Sepsis and Infective Endocarditis

Michal Holub

Department of Infectious Diseases
First Faculty of Medicine
Charles University in Prague and University Military Hospital

Bacteremia and Sepsis

- **bacteremia** = presence of bacteria in the bloodstream
- **sepsis** = syndrome of systemic inflammatory response (SIRS) to infection
- **sepsis** = presence of focal bacterial infection in the body, from which bacteria are released, inducing systemic response

Criteria of SIRS

- temperature (°C) >38 or <36
- heart rate (pulses/min.) >90
- breathing rate (breaths/min.) >20
- PaCO₂ (mm Hg) <32
- leukocytes (x10⁹/l) >12 or <4 or >10% bands

Epidemiology

- statistically sepsis is the main cause of death in ICU
- high incidence of sepsis - 900,000 cases annually (USA)
- sepsis is 7th cause of death (USA, E.U.)
- morbidity of sepsis is growing - aging of population, invasive therapy, immunosuppressive therapeutic procedures etc.

Mortality and morbidity of sepsis (USA)


Etiology of sepsis
Pathogenesis

- infectious SIRS = reaction to bacteria or their signal molecules in blood circulation
- autoaggressive SIRS = inflammatory damage to organs
- syndrome of multiorgan dysfunction (MODS) or failure (MOFS)

Clinical stages

- sepsis
- severe sepsis (associated with MOFS)
- septic shock (circulatory failure)

Clinical picture

- fever or hypothermia
- hypotension or tachycardia
- findings on the skin
- heart murmurs (endocarditis)
- alterations of mental status
- septic arthritis, flebitides, erysipelas, early infections, etc.

Toxic shock syndrome - TSS

Sufusions in invasive meningococcal disease

Diagnostics

- hemocultures (three pairs for aerobic and anaerobic cultivation)
- inflammatory markers
- laboratory and clinical marks of DIC
- findings of infectious foci (chest X ray, ENT examination, abdominal ultrasound, CT and others)
- neurological examination ⇒ lumbar puncture in case of alteration of consciousness and meningeal irritation
Severe sepsis

- MODS/MOFs: ALI/ARDS, acute renal failure etc.
- Circulatory failure - hypotension (syst. pressure <90 mm Hg)
- DIC - Gram-negative sepsis
- GIT failure, hepatic failure
- Damage of CNS - septic encephalopathy

Periferal vasoconstriction and hemorrhage

Gangrenes in meningococcal sepsis

ARDS and myocarditis

Gangrenes in meningococcal sepsis

Treatment of severe sepsis and septic shock

- Fluid therapy, oxygenotherapy, circulatory support, insertion of catheters, mechanical ventilation and others
- Antibiotics (!!!)
- Source control - surgical evacuation of abscesses etc.
- Corticosteroids, normoglycemia, normocalcemia etc.
Nosocomial sepsis

Resistance of *P. aeruginosa* to carbapenems

MRSA in European countries

Sepsis – the major cause of death in ICU
- 20-50% of patients in ICU suffer from nosocomial infection
- ventilatory pneumonia
- catheter-related sepsis
- urosepsis
- decubital sepsis

Infective endocarditis
- life-threatening infectious disease
- presence of thrombus („vegetation“) on cardiac valve
- endocarditis on native valve
- endocarditis on valve implants

Damage of valves

- Vegetation
- Left atrium
- Mitral valve
- Pulmonary valve
- Right atrium
- Right ventricle
- Tricuspid valve
- Aortic valve
Etiology

- Staphylococcus aureus - may infect pathologically changed and healthy valves
- coagulases-negative staphylococci (S. epidermidis, S. haemolyticus, S. hominis) - have affinity to artificial surfaces
- viridans group streptococci (S. mitis, S. sanguis, S. mutans)
  - in oral cavity and GIT
- enterococci - are common in GIT
- Gram-negative bacteria and fungi

Etiology of native valve IE

- streptococci 55% (S. viridans [sanguis, mutans, mitis], S. bovis, S. equinus, S. pyogenes - group A)
- staphylococci 30% (S. aureus, S. epidermidis)
- enterococci 6% (Enterococcus faecalis, E. faecium)
- bacteria of the group HACEK (Haemophilus spp, Actinobacillus actinomycetemcomitans, Cardiobacterium hominis, Eikenella spp, Kingella kingae)

Etiology in injection drug users

- S. aureus ~50%
- streptococci and enterococci ~20%
- Candida sp. ~6%
- Gram-negative bacteria ~6%

Pathogenesis

S. aureus can attack intact valve

- preexisting heart damage in 60-80% of patients
- degenerative changes of valves (30-40%)
- post-rheumatic changes (<25%)
- inherited cardiac defects (6-25%)
- endothelial damage in catheterization (5-25%)

Clinical picture

- sepsis with embolization into skin
- feverish condition in a patient with predisposing heart disease
- every feverish condition with isolation of viridating streptococci, S. aureus, enterococci and bacteria of the group HACEK from hemoculture
- migrating pneumonia
- unexplainable fever in intravenous drug users
- CVA picture associated with fever and increase of inflammatory parameters
Diagnostics and therapy

- echocardiography
- hemocultivation
- staphylococci - oxacillin (12-18 g/day) + adjunctive antibiotic
- streptococci and enterococci - penicillin (10-20 mil EU/day) + adjunctive antibiotic
- unknown etiology with subacute course - ampicillin/subactam + gentamicine
- unknown etiology with acute course - vancomycin + adjunctive antibiotic

Transesophageal echocardiography
Hemocultivation
- specimen should be taken before fever spikes
- specimen is taken to STADARD bottles before administration of antibiotics
- PLUS bottles can be used in patients treated with antibiotics
- site of venipuncture must be properly disinfected
- the amount of collected blood is usually 8-10 mL in adults
- the amount of blood in children is usually 2-3 mL (Pedi bottle)

Life-threatening complications

- valve damage
- congestive heart failure
- spread of infection to subvalvular tissue
- septic embolisation of organs
- aneurysm of blood vessels
- multiple organ failure

Preventive measures and antibiotic prophylaxis for dental patients at risk for infection

Dental procedures for which prophylaxis is reasonable

- manipulation of gingival tissue
- manipulation with periapical region of teeth
- perforation of the inflamed oral mucosa

No prophylaxis

- anesthetic injections through non-infected tissue, dental radiographs, placement of orthodontic appliances, bleeding from trauma to lips or oral mucosa.
Recommendation for patients with cardiac condition

- daily oral hygiene
- daily plaque removal
- daily flossing
- regular dental care

Patients with compromised immunity

- secondary immunodeficiencies: HIV, neutropenia, cancer chemotherapy and hematopoietic stem cell or solid organ transplantation
- head and neck radiotherapy
- autoimmune diseases
- sickle cell anemia
- asplenism
- diabetes and chronic steroid usage

Postoperative antibiotic therapy

- procedures involve infected tissues
- procedures on a patient with compromised immunity

Post-procedural symptoms of acute infection

- fever
- malaise
- weakness and lethargy