

## Infectious Diseases in Intensive Care

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bacterial meningitis

sepsis and septic shock

invasive meningococcal disease

polyradiculoneuritis



## **Bacterial meningitis**

#### rapid development of alteration of mental status

unconsciousness - Glasgow Coma Scale

e.g. sepsis + organ failure



### Management

venous access

maintain airways

administration of anti-edematous treatment - Mannitol

rapid transport to the hospital



## Cerebrospinal fluid analysis

↑WBC >1,000/mm<sup>3</sup> ↑PMNs > 60% ↓glucose - CSF/blood ratio< 45% ↑protein >1.0 g/L latex agglutination + 50% Gram stain + 80% bacterial culture + 90% PCR positive >90% of samples



## Pathogenesis of brain edema

cytotoxic edema



elevated intracranial

pressure

decreased cerebral perfusion pressure (CPP)

CPP = MAP - (ICP + CVP)







## Supportive treatment

reduction of intracranial pressure (ICP) with aggressive treatment using mechanical ventilation to decrease PaCO<sub>2</sub>

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



## Bacteremia and Sepsis

bacteremia = presence of bacteria in the bloodstream

 <u>sepsis = life-threatening organ dysfunction caused by</u> <u>a dysregulated host response to infection</u>.

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



#### **Clinical Review & Education**

#### Special Communication | CARING FOR THE CRITICALLY ILL PATIENT

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

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IMPORTANCE Definitions of sepsis and septic shock were last revised in 2001. Considerable advances have since been made into the pathobiology (changes in organ function, morphology, cell biology, biochemistry, immunology, and circulation), management, and epidemiology of sepsis, suggesting the need for reexamination.

OBJECTIVE To evaluate and, as needed, update definitions for sepsis and septic shock.

PROCESS A task force (n = 19) with expertise in sepsis pathobiology, clinical trials, and epidemiology was convened by the Society of Critical Care Medicine and the European Society of Intensive Care Medicine. Definitions and clinical criteria were generated through meetings. Delphi processes, analysis of electronic health record databases, and voting, followed by circulation to international professional societies, requesting peer review and endorsement (by 3) societies listed in the Acknowledgment).

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.

RECOMMENDATIONS Sepsis should be defined as life-threatening organ dysfunction caused by a dysregulated host response to inflection. For clinical operationalization, organ dysfunction can be represented by an increase in the Sequential [Sepsis-related] Organ Failure Assessment (SOFA) score of 2 points or more, which is associated with an in-hospital mortality greater than 10%. Septic shock should be defined as a subset of sepsis in which particularly profound circulatory, cellular, and metabolic abnormalities are associated with a greater risk of mortality than with sepsis alone. Patients with septic shock can be clinically identified by a vasopressor requirement to maintain a mean arterial pressure of 65 mm Hg or greater and serum lactate level greater than 2 mmol/L (>18 mg/dL) in the absence of hypovolemia. This combination is associated with hospital mortality rates greater than 40%. In out-of-hospital, emergency department, or general hospital was destings, adult patients with suspected infection can be rapidly identified as being more likely to have poor outcomes typical of sepsis if they have at least 2 of the following clinical criteria that together constitute a new bedside clinical score termed quickSOFA (qSOFA): respiratory rate of 22/min or greater, altered mentation, or systolic blood pressure of 100 mm Hg or less.

CONCLUSIONS AND RELEVANCE These updated definitions and clinical criteria should replace previous definitions, offer greater consistency for epidemiologic studies and clinical trials, and facilitate earlier recognition and more timely management of patients with sepsis or at risk of developing sepsis. Editorial page 757

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## Epidemiology of sepsis

leading cause of death in intensive care settingincidence is increasing900,000 cases of sepsis annually in the USA7th leading cause of deathmorbidity is increasing in developed countries



Severity of sepsis

sepsis

septic shock



## Septic shock

- septic shock is a subset of sepsis in which underlying circulatory and cellular/metabolic abnormalities are profound enough to substantially increase mortality
- septic shock can be identified in a septic patient 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



## Nosocomial sepsis

pneumonia (ventilator associated pneumonia - VAP)

catheter-related sepsis

UTIs' related sepsis

25% patients in ICU develop nosocomial infection

sepsis is leading cause of death in ICU





#### **Clinical picture**

- 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** 

blood cultures

inflammatory markers

laboratory signs of DIC - thrombocytopenia, low AT III

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, ionotropic agent peripheral or central venous catheters, ventilatory support

intravenous bactericidal antibiotics in adequate doses

surgery - e.g. evacuation of abscesses

glycemia <10 mmol/l



# Early empirical antibiotic treatment of septic shock





## 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
- CNS involvement alteration of consciousness



## Invasive meningococcal disease

- acute bacterial infection caused by Neisseria
  meningitidis
- serotypes distrubutes geographically: B in Europe, A and W135 in Africa and Latin America
- low incidence in the Czech Republic 45 cases in 2015
- rapid onset and petechial rash
- high fatality rate



#### Forms

#### meningococcal meningitis

meningococcal meningitis + sepsis

meningococcal sepsis = fulminant meningococceamia



## **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, i.v 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

1. LÉKAŘSKÁ FAKULTA

UNIVERZITY KARLOVY V PRAZE

facial mask + gloves

antibiotics to contacts including health care workers, oral penicillin for 7 days

vaccination of health care workers

new conjugated vaccine against N. meningitidis type B



## Guillain-Barré syndrome

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



## **Complications and Outcome**

# <u>complications</u>: progression of palsies to cranial nerves, ventilatory failure, persistence of residual palsies

<u>outcome</u>: full recovery in 60% of patients, death rate 5-10%



## EXAM QUESTIONS:

Infectious diseases in intensive care Bacterial meningitis in adults Invasive meningococcal disease Acute polyradiculoneuritis Sepsis

Septic shock