Sepsis from a microbiological perspective

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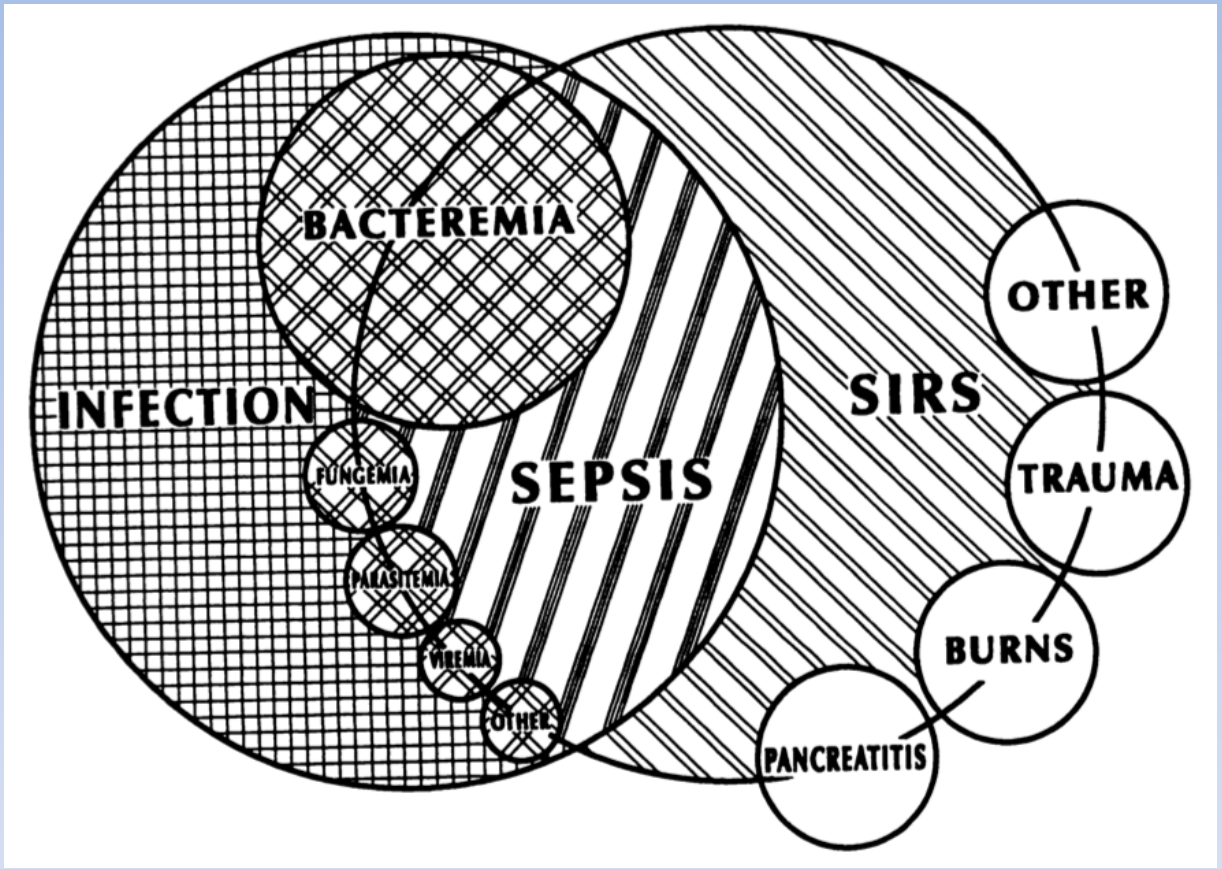
Sepsis

- **Definition od sepsis**
- Septic haemodynamic
- Presence of infection
- SIRS

Response of the macroorganism

- Systemic Inflammatory Response Syndrome (SIRS)
- Sepsis = SIRS + infection
- Severe sepsis = sepssis + signs of organ dysfunction
- Septic shock = severe sepsis + haemodynamic changes

Infection, SIRS, sepsis



Bone, R., Balk, R., Cerra, F., Dellinger, R., Fein, A., Knaus, W., Schein, R., et al. (1992). Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. The ACCP/SCCM Consensus Conference Committee. American College of Chest Physicians/Society of Critical Care Medicine. *Chest*, *101*(6), 1644–1655.

Sepsis

- Cytokine storm
- **Systemic Inflammatory Response Syndrome (SIRS)**
- Reaction of immune system to microbial products
- SIRS include
  - 1) Body temperature <36 °C or >38 °C
  - 2) Heart rate greater than 90 beats per minute
  - 3) Tachypnea (high respiratory rate), >20 breaths per minute
    or arterial partial pressure of carbon dioxide <4.3 kPa (32 mmHg)
  - 4) White blood cell count <4000 cells/mm^3 (4 x 10^9 cells/L) or >12,000 cells/mm^3 (12 x 10^9 cells/L)
    or the presence of >10% immature neutrophils (band forms) - "left-shift"
- The septic patients meet criteria for SIRS

Bedside dg. of sepsis

- Clinical symptoms
  - Temperature
  - Respiratory rate
  - Pulse rate
  - Nausea
  - Confusion
  - Blood pressure
  - Urine secretion
- + Laboratory markers
  - Number of leukocytes
  - Haemocoagulation
  - Respiratory-metabolical acidosis
  - Organ dysfunction
  - Inflammatory markers

SIRS criteria x SOFA score x qSOFA score

- SOFA score - Sequential organ failure assessment score

- Based on six different scores
  - Respiratory, cardiovascular, hepatic, coagulation, renal and neurological systems

- qSOFA - simplified
  - Low blood pressure (SBP ≤ 100 mmHg)
  - High respiratory rate (≥ 22 breaths/min)
  - Altered mentation (GCS < 15)

Sepsis vs. microbaemia

Bacteriaemia

↓ !!!

Starting **sepsis**

↓

Interaction with **immunity system**

↓

Cytokines → endothelium of capillars + inflammation

↓

Systemic Inflammatory Response Syndrome (SIRS)

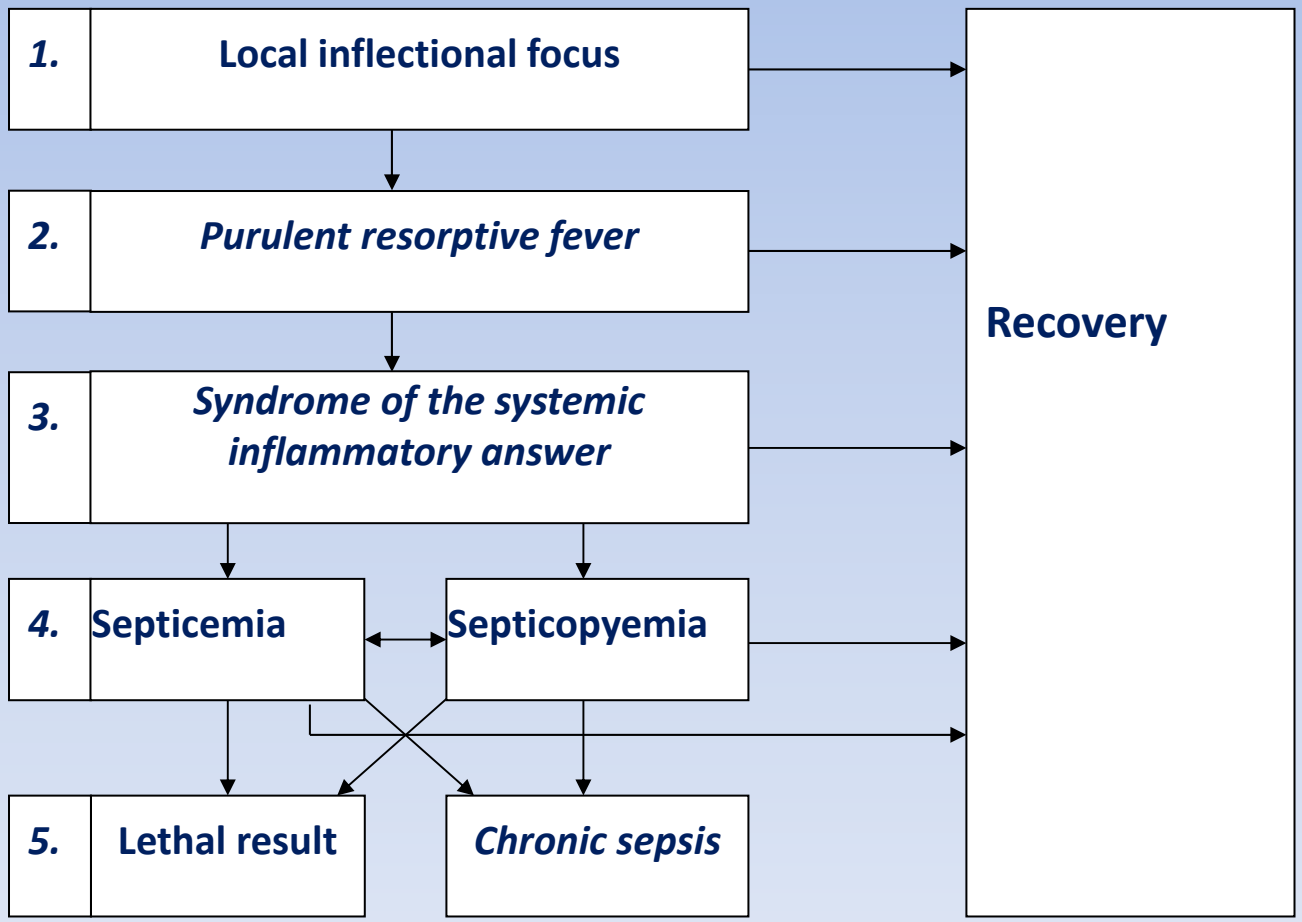
+

Compensatory Anti-inflammatory Response Syndrome (CARS)

Sepsis vs. microbaemia

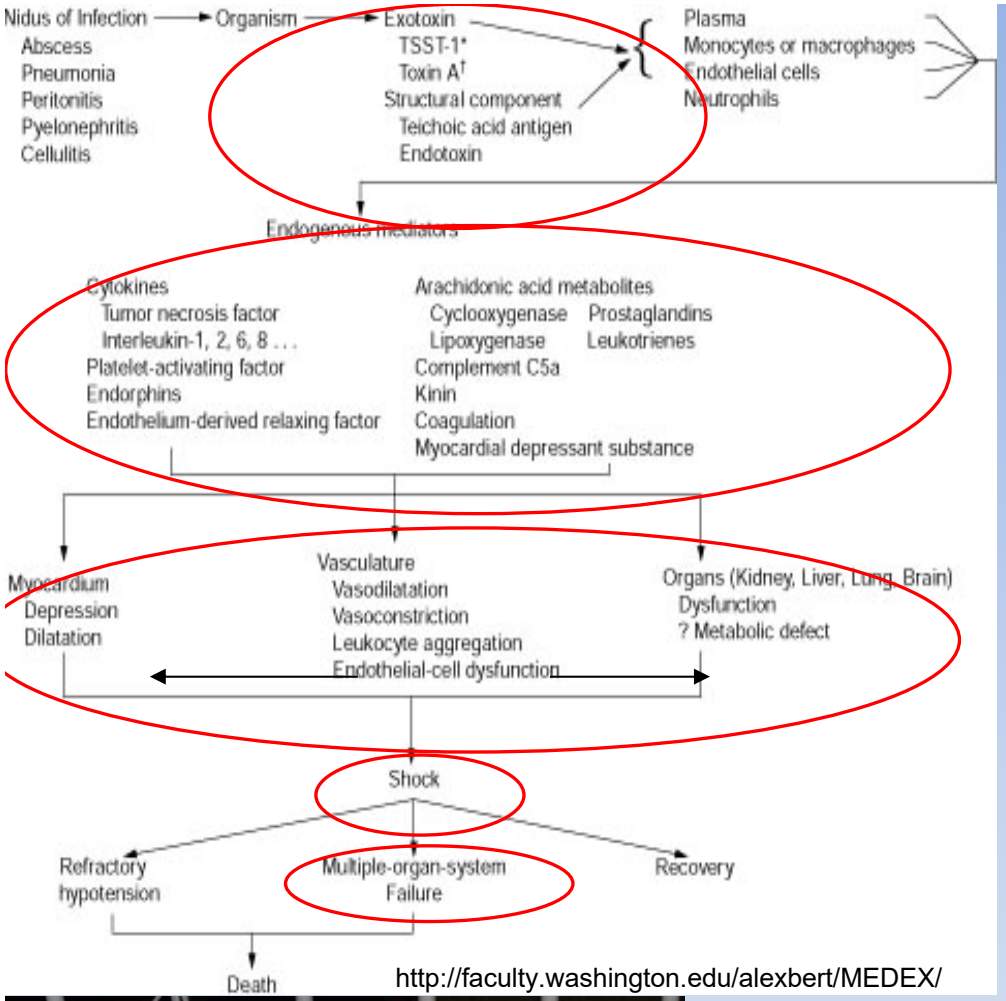
- Sepsis **x** bacteraemia and bacteraemia **x** sepsis
- Blood normally sterile
- **Not necessarily** present in developed sepsis
- High risk of multi-organ failure
- **Sepsis** - mortality
- **Septic shock**

The phases of the development of the generalized infection



Pathogenesis of sepsis

- Microbial process
- Necessary conditions
- Most bacteria – only in attenuated patient



http://faculty.washington.edu/alexbert/MEDEX/

www.nzma.org.nz

- **Clinical symptoms**
- **Pathological physiology**
  - Local x generalized inflammation
- **Laboratory markers**

Pathogenesis of sepsis I.

- Developes mostly from localised infection
- Necessary conditions
  - Large population of microbes
  - Stimulation of cytokins release
  - Dissemination
- Most bacteria – only in attenuated patient

Pathogenesis of sepsis II.

- Pathogenesis of damage
  - „hot shoc“
  - „cold shoc“
- Respiratory problems
- Accute renal failure

Pathogenesis of sepsis III.

- Icterus
- Hemorragic necroses
- Involvement of mental functions
- Metabolic acidosis
- Increased level of stress hormons (cortisol)
- Mailfunction of O_2 metabolism

Organ dysfunction in sepsis

- Lungs
- Kidneys
- Heart
- Livers
- Intestine
- Brain
- Adrenals
- Pancreas (B-cells)
- Coagulation system (DIC)
- Leukocytes (PMNs)

Therapy of sepsis

- Intensive
- Complex
- ATB treatment not satisfactory
- Need of shock treatment
- Event. surgical intervention

Spectrum of etiological agents of sepses

- Autumn semester microbiological lectures
  - Wound sepsis
  - Fulminant sepsis
  - Urosepsis
  - Intraabdominal sepsis
  - Nosocomial sepsis
  - Sepsis puerperalis
  - Newborn sepsis
  - Blood stream infections
- **Catheter-related BSI & sepsis**

BSI related sepsis

- Catheter sepsis
- Trombophlebitis
- Central sepsis
  - Endarteritis and (trombo-)phlebitis
  - Endocarditis
    - Accute endocarditis
    - Subaccute and chronic endocarditis → sepsis lenta
    - „Culture-negative“ endocarditis

Microbiological dg. of sepsis

- Rapidity
- Sensitivity
- Specifity
- Correct sampling technique

Haemoculture sampling

- Patient with suspiction of bacterial infection
  - CRP > 60 mg/l
  - Fever in anamnesis
  - (Inserted catheters)
- Aseptic sampling
- 2-3 haemoculture bottles
- 30-60 min. intervals
- **Before** ATB treatment
- If treated, sample **prior to next** ATB dose

Haemoculture sampling

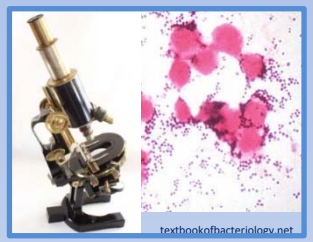
- Skin disinfection
  - 0,5% chlorhexidine in 70% alcohol
  - Polyvinylpyrolidon w. 10% of iodine
  - Iodine tincture
  - 70% alcohol
- Change of needle
- Disinfection of bottle end-seal

Haemoculture examination

Rapidity + sensitivity + specifity

Culture (up to 7 days)

Microscopy (15 min)



ID (60 min)

Culture (24–48 hrs.)

ID (15–60 min)

ID ((5hrs) 24–48 hrs)

„Genetics“(cca 3–7 hod.)

PCR – quantification
Broad range PCR assay
FISH (*Fluorescent in situ hybridisation*)
etc.

ID (hrs-days)

ID (hrs-days)

Sequenace
PCR identification
Typing (MLAST, PFGE…)
etc.

Haemoculture examination

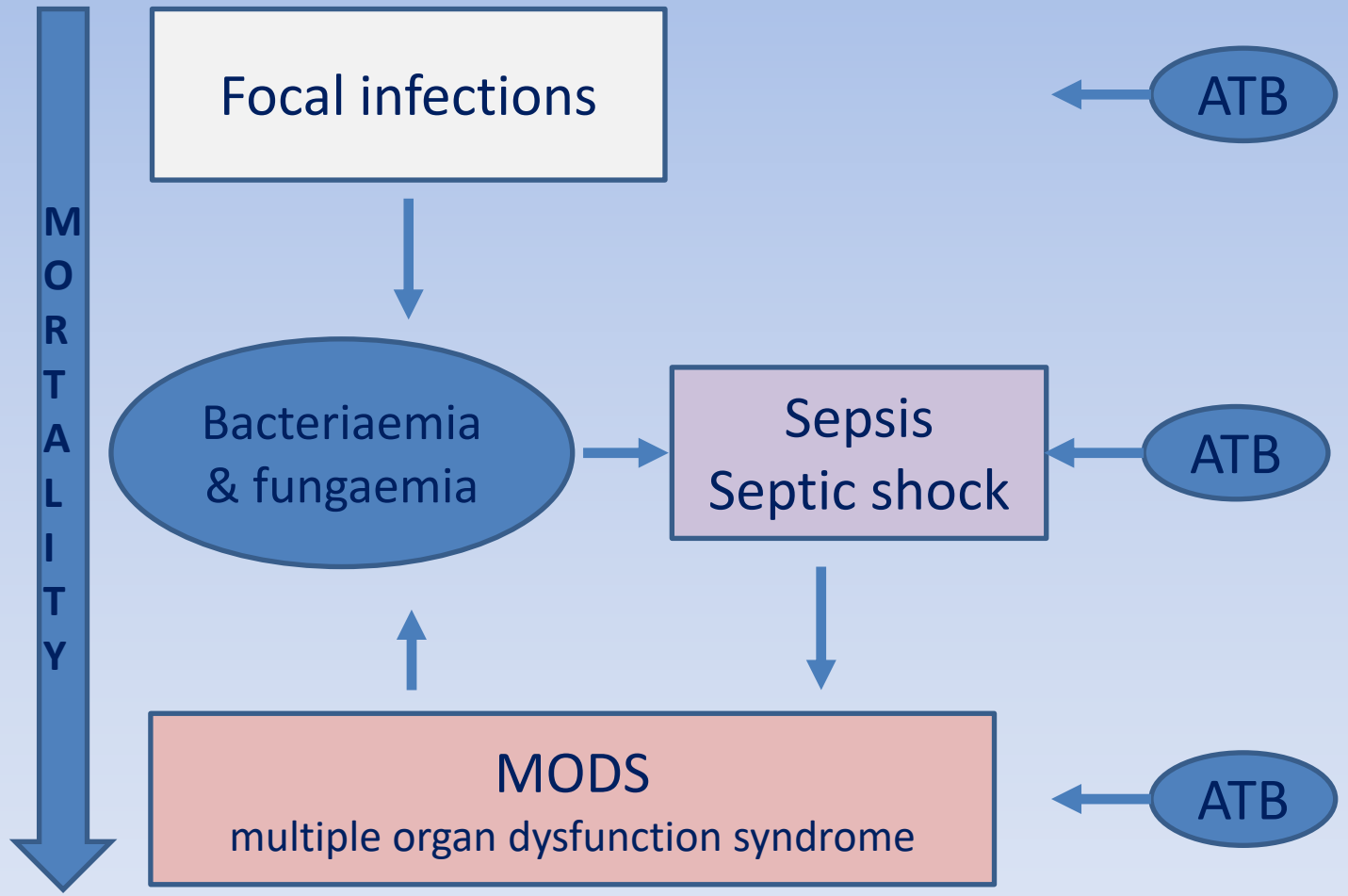
- Positivity
- Length of culture
  - HACEK
  - Fungaemia
- TTD

- No of anaerobic BSI very low

Other possibilitieas of sepsis diagnostic

- Serology
- Biochemistry
- MALDI from sample

Chance of ATBs to affect infectious process



Treatment of the sepsis

- **Control the infection**
  - Elimination of CA
  - Finding the focus and surgical intervention
  - Removal of cause of septic state
- **Symptomatic therapy**
  - Breething support
  - Adjustment of haemodynamic
  - Support for failing organs
  - Continuous veno-venous hemodiafiltration
  - In DIC (disseminated intravascular coagulation)