

Septicaemia & SIRS

Septicaemia is a life-threatening condition that arises when the physical reaction to an infection, causes damage to tissue and organs

Basics from anatomy and physiology classes

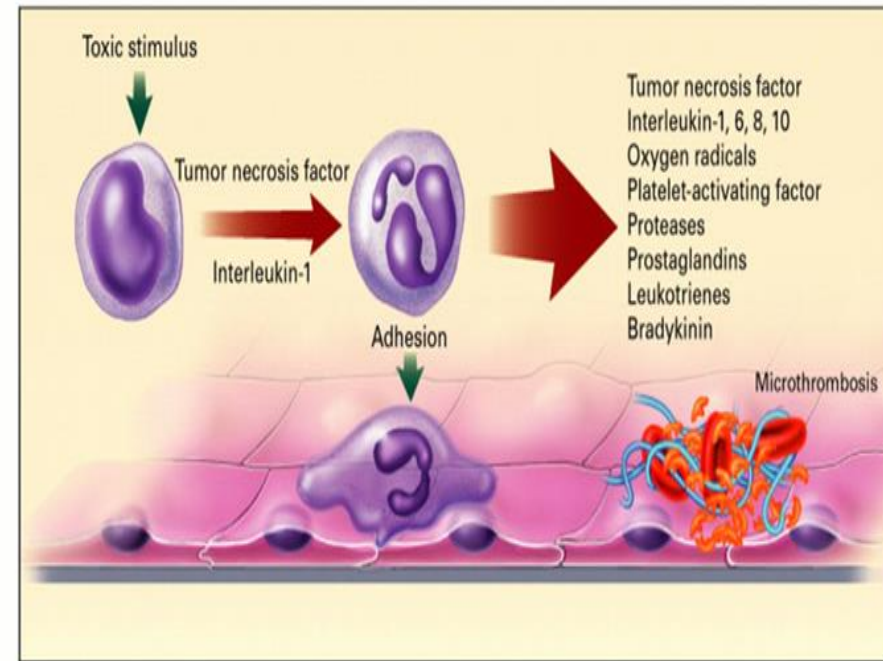
Local tissue reactions

When cells are destroyed intracellular substances are lead into the surrounding tissue

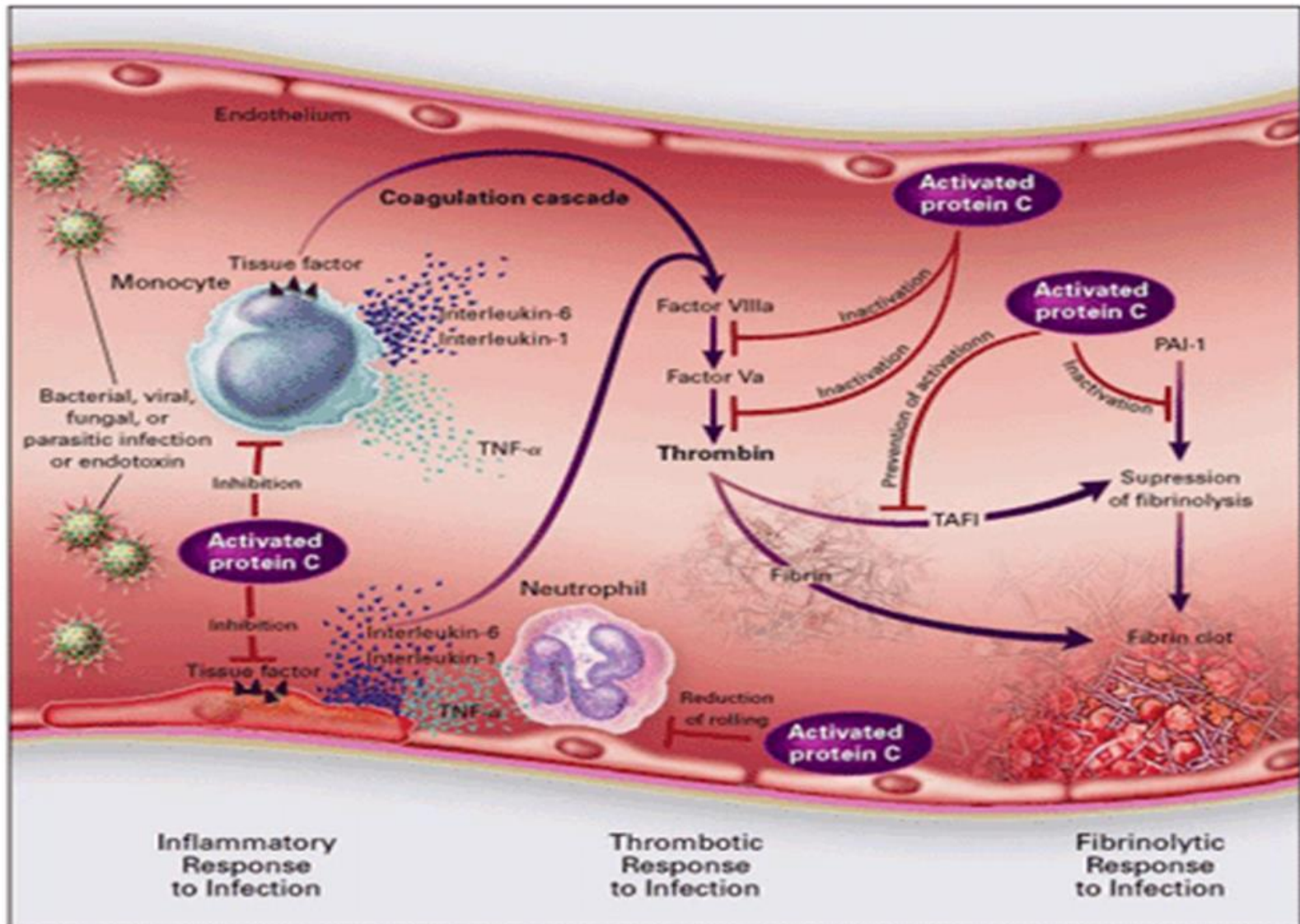
- K⁺, H⁺, lactate, acetylcholin and prostaglandines.

Furthermore there is a local release of

- histamin, serotonin og interleukiner that all activate -
- coagulation, fibrinolysis, macrofagcytosis, TNF, granulocytes, and lymphocytes

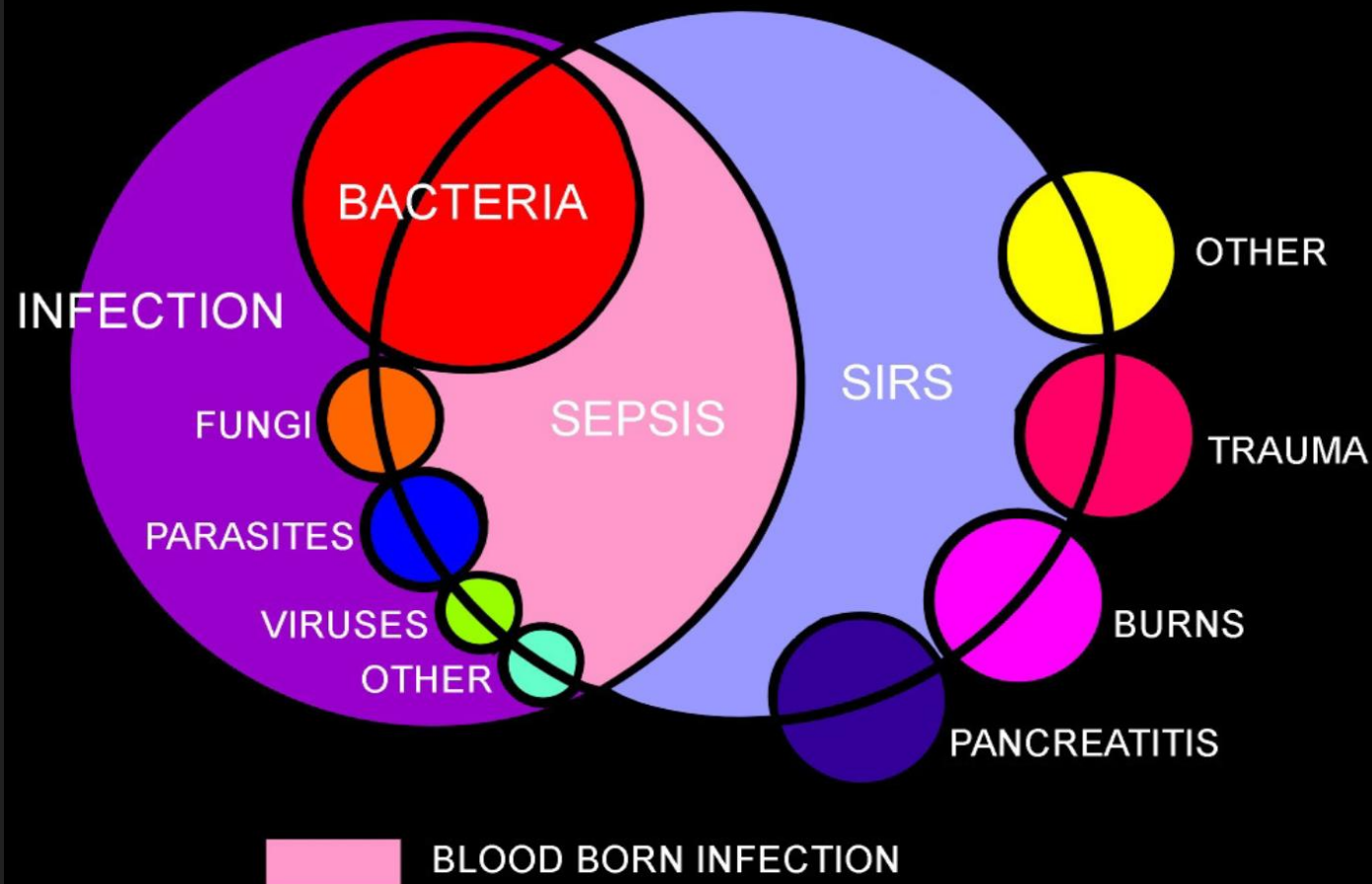


Systemic reaction




Causes of septicaemia –

**Meningococcus, E. Coli, Salmonella and Pneumococcus
(frequently related to pneumonia or UTI)**



EWS, GCS, qSOFA, SOFA

qSOFA



HYPOTENSION
 $\leq 100\text{mmHg}$

AMS
 $\text{GCS} \leq 13$

TACHYPNEA
 $\text{RR} \geq 22 \text{ bpm}$



Glasgow Coma Scale

Points Scored

Category	1	2	3	4	5	6
Best motor response	No motor response	Extends to pain (decerebrate)	Flexes to pain (decorticate)	Withdraw from pain	Localize to pain	Obeys commands
Best verbal response	No verbal response	Incomprehensible sounds	Inappropriate words	Confused	Oriented	Oriented
Eye opening	No opening	Pain	Verbal Command	Spontaneous		

Remember: even a toaster has a GCS of 3!

If an infection is suspected in adults, outside of a hospital setting, in acute wards or in a non-ICU/high dependency wards, it can easily be identified by utilizing the qSOFA assessment

The objective is to assess the risk of long intensive Care treatment and early death. The aim is prevention by early evaluation and treatment.

- Altered mental status (GCS \leq 13)
- Systolic pressure \leq 100 mm Hg
- Respiratory rate \geq 22/min.

Abbreviations and links;

qSOFA, quick SOFA; <http://www.qsofa.org/>
<http://www.qsofa.org/#calc>

qSOFA

qSOFA test does not require lab-tests and can be utilized repeatedly without much discomfort for the patient.

The score must be used

- to initiate further investigations in monitoring organ dysfunction.

- To increase the level of therapy

- To increase level of monitoring or-

- Transfer to an ICU

- Furthermore a positive **qSOFA** score may point to an undiscovered infection.

MODS & MOF

Multi Organ Dysfunction & Multi Organ Failure

Mortality:

- overall 70%
- Failure of three organs 90-95%

KEY FINDINGS FROM EVIDENCE SYNTHESIS:

- Limitations of previous definitions included an excessive focus on inflammation, the misleading model that sepsis follows a continuum through severe sepsis to shock, and inadequate specificity and sensitivity of the systemic inflammatory response syndrome (SIRS) criteria.
- Multiple definitions and terminologies are currently in use for sepsis, septic shock, and organ dysfunction, leading to discrepancies in reported incidence and observed mortality.
- The task force concluded the term severe sepsis was redundant.

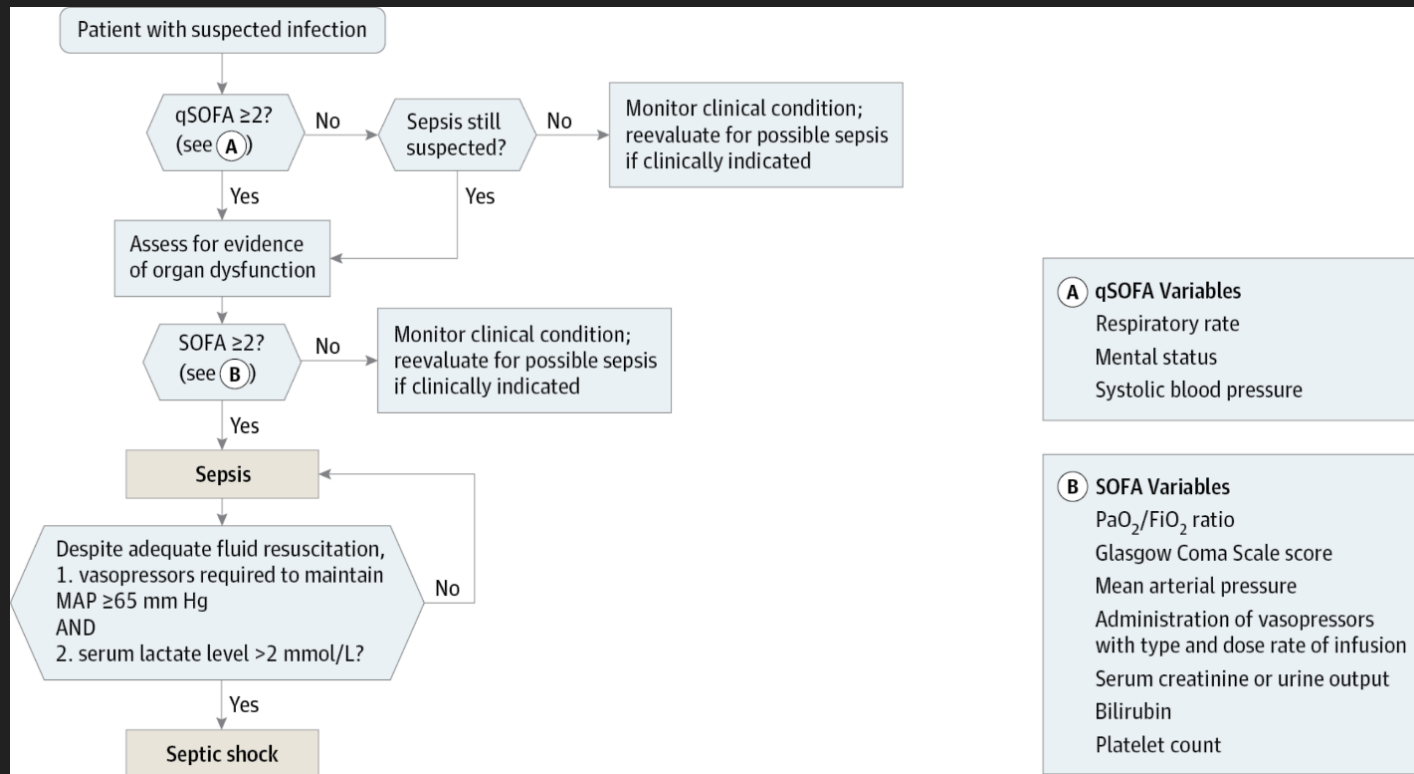
JAMA. 2016 Feb 23;315(8):801-10. doi: 10.1001/jama.2016.0287.

The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3).

Singer M¹, Deutschman CS², Seymour CW³, Shankar-Hari M⁴, Annane D⁵, Bauer M⁶, Bellomo R⁷, Bernard GR⁸, Chiche JD⁹, Coopersmith CM¹⁰, Hotchkiss RS¹¹, Levy MM¹², Marshall JC¹³, Martin GS¹⁴, Opal SM¹², Rubinfeld GD¹⁵, van der Poll T¹⁶, Vincent JL¹⁷, Angus DC¹⁸.

From: **The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)**

JAMA. 2016;315(8):801-810. doi:10.1001/jama.2016.0287



Operationalization of Clinical Criteria Identifying Patients With Sepsis and Septic Shock The baseline Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score should be assumed to be zero unless the patient is known to have preexisting (acute or chronic) organ dysfunction before the onset of infection. qSOFA indicates quick SOFA; MAP, mean arterial pressure.

SOFA:

Sequential [Sepsis-related] Organ Failure Assessment.

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.

<http://clincalc.com/icumortality/sofa.aspx>



From: **The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3)**

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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, ×10 ³ /μL	≥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: FIO₂, fraction of inspired oxygen; MAP, mean arterial pressure; PaO₂, 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.

Sequential [Sepsis-Related] Organ Failure Assessment Score^a

<http://jama.jamanetwork.com/issue.aspx?journalid=67&issueid=935012>

Be open to criticism:

<http://emcrit.org/pulmcrit/problems-sepsis-3-definition/>

“Septic shock is defined as a subset of sepsis with particularly profound circulatory, cellular, and metabolic abnormalities”

- Patients with septic shock present the following clinical signs;
 - a vasopressor requirement to maintain a mean artery pressure/ MAP of 65mmHg or, in case the patient does not have hypovolemia;
 - serum lactate > 2 mmol/L (>18mg/dL)

This is consistent with a mortality higher than 40%.

Symptoms and findings

HYPERDYNAMIC PHASE

- Fever and fatigue
- Dilated veins
- Warm periphery
- tachycardia
- Moderate ↓ BP

Vessels are in large part of the circulatory system dilated and the capillaries become permeable

Extracellular fluids are forming edema in tissue, both periphery and centrally

HYPODYNAMIC PHASE

- Cyanosis
- Discoloration of the skin (blue)
- Cold periphery ↑P
- BP ↓ and difficult to regulate
- Oliguria– anuria
- Organfailure

Symptoms and findings

Meningococcal
septicaemia



Necrotizing fasciitis:

Polymicrobial (most common)

Type II: Monomicrobial
(*Staphylococcus*,
Streptococcus, *Clostridia*
species)



Treatment aggressive!



Immediately and within the hour the following has to be initiated:

- 1) Antibiotic treatment
- 2) Volume therapy
- 3) investigation into the nature and location of the infection

Kumar, A. et al(2006). Duration of hypotension before initiation of effective antimicrobial therapy is the critical determinant of survival in human septic shock. *Critical care medicine* 34(6):1589-96

<http://www.survivingsepsis.org/SiteCollectionDocuments/Implement-PocketGuide.pdf>



MAP, or mean arterial pressure, is defined as the average pressure in a patient's arteries during one cardiac cycle. It is considered a better indicator of perfusion to vital organs than systolic blood pressure (SBP). True MAP can only be determined by invasive monitoring and complex calculations; however it can also be calculated using a formula of the SBP and the diastolic blood pressure (DBP).

To calculate a mean arterial pressure, double the diastolic blood pressure and add the sum to the systolic blood pressure. Then divide by 3. For example, if a patient's blood pressure is 83 mm Hg/50 mm Hg, his MAP would be 61 mm Hg. Here are the steps for this calculation:

$$\text{MAP} = \frac{\text{SBP} + 2 (\text{DBP})}{3}$$

$$\text{MAP} = \frac{83 + 2 (50)}{3}$$

$$\text{MAP} = \frac{83 + 100}{3}$$

$$\text{MAP} = \frac{183}{3}$$

$$\text{MAP} = 61 \text{ mm HG}$$

- Another way to calculate the MAP is to first calculate the pulse pressure (subtract the DBP from the SBP) and divide that by 3, then add the DBP:

$$\text{MAP} = 1/3 (\text{SBP} - \text{DBP}) + \text{DBP}$$

$$\text{MAP} = 1/3 (83-50) + 50$$

$$\text{MAP} = 1/3 (33) + 50$$

$$\text{MAP} = 11 + 50$$

$$\text{MAP} = 61 \text{ mm Hg}$$