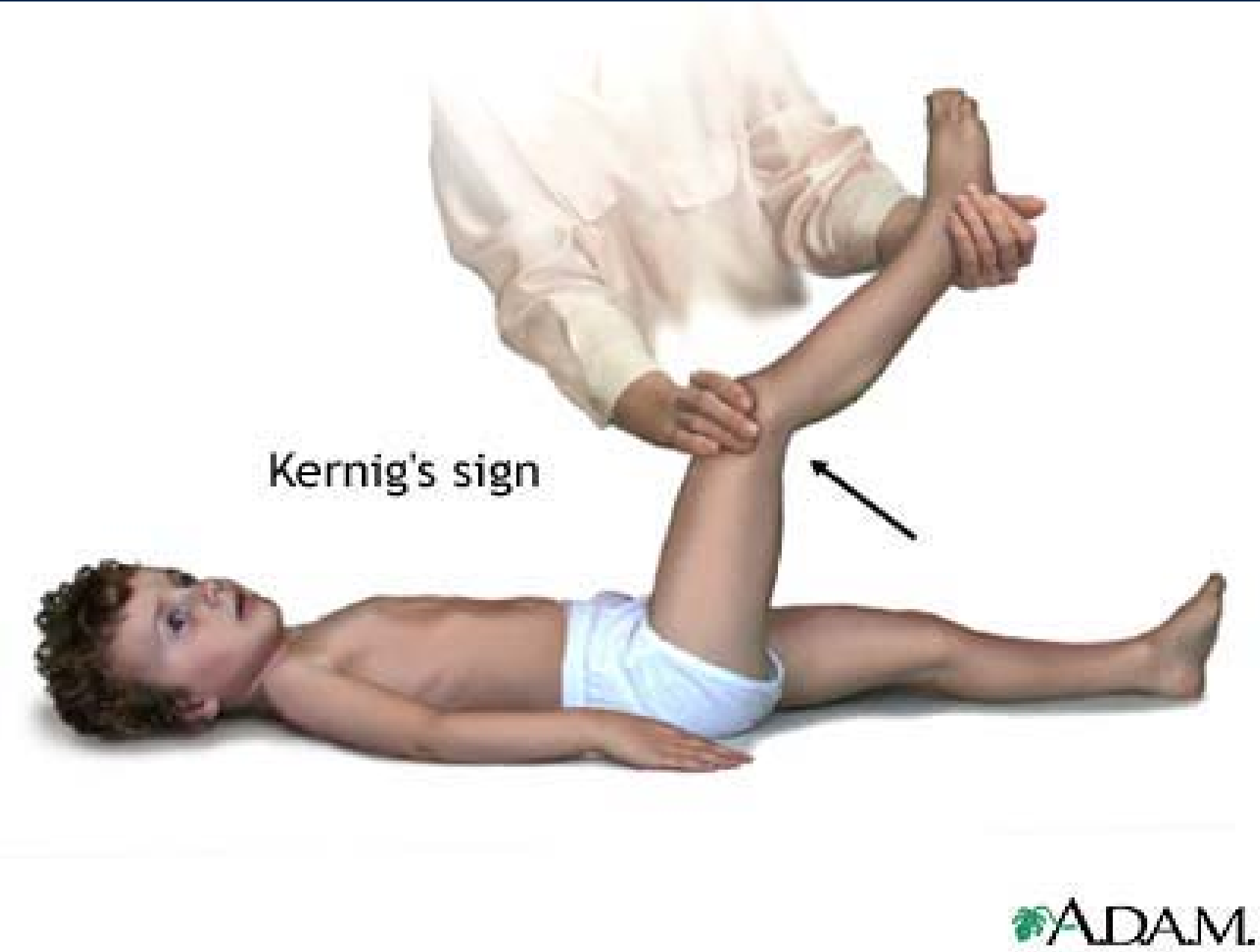
- Infective illness in mother
- PROM
- Difficult delivery
- Premature babies
- Spina bifida

Examination

- General physical- Check for Consciousness level according to GCS scoring, irritability, dullness.
- Vitals: temperature , HR, BP, RR.
- Signs of Increased ICP-
Bulging fontanelle, headache, nausea, vomiting, ocular palsies, altered level of consciousness, and papilledema
- Fundus: papilloedema
- CN palsies: (occulomotor, facial, and auditory)

Examination

- Meningismus - check for nuchal rigidity with passive neck flexion (gives 'involuntary resistance').
- Brudzinski sign (hip & knee flexion with neck movement)
- Kernig sign (extend knee with hip flexed)
- Hemiparesis.
- Rash: petechial or purpuric rash



Kernig's sign




Brudzinski's neck sign

Contraindication for LP

- Increase intracranial pressure.
- Unstable patient.
- Skin infection at site of LP.
- Thrombocytopenia.
- Papilloedema.

Treatment

Supportive therapy:

- Maintain fluid & electrolyte balance as required
 - Transfuse whole blood, PRC, FFP or platelets as required.
 - Maintain temperature.
 - Monitor OFC
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Indication

Antibiotic

Preterm infants to infants <1 month

Ampicillin + cefotaxime

Infants 1–3 mos

Ampicillin + cefotaxime or
ceftriaxone

Immunocompetent children >3 mos and
adults <55

Cefotaxime or ceftriaxone +
vancomycin

Adults >55 and adults of any age with alco-
holism or other debilitating illnesses

Ampicillin + cefotaxime or
ceftriaxone + vancomycin

Hospital-acquired meningitis, posttrau-
matic or postneurosurgery meningitis,
neutropenic patients, or patients with
impaired cell-mediated immunity

Ampicillin + ceftazidime +
vancomycin

Total Daily Dose and Dosing Interval

Antimicrobial Agent	Total Daily Dose and Dosing Interval	
	Child (>1 month)	Adult
Ampicillin	200 (mg/kg)/d, q4h	12 g/d, q4h
Cefepime	150 (mg/kg)/d, q8h	6 g/d, q8h
Cefotaxime	200 (mg/kg)/d, q6h	12 g/d, q4h
Ceftriaxone	100 (mg/kg)/d, q12h	4 g/d, q12h
Ceftazidime	150 (mg/kg)/d, q8h	6 g/d, q8h
Gentamicin	7.5 (mg/kg)/d, q8h ^b	7.5 (mg/kg)/d, q8h
Meropenem	120 (mg/kg)/d, q8h	3 g/d, q8h
Metronidazole	30 (mg/kg)/d, q6h	1500–2000 mg/d, q6h
Nafcillin	100–200 (mg/kg)/d, q6h	9–12 g/d, q4h
Penicillin G	400,000 (U/kg)/d, q4h	20–24 million U/d, q4h
Vancomycin	60 (mg/kg)/d, q6h	2 g/d, q12h ^b

Organism	Antibiotic
<i>Neisseria meningitides</i>	
Penicillin-sensitive	Penicillin G or ampicillin
Penicillin-resistant	Ceftriaxone or cefotaxime
<i>Streptococcus pneumoniae</i>	
Penicillin-sensitive	Penicillin G
Penicillin-intermediate	Ceftriaxone or cefotaxime
Penicillin-resistant	(Ceftriaxone or cefotaxime) + vancomycin
Gram-negative bacilli (except <i>Pseudomonas</i> spp.)	Ceftriaxone or cefotaxime
<i>Pseudomonas aeruginosa</i>	Ceftazidime or cefepime or meropenem
<i>Staphylococci</i> spp.	
Methicillin-sensitive	Nafcillin
Methicillin-resistant	Vancomycin
<i>Listeria monocytogenes</i>	Ampicillin + gentamicin
<i>Haemophilus influenzae</i>	Ceftriaxone or cefotaxime
<i>Streptococcus agalactiae</i>	Penicillin G or ampicillin
<i>Bacteroides fragilis</i>	Metronidazole
<i>Fusobacterium</i> spp.	Metronidazole

Duration of Rx

- *N meningitidis* - 7 days
- *H influenzae* - 7 days
- *S pneumoniae* - 10-14 days
- *S agalactiae* (GBS) - 14-21 days
- Aerobic gram-negative bacilli - 21 days or 2 weeks beyond the first sterile culture (whichever is longer)
- *L monocytogenes* - 21 days or longer

Viral meningitis

- HSV encephalitis : Acyclovir (10 mg/kg every 8 h) . minimum 14-day course of therapy.
- Arbovirus: Ribavarin
- CMV: Gancyclovir.

Treatment

- Steroids:

Dexamethasone useful for H.influenzae type b,
First dose should be given 1 hr prior to starting
antibiotics.

Complications

- Cranial nerve palsies
- Subdural empyema
- Brain abscess
- Hearing loss
- Obstructive hydrocephalus
- Learning disability, CP, seizures, Mental retardation.
- Septic shock/ DIC
- Ataxia
- Stroke
- SIADH

Tuberculous Meningitis



CLINICAL FEATURES OF TBM

Always sec. to primary tuberculosis.


First Phase: Vague symptoms

- Child doesn't play, is irritable, restless or drowsy.
- Fever, anorexia & vomiting
- Headache.
- Possibly preceding history of Measles or another illness with incompletely recovery

SECOND PHASE:

- Later drowsy with neck stiffness & rigidity.
- Kernig & Brudzinski sign may become positive, anterior fontanel bulges
- Twitching of muscles, convulsions, raised temperature.
- strabismus, nystagmus, and papilloedema may be present.
- Fundoscopy: Choroidal TB may be seen

TERMINAL PHASE

- Comatose
 - opisthotonus
 - multiple focal paresis.
 - Cranial nerve palsies.
 - High grade fever often occurs terminally.
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Treatment

- **2 mo of Isoniazid, Rifampin, Pyrazinamide and an Aminoglycoside or ethionamide, once a day,**
- **f/ b 7–10 mo of isoniazid and rifampin, once a day or twice a week (9–12 mo total)**

➤ **STERIODS:**

reduce cerebral edema

prevent fibrosis & subsequent obstruction
to CSF

Dose: 2mg/kg/24 hours of prednisolone for
6-8 weeks

Prognosis

- It depends on the
 - age,
 - duration,
 - complications,
 - micro-organism &
 - immune status.
- Viral meningitis: good prognosis .
- Worse : Age (ie, <2 y, >60 y),
Significant Comorbidities ,
Immunodeficiency.
Impaired level of consciousness.
Seizures

Prevention

- The vaccines against Hib, measles, mumps, polio, meningococcus, and pneumococcus can protect against meningitis
- Hib vaccine: all infants should receive at 2,4,6 months of age & booster 1 year later.
- After 1 year 1 dose is given till the age of 5 years.
- Pneumococcal vaccine: 0.5 ml is given IM

Prevention

- High-risk children should also be immunized routinely.
- Vaccination before travelling to an endemic area
- Chemoprophylaxis for susceptible individuals or close contacts:
 - H influenzae type b : Rifampin(20 mg/kg/d) for 4 days
 - N meningitidis: Rifampin (600 mg PO q12h) for 2 days
 - Ceftriaxone (250 mg IM) single dose or Ciprofloxacin(500-750 mg) single dose.

FUNGAL MENINGITIS

- **Amphotericin B (0.7 mg/kg/day) + flucytosine (100 mg/kg/day) -- 6–10 wk (induction),**
- **f/b Fluconazole (400 mg/day)-- 8-10wk (consolidation)**
- **Fluconazole (200–400 mg/day) continued for life (maintenance therapy) after the completion of consolidation therapy**

Parasitic meningitis

- Amphotericin B, rifampin, and fluconazole or ketoconazole; amphotericin B, rifampin, and chloramphenicol and amphotericin B alone.
- The optimal duration of treatment is unknown.

References

- Nelson textbook of pediatrics
 - O P Ghai text book of pediatrics
 - Harrisons text book of internal medicine
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