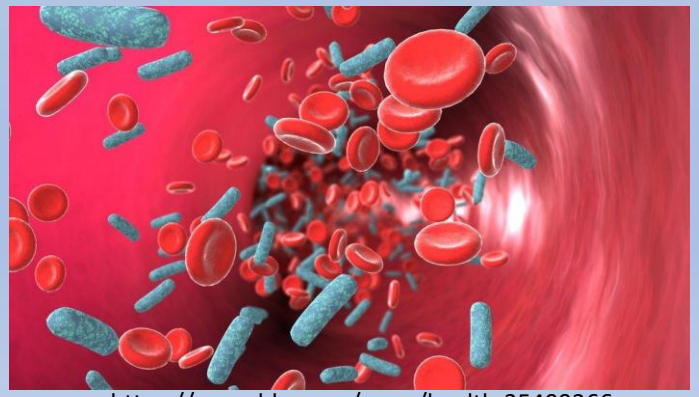
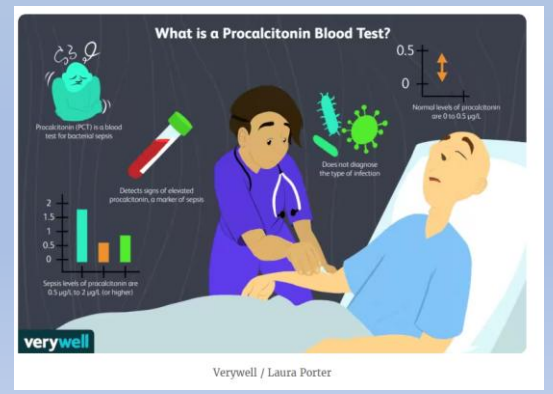
Sepsis

Véráram-fertőzés? Bacteraemia? Pozitív haemocultura? Septicus laborparaméterek? Sepsis?

Sipos Dávid



https://www.bbc.com/news/health-35409266



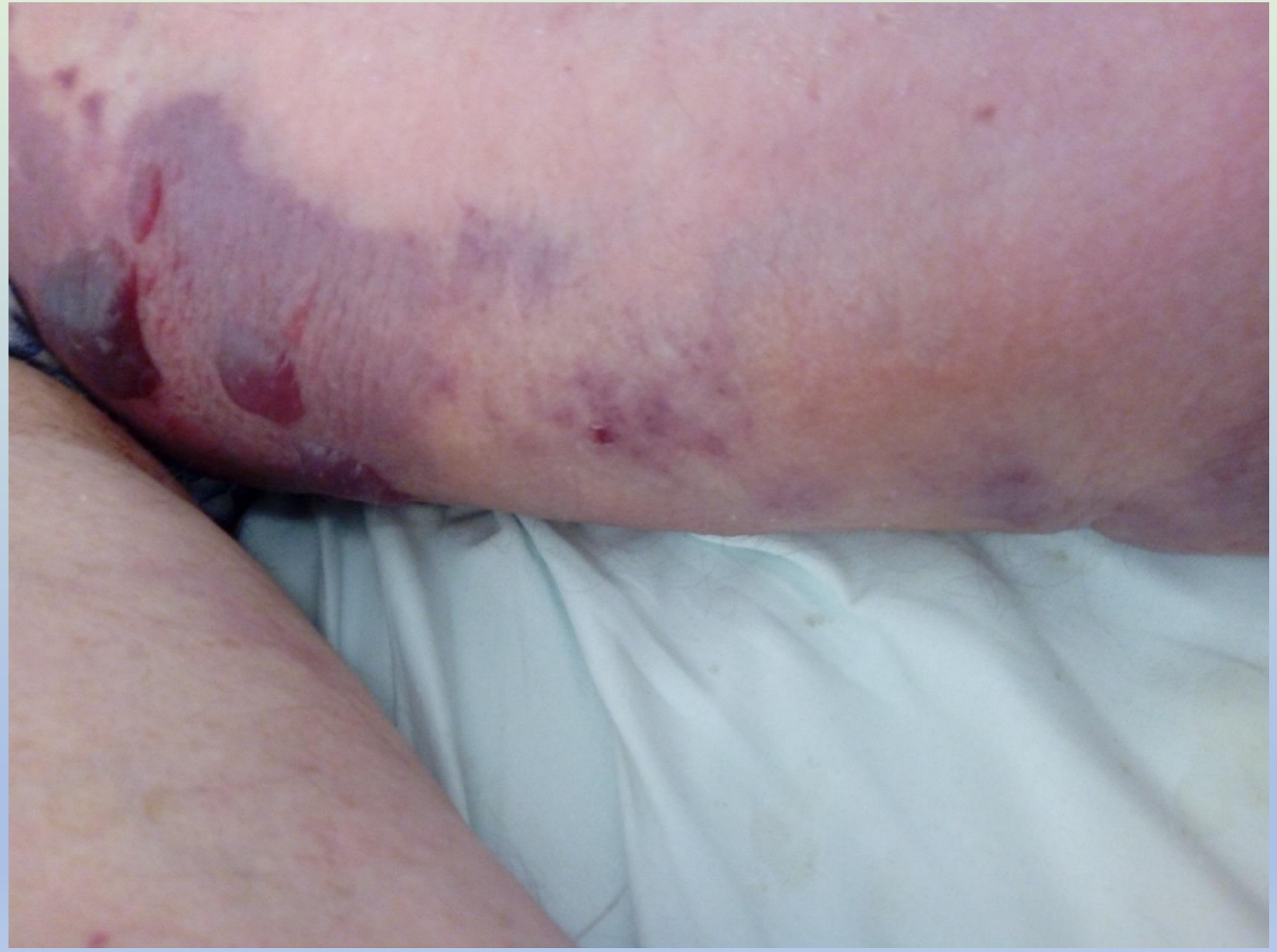
Verywell / Laura Porter

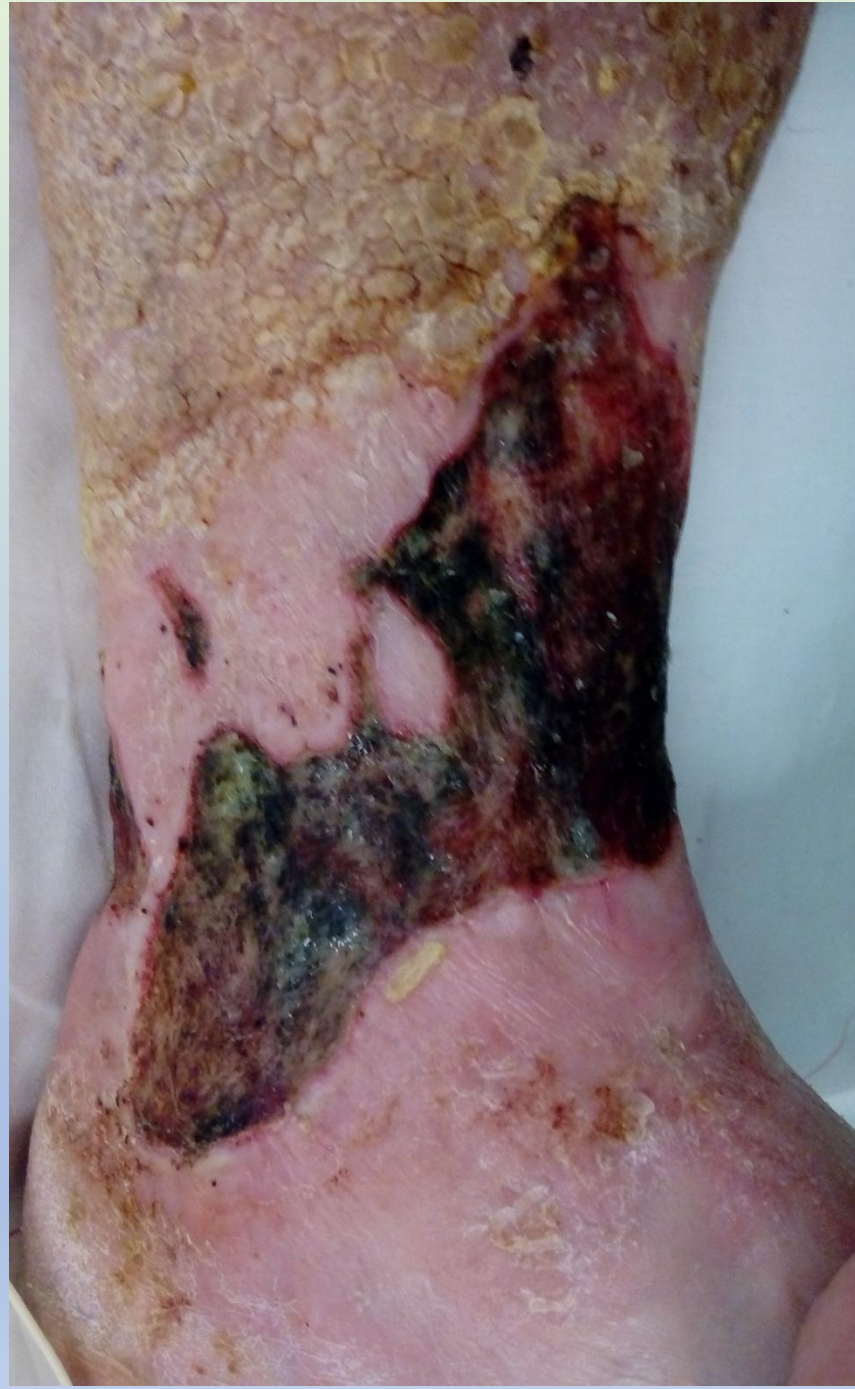
https://www.verywellhealth.com/procalcitonin-results-and-what-they-mean-3156825

76 éves férfi

- Anamnézis
  - Hypertonia, dysbasiás panaszok miatt érsebészeti vizsgálat
  - 1,5 éve AFC aneurysma – femoropoplitealis bypass
  - 1 éve Femoropoplitealis occlusio – alsó végtagi fekélyek
  - 1 hónapja alsó végtagi fekélyek – femoropoplitealis bypass
  - 1 hónapja fekélyek miatt számos kezelés, necrosisok

- Jelen panaszok:
  - 4 nappal korábban hasmenés, napi 1-3 lazább széklet
  - Bal alsó végtag duzzanata és fájdalma
  - Romló általános állapot, gyengeség





Patomechanizmus

Rizikótényezők

TABLE 73.3 Risk Factors for Sepsis

Demographic Factors

Older age (>65 years old)
Male sex
Black race
Nutrition
Vaccination status
Genetic polymorphisms

Environmental Factors

Poor socioeconomic status
Seasonal variation and contacts
Disease outbreaks
Travel

Comorbidities

Diabetes
Chronic obstructive pulmonary disease
Cancer
Chronic renal disease
Chronic liver disease
Human immunodeficiency virus
Use of immunosuppressive agents

Hospital Factors

Duration of hospitalization
Antibiotic resistance
Catheters (e.g., urine catheters, intravenous lines)
Complications of surgery (wound infection, emergency vs. elective surgery)

MANDELL, DOUGLAS, AND BENNETT'S PRINCIPLES AND PRACTICE OF INFECTIOUS DISEASES, NINTH EDITION

***Panel 1:* Risk factors for infection and sepsis**

Risk factors for developing an infection

Generic infection

- Host genetics (eg, tumour necrosis factor α and Toll-like receptor polymorphisms)
- Extremes of age
- Genetic immunosuppression
- Exposure to epidemic
- Acquired immunosuppression or immune dysregulation (eg, cancer, immunosuppressive medications, diabetes, alcohol abuse, indwelling catheters, conditions with altered skin)

Primary bloodstream infection

- Indwelling catheters
- Parenteral nutrition

Chest infection

Same as for generic infection, plus

- Chronic obstructive pulmonary disease
- Prolonged intubation
- Recent thoracic, abdominal, major orthopaedic surgery
- Aspiration

Urinary tract infection

- Indwelling catheters
- Poor mobility (eg, in nursing home residents)
- Female sex

Risk factors for developing sepsis

- Less defined
- Same as for infection risk
- Host genetics

Cecconi M, Evans L, Levy M, Rhodes A. Sepsis and septic shock. Lancet 2018; 392: 75-87.

TABLE 2 Predisposing factors that contribute to immunosuppression

Therapy
Immunosuppressive
Antimicrobial (i.e., broad-spectrum)
Antifungal

Bacterial colonization
Staphylococcus aureus (i.e., MRSA)
Distortions in normal bacterial microbiota (due to antimicrobial prophylaxis)

Immune deficiency
Autoimmune disease

Devitalized tissue, fluid collections

Neutropenia, lymphopenia

Medical Comorbidities
Uremia
Malnutrition
Diabetes
Alcoholism with cirrhosis
Peripheral vascular disease
Congestive heart failure
Renal and liver disease

Infection with immunomodulating viruses
CMV
EBV
HBV
HCV
HIV

Surgical and/or invasive procedure
Catheterization (i.e., urinary tract, central venous, central line-associated BSIs)

Martinez RM, Wolk DM. 2016. Bloodstream infections. Microbiol Spectrum 4(4):DMIH2-0031-2016. doi:10.1128/microbiolspec.DMIH2-0031-2016.

Labor (8:36)

Megnevezés	Érték	Abn	Egység	Referencia tart.
Nátrium	140		mmol/l	136-145
Kálium	4,59		mmol/l	3,50-5,10
Glükóz	5,09		mmol/l	3,90-6,00
Diabetes csak 7mmol/l érték felett valószínû (éhgyomri állapotban).				
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Protrombin ráta	1,96	U H	.	0,90-1,15
Protrombin INR	1,97	U H	.	0,90-1,15
Vérkép automatával:				
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Minõségi vérkép (kenetellenõrzés):				
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Monocita #	0,9		%	
Eozinofil #	0,0		%	
Bazofil #	0,0		%	
Szétesett sejt #	1,8		/100FVS	
Vörösvértest	3,80	L	T/l	4,50-6,00
Hemoglobin	125	L	g/l	137-175
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RDW	13,5		%CV	11,6-14,4

Proinflammatorikus cytokinek
tumor necrosis factor (TNF), IL-1β,IL-6, IL-12, IL-18, IFN-γ, ROI

Anti-inflammatorikus cytokinek
IL4,6,10,11,13,16, TGF-β, NO, leptin

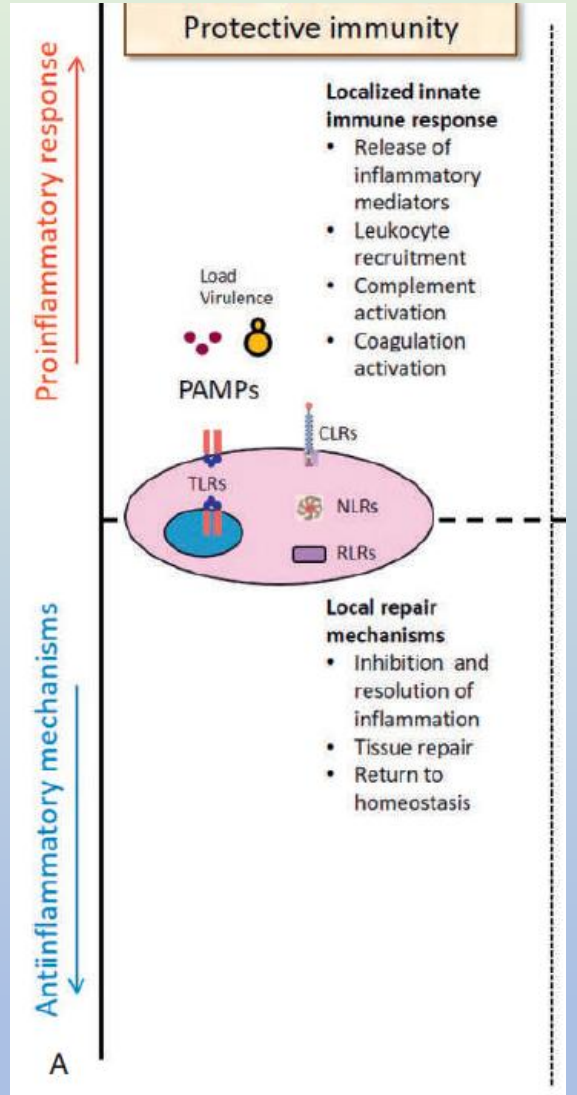

FIG. 73.3 **Host response to infection and during s**
by sensing pathogen-associated molecular patterns *(PA*
Toll-like receptors *(TLRs)*, nucleotide-binding oligomeriza
receptors *(RLRs)*, and C-type lectin receptors *(CLRs)*. A b
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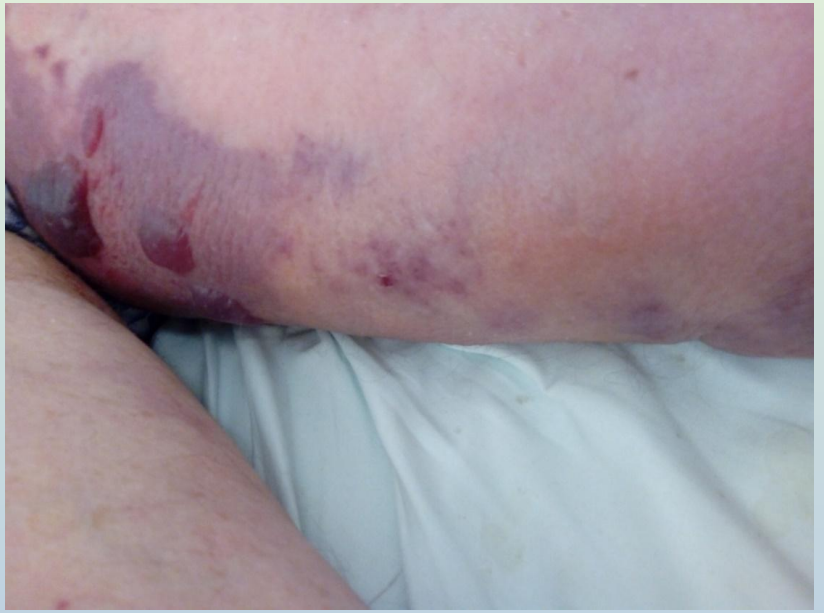
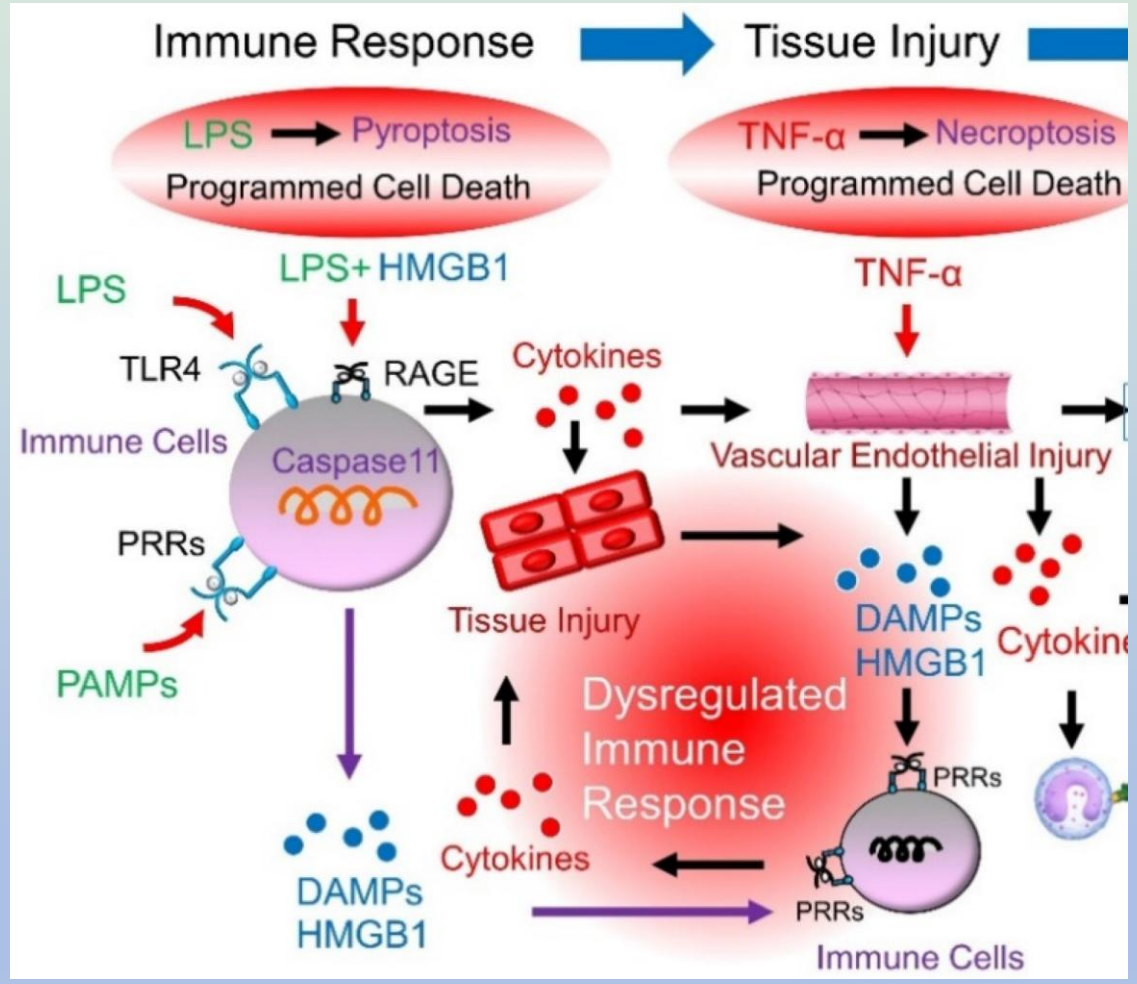
aimed at tempering the initial inflammation and tissue
and harmful to the host. The host response during sep
text for description of hyperinflammatory and immuno

MANDELL, DOUGLAS, AND BENNETT'S PRINCIPLES AND PRACTICE OF INFECTIOUS DISEASES, NINTH EDITION

Fizikális lelete 16:46



- Végtag
- Bőre hűvös, nyirkos
- RR: 90/60 fr: 120/min, légzésszám: 36/min, SpO2 97%
- GCS 15
- Egyebekben negatív



MANDELL, DOUGLAS, AND BENNETT'S PRINCIPLES AND PRACTICE OF INFECTIOUS DISEASES, NINTH EDITION

Proinflammatorikus cytokinek:
tumor necrosis factor (TNF), IL-1β,IL-6, IL-12, IL-18, IFN-γ, ROI

Antiinflammatorikus citokinek
IL4,6,10,11,13,16, TGF-β, NO, leptin

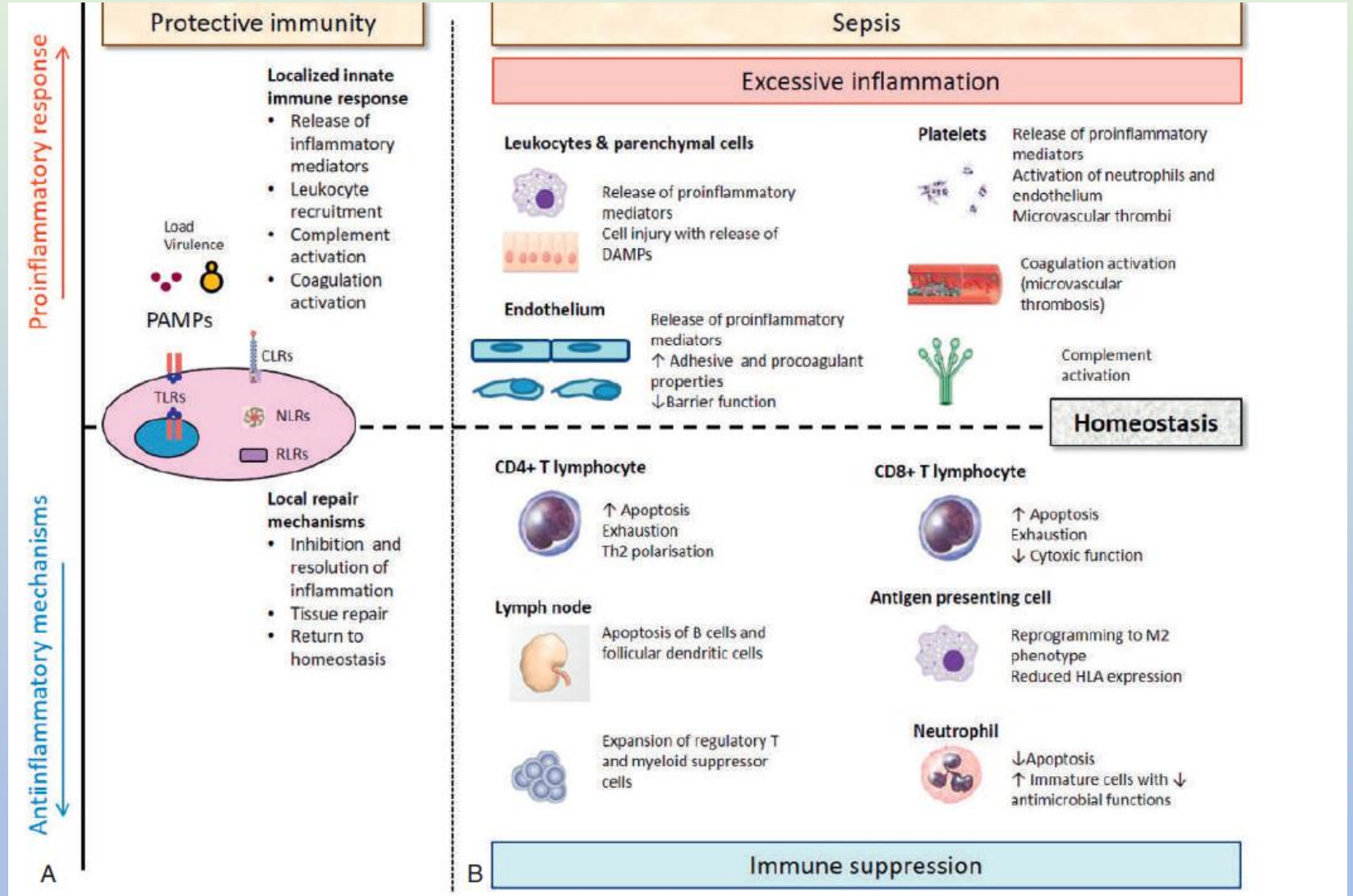
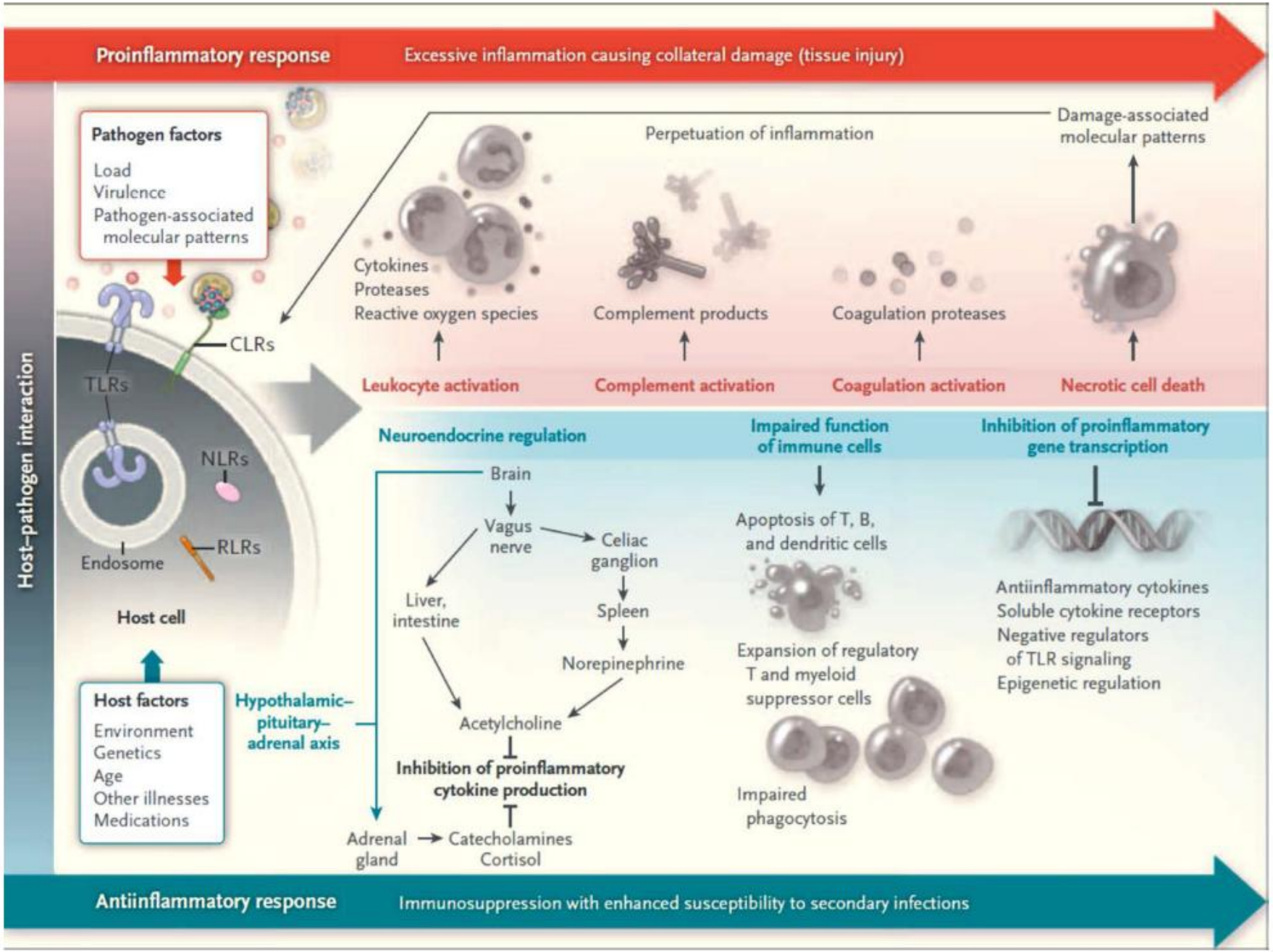


FIG. 73.3 Host response to infection and during sepsis. (A) During a protective immune response, innate immune cells recognize invading pathogens by sensing pathogen-associated molecular patterns *(PAMPs)* through a collection of cell surface and intracellular pattern recognition receptors including Toll-like receptors *(TLRs)*, nucleotide-binding oligomerization domain-like receptors *(NLRs)* (which include inflammasomes), retinoic acid–inducible gene-like receptors *(RLRs)*, and C-type lectin receptors *(CLRs)*. A balanced response entails a variety of proinflammatory reactions such as release of cytokines, influx of phagocytes, and local activation of the complement and coagulation systems, followed by a return to homeostasis by a set of compensatory mechanisms aimed at tempering the initial inflammation and tissue repair. (B) If the pathogen succeeds in multiplying, the immune response becomes unbalanced and harmful to the host. The host response during sepsis is characterized by concurrent hyperinflammation *(top)* and immunosuppression *(bottom)*. See text for description of hyperinflammatory and immunosuppressive responses in sepsis. *DAMPs,* Damage-associated molecular patterns.

MANDELL, DOUGLAS, AND BENNETT'S PRINCIPLES AND PRACTICE OF INFECTIOUS DISEASES, NINTH EDITION



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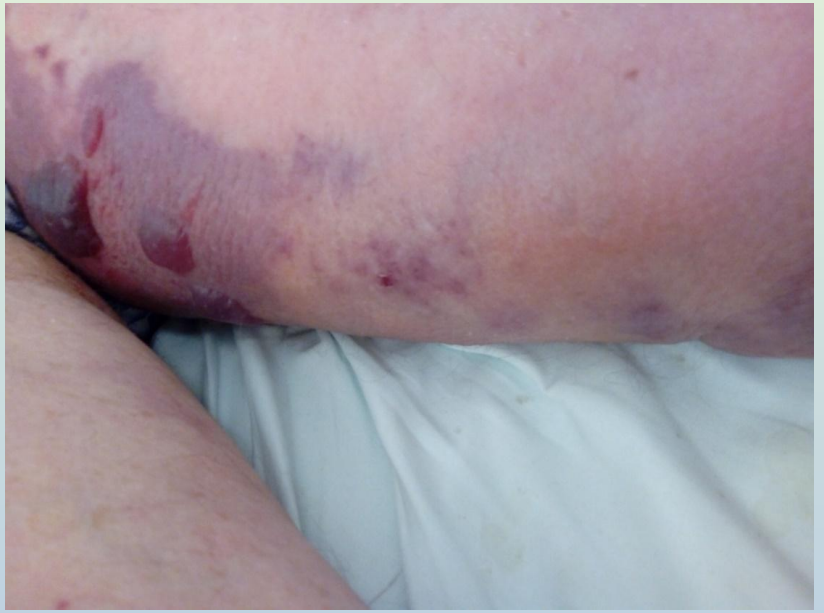

- Végtag
- Bőre hűvös, nyirkos
- RR: 90/60 fr: 120/min, légzésszám: 36/min, SpO2 97%
- GCS 15
- Egyebekben negatív

SEPSIS?

- Már az ókori görögök
  - Homérosz (Iliász) – sepsis (σηπω)
    - Szerves anyag rothadása, elbomlása

- Sepsis-1 (1991)
  - Gyanított vagy igazolt infekció, ami SIRS-hez vezet
  - Súlyos sepsis
  - Sepcticus shcok

1991 Consensus Conference[1]	
SIRS	At least two of the following: • Temperature >38°C or <36°C • Heart rate >90 beats/min • Respiratory rate >20 breaths/min or arterial CO_2 <32 mm Hg • White blood cell count >12 × 10^9/L or <4 × 10^9/L or >10% immature forms
Sepsis	Infection[a] + SIRS
Severe sepsis	Sepsis + acute organ dysfunction
Septic shock	Sepsis + persistent hypotension after fluid resuscitation

Fizikális lelete 16:46

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Term	Criteria
SIRS	2 out of the 4 following criteria: Temperature >38 °C or <36 °C Heart rate >90/min Hyperventilation evidenced by respiratory rate >20/min or arterial CO2 < 32 mmHg White blood cell count >12 000 cells/μl or <4000 cells/μl

Sarkar, Dattatreya & Chatterji, Rajeev. (2022). Role of Procalcitonin Levels in Patients with Sepsis in Medical Intensive Care Unit. National Journal of Medical Research. 12. 35-41. 10.55489/njmr.12032022906.

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MCHC	339		g/l	310-360
RDW	13,5		%CV	11,6-14,4

Definíció

- Sepsis-2 (2001)
  - Septicus shock:
    - Szisztolés art. nyomás < 90 Hgmm (gyermek <2 SD a normálhoz képest)
    - MAP < 60 Hgmm
    - Szisztolés vérnyomás csökkenése >40 Hgmm

Table 1. Diagnostic criteria for sepsis

Infection,[a] documented or suspected, and some of the following:[b]
General variables
Fever (core temperature >38.3°C)
Hypothermia (core temperature <36°C)
Heart rate >90 min^{-1} or >2 SD above the normal value for age
Tachypnea
Altered mental status
Significant edema or positive fluid balance (>20 mL/kg over 24 hrs)
Hyperglycemia (plasma glucose >120 mg/dL or 7.7 mmol/L) in the absence of diabetes
Inflammatory variables
Leukocytosis (WBC count >12,000 μL^{-1})
Leukopenia (WBC count <4000 μL^{-1})
Normal WBC count with >10% immature forms
Plasma C-reactive protein >2 SD above the normal value
Plasma procalcitonin >2 SD above the normal value
Hemodynamic variables
Arterial hypotension[b] (SBP <90 mm Hg, MAP <70, or an SBP decrease >40 mm Hg in adults or <2 SD below normal for age)
$S\bar{v}O_2$ >70%[b]
Cardiac index >3.5 $L \cdot min^{-1} \cdot M^{-23}$
Organ dysfunction variables
Arterial hypoxemia (PaO_2/FIO_2 <300)
Acute oliguria (urine output <0.5 $mL \cdot kg^{-1} \cdot hr^{-1}$ or 45 mmol/L for at least 2 hrs)
Creatinine increase >0.5 mg/dL
Coagulation abnormalities (INR >1.5 or aPTT >60 secs)
Ileus (absent bowel sounds)
Thrombocytopenia (platelet count <100,000 μL^{-1})
Hyperbilirubinemia (plasma total bilirubin >4 mg/dL or 70 mmol/L)
Tissue perfusion variables
Hyperlactatemia (>1 mmol/L)
Decreased capillary refill or mottling

Levy MM, Fink MP, Marshall JC, et al. 2001 SCCM/ ESICM/ACCP/ATS/SIS international sepSIS definitions conference. *Crit Care Med*. 2003;31:1250–1256.

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Szervrendszer szintű változások

- Keringés
  - Endothel – prostaciklinek, NO – vazodilatáció
  - Csökkent ADH-szekréció
  - Megnövekedett kapilláris permeabilitás → folyadékkilépés, szöveti ödéma

  } hipotenzió

  - Vazokonstrikció károsodása (a vér redisztribúciója a splanchnikus szervektől nem megfelelő)
  - Kapilláris átáramlás romlása
    - Szöveti ödéma okozta kompresszió, endothel duzzanata, lumen elzáródása (leukocyták, vörösvértestek)
  - Endothelkárosodás
    - Diszfunkció, alvadási eltérések, csökkent VVT-deforambilitás, adhézió, glycocalyx degradációja

- Szív
  - Keringési elégtelenség infekcióval társulva
    - Nem megfelelő myocardium vérátáramlás
    - Direkt myocardiumdepresszió (IL-1ß, TNF-a – ß-receptorok, NO down-regulációja; C5a mediálta cardiodepresszzió)
    - Károsodott mitokondriumfunkció (NO, ROI; mitokondrium Ca-túltelítődése – permeabilitás nő – mtDNS szabaddá válik – DAMP – TLR-9)

Labor (8:36)

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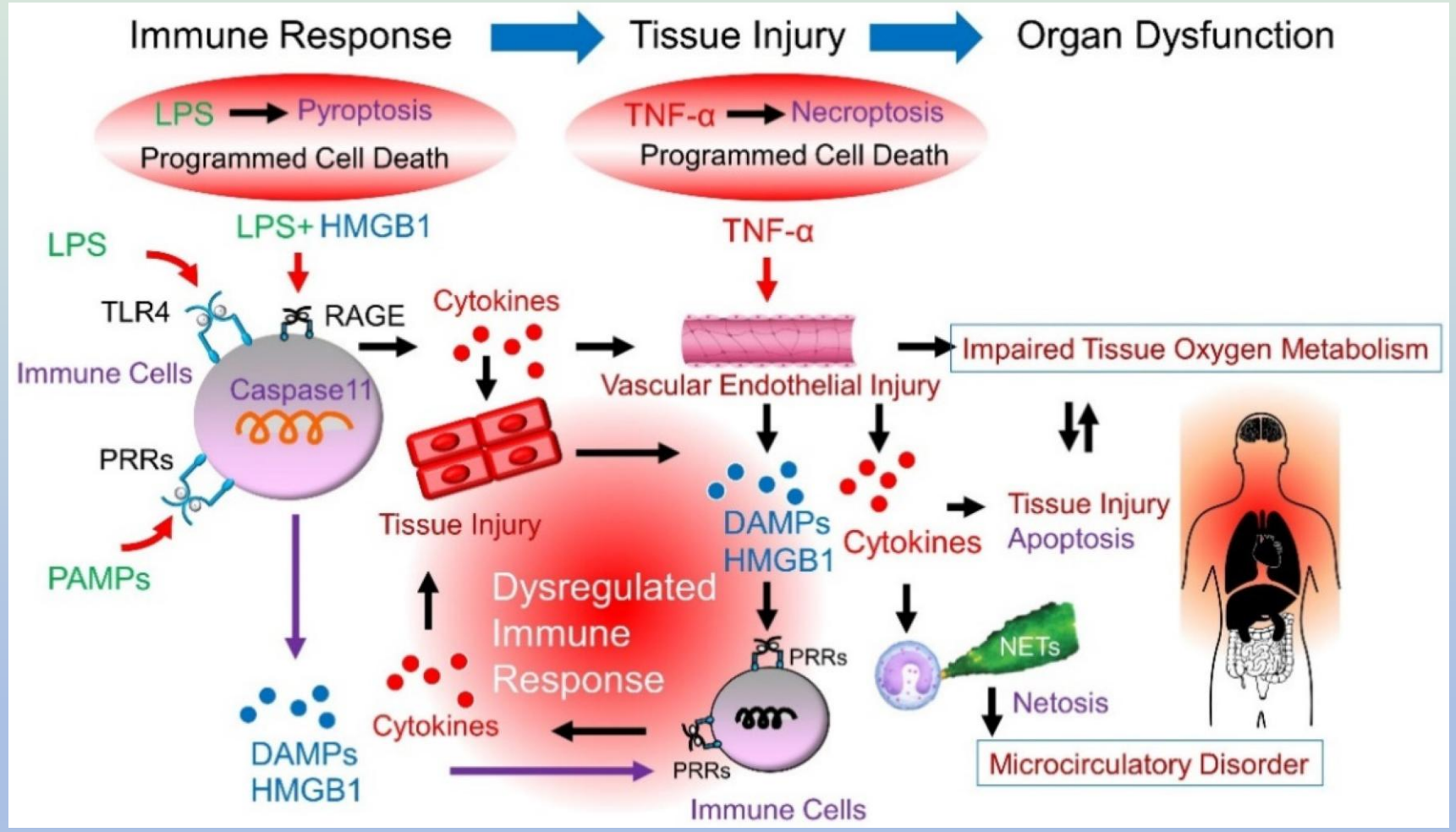
Szervrendszer szintű változások

- Vese
  - Hipoxémia, hipoperfúzió -> ATN
  - Szisztémás hypotensio, direkt vasoconstrictio, cytokinek (pl. TNF)
  - Tubularis epithel – TLR-2,-4 – oxidatív stressz, mitokondium-károsodás
  - Kapillárisocclusio – endothelkárosodás – vazodilatáció, endothel leakage – ödema- peritubularis tér nő – tubularis epithel O2-ellátása romlik – vesén belüli redistribució – medulla hipoperfúziója


Immune Response
Tissue Injury
Organ Dysfunction
LPS
Pyroptosis
Programmed Cell Death
TNF-α
Necroptosis
Programmed Cell Death
LPS
LPS+ HMGB1
TNF-α
TLR4
RAGE
Cytokines
Immune Cells
Caspase11
PRRs
PAMPs
Tissue Injury
Vascular Endothelial Injury
Impaired Tissue Oxygen Metabolism
DAMPs
HMGB1
Cytokines
Tissue Injury
Apoptosis
Dysregulated
Immune
Response
Cytokines
DAMPs
HMGB1
PRRs
PRRs
Immune Cells
NETs
Netosis
Microcirculatory Disorder

Definíció

- Sepsis-3

(2016 JAMA)

Box 3. New Terms and Definitions

- Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection.
- Organ dysfunction can be identified as an acute change in total SOFA score ≥2 points consequent to the infection.
  - The baseline SOFA score can be assumed to be zero in patients not known to have preexisting organ dysfunction.
  - A SOFA score ≥2 reflects an overall mortality risk of approximately 10% in a general hospital population with suspected infection. Even patients presenting with modest dysfunction can deteriorate further, emphasizing the seriousness of this condition and the need for prompt and appropriate intervention, if not already being instituted.
- In lay terms, sepsis is a life-threatening condition that arises when the body's response to an infection injures its own tissues and organs.
- Patients with suspected infection who are likely to have a prolonged ICU stay or to die in the hospital can be promptly identified at the bedside with qSOFA, ie, alteration in mental status, systolic blood pressure ≤100 mm Hg, or respiratory rate ≥22/min.

Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA*. 2016;315:801–810.

SOFA – qSOFA

Table 1. Sequential [Sepsis-Related] Organ Failure Assessment Score[a]

System	Score 0	1	2	3	4
Respiration					
Pao_2/Fio_2, mm Hg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation					
Platelets, $\times 10^3/\mu L$	≥150	<150	<100	<50	<20
Liver					
Bilirubin, mg/dL (μmol/L)	<1.2 (20)	1.2-1.9 (20-32)	2.0-5.9 (33-101)	6.0-11.9 (102-204)	>12.0 (204)
Cardiovascular	MAP ≥70 mm Hg	MAP <70 mm Hg	Dopamine <5 or dobutamine (any dose)[b]	Dopamine 5.1-15 or epinephrine ≤0.1 or norepinephrine ≤0.1[b]	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1[b]
Central nervous system					
Glasgow Coma Scale score[c]	15	13-14	10-12	6-9	<6
Renal					
Creatinine, mg/dL (μmol/L)	<1.2 (110)	1.2-1.9 (110-170)	2.0-3.4 (171-299)	3.5-4.9 (300-440)	>5.0 (440)
Urine output, mL/d				<500	<200

Abbreviations: Fio_2, fraction of inspired oxygen; MAP, mean arterial pressure; Pao_2, partial pressure of oxygen.

[a] Adapted from Vincent et al.[27]

[b] Catecholamine doses are given as μg/kg/min for at least 1 hour.

[c] Glasgow Coma Scale scores range from 3-15; higher score indicates better neurological function.

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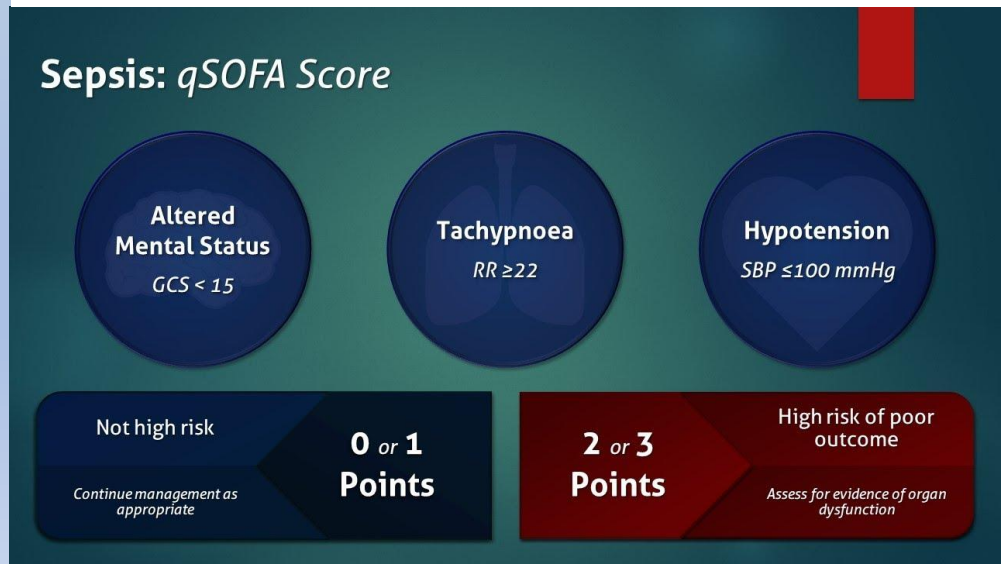
Screening for sepsis in hospital

Recommendation	
4. For acutely ill patients in hospital, we "recommend" using NEWS, NEW2, MEWS, or SIRS over qSOFA as a single tool to screen for sepsis (strong recommendation, moderate certainty evidence)	**Revisited**

Prescott H, Antonelli M, Alhazzani W, et al. Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock 2026. Crit Care Med. 2026 Mar. Forthcoming. doi.org/10.1097/CCM.0000000000007075

Box 4. qSOFA (Quick SOFA) Criteria

- Respiratory rate ≥22/min
- Altered mentation
- Systolic blood pressure ≤100 mm Hg



Definíció

- Sepsis-3 (2016 JAMA)

• Septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality.

• Patients with septic shock can be identified with a clinical construct of sepsis with persisting hypotension requiring vasopressors to maintain MAP ≥65 mm Hg and having a serum lactate level >2 mmol/L (18 mg/dL) despite adequate volume resuscitation. With these criteria, hospital mortality is in excess of 40%.

Box 3. New Terms and Definitions

• Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection.

• Organ dysfunction can be identified as an acute change in total SOFA score ≥2 points consequent to the infection.

  • The baseline SOFA score can be assumed to be zero in patients not known to have preexisting organ dysfunction.

  • A SOFA score ≥2 reflects an overall mortality risk of approximately 10% in a general hospital population with suspected infection. Even patients presenting with modest dysfunction can deteriorate further, emphasizing the seriousness of this condition and the need for prompt and appropriate intervention, if not already being instituted.

• In lay terms, sepsis is a life-threatening condition that arises when the body's response to an infection injures its own tissues and organs.

• Patients with suspected infection who are likely to have a prolonged ICU stay or to die in the hospital can be promptly identified at the bedside with qSOFA, ie, alteration in mental status, systolic blood pressure ≤100 mm Hg, or respiratory rate ≥22/min.

Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA*. 2016;315:801–810.

Fizikális lelete 16:46

- Végtag
- Bőre hűvös, nyirkos
- RR: 90/60 fr: 120/min, légzésszám: 36/min, SpO2 97%
- GCS 15
- Egyebekben negatív

System	Score				
	0	1	2	3	4
Respiration PaO_2/FIO_2, mmHg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation Platelets, $\times 10^3\ \mu L^{-1}$	≥150	<150	<100	<50	<20
Liver Bilirubin, mg dL^{-1} ($\mu mol\ L^{-1}$)	<1.2 (20)	1.2–1.9 (20–32)	2.0–5.9 (33–101)	6.0–11.9 (102–204)	>12.0 (204)
Cardiovascular	MAP ≥ 70 mmHg	MAP < 70 mmHg	Dopamine < 5 or dobutamine (any dose)[a]	Dopamine 5.1–15 or epinephrine ≤ 0.1 or norepinephrine ≤ 0.1[a]	Dopamine > 15 or epinephrine > 0.1 or norepinephrine > 0.1[a]
Central Nervous System (CNS) Glasgow Coma Scale score[b]	15	13–14	10–12	6–9	<6
Renal Creatinine, mg dL^{-1} ($\mu mol\ L^{-1}$)	<1.2 (110)	1.2–1.9 (110–170)	2.0–3.4 (171–299)	3.5–4.9 (300–440)	>5.0 (440)
Urine output, mL per day				<500	<200

FIO_2: fraction of inspired oxygen; MAP: mean arterial pressure; PaO_2: partial pressure of oxygen.
[a]Catecholamine doses are given as $\mu g kg^{-1} min^{-1}$ for at least 1 h.
[b]Glasgow Coma Scale scores range from 3 to 15; higher score indicates better neurological function.

Megnevezés	Érték	Abn	Egység	Referencia tart.
Nátrium	140		mmol/l	136-145
Kálium	4,59		mmol/l	3,50-5,10
Glükóz	5,09		mmol/l	3,90-6,00
Diabetes csak 7mmol/l érték [illegible] valószínű (éhgyomri állapotban).				
Karbamid	18,34	U H	mmol/l	2,14-8,21
Kreatinin	226	U H	umol/l	62-106
GOT	52	U H	U/l	<44
GPT	25	U	U/l	<50
Ultraszenzitiv CRP	315,80	U H	mg/l	<5,00
PTR idő	24,10	U H	sec	9,40-12,50
Protrombin ráta	1,96	U H	.	0,90-1,15
Protrombin INR	1,97	U H	.	0,90-1,15
Vérkép automatával:				
Fehérvérsejt	17,200	U H	Giga/l	4,000-10,000
Minőségi vérkép (kenetellenőrzés):				
Neutrofil karéjozott #	75,5		%	
Neutrofil Stab #	22,7		%	
Mielocita #	0,9		%	
Limfocita #	0,0		%	
Monocita #	0,9		%	
Eozinofil #	0,0		%	
Bazofil #	0,0		%	
Szétesett sejt #	1,8		/100FVS	
Vörösvértest	3,80	L	T/l	4,50-6,00
Hemoglobin	125	L	g/l	137-175
Hematokrit #	36,9	L	%	40,1-51,0
MCV	97,1	H	fl	80,0-95,0
MCH	32,9	U	pg	26,0-33,0
MCHC	339		g/l	310-360
RDW	13,5		%CV	11,6-14,4

Diagnózis – SOFA, DE

- Haematológiai és biokémiai markerek
  - Leukocytosis (>12000 G/l) v. leukopaenia (<4000 G/l)
  - Éretlen alakok >10%
  - CRP >2 SD normál tartomány
  - PCT >2 SD nomrál tartomány

Table 1. Diagnostic criteria for sepsis

Infection,[a] documented or suspected, and some of the following:[b]
General variables
Fever (core temperature >38.3°C)
Hypothermia (core temperature <36°C)
Heart rate >90 min^{-1} or >2 SD above the normal value for age
Tachypnea
Altered mental status
Significant edema or positive fluid balance (>20 mL/kg over 24 hrs)
Hyperglycemia (plasma glucose >120 mg/dL or 7.7 mmol/L) in the absence of diabetes
Inflammatory variables
Leukocytosis (WBC count >12,000 μL^{-1})
Leukopenia (WBC count <4000 μL^{-1})
Normal WBC count with >10% immature forms
Plasma C-reactive protein >2 SD above the normal value
Plasma procalcitonin >2 SD above the normal value
Hemodynamic variables
Arterial hypotension[b] (SBP <90 mm Hg, MAP <70, or an SBP decrease >40 mm Hg in adults or <2 SD below normal for age)
$S\bar{v}O_2$ >70%[b]
Cardiac index >3.5 $L \cdot min^{-1} \cdot M^{-23}$
Organ dysfunction variables
Arterial hypoxemia (PaO_2/FIO_2 <300)
Acute oliguria (urine output <0.5 $mL \cdot kg^{-1} \cdot hr^{-1}$ or 45 mmol/L for at least 2 hrs)
Creatinine increase >0.5 mg/dL
Coagulation abnormalities (INR >1.5 or aPTT >60 secs)
Ileus (absent bowel sounds)
Thrombocytopenia (platelet count <100,000 μL^{-1})
Hyperbilirubinemia (plasma total bilirubin >4 mg/dL or 70 mmol/L)
Tissue perfusion variables
Hyperlactatemia (>1 mmol/L)
Decreased capillary refill or mottling

DOI-10.21304/2018.0504.00408

Symposium

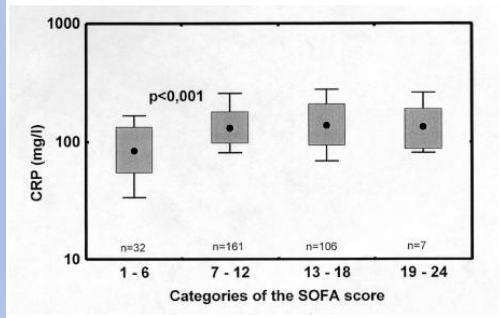
Biomarkers in Sepsis

Amita Kaul*, Sachin Shah**
*Consultant PICU, **Chief Consultant and Director, Surya Mother and Child Superspecialty hospital, Pune, India
Received: 21-Jul-18/Accepted: 02-Aug-18/Published online: 30-Aug-18

Table 2 : Comparision between CRP and Procalcitonin.[8]

C-reactive protein	Procalcitonin
Begins to rise 12-24 hours and peaks Within 2-3 days	Detectable with 3-4 hours and peaks within 6-24hours
High in other inflammatory conditions like SLE,JRA, etc	Doesn't rise in these inflammatory conditions
As a marker of sepsis sensitivity :0.75 (95% CI, 0.62-0.84)	0.88 (95% CI -0.8-0.93)
Specificity :0.67(95%CI, 0.56-0.77)	0.81(95% CI,0.67-0.90)

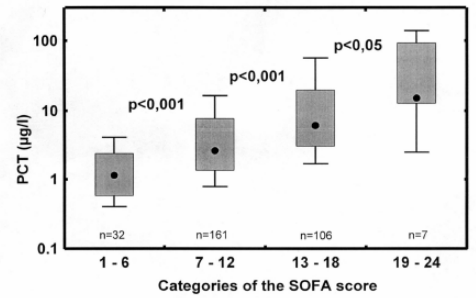
Figure 2



Plasma concentrations of the corresponding C-reactive protein (CRP) concentrations of patients within four categories of the sepsis-related organ failure assessment (SOFA) score. Indicated are median (●), 25/75 percentiles (box) and 10/90 percentiles (whisker) of CRP concentrations (*n*) obtained from 40 patients during a 15-day observation period. **P*<0.05 compared with the preceding category (Mann–Whitney U-test).

Comparison of procalcitonin (PCT) and C-reactive protein (CRP) plasma concentrations at different SOFA scores during the course of sepsis and MODS
Michael Meisner, Klaus Tschaikowsky, Thomas Palmaers and Joachim Schmidt

Figure 1



Procalcitonin (PCT) plasma concentrations of patients within four categories of the sepsis-related organ failure assessment (SOFA) score. Indicated are median (●), 25/75 percentiles (box) and 10/90 percentiles (whisker) of PCT observations (*n*) obtained from 40 patients during a 15-day observation period. **P*<0.05 compared with the preceding category (Mann–Whitney U-test).

Procalcitonin

- Pajzsmirigy C-sejtjei, más szervek IL-6, TNF-α, IL-1ß
  - IFN-γ
- Kinetika
  - 3-4 óra elteltével kezd emelkedni
  - Csúcs 6-12 óra múlva
  - Féléletidő 24 óra
- Egyéb okok
  - Sebészi beavatkozás, súlyos trauma, súlyos égés, elhúzódó kardiogén shock
  - Gombainfekció, malária, babesia
  - Medullaris pajzsmirigycc., kissejtes tüdőrák
  - Gyógyszerek (alemtuzumab, IL-2/granulocyta-transzfúzió)
  - CKD
  - Amfetamin

Vizsgálat	M.Egys.	2021.08.26.	2021.08.27.	2021.08.29.	2021.08.31.	2021.09.02.
GPT	U/l	15	15			12
Alkalikus foszfatáz	U/l		90			66
Gamma-GT	U/l		16			22
LDH	U/l		267		238	177
Fehérvérsejt	G/l	24,19	20,5	16,49	5,15	10,42
NEUT	%		94,5	92,7	77,2	81,6
NEUT	Giga/l		19,38	15,3	3,98	8,51
Limfocita	%		1,6	2,2	10,9	8,3
Limfocita (abs)	Giga/l		0,32	0,36	0,56	0,86
Eozinofil	%		0,1	0,1	1,6	2
Eozinofil (abs)	Giga/l		0,03	0,01	0,08	0,21
Bazofil	%		0,1	0,2	0,6	0,9
Bazofil (abs)	Giga/l		0,02	0,03	0,03	0,09
VV	T/l	5,03	5,12	5,2	4,76	5
Hemoglobin	g/l	149	151	151	137	147
HTK	%	43,1	45,9	46,3	42	44,7
MCV	fl	85,7	89,6	89	88,2	89,4
MCH	pg	29,6	29,5	29	28,8	29,4
MCHC	g/l	346	329	326	326	329
Trombocita	G/l	124	115	142	146	165
Ultraszenzitiv CRP	mg/l	250,3	291,1	227,8	108,7	46,2
Procalcitonin #	ng/ml	2,02	1,68	1,4	0,52	

Procalcitonin

Review Article

Clinical Utility and Measurement of Procalcitonin

Intan Samsudin,[1,2] *Samuel D Vasikaran[1]
[1]Department of Clinical Biochemistry, PathWest Laboratory Medicine WA, Fiona Stanley Hospital, Murdoch, WA 6150, Australia; [2]Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, Serdang, Selangor 43400, Malaysia
*For correspondence: Dr Samuel Vasikaran, Samuel.vasikaran@health.wa.gov.au

- Alapellátás
  - 0,25 ug/l
  - Briel és mtsai. 72%-al kevesebb antibiotikum-kezelés, 40% felső légúti infekciók esetén
  - Burkhardt és mtsai 42%-al kevesebb antibiotikum-felhasználás
  - Mortalitásban nincs különbség
- Sürgősségi Osztály
  - ProHosp
  - 1/3-al kevesebb antibiotikum-felhasználás alsó légúti infekciók esetén
- ITO
  - PRORATA? – alacsonyabb expozíció

  de (nem szignifikánsan) magasabb 60 napos mortalitás
  - SAPS
    - Leállításhoz 5 vs 7 nap antibiotikum, alacsonyabb mortalitás

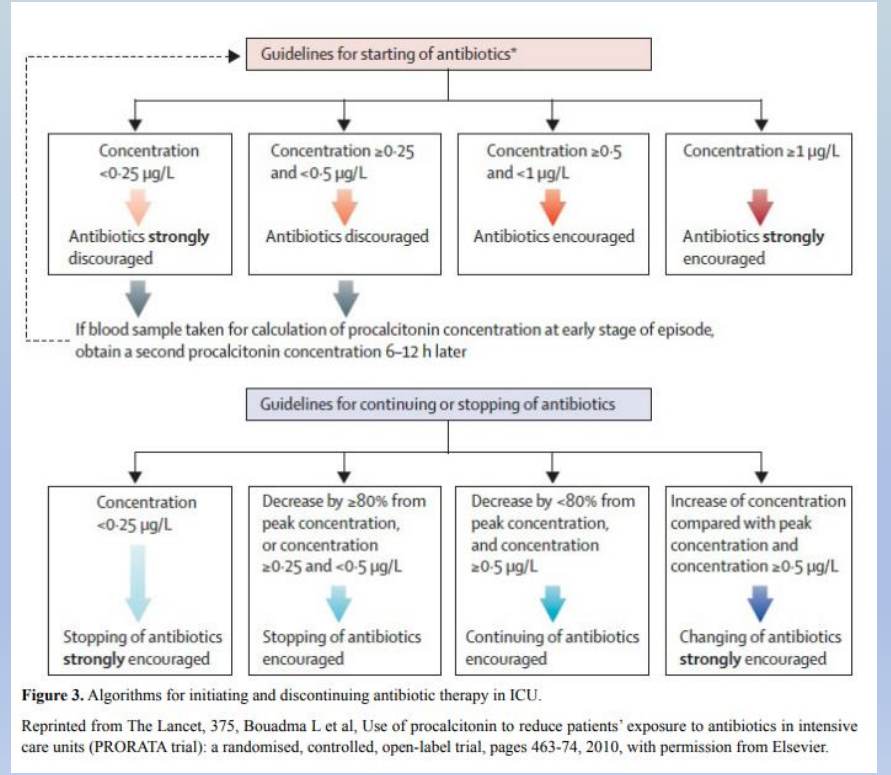


Figure 3. Algorithms for initiating and discontinuing antibiotic therapy in ICU.

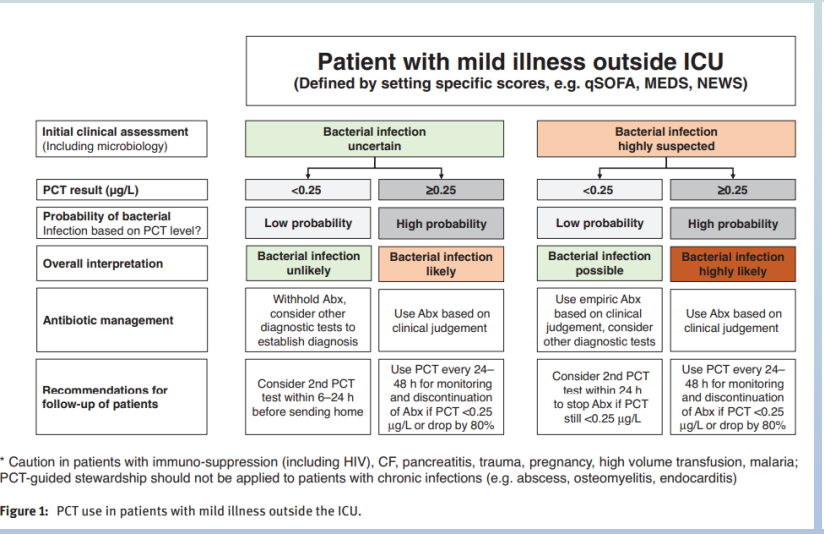
Reprinted from The Lancet, 375, Bouadma L et al, Use of procalcitonin to reduce patients' exposure to antibiotics in intensive care units (PRORATA trial): a randomised, controlled, open-label trial, pages 463-74, 2010, with permission from Elsevier.

Clin Chem Lab Med 2019; 57(9): 1308–1318 DE GRUYTER

Opinion Paper

Philipp Schuetz*, Albertus Beishuizen, Michael Broyles, Ricard Ferrer, Gaetan Gavazzi, Eric Howard Gluck, Juan González del Castillo, Jens-Ulrik Jensen, Peter Laszlo Kanizsai, Andrea Lay Hoon Kwa, Stefan Krueger, Charles-Edouard Luyt, Michael Oppert, Mario Plebani, Sergey A. Shlyapnikov, Giulio Toccafondi, Jennifer Townsend, Tobias Welte and Kordo Saeed

Procalcitonin (PCT)-guided antibiotic stewardship: an international experts consensus on optimized clinical use



* Caution in patients with immuno-suppression (including HIV), CF, pancreatitis, trauma, pregnancy, high volume transfusion, malaria; PCT-guided stewardship should not be applied to patients with chronic infections (e.g. abscess, osteomyelitis, endocarditis)

Figure 1: PCT use in patients with mild illness outside the ICU.

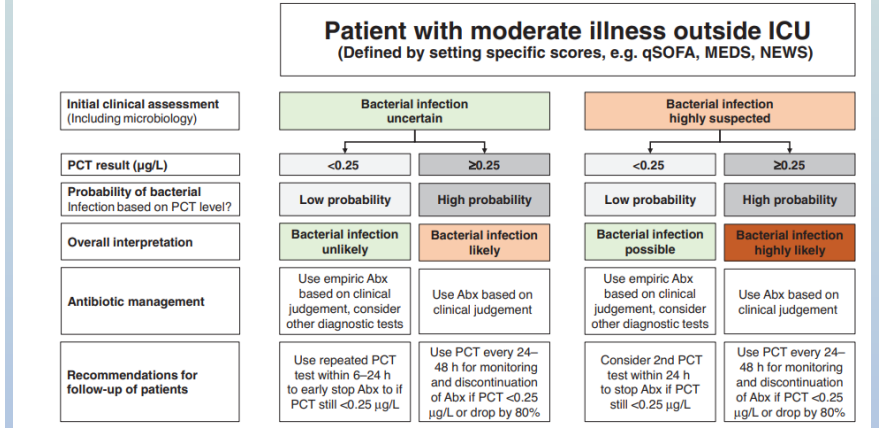


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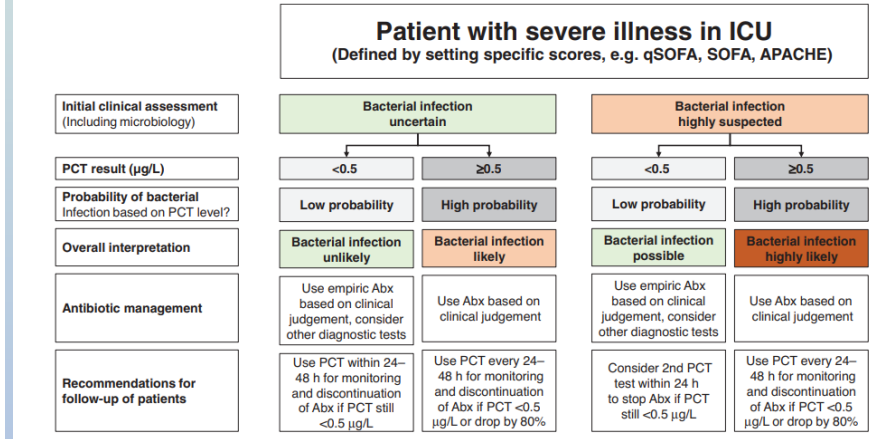
Figure 2: PCT use in patients with moderate illness outside the ICU.



* Caution in patients with immuno-suppression (including HIV), CF, pancreatitis, trauma, pregnancy, high volume transfusion, malaria; PCT-guided stewardship should not be applied to patients with chronic infections (e.g. abscess, osteomyelitis, endocarditis)

Figure 3: PCT use in patients with severe illness in the ICU.

Based on the analysis of trials, the group agreed that for optimal use, the PCT levels should be put into the context of the clinical assessment in regard to severity of illness and probability of bacterial infection to make reasonable recommendations. We thus derived three different algo-

tion across departments. Our recommendation was to use PCT for initiation of antibiotics mainly in low risk patients with uncertain bacterial infection, and for other patients to monitor PCT to stop antibiotic treatment early. In higher risk patients, the algorithm focuses on early stop of treatment in the case of low PCT and no evidence for bacterial infection. The specification of one cut-off for

Emelkedett procalcitonin ≠ sepsis

Diagnózis

- Haematológiai és biokémiai markerek
  - Leukocytosis (>12000 G/l) v. leukopaenia (<4000 G/l)
  - Éretlen alakok >10%
  - CRP >2 SD normál tartomány
  - PCT >2 SD
  - Kreatinin-e
  - Bilirubin >7
  - Thrombocy
  - Laktát >1 n
  - Sepsis indukálta hyperlycaemia >7,7 mmol/l
  - Hypoxaemia paO2/FiO2 < 400

Table 1. Diagnostic criteria for sepsis

Infection,[a] documented or suspected, and some of the following:[b]
General variables
- Fever (core temperature >38.3°C)
- Hypothermia (core temperature <36°C)
- Heart rate >90 min^{-1} or >2 SD above the normal value for age
- Tachypnea
- Altered mental status
- Significant edema or positive fluid balance (>20 mL/kg over 24 hrs)
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- Arterial hypotension[b] (SBP <90 mm Hg, MAP <70, or an SBP decrease >40 mm Hg in adults or <2 SD below normal for age)
- $S\bar{v}O_2$ >70%[b]
- Cardiac index >3.5 $L \cdot min^{-1} \cdot M^{-23}$

Organ dysfunction variables
- Arterial hypoxemia (PaO_2/FiO_2 <300)
- Acute oliguria (urine output <0.5 $mL \cdot kg^{-1} \cdot hr^{-1}$ or 45 mmol/L for at least 2 hrs)
- Creatinine increase >0.5 mg/dL
- Coagulation abnormalities (INR >1.5 or aPTT >60 secs)
- Ileus (absent bowel sounds)
- Thrombocytopenia (platelet count <100,000 μL^{-1})
- Hyperbilirubinemia (plasma total bilirubin >4 mg/dL or 70 mmol/L)

/L)
mottling

Recommendation	
5. Sepsis is a clinical diagnosis and should not be ruled in or ruled out using a single biomarker or diagnostic test (good practice statement)	**New**
6. There is "insufficient evidence" to make a recommendation regarding use of novel rapid host response diagnostics	**New**

Definíció

- Sepsis-3 (2016 JAMA)

Box 3. New Terms and Definitions

- Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection.
- Organ dysfunction can be identified as an acute change in total SOFA score ≥2 points consequent to the infection.
  - The baseline SOFA score can be assumed to be zero in patients not known to have preexisting organ dysfunction.
  - A SOFA score ≥2 reflects an overall mortality risk of approximately 10% in a general hospital population with suspected infection. Even patients presenting with modest dysfunction can deteriorate further, emphasizing the seriousness of this condition and the need for prompt and appropriate intervention, if not already being instituted.
- In lay terms, sepsis is a life-threatening condition that arises when the body's response to an infection injures its own tissues and organs.
- Patients with suspected infection who are likely to have a prolonged ICU stay or to die in the hospital can be promptly identified at the bedside with qSOFA, ie, alteration in mental status, systolic blood pressure ≤100 mm Hg, or respiratory rate ≥22/min.

- Septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality.
- Patients with septic shock can be identified with a clinical construct of sepsis with persisting hypotension requiring vasopressors to maintain MAP ≥65 mm Hg and having a serum lactate level >2 mmol/L (18 mg/dL) despite adequate volume resuscitation. With these criteria, hospital mortality is in excess of 40%.

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SOFA: 3

Fizikális lelete 16:46

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Urine output, mL per day				<500	<200

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Vérkép automatával:				
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Neutrofil Stab #	22,7		%	
Mielocita #	0,9		%	
Limfocita #	0,0		%	
Monocita #	0,9		%	
Eozinofil #	0,0		%	
Bazofil #	0,0		%	
Szétesett sejt #	1,8		/100FVS	
Vörösvértest	3,80	L	T/l	4,50-6,00
Hemoglobin	125	L	g/l	137-175
Hematokrit #	36,9	L	%	40,1-51,0
MCV	97,1	H	fl	80,0-95,0
MCH	32,9	U	pg	26,0-33,0
MCHC	339		g/l	310-360
RDW	13,5		%CV	11,6-14,4

Ellátás

ONLINE SPECIAL ARTICLE

Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021

KEY WORDS: adults; evidence-based medicine; guidelines; sepsis; septic shock

Laura Evans[1]
Andrew Rhodes[2]
Waleed Alhazzani[3]

Recommendations 2021	Recommendation Strength and Quality of Evidence
1. For hospitals and health systems, we recommend using a performance improvement program for sepsis, including sepsis screening for acutely ill, high-risk patients and standard operating procedures for treatment.	***Strong,*** *moderate-quality evider (for screening)* ***Strong,*** *very low-quality evidenc (for standard operating procedures)*
2. We recommend against using qSOFA compared with SIRS, NEWS, or MEWS as a single-screening tool for sepsis or septic shock.	***Strong,*** *moderate-quality evider*
3. For adults suspected of having sepsis, we suggest measuring blood lactate.	***Weak,*** *low quality of evidence*
INITIAL RESUSCITATION	
4. Sepsis and septic shock are medical emergencies, and we recommend that treatment and resuscitation begin immediately.	***Best practice statement***
5. For patients with sepsis induced hypoperfusion or septic shock we suggest that at least 30 mL/kg of IV crystalloid fluid should be given within the first 3 hr of resuscitation.	**Weak,** *low quality of evidence*
6. For adults with sepsis or septic shock, we suggest using dynamic measures to guide fluid resuscitation, over physical examination, or static parameters alone.	***Weak,*** *very low quality of evider*
7. For adults with sepsis or septic shock, we suggest guiding resuscitation to decrease serum lactate in patients with elevated lactate level, over not using serum lactate.	***Weak,*** *low quality of evidence*
8. For adults with septic shock, we suggest using capillary refill time to guide resuscitation as an adjunct to other measures of perfusion.	***Weak,*** *low quality of evidence*
MEAN ARTERIAL PRESSURE	
9. For adults with septic shock on vasopressors we recommend an initial target mean arterial pressure (MAP) of 65 mm Hg over higher MAP targets.	***Strong,*** *moderate-quality evider*
ADMISSION TO INTENSIVE CARE	
10. For adults with sepsis or septic shock who require ICU admission, we suggest admitting the patients to the ICU within 6 hr.	***Weak,*** *low quality of evidence*

Recommendations 2021	Recommendation S and Quality of Evide
INFECTION	
11. For adults with suspected sepsis or septic shock but unconfirmed infection, we recommend continuously re-evaluating and searching for alternative diagnoses and discontinuing empiric antimicrobials if an alternative cause of illness is demonstrated or strongly suspected.	***Best practice stater***
12. For adults with possible septic shock or a high likelihood for sepsis, we recommend administering antimicrobials immediately, ideally within 1 hr of recognition.	***Strong,*** *low quality of evidence (Septic shoc* ***Strong,*** *very low qual dence (Sepsis withou*
13. For adults with possible sepsis without shock, we recommend rapid assessment of the likelihood of infectious versus noninfectious causes of acute illness.	***Best practice stater***
14. For adults with possible sepsis without shock, we suggest a time-limited course of rapid investigation and if concern for infection persists, the administration of antimicrobials within 3 hr from the time when sepsis was first recognized.	***Weak,*** *very low qualit*
15. For adults with a low likelihood of infection and without shock, we suggest deferring antimicrobials while continuing to closely monitor the patient.	***Weak,*** *very low qualit*
16. For adults with suspected sepsis or septic shock, we suggest against using procalcitonin plus clinical evaluation to decide when to start antimicrobials, as compared to clinical evaluation alone.	***Weak,*** *very low qualit*
17. For adults with sepsis or septic shock at high risk of MRSA, we recommend using empiric antimicrobials with MRSA coverage over using antimicrobials without MRSA coverage.	***Best practice stater***

Recommendations 2021	Recommendati and Quality of E
18. For adults with sepsis or septic shock at low risk of MRSA, we suggest against using empiric antimicrobials with MRSA coverage, as compared with using antimicrobials without MRSA coverage.	***Weak,*** *low qualit*
19. For adults with sepsis or septic shock and high risk for multidrug resistant (MDR) organisms, we suggest using two antimicrobials with gram-negative coverage for empiric treatment over one gram-negative agent.	***Weak,*** *very low q evidence*
20. For adults with sepsis or septic shock and low risk for multidrug resistant (MDR) organisms, we suggest against using two gram-negative agents for empiric treatment, as compared to one gram-negative agent.	***Weak,*** *very low q evidence*
21. For adults with sepsis or septic shock, we suggest against using double gram-negative coverage once the causative pathogen and the susceptibilities are known.	***Weak,*** *very low q evidence*
22. For adults with sepsis or septic shock at high risk of fungal infection, we suggest using empiric antifungal therapy over no antifungal therapy.	***Weak,*** *low qualit*
23. For adults with sepsis or septic shock at low risk of fungal infection, we suggest against empiric use of antifungal therapy	***Weak,*** *low qualit*
24. We make no recommendation on the use of antiviral agents.	***No recommend***
25. For adults with sepsis or septic shock, we suggest using prolonged infusion of beta-lactams for maintenance (after an initial bolus) over	***Weak,*** *moderate*

Recommendations 2021	Recommendation Strength and Quality of Evidence	Changes From 2016 Recommendations
26. For adults with sepsis or septic shock, we recommend optimising dosing strategies of antimicrobials based on accepted pharmacokinetic/pharmacodynamic (PK/PD) principles and specific drug properties.	***Best practice statement***	
27. For adults with sepsis or septic shock, we recommend rapidly identifying or excluding a specific anatomical diagnosis of infection that requires emergent source control and implementing any required source control intervention as soon as medically and logistically practical.	***Best practice statement***	
28. For adults with sepsis or septic shock, we recommend prompt removal of intravascular access devices that are a possible source of sepsis or septic shock after other vascular access has been established.	***Best practice statement***	
29. For adults with sepsis or septic shock, we suggest daily assessment for de-escalation of antimicrobials over using fixed durations of therapy without daily reassessment for de-escalation.	***Weak,*** *very low quality of evidence*	
30. For adults with an initial diagnosis of sepsis or septic shock and adequate source control, we suggest using shorter over longer duration of antimicrobial therapy.	***Weak,*** *very low quality of evidence*	
31. For adults with an initial diagnosis of sepsis or septic shock and adequate source control where optimal duration of therapy is unclear, we suggest using procalcitonin AND clinical evaluation to decide when to discontinue antimicrobials over clinical evaluation alone.	***Weak,*** *low quality of evidence*	
HEMODYNAMIC MANAGEMENT		
32. For adults with sepsis or septic shock, we recommend using crystalloids as first-line fluid for resuscitation.	***Strong,*** *moderate-quality evidence*	
33. For adults with sepsis or septic shock, we suggest using balanced crystalloids instead of normal saline for resuscitation.	***Weak,*** *low quality of evidence*	***CHANGED from weak recommendation,*** *low quality of evidence.* "We suggest using either balanced crystalloids or saline for fluid resuscitation of patients with sepsis or septic shock"
34. For adults with sepsis or septic shock, we suggest using albumin in patients who received large volumes of crystalloids.	***Weak,*** *moderate-quality evidence*	
35. For adults with sepsis or septic shock, we recommend against using starches for resuscitation.	***Strong,*** *high-quality evidence*	

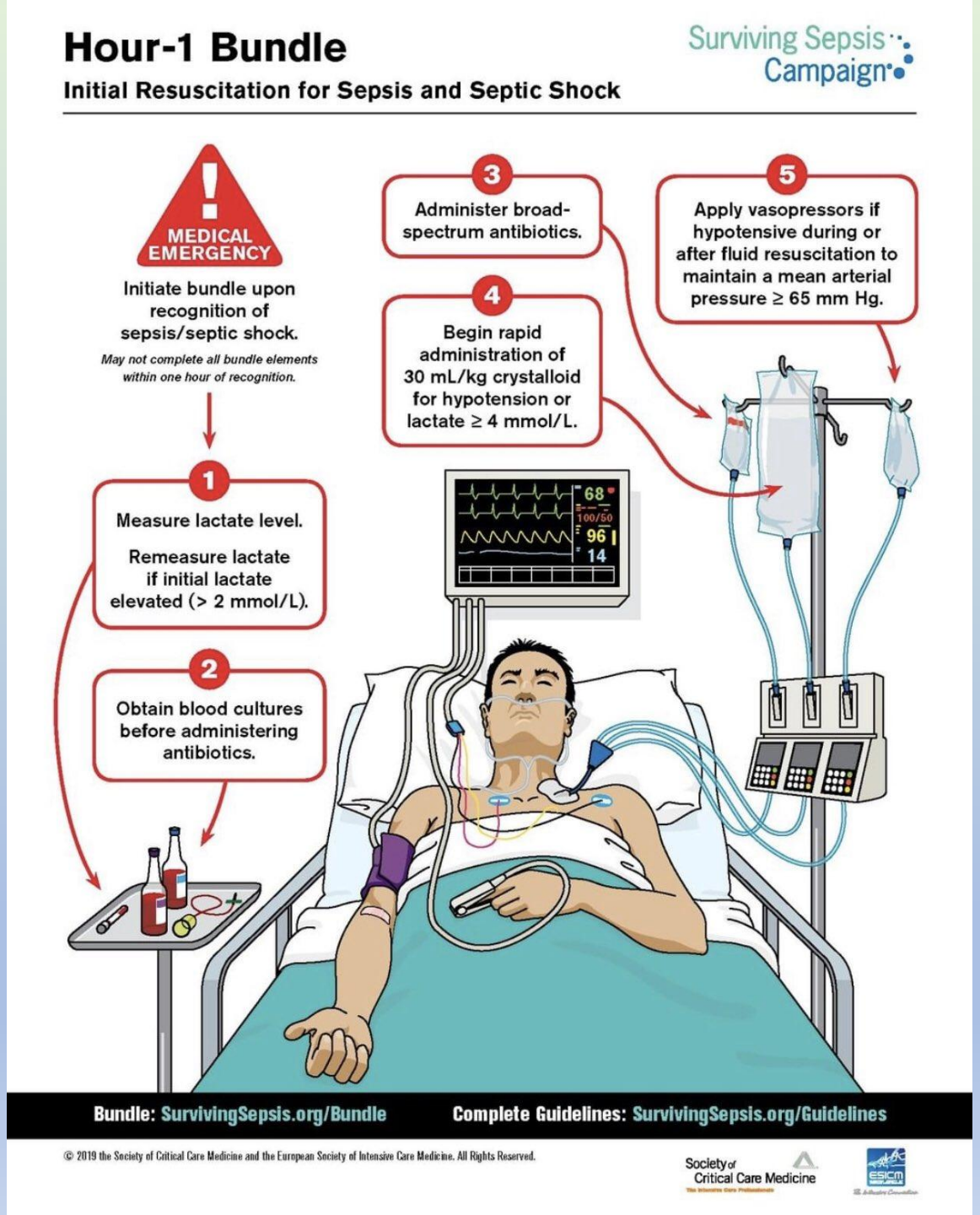
GUIDELINES

Surviving Sepsis Campaign: international guidelines for management of sepsis and septic shock 2026

Hallie C. Prescott[1,2*], Massimo Antonelli[3,4], Waleed Alhazzani[5,6,7], Morten Hylander Møller[8,9], Fayez Alshamsi[10], Luciano C. P. Azevedo[11], Emilie Belley-Cote[12,13,14], Jan De Waele[15,16], Lennie Derde[17,18], Joanna C. Dionne[19,20], Laura Evans[21], Hayley B. Gershengorn[22,23], Carol L. Hodgson[24,25], Kimia Honarmand[26,27], Jozef Kesecioglu[28], Lauralyn McIntyre[29,30], Mervyn Mer[31], Mark E. Nunnally[32], Simon J. W. Oczkowski[20,27], Bram Rochwerg[20,27], Olurotimi Olaolu Akinola[33], Kwame A. Akuamoah-Boateng[34], Laura Alberto[35,36], Derek C. Angus[37], Yaseen M. Arabi[38], Elie Azoulay[39], Maurizio Cecconi[40,41], Pauline F. Convocar[42,43,44], Gennaro De Pascale[3,4], Kent Doi[45], Bin Du[46], Moritoki Egi[47], Marie-Carmelle Elie-Turenne[48,49], Ricard Ferrer[50,51], Alison Fox-Robichaud[52,53], Craig French[24,54], Yonathan Freund[55,56], Michelle Ng Gong[57], Caleb P. Hale[58], Naomi E. Hammond[59,60], Madiha Hashmi[61], Leo Heunks[62], Theodore J. Iwashyna[63,64], Shevin T. Jacob[65,66], Michael Klompas[67,68], Arthur Kwizera[69], Murdoch Leeies[70,71], Joanna D. Lejnieks[72], Mitchell M. Levy[73], Flavia R. Machado[74], Marcelo O. Maia[75,76,77], Henry Masur[78], Ryan C. Maves[79,80], Steven McGloughlin[25,81], Joanne McPeake[82], Nicholas M. Mohr[83,84,85], Sheila Nainan Myatra[86], Marlies Ostermann[87,88], Sandra L. Peake[89,90,91], Mathias W. Pletz[92,93], Jason A. Roberts[94,95,96], Regis G. Rosa[97,98,99], Robert G. Sawyer[100], Christa A. Schorr[101,102], Steven Q. Simpson[103], Li Weng[104], W. Joost Wiersinga[105,106,107], Andrew Rhodes[108] and Craig M. Coopersmith[109]

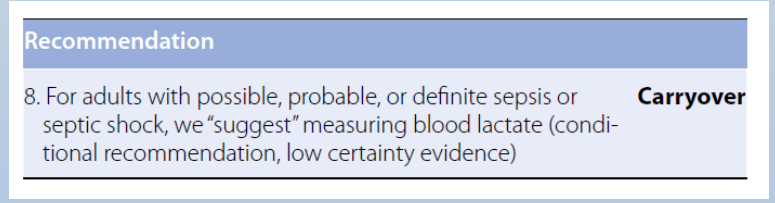
Initial Resuscitation

Recommendations
4. Sepsis and septic shock are medical emergencies, and we **recommend** that treatment and resuscitation begin immediately. *Best practice statement.*



Kezdeti ellátás

- Egészségügyi veszélyhelyzet – azonnali kezelés, „reszuszcitáció”
- Sepsis gyanúja esetén az első órában javasolt laktát-szint ellenőrzése



Recommendation	
8. For adults with possible, probable, or definite sepsis or septic shock, we “suggest” measuring blood lactate (conditional recommendation, low certainty evidence)	**Carryover**

  - Önmagában a diagnózishoz nem elég, de segít annak felállításában
  - Prognózis becslésében segít

Infekció eredete, kórokozók

- Baktétiumok, gombák
- Vírusok 1-7%-ban

- Virulenciafaktorok
  - Quorum sensing
    - Bizonyos génátíródások szuppressziója, mások indukálása, biofilm-képzés
  - Toxintermelés
    - SzuperAg, barrierkárosodás
  - PAMP-ok
    - LPS, peptidoglycan, lipopeptidek, flagellin, bakteriális DNS

- Rezisztencia

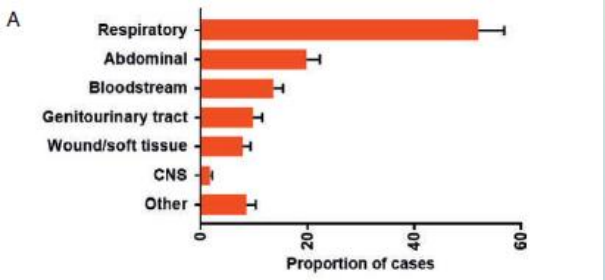
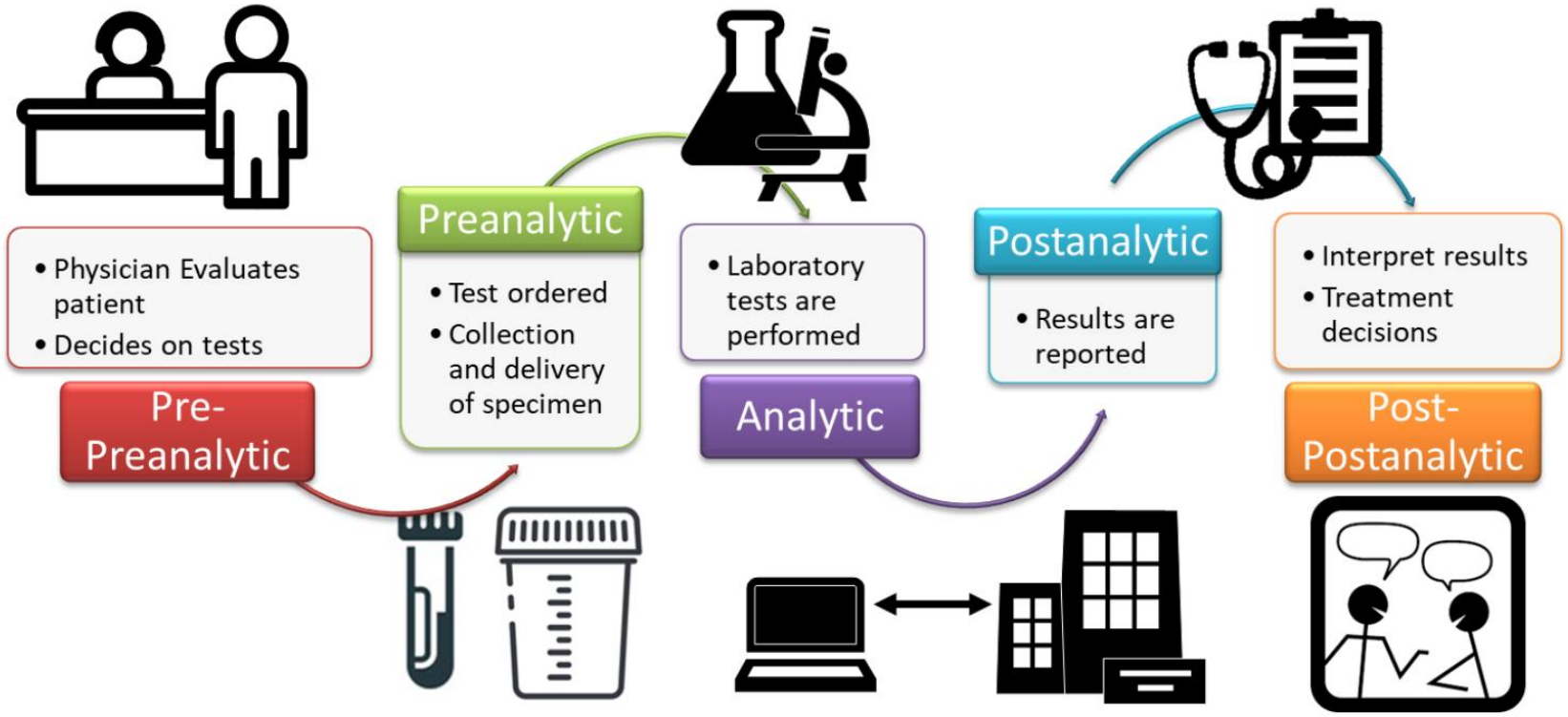


TABLE 73.4 Distribution in Percentages of Identified Organisms in Culture-Positive Infected Patients Included in the EPIC II Study According to Geographic Region

ORGANISM	WESTERN EUROPE	EASTERN EUROPE	CENTRAL/SOUTH AMERICA	NORTH AMERICA	OCEANIA	AFRICA	ASIA
Gram-Positive							
Staphylococcus aureus	20%	22%	19%	27%	28%	30%	16%
Staphylococcus epidermidis	11%	12%	9%	12%	8%	15%	9%
Streptococcus pneumoniae	5%	5%	3%	4%	3%	6%	2%
Enterococcus spp.	13%	15%	4%	10%	9%	0%	6%
Other	7%	4%	4%	11%	9%	7%	4%
Gram-Negative							
Escherichia coli	17%	15%	14%	14%	13%	11%	17%
Enterobacter	7%	8%	9%	8%	3%	7%	5%
Klebsiella spp.	10%	21%	16%	9%	12%	19%	21%
Pseudomonas spp.	17%	29%	26%	13%	15%	15%	30%
Acinetobacter spp.	6%	17%	14%	4%	4%	15%	19%
Other	18%	15%	17%	11%	21%	20%	15%
Anaerobes	5%	3%	1%	8%	3%	2%	3%
Fungi							
Candida	19%	19%	13%	19%	13%	11%	16%
Aspergillus	2%	1%	1%	3%	2%	0%	1%

Parasites accounted for 1% or fewer of all isolates in all regions. Percentages do not necessarily equal 100 because patients may have had more than one type of infection or microorganism.
Data from Vincent JL, Rello J, Marshall J, et al. International study of the prevalence and outcomes of infection in intensive care units. JAMA. 2009;302:2323–2329.

Diagnostic Process



1. **We recommend that appropriate routine microbiologic cultures (including blood) be obtained before starting antimicrobial therapy in patients with suspected sepsis or septic shock if doing so results in no substantial delay in the start of antimicrobials (BPS).**

Remarks: Appropriate routine microbiologic cultures always include at least two sets of blood cultures (aerobic and anaerobic).

Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016

We recommend that blood cultures be obtained prior to initiating antimicrobial therapy if cultures can be obtained in a timely manner. However, the risk/benefit ratio favors rapid administration of antimicrobials if it is not logistically possible to obtain cultures promptly. Therefore, in patients with suspected sepsis or septic shock, appropriate routine microbiologic cultures should be obtained before initiation of antimicrobial therapy from all sites considered to be potential sources of infection if it results in no substantial delay in the start of antimicrobials. This may include blood, cerebrospinal fluid, urine, wounds, respiratory secretions, and other body fluids, but does not normally include samples that require an invasive procedure such as bronchoscopy or open surgery. The decision regarding which sites to culture requires careful consideration from the treatment team. "Pan culture" of all sites that could potentially be cultured should be discouraged (unless the source of sepsis is not clinically apparent), because this practice can lead to inappropriate antimicrobial use (58). If history or

Blood cultures

Recommendation	
7. For adults with possible, probable, or definite sepsis or septic shock, we "recommend" collecting blood cultures as soon as possible and ideally before the administration of antimicrobial therapy (strong recommendation, low certainty evidence)	**New**

Prescott H, Antonelli M, Alhazzani W, et al. Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock 2026. Crit Care Med. 2026 Mar. Forthcoming. doi.org/10.1097/CCM.0000000000007075

Two or more sets (aerobic and anaerobic) of blood cultures are recommended before initiation of any new antimicrobial in all patients with suspected sepsis (59). All necessary blood cultures may be drawn together on the same occasion. Blood culture yield has not been shown to be improved with sequential draws or timing to temperature spikes (60, 61). Details on appropriate methods to draw and transport blood culture samples are enumerated in other guidelines (61, 62).

Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock: 2016

Die Nachweisrate bei Blutkulturen steigt mit dem abgenommenen Blutvolumen[88, 89]. Um ein ausreichend großes Blutvolumen zu gewinnen, werden mindestens zwei Blutkultur-Sets benötigt (40-60 ml Blut).

Alle erforderlichen Blutkulturen können zeitgleich aus derselben Punktionsstelle entnommen werden[90-92]. Dies senkt die Kontaminationsgefahr[91]. Eine sequentielle Abnahme, mehrfache Punktion oder die Abnahme im Temperaturanstieg führen nicht zu einer höheren Nachweisrate[93, 94].

Key points for the laboratory diagnosis of bacteremia/fungemia:

- Volume of blood collected, not timing, is most critical.
- Disinfect the venipuncture site with chlorhexidine or 2% iodine tincture in adults and children >2 months old (chlorhexidine NOT recommended for children <2 months old).
- Draw blood for culture before initiating antimicrobial therapy.
- Catheter-drawn blood cultures have a higher risk of contamination (false positives).
- Do not submit catheter tips for culture without an accompanying blood culture obtained by venipuncture.
- Never refrigerate blood prior to incubation.
- Use a 2–3 bottle blood culture set for adults, at least one aerobic and one anaerobic; use 1–2 aerobic bottles for children.
- *Streptococcus pneumoniae* and some other gram-positive organisms may grow best in the anaerobic bottle.

Contaminated blood culture bottles are common, very costly to the healthcare system, and frequently confusing to clinicians. To minimize the risk of contamination of the blood culture with commensal skin flora, meticulous care should be taken in skin preparation prior to venipuncture. Consensus guidelines [2] and expert panels [1] recommend peripheral venipuncture as the preferred technique for obtaining blood for culture based on data showing that blood obtained in this fashion is less likely to be contaminated than blood obtained from an intravascular catheter or other device. Several studies have documented that iodine tincture, chlorine peroxide, and chlorhexidine gluconate (CHG) are superior to povidone-iodine preparations as skin disinfectants for blood culture (data summarized in refs [1] and [2]). Iodine tincture and CHG require about 30 seconds to exert an antiseptic effect compared with 1.5–2 minutes. for povidone-iodine preparations [2]. CHG is not recommended for use in infants less than 2 months of age.

A Guide to Utilization of the Microbiology Laboratory for Diagnosis of Infectious Diseases: 2013 Recommendations by the Infectious Diseases Society of America (IDSA) and the American Society for Microbiology (ASM)

FOR BLOOD CULTURE COLLECTION

A SUMMARY OF GOOD PRACTICE

A) USING WINGED BLOOD COLLECTION SET

(preferred method of collection)[5-8]

1 PREPARE BLOOD COLLECTION KIT

Confirm the patient's identity and gather all required materials before beginning the collection process.

Do not use blood culture bottles beyond their expiration date, or bottles which show signs of damage, deterioration or contamination.

It is recommended to identify the Fill-to Mark or mark the target fill level on the blood culture bottle label about 10 ml above the media level.

2 PREPARE BOTTLES FOR INOCULATION

Wash hands with soap and water then dry, or apply an alcohol hand rub or another recognized effective hand rub solution.

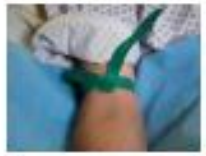
Remove the plastic "flip-cap" from the blood culture bottles and disinfect the septum using an appropriate and recognized effective disinfectant, including chlorhexidine in 70% isopropyl alcohol, tincture of iodine, povidone-iodine in swab or applicator form. Use a fresh swab/applicator for each bottle. **Allow bottle tops to dry in order to fully disinfect.**

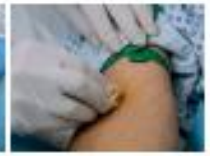
Attach a winged blood collection set to a collection adapter cap*.

3 PREPARE VENIPUNCTURE SITE

If skin is visibly soiled, clean with soap and water. Apply a disposable tourniquet and palpate for a vein. **Apply clean examination gloves** (sterile gloves are not necessary).

Cleanse the skin using an appropriate disinfectant, including chlorhexidine in 70% isopropyl alcohol, tincture of iodine, povidone-iodine in swab or applicator form. **The venipuncture site is not fully clean until the disinfectant has fully evaporated.**





4 VENIPUNCTURE

To prevent contaminating the puncture site, do not re-palpate the prepared vein before inserting the needle. Insert the needle into the prepared vein.

5 CULTURE BOTTLE INOCULATION

Place the adapter cap over the **aerobic bottle** and **press straight down** to pierce the septum. Hold the bottle upright, below the level of the draw site, and add up to 10 ml of blood per adult bottle and up to 4 ml per pediatric bottle.** Ensure the bottle is correctly filled to the Fill-to Mark or target fill level. Once the aerobic bottle has been inoculated, repeat the procedure for the **anaerobic bottle**.

6 OTHER BLOOD TESTS

If blood is being collected for other tests, an insert placed into the adapter cap may be required. The insert is used to guide blood collection tubes onto the needle.

If other blood tests are requested, always collect the blood culture first.

7 FINISH THE PROCEDURE

Discard the winged collection set into a sharps container and cover the puncture site with an appropriate dressing. Remove gloves and wash hands before recording the procedure, including indication for culture, date, time, site of venipuncture, and any complications.

Ensure that additional labels are placed in the space provided on the bottle label and do not cover the bottle barcodes, and that the tear-off barcode labels are not removed. If additional labels contain a barcode, they should be positioned in the same manner as the bottle barcode.

Inoculated bottles should be transported to the laboratory for testing as quickly as possible, preferably within 2 hours per CLSI.[1] If delays are expected, it is important to refer to the manufacturer's Instructions for Use for guidance.

*The use of blood collection sets without blood collection adapters is not recommended.

**Avoid holding the blood culture bottle in a horizontal or upside down position or drawing blood with a needle connected directly to the adaptor cap, as fill level cannot be monitored during collection and there is a possible risk of media reflux into the bloodstream.

These recommendations illustrate the best practices for blood culture collection based on the World Health Organization recommendations (WHO guidelines on drawing blood: best practices in phlebotomy. 2010. ISBN 978 92 4 159922 1). Best practices may vary between healthcare facilities; refer to guidelines applicable in your facility.

Mikor?

JOURNAL OF CLINICAL MICROBIOLOGY, Apr. 2008, p. 1381–1385 Vol. 46, No. 4
0095-1137/08/$08.00+0 doi:10.1128/JCM.02033-07

Timing of Specimen Collection for Blood Cultures from Febrile Patients with Bacteremia[▽]

Stefan Riedel,[1] Paul Bourbeau,[2] Brandi Swartz,[2] Steven Brecher,[3] Karen C. Carroll,[4] Paul D. Stamper,[4] W. Michael Dunne,[5] Timothy McCardle,[5] Nathan Walk,[5] Kristin Fiebelkorn,[6] David Sewell,[7] Sandra S. Richter,[1] Susan Beekmann,[1] and Gary V. Doern[1]*

University of Iowa College of Medicine, Iowa City, Iowa[1]; Geisinger Medical Center, Danville, Pennsylvania[2]; VA Boston Healthcare System, West Roxbury, Massachusetts[3]; Johns Hopkins University School of Medicine, Baltimore, Maryland[4]; Barnes-Jewish Hospital, Washington University School of Medicine, St. Louis, Missouri[5]; University of Texas Health Science Center, San Antonio, Texas[6]; and the VA Medical Center, Portland, Oregon[7]

Lázcsúcstól függetlenül

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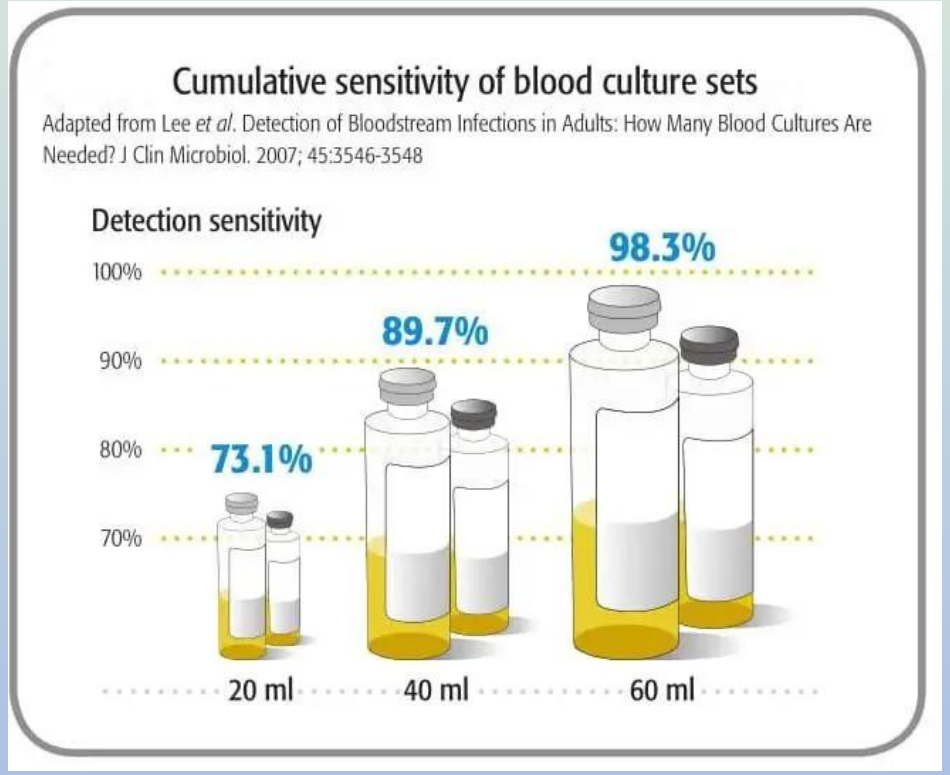


Lee,A.,Mirrett,S.,Reller,L.B.,andWeinstein,M.P.(2007).Detectionof bloodstreaminfectionsinadults:howmanybloodculturesareneeded? *J.Clin. Microbiol.* 45,3546–3548.doi:10.1128/JCM.01555-07

Table I-1a. Recommended Volumes of Blood for Culture in Pediatric Patients (Blood Culture Set May Use Only 1 Bottle)

Weight of Patient (kg)	Total Patient Blood Volume (mL)	Recommended Volume of Blood for Culture (mL)		Total Volume for Culture (mL)	% of Total Blood Volume
		Culture Set No. 1	Culture Set No. 2		
≤1	50–99	2	. . .	2	4
1.1–2	100–200	2	2	4	4
2.1–12.7	>200	4	2	6	3
12.8–36.3	>800	10	10	20	2.5
>36.3	>2200	20–30	20–30	40–60	1.8–2.7

When 10 mL of blood or less is collected, it should be inoculated into a single aerobic blood culture bottle.

A Guide to Utilization of the Microbiology Laboratory for Diagnosis of Infectious Diseases: 2013 Recommendations by the Infectious Diseases Society of America (IDSA) and the American Society for Microbiology (ASM)

TABLE 3 | Quality of bottle filling.

References	Under-filled bottles		Over-filled bottles		Country
	Threshold (mL)	Rate (%)	Threshold (mL)	Rate (%)	
Vitrat-Hincky et al., 2011	< 8	65	>10	13.0	France
Willems et al., 2012[a,b]	< 8	26.2–36.0	>12	7.6-12.8	Belgium
van Ingen et al., 2013	< 8	55.3	–	–	The Nederlands
Coorevits and Van den Abeele, 2015	< 8	28.0	>12	23.2	Belgium
Chang et al., 2015	< 8	97.7	>10	0.2	South Korea
Lin et al., 2013	< 7	28.3	>10	13.3	Taiwan
Mermel and Maki, 1993	< 5	20	–	–	USA
Chang et al., 2015	< 3	48.4	–	–	South Korea

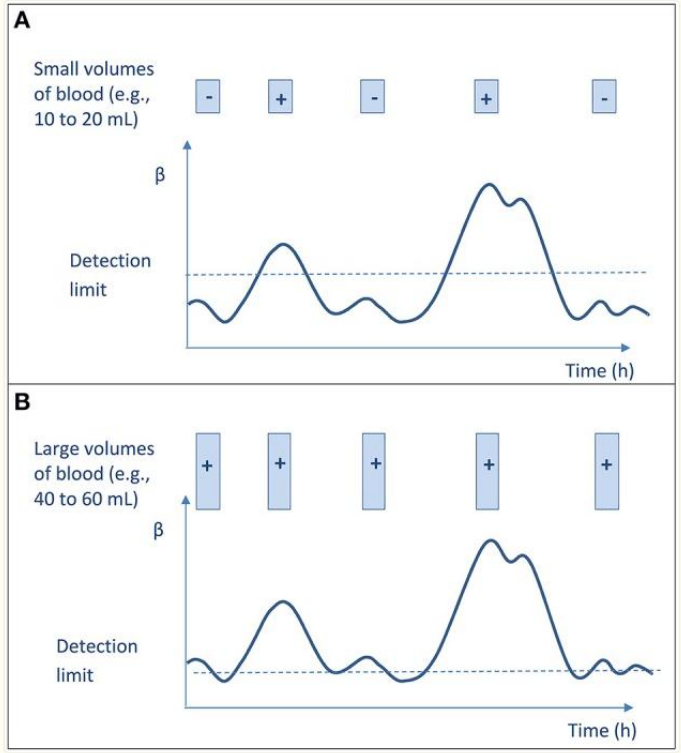
[a] *Data from 5 hospitals*
[b] *Thresholds were defined as 2 mL below and above the recommended volume per vial.*

Mennyit mikor?

How to Optimize the Use of Blood Cultures for the Diagnosis of Bloodstream Infections? A State-of-the Art

Brigitte Lamy[1†], Sylvie Dargère[2†], Maiken C. Arendrup[3], Jean-Jacques Parienti[4] and Pierre Tattevin[5]*

Figure 1.



How to Optimize the Use of Blood Cultures for the Diagnosis of Bloodstream Infections? A State-of-the Art

Brigitte Lamy[1†], Sylvie Dargère[2†], Maiken C. Arendrup[3], Jean-Jacques Parienti[4] and Pierre Tattevin[5]*

Multi-Sampling Strategy

Rationale

The multi-sampling strategy has been developed, and recommended for more than 40 years, and its practice has been generalized (Washington, 1975, 1992). The rationale of this strategy is based on the following points: (i) repetition of samples increases the total volume of blood cultured, thereby improving BC sensitivity, (ii) separate samples may discriminate contaminants from pathogens when BCs grow, (iii) separate samples improve BSI detection in case of intermittent bacteremia (Washington, 1975; Reimer et al., 1997).

It has been successful to improve BSI detection in several studies which concluded that, under routine circumstances, at least two separate sets of BCs should be sampled during a 24-h period for the diagnosis of BSIs (Mermel and Maki, 1993; Li et al., 1994; Weinstein, 1996; Cockerill et al., 2004; Bouza et al., 2007; Lee et al., 2007), and guidelines recommend two to three - or four - BC sets (O'Grady et al., 2008; Lamy and Seifert, 2012; Baron et al., 2013; Dellinger et al., 2013; Public Health England, 2014; Accoceberry et al., 2015a).

Single-Sampling Strategy

Rationale

The single-sampling strategy collects the total volume from one single draw, a "BC set" of 4 to 6 bottles. This satisfies both the need to collect a sufficient volume and the need to decrease contamination rate by lim number of punctures. In addition, this would be a with decreased workload and risk of occupational to blood-transmissible pathogens for nurses, decrea and improved comfort for patients, by reducing the of invasive, potentially painful, procedures. This stra developed since the late 1990s, based on the follo the concept of intermittent bacteremia or fungemia erroneous (Jonsson et al., 1993; Li et al., 1994; Riedel et a

(ii) the key determinant for the capacity of BCs to diagnose BSI is the total volume of blood inoculated (Li et al., 1994); (iii) the rate of false-positive results increases with the number of draws; (iv) for a given volume of blood inoculated, the multi- and single-sampling strategies are expected to have similar sensitivity; (v) because the total volume is obtained at once with the single-sampling strategy, there is no risk of omitting subsequent draws, thereby eradicating the risk of solitary BC. Hence, the median total volume of blood inoculated will necessarily be greater; (vi) the single-sampling strategy should enable early initiation of empirical antibiotic treatment when indicated (e.g., severe sepsis), as there will be no need to postpone until subsequent sampling; and (vii) patient comfort will be improved, as only one venipuncture will be requested for this strategy.

- Ismételt mintavételekkel nő a levett mennyiség
- Kontamináció elkülönítése
- Intermittáló bacteraemia esetén nagyobb pozitivitási arány

- Nagyobb az esélye az 1 pár levételének (kontamináció?)
- Minden punctio új lehetőség a kontaminációra
- Intermittáló bacteraemia? – folyamatos, alacsony szintű bacteraemia

- Kevesebb punctio – megfelelő mennyiségű minta, kevesebb esély kontaminációra
- Nővérek számára kisebb terhelés, kevesebb expozíció
- Beteg számára kevésbé megterhelő
- Korai antibiotikum-kezdés

- Kontamináció?

- Kevesebb tapasztalat, adat

Vizsgálati anyag: aerob hemokultura: szúrt véna

Eredmény:

Az eredmény kiadva: 2024.11.12

Tenyésztéssel Staphylococcus hominis

	Érz.	ug/ml
Oxacillin	E	-
Cefazolin	E	-
Gentamicin	E	-
Amikacin	E	-
Erythromycin	E	-
Clarithromycin	E	-
Ciprofloxacin	M	-
Levofloxacin	M	-
Azithromycin	E	-
Clindamycin	E	-
Tobramycin	E	-
Sulfamethoxasole/ trimethoprim	E	-
Doxycyclin	E	-
Tetracyclin	E	-
Linezolid	E	-
Rifampicin	E	-

Gombatenyésztés negatív.

20,5 óra laboratóriumi inkubálás után pozitív.

Vizsgálati anyag: anaerob hemokultura: szúrt véna

Eredmény:

Az eredmény kiadva: 2024.11.12

Tenyésztéssel Staphylococcus hominis

	Érz.	ug/ml
Oxacillin	E	-
Cefazolin	E	-
Gentamicin	E	-
Amikacin	E	-
Erythromycin	E	-
Clarithromycin	E	-
Ciprofloxacin	M	-
Levofloxacin	M	-
Azithromycin	E	-
Clindamycin	E	-
Tobramycin	E	-
Sulfamethoxasole/ trimethoprim	E	-
Doxycyclin	E	-
Tetracyclin	E	-
Linezolid	E	-
Rifampicin	E	-

Anaerob baktérium nem tenyészett ki.

Kontamináció valószínű

Kórokozó szerepe kétes!

52 óra laboratóriumi inkubálás után pozitív.

Vizsgálati anyag: anaerob hemokultura: szúrt véna

Eredmény:

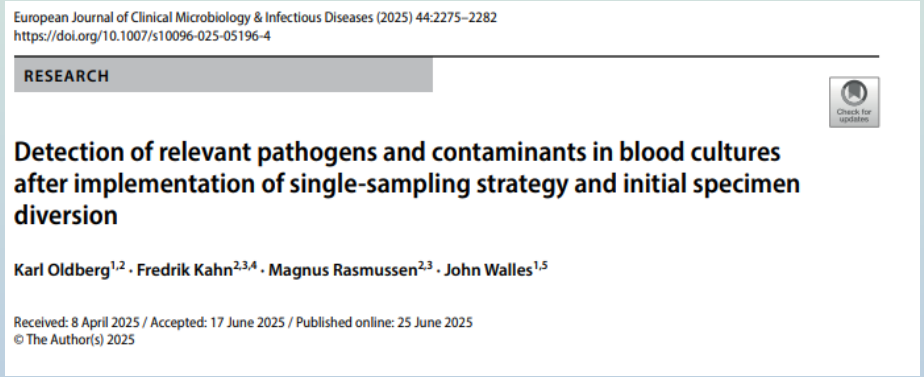
Aerob és anaerob baktérium nem tenyészett ki.

Mi lett az eredmény?

- SSS + ISDT
  - 117142 „esemény”
  - Legalább 4 palack 87,6 -> 92,3%

	Before intervention $n=89\,896$	After intervention $n=27\,246$	Univariate p
Age, median (IQR)	73 (59–82)	75 (62–83)	$P<0.001$
At least 4 bottles	78 763 (87.6%)	25 154 (92.3%)	$P<0.001$
Positive blood culture in sampling event	16 759 (18.6%)	4 989 (18.3%)	$P=0.22$
Relevant pathogens in sampling event	12 221 (13.6%)	3 697 (13.6%)	$P=0.92$
Contaminant species in sampling event	5 197 (5.8%)	1 491 (5.5%)	$P=0.056$
CoNS in sampling event	4 633 (5.2%)	1 318 (4.8%)	$P=0.039$

  - 1-2 palackban CNS csökkent, 3-4 palackban CNS nőtt


European Journal of Clinical Microbiology & Infectious Diseases (2025) 44:2275–2282
https://doi.org/10.1007/s10096-025-05196-4

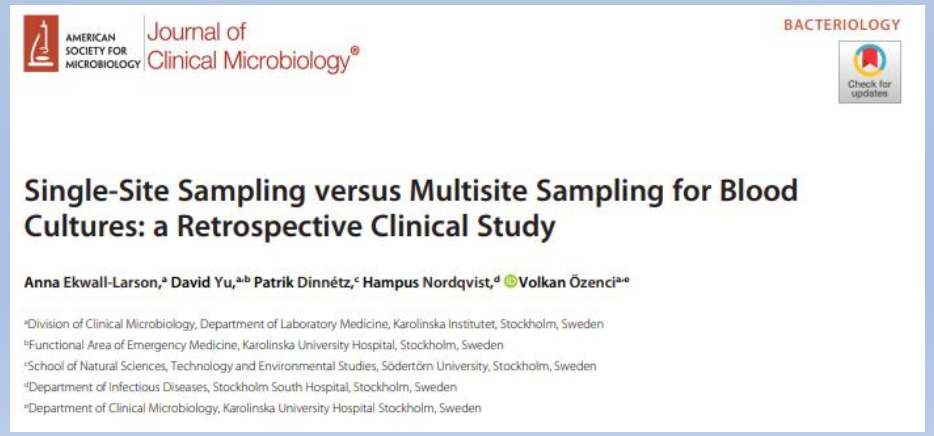
RESEARCH

Detection of relevant pathogens and contaminants in blood cultures after implementation of single-sampling strategy and initial specimen diversion

Karl Oldberg[1,2] · Fredrik Kahn[2,3,4] · Magnus Rasmussen[2,3] · John Walles[1,5]

Received: 8 April 2025 / Accepted: 17 June 2025 / Published online: 25 June 2025

- MSS – SSS
  - 5248 – 5364 beteg
  - Megfelelő mennyiség szignifikánsan többször
  - Szignifikánsan magasabb pozitivitási arány
  - Nem magasabb kontaminációs ráta


AMERICAN SOCIETY FOR MICROBIOLOGY | Journal of Clinical Microbiology®

BACTERIOLOGY

Single-Site Sampling versus Multisite Sampling for Blood Cultures: a Retrospective Clinical Study

Anna Ekwall-Larson,[a] David Yu,[a,b] Patrik Dinnétz,[c] Hampus Nordqvist,[d] Volkan Özenci[a,e]

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[d]Department of Infectious Diseases, Stockholm South Hospital, Stockholm, Sweden
[e]Department of Clinical Microbiology, Karolinska University Hospital Stockholm, Sweden

Baktérium a haemoculturában – Bactraemia – Véráram-fertőzés

- Pozitív haemocultura okai
  - Véráram-fertőzés
    - Primer
    - Szekunder
  - Bacteraemia
    - Intermittáló
    - Folyamatos
  - IV kanül kolonizációja
  - Minta kontaminációja 2,1-6%
    - (kanül: 3,4-13%)

- Kórokozók
  - Álatlában kontaminánsok, de lehetnek valódi kórokozók
    - Koaguláz-negatív Staphylococcusok (IE?), Corynebacterium sp., Cutibacterium acnes, Bacillus sp, Micrococcus sp.

Pozitív haemocultura

- Klinikai jelentőség mérlegelése
  - Pozitív/levett minták száma
  - Kimutatott kórokozó, kórokozók, (számuk?)
  - Pozitivitásig eltelt idő
  - Mintavétel helye (véna/kanül/mindegyik)
  - Klinikai kép

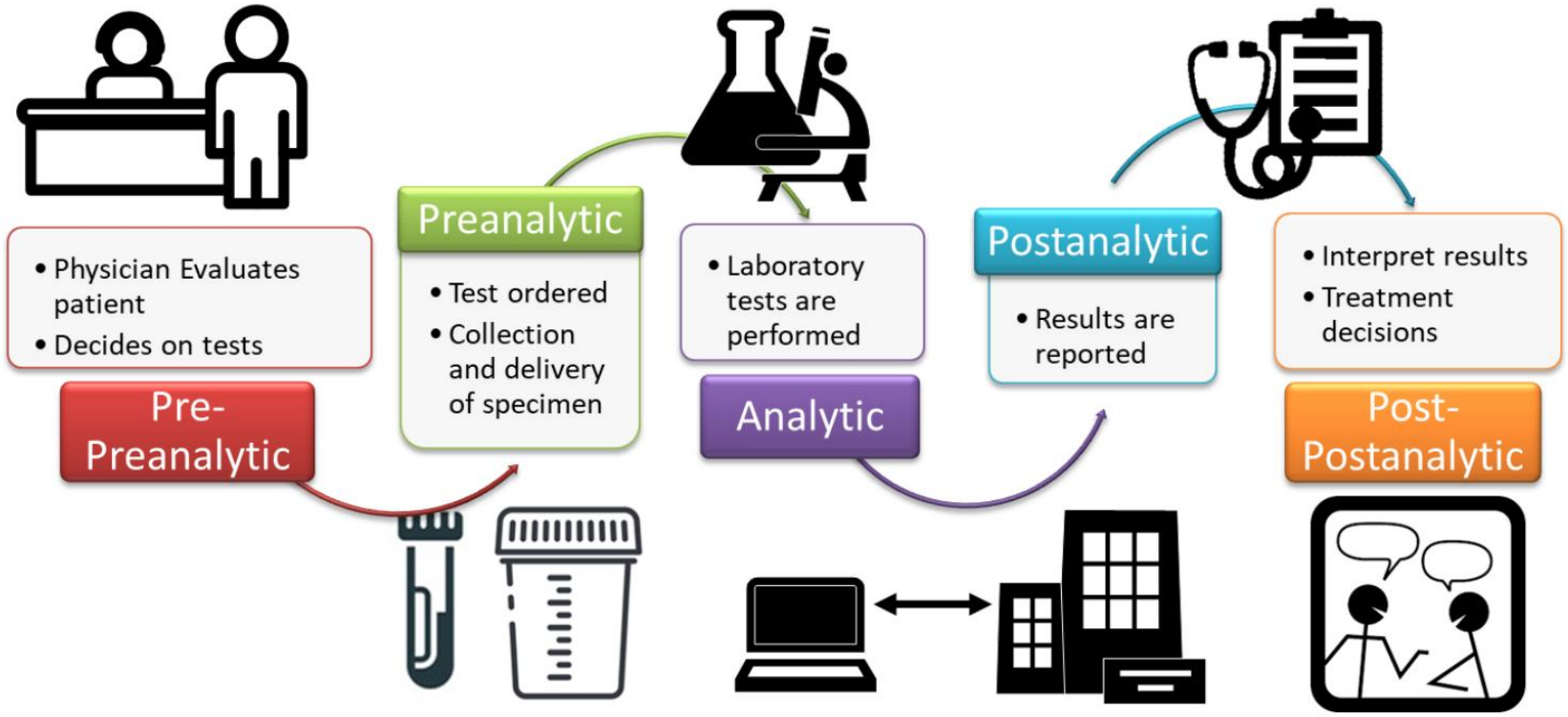
Pretest probability of bacteremia in common clinical scenarios (percentages as reported in the studies)

<5% (very low)	<10% (low)	Between 10% and <20% (low-moderate)	Between 20% and <50% (moderate)	≥50% (high)
▪ Fever within first 48 hours of surgery[1-5] ▪ Isolated fever[6, 7]	▪ Uncomplicated cellulitis[6-12], including periorbital cellulitis[13, 14] ▪ Lower urinary tract infection[15, 16] ▪ CAP[6, 17-21] ▪ HCAP[17, 20, 22, 23]	▪ Cellulitis in patients with severe comorbidities[24-26] ▪ VAP[27, 28]	▪ Acute pyelonephritis[29-32] ▪ Cholangitis[33, 34] ▪ Pyogenic liver abscess[35] ▪ Severe CAP[36] ▪ Nonvascular shunt infections[37] ▪ Severe sepsis[38, 39] ▪ Shaking chills in febrile patient[6]	▪ Discitis and VO[40-42] ▪ Epidural abscesses[41, 43] ▪ Acute nontraumatic native septic joints[44] ▪ Meningitis[6] ▪ Ventriculoatrial shunt infections[37] ▪ Septic shock[6] ▪ Catheter-related bloodstream infections

CAP: community-acquired pneumonia; HCAP: health care-associated pneumonia; VAP: ventilator-associated pneumonia; VO: vertebral osteomyelitis.

https://www.uptodate.com/contents/detection-of-bacteremia-blood-cultures-and-other-diagnostic-tests

Diagnostic Process



Kezdeti ellátás

2016

A. INITIAL RESUSCITATION

1. Sepsis and septic shock are medical emergencies, and we recommend that treatment and resuscitation begin immediately (BPS).
2. We recommend that, in the resuscitation from sepsis-induced hypoperfusion, at least 30 mL/kg of IV crystalloid fluid be given within the first 3 hours (strong recommendation, low quality of evidence).

F. FLUID THERAPY

1. We recommend that a fluid challenge technique be applied where fluid administration is continued as long as hemodynamic factors continue to improve (BPS).
2. We recommend crystalloids as the fluid of choice for initial resuscitation and subsequent intravascular volume replacement in patients with sepsis and septic shock (strong recommendation, moderate quality of evidence).
3. We suggest using either balanced crystalloids or saline for fluid resuscitation of patients with sepsis or septic shock (weak recommendation, low quality of evidence).
4. We suggest using albumin in addition to crystalloids for initial resuscitation and subsequent intravascular volume replacement in patients with sepsis and septic shock when patients require substantial amounts of crystalloids (weak recommendation, low quality of evidence).
5. We recommend against using hydroxyethyl starches (HESs) for intravascular volume replacement in patients with sepsis or septic shock (strong recommendation, high quality of evidence).
6. We suggest using crystalloids over gelatins when resuscitating patients with sepsis or septic shock (weak recommendation, low quality of evidence).

2021

5. For patients with sepsis induced hypoperfusion or septic shock we **suggest** that at least 30 mL/kg of IV crystalloid fluid should be given within the first 3 hours of resuscitation.

Weak recommendation, low-quality evidence.

HEMODYNAMIC MANAGEMENT		
32. For adults with sepsis or septic shock, we recommend using crystalloids as first-line fluid for resuscitation.	***Strong,*** *moderate-quality evidence*	
33. For adults with sepsis or septic shock, we suggest using balanced crystalloids instead of normal saline for resuscitation.	***Weak,*** *low quality of evidence*	**CHANGED from *weak recommendation*,** *low quality of evidence.* "We suggest using either balanced crystalloids or saline for fluid resuscitation of patients with sepsis or septic shock"
34. For adults with sepsis or septic shock, we suggest using albumin in patients who received large volumes of crystalloids.	***Weak,*** *moderate-quality evidence*	
35. For adults with sepsis or septic shock, we recommend against using starches for resuscitation.	***Strong,*** *high-quality evidence*	

Surviving Sepsis Campaign: International Guidelines for Management of Sepsis and Septic Shock 2021. Critical Care Medicine 49(11):p e1063-e1143, November 2021. | DOI: 10.1097/CCM.0000000000005337

Prescott H, Antonelli M, Alhazzani W, et al. Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock 2026. Crit Care Med. 2026 Mar. Forthcoming. doi.org/10.1097/CCM.0000000000007075

2026

Recommendation	
10. For adults with sepsis-induced hypoperfusion or septic shock, we "suggest" administering at least 30 mL/kg of IV crystalloid in the first 3 h (conditional recommendation, low certainty evidence) ***Remark***: Consideration should be given to individual patient characteristics and context when selecting initial fluid volume ***Remark***: Clinicians prescribing fluids should perform frequent, ongoing reassessment and closely monitor patients to avoid harms of under- or over-resuscitation ***Remark***: Weight-based fluid volume should be calculated based on actual body weight, or by adjusted or ideal body weight in patients with body mass index > 30 kg/m^2 (Table 4)	**Revisited**
43. For adults with sepsis or septic shock, we "recommend" using crystalloids as first-line fluid for resuscitation (strong recommendation, moderate certainty evidence)	**Carryover**
44. For adults with sepsis or septic shock undergoing initial resuscitation, we "suggest" using balanced crystalloids over 0.9% saline (conditional recommendation, moderate certainty evidence) ***Remark***: For patients with sepsis and traumatic brain injury, we suggest using 0.9% saline	**Revisited**
45. For adults with sepsis or septic shock, we "suggest" using crystalloids alone over crystalloids with supplemental albumin for fluid resuscitation (conditional recommendation; moderate certainty evidence) ***Remark***: Use of supplemental albumin may be appropriate for patients who already received large crystalloid volumes or have cirrhosis. Supplemental albumin should be avoided in patients with traumatic brain injury	**Revisited**
46. For adults with sepsis or septic shock, we "recommend against" using starches for resuscitation (strong recommendation, high-certainty evidence)	**Carryover**
47. For adults with sepsis and septic shock, we "suggest against" using gelatin for resuscitation (conditional recommendation, moderate certainty evidence)	**Carryover**

Kezdeti ellátás

- Sepsis indukálta hipoperfúzió, septicus shock esetén minimum 30 ml/kg krisztalloid 3 órán belül

- Kezdeti ellátáson túli folyadékterápia
  - Veszély: folyadék-túltöltés - lélegeztetés, AKI, mortalitás
  - Dinamikus paraméterek
    - Passzív alsó végtagemelés v. folyadékbolus + SV, PPV mérése
    - Intratorakális nyomás változás – szisztolés RR, SV-emelkedés
  - Laktát önmagában nem elégséges a szöveti perfúzió ellenőrzésére, de a cél a laktát csökkenése
  - Magasabb rendű hemodinaikai módszer nem érhető el, akkor CRT, végtag hőmérséklete segít a szervperfúzió (folyadékterápia) ellenőrzésére

Kanül kérdés

- Rhonda L Stuart és mtsai [1]
  - S. aureus kanül-asszociálta véráram-fertőzés
  - 4 vagy annál több nap, 61% sürgősségi osztály vagy mentőszolgálat
- Mohamad G Fakih [2]
  - PVCABSI 75%-a esetén kanülbehelyezés a sügősségi ellátás kapcsán
- T. Tony Trinh és mtsai [3]
  - Sürgősségi ellátás kapcsán behelyezett kanül 6x rizikó, ill. kórházon kívül
  - Sürgős szükség esetén behelyezett kanül cseréje 24 órán belül
- Matteo Faltoni és mtsai [4]
  - 16G vagy nagyobb 4,52x rizikó
- Nicco¸lo Buetti és mtsai [5]
  - Kéz vagy proximálisabb terület – 0,37 HR (3 napon túl)

1 Stuart LS et al. Peripheral intravenous catheter-associated Staphylococcus aureus bacteraemia: more than 5 years of prospective data from two tertiary health services, MJA 2013; 198: 551–553 doi: 10.5694/mja12.11699
2 Mohamad G. Fakih et al Sustained Improvements in Peripheral Venous Catheter Care in Non–Intensive Care Units: A Quasi-Experimental Controlled Study of Education and Feedback Author(s): Infection Control and Hospital Epidemiology, Vol. 33, No. 5 (May 2012), pp. 449-455
3 T Tony Trinh et al Peripheral Venous Catheter-Related Staphylococcus aureus Bacteremia, Infection Control & Hospital Epidemiology , Volume 32 , Issue 6 , June 2011 , pp. 579 - 583
DOI: https://doi.org/10.1086/660099
4 Matteo Faltoni et al Catheter size and risk of short-term peripheral venous
catheter-associated bloodstream infections: an observational study Clinical Microbiology and Infection 30 (2024) 548e551
5 Buetti et al. Lower risk of peripheral venous catheter-related bloodstream infection by hand insertionAntimicrobial Resistance & Infection Control (2022) 11:80 https://doi.org/10.1186/s13756-022-01117-8

Kezdeti ellátás

- Septicus shock + vazopresszor esetén cél MAP 65 Hgmm (nem magasabb)
  - Magasabb MAP 10,5%-al csökkentette a RRT igényét, de gyakoribb PF
  - Túlélést nem befolyásolta
  - 65 év felett 60-65 Hgmm
- ITO ellátást igénylő betegek felvétel 6 órán belül történjék meg

Recommendation	
11. For adults with sepsis-induced hypotension, we "suggest" initial IV crystalloid fluid bolus resuscitation followed by vasopressor support if hypotension persists (conditional recommendation, very low certainty evidence) ***Remark***: In patients with unstable septic shock, immediate concurrent administration of vasopressors together with IV crystalloid fluid may be warranted on a case-by-case basis. Presence of unstable shock should be determined by physical examination. Suggestive clinical features of unstable shock include severely reduced blood pressure, mottled skin, ashen appearance, cyanosis/decreased oxygen saturation, tachycardia, and altered mentation	**New**

Recommendation	
12. In adults with septic shock, we "suggest" starting vasopressors peripherally to restore mean arterial pressure rather than delaying initiation until central venous access is secured (conditional recommendation, very low certainty evidence) ***Remark***: Data are insufficient to recommend a duration of use, dose, or access route (size of peripheral IV line or anatomic location). Midline catheters were not considered	**Revisited**

Prescott H, Antonelli M, Alhazzani W, et al. Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock 2026. Crit Care Med. 2026 Mar. Forthcoming. doi.org/10.1097/CCM.0000000000007075

Hemodinamikai ellátás

- Folyadékterápia
  - Balanszírozott krisztalloid > fiziológiás sóoldat
    - Klór-restriktív oldatok – alacsonyabb hyperchlor. acid, renalis vasoconsrt, cytokinszekérció, AKI, mortalitás
  - Albumin – nagyobb mennyiségű krisztalloid esetén ?
  - Keményítő-, zselatintartalmú oldatok kerülendők
    - Magasabb mortalitás, RRT

- Vazoaktív szerek
  - Első választandó noradrenalin
  - Nem megfelelő MAP esetén vazopresszin kiegészítés (0,03E/min) javasolt (0,25-0,5 ug/kg/min noradrenalin dózisnál) – mortalitást csökkentheti
  - Noradrenalin + vazopressin ellenére nem megfelelő MAP + adrenalin
  - Terlipressin, selepressin, dopamin nem javasolt

- Inotrop szerek
  - Septicus shock + myocardiumdiszfunkció + perzisztáló hipoperfúzió adekvát folyadékstátusz és MAP ellenére
    - + adrenalin vagy dobutamin
    - Levosimendan nem javasolt

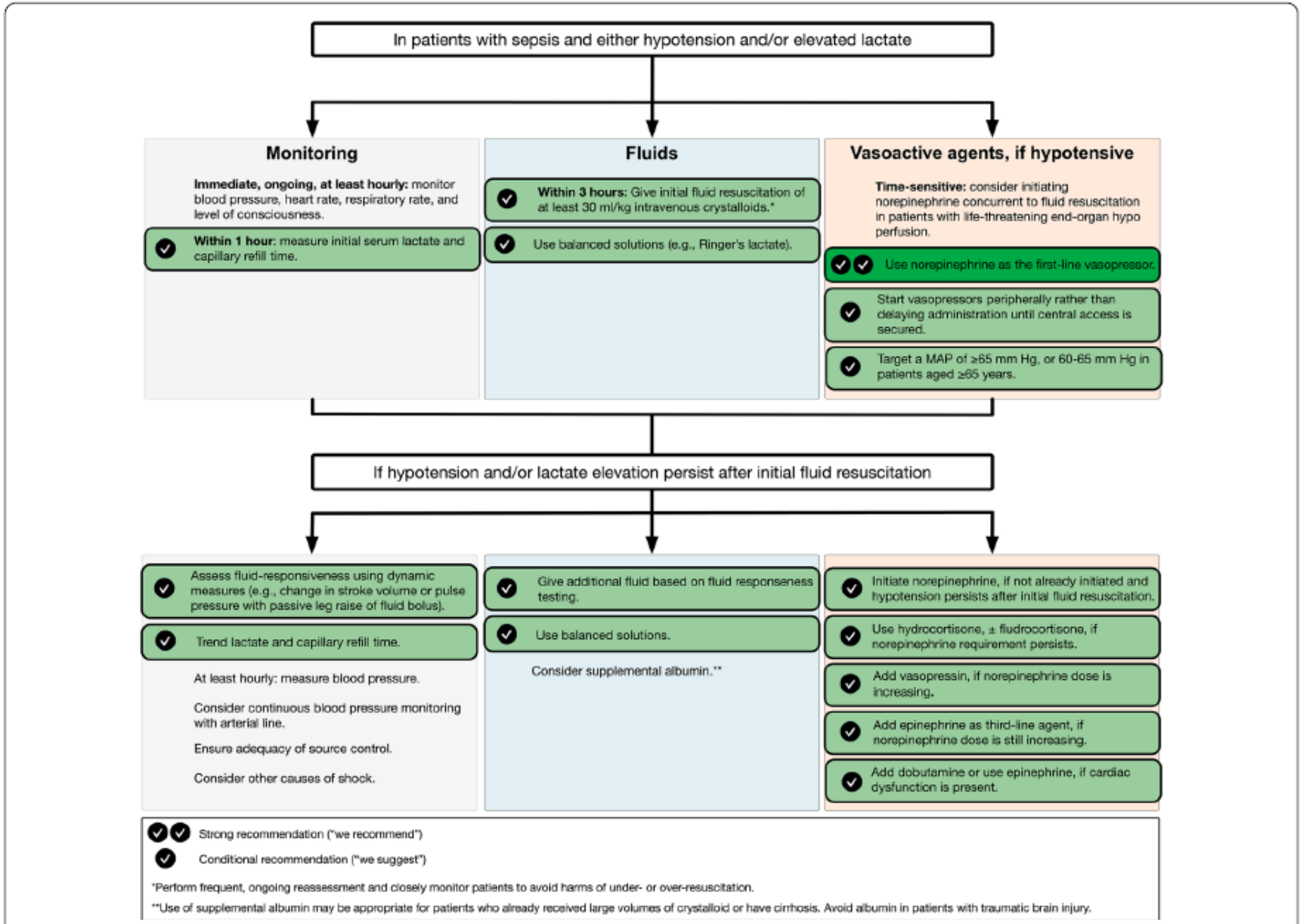


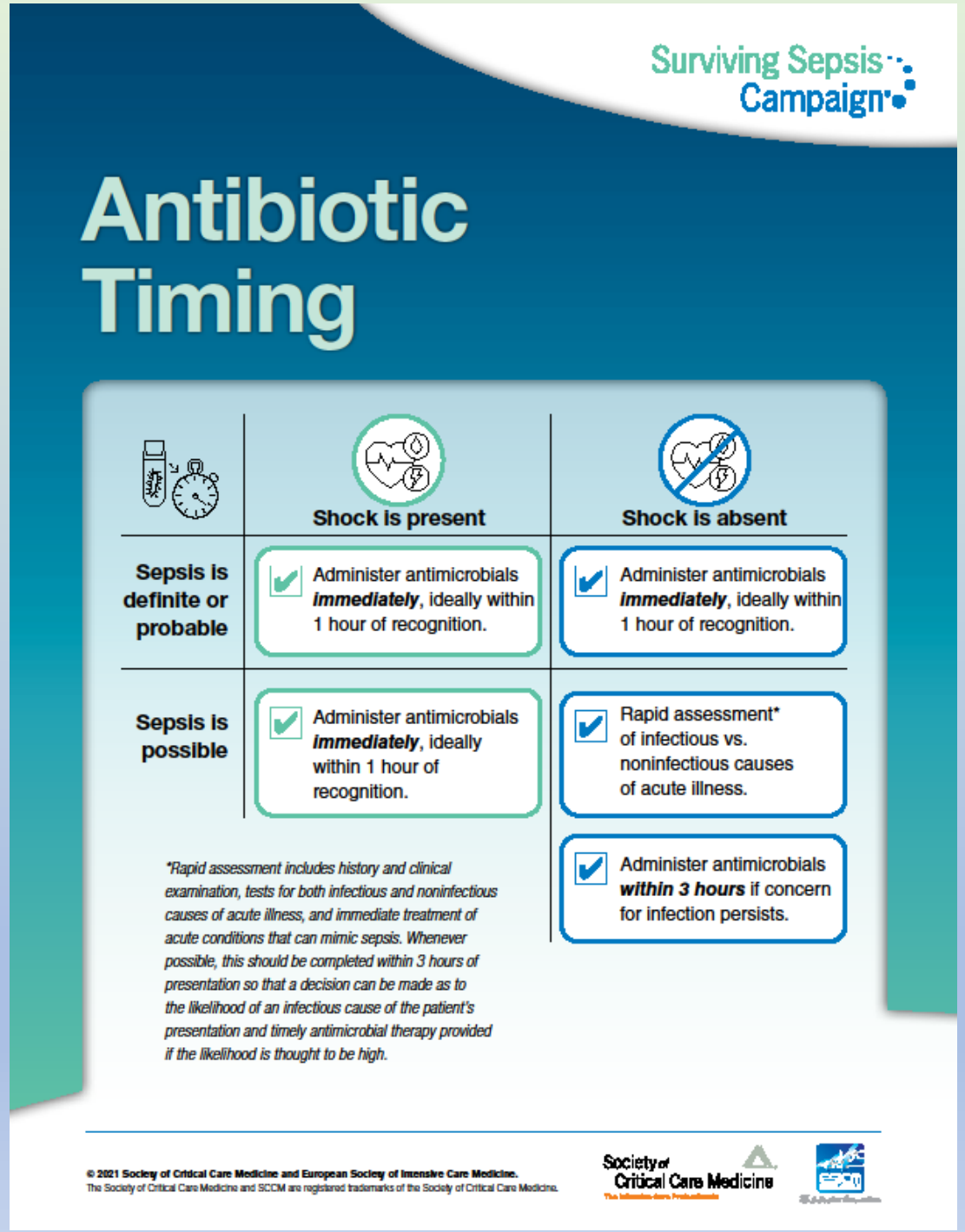
Fig. 3 Quick guide for resuscitation and hemodynamic support in adults with sepsis and septic shock. This figure is intended a quick reference summarizing hemodynamic monitoring and interventions for patients with sepsis-induced hypotension of hypoperfusion. It is not an exhaustive summary of statements on resuscitation included in the Surviving Sepsis Campaign guidelines. We prioritized inclusion of recommendations in this figure to quickly assist with bedside management, including the monitoring and interventions most commonly used in clinical practice

Prescott H, Antonelli M, Alhazzani W, et al. Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock 2026. Crit Care Med. 2026 Mar. Forthcoming. doi.org/10.1097/CCM.0000000000007075

Beta-blockers

Recommendation	
64. For adults with septic shock, we "suggest against" using beta-blockers as a treatment for septic shock (conditional recommendation; very low certainty evidence) ***Remark***: This recommendation is based on evidence for short-acting, IV beta-blockers (esmolol and landiolol) prescribed for treatment of septic shock	**New**

Prescott H, Antonelli M, Alhazzani W, et al. Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock 2026. Crit Care Med. 2026 Mar. Forthcoming. doi.org/10.1097/CCM.0000000000007075



Biomarker-guided initiation of antimicrobial therapy

Recommendation	
22. For adults with possible or probable sepsis or septic shock, we "suggest" using clinical evaluation alone over procalcitonin plus clinical evaluation to decide whether to start antimicrobial therapy (conditional recommendation, very low certainty evidence)	**Carryover**

Prolonged infusion of β-lactam antibiotics

Recommendation	
33. For adults with sepsis or septic shock, we "recommend" using prolonged infusion of beta-lactams for maintenance (after an initial loading dose) over bolus administration (strong recommendation, moderate certainty evidence)	**Revisited**

Recommendation	
36. For adults with sepsis or septic shock, we "recommend" de-escalation of antimicrobial therapy over no de-escalation when a confirmed microbiological diagnosis and susceptibility profile is available (strong recommendation, very low certainty evidence) ***Remark***: De-escalation involves discontinuing unnecessary antimicrobial therapy or narrowing the spectrum of antimicrobial agents where appropriate	**Revisited**
37. For adults with sepsis or septic shock, we "suggest" de-escalation of antimicrobial therapy over no de-escalation when no pathogens are identified on final culture results (conditional recommendation, very low certainty evidence)	**Revisited**

Prescott H, Antonelli M, Alhazzani W, et al. Surviving Sepsis Campaign: International guidelines for management of sepsis and septic shock 2026. Crit Care Med. 2026 Mar Forthcoming. doi.org/10.1097/CCM.0000000000007075

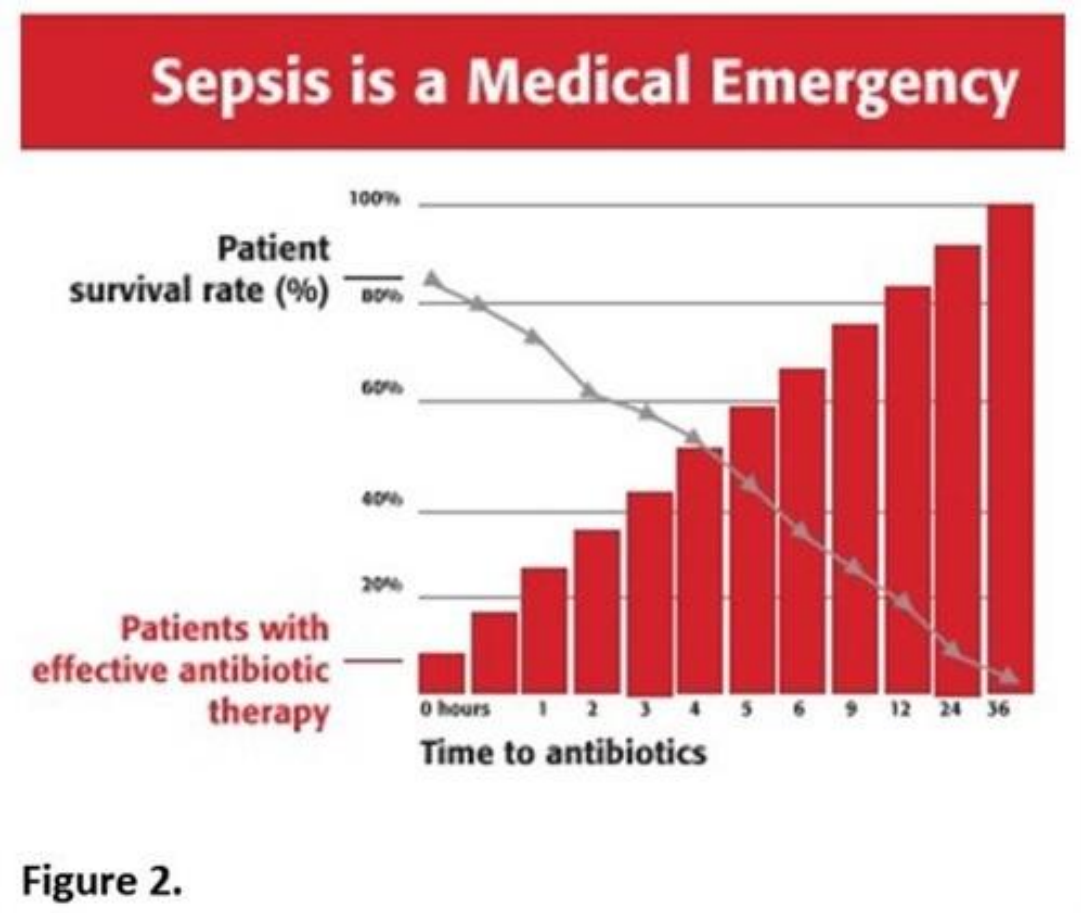


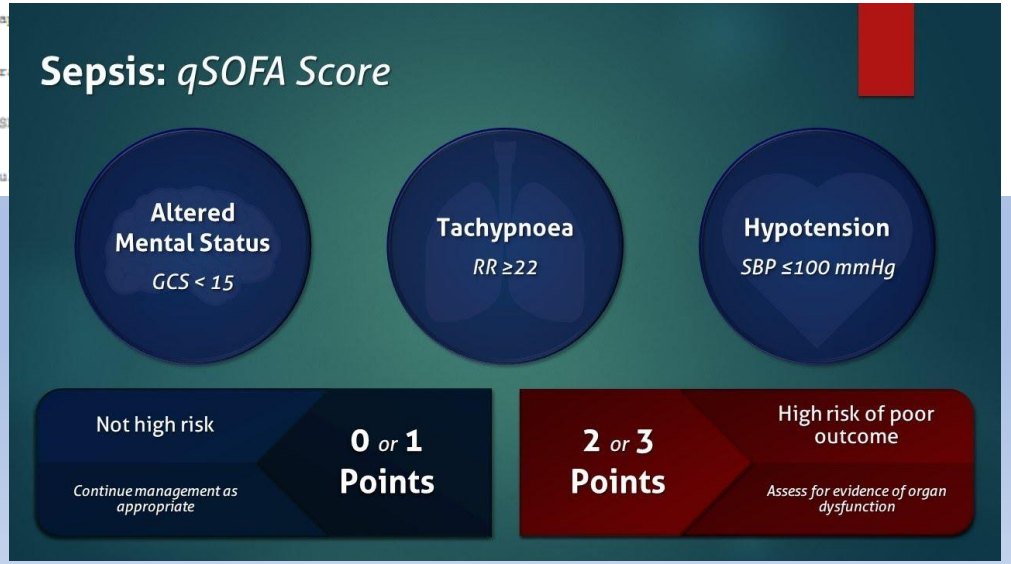
Figure 2.

https://journals.lww.com/em-news/blog/breakingnews/pages/post.aspx?PostID=379

Vissza a beteghez

- Meropenem + clindamycin
- 2000 ml Isolyte
- O2 30%

Tenyésztéssel	Proteus mirabilis		Klebsiella pneumoniae		Proteus penneri	
	Érz.	ug/ml	Érz.	ug/ml	Érz.	ug/ml
	-	-	-	-	-	-
Ampicillin	E	-	R	-	R	-
Amoxicillin/clav.sav	E	-	R	-	R	-
Gentamicin	E	-	E	-	E	-
Ampicillin/sulbactam	E	-	R	-	R	-
Piperacillin/Tazobactam	E	-	R	-	E	-
Ceftriaxon	E	-	R	-	E	-
Cefepime	E	-	R	-	E	-
Amikacin	E	-	E	-	E	-
Ciprofloxacin	E	-	R	-	E	-
Levofloxacin	E	-	R	-	-	-
Imipenem	-	-	E	-	-	-
Meropenem	E	-	E	-	E	-
Erta						-
Tobr						-
R=ES						-
R=Mu						-



SOFA: 8

Mi történt a beteggel?

- ITO 19:58
- Vezopresszor
- CT
- Seb

cBase(B,ox)	-16.1	X	mmol/l
cBase(Ecf,ox)	-17.9	X	mmol/l
cCa2+	0.90	X	mmol/l
cCa2+(7.4)	0.84	X	mmol/l
FO2(I)	30.0	X	%
cGlu	5.7		
cHCO3-(P)	9.8		
cHCO3-(P,st)	12.4		
Hct	45		
cK+	8.1		
cLac	8.7		
cNa+	131		
sO2	97		
ctCO2(B)	10.5		
ctHb	14.0		

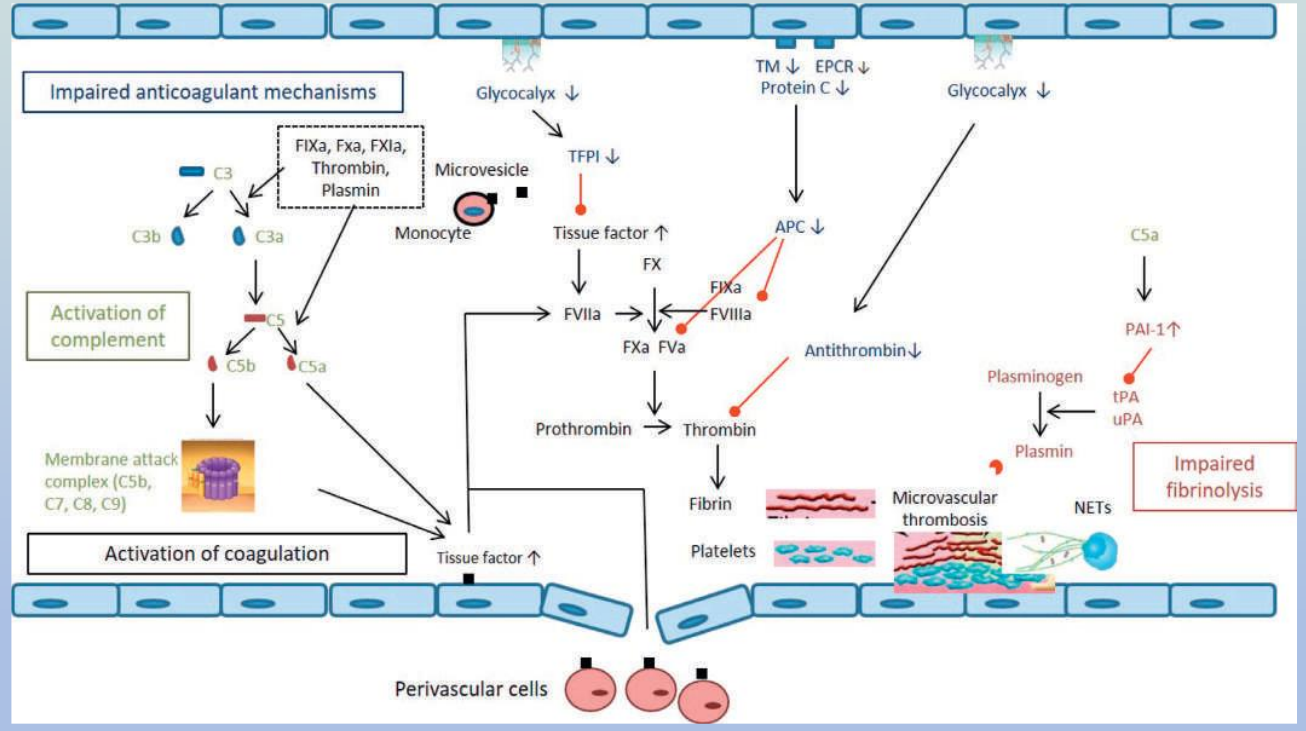
Source control

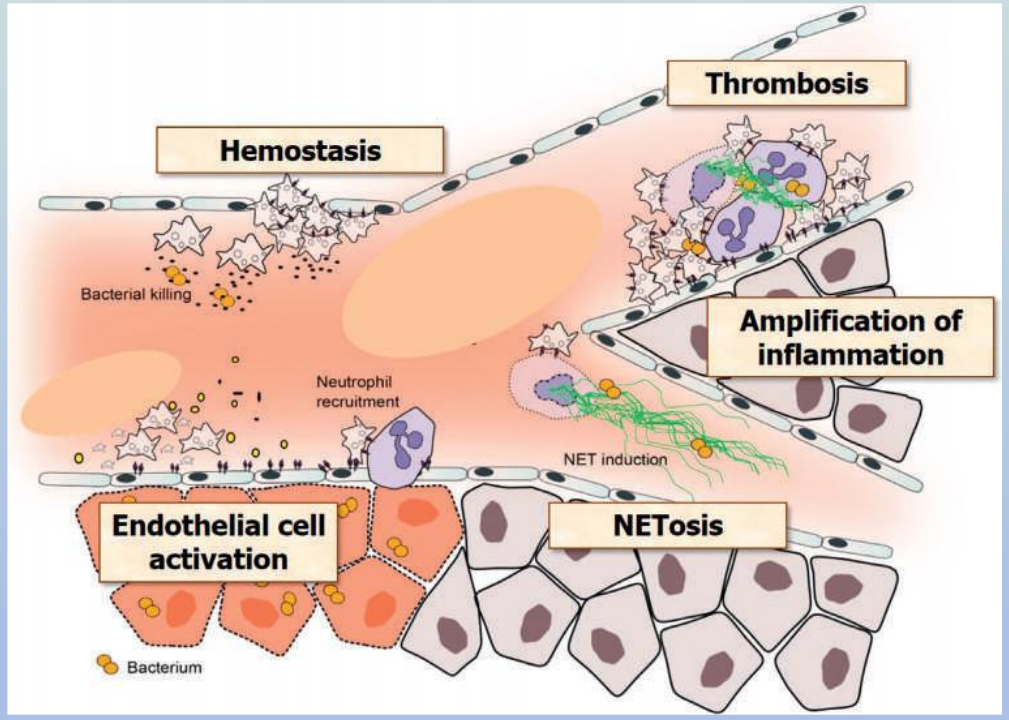
Recommendation	
23. Adults with sepsis or septic shock should be rapidly evaluated for specific anatomical diagnoses or sources of infection that require emergent source control (good practice statement)	**Carryover**
24. For adults with sepsis or septic shock and a specific anatomical diagnosis or source of infection that requires source control, we "suggest" early source control over late source control, ideally within 6 h of diagnosis of sepsis or septic shock requiring source control (conditional recommendation, very low certainty evidence)	**Revisited**

		tartomány	09:33	12:17	22:05	23:17
AITI II. laborkérőlap						
Nátrium	mmol/l	136-145 -	140		137	
Kálium	mmol/l	3,50-5,10 -	4,59		5,25	
Glükóz	mmol/l	3,90-6,00 -	5,09			
Karbamid	mmol/l	2,14-8,21 -	18,34		20,57	
Kreatinin	umol/l	62-106 -	226		273	
Fehérvérsejt	Giga/l	4,000-10...	17,200		3,000	
Vörösvértest	T/l	4,50-6,00 -	3,80		4,29	
Hemoglobin	g/l	137-175 -	125		140	
Hematokrit	%	40,1-51,0 -	36,9		40,5	
Trombocita	Giga/l	140,0-44...	144,0		104,0	
Ultraszenzitiv CRP	mg/l	<5,00 -	315,80		313,30	
Protrombin INR	.	0,90-1,15 -	1,97			
Procalcitonin	ng/ml	<0,50 -		14,08		
Fibrinogén	g/l	2,00-4,00 -				
Összbilirubin	umol/l	2,5-21,0 -				31,5
GOT	U/l	<44 -	52		261	
GPT	U/l	<50 -	25		51	
Gamma-GT	U/l	<60 -			135	
Alkalikus foszfatáz	U/l	40-130 -			140	
Amiláz	U/l	28-100 -				31
Lipáz	U/l	<60 -				19
LDH	U/l	240-480 -			1366	
Kreatin-kináz	U/l	<190 -			9611	

Véralvadás – SIC

TF, VIIa, Xa, trombin, fibrin – proinflammatorikus kaszkád erősödése





Szervrendszer szintű változások

- Máj
  - Diszfunkció-> enterális eredetű endotoxin és bakterialis eredetű termékek szisztémás keringésbe
- Tüdő
  - Endothelkárosodás -> kapilláris átrendeződés, permeabilitás nő ->interstitialis és alveolaris oedema ->V/Q aránytalanság -> hipoxémia - ARDS
  - Surfactant inaktiválása és csökkent termelése II. pneumocyták révén – diffúz microatelectasiák
  - FVS, TCT lerakódás, I. pneumocyta károsodás, II pneumocyta hyperplasia – diffuse alveolar damage

Légzéstámogatás

- "Konzervatív/liberális" O2-pótlás/célértékek ?
- HFNO > NIV (ha nincs hiperkapnia) (90 napos mortalitás jobb, intubációs igény alacsonyabb)
- ARDS- invazív lélegeztetés, ECMO

Oxygen targets

Recommendation	
66. For adults with sepsis and acute hypoxemic respiratory failure, we "suggest" titrating F_{IO_2} to target either higher, more liberal oxygen levels or lower, conservative oxygen levels depending on patient factors and resource limitations (conditional recommendation, low certainty evidence) ***Remark***: Although there was variability across trials informing this recommendation, most used a lower target of approximately 90–93% S_{PO_2} and a higher target of $S_{PO_2} \geq 96$ ***Remark***: "In our practice", panelists target S_{PO_2} between 90% (IQR 90–92%) to 96% (IQR 94–98%) for patients with sepsis and acute hypoxemic respiratory failure	**New**

Non-invasive respiratory support

Recommendation	
67. For adults with sepsis and acute hypoxemic respiratory failure, we "suggest" using high-flow nasal cannula (HFNC) therapy over conventional oxygen therapy (conditional recommendation, very low certainty evidence) ***Remark***: This recommendation pertains to patients with a P_{AO_2}/F_{IO_2} ratio < 200 or S_{PO_2}/F_{IO_2} ratio < 235	**New**
68. For adults with sepsis and acute hypoxemic respiratory failure, we "suggest" using HFNC as the initial therapy over non-invasive positive pressure ventilation (conditional recommendation, low certainty evidence)	**New**
69. For adults with sepsis and acute hypoxemic respiratory failure, we "suggest" using HFNC over high flow alternating with non-invasive positive pressure ventilation (conditional recommendation, very low certainty evidence)	**New**

Awake proning

Recommendation	
70. For adults with sepsis and acute hypoxemic respiratory failure who are not intubated, we "suggest" a trial of awake proning (conditional recommendation, very low certainty evidence) ***Remarks***: The duration and frequency of proning will depend on patient tolerance. Sedation should not be used for the purposes of promoting tolerance of proning in non-intubated patients	**New**

SOFA: 14

Hogy

- ITO 19
- Vazop
- CT
- Sebész

- Anuria
- Tudatzavar - intubatio
- Emelkedő vazopresszor-i

cBase(B,ox)	-8.8	X mmol/l
cBase(Ecf,ox)	-9.7	X mmol/l
cCa2+	0.95	X mmol/l
cCa2+(7.4)	0.91	X mmol/l
FO2(I)	30.0	X %
cGlu	1.6	X mmol/l
cHCO3-(P)	16.7	X mmol/l
cHCO3-(P,st)	18.0	X mmol/l
Hct	41	X %
cK+	5.0	
cLac	9.9	
cNa+	138	
sO2	96	
ctCO2(B)	17.7	
ctHb	12.7	
pCO2	34	
pH	7.30	
pO2	87	
Temp	37.0	
Minta típusa	Arter	

	Egys	tartomány	09:33	12:17	22:05	23:17	23:33	23:37	05:33
AITI II. laborkérőlap									
Nátrium	mmol/l	136-145 -	140		137				142
Kálium	mmol/l	3,50-5,10 -	4,59		5,25				6,29
Glükóz	mmol/l	3,90-6,00 -	5,09						
Karbamid	mmol/l	2,14-8,21 -	18,34		20,57				20,69
Kreatinin	umol/l	62-106 -	226		273				293
Fehérvérsejt	Giga/l	4,000-10...	17,200		3,000				3,920
Vörösvértest	T/l	4,50-6,00 -	3,80		4,29				4,38
Hemoglobin	g/l	137-175 -	125		140				137
Hematokrit	%	40,1-51,0 -	36,9		40,5				41,0
Trombocita	Giga/l	140,0-44...	144,0		104,0				77,0
Ultraszenzitiv CRP	mg/l	<5,00 -	315,80		313,30				302,20
Protrombin INR	.	0,90-1,15 -	1,97					2,68	1,68
Procalcitonin	ng/ml	<0,50 -		14,08					19,23
Fibrinogén	g/l	2,00-4,00 -						4,99	4,77
Összbilirubin	umol/l	2,5-21,0 -				31,5			
GOT	U/l	<44 -	52		261				401
GPT	U/l	<50 -	25		51				69
Gamma-GT	U/l	<60 -			135				
Alkalikus foszfatáz	U/l	40-130 -			140				
Amiláz	U/l	28-100 -				31			
Lipáz	U/l	<60 -				19			
LDH	U/l	240-480 -			1366				
Kreatin-kináz	U/l	<190 -			9611				10810

Szervrendszer szintű változások

- Idegrendszer
  - Vér-agy-gát károsodása – FVS infiltratio, toxikus mediátorok, citoikinek – encephalopathia
  - Paraszimpatikus tónus – Ach - proinflammatórikus citokintermelés csökken
- GI-rendszer
  - Barrierfunkció károsodása -> bakteriális és endotoxin transzlokáció

SOFA: 14

Hogy

- ITO 19
- Vazop
- CT
- Sebész

- Anuria
- Tudatzavar - intubatio
- Emelkedő vazopresszor-i

cBase(B,ox)	-8.8	X	mmol/l
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cCa2+	0.95	X	mmol/l
cCa2+(7.4)	0.91	X	mmol/l
FO2(I)	30.0	X	%
cGlu	1.6	X	mmol/l
cHCO3-(P)	16.7	X	mmol/l
cHCO3-(P,st)	18.0	X	mmol/l
Hct	41	X	%
cK+	5.0		
cLac	9.9		
cNa+	138		
sO2	96		
ctCO2(B)	17.7		
ctHb	12.7		
pCO2	34		
pH	7.30		
pO2	87		
Temp	37.0		
Minta típusa	Arter		

	Egys	tartomány	09:33	12:17	22:05	23:17	23:33	23:37	05:33
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Hemoglobin	g/l	137-175 -	125		140				137
Hematokrit	%	40,1-51,0 -	36,9		40,5				41,0
Trombocita	Giga/l	140,0-44...	144,0		104,0				77,0
Ultraszenzitiv CRP	mg/l	<5,00 -	315,80		313,30				302,20
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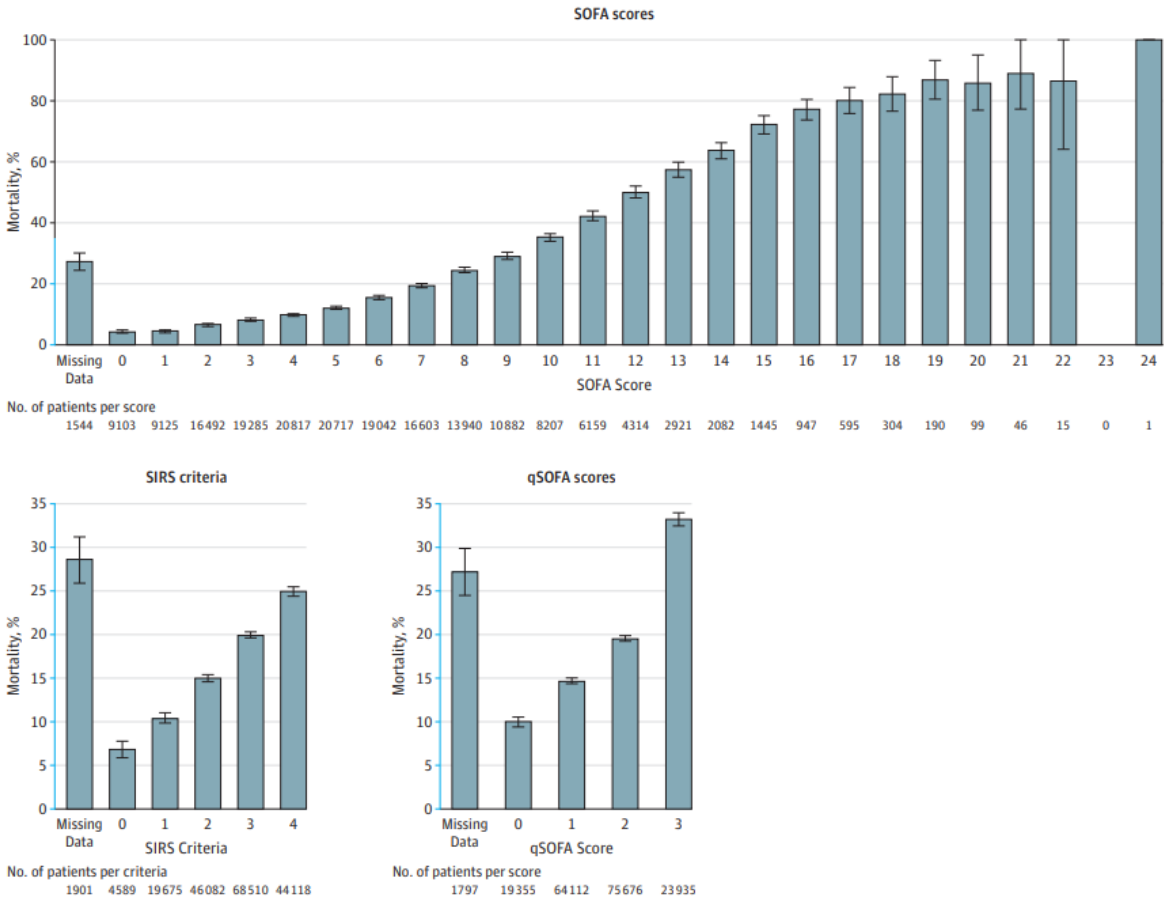
Amiláz	U/l	28-100 -				31			
Lipáz	U/l	<60 -				19			
LDH	U/l	240-480 -			1366				
Kreatin-kináz	U/l	<190 -			9611				10810

System	Score				
	0	1	2	3	4
Respiration					
PaO_2/FIO_2, mmHg (kPa)	≥400 (53.3)	<400 (53.3)	<300 (40)	<200 (26.7) with respiratory support	<100 (13.3) with respiratory support
Coagulation					
Platelets, $\times 10^3$ μL^{-1}	≥150	<150	<100	<50	<20
Liver					
Bilirubin, mg dL^{-1} (μmol L^{-1})	<1.2 (20)	1.2–1.9 (20–32)	2.0–5.9 (33–101)	6.0–11.9 (102–204)	>12.0 (204)
Cardiovascular	MAP≥70 mmHg	MAP<70 mmHg	Dopamine<5 or dobutamine (any dose)[a]	Dopamine 5.1–15 or epinephrine ≤0.1 or norepinephrine ≤0.1[a]	Dopamine >15 or epinephrine >0.1 or norepinephrine >0.1[a]
Central Nervous System (CNS)					
Glasgow Coma Scale score[b]	15	13–14	10–12	6–9	<6
Renal					
Creatinine, mg dL^{-1} (μmol L^{-1})	<1.2 (110)	1.2–1.9 (110–170)	2.0–3.4 (171–299)	3.5–4.9 (300–440)	>5.0 (440)
Urine output, mL per day				<500	<200

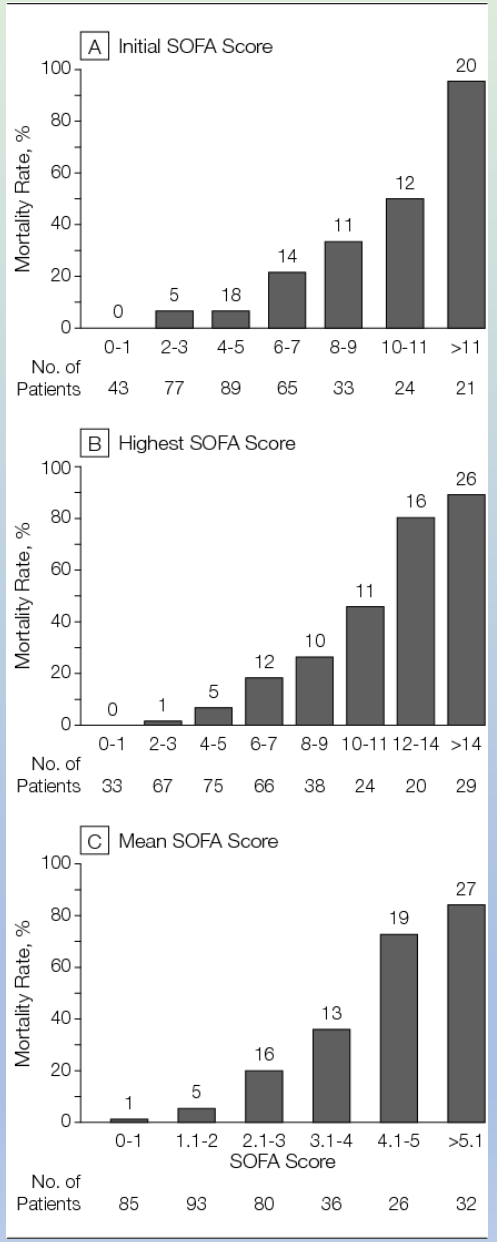
FIO_2, fraction of inspired oxygen; MAP, mean arterial pressure; PaO_2, partial pressure of oxygen.
[a]Catecholamine doses are given as μg kg^{-1} min^{-1} for at least 1 h.
[b]Glasgow Coma Scale scores range from 3 to 15; higher score indicates better neurological function.

Figure 2. Mortality by SOFA Score, SIRS Criteria, and qSOFA Score on ICU Admission Among Patients With Suspected Infection (N = 184 875)



ICU indicates intensive care unit; qSOFA, quick Sequential [Sepsis-related] Organ Function Assessment; SIRS, systemic inflammatory response syndrome; SOFA, Sequential [Sepsis-related] Organ Function Assessment. Number of patients included in the analysis were 183 331 for SOFA, 183 078 for qSOFA, and 182 974 for SIRS criteria. Error bars indicate 99% CIs. Y-axis scale shown in blue indicates the range from 0% to 35%.

Raith, Eamon P et al. "Prognostic Accuracy of the SOFA Score, SIRS Criteria, and qSOFA Score for In-Hospital Mortality Among Adults With Suspected Infection Admitted to the Intensive Care Unit." *JAMA* 317 (2017): 290–300.



Ferreira FL, Bota DP, Bross A, Mélot C, Vincent J. Serial Evaluation of the SOFA Score to Predict Outcome in Critically Ill Patients. JAMA. 2001;286(14):1754–1758. doi:10.1001/jama.286.14.1754

Definíció

- Sepsis-3 (2016 JAMA)

Box 3. New Terms and Definitions

- Sepsis is defined as life-threatening organ dysfunction caused by a dysregulated host response to infection.
- Organ dysfunction can be identified as an acute change in total SOFA score ≥2 points consequent to the infection.
  - The baseline SOFA score can be assumed to be zero in patients not known to have preexisting organ dysfunction.
  - A SOFA score ≥2 reflects an overall mortality risk of approximately 10% in a general hospital population with suspected infection. Even patients presenting with modest dysfunction can deteriorate further, emphasizing the seriousness of this condition and the need for prompt and appropriate intervention, if not already being instituted.
- In lay terms, sepsis is a life-threatening condition that arises when the body's response to an infection injures its own tissues and organs.
- Patients with suspected infection who are likely to have a prolonged ICU stay or to die in the hospital can be promptly identified at the bedside with qSOFA, ie, alteration in mental status, systolic blood pressure ≤100 mm Hg, or respiratory rate ≥22/min.

- Septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality.
- Patients with septic shock can be identified with a clinical construct of sepsis with persisting hypotension requiring vasopressors to maintain MAP ≥65 mm Hg and having a serum lactate level >2 mmol/L (18 mg/dL) despite adequate volume resuscitation. With these criteria, hospital mortality is in excess of 40%.

Singer M, Deutschman CS, Seymour CW, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA*. 2016;315:801–810.

További terápiás lehetőségek, ajánlások

- Kortikoszteroidok
  - 200 mg hidrokortizon folyamatos infúzióban vagy 4x50 mg

- „Vértisztító eljárások”
  - Polymyxin B hemoperfúzió nem javasolt
  - Egyébre nincs állásfoglalás

- Vörösvértest-transzfúzió
  - Restriktív transzfúziós stratégia (cél 70g/l, DE – beteg állapota, MI, súlyos hipoxémia, akut vérzés)

Recommendation	
79. For adults with septic shock, we "suggest" using IV corticosteroids (conditional recommendation, low certainty evidence)	**Revisited**

További terápiás lehetőségek, ajánlások

- IVIG
  - Nem javasolt
- Stressz ulcus profilaxis
  - Sepsis/septicus shock + rizikófaktor GI-vérzésre
- Vénás trombembólia profilaxis
  - Kontraindikáció hiányában sepsis/septicus shock esetén javasolt
  - LMWH
  - Mechanikai módszerek nem javasoltak gyógyszeres kezelés mellé

További terápiás lehetőségek, ajánlások

- Vesepótló kezelés
  - Sepsis/septicus shock + AKI + RRT szükséglet – folyamatos v intermittáló
  - Nincs RRT szükséglet – nem javasolt RRT

- Glikémiás kontroll
  - Inzulin javasolt 10 mmol/l felett
  - Cél vércukor 8-10 mmol/l

- C-, D-vitamin
  - Nem javasolt

További terápiás lehetőségek, ajánlások

Stage	Serum Creatinine	Urine Output
1	Increase ≥0.3 mg/dL (≥26.4 μmol/L), or Increase ≥150–200% (1.5-~2-fold) from baseline	<0.5 mL/kg/h for 6 h
2	Increase ≥200–300% (2-~3-fold) from baseline	<0.5 mL/kg/h for 12 h
3[a]	Increase > 300% (>3-fold) from baseline, or Serum creatinine to ≥4 mg/dL (≥354 μmol/L) with an acute increase ≥0.5 mg/dL (≥44 μmol/L)	<0.3 mL/kg/h for 24 h, or Anuria for ≥12 h

[a] Patients receiving renal replacement therapy are included in Stage 3.

- Bikarbonát
  - Septicus shock – hipoperfúzió okozta laktátacidózisban nem javasolt
  - Sepsis + metabolikus acidózis (pH≤7,2) és AKI (AKIN 2-3) - javasolt

- Táplálás
  - Korai (72 órán belül) enterális táplálás javasolt

IV XueBiJing

Recommendation	
86. For adults with sepsis or septic shock, we "suggest against" using XueBiJing injection outside of jurisdictions where it has regulatory approval (conditional recommendation, very low certainty evidence)	**New**

Active fluid removal

Recommendation	
89. For adults with septic shock after the acute resuscitation phase, we "suggest" using active fluid removal (conditional recommendation; very low certainty evidence) ***Remark***: Acute resuscitation refers to escalating doses of vasopressors, ongoing high doses of vasopressors, or needing ongoing volume expansion. Active fluid removal refers to diuretics and, if diuretics are insufficient, ultrafiltration or extracorporeal fluid removal. Factors to be considered when deciding to initiate active fluid removal include cardiorespiratory function; vasopressor dose; clinical course; peripheral edema; weight; and fluid balance	**New**

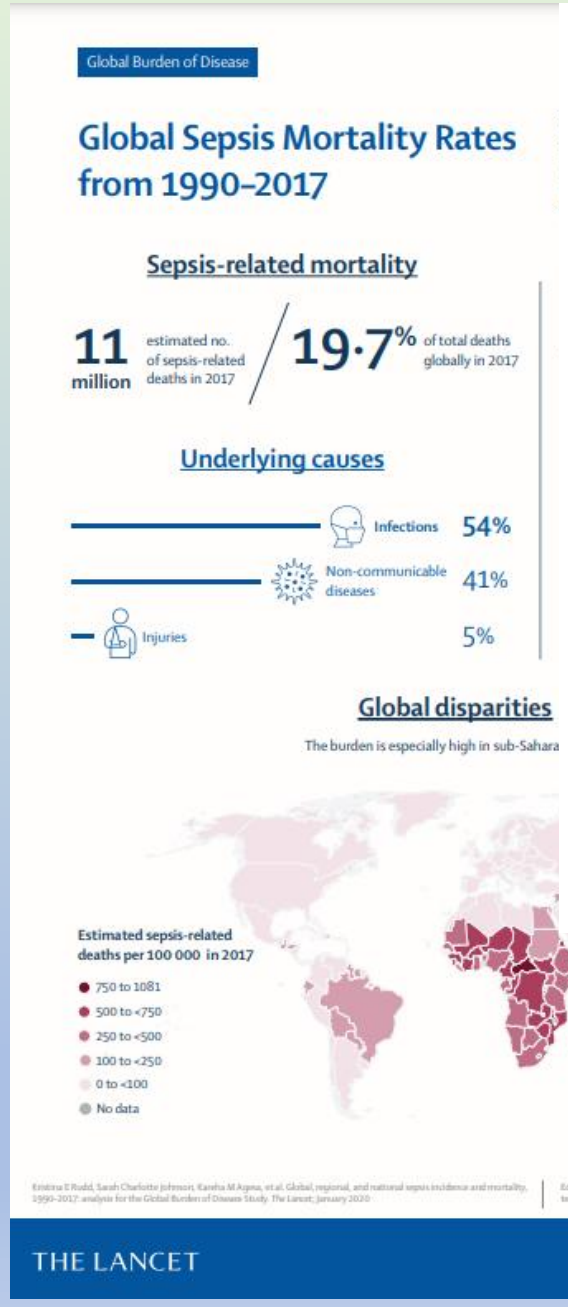
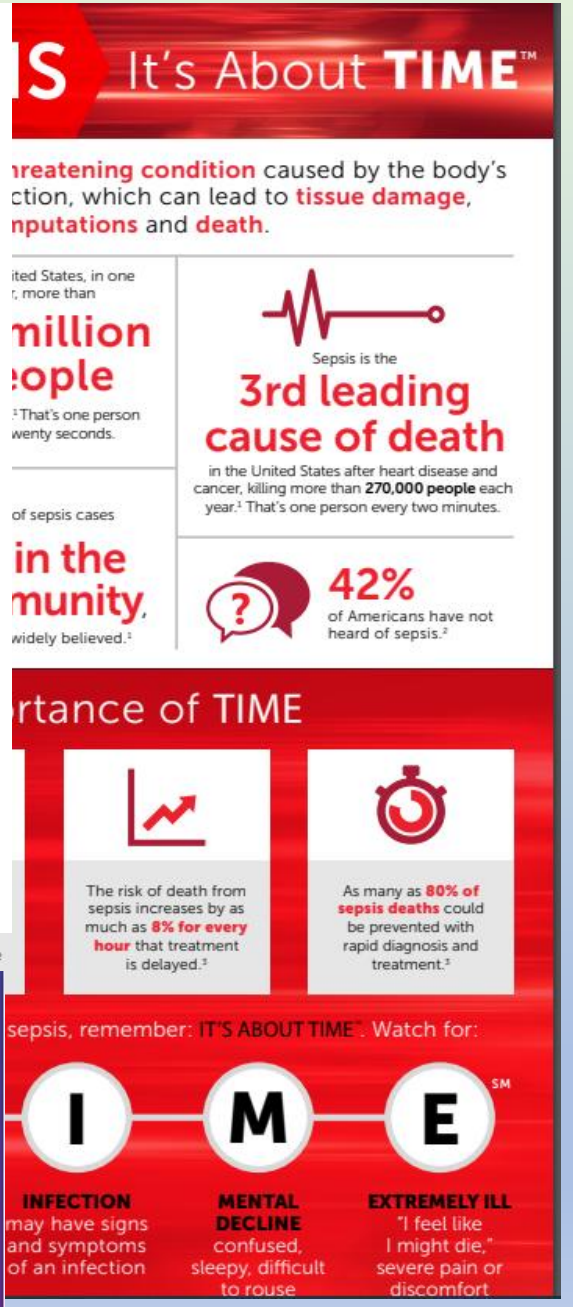


Table 1 Summary findings of the systematic review and meta-analysis of the literature on the incidence of hospital-treated sepsis.

WHO regions (number of studies on sepsis incidence/mortality)	Incidence per 100.000 population [95% confidence interval]	Mortality % [95% confidence interval]
Hospital-treated sepsis		
All regions (AMR, EUR, WPR; n= 28/22)	189 [133, 267]	26.7 [22.9, 30.7]
AMR (n= 9/6)	124 [78, 197]	30.1 [25.1, 35.6]
EUR (n= 13/12)	289 [166, 504]	22.1 [16.7, 28.7]
WPR (n= 6/4)	245 [124, 485]	24.3 [17.2, 33.1]
ICU-treated sepsis		
All regions (AFR, AMR, EUR, WPR; n= 34/19)	58 [42, 81]	41.9 [36.2, 47.7]
AFR (n= 1/1)	52 [39, 71]	40.4 [34.9, 46.2]
AMR (n= 5/4)	2 [0, 6]	76.0 [58.5, 87.7]
EUR (n= 21/11)	139 [75, 256]	42.7 [33.7, 52.2]
WPR (n= 7/3)	72 [43, 120]	34.6 [25.4, 45.2]

Note: numbers in brackets represent 95% confidence intervals. This table has been produced by WHO based on data included in reference *11*.

ICU: intensive care unit; AFR: African Region; AMR: Region of the Americas; EUR: European Region; WPR: Western Pacific Region.

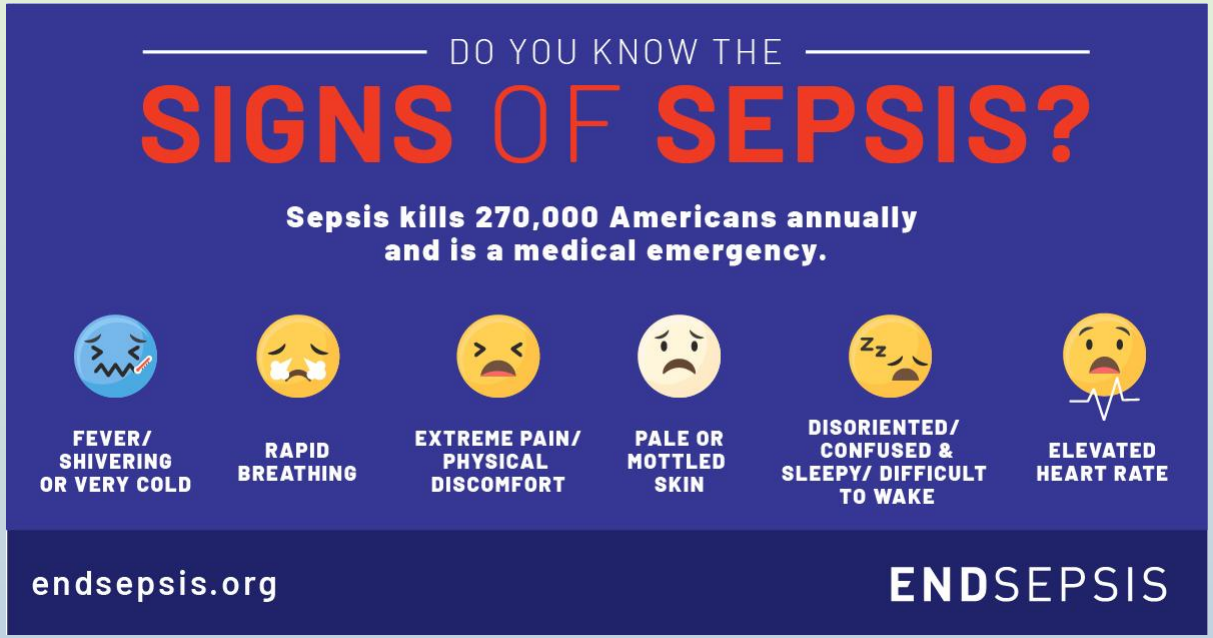


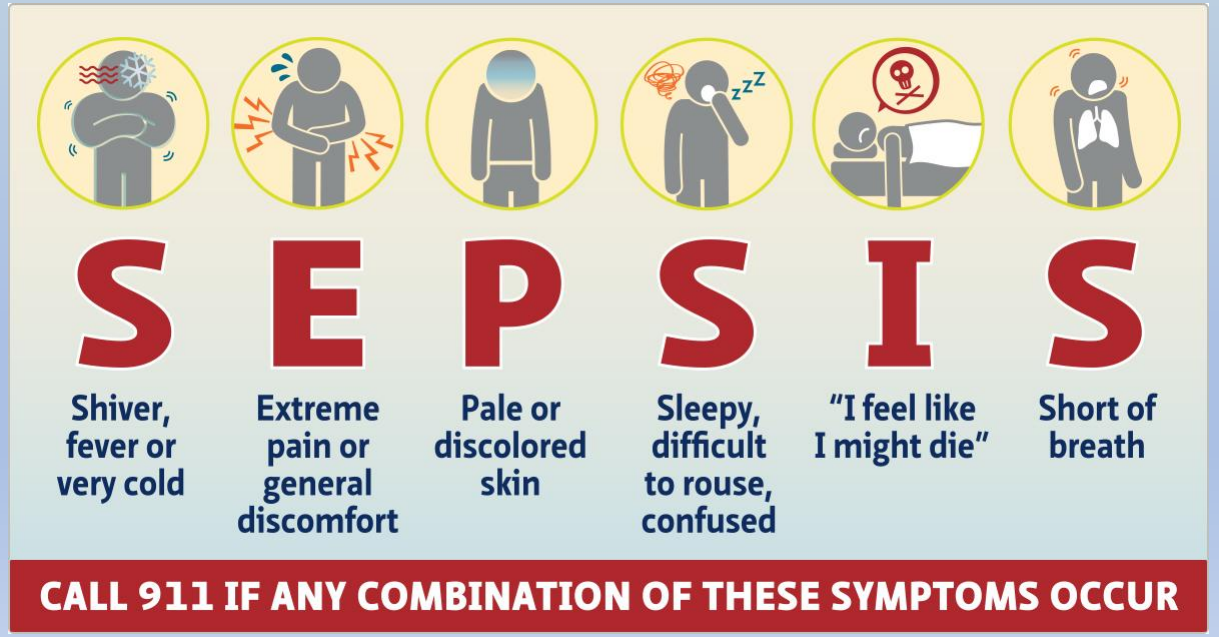
Klinikai kép

- Függ:
  - Infekció eredete
  - Kórokozó
  - Szervi elégtelenség típusa, súlyossága
  - Komorbiditások
  - Gyógyszerek
  - Terápia kezdetéig eltelt idő hossza

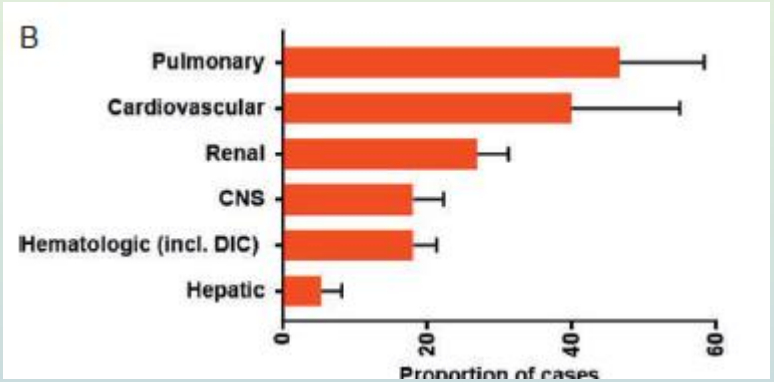
Klinikai kép

- Általános tünettan



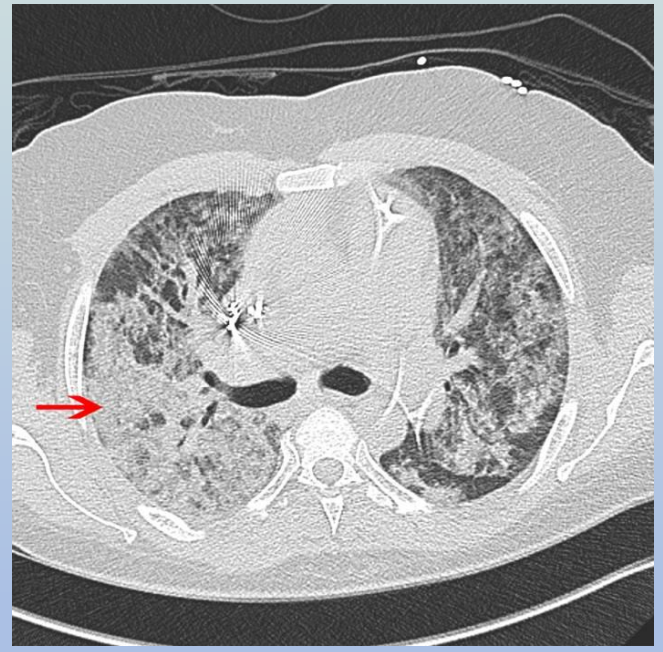


Klinikai kép



- Infekció + szervi érintettség

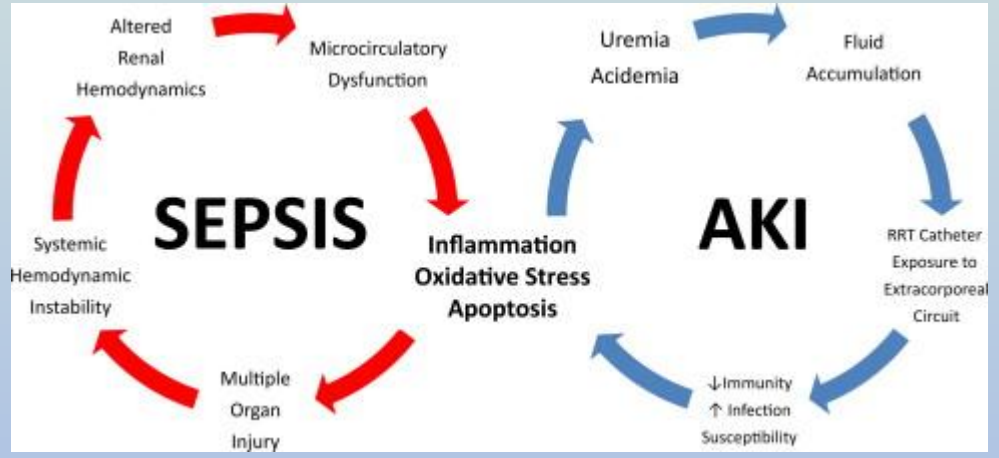
- ALI
  - Légzési elégtelenség, ARDS (enyhe – kp- súlyos – súlyos – pO2/FiO2 300-200-100)



- Keringési rendszer
  - Artériás hipotenzió: szisztolés vérnyomás < 90 Hgmm artériás középnyomás < 70 Hgmm, szisztolés vérnyomás esése > 40 Hgmm

Klinikai kép

- Akut vesekárosodás (súlyosabb, mint nem SI-AKI, rossz prognózis)
  - Oligo-/anuria
  - Emelkedett kreatinin-érték
  - Proteinúria



- Idegrendszer
  - Sepsis-associated encephalopathy
    - Zavartság, delirium, coma
  - Critical illnes polyneuropathia, myopathia

Klinikai kép

- Véralvadás
  - INR, aPTI megnyúlás, thrombocytopenia, emelkedett D-dimer
  - DIC

- Gasztrointesztinális traktus és máj
  - Epithelkárosodás, transzlokáció (gyull. mediátorok)
  - Gyomor-, duodenum erosiok
  - Ileus
  - Dysbiosis
  - Cholesztatikus sárgaság
  - Elhúzódó shock esetén hypoxiás májsejtnecrosis

Klinikai kép

- Bőrtünetek
- Szignifikáns ödéma vagy pozitív folyadékegyensúly (> 20 ml/kg 24 órán túl)
- Hiperglikémia (plazma glükóz > 7,7 mmol/l) korábban felismert diabetes mellitus nélkül

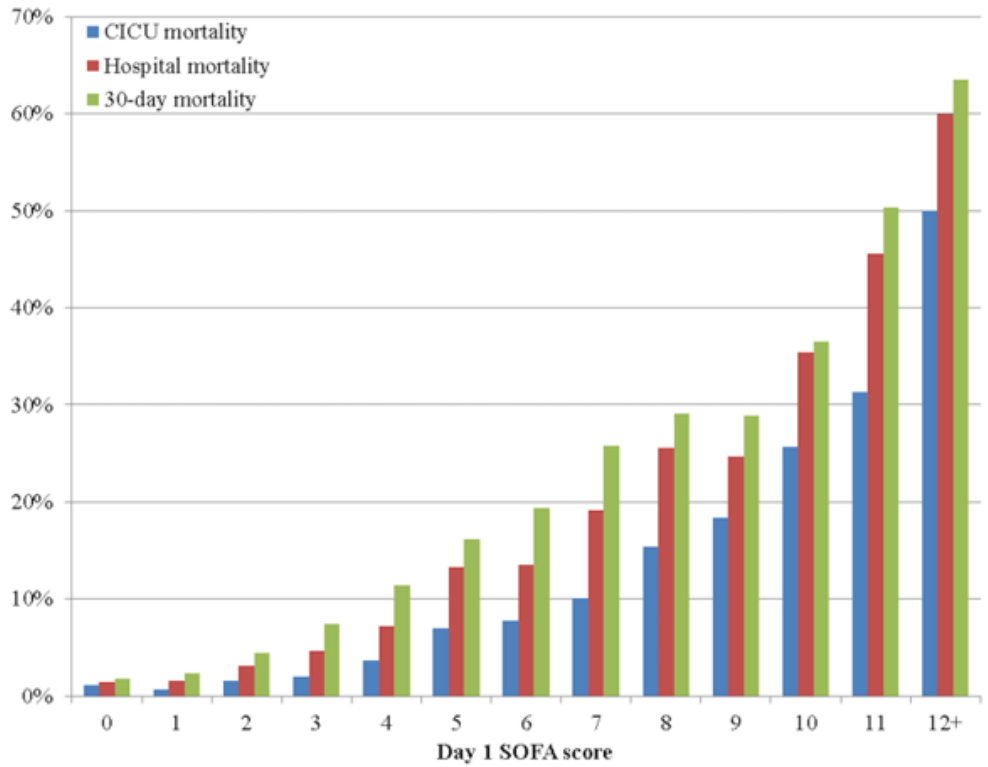
Antiinflammáció - persistent inflammation, immunosuppression, and catabolism syndrome.

- Klinikai jelentősége
  - szekunder fertőzések kevésbé virulens kórokozók által (*Stenotrophomonas, Acinetobacter, Enterococcus, Candida sp.*)
  - Vírusreaktiváció – CMV, HSV

- Veleszületett immunválasz
  - Kései neutrofil apoptózis, csökkent kemotaxis, recruitement,
  - ROI, cytokinek termelésének csökkenése
  - AG-prezentáló sejtek HLA-DR expressziója (opszonizáció, megfelelő Th1/2 válasz károsodik), proinflammarotikus citokeintermelése csökken

- Szerzett immunválasz
  - CD4+/CD8+ T-sejt és dendritikus sejt apoptózisa
  - T-sejt kifáradás – csökkent TNF és INF-y termelés – letalitás nő
    - PD1(T-sejt) – PD-L1 (Makrofág, endothel) – target terápia
  - Treg sejtek aránya nő – monocita, neutrofil funkció gátlása

Immunparalysis – helytelen, mert bizonoys funkciók megtarotttak, pl. antiinflamm. IL-10 termelés



Jacob C. Jentzer. Journal of the American Heart Association.
Predictive Value of the Sequential Organ Failure Assessment Score for Mortality in a Contemporary Cardiac Intensive Care Unit Population, Volume: 7, Issue: 6, DOI: (10.1161/JAHA.117.008169)

SSC Guideline utolsó 8 -> 6 oldala. Long-term outcomes and goals

- Fizikai rehabilitáció + ellátásszervezés, szövődmények elkerülése, visszaesés + beteg és család igényei

- Ellátás céljai
  - Ellátás célja és prognózis megbeszélése beteggel, családdal
  - Ellátás céljának meghatározása 72 órán belül

- Palliatív ellátás
  - Amikor szükséges, javasolt palliatív ellátás alapelveinek integrálása az ellátásba, palliatív konzultáció szervezése
  - Nem minden sepsis/septicus shock esetén

- Peer support group

SSC Guideline utolsó 8 oldala..
Long-term outcomes and goals

- Kezelés (kezelés helyének) megváltozásakor kritikus adatok átadása
- Szociális, anyagi „szűrés”
- Sepsis "oktatás" elbocsátás előtt
- Közös döntéshozás ITO kihelyezés, hazabocsátás előtt

SSC Guideline utolsó 8 oldala..
Long-term outcomes and goals

- Terápia revíziója elbocsátás előtt (több, kevesebb?)

- Tartós egészségkárosodás esetén követés megtervezése, irányítása
  - Ismételt felvétel 90 napon belül 40%
  - Infekciók, AKI, cardiovascularis kórképek

- Kontroll – fizikai, kognitív, emocionális egészség

- Rehabilitáció
  - Sepsist túlélők
  - Septicus shock + gépi lélegeztetés 48 órán túl
  - ITO 72 órán túl

- ITO
  - Delirium, acut distress, immobilitás
- Osztály
  - Tájékoztatás
- Hazabocsátást követően
  - Rehabilitáció, megváltozott képességekhez való adaptáció, emocionális támogatás, aktív surviellance

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Improving Long-term Outcomes after Sepsis

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Box 2

ABCDEF bundle and selected evidence in support of each bundle element

Bundle Element		Evidence
A	Assess, Prevent, and Manage Pain	Pain is a common memory of ICU survivors[8687] and increases risk for post-traumatic stress disorder[19,20]. When pain is routinely assess using a validated pain scale and controlled with intravenous narcotics, sedation can often be avoided[878840].
B	Both Spontaneous Awakening and Spontaneous Breathing Trials	Spontaneous awakening and breathing trials are associated with shorter duration of mechanical ventilation, better psychological outcomes, and significantly improved 1-year mortality[66,67,68].
C	Choice of Analgesia and Sedation	Non-benzodiazepine sedatives are associated with less delirium[8889], particularly in septic patients. In general, patients do better with less sedation[8990]. Less sedation may be achieved by spontaneous awakening trials, bolus versus continuous sedation, and targeting a lighter depth of sedation[8990].
D	Delirium Monitoring and Management	Delirium is associated with greater mortality and cognitive impairment[9019,91]. Screening for delirium with tools such as the Confusion Assessment Method for the ICU (CAM-ICU) can increase recognition of delirium[9192], prompting clinicians to address driving factors such as medications, environment and medical conditions.
E	Early Mobility and Exercise	Skeletal muscle wasting begins within 24 hours of critical illness[5657]. Early mobility, including walking patients during invasive mechanical ventilation, has been shown to be safe and effective at reducing short-term physical disability associated with critical illness, as well as at reducing delirium[5354,5455].
F	Family Engagement and Empowerment	Families are important supports for patients' recovery, also experience poor outcomes related to ICU care[6263]. Family presence on ICU rounds and open visiting hours are associated with improved satisfaction and communication[63 65,66].

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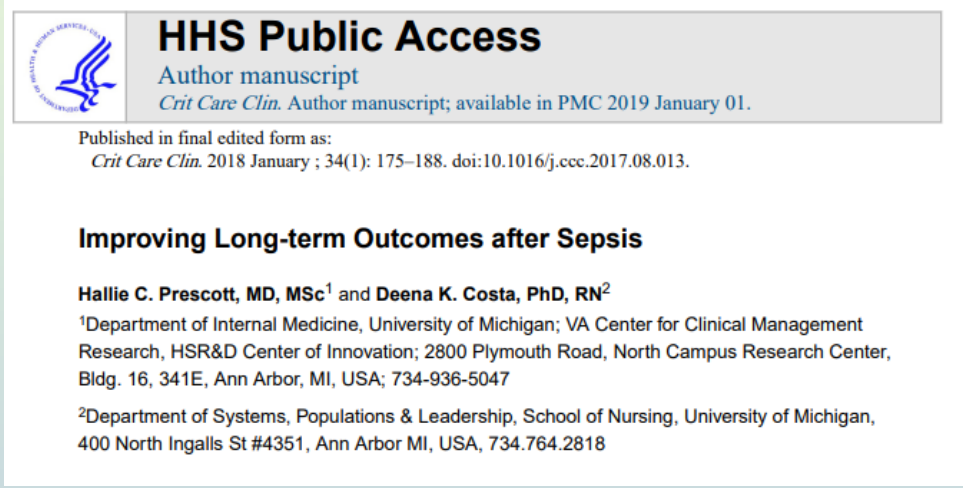
- Rövidebb antibiotikum-kezelés
  - PCT-vezérelte rövid terápia – mikrobiom – recurráló infekció?
- Stress ulcus profilaxis
- Fájdalom és nyugtalanság – sedatio
  - BZD helyett propofol, dexmedetomidine
  - Felületes sedatio



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- ITO napló
- Korai mobilizálás
  - Izomvesztés kritikus állapotú betegnél 24 órán belül megkezdődik
- Korai kognitív terápia
- Korai ambuláns kontroll

Mikor? A kézhigiéne 5 momentuma