



Læknanemar 5. ári

2026-2027

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**SEPSIS HJÁ BÖRNUM**  
**-EARLY RECOGNITION SAVES LIVES**



# Skilgreiningar

- Clinical syndrome
    - Óhóflegt bólguviðbragð við sýkingu
  - Pro-inflammatory
    - Severe sepsis
    - Septic shock
    - Multi-organ failure
- 

# Sepsis

Table. The Phoenix Sepsis Score<sup>a</sup>

| Variables                                    | 0 Points                                                                       | 1 Point                                                                                                                                     | 2 Points                                                                                                | 3 Points                                                                                            |
|----------------------------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|
| <b>Respiratory, 0-3 points</b>               |                                                                                |                                                                                                                                             |                                                                                                         |                                                                                                     |
|                                              | $\text{PaO}_2\text{:Fio}_2 \geq 400$ or $\text{Spo}_2\text{:Fio}_2 \geq 292^b$ | $\text{PaO}_2\text{:Fio}_2 < 400$ on any respiratory support or $\text{Spo}_2\text{:Fio}_2 < 292$ on any respiratory support <sup>b,c</sup> | $\text{PaO}_2\text{:Fio}_2$ 100-200 and IMV or $\text{Spo}_2\text{:Fio}_2$ 148-220 and IMV <sup>b</sup> | $\text{PaO}_2\text{:Fio}_2 < 100$ and IMV or $\text{Spo}_2\text{:Fio}_2 < 148$ and IMV <sup>b</sup> |
| <b>Cardiovascular, 0-6 points</b>            |                                                                                |                                                                                                                                             |                                                                                                         |                                                                                                     |
|                                              |                                                                                | 1 Point each (up to 3)                                                                                                                      | 2 Points each (up to 6)                                                                                 |                                                                                                     |
|                                              | No vasoactive medications <sup>d</sup>                                         | 1 Vasoactive medication <sup>d</sup>                                                                                                        | $\geq 2$ Vasoactive medications <sup>d</sup>                                                            |                                                                                                     |
|                                              | Lactate $< 5$ mmol/L <sup>e</sup>                                              | Lactate 5-10.9 mmol/L <sup>e</sup>                                                                                                          | Lactate $\geq 11$ mmol/L <sup>e</sup>                                                                   |                                                                                                     |
| <b>Age based<sup>f</sup></b>                 |                                                                                |                                                                                                                                             |                                                                                                         |                                                                                                     |
|                                              | Mean arterial pressure, mm Hg <sup>g</sup>                                     |                                                                                                                                             |                                                                                                         |                                                                                                     |
| $< 1$ mo                                     | $> 30$                                                                         | 17-30                                                                                                                                       | $< 17$                                                                                                  |                                                                                                     |
| 1 to 11 mo                                   | $> 38$                                                                         | 25-38                                                                                                                                       | $< 25$                                                                                                  |                                                                                                     |
| 1 to $< 2$ y                                 | $> 43$                                                                         | 31-43                                                                                                                                       | $< 31$                                                                                                  |                                                                                                     |
| 2 to $< 5$ y                                 | $> 44$                                                                         | 32-44                                                                                                                                       | $< 32$                                                                                                  |                                                                                                     |
| 5 to $< 12$ y                                | $> 48$                                                                         | 36-48                                                                                                                                       | $< 36$                                                                                                  |                                                                                                     |
| 12 to 17 y                                   | $> 51$                                                                         | 38-51                                                                                                                                       | $< 38$                                                                                                  |                                                                                                     |
| <b>Coagulation (0-2 points)<sup>h</sup></b>  |                                                                                |                                                                                                                                             |                                                                                                         |                                                                                                     |
|                                              |                                                                                | 1 Point each (maximum 2 points)                                                                                                             |                                                                                                         |                                                                                                     |
|                                              | Platelets $\geq 100 \times 10^3/\mu\text{L}$                                   | Platelets $< 100 \times 10^3/\mu\text{L}$                                                                                                   |                                                                                                         |                                                                                                     |
|                                              | International normalized ratio $\leq 1.3$                                      | International normalized ratio $> 1.3$                                                                                                      |                                                                                                         |                                                                                                     |
|                                              | D-dimer $\leq 2$ mg/L FEU                                                      | D-dimer $> 2$ mg/L FEU                                                                                                                      |                                                                                                         |                                                                                                     |
|                                              | Fibrinogen $\geq 100$ mg/dL                                                    | Fibrinogen $< 100$ mg/dL                                                                                                                    |                                                                                                         |                                                                                                     |
| <b>Neurological (0-2 points)<sup>i</sup></b> |                                                                                |                                                                                                                                             |                                                                                                         |                                                                                                     |
|                                              | Glasgow Coma Scale score $> 10$ ; pupils reactive <sup>j</sup>                 | Glasgow Coma Scale score $\leq 10^j$                                                                                                        | Fixed pupils bilaterally                                                                                |                                                                                                     |
| <b>Phoenix sepsis criteria</b>               |                                                                                |                                                                                                                                             |                                                                                                         |                                                                                                     |
| Sepsis                                       | Suspected infection and Phoenix Sepsis Score $\geq 2$ points                   |                                                                                                                                             |                                                                                                         |                                                                                                     |
| Septic shock                                 | Sepsis with $\geq 1$ cardiovascular point(s)                                   |                                                                                                                                             |                                                                                                         |                                                                                                     |

The task force recommends that sepsis in children be identified by a Phoenix Sepsis Score of at least 2 points in children with suspected infection, which indicates potentially life-threatening dysfunction of the respiratory, cardiovascular, coagulation, and/or neurological systems.”



# How Bad is Sepsis?

- Children with a Phoenix Sepsis Score of at least 2 points had in-hospital mortality of:
    - 7.1% in higher-resource settings
    - 28.5% in lower-resource settings
    - More than 8 times higher children with suspected infection not meeting these criteria.
  - Better to spot those at risk before they develop sepsis!
- 



# Faraídsfræði

- Hærri tíðni á sepsis hjá yngstu börnunum
- Mjög há tíðni á PICU
  - 7-10%
- Dánartíðni í Vestrænum (“próuðu”) löndum enn mjög há
  - 5-10%



# Áhættuþættir

- Ungur aldur
  - High energy trauma (penetrating)
  - Alvarleg krónísk undirliggjandi vandamál
  - Ónæmisbæling
  - Innliggjandi aðskotahlutir
- 

# Ástæður sepsis syndrome hjá börnum

- Svörun við sýkingu
  - Ýkt pro- vs anti-inflammatory viðbragð
  - Vasodilation og æðaleki
- Nýburar
  - GBS, *E. coli*, *S. aureus*, Herpes simplex
- Eldri börn
  - Pneumococcar, meningococcar, GAS, *S. aureus*, *E. coli*
- Aðrir pathógenar
  - *Pseudomonas*, *Salmonella* spp, Malaría, candida spp, Aspergillus, influenza, RSV, HSV, Enterococcar

# Að þekkja sepsis hjá börnum

- MUNA sepsis
- Láta sér detta það í hug: “er þetta sepsis?”
- Blóðrannsóknir oft óáreiðanlegar
- Klínískt mat og “nef” nauðsynlegt
- Ef grunur um sepsis – meðhöndla sem slíkt á meðan rannsóknir fara fram

# Klínísk einkenni

- Hiti er algengasta einkennið
- Önnur einkenni eru breytileg og oft háð aldri barnsins/bakgrunni og örveru sem veldur sýkingunni
- Óeðlileg (inappropriate) tachycardia
- Breytingar á mental state
- Lengd háræðafylling (>2 sekúndur)

# PEWS – kids

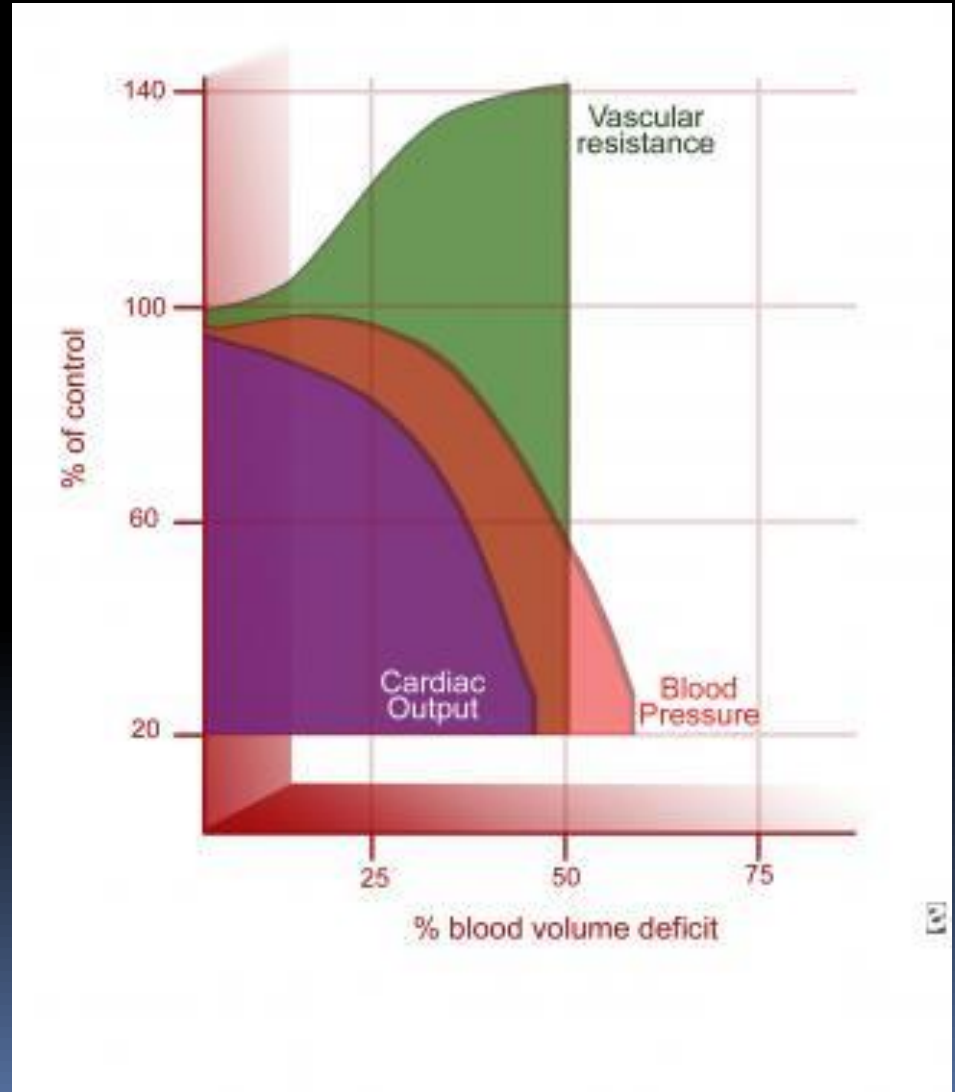
| <b>Brighton Pediatric Early Warning Score</b>                                                        |                                                          |                                                                                                       |                                                                                                                    |                                                                                                                                       |              |
|------------------------------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|--------------|
|                                                                                                      | <b>0</b>                                                 | <b>1</b>                                                                                              | <b>2</b>                                                                                                           | <b>3</b>                                                                                                                              | <b>SCORE</b> |
| <b>Behaviour</b>                                                                                     | Playing<br>Appropriate                                   | Sleeping                                                                                              | Irritable                                                                                                          | Lethargic <b>&amp;/OR</b><br>Confused <b>&amp;/OR</b><br>Reduced response to pain                                                     |              |
| <b>Respiratory</b>                                                                                   | Within normal parameters<br>No recession or tracheal tug | 10 above normal parameters, Using accessory muscles,<br><b>&amp;/OR</b><br>30+% FiO2 or 4+ liters/min | >20 above normal parameters<br>recessing/retractions, tracheal tug<br><b>&amp;/OR</b><br>40+% FiO2 or 6+liters/min | 5 below normal parameters with sternal recession/retractions, tracheal tug or grunting<br><b>&amp;/OR</b><br>50% FiO2 or 8+liters/min |              |
| <b>Cardiovascular</b>                                                                                | Pink <b>&amp;/OR</b> capillary refill 1-2 seconds        | Pale <b>&amp;/OR</b> capillary refill 3 seconds                                                       | Grey <b>&amp;/OR</b> capillary refill 4 seconds<br>Tachycardia of 20 above normal rate.                            | Grey and mottled or capillary refill 5 seconds or above<br><b>OR</b><br>Tachycardia of 30 above normal rate or bradycardia            |              |
| Q15 minutes bronchodilators <b>&amp;/OR</b><br>persistent vomiting following surgery (2 points each) |                                                          |                                                                                                       |                                                                                                                    |                                                                                                                                       |              |
| <b>TOTAL PEWS SCORE</b>                                                                              |                                                          |                                                                                                       |                                                                                                                    |                                                                                                                                       |              |

# Einkenni - frh

- Minnkaður þvagútskilnaður
- Útbrot
  - Purpura fulminans
  - Toxin mediated
- Lágur blóðþrýstingur er pre-terminal einkenni!

# Sepsis and circulation

## Paediatric shock



1919 – W.W. Herrick- “no other infection so quickly slays”





# Útbrotin



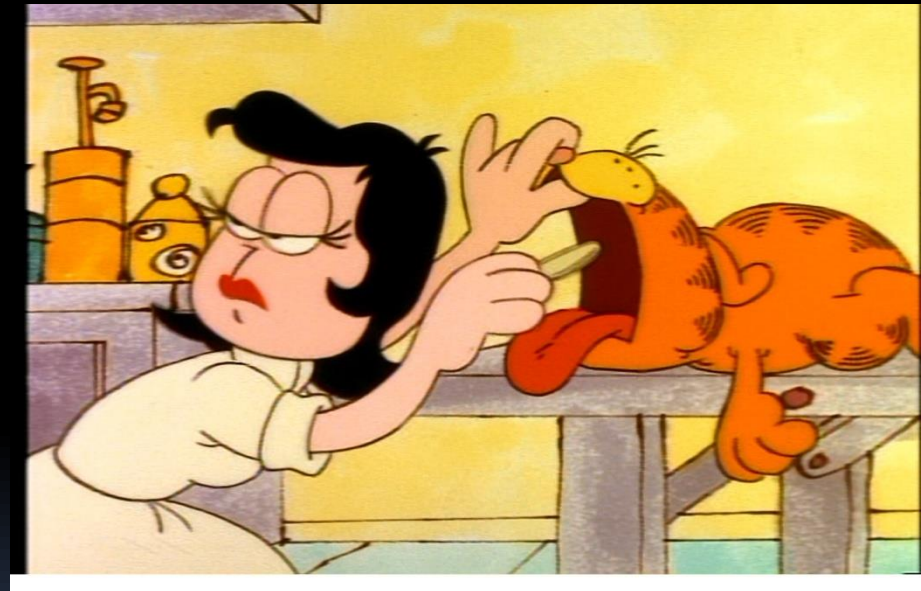


# Tímasetning atburða

- Í upphafi eru f.o.f ósértæk einkenni
  - Fyrstu einkenni sepsis:  
Fótaverkir, breyttur húðlitur, kaldar hendur/fætur.
  - Þorsti í eldri krökkum
  - Drowsiness / öndunarerfiðleikar hjá yngri krökkum
- 

# Tilfelli

- 2 ára drengur, almennt hraustur
- Hiti í 2 daga
  - 39°C
  - Slappur
- Lífsmörk
  - PR: 180/mín
  - RR: 35/mín
  - SaO<sub>2</sub>: 95%
  - 105/75
- Skoðun
- Plan





# Tilfelli – 2 ára drengur

- Rannsóknir

- 
- Meðferð



Pyngd:  
(Aldur+4)x2

# Rannsóknir- LP

- Mænustunga?
  - Ef já, þá hvenær?
- Allir nýburar <4 vikna með hita >38°C
- Áhættuþættir (maternal herpes hjá nýbura, ónæmisbæling)
- Einkenni ("pirringur", hnakkastífleiki, flog)
- "Gut feeling"

# Blood volume for cultures

- Sensitivity increases by 4-5% for every 1ml
- Don't go above 2% of blood volume

**Table 3**

Summary of recommendations for optimal blood volume based on self-defined age or weight classes

| Patient weight (kg) | Total blood volume <sup>a</sup> (mL) | References               |
|---------------------|--------------------------------------|--------------------------|
| ≤2.0                | 1.0–4.5                              | [1,16,27,28,35,36,38,39] |
| >2.0–5.0            | 1.0–6.0                              |                          |
| >5.0–10.0           | 1.5–10.0                             |                          |
| >10.0–20.0          | 6.0–23.0                             |                          |
| >20.0–30.0          | ≥10.0                                |                          |
| Patient age         | Total blood volume <sup>a</sup> (mL) | References               |
| <1 y                | >0.5–3.0                             | [1,40–43]                |
| ≥1–3 y              | 1.0–4.0                              |                          |
| >3–10 y             | 3.0–8.0                              |                          |
| ≥10 y               | 20.0                                 |                          |

<sup>a</sup> Minimum and maximum recommended total blood volume to be drawn for paediatric blood culture.

# Rannsóknir

- Engar rannsóknir sem eru afgerandi
- Hefðbundin uppvinnsla
  - blóðhagur, CRP (PCT, IL-6), blóðræktun
    - Nota pediatric kolbur ef <4ml af blóði
  - Blóðgas, laktat, LFT's, storkupróf
- "New and coming"
  - CD64 neutrophilar, IL-6, IL-18, mRNA expression profiles (Ramilo et al)

# Meðferð

- Sýklalyf
  - Hvaða?
- Vökvar
  - Crystalloid vs colloid?
    - Hve mikið og hve hratt?
      - 10-20ml/kg að total 40-60ml/kg
  - Plasma/blóð
- Inotropar



# Balanced vs unbalanced fluids

**TABLE 3. Unadjusted Outcomes for 24- and 72-Hour Fluid Groups**

| 24-hr Fluid Group Outcomes                                    | Balanced Fluids Only<br>(n = 2,398) | Unbalanced Fluids Only<br>(n = 30,166) | p       |
|---------------------------------------------------------------|-------------------------------------|----------------------------------------|---------|
| Mortality, n (%)                                              | 343 (14.3)                          | 4,776 (15.8)                           | 0.048   |
| Acute kidney injury, n (%)                                    | 413 (17.2)                          | 7,001 (23.2)                           | < 0.001 |
| Continuous renal replacement therapy use, n (%)               | 147 (6.1)                           | 2,710 (9.0)                            | < 0.001 |
| Median total LOS in days (25–75th percentile)                 | 23 (11–45)                          | 19 (9–39)                              | < 0.001 |
| Median total LOS in nonsurvivors in days (25–75th percentile) | 25 (7–57)                           | 19 (5–49)                              | 0.001   |
| Median total PICU LOS in days (25–75th percentile)            | 10 (4–22)                           | 8 (3–19)                               | < 0.001 |
| 72-hr Fluid Group Outcomes                                    | Balanced Fluids Only<br>(n = 1,641) | Unbalanced Fluids Only<br>(n = 27,973) | p       |
| Mortality, n (%)                                              | 234 (14.3)                          | 4,449 (15.9)                           | 0.076   |
| Acute kidney injury, n (%)                                    | 266 (16.2)                          | 6,471 (23.1)                           | < 0.001 |
| Continuous renal replacement therapy use, n (%)               | 101 (6.2)                           | 2,486 (8.9)                            | < 0.001 |
| Median total LOS in days (25–75th percentile)                 | 23 (11–48)                          | 19 (9–39)                              | < 0.001 |
| Median total LOS in nonsurvivors in days (25–75th percentile) | 28 (7–67)                           | 19 (5–50)                              | 0.001   |
| Median total PICU LOS in days (25–75th percentile)            | 9 (3–22)                            | 8 (3–19)                               | < 0.001 |

LOS = length of stay.

Outcomes including mortality, acute kidney injury, use of continuous renal replacement therapy, and length of stay for patients receiving exclusively balanced fluids or exclusively unbalanced fluids at 24 and 72 hr of resuscitation.

# Sýklalyfjameðferð

- Sýklalyf
  - < 2mán: ampicillin & 3. kynslóðar cephalosporin (acyclovir ef grunur um CNS sýkingu)
  - > 2 mán: 3. kynslóðar cephalosporin
  - Breiðvirkari lyf í völdum aðstæðum
- Viðeigandi fyrir aldur
- Næmi algengustu baktería þar sem þú vinnur
  - MRSA algengur, ESBL osfrv
- Ónæmisbældir?
- Hve lengi? En ef allar ræktanir neikvæðar?



# Meðferð

- Almenn stuðningsmeðferð
    - O<sub>2</sub>
  - PICU/ICU
    - Senior hjálp
- 

# Yfirvofandi sepsis

- Hiti algengast
- Önnur teikn eru breytileg og háð aldri og pathogen
- “Unwell appearance”: clinical “gut feeling”
- Inappropriate tachycardia
- Breytingar á meðvitund
- Lengd háræðafylling(>2 sek)
- Hypotension er síðkomið teikn og oft pre-terminal!



# Samantekt áhættupáttta fyrir slæma útkomu

1. Vanmat á alvarleika veikinda
  2. Ekki nægilega agressíf meðhöndlun
  3. Ónóg þekking á vinnuferlum sjúkrahússins
  4. Skortur á – eða léleg stjórnun / Blind hlýðni
  5. Ónóg tengsl við gjörgæslu
  6. Lack of urgency
- 





# Samantekt

- Að greina sepsis snemma er afar erfitt
    - ▣ Takið ykkur tíma (External stress factorar)
  - Takið eftir rauðum flöggum
  - Ef grunur um ífarandi sýkingu – setja rannsóknir og meðferð af stað og kalla á hjálp
  - Verðið að þekkja sýklalyfjanæmi og meðferðarleiðbeiningar á þínum spítala/svæði/sjúklingahópi
- 



# BMJ statement

.... Thus doctors of the first contact have to have knowledge out of proportion with their previous experience.



**Gangi ykkur vel!**

Leseefni

# Pediatric Sepsis Diagnosis, Management, and Sub-phenotypes

Scott L. Weiss, MD, MSCE,<sup>a,b</sup> Julie C. Fitzgerald, MD, MSCE, PhD<sup>c,d</sup>

PEDIATRICS Volume 153, number 1, January 2024:e2023062967



## Paediatric Sepsis 1

### The burden and contemporary epidemiology of sepsis in children

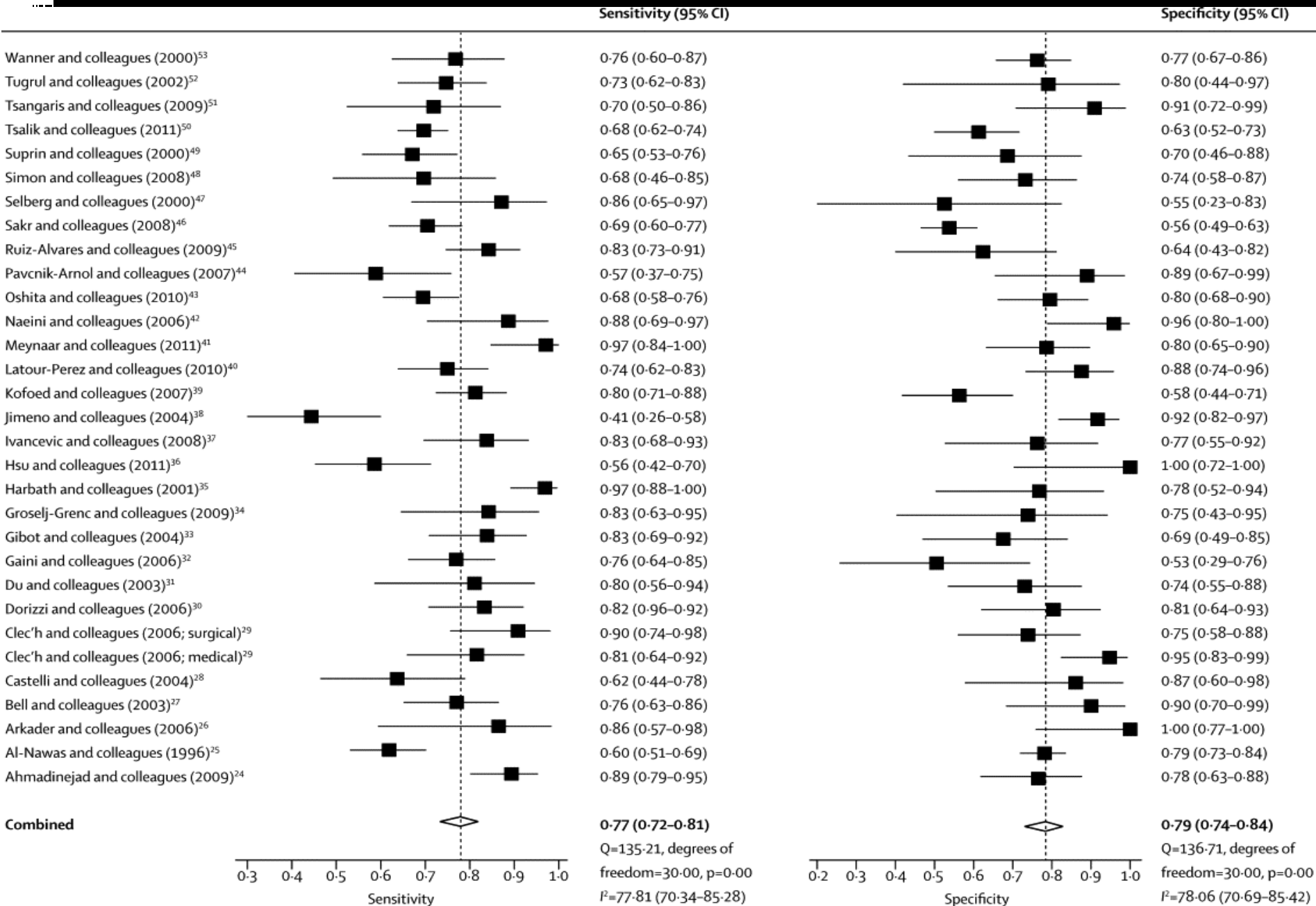
*R Scott Watson, Enitan D Carrol, Michael J Carter, Niranjana Kissoon, Suchitra Ranjit, Luregn J Schlapbach*

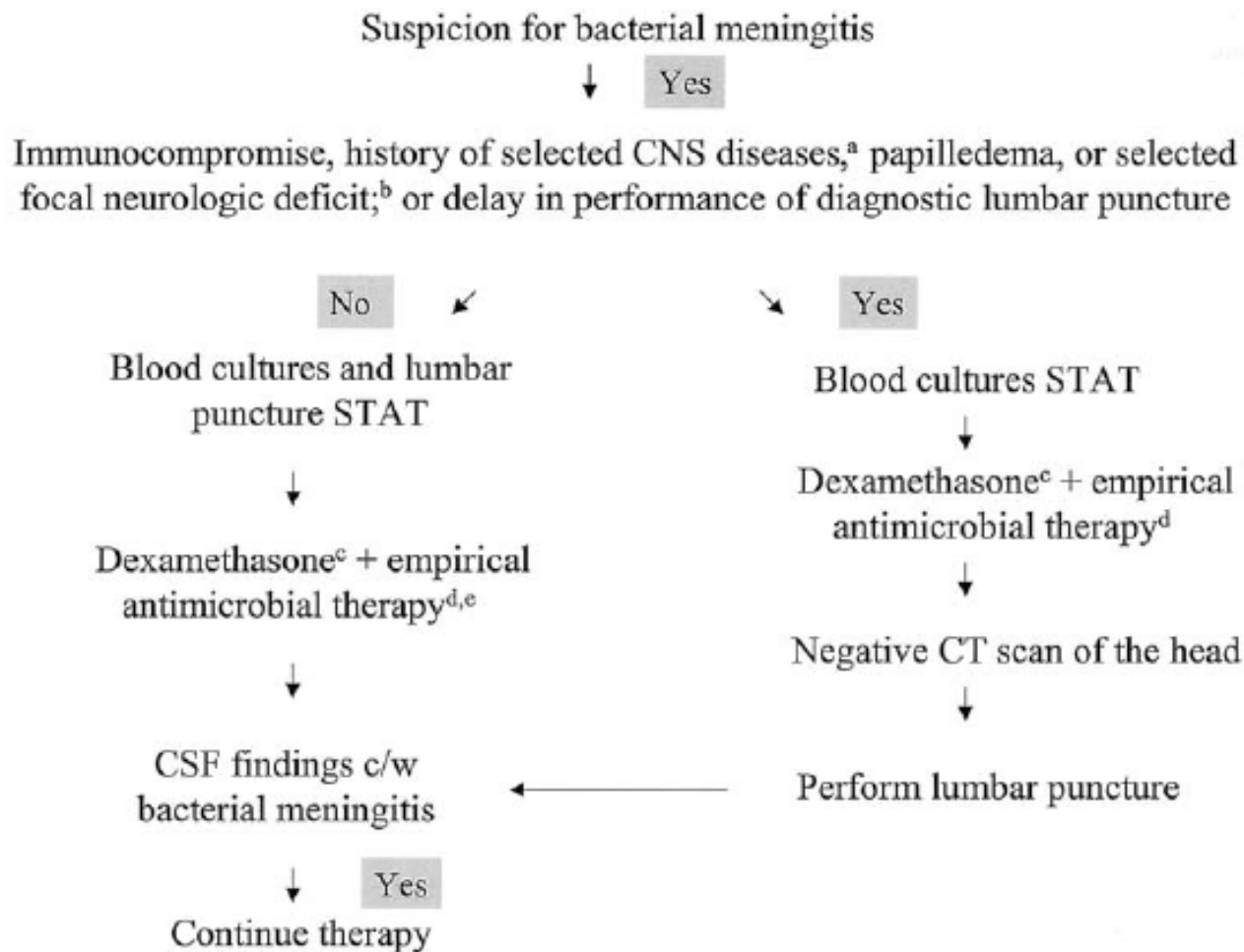
*Lancet Child Adolesc Health*  
2024; 8: 670–81

This is the first in a **Series** of four papers on paediatric sepsis (Paper 4 appears in *The Lancet Digital Health*). All papers in the Series are available at [thelancet.com/series/paediatric-sepsis](https://thelancet.com/series/paediatric-sepsis)

Sepsis is a dysregulated host response to infection that leads to life-threatening organ dysfunction. Half of the 50 million people affected by sepsis globally every year are neonates and children younger than 19 years. This burden on the paediatric population translates into a disproportionate impact on global child health in terms of years of life lost, morbidity, and lost opportunities for children to reach their developmental potential. This Series on paediatric sepsis presents the current state of diagnosis and treatment of sepsis in children, and maps the challenges in alleviating the burden on children, their families, and society. Drawing on diverse experience and multidisciplinary expertise, we offer a roadmap to improving outcomes for children with sepsis. This first paper of the Series is

# Procalcitonin Meta-analysis. Wacker et al. Lancet Inf Dis. 2013.





**Figure 1.** Management algorithm for infants and children with suspected bacterial meningitis. "Stat" indicates that the intervention should be done emergently. C/W, consistent with. <sup>a</sup>Includes those associated with CSF shunts, hydrocephalus, or trauma, those occurring after neurosurgery, or various space-occupying lesions. <sup>b</sup>Palsy of cranial nerve VI or VII is not an indication to delay lumbar puncture. <sup>c</sup>See text for recommendations for use of adjunctive dexamethasone in infants and children with bacterial meningitis. <sup>d</sup>See table 4. <sup>e</sup>Dexamethasone and antimicrobial therapy should be administered immediately after CSF is obtained.

## Practice Guidelines for the Management of Bacterial Meningitis

Allan R. Tunkel,<sup>1</sup> Barry J. Hartman,<sup>2</sup> Sheldon L. Kaplan,<sup>3</sup> Bruce A. Kaufman,<sup>4</sup> Karen L. Roos,<sup>5</sup> W. Michael Scheld,<sup>6</sup> and Richard J. Whitley<sup>7</sup>