Meningitis

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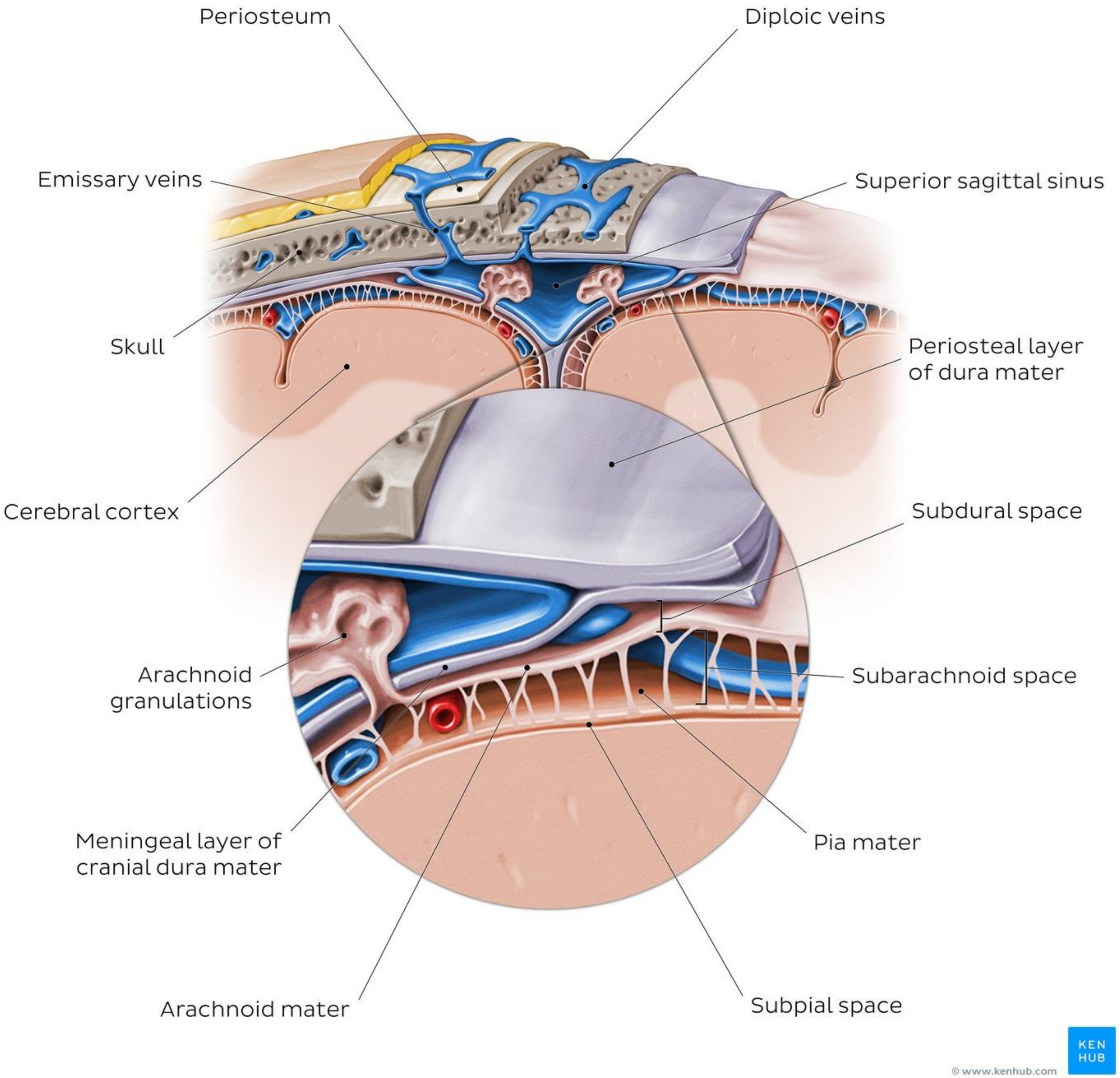
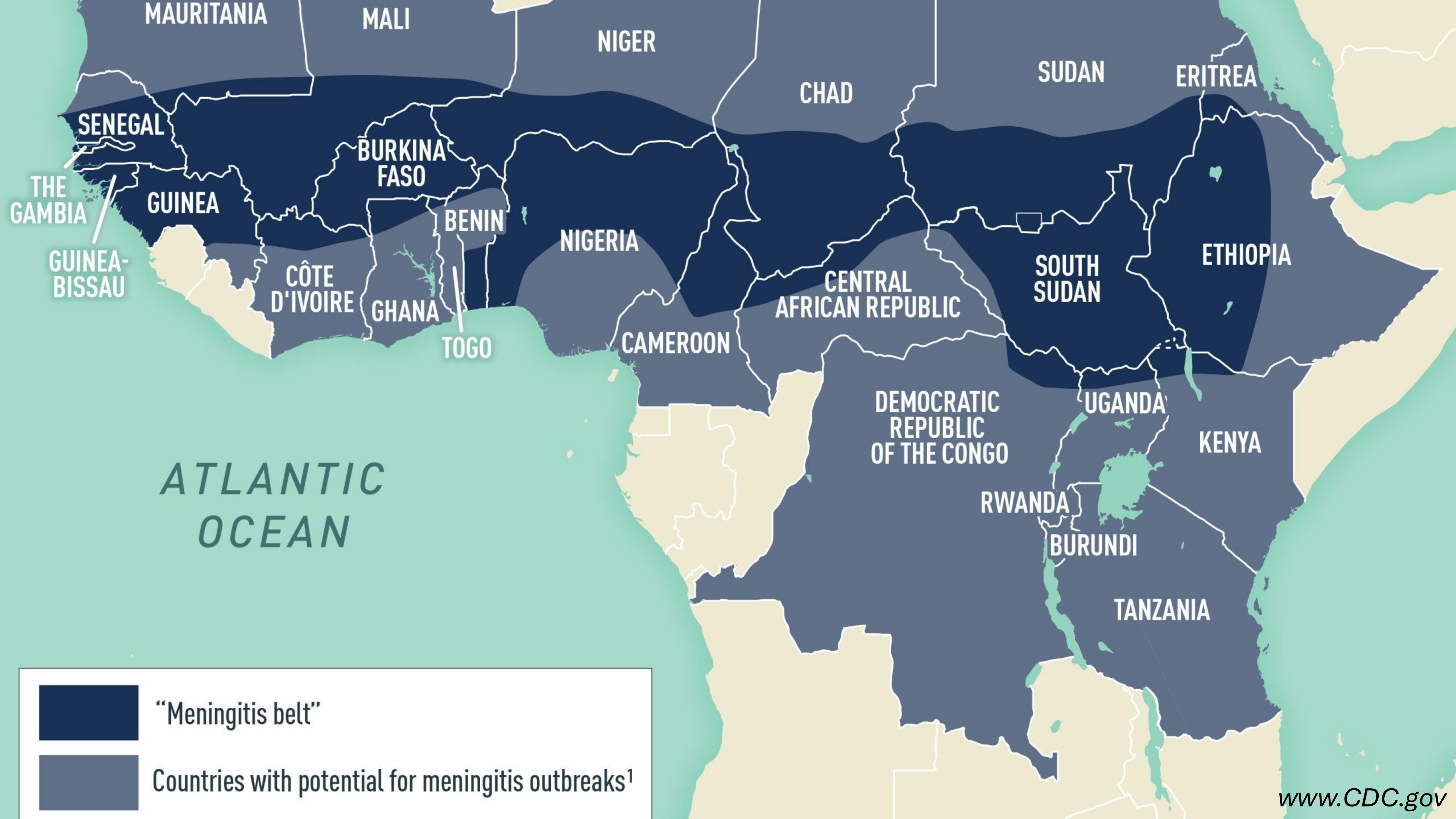


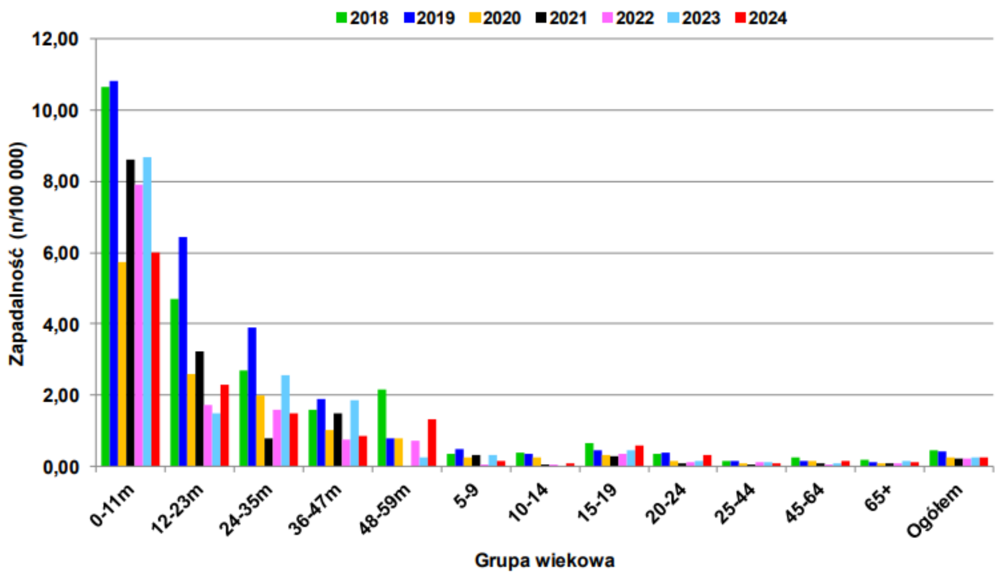
Definition & pathomechanism

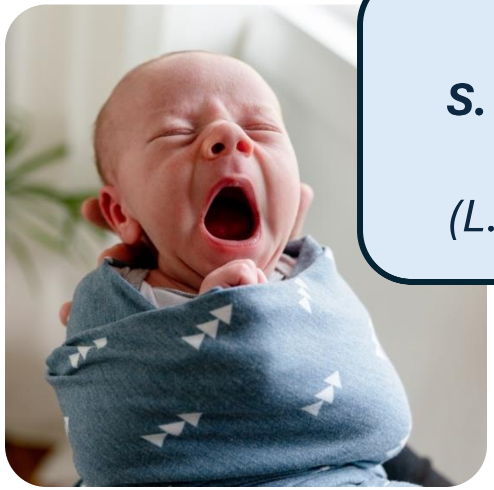
- Inflammation of the pia mater, arachnoid mater, and the subarachnoid space
- Most commonly infectious in origin:
  - bacteria
  - viruses
  - much less frequently fungi or parasites
- Most common route of infection: hematogenous spread
  - Less common: contiguous spread
- Risk factors: age, immunosuppression, head trauma, cochlear implant, ventriculoperitoneal shunt, lack of vaccination, close contact with a meningitis case, travel to/ residence in the “meningitis belt”


MAURITANIA
MALI
NIGER
CHAD
SUDAN
ERITREA
SENEGAL
BURKINA FASO
THE GAMBIA
GUINEA
BENIN
NIGERIA
GUINEA-BISSAU
CÔTE D'IVOIRE
GHANA
TOGO
ETHIOPIA
SOUTH SUDAN
CENTRAL AFRICAN REPUBLIC
CAMEROON
DEMOCRATIC REPUBLIC OF THE CONGO
UGANDA
KENYA
RWANDA
BURUNDI
TANZANIA
ATLANTIC OCEAN
"Meningitis belt"
Countries with potential for meningitis outbreaks[1]
www.CDC.gov

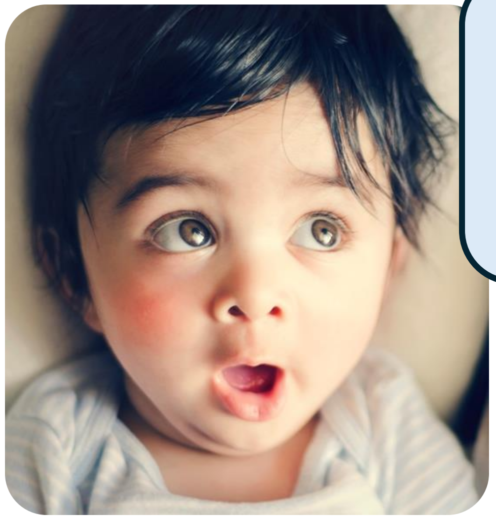
Etiology & epidemiology

- Incidence: 1–2 per 100,000
  - Highest in infants
  - Neonates: 80 per 100,000
- Etiologic factors vary by age
- Peak incidence: December–February





<u>NEONATES:</u>
***S. agalactiae* (GBS)**
E. coli
(*L. monocytogenes*)



<u>OLDER KIDS:</u>
S. pneumoniae
N. meningitidis
(*H. influenzae*)

Signs and symptoms of meningitis

Babies and Toddlers

- Fever, cold hands and feet
- Refusing food and vomiting
- Fretful, dislike being handled
- Drowsy, floppy, unresponsive
- Rapid breathing or grunting
- Pale, blotchy skin Spots/rash
- Unusual cry, moaning
- Tense, bulging fontanelle (soft spot)
- Stiff neck, dislike bright lights
- Convulsions/ seizures

Meningitis now

Signs and symptoms of meningitis

Children and Adults

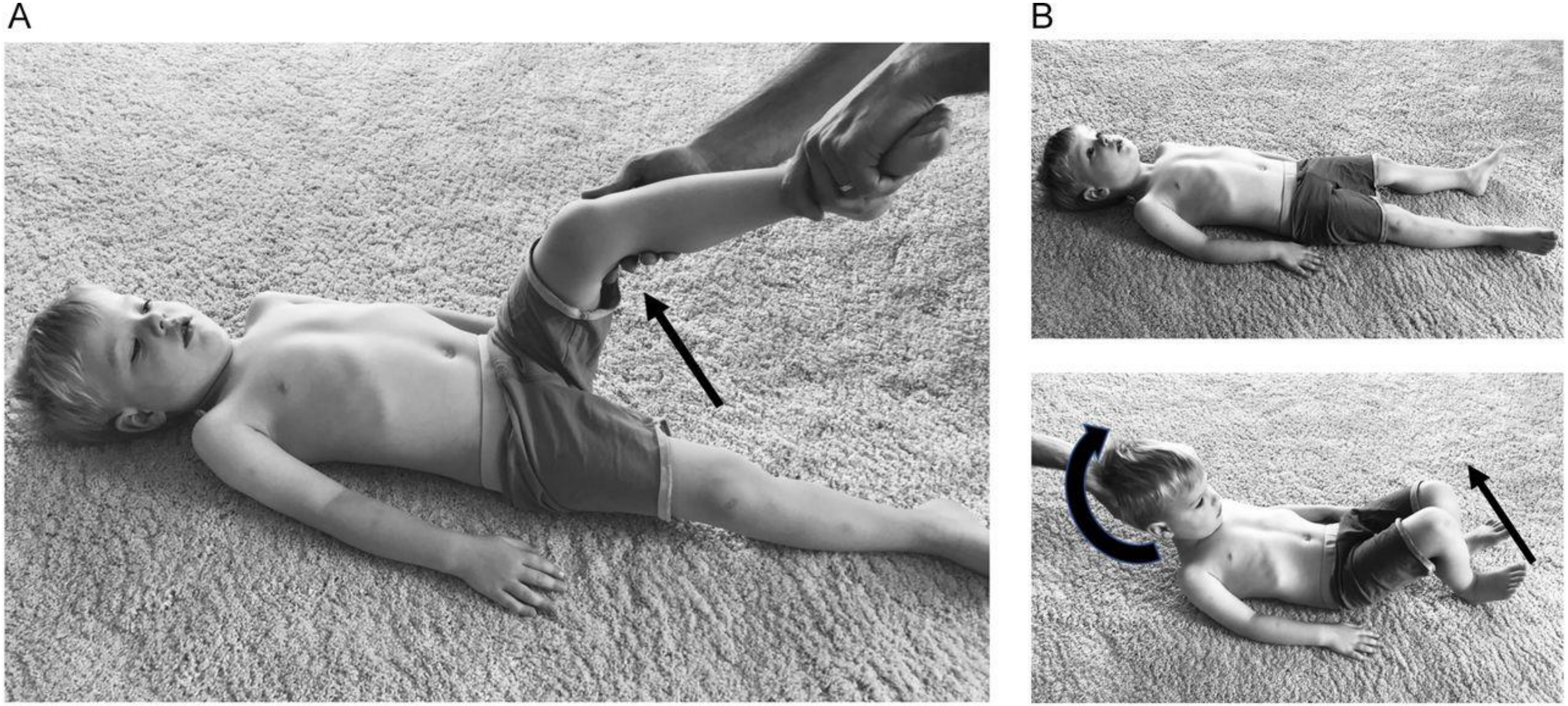
- Fever, cold hands and feet
- Vomiting
- Drowsy, difficult to wake
- Confusion and irritability
- Severe muscle pain
- Pale, blotchy skin Spots/rash
- Severe headache
- Stiff neck
- Dislike bright lights
- Convulsions/ seizures

Meningitis now

Physical Examination (Bacterial Meningitis)

- General condition: moderate / severe / progressively worsening
- Altered level of consciousness
- Vital signs: tachycardia, tachypnea, possible signs of shock
- Skin: may appear normal; may show macular rash; purpura is characteristic
- Meningeal signs

Meningeal signs



Kernig's Sign

Brudzinski's Sign

Tracy, *Archives of Disease in Childhood - Education and Practice*, 2020

Purpura

Fot. dzięki uprzejmości dr Anny Zacharzewskiej, dr Anny Piwowarczyk oraz dr D. Adamczuk-Moskwy

2 blood cultures

2 *i.v.* lines

Other tests:

- CBC
- CRP, PCT
- Glucose
- BUN, creatinine
- Na, K
- ALT, AST, bilirubin
- APTT, INR, PT, D-dimers, fibrinogen
- Blood group
- Blood gas analysis
- Lactate

Lumbar puncture,
if not contraindicated

Lumbar puncture

Contraindications to Lumbar Puncture

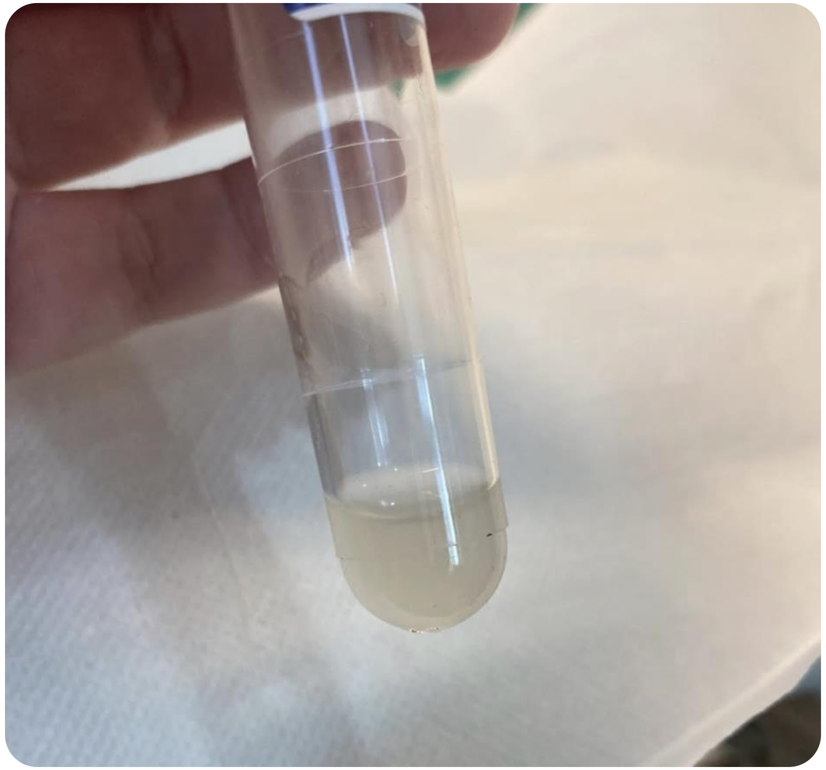
- Severe general condition
- Coagulation disorders
- Local skin infection in the lumbar region
- New-onset seizures
- Signs of focal CNS lesion
- Immunosuppression
- Moderate/severe altered consciousness (GCS < 10, fluctuating)
- Cushing's triad, abnormal pupillary reflexes

If lumbar puncture is contraindicated, treatment should be initiated immediately

Indications for Neuroimaging

https://www.rch.org.au/clinicalguide/guideline_index/Lumbar_puncture

CSF – bacterial meningitis

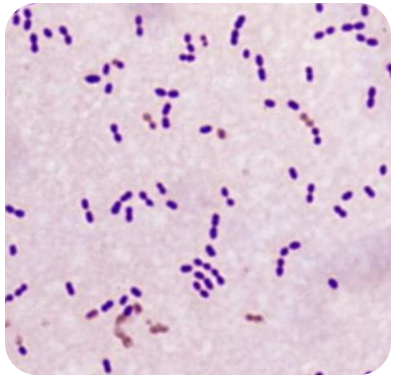


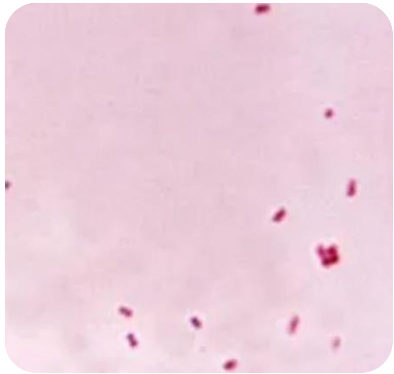
GENERAL EXAMINATION

- Cloudy fluid
- Decreased glucose concentration
- Elevated protein concentration
- Elevated lactate concentration
- Pleocytosis (generally >2000/μL) with predominance of neutrophils

PATHOGEN IDENTIFICATION

- Direct smear
- PCR
- **Culture**





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Lumbar puncture,
if not contraindicated

Treatment

1-3 h!

Isotonic fluid *i.v.* 10-20 ml/kg,
Rate dependent on the degree of dehydration

Dexamethasone	**0.15 mg/kg**
Ceftriaxone	**100 mg/kg**
Vancomycin	**15 mg/kg**

Initiall treatment

- Dexamethasone 4 × 0.15 mg/kg i.v. (max. 10 mg) for 4 days should be administered to all patients with meningitis, except for neonates and those infected with L. monocytogenes

Empirical antibiotic therapy

Neonates	Ampicillin + cefotaxime or gentamycin
People up to 50 years old	Ceftriaxone or cefotaxime + vancomycin
People >50 years old **Pregnant** **Immunosupressed**	Cefotaxime or ceftriaxone Vancomycin Ampicillin

van de Beek, *Lancet*, 2021

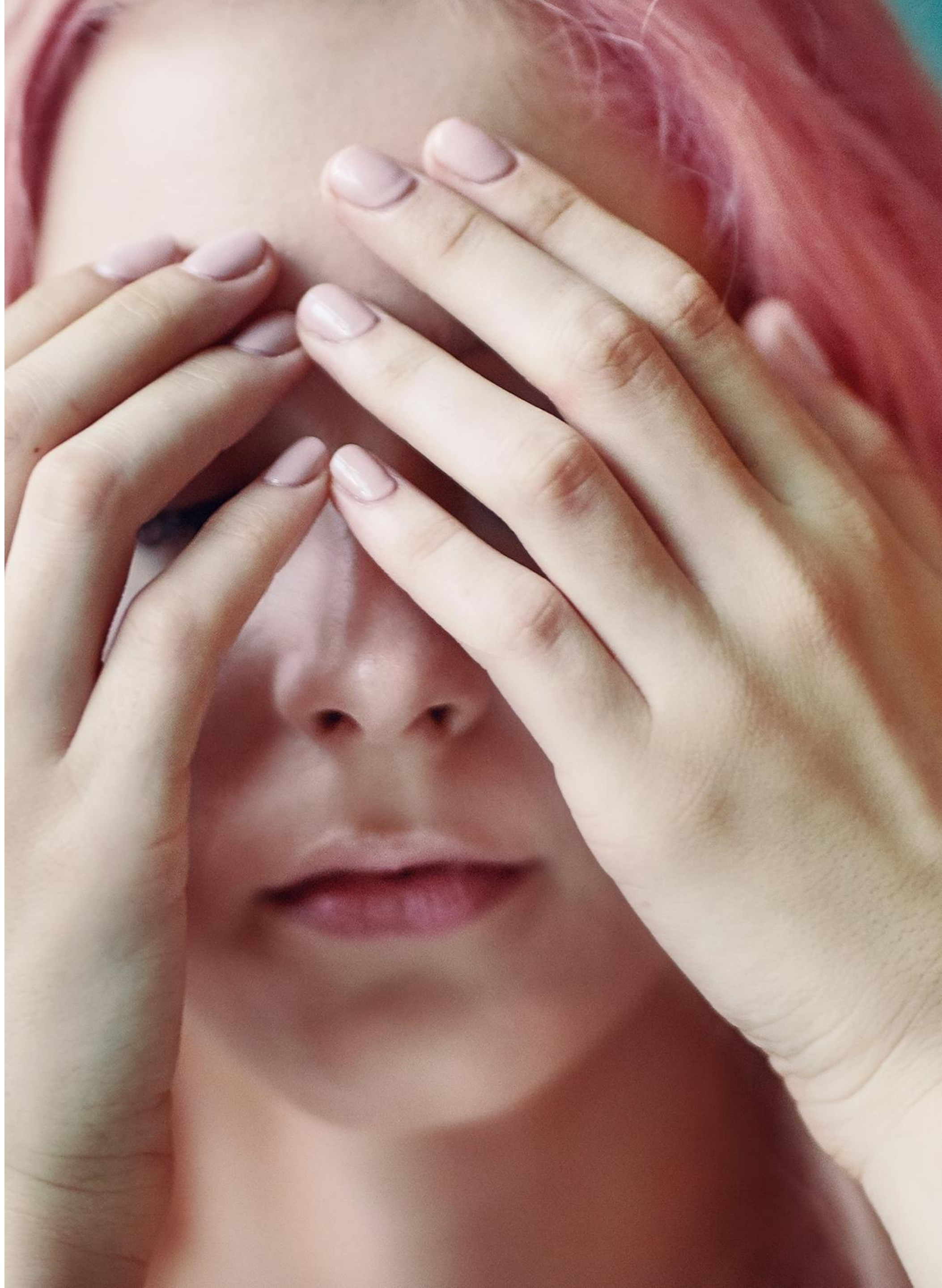
Targeted treatment

- Antibiotic therapy with the narrowest possible spectrum, depending on the antibiogram results

- Duration of treatment:
  - *S. pneumoniae* 10-14 days
  - *N. meningitidis* 7 days
  - *H. influenzae* 7-10 days
  - *S. agalactiae* 14-21 days
  - *L. monocytogenes, E. coli* min. 21 days

Patient with viral meningitis

- **Same symptoms**: fever, headache, photophobia, vomiting, but generally better overall condition; vital signs often normal
- **Possible concomitant symptoms** typical for viral infection: e.g., symmetrical rash, pharyngitis, diarrhea
- History of exposure to a person with viral infection
- Most common cause: **ENTEROVIRUSES**
- Highest incidence: **summer**
- **CSF findings**: pleocytosis usually <1000 cells/μL and slightly elevated protein concentration
- **Treatment**: symptomatic only



Patient with encephalitis

- Fever and meningeal symptoms may be present, but features of CNS involvement predominate:
  - **Altered consciousness (>24 h, mandatory criterion)**
  - Focal neurological signs
  - Seizures
- Often **severe, unpredictable** course with life-threatening potential
- **Etiology**: most commonly viral, but autoimmunization is also possible
- Most frequent cause **in Poland: TBE** (tick-borne encephalitis)
- **CSF findings**: pleocytosis usually <1000 cells/µL and slightly elevated protein concentration
- Empirical treatment: **acyclovir should always be administered** until HSV and VZV infection are excluded


KEEP
CALM
AND
STICK TO
THE PLAN


KEEP
CALM
AND
VACCINATE
YOUR KIDS