Sepsis

Sepsis is a concept dealing with the body's response to infection. The definition of sepsis has historically changed over time.

The definition recommended by the latest revision is that **sepsis** is a life-threatening organ dysfunction caused by an aberrant response to infection[1].

Diagnostic criteria and definition[2]

For what? A patient with sepsis has a large chance of dying. The spread of infection leads to shock, organ failure and death. It is important to know specifically and sensitively whether it moves along the "pathway of sepsis" and to cure on time.

The resulting diagnostic criteria aim to prognostically assess the mortality of the hospitalized patient.

The first diagnostic criterion for sepsis was SIRS, defined within Sepsis-1. SOFA, qSOFA, etc. criteria were devised within the framework of improving forecast prediction.

Sepsis-1

The original 1991 classification defines the term **sepsis, SIRS, severe sepsis and septic shock**.

- **Sepsis**

Defined as an infection or suspected infection leading to the onset of SIRS.

- **SIRS**

SIRS

- **Severe sepsis**

Defined as sepsis complicated by organ dysfunction.

- **Septic shock**

Defined as sepsis-induced hypotension unresponsive to fluid replenishment. Signs of hypoperfusion (lactate, oliguria, alterations of mental state).

Sepsis-2

Essentially the same as Sepsis-1, except that **infection must be demonstrated** in sepsis, suspicious is not enough.

Sepsis-3

- **Sepsis**

Recommendations to redefine sepsis as a life-threatening organ dysfunction caused by a dysregulated host response to infection[3].

SOFA

Scoring system with a higher predictive value of patient mortality, but more complicated. Example here: https://www.mdcalc.com/sequential-organ-failure-assessment-sofa-score

qSOFA

The system follows the SOFA, because it turned out that SOFA is not a practical system in clinical practice (read too complex). Criteria:

- Respiratory rate 22/min
- Mental state changes
- Systole <100 mmHg

Significant simplification compared to SOFA. An unpleasant fact and justified criticism is that although qSOFA is **highly specific** (96.1%), it is **not sensitive** (29.7%). Therefore, it is not a good test for early detection of sepsis, it only reliably confirms it in a developed state.

Which criteria to use in practice?

Retrospective cohort studies in Australia and New Zealand comment on the prognostic value of inpatient mortality scores as follows: SOFA> SIRS> qSOFA

Unfortunately, other studies recommend qSOFA> SIRS.

Pathophysiology

Infectious insult

The onset of infection, patient and pathogen factors play a role.

Early system response

It depends on the amount and speed of cytokine penetration into the circulation - this develops **SIRS**. The development of SIRS tells us that the infection is starting to spiral out of local control. The main cytokines responsible for this condition are **TNFα, IL-1, IL-6 and IFNγ**.

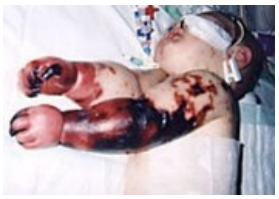
Fever is caused by the action of IL-1 on the hypothalamus. Benefits of fever - slows the growth of agents, potentiates Ig production, macrophage rate and the formation of growth factors for neutrophils.

Advanced system response

The stage when the patient can no longer control the inflammatory process. Endothelial dysfunction by TNF and IL-1 plays a fundamental role. Microthrombi formation, accumulation of polymorphonuclear cells and platelets occur. This will cause the microcirculation to malfunction. Endothelial dysfunction eventually leads to vasodilation, development of DIC, septic shock with leakage of intravascular fluids out of circulation, centralized circulation and organ dysfunction (development of MODS).

Diagnostics

SIRS criteria are more for the needs of different studies, they cannot be routinely used as diagnostic criteria. The basis of the diagnosis is the search for the presence of infection and signs of its systemic impact.



Extensive suffocations can be complicated by gangrene, which sometimes leads to limb amputation.

For diff. Dg. it is also important to know the non-infectious causes of SIRS:

- trauma, burns, surgery;
- ischemic tissue insults– AIM;
- tissue necrosis – pancreatitis, *tumour lysis syndrome*;
- bleeding, hematomas, CNS bleeding;
- post-transfusion reactions, drug reactions;
- metabolic and endocrine diseases;
- poisoning.

General principles of sepsis

Immediate treatment must always follow the "ABC".

We treat patients with advanced sepsis and at risk of developing MODS in the ICU. We monitor invasive blood pressure, secure central vein (for volume therapy and catecholamine circulatory support), urinary catheter (monitoring urine output and kidney function), continuously measure patient's temperature, monitor the internal environment at regular intervals (acid-base balance and blood gas values, ions). If necessary, we will start artificial lung ventilation, hemodialysis.

Removal of the source of sepsis

The basic thing is to detect the source as soon as possible. Removal includes - drainage of abscesses, drainage of empyema, necrectomy, removal of foreign bodies (including venous catheters), exclusion of an organ permeated with infection, removal of the affected area from the function (colostomy).

Treatment of infection

Appropriate ATB treatment - usually empirical, with the most common sources of sepsis being respiratory infections (35%) and circulatory infections (20%).

Combination of beta-lactams + aminoglycosides, or cephalosporins III. or IV. generation in monotherapy. Deescalating treatment - begins with the deployment of broad-spectrum combination therapy with the greatest possible coverage. In **48-72 hours**, ATB therapy is modified according to the result of cultivation.

Treatment of circulatory changes

The aim is to restore organ perfusion (massive volume therapy while maintaining organ perfusion takes precedence over the risk of pulmonary oedema and lung damage (barotrauma) during invasive artificial lung ventilation).

Assessment of organ perfusion is difficult and actually takes place ex-post only according to the assessment of the degree of damage. We evaluate here mainly blood pressure, diuresis, state of consciousness and peripheral blood circulation, laboratory lactate. The basis of therapy is fluid resuscitation - the basic and first step - hypotension should not be addressed by catecholamines without adjusting the volume. Cannot balance with diuresis – in septic shock, the fluid balance is always positive. Both crystalloids and colloids can be used (there is constant discussion about which of the solutions is more suitable for supplementing hypovolemia in the treatment of shock, and this is the subject of many clinical studies). If fluids do not help - we give vasoactive substances - invasive blood pressure assessment is recommended. The drug of choice – norepinephrine and dopamine.

Treatment of respiratory failure

Early indication of ventilation support. Indications for intubation – impaired consciousness, congestion, paO_2 below 7 kPa, respiratory rate above **35/min**, $paCO_2$ above 6.5 kPa. Possibility to use PEEP.

Jet ventilation or ECMO methods can be used if ARDS and difficulties in invasive artificial lung ventilation are developed (insufficient saturation and paO_2 and increased $paCO_2$ despite ventilation with 100% oxygen).

Further treatment

Prophylaxis of stress ulcers with H_2-blockers, nutrition, prophylaxis of thrombosis

Links

Related articles

- SIRS
- MODS
- Neonatal sepsis

References

1. HOLUB, M. *New definition of sepsis* [online]. Společnost infekčního lékařství, ©2016. The last revision 2016-09-19, [cit. 2017-03-10]. <https://www.infekce.cz/zprava16-24.htm>.
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5418298/
3. https://jamanetwork.com/journals/jama/fullarticle/2492881

External links

- Sepsis (English wikipedia)

References

- BENEŠ, Jiří. *Study Materials* [online]. ©2007. [cit. 2009]. <http://jirben.wz.cz>.