

Infectious Diseases in Intensive Care

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Important infectious diseases in intensive care

- bacterial meningitis
- severe sepsis and septic shock
- invasive meningococcal disease
- Polyradiculoneuritis

Bacterial meningitis: frequent complications

- rapid development of alteration of mental status
- unconsciousness - Glasgow Coma Scale
- severe sepsis - e.g. sepsis + organ failure

Management

- venous access
- maintain airways
- administration of anti-edematous treatment - Mannitol
- rapid transport to the hospital

Cerebrospinal fluid examination: the most important diagnostic tool

- \uparrow WBC $>1,000/\text{mm}^3$
- \uparrow PMNs $>60\%$
- \downarrow glucose - CSF/blood ratio $<45\%$
- \uparrow protein $>1.0 \text{ g/L}$
- latex agglutination + 50%
- Gram stain + 80%
- bacterial culture + 90%
- PCR positive $>90\%$ of samples

Bacterial meningitis: inflammation of meninges and brain edema

- cytotoxic edema
- breakdown of the blood-brain barrier
- elevated intracranial pressure
- decreased cerebral perfusion pressure (CPP)

Bacterial meningitis: supportive treatment

- reduction of intracranial pressure (ICP) with aggressive treatment using mechanical ventilation to decrease PaCO₂
- corticosteroids - significantly reduce risk of hearing loss as a sequelae of bacterial meningitis due to *H. influenzae* type B and lethality of pneumococcal meningitis in adults

Sepsis

- Sepsis is defined as systemic inflammatory response - SIRS - to infection
- Definition according to SCCM/ACCP Consensus Conference 1992

Criteria of SIRS

- temperature (C°) > 38 or < 36
- heart rate (pulses/min.) > 90
- breathing rate (breaths/min.) > 20
- PaCO₂ (mmHg) < 32
- WBC (cellsx10⁹/L) > 12 or < 4 or > 10% of bands

Epidemiology of sepsis

- leading cause of death in intensive care setting
- incidence is increasing
- 900,000 cases of sepsis annually in the USA
- 7th cause of death
- morbidity is increasing in developed countries

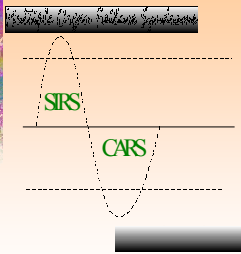
Pathogenesis of bacterial sepsis

- systemic inflammatory response to bacteria or their compounds gaining entry into the bloodstream
- systemic inflammatory response can be exaggerated leading to inflammatory injury of organs
- Multiple Organ Dysfunction Syndrome - MODS - or Multiple Organ Failure Syndrome - MOFS

Severity of sepsis

- sepsis
- severe sepsis = sepsis + MOFS
- septic shock = sepsis + circulatory failure

Kinetics of inflammatory response during sepsis



- exaggerated SIRS is associated with MOFS
- Compensatory Anti-inflammatory Response Syndrome - CARS
- overzealous CARS is associated with immunosuppression
- nosocomial infections as complication of CARS

Nosocomial sepsis

- pneumonia (ventilator associated pneumonia - VAP)
- catheter-related sepsis
- UTIs' related sepsis
- 25% of ICU patients have nosocomial infection
- sepsis is leading cause of death in ICU

Clinical picture – I.

- fever or hypothermia
- hypotension and tachycardia
- skin - furuncles, i.v. sites, petechial rash
- peripheral stigmata of bacterial endocarditis
- jaundice (acute biliary tract obstruction)

Diagnostics of sepsis - special examinations

- blood cultures
- inflammatory markers
- laboratory signs of DIC - thrombocytopenia, low AT III etc.
- detection of infectious foci
- chest X-ray, ENT examination, ultrasonography, CT etc.
- neurological examination
- community-versus hospital acquired infection

Treatment

- supportive treatment is essential
- monitoring, fluid replacement, oxygen therapy, inotropic agent peripheral or central venous catheters, ventilatory support
- intravenous bactericidal antibiotics in adequate doses
- surgery - e.g. evacuation of abscesses
- corticosteroids - in initial phase of septic shock that does not respond to catecholamines
- glycemia <10 mmol/l

Complications

- multiple organ failure - MOFS
- acute respiratory failure - ARDS - in 40% of septic patients
- acute renal failure - AFR
- circulatory failure - hypotension
- disseminated intravascular coagulopathy - DIC
- GI tract failure - vomiting, diarrhea and/or bleeding
- hepatic dysfunction - elevated bilirubin, ALT, AST etc.
- involvement of central nervous system - alteration of consciousness

Invasive meningococcal disease: etiology & forms

- acute bacterial infection caused by *N. Meningitidis*
- serotypes A, B, C, W135 and Y
- meningococcal meningitis
- meningococcal meningitis + sepsis
- meningococcal sepsis = fulminant meningococcaemia

Clinical picture

- acute febrile illness
- typical skin exanthema: haemorrhagic rash
- rapid development of multiple organ failure: circulatory failure, ARDS, acute renal failure, DIC
- rapid progression of unconsciousness

Diagnostics

- CSF examination - increase of WBC, protein and lactate
- increase of PCT a CRP
- leucocytosis or leucopenia
- trombocytopenia and coagulopathy
- positive blood culture or CSF culture

Treatment and outcome

- vital functions - transport, iv access, airways etc.
- penicillin during the transport
- intensive care = specialized ICU
- fatality rate is depending on the form of IMD

Protection from professional infection

- infection is spread droplets
- facial mask + gloves
- antibiotics to contacts including health care workers, oral penicillin for 7 days
- vaccination of health care workers
- new conjugated vaccine only against *N. meningitidis* type B

Polyneuropathy - Guillain-Barré syndrome (GBS)

- postinfectious inflammatory process of peripheral nerves
- rapid development of sensory and motor weakness of lower extremities
- cranial nerve involvement
- progression to ventilatory failure
- incidence 0.4-4 cases per 100,000 persons annually in the USA
- associated with certain infectious diseases: campylobacteriosis, CMV, Lyme disease, HIV and influenza

Clinical picture

- mild respiratory of GI tract infection in patient's history
- symmetrical involvement of sensory nerves (parasthesias) and weakness of lower extremities
- progression of weakness to the upper extremities and palsies of ventilatory muscles in about 5-10% of patients

Diagnosis

- typical clinical picture
- CSF examination with increased protein
- typical EMG tracings with slow activity
- positive serology for certain infectious diseases

Treatment

- monitoring for rapid detection of ventilatory failure
- intensive or intermediate care
- maintain airways and ventilatory support
- high doses of i.v. immunoglobulins
- plasmapheresis

Complications and Outcome

- **complications:** progression of palsies to cranial nerves, ventilatory failure, persistence of residual palsies
- **outcome:** full recovery in 60% of patients, death rate 5-10%