Akut Bakteriell Meningit

best practice

Magnus Brink

Infektion

Sahlgrenska Universitetssjukhuset

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covid-19

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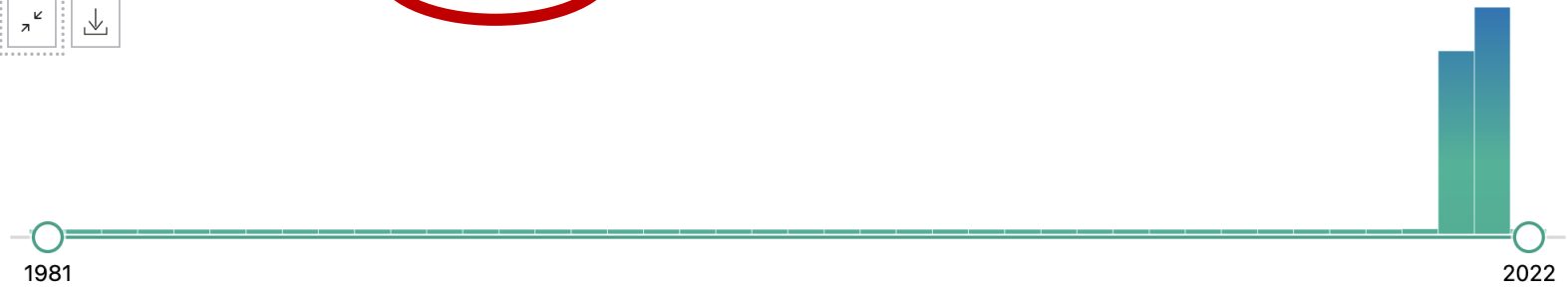
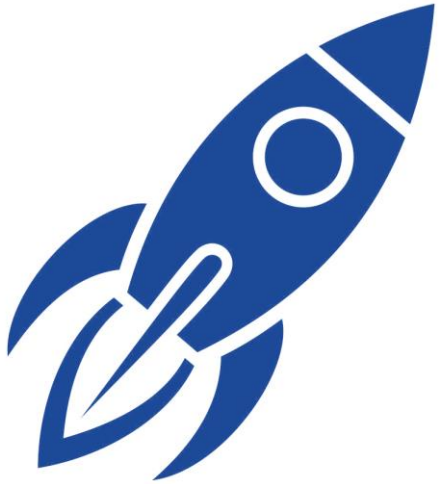
RESULTS BY YEAR

194,745 results

Page 1 of 1,948





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bacterial meningitis

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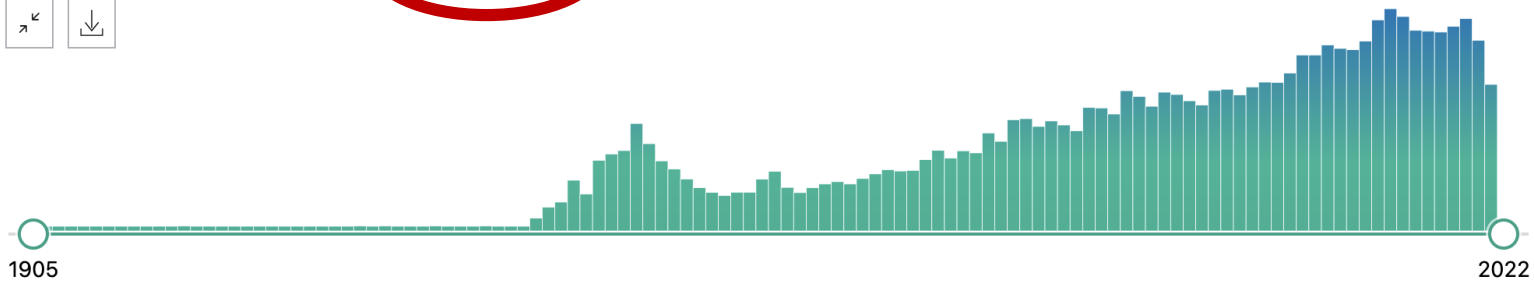
RESULTS BY YEAR

36,006 results

Page 1 of 361



bakteriell meningit MILSTOLPAR

VAD SAKNAS?


profylax
HIB
MNK
PNK

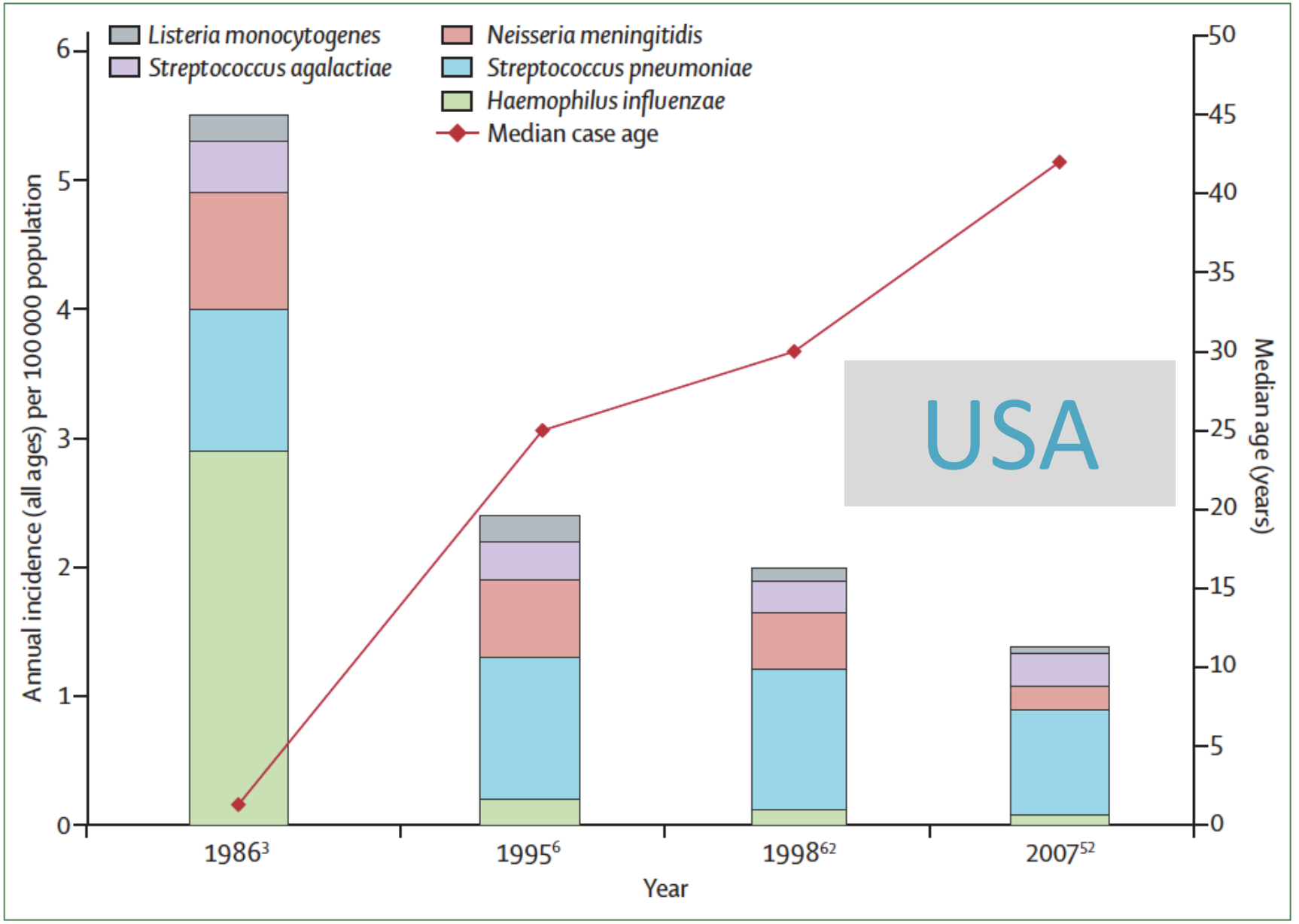
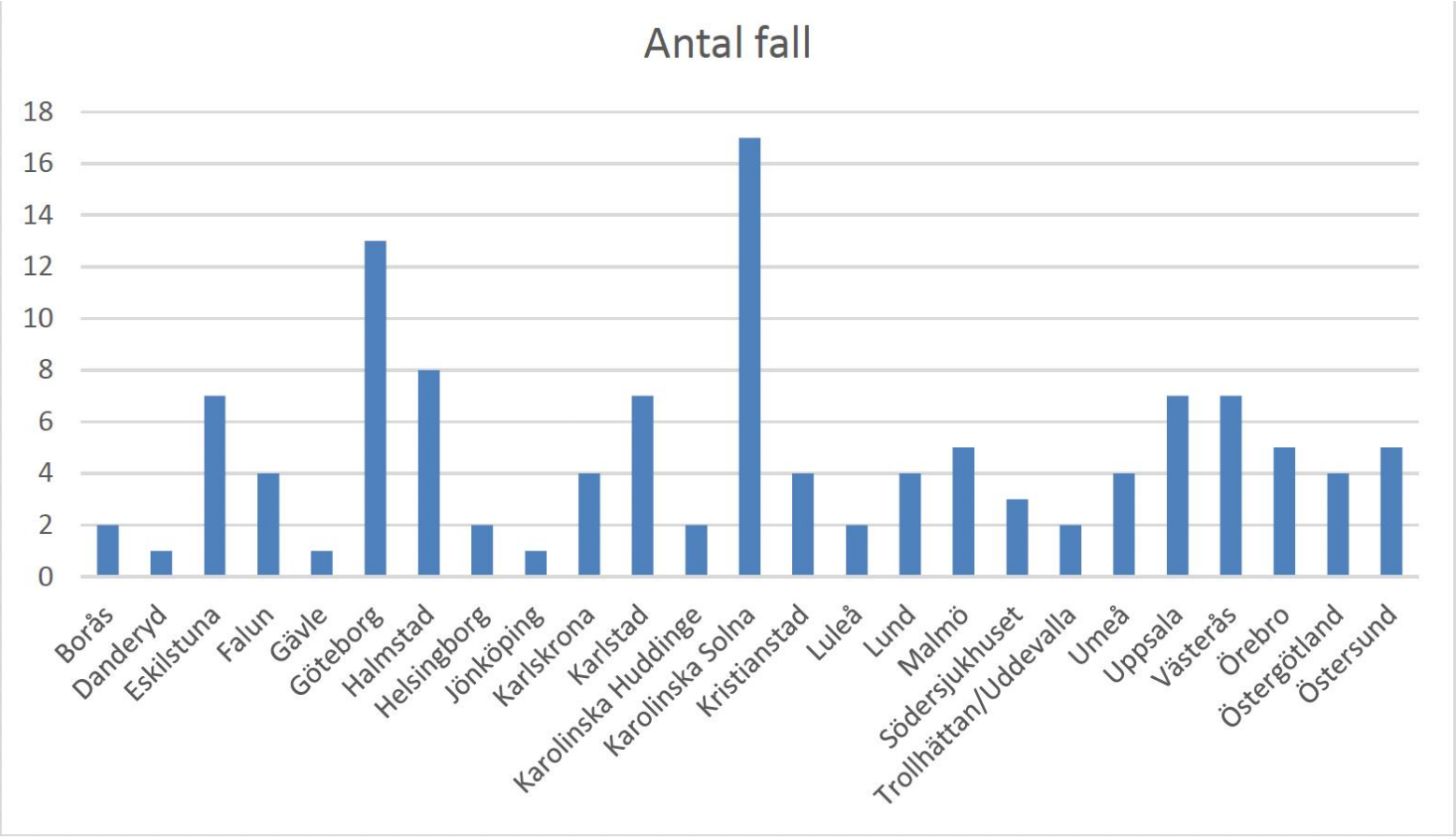


Figure 2: Prevalence of bacterial meningitis in the USA attributable to *Haemophilus influenzae*, *Streptococcus pneumoniae*, *Neisseria meningitidis*, *Streptococcus agalactiae*, and *Listeria monocytogenes*, 1986–2007[3,6,52]

> 95 % av alla dödsfall i akut bakteriell meningit sker bland barn i låginkomstländer

agens:
pneumokocker
meningokocker
haemophilus

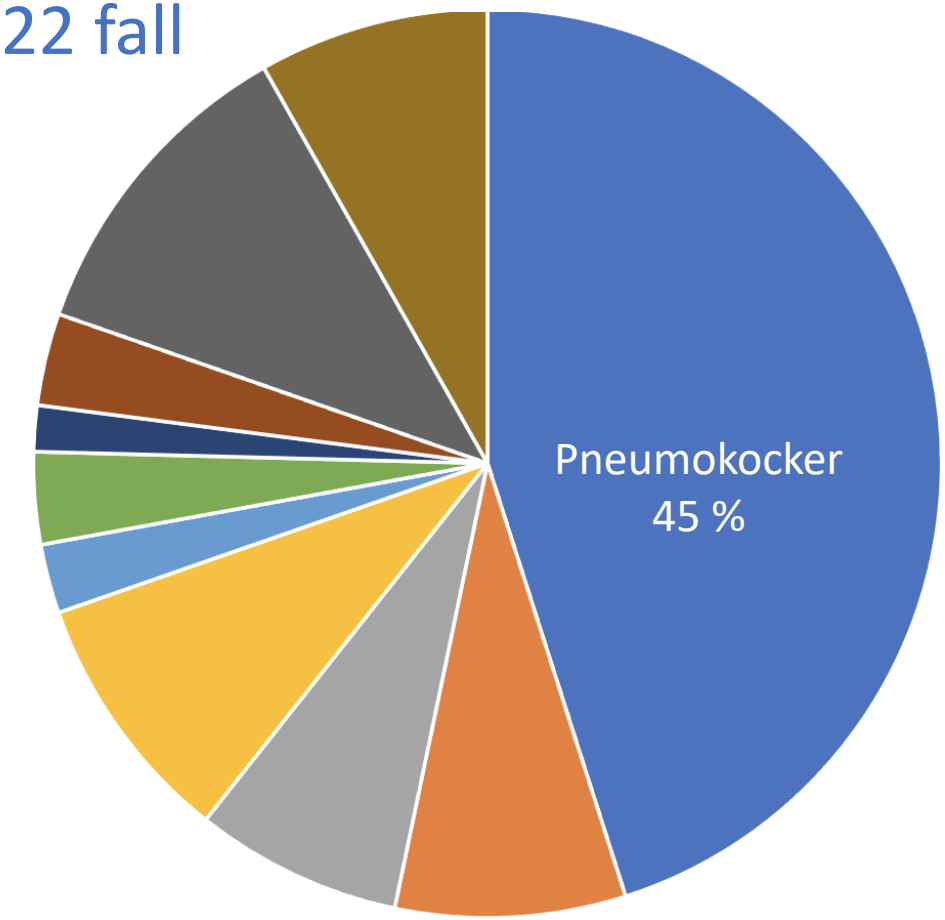
ABM hos vuxna i Sverige 2019



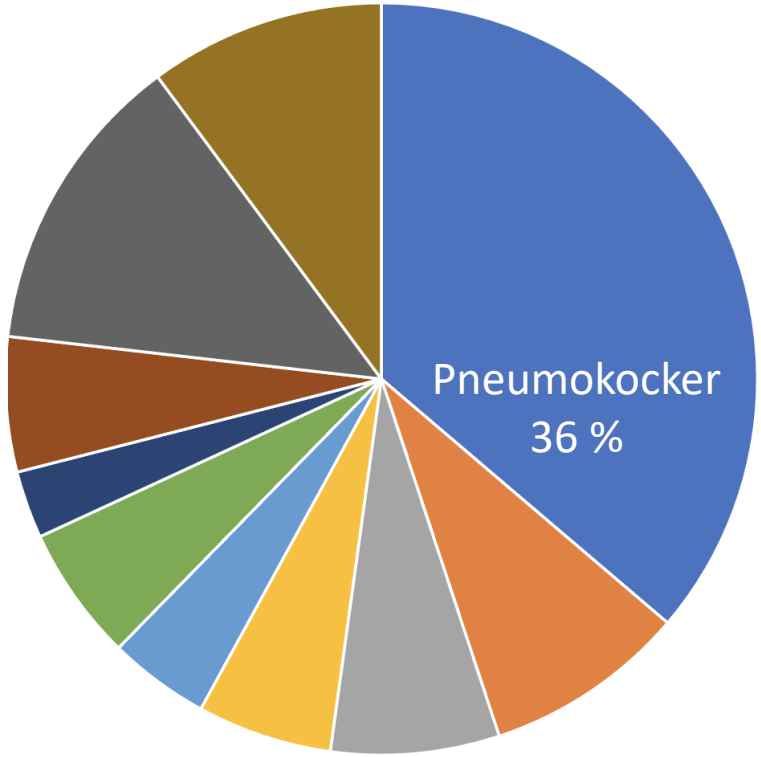
Antal fall	122
Medianålder	65 år
Sjukhusmortalitet	11,5 %

SILF meningitregister

2019
122 fall



2020
69 fall

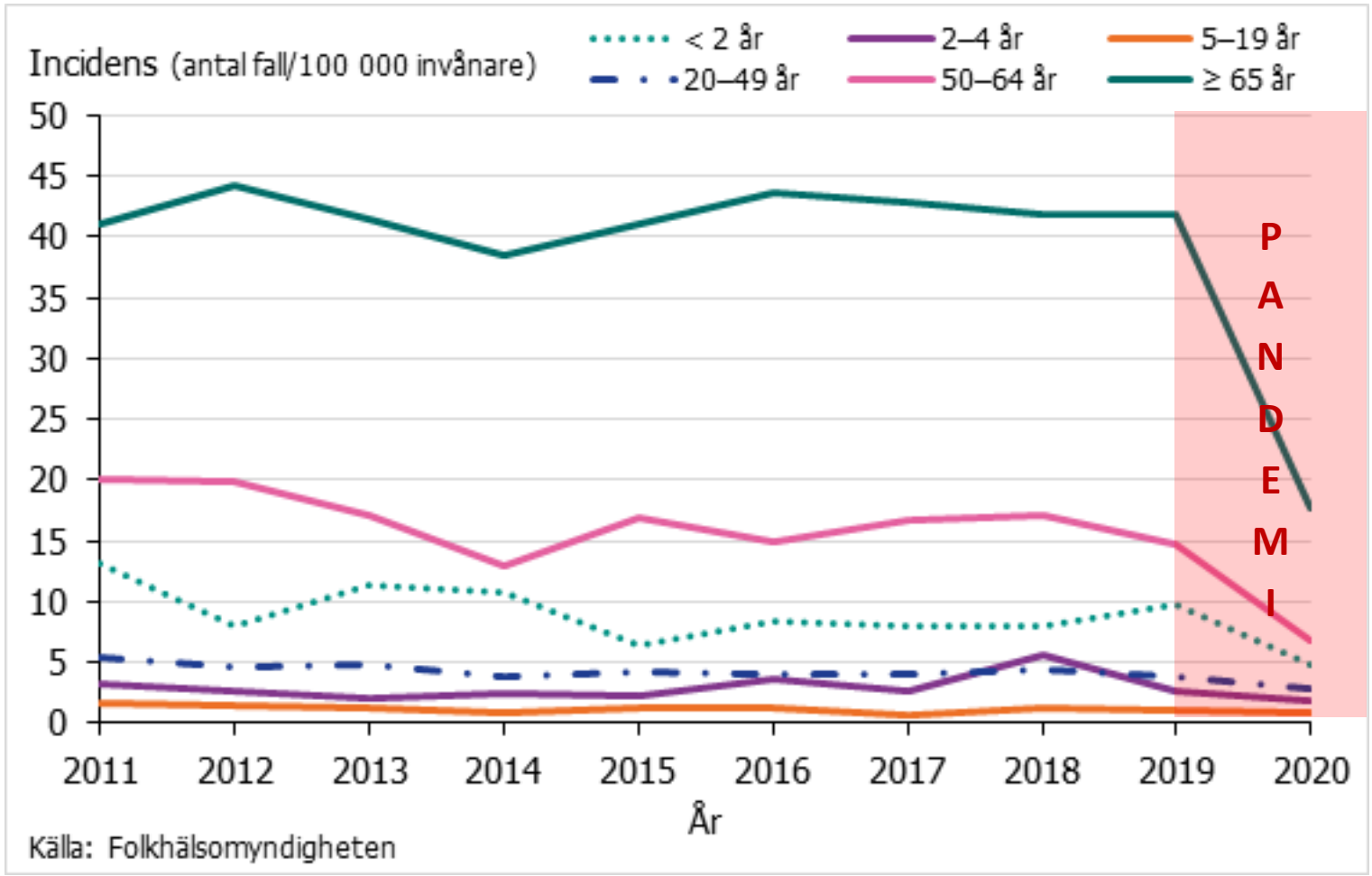


S. pneumoniae
N. meningitidis
H. influenzae
L. monocytohenes
B-hem streptokock
A-hem streptokock
S. aureus
Enterobacterales
Annan
Okänd

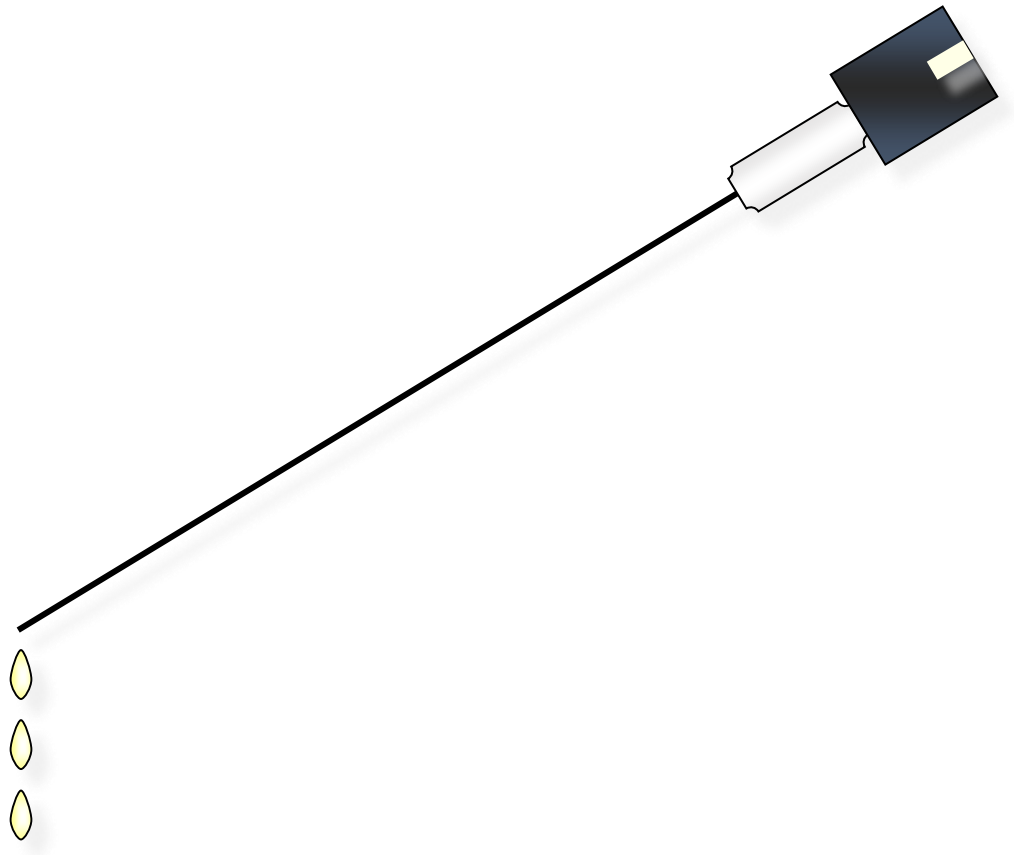
SILF meningitregister

Invasiv pnk-infektion i Sverige

(pneumokocker påvisade i blod eller likvor)



Diagnostik



Beslutsregel LP/behandling

”Klassisk triad”
feber + vakenhetssänkning + nackstyvhet

- Sensitivitet: 44 %

≥ 2 av feber/nackstyvhet/ huvudvärk/vakenhetssänkning

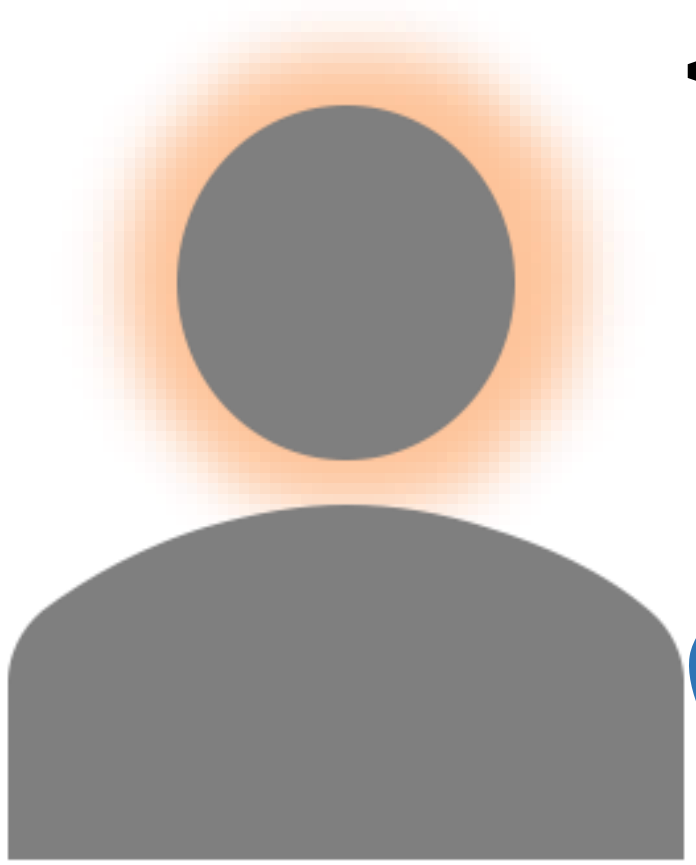
- Sensitivitet: 95 %

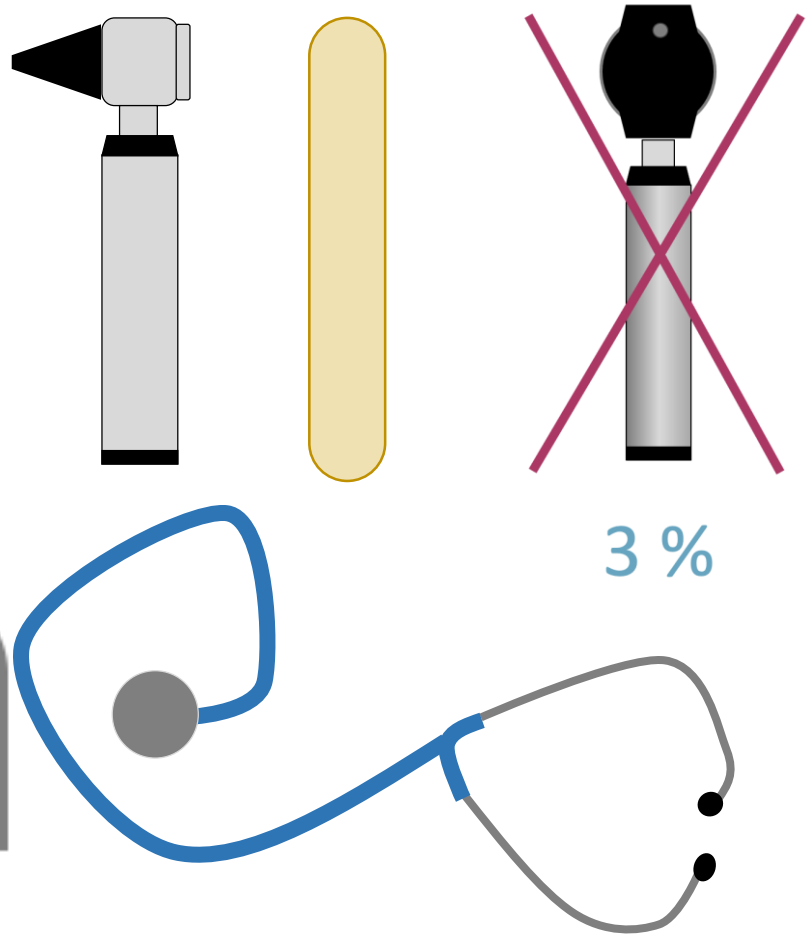
van de Beek, NEJM, 2004

Vanligt med annat primärfokus

sinuit, otit, pneumoni…

SILF meningitregister 2008–2019	
Annat fokus	N=1 269
öron	27 % (340)
sinus	9 % (114)
lungor	11 % (139)
svalg	6 % (73)
annat	22 % (269)





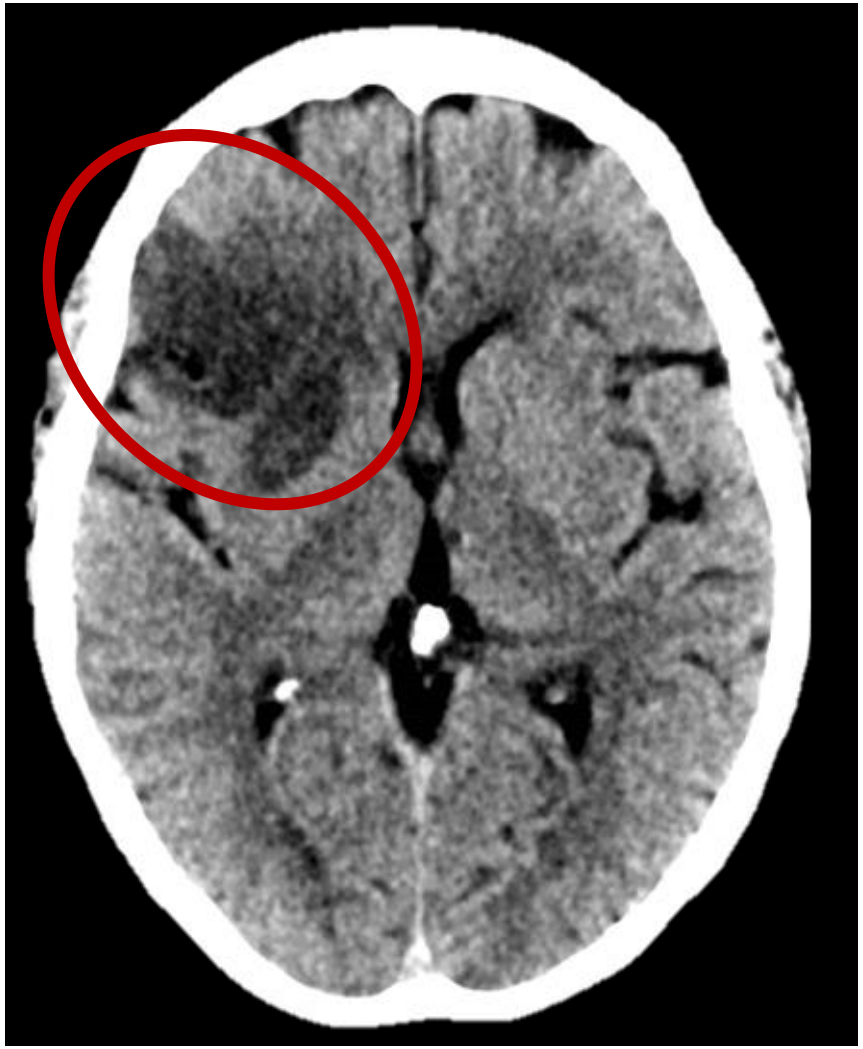
3 %

Cerebral infarkt

Förekomst av infarkt, Holland 1998–2002

totalt	25 %	174/696
S. pneumoniae	36 %	128/257
N. meningitidis	9 %	22/257
Övriga	28 %	24/87

Shut, neurocritical care, 2012



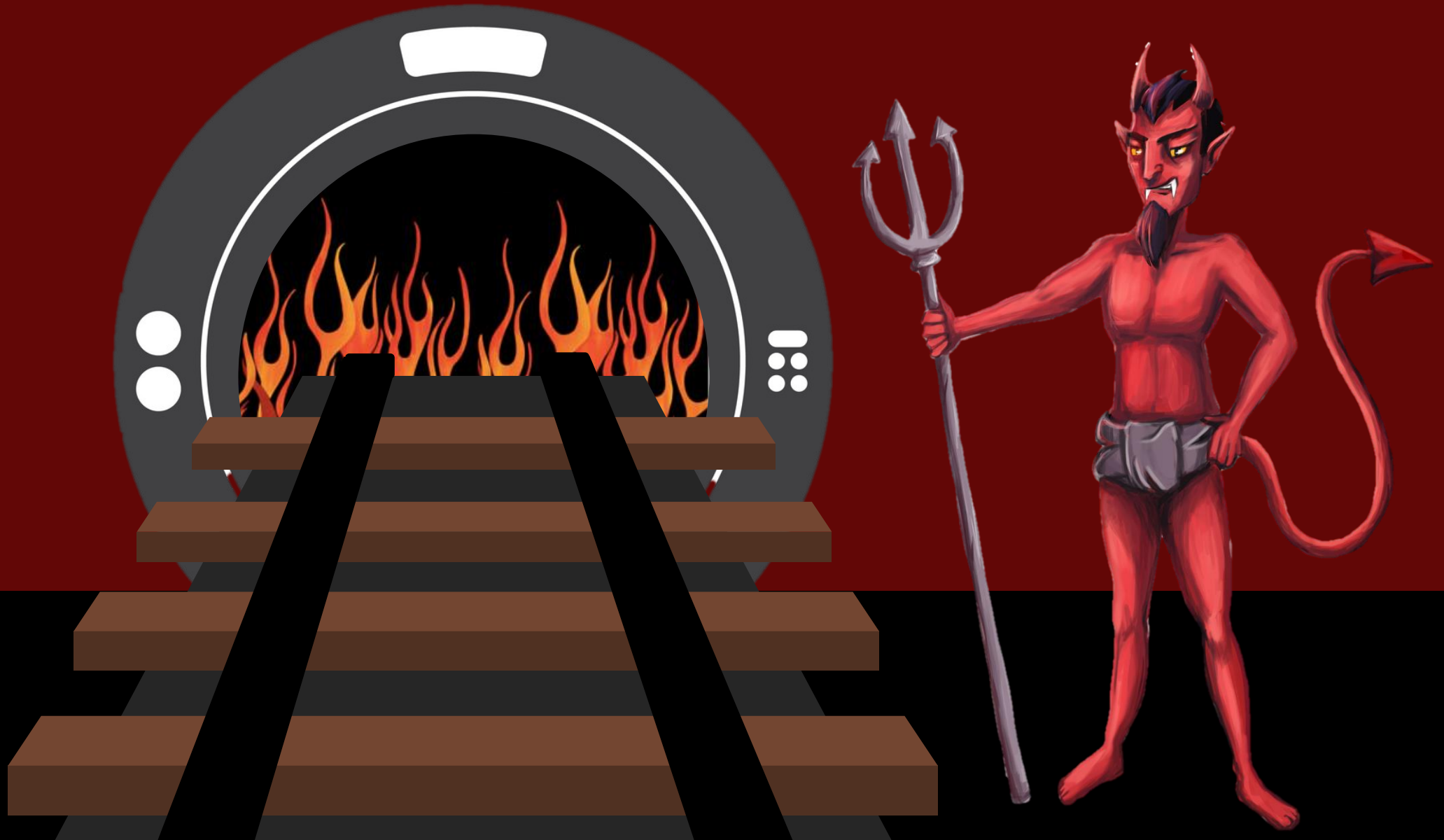

LP

Grundregel

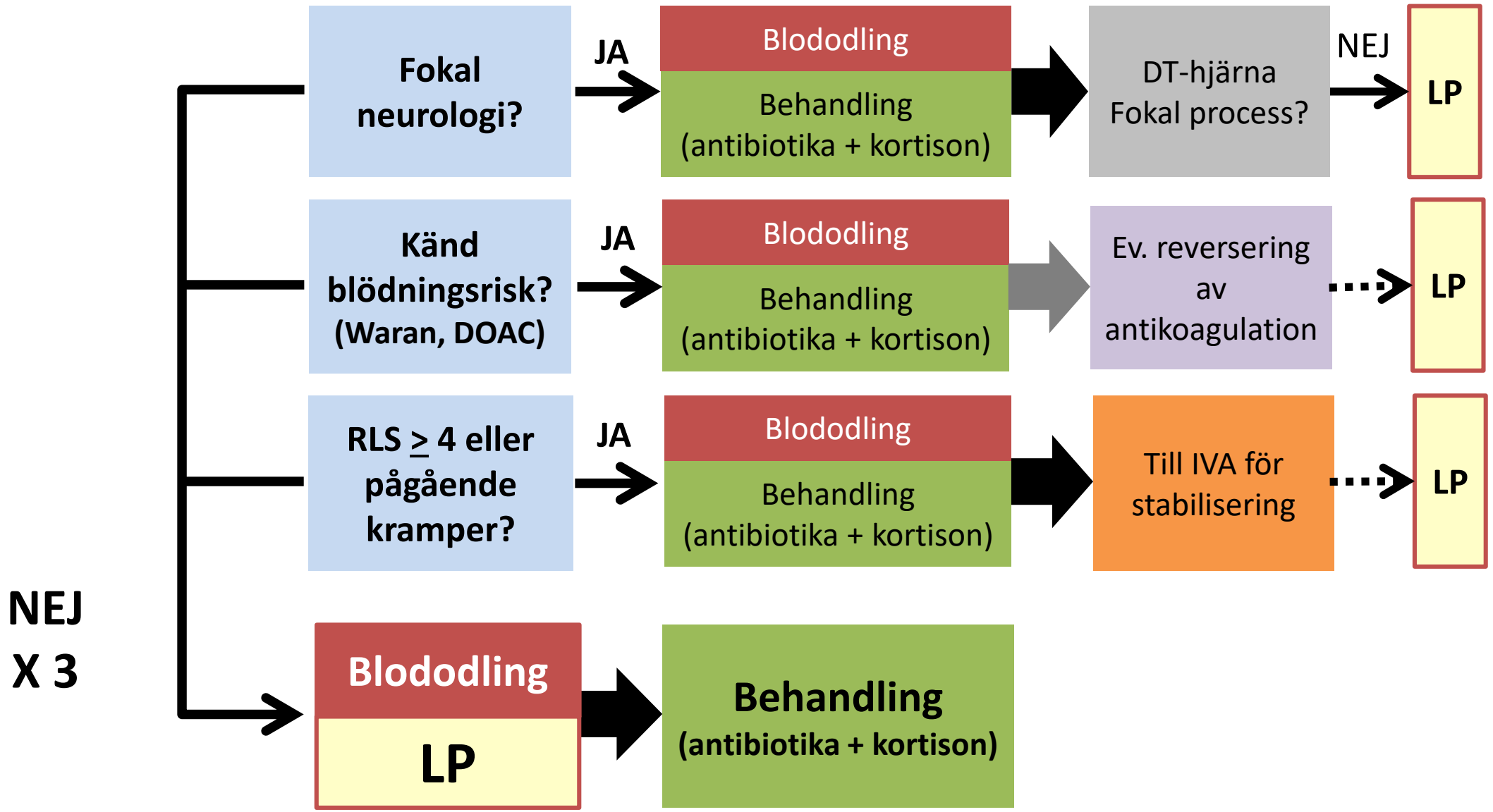
LP skall utföras AKUT vid minsta misstanke om ABM


Kan det vara farligt att göra LP på patienter med misstänkt meningit?
Kanske bäst att köra en CT först…

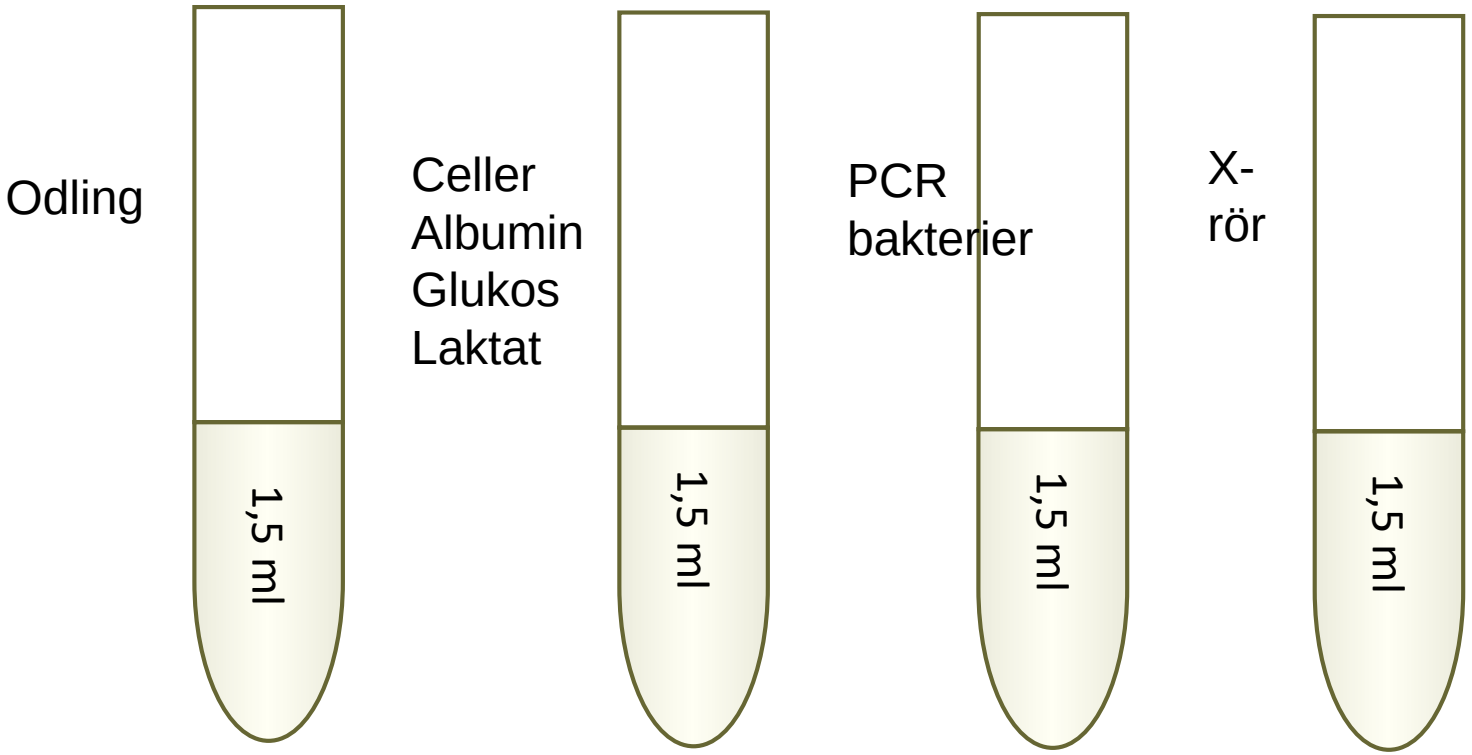
HJÄRNVÄGEN…



≥ 2 av feber, nackstyvhet, RLS ↓, svår huvudvärk



Likvoranalyser vid misstänkt ABM



Tolkning av kemiska analyser – bedöm helhetsbilden

- Celler – höga
  ofta mycket höga nivåer (>1000 x 10^6/L)
  oftast dominans av granulocyter
- Albumin – högt
  ofta > 1000 mg/L
- Glukos – lågt
  ofta < 2 mmol/L
- Laktat – högt
  ofta > 4 mmol/L

Bakterieodling

+ utöver etiologi även resistensbesked

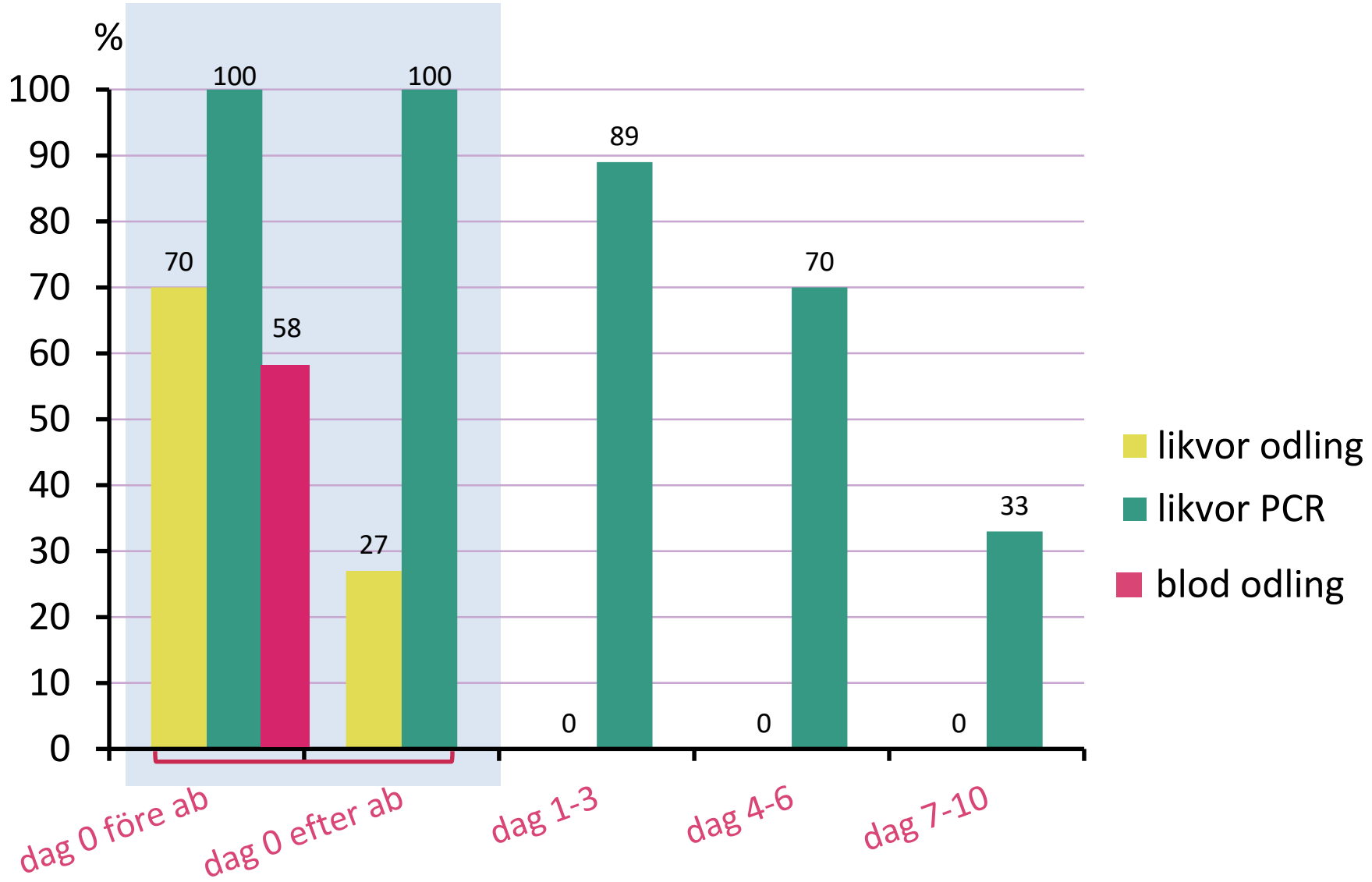
– begränsad känslighet

PCR

+ hög känslighet, snabb

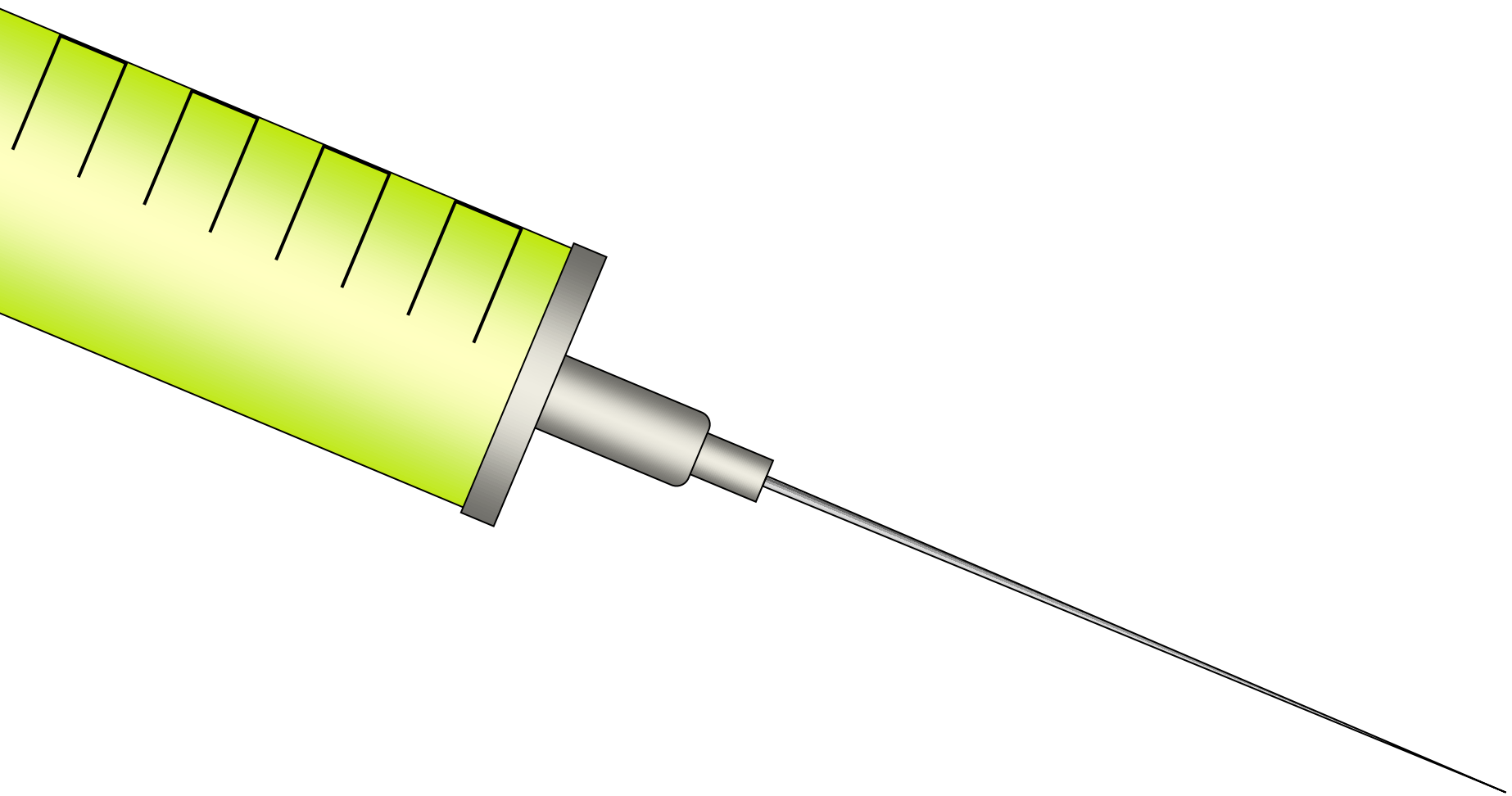
– ingen resistensbedömning

Positiva resultat över tid



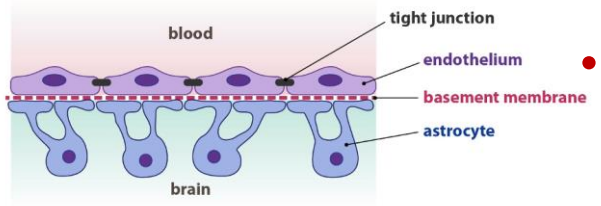
Brink 2015

Behandling

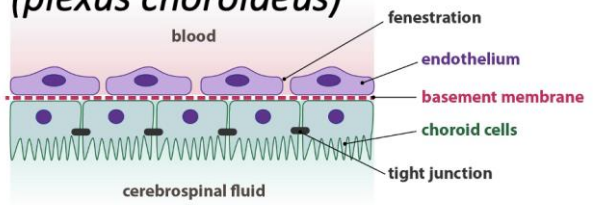


Antibiotikabehandling vid samhällsförvärvad ABM hos vuxna

Blod-hjärnbarriären



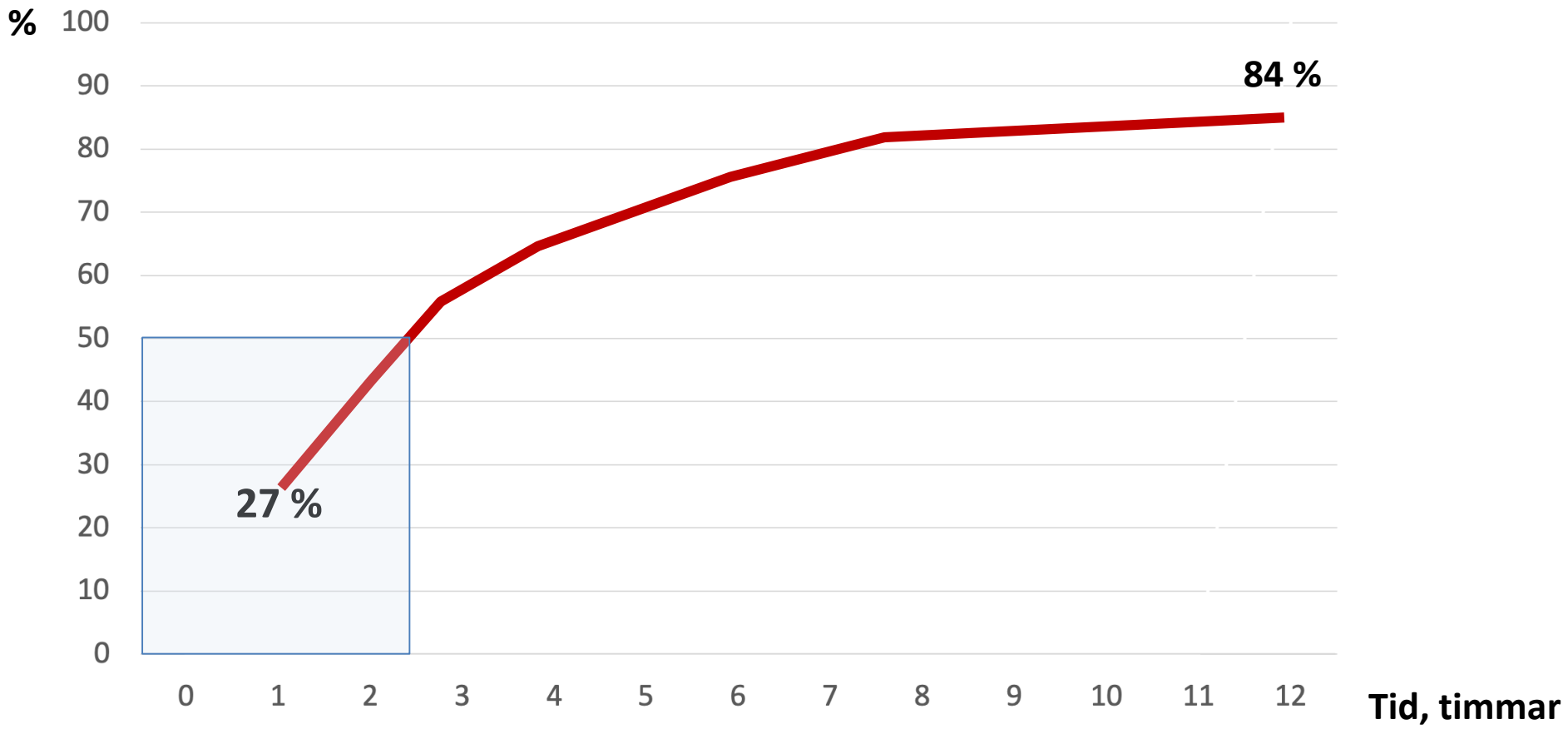
Blod-likvorbarriären
(plexus choroideus)



- **Standardbehandling** *(ej immunsupprimerad, ej utlandsresa):*
  cefotaxim 3 g x 4 + ampicillin 3 g x 4
  alternativt meropenem 2 g x 3
- **Immunsupprimerad patient:**
  meropenem 2 g x 3
- **Efter vistelse (inom 6 månader) i land med hög förekomst av resistenta *S. pneumoniae*:**
  cefotaxim 3 g x 4 + ampicillin 3 g x 4 *alternativt* meropenem 2 g x 3
  tillsammans med linezolid 600 mg x 2 eller vancomycin 15 mg/kg x 3
- **ABM hos patient med allvarlig överkänslighet mot betalaktamantibiotika**
  moxifloxacin 400 mg x 1 alternativt levofloxacin 500 mg x 2
  tillsammans med linezolid 600 mg x 2 eller vancomycin 15 mg/kg x 3

SILF, vårdprogram bakteriella CNS-infektioner 2020

Tid från ankomst till *adekvat* antibiotika, 2019



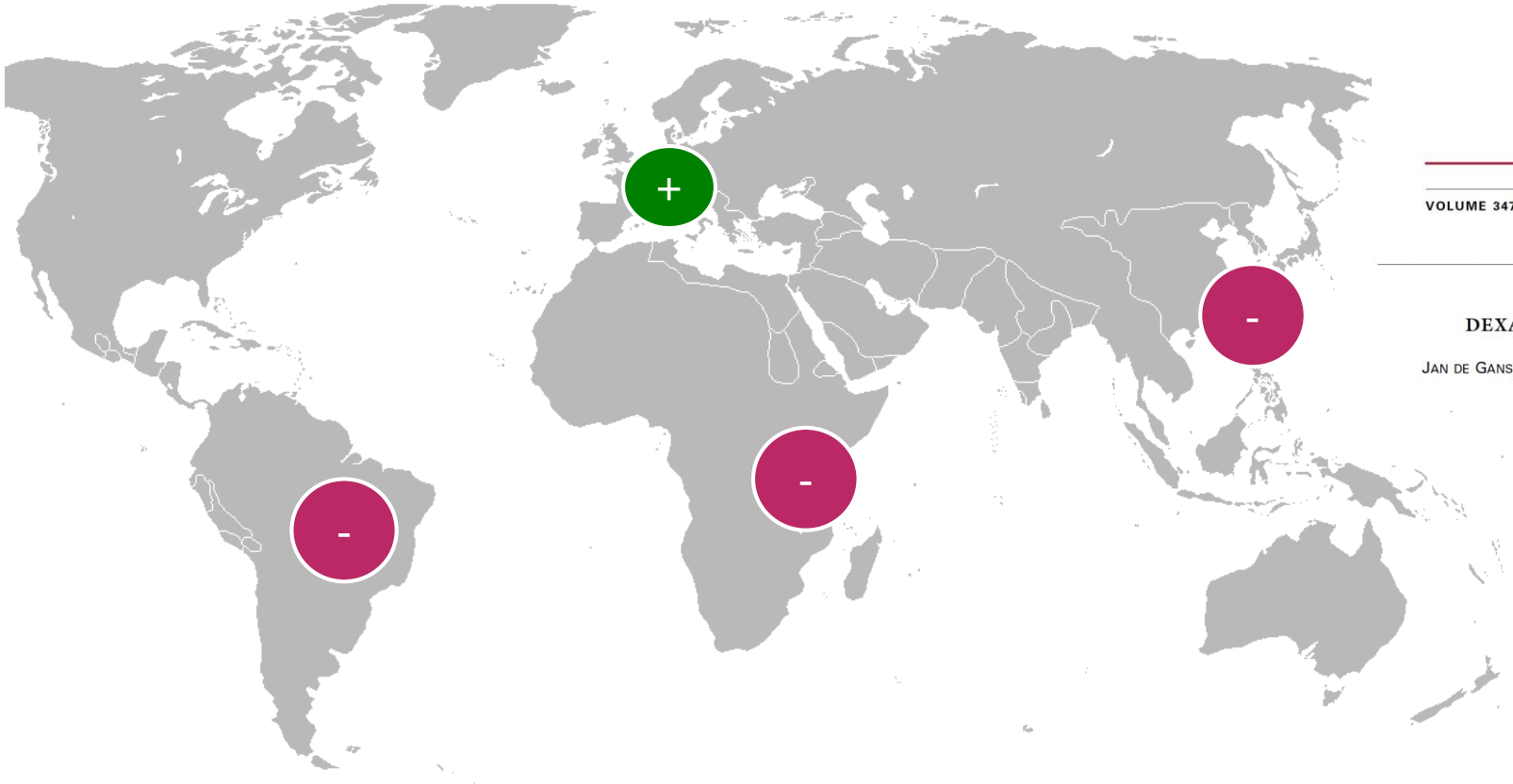
SILF, meningitregistret

Riktad antibiotikabehandling

N. meningitidis	Pc-G/cefotaxim	7 dagar
H. influenzae	cefotaxim	10 dagar
S. pneumoniae	Pc-G/cefotaxim	10–14 dagar
S. pyogenes	Pc-G	10–14 dagar
S. aureus	cefotaxim + linezolid	14–21 dagar
L. monocytogenes	ampicillin + trim/sulfa	14–21 dagar
enterobacteriacae	cefotaxim/meropenem	21 dagar

SILF, vårdprogram bakteriella CNS-infektioner 2020

Adjuvant behandling med kortison



The New England
Journal of Medicine

VOLUME 347 NOVEMBER 14, 2002 NUMBER 20

DEXAMETHASONE IN ADULTS WITH BACTERIAL MENINGITIS

JAN DE GANS, PH.D., AND DIEDERIK VAN DE BEEK, M.D., FOR THE EUROPEAN DEXAMETHASONE IN ADULTHOOD BACTERIAL MENINGITIS STUDY INVESTIGATORS*

Relativ risk of death: 0.48
(CI 0.24 to 0.96; P=0.04)

Kortikosteroider

- **Indikation:**

  Vid alla fall av ABM ska kortikosteroid ges samtidigt med första dosen antibiotika (AII)

- **Dosering:**

  Betametason (Betapred®) 0,12 mg/kg x 4 iv (max 8 mg per dos) (AII)

  Dexametason (Dexavit®) 0,15 mg/kg x 4 iv (max 10 mg per dos) (AII)

- **Behandlingstid:**

  Grundrekommendationen är *4 dagar med utsättning utan nedtrappning* (AII)

  Steroidbehandlingen kan avslutas tidigare vid fynd av Listeria samt oavsett etiologi vid snabb klinisk förbättring (RLS 1, inga neurologiska symtom) (BIII)

SILF vårdprogram, Bakteriella CNS infektioner, 2020

Vårdnivå

- **RLS 1, okomplicerad**
  vårdavdelning (med tillräckligt hög kompetens)

- **RLS > 1 eller fokalneurologi, kramper, septisk chock**
  IMA/IVA

- **Djup medvetslöshet/inklämning**
  överväg NIVA

Intensivvårdade patienter med ABM 2019

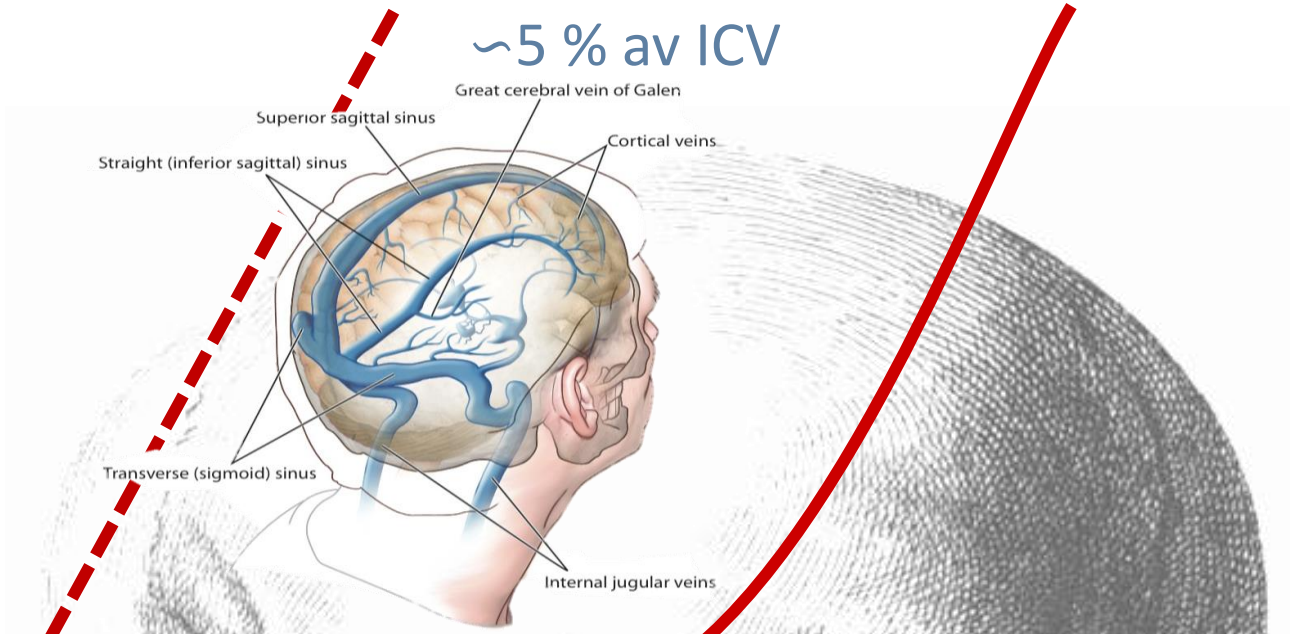
- av 120 (60 %)
- 50 av 120 (42 %) i respirator
- 36 av 120 (30 %) på NIVA med ICP-styrd behandling

Reaktionsgrad (RLS-85)	n=119
1	45 (38 %)
2–3	56 (47 %)
4–8	18 (15 %)
Septisk chock	10 (8 %)
Kramper	13 (11 %)

SILF, meningitregister, årsrapport 2019

TRYCK

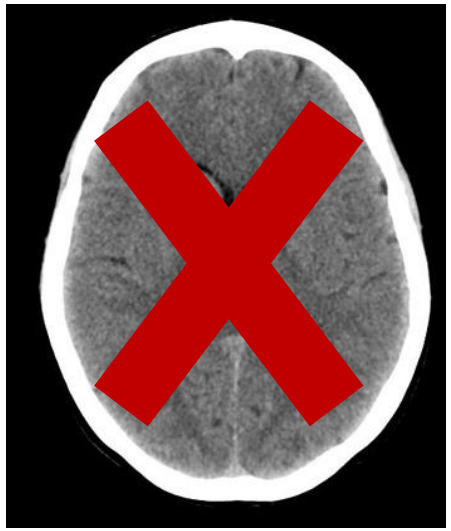
~5 % av ICV

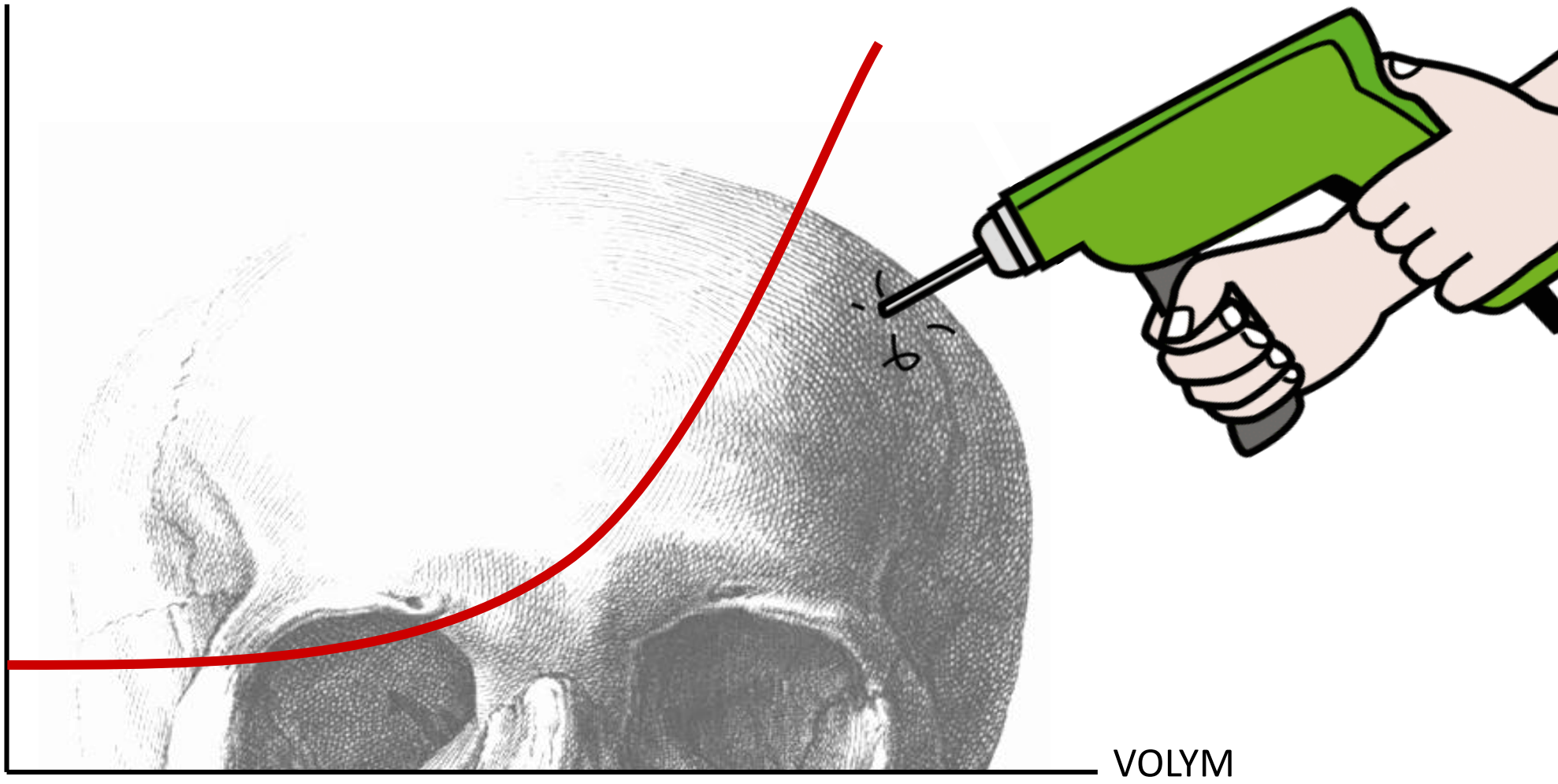


VOLYM

Dålig

Tryckmätare





KLINISKA TECKEN

GCS alt. RLS 85

ICP-styrd behandling

Ödembehandling

- Högdos steroider *(bäst evidens – men ges till alla oavsett ICP)*
- Höjd huvudända (30°) *(standardbehandling)*
- Osmotiska diuretika
- Hyperton NaCl

Sänkning av ICV

- Likvordränering
- Hyperventilation

Sänk cerebral metabolism

- Fördjupad sedering
- Barbituratnarkos
- Kylning

Förbättrad cerebral perfusion

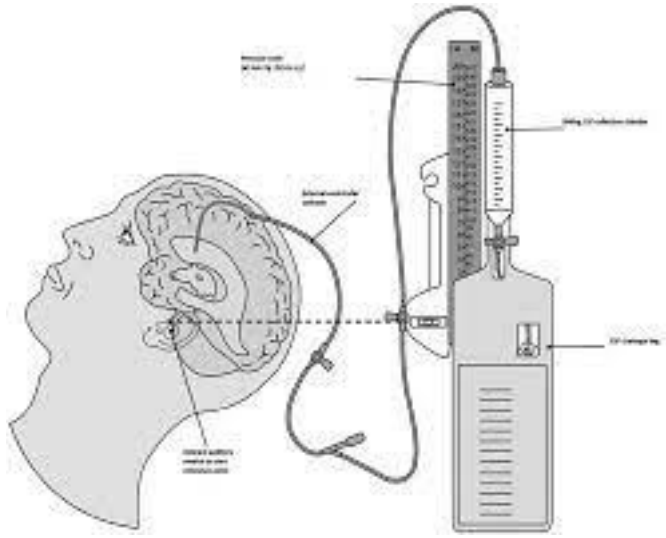
- Reglering av blodtryck med vasopressor → cerebralt perfusionstryck

TABLE 1. Summary of literature review

Study	Study Design	No. of Patients	Etiology	ICP Monitoring/ CSF Drainage	Results/Conclusions
Abulhasan et al., 2013	Retrospective cohort	37	Bacterial meningitis	LD in 11 patients	Mortality in LD 0% vs non-LD 15.4% (p = 0.0001); improved GOS score at 3 mos in LD (OR 1.49, 95% CI 1.06–2.1, p = 0.007)
Baussart et al., 2006	Case report	1	*Neisseria meningitidis*	ICP monitor	GOS score of 3 at discharge, GOS score of 4 at 6 mos
Bordes et al., 2010	Case report	1	Type A *Streptococcus*	ICP monitor	GOS score 4–5 at discharge & 12 mos
Depreitere et al., 2016	Retrospective cohort	17	Bacterial meningitis	ICP/CPP monitoring	Decision management was affected in all patients; GOS score was significantly & negatively associated w/ the highest documented ICP (r = –0.70, p < 0.01) & positively associated w/ the lowest documented CPP (r = 0.61, p < 0.05)
Di Rienzo et al., 2008	Case series	3	Meningoencephalitis; Patient 1: HSV, Patients 2 & 3: *S. pneumoniae*	ICP monitor	Patient 1: GOS score 4–5 at discharge; Patient 2: GOS score 1 after surgery; Patient 3: GOS score 4–5 at 1 mo
Gliemroth et al., 2002	Case report	1	Meningoencephalitis	ICP monitor	GOS score 4–5 at 1 yr after discharge
Glimåker et al., 2014	Prospective interven-tion-control comparison	105: intervention 52, control 53	Bacterial meningitis	Intervention group: GCS score ≤9, CT scan, EVD n = 48/52, ICP monitor n = 4/52	Mortality in intervention group 10% vs 30% in controls (RRR 68%, p < 0.05); GOS score 5, 54% intervention group & 32% in controls (RRR of unfavorable outcomes 40%, p < 0.05)
Grände et al., 2002	Interventional study	12	Bacterial meningitis	ICP monitor	At 2-yr follow-up, complete recovery in 7 patients, GOS score 3–4 in 3 patients, death in 2 patients
Kumar et al., 2014	Randomized controlled trial	ICP-targeted therapy group 55, CPP-targeted therapy group 55	Multiple pathogens (bacterial, viral, aseptic, fungal)	ICP monitor	90-day mortality in ICP group was higher than CPP group (38.2% vs 18.2%; RR 2.1, 95% CI 1.09–4.04, p = 0.02)
Larsen et al., 2017	Retrospective cohort	39	Bacterial meningitis	ICP/CPP monitoring	Overall mortality rate was 33% (13/39) & neurological impairment in surviving patients was 84.6% (22/26); lower mean CPP was found to correlate w/ adverse outcome (p = 0.005); increased ICP (>20 mm Hg) was found in 24 patients; no significant correlation btwn measured ICP & CT scans w/ signs of elevated ICP
Lindvall et al., 2004	Interventional study	15	Bacterial meningitis	ICP monitor in 14/15, EVD in 1/15	Mortality in 5/15, mean ICP was higher & CPP lower in nonsurvivors
Macsween et al., 2005	Case report	1	Cryptococcal meningitis	LD	Complete recovery & no neurological deficits at 1-yr follow-up
Perin et al., 2008	Case report	1	*S. pneumoniae*	EVD	Fully independent at 33-day follow-up but complete bilat hearing loss
Pili-Floury et al., 2009	Case report	1	Herpetic encephalitis	ICP monitor	Complete recovery at 7–8-mo follow-up
Sparing et al., 2004	Case report	1	*Mycoplasma pneumoniae*	ICP monitor, EVD s/p surgery	GOS score 5 at 3 mos & eventual return to employment in subsequent follow-up visit

EVD = extraventricular drainage; HSV = herpes simplex virus; LD = lumbar drainage; RRR = RR reduction; s/p = status post.

Publikationer
ICP-mätning vid akut bakteriell meningit



Tariq, Neurosurg Focus, 2017

Table 3. Intracranial pressure (ICP)-targeting therapy used in the intervention group, (n = 52, external ventricular drainage; n = 48, parenchymal ICP-monitor; n = 4).

	n	%
Mannitol prior to intervention	5	10
Drainage of Csf at operation	48	92
Drainage of Csf at NICU	46	88
Hyperosmolar therapy	21	40
Hyperventilation	13	25
External cooling	9	17
Methylprednisolone	3	6
Barbiturate coma	2	4
No ICP-treatment in addition to deep sedation and mechanical ventilation in 30° sitting position	3	6

Csf = cerebrospinal fluid; NICU = neuro-intensive care unit.
doi:10.1371/journal.pone.0091976.t003

Table 4. Outcomes at follow-up after 2–6 months in the intervention group and in the controls.

	Intervention group		Eligible as control patients		
Outcome	**Intention to treat group**	**Per protocol group**	**Control group[a]**	**Cases from Stockholm missed for intervention**	**NICU-treated cases outside Stockholm**
	n = 57 (%)	**n = 52 (%)**	**n = 53 (%)**	**n = 12 (%)**	**n = 20 (%)**
Recovery; GOS 5 and normal hearing	30 (53)*	28 (54)*	17 (32)*	4 (33)	8 (40)
GOS 5 and impaired hearing	4 (7)	4 (8)	6 (11)	1 (8)	1 (5)
GOS 2–4 +/− impaired hearing	16 (28)	15 (29)	14 (26)	4 (33)	6 (30)
Death; GOS 1	7 (12)*	5 (10)*	16 (30)*	3 (25)	5 (25)

NICU = neuro-intensive care unit. GOS = Glasgow outcome score.
*$p<0.05$ with two-tailed Fisher's exact test when comparing the intention to treat group, and the per protocol group, with the control group.
[a]Patients included as final controls according to inclusion and exclusion criteria.
doi:10.1371/journal.pone.0091976.t004

OPEN ACCESS Freely available online PLOS ONE

Neuro-Intensive Treatment Targeting Intracranial Hypertension Improves Outcome in Severe Bacterial Meningitis: An Intervention-Control Study

Martin Glimåker[1]*, Bibi Johansson[2], Halla Halldorsdottir[3], Michael Wanecek[3], Adrian Elmi-Terander[4], Per Hamid Ghatan[5], Lars Lindquist[2], Bo Michael Bellander[4]*

Glimåker, Plos One, 2014

Mätning och behandling av högt intrakraniellt tryck (ICP) bör övervägas vid akut bakteriell meningit hos vuxen med följande klinisk bild (kontakta neurokirurg/neurointensivist):

- GCS ≤8, RLS ≥4
- GCS 9–12, RLS 3 om klinisk försämring under de första timmarna. Lumbalt likvortryck >40 cmH_2O ökar indikationen.
- Upprepade svårbehandlade kramper av epileptisk natur.
- Kliniska tecken till inklämning, cerebral herniering (se faktaruta 6).
- Fynd på DT/MRT-hjärna som tyder på kraftigt förhöjt ICP (DT-hjärna kan dock bara ibland påvisa sådana patologiska fynd trots kraftigt förhöjt ICP).

SILF, vårdprogram bakteriella CNS-infektioner, 2020

ORIGINAL ARTICLE

ESCMID guideline: diagnosis and treatment of acute bacterial meningitis

D. van de Beek[1], C. Cabellos[2], O. Dzupova[3], S. Esposito[4], M. Klein[5], A. T. Kloek[1], S. L. Leib[6], B. Mourvillier[7], C. Ostergaard[8], P. Pagliano[9], H. W. Pfister[5], R. C. Read[10], O. Resat Sipahi[11] and M. C. Brouwer[1], for the ESCMID Study Group for Infections of the Brain (ESGIB)

Intracranial pressure–based treatment. During bacterial meningitis, intracranial pressure is elevated as a result of several factors (e.g. brain swelling or hydrocephalus). Several multistep treatment strategies have been described to reduce intracranial pressure in observational studies [108–110] and have been suggested to improve outcome. However, no RCTs have been performed, and results varied considerably between observational studies. As the described interventions may also cause harm, further studies are needed before these treatment strategies can be advised for routine use in patients with bacterial meningitis.

Van de Beek, Clin Microbio Inf Dis, 2016

Journal of Infection (2016) 72, 405–438

ELSEVIER

BIAMM British Infection Association

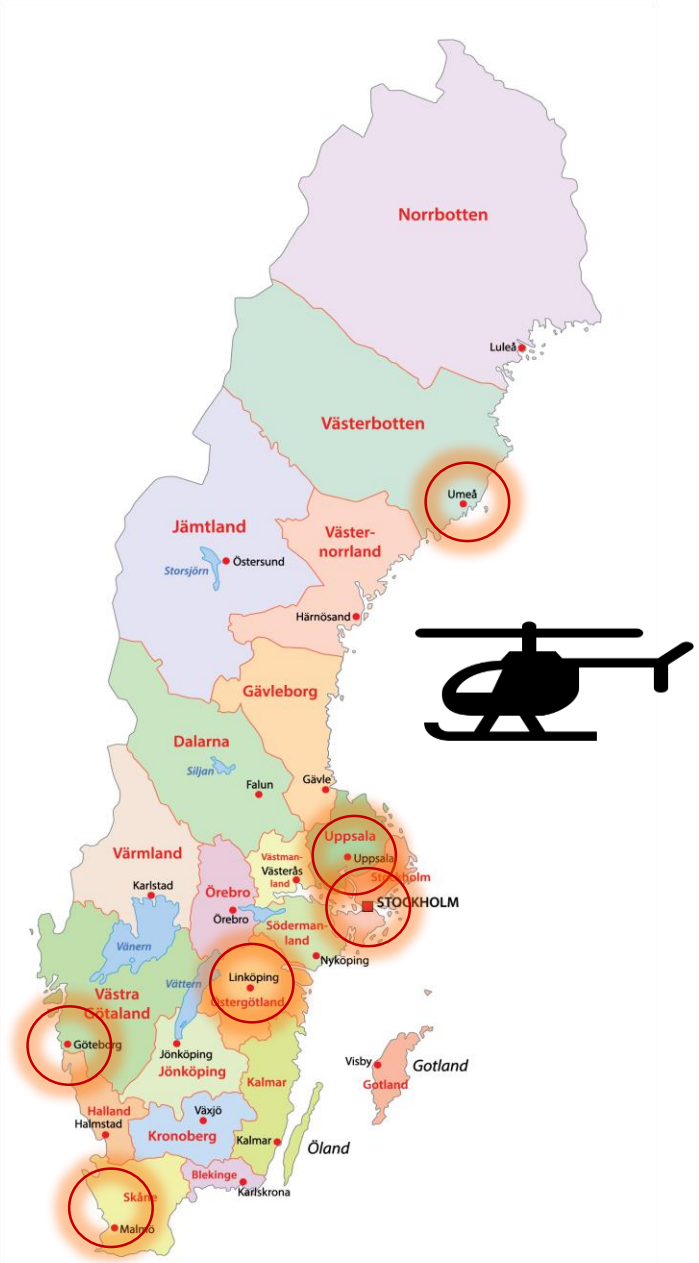
www.elsevierhealth.com/journals/jinf

The UK joint specialist societies guideline on the diagnosis and management of acute meningitis and meningococcal sepsis in immunocompetent adults☆

CrossMark

In patients with meningitis, control of raised intracranial pressure is also essential to prevent mortality although it is still not clear how best to achieve this and there is not sufficient evidence to support the routine use of ICP monitoring.[31,191] Measures such as achievement of normal

Mc Gill, J Infection, 2016



Är transport
till regionsjukhus
ICP-styrd behandling

bättre för patienten

än kliniskt styrd behandling
på hemortssjukhuset

?

Akut bakteriell meningit – best practice

- **Tidig upptäckt/diagnos**
  klinisk bedömning + LP
- **Tidig behandling**
  antibiotika + kortison
- **Adekvat vårdnivå**
  infektion/MAVA, IVA, IMA
- **DT hjärna** vid fokalitet, allvarligt förlopp
- **Överväg neurointensivvård i vissa fall**
- **Strukturerad uppföljning**

Tidig infektionsläkarkontakt vid misstanke om ABM

Uppföljning – Resttillstånd

- Återbesök 3–4 veckor
- Vaccination mot pneumokocker
- Hörseltest
- Neuropsykologisk utredning/rehab v.b.

Table 1 Neurologic sequelae of bacterial meningitis in high-resource countries.

Sequelae	Pneumococcal meningitis	Meningococcal meningitis	References
Focal deficits			
Children	3–14%	3%	10,23,24
Adults	11–36%	2–9%	15,23,26
Hearing loss			
Children	14–32%	4%	37,38,40
Adults	22–69%	3–40%	27,35,36
Seizures			
Children	15–48%	2%	10,44,45
Adults	31%	6%	47
Hydrocephalus			
Children	4–21%	–	37,56
Adults	4%	3%	57
Cognitive impairment			
Children	–	12–19%	12,38,59
Adults	32%	32%	60

Lucas, J of Infect, 2016

CNS-infektioner, bakteriella

Vårdprogram för bakteriella CNS-infektioner hos vuxna:akut bakteriell meningit, neurokirurgisk infektion, tuberkulös meningit, hjärnabscess och neuroborrelios. Publicerat första gången hösten 2004, reviderat 2010 samt 2020. Kontaktperson **Johanna Sjöwall** eller annan deltagare i vårdprogramgruppen, vilka framgår på sida 1 i vårdprogrammet.

Vårdprogrammet kan öppnas eller laddas ned i pdf-format. F.n. planeras ingen webbversion av dokumentet.

- Akut bakteriell meningit
- Neurokirurgiska CNS-infektioner
- Hjärnabscess
- Neuroborrelios
- CNS-tuberkulos