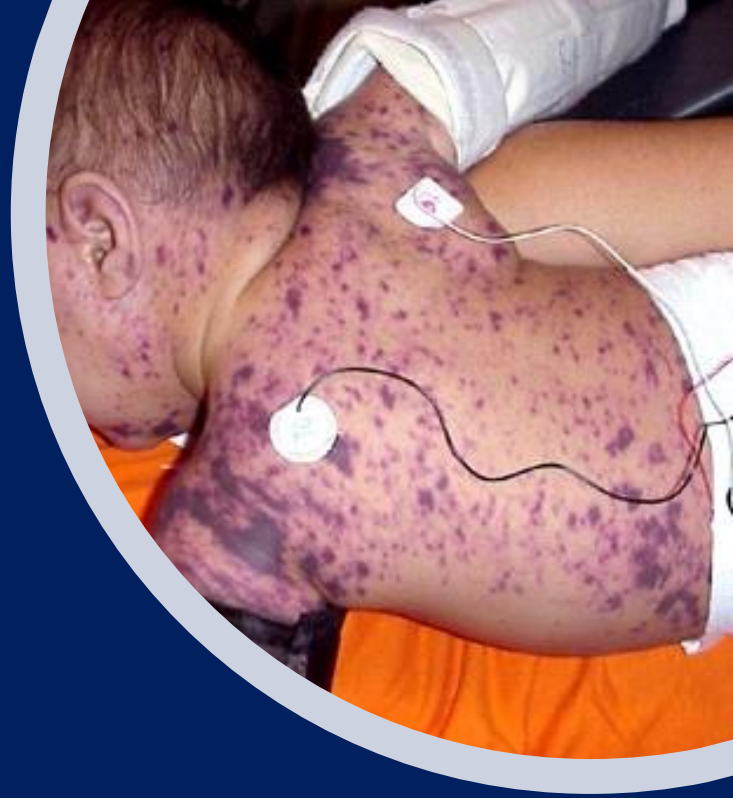
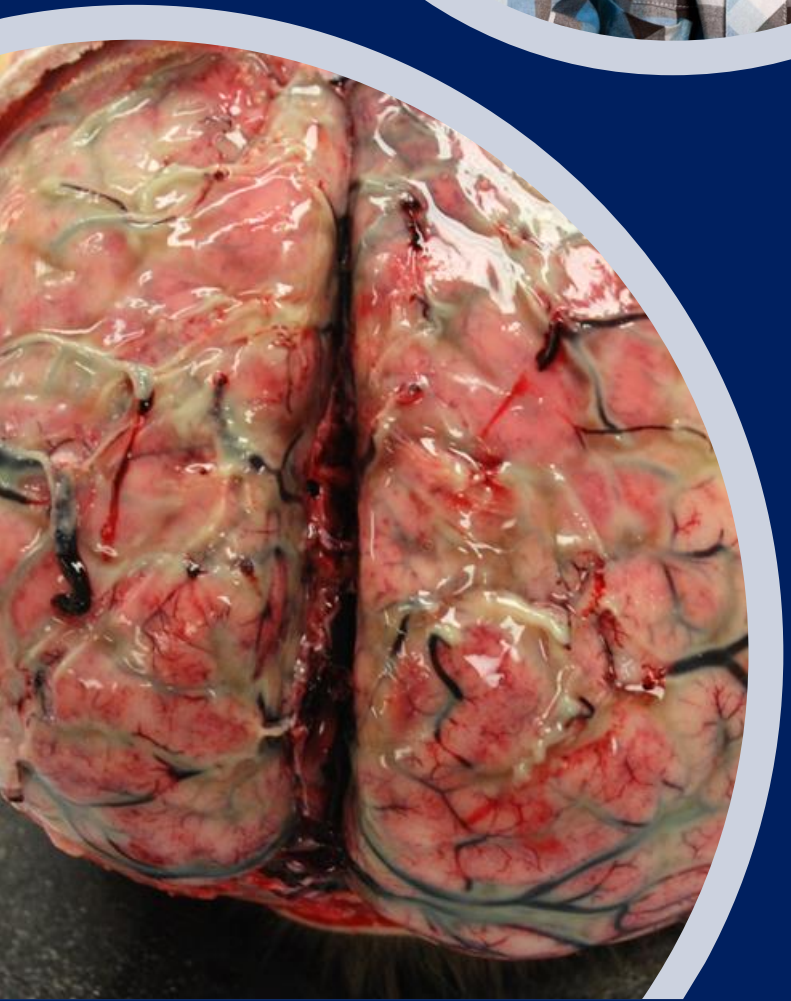


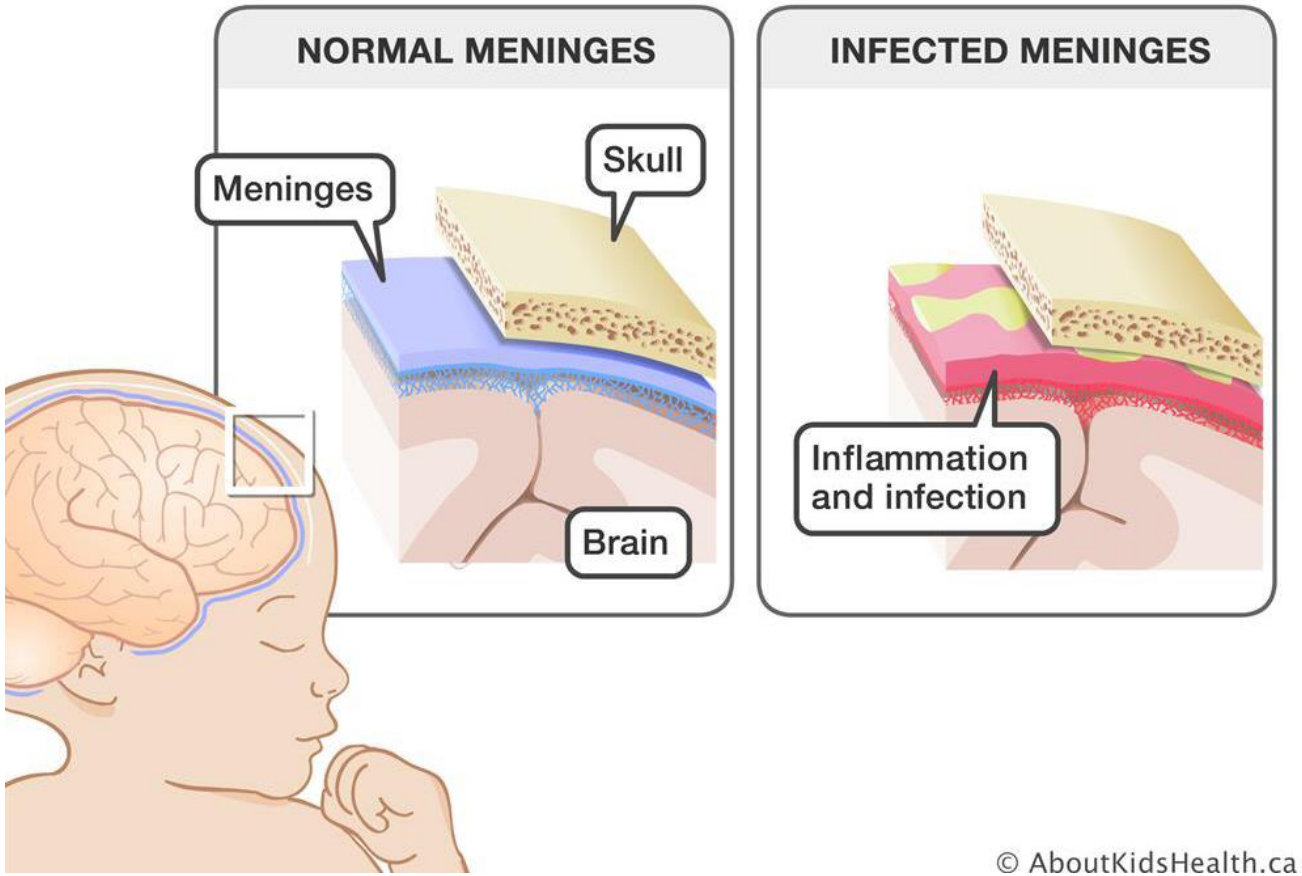


Magdalena Okarska-Napierała

Meningitis in children

Meningitis

- Inflammation of meninges (pia mater, arachnoid and subarachnoid space)
- Usually infectious
- Usually blood-born
- Bacterial meningitis = **life threaten** / risk of serious complications



Etiology

Bacterial meningitis	**ETIO**
Newborns	*S. agalactiae*, *E. coli*, *Klebsiella* spp., G(-) bacilli, *L. monocytogenes*
Infants 1-3/12	*N. meningitidis*, *H. infuenzae*, *S. pneumoniae*, rarely – neonatal pathogens
Older infants, children and adults	*S. pneumoniae*, *N. meningitidis* (B, C, W), *H. influenzae*, rarely: *L. monocytogenes*
Viral meningitis	
	Enterovirus, Herpes family, TBE

!

Meningitis Symptoms

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

Meningitis now

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

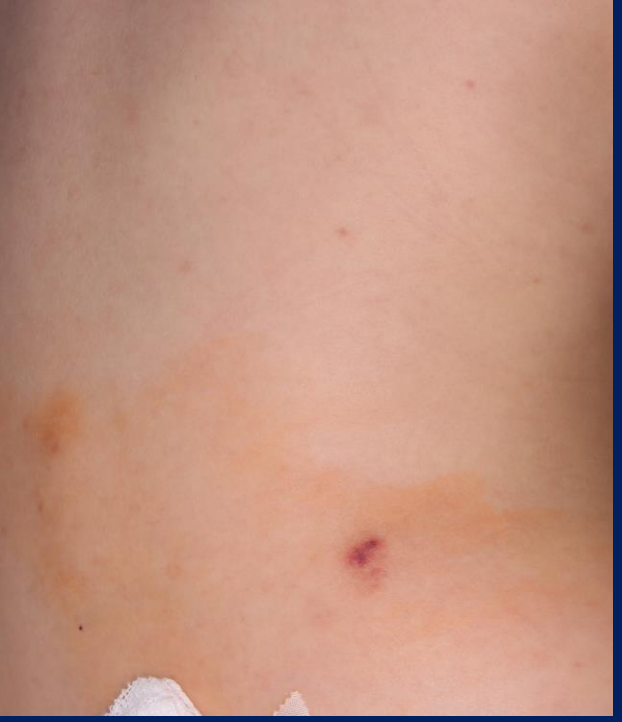
Tense,
bulging
fontanelle
(soft spot)

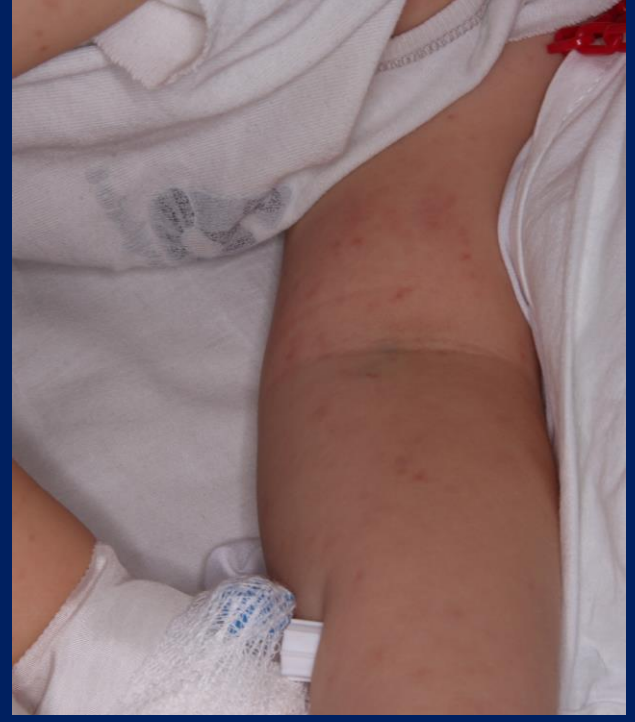
Stiff neck,
dislike
bright
lights

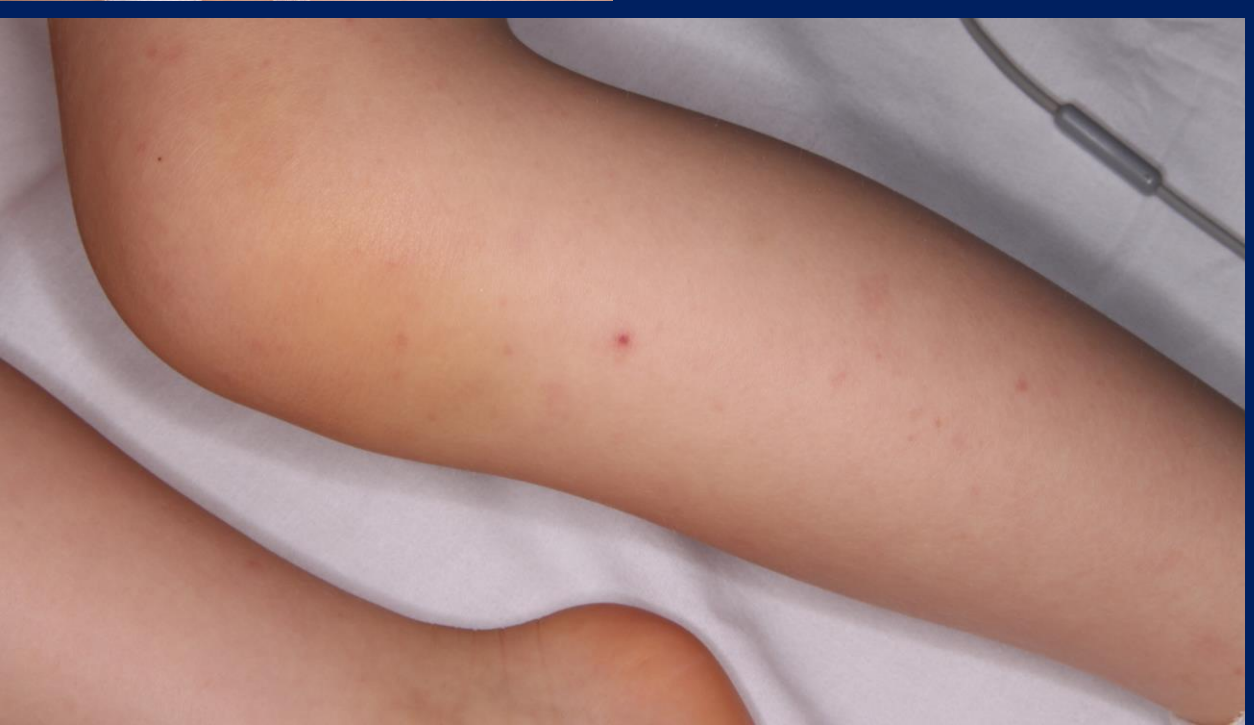
Convulsions/
seizures

Viral meningitis – clinical picture

- **Relatively good general condition**
- Possible coexistence of **other viral signs and symptoms** – sore throat, conjunctivitis, wysypka rash, diahorrea
- Viral infection in close contacts







Physical

- **General condition**: usually severe
- **Vitals**: fever, tachycardia, tachypnoe, possible shock
- The skin: macular rash —> **purpura**
- bulging **fontanelle**
- **MENINGEAL SIGNS**

?

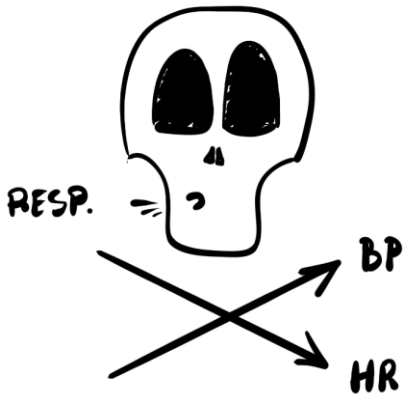
clinical picture of **MENINGITIS**

1) VITALS: HR, RR, BP, sat, temp, GCS
2) Oxygen
3) Lab tests:
    1) 2 x blood CULTURE
    2) CBC + smear
    3) CRP, PCT, BUN, creat, glucose, Na, K
    4) Clotting: APTT, INR, fibrynogen
    5) Blood gases

Lumbar puncture, if no ***contraindications***

Contraindications
To lumbar puncture

1) Grave general condition
2) Skin infection in lumbar area
3) Severe coagulation abnormalities
4) Immunosupression
5) CNS disease in past
6) New seizures episode
7) Cushing triad
8) Papilledema
9) New focal neurologic signs
10) Abnormal consciousness



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Lumbar puncture, if no ***contraindications***

Computed tomography

NO ROUTINE CT

CT CAN'T DELAY TREATMENT!

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To lumbar puncture

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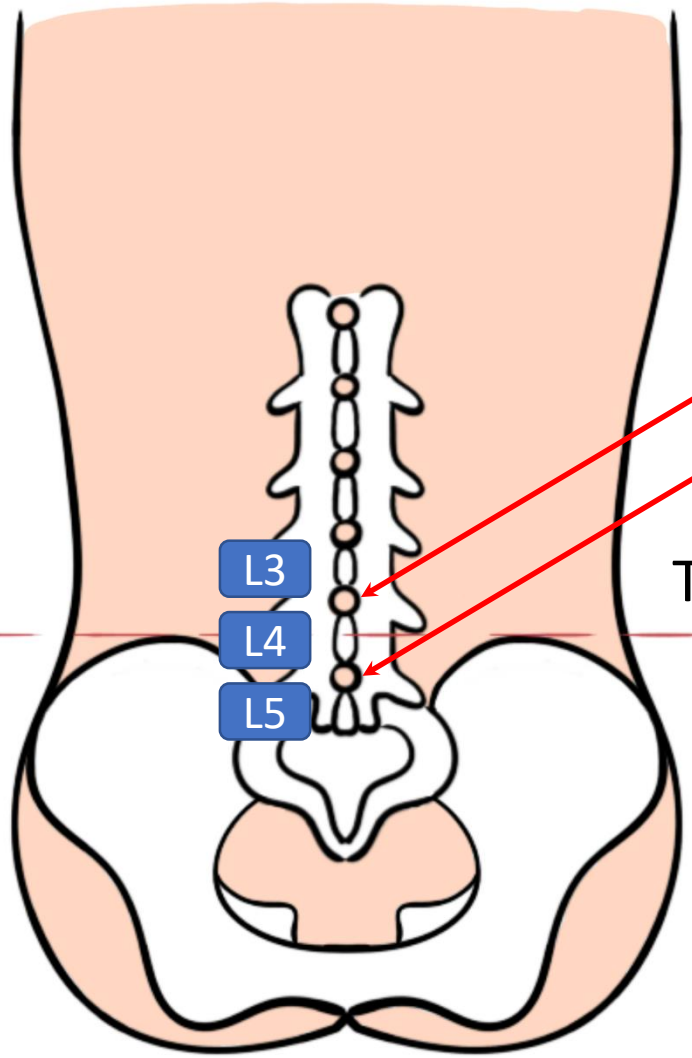
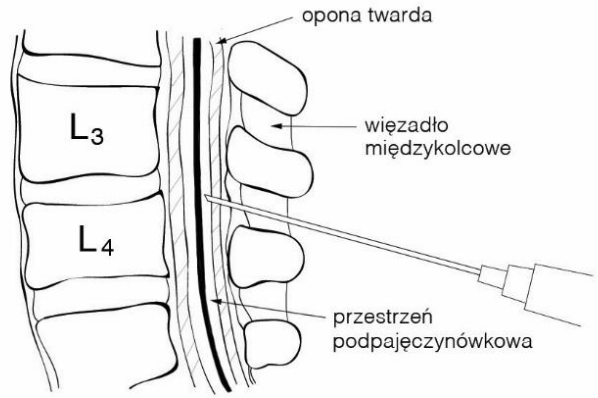
Lumbar puncture



Tuffier's line



Lumbar puncture

- Local/systemic anesthesia
- Glucose measurement
- 3 x wash
- Puncture – 3 probes:
  - biochemistry
  - smear
  - culture
  - PCR!

	Healthy neonate	Zdhelathy infant	Child > 12/12	Bacterial meningitis	Viral meningitis/ encephalitis	Neuro-boreliosis	TB
Colour	Colourless			Yellowish or greenish	Clolourless	Clourless	Colourless
Transparency	Transparent			Clouded	Transparent	Transparent or opalescent	
Cytosis	≤ 10	≤ 5		> 1000 (NEUT)	Several dozen - hundred (initially NEUT, then LYMPH)		Several dozen–500 (LYMPH)
Protein [mg/dl]	< 100	< 40	15-45	> 100	50-200		> 100
Glucose CSF/serum	≥ 0.6			< 0.4	> 0.6		< 0.3
Lactate[mg/dl]	< 2.1			> 4	2,1 – 3	N lub ↑	> 4
Chloride [mmol/l]	> 117			N lub ↓	N lub ↓		↓

clinical picture of **MENINGITIS**

1) VITALS: HR, RR, BP, sat, temp, GCS
2) Oxygen
3) Lab tests:
    1) 2 x blood CULTURE
    2) CBC + smear
    3) CRP, PCT, BUN, creat, glucose, Na, K
    4) Clotting: APTT, INR, fibrynogen
    5) Blood gases

1) Dexamethasone 2 x 0.4 mg/kg
2) ATB: **cefalosporin III gen + vancomycin**
3) Correction od hypovolemia, hypoglicemia, acidosis, coagulopathy
4) Head elevation 20-30 degrees

Contraindications
To lumbar puncture

1) Grave general condition
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10) Abnormal consciousness

TREATMENT: first **ATB**

Bacterial meningitis	**LECZENIE**
Neonates	Ampicillin + (gentamicin OR cefotaxime)
Infants 1-3/12	(Cefotaxime OR ceftriaxone) + vancomycin + possibly ampiicillin
Older infants, children, adults	**(Cefotaxime OR ceftriaxone) + vancomycin**
Viral meningitis	
	???

TREATMENT: second **FLUIDS**

- Fluid resuscitation:

20 ml/kg balanced crystalloid in bolus

- 40-60 ml/kg if needed (up to 3 boluses)
- 20 ml/kg/h of balanced crystalloid for 2-4 h in case of dehydration without shock
- Maintenance needs afterwards

TREATMENT: third **supportive treatment**

• Low glucose?	Glucose iv.
• DIC?	FFP / cryoprecipitate / PLT
• Brain oedema?	Mannitol / 3% NaCl
• Seizures?	Diazepam / midazolam / phenobarbital


KEEP
CALM
AND
STICK TO
THE PLAN


KEEP
CALM
AND
VACCINATE
YOUR KIDS