



SÝKINGAR Í MIÐTAUGAKERFINU



Læknanemar 5. ári

2026-2027

Valtýr Stefánsson Thors - Smitsjúkdómar barna

Þetta þurfið þið að kunna

- Meingerð
- Orsakir eftir aldri sjúklings
- Áhættuþættir
- Einkenni eftir aldri sjúklings
- Uppvinnsla og greining
- Meðferð og meðferðalengd eftir orsökum
- Helstu langvarandi afleiðingar heilahimnubólgu
- Mismunagreiningar

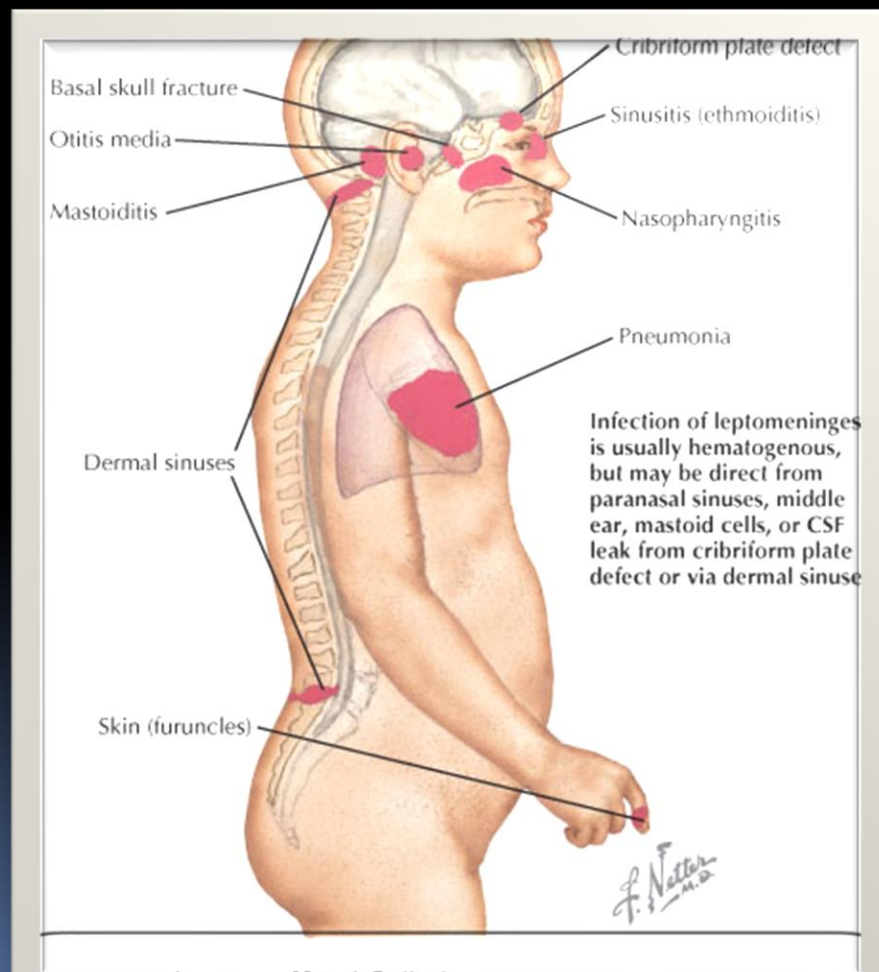


Meingerð?



Meingerð-Pathogenesis

- Fimbria og pili auka viðloðun við slímhúð
- Brjóta sér leið inn í blóðrás og verjast complement kerfinu með fjölsykruhjúp sínum
- Brjóta sér leið í gegnum blood brain barrier, fjölga sér og valda bólgusvari





Orsakir heilahimnubólgu?

- Nýburar-4 vikna
- Eldri en 4 vikna





Orsakir heilahimnubólgu

Fyrirburar/nýburar- 4 vikur

- gr. B Strep. - GBS
- *E. coli*
- *S. aureus*
- CONS
- Enterococcus
- *N. meningitidis*
- *S. pneumoniae*
- *Listeria monocytogenes*
- Enteroveirur
- HSV

Börn >4 vikna

- *S. pneumoniae*
- *N. meningitidis*
- Enteroveirur
- Gram neikvæðir stafir:
 - *E.coli, Pseudomonas, Klebsiella*
- gr. B Strep. - GBS
- HSV



Áhrif áhættupátta á orsakir?



Áhrif undirliggjandi áhættuþátta!

Áhættuþættir	Bakteríur
Leki á mænuvökva (eyru/nef)	<i>S. pneumoniae</i> , <i>H. infl.</i>
Dermal sinus tract, meningomyelocele	Staphylococcar, gram neikvæðar bakt.
Terminal komplement galli	<i>N. meningitidis</i>
Asplenia	<i>S. pneum.</i> , <i>N. meningitidis.</i> , <i>Salmonella spp.</i>
Nýrnatransplant, T-lymphocyta galli, nýburi	<i>Listeria monocytogenes</i>
Fistula í eyra (stapes, footplate, oval window) Cochlear implant	<i>S. pneumoniae</i>
Ventricular peritoneal shunt	Staphylococcar, <i>S. pneum.</i> , <i>H. infl.</i> , <i>N. meningitidis</i> , Diptheroids
Alvarlegir ónæmisgallar s.s HIV eða hypogammaglobulinaemia	<i>S. pneum.</i> , <i>H. influenzae B</i> , <i>N. meningitidis</i> , TB
Penetrating trauma	Fer eftir gerð áverka (hunda eða katta bit: <i>P. multocida</i> , húðbakteríur við höfuðáverka osfrv.
Skurðaðgerð	Húðbakteríur, spítalabakteríur
Óbólusettir	<i>H. influenzae B</i> , <i>N. meningitidis</i> , <i>S. pneumoniae</i>



Lífsmörk og mat

Hvað á að mæla/meta?

- Hitastig
- Púls
- Öndunartíðni
- Blóðþrýstingur
- Háræðafylling
- Súrefnismettun
- Ljósop
- Útbrot
- Hnakkastífleiki, fontanella
- Meðvitundarstig (AVPU eða Glasgow-Coma)

Eðlileg gildi

Aldur	Púls/min	Önduntíð.	Systol BP
< 1árs	110-160	30-40	70-90
1-2	100-150	25-35	80-95
2-5	95-140	25-30	80-100
5-12	80-120	20-25	90-110
Eldri en 12	60-100	15-20	100-120



Klínísk einkenni

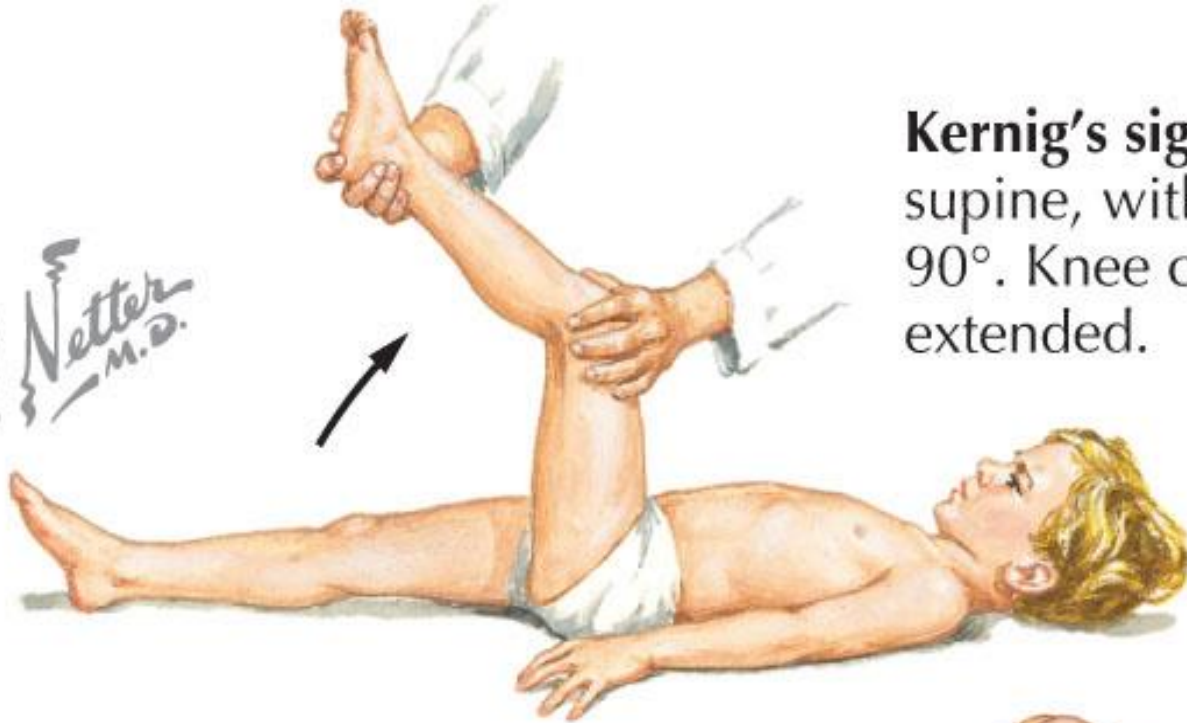
Fyrirburar/nýburar- 4 vikur

- Óstábílt hitastig. $>38^{\circ}\text{C}$ eða $<36^{\circ}\text{C}$ (60%)
- Pirringur (60%), slappleiki, skjálfti eða krampar (20-50%) oftast staðbundnir
- Spennt fontanella (25%) hnakkastífleiki (15%)
- Drekka illa
- Öndunarörðugleikar, apneur
- Septískt lost

Börn > 4 vikna

- Hiti
- Einkenni heilahimnu-ertingar: ógleði, uppköst, pirringur, höfuðverkur, lystarleysi, rugl, bakverkur, hnakkastífleiki
- Krampar generaliseraðir 20-30%
- Húðblæðingar
- Heilahimnuerting: Kernig eða Brudzinski sign
- Septískt lost

Kernig's sign. Patient supine, with hip flexed 90°. Knee cannot be fully extended.



Neck rigidity (Brudzinski's neck sign). Passive flexion of neck causes flexion of both legs and thighs.



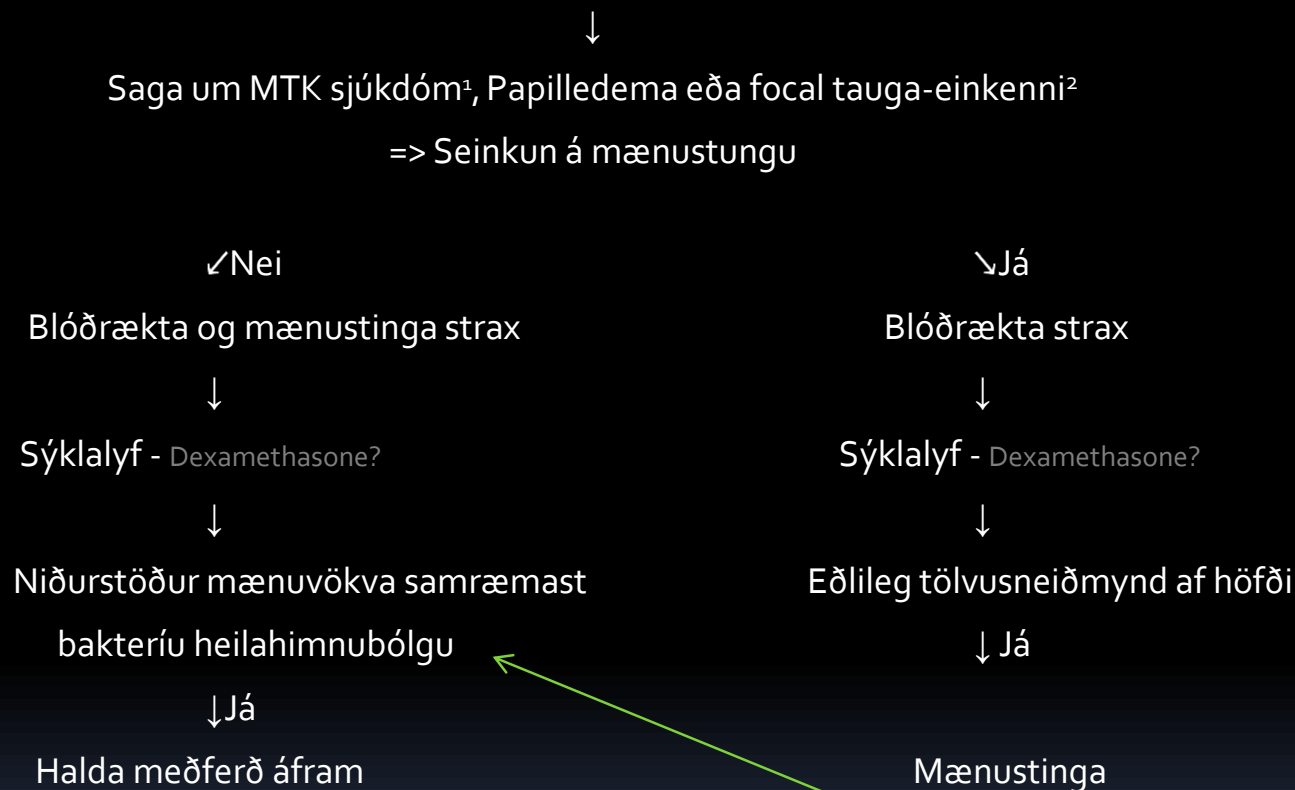


Grunur um heilahimnubólgu

Hvað geri ég næst?

Ef grunur um Heilahimnubólgu

Hvað geri ég næst: A-B-C



1. CSF shunt, hydrocephalus, áverki á MTK, heilaskurðaðgerð
2. Lömun einskorðuð við abducenstaug (VI) eða andlitstaug (VII) er ekki talin ástæða til að seinka mænustungu.

Review article

Should corticosteroids be used in bacterial meningitis in children?

Susanna Esposito*, Margherita Semino, Irene Picciolli, Nicola Principi

Pediatric Clinic, Department of Pathophysiology and Transplantation, Università degli Studi di Milano, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy

3.1. Mortality rate

Corticosteroids for acute bacterial meningitis

Matthijs C Brouwer¹, Peter McIntyre², Kameshwar Prasad³, Diederik van de Beek⁴

¹Department of Neurology, Center for Infection and Immunity Amsterdam (CINIMA), Academic Medical Center University of Amsterdam, Amsterdam, Netherlands. ²National Centre for Immunisation Research and Surveillance of Vaccine Preventable Diseases, Children's Hospital at Westmead and University of Sydney, Sydney, Australia. ³Department of Neurology, All India Institute of Medical Sciences (AIIMS), New Delhi, India. ⁴Department of Neurology, Academic Medical Centre, University of Amsterdam, Amsterdam, Netherlands

Contact address: Diederik van de Beek, Department of Neurology, Academic Medical Centre, University of Amsterdam, P.O. Box 22660, Amsterdam, 1100 DE, Netherlands. D.vandeBeek@amc.uva.nl.

Editorial group: Cochrane Acute Respiratory Infections Group.

Publication status and date: Edited (no change to conclusions), comment added to review, published in Issue 11, 2018.

Citation: Brouwer MC, McIntyre P, Prasad K, van de Beek D. Corticosteroids for acute bacterial meningitis. *Cochrane Database of Systematic Reviews* 2015, Issue 9. Art. No.: CD004405. DOI: [10.1002/14651858.CD004405.pub5](https://doi.org/10.1002/14651858.CD004405.pub5).

Copyright © 2018 The Cochrane Collaboration. Published by John Wiley & Sons, Ltd.

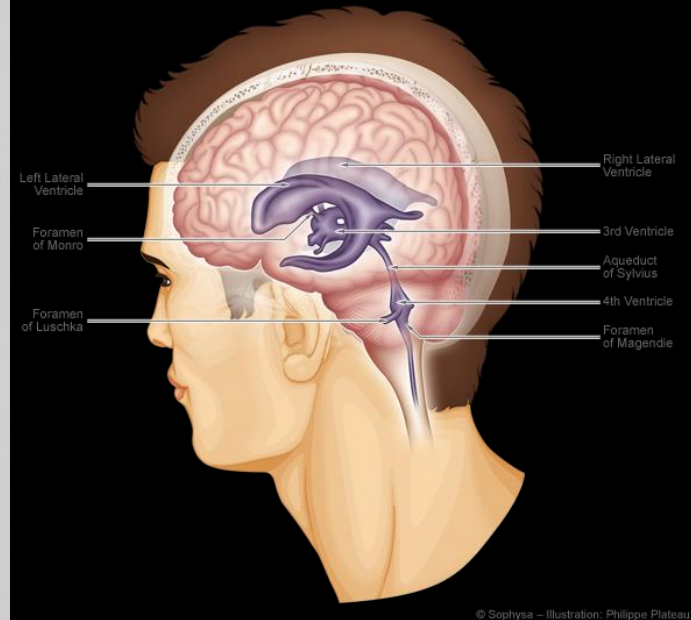
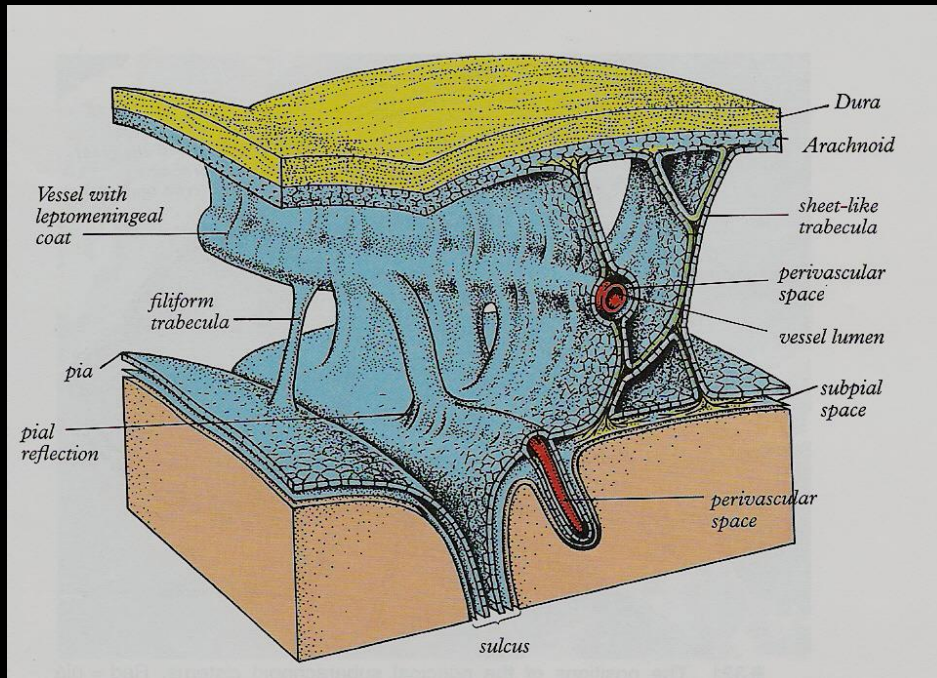


Rannsóknir

- CSF:
 - frumtalning, granslitun og ræktun, glúkósi, protein, HSV og enteroveiru PCR
 - Sérstakur panell fyrir PCR
 - Helstu veirur og bakteríur
- Blóð:
 - Blóðræktun, blóðstatus og deilitalning, electrolýtar, glúkósi, kreatinin, Urea, ALAT, PT, PTT

Hverjir þurfa tölvusneiðmynd af höfði fyrir mænustungu?

- Merki um aukin innankúpuþrýsting
- Papilledema
- Focal neurólógísk einkenni: Vítt ljósstíft annað sjáaldur, óeðlilegar augnhreyfingar, óeðlilegt tal, lömun í útlim.
- Saga um innankúpuvandamál, ss. saga um heilatumor, hydrocephalus, VP-shunt.

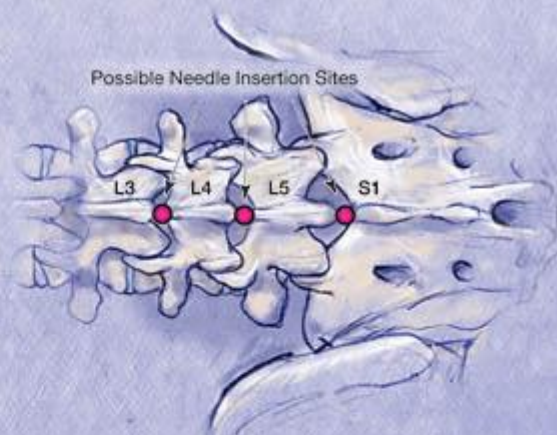
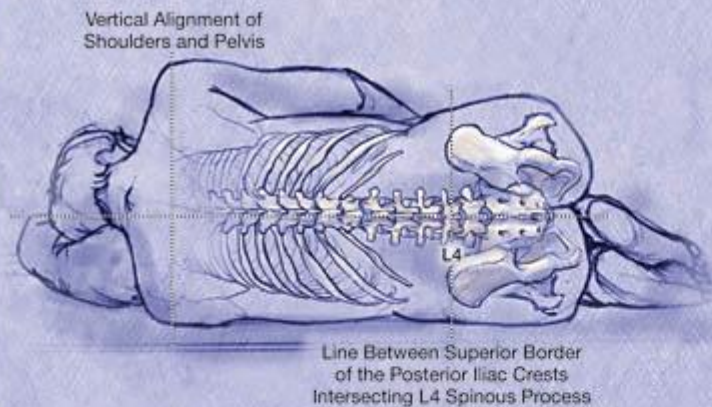


Magn mænuvökva: Nýburi 40 mL
Eldri börn 90 mL
Fullorðnir 150 mL

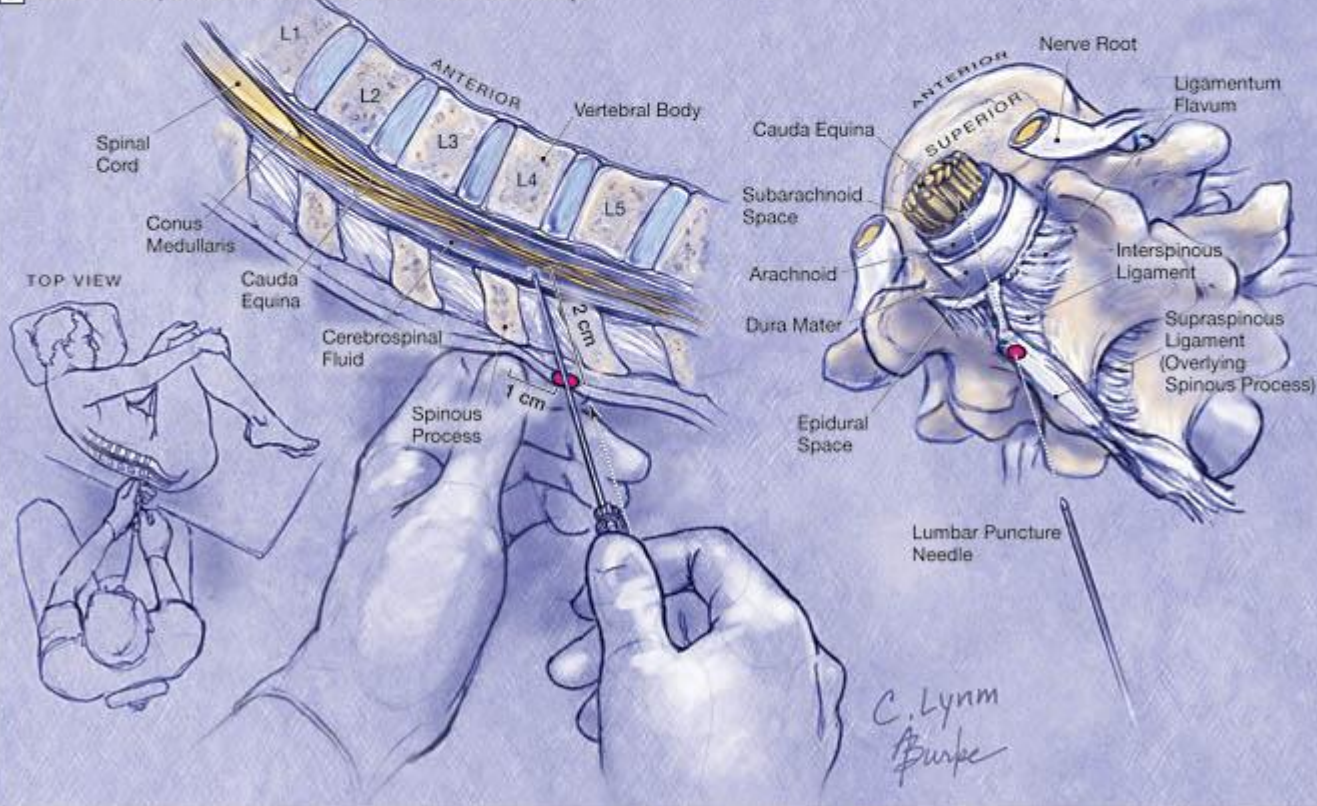


NÚ ÆTLA ÉG AÐ MÆNUSTINGA
HVERNIG GERI ÉG ÞAÐ OG Í
HVAÐA LIÐBIL?

A Patient Position and Identification of Bony Landmarks



B Hand Position, Needle Direction, and Anatomical Relationships



Cerebrospinal fluid analysis in central nervous system infection

	Glucose (mg/dL)		Protein (mg/dL)		Total white blood cell count (cells/ μ L)		
	<10*	10-45•	>250Δ	50-250◇	>1000	100-1000	5-100
More common	Bacterial meningitis	Bacterial meningitis	Bacterial meningitis	Viral meningitis Lyme disease Neurosyphilis	Bacterial meningitis	Bacterial or viral meningitis TB meningitis	Early bacterial meningitis Viral meningitis Neurosyphilis TB meningitis
Less common	TB meningitis Fungal meningitis	Neurosyphilis Some viral infections (such as mumps and LCMV)	TB meningitis		Some cases of mumps and LCMV	Encephalitis	Encephalitis

LCMV: lymphocytic choriomeningitis virus.

* <0.6 mmol/L

• 0.6-2.5 mmol/L

Δ >2.5 g/L

◇ 0.5-2.5 g/L



MEÐFERÐ HEILAHIMNUBÓLGU?



Meðferð við heilahimnubólgu

Fyrirburar/nýburar- 4 vikur

- Stuðningsmeðferð: súrefnismettun, hypoglycemia, krampalyf, ICP, vökvameðferð og saltbúskapur.
- **Cefotaxime og ampicillin.**
- Ef Gram neikvæðir stafir oft gentamicin bætt við 3ju kynslóðar cephalosporin.
- Acyclovir

Börn >1 mánaða

- Stuðningsmeðferð sbr. fyrr.
- **Cefotaxime og ampicillin** ef <6-8 vikna
- **Ceftriaxone** ef >6-8 vikna
- Ef Gram neikvæðir stafir oft gentamicin bætt við 3ju kynslóðar cephalosporin.
- Acyclovir



Meðferðarlengd við heilahimnubólgu

Fyrirburar/nýburar- 4 vikur

- Strep. gr. B. 14-21 dagar
- Gram neikvæðir stafir: 21 dagur eða 14 daga eftir sterílan mænuvökva
- *Listeria monocytogenes* 14 dagar
- HSV 3 vikur
- Endurtaka mænustungu eftir 2 daga á meðferð ef ekki góð svörun

Börn >1 mánaðar

- *S. pneumoniae* 10-14 dagar
- *N. meningitidis* 5-7 daga
- *H. influenzae* 7-10 daga
- *L. monocytogenes* 14-21 dagur
- Gram neikvæðir stafir : 21 dagur eða 14 daga eftir sterílan mænuvökva
- *S. aureus* amk. 2 vikur
- HSV 3 vikur



BRÁÐAR OG LANGVARANDI
AFLEIÐINGAR
HEILAHIMNUBÓLGU?

Bráðar og langvarandi afleiðingar heilahimnubólgu

Fyrirburar/nýburar- 4 vikur

- Dánartíðni <10%
- Septískt lost, DIC, ARDS, ↑ICP
- Meðvitundarskerðing
- Subdural eða epidural abscess
- 20% miðlungs-alverleg fötlun (CP sem veldur takmökum á ADL, veruleg þroskaskerðing, blinda og heyrnarskerðing/leysi)
- 35% væg fötlun

Börn >1 mánaðar

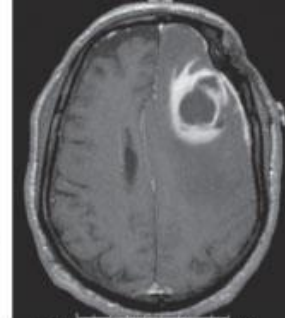
- Dánartíðni <10%
- Septískt lost, DIC, ARDS, ↑ICP
- Meðvitundarskerðing
- Subdural eða epidural abscess
- Akút krampar 20-30%
- Heyrnarskerðing/leysi 11%
- Vitsmunaleg þroskaskerðing 4%
- Lamanir og/eða spastískir limir 4%
- Langvarandi krampar 4%



MISMUNAGREININGAR?

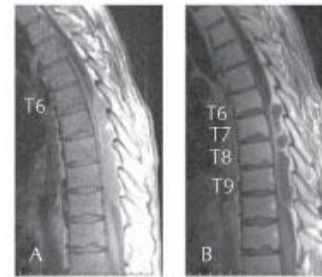
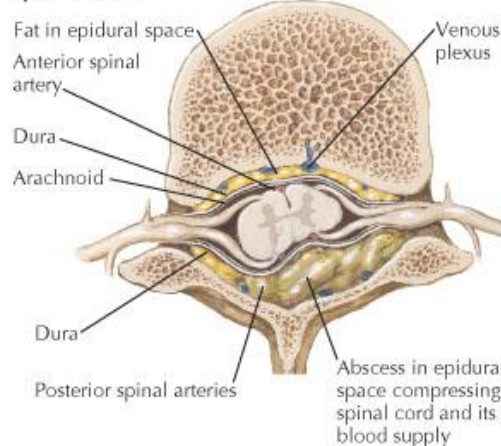
Mismunagreining við heilahimnubólgu

Brain abscess



Axial T1-weighted gadolinium enhancing left frontal mass with central hypointensity

Epidural abscess



Epidural abscess. Sagittal T1-weighted images without (A) and with (B) gadolinium enhancement demonstrate an extensive posterior epidural process from T6 to T11. Enhancement of the granulation tissue allows appreciation of nonenhancing focal pus collections.

Subdural abscess



Osteomyelitis of skull, with penetration of dura to form subdural "collar button" abscess

Copyright © 2012 Elsevier Inc. www.netterimages.com Netter's Pediatrics

Ekki gleyma encephalitis!

Possible infectious etiologies of meningoencephalitis

Viruses	Bacteria
Herpes simplex type 1	<i>Mycoplasma pneumoniae</i>
Herpes simplex type 2	<i>Listeria monocytogenes</i>
Enteroviruses (echovirus, parechovirus, coxsackievirus A and B, poliovirus, and the numbered enteroviruses)	<i>Mycobacterium tuberculosis</i>
Varicella zoster virus	<i>Treponema pallidum</i>
Epstein-Barr virus	<i>Bartonella henselae</i> (cat scratch disease)
Cytomegalovirus	<i>Bartonella quintana</i> ("trench fever")
Human herpesvirus 6	<i>Borrelia burgdorferi</i> (Lyme disease)
Human immunodeficiency virus	<i>Coxiella burnetii</i> (Q fever)
Arboviruses (LaCrosse virus, West Nile virus, St. Louis encephalitis virus , Eastern and Western equine encephalitis virus, Japanese encephalitis virus)	<i>Rickettsia rickettsii</i> (Rocky Mountain spotted fever)
Rabies virus	<i>Ehrlichia chaffeensis</i> (human monocytotropic ehrlichiosis)
Influenza virus	<i>Anaplasma phagocytophilum</i> (human granulocytotropic ehrlichiosis)
Measles virus	Fungi
Mumps virus	<i>Cryptococcus neoformans</i>
Rubella virus	<i>Coccidioides species</i>
Murray Valley encephalitis virus	<i>Histoplasma capsulatum</i>
Nipah virus	Parasites
Hendra virus	<i>Toxoplasma gondii</i>
Tick-borne encephalitis virus	<i>Plasmodium falciparum</i>
Powassan virus	<i>Naegleria fowleri</i>
B virus	<i>Acanthamoeba spp</i>
Hepatitis E virus	<i>Balamuthia mandrillaris</i>
	<i>Taenia solium</i> (cysticercosis)
	<i>Baylisascaris procyonis</i>
	<i>Gnathostoma spinigerum</i>

Pathogens depicted in **red** may require specific antimicrobial therapy. Pathogens depicted in **bold** text are the most commonly isolated.

Courtesy of Hordur Hardarson, MD.

Conditions that mimic viral encephalitis (all of these conditions require specific therapy)

Condition	Potential clues
Bacterial infections	
Bacterial meningitis	Meningeal signs; CSF pleocytosis with predominance of polymorphonuclear cells
CNS tuberculosis	Residing in, travel to, or exposure to contact from endemic areas (Asia, Africa, Latin America, Eastern Europe); contact with an adult with tuberculosis; lacunar infarction; hydrocephalus; low CSF glucose and elevated CSF protein
Parameningeal infection	
Listeriosis	Age <1 month; immune compromise; rhomboencephalitis (ataxia, cranial nerve deficits, nystagmus)
Cat scratch disease	Cat bite/scratch; regional lymphadenopathy; neuroretinitis
Parasitic infections	
Amoebiasis	Immune compromise; swimming in lakes/brackish water; travel to an endemic area; change in taste or smell
Cerebral malaria	Travel to endemic area without prophylaxis
Toxoplasmosis	Immune compromise; extrapyramidal symptoms and signs
Cysticercosis	Travel to endemic area; seizures, hydrocephalus; ingestion of undercooked pork
Echinococcus (tapeworm)	Hydatid cysts
Trichinosis	Gastrointestinal symptoms (abdominal pain, nausea, vomiting, diarrhea); ingestion of bear meat or other potentially contaminated foods
Fungal infections	
Histoplasmosis	Residing in or travel to endemic area (eastern and central US and Canada)
Blastomycosis	Residing in or travel to endemic area (in the US, southeastern, central, and states bordering the Great Lakes)
Cryptococcus	Immune compromise; exposure to bird droppings
Coccidiomycosis	Residing in or travel to endemic areas, such as the southwestern United States
Candidiasis	Immune compromise
Rickettsial infection	
Rocky Mountain spotted fever	Tick exposure in endemic region; maculopapular/petechial rash; intractable seizures
Murine typhus	Flea exposure
Q fever	Exposure to cats, sheep, goats (particularly placental tissue, parturient fluids, newborn animals)
Ehrlichiosis	Tick exposure, rash, leukopenia, thrombocytopenia
Other central nervous system conditions	
Head trauma	History of trauma (may be absent in child abuse)
Intracranial hemorrhage	Neuroimaging; increased opening pressure during lumbar puncture
Intracranial thrombosis	Neuroimaging
Idiopathic intracranial hypertension (pseudotumor cerebri)	Visual obscurations, diplopia, cranial nerve palsy; papilledema; increased opening pressure during lumbar puncture
Status epilepticus (especially nonconvulsive seizures)	Electroencephalogram
Acute disseminated encephalomyelitis (ADEM, postinfectious encephalitis)	History of recent infection or immunization; multifocal neurologic signs and symptoms; neuroimaging
Tumor	Neuroimaging; increased opening pressure during lumbar puncture (however, lumbar puncture usually is not performed if a tumor is suspected)
Acute confusional migraine	History of migraine headaches; exclusion of other causes
NMDAR encephalitis	No identifiable infectious etiology; encephalitis with psychiatric manifestations
Metabolic disorders	
Hypoglycemia	Serum glucose
Uremic encephalopathy	Elevation of blood urea nitrogen, creatinine
Hepatic encephalopathy	Elevation of serum aminotransferases; increased opening pressure during lumbar puncture
Toxins	
Acute toxic ingestion	Toxicology screening; pupillary changes
Lead poisoning	History of lead exposure or pica; elevated blood lead level (confirmatory)
Reye syndrome	History of aspirin use; recent viral infection; increased opening pressure during lumbar puncture
Inborn errors of metabolism (eg, organic acidemia, urea cycle disorder, mitochondrial disorders, mitochondrial fatty acid oxidation disorders, etc.)	Abnormal laboratory findings (eg, hypoglycemia, hyperammonemia, acidosis)

CNS: central nervous system; CSF: cerebrospinal fluid; NMDAR: anti-N-methyl-D-aspartate receptor.
 Courtesy of Hordur Hardarson, MD.



Samantekt

- Meingerð
 - Orsakir eftir aldri sjúklings
 - Áhættuþættir
 - Einkenni eftir aldri sjúklings
 - Uppvinnsla og greining
 - Meðferð og meðferðalengd eftir orsökum
 - Helstu langvarandi afleiðingar heilahimnubólgu
 - Mismunagreiningar
- 