

## Life-Threatening Infectious Diseases in Primary Pediatric Care

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### Abstract

The article deals with invasive bacterial infections in children. These are all infections caused by vaccine-induced bacteria, some of which have been completely eradicated. Due to the criminal activity of those refusing vaccinations, these infections are reappearing. The authors report how to recognize them in primary care, how to treat them and how to arrange transport to the intensive care unit.

**Keywords:** *Life-Threatening Bacterial Disease; Primary Pediatric Care; Diagnosis; First Aid*

### General characteristics of life-threatening bacterial diseases

From a clinical point of view, it is an invasive bacterial disease, where a bacterial-induced systemic inflammatory reaction leads to a threat to the basic vital functions of the patient within hours. It's actually an onset of a general infection-sepsis. Sepsis is a systemic inflammatory reaction in the presence of infection [1]. The bacteria are in blood and possibly in cerebrospinal fluid.

Microbiological or immunological evidence of bacterial infection is unavailable in primary care in a critically ill child. Clinical findings should be followed by a history and physical examination. Of the auxiliary examinations available in primary care for severe bacterial infection is the point-of-care determination of CRP from capillary blood. We can assume that major role in etiology invasive bacterial infection will play *Streptococcus pneumoniae*, *Haemophilus influenzae b* and *Neisseria meningitidis*. They are particularly dangerous mainly in children under 5 years of age. Immunoglobulins IgG2 are important for protection against lipopolysaccharides in the cell wall of the invasive bacteria. While other subgroups of IgG are normal after birth, the level of IgG2 is only a third of normal value [2].

How do we detect an invasive bacterial disease in pediatric primary care?

- Goal-directed anamnestic questions.
- Clinical examination + CRP.

Anamnestic questions should focus on the following issues:

- Since does a child appear to a mother to be sick and why?
- What is his body temperature and how long does the change in body temperature last (fever, but also temperature below 36°C)?

- How does a child eat and drink, what stool does he have, and whether he vomits?
- How does a child urinate (“when was the last time her diapers were wet”)?
- How does the child behave - state of consciousness, reactivity, irritability, behavioral change?
- Complaints from the child (abdominal pain, headache, fatigue) receptive to invasive bacterial diseases.
- Contact with a sick person.
- What vaccinations the child has?

### Clinical finding and CRP [4]

Notice signs of infection in particular. The fever may  $>$  to  $38^{\circ}\text{C}$  or body temperature ( $T$ )  $<$  and  $36^{\circ}\text{C}$ , skin and mucosal bleeding manifestations (petechiae, suffusion). Significant is the difference between central and peripheral  $T$ , which, in a temperature-neutral environment, should not be  $>$   $3^{\circ}\text{C}$  in favor of central  $T$ . Higher temperature difference is a signal of cold shock caused by rise of systemic vascular resistance. The manifestation of shock is also the extension of peripheral capillary return by  $>$  2 sec after anemia of the skin on the periphery by pressure. Related to this is changes in blood pressure, which can initially be “normal” to elevated due to high vascular peripheral resistance. The decrease in value for a given age indicates septic shock. Information on sufficient organ perfusion is diuresis. If the child does not  $>$  6 hours, this is a warning sign. If we get a urine sample, then its specific weight should not be wet  $>$  1,030. Significant is the fact that the child refuses food and drink. On the contrary, if the child drinks greedily (our teachers said that “the infant beats his tongue loudly”), this is a good sign. Consciousness disorder (according to Glasgow Coma Scale [GSC]  $<$  12 points) is warning and in itself should be a reason for intensive care in the hospital. The same goes for convulsions. The child can be irritating, the mother indicates a change in behavior, sometimes states that the child is not calm even in her arms. Symptoms indicative of meningeal syndrome are important. It is a set of symptoms that arise from irritating the brain diaphragms and roots of the brain nerves through a diseased process, in children most often inflammation, rarely subarachnoid bleeding. There are several maneuvers we can use to irritate brain packs - meningeal symptoms (e.g. reaction during Kernig and Lasague maneuvers). Respiratory disorders may be significant. Tachypnoea, alary veal, open mouth breathing, retracting of soft parts of the chest, hoops or weak breathing and fierceness cough can indicate a serious lung infection. It should be pneumonia, and if the cause is *Streptococcus pneumoniae* it should be a serious disease.

### CRP

CRP is an important helper for belief that we see a child with a serious bacterial infection in front of us. CRP values rise within 6 hours of infection due to cytokine and  $>$  60 mg/l are indicative of bacterial infection. The significance is higher when we compare the CRP value with the number of hours from the onset of symptoms, especially fever. There is talk of “CRP velocity” [3]. For example, a value of 62 mg/l measured 12 hours after the onset of fever should be considered as a more severe figure than that measured within 48 hours of clinical baseline ( $62:12 = 5.2\dots$   $62:48 = 1.29$ ). This increases both the sensitivity and specificity of CRP for the diagnosis of severe bacterial infection. A very useful laboratory indicator of sepsis, procalcitonin ( $>$  2 ng/ml), is practically not available in primary care.

We have created a score that uses clinical signs in physical examination and CRP values to determine the severity of infectious bacterial disease. The score when re-determining the number of points helps the doctor in primary care to monitor the dynamics of the infection and, according to the height of the point total, also gives some guidance on what care to provide to the child.

### Infection severity score using clinical findings and CRP

Score	0	1	2
Central nervous system	Normal function	GCS 10 < 15, apathy or irritation, high, howly crying, fever	GCS < 10, convulsion, meningeal symptoms are positive
Circulation	No bleeding, normal BP, warm feet with good pulsation, good diuresis 1 ml/kg/1h	At the beggining, BP lower, then higher; stubby non-pulsating periphery. Lower diuresis rare petechias, fever or hypothermia	Systemic inflammatory reaction, low BP petechiae and suffuse, systemic inflammatory reaction, catecholamines are essential multiple organ failure
Respiration	Normal	Tachypnoea, weak, Irregular breathing, crepitus, cough	Tachypnoea, edging breathing, crepitus, cough; hypercapnia,, hypoxia-artificial pulmonary ventilation appears essential
CRP values corresponding to the seriousness of infection	< 60 mg/1l	60 - 100/1l	> 100 mg/ 1l

**Results and recommendations on what to do next**

- 0 - 3 points > no bacterial infection.
- 4 - 7 points > more serious bacterial infection > hospitalization.
- 7 and more points > serious bacterial infection, sepsis > ICU- top life support.

**General treatment measures [4-6]**

If basic vital signs are at risk (children with the score > 4 points), we immediately start emergency treatment. We have to take in consideration that etiology of severe bacterial infection is mostly *Haemophilus influenzae*, *Streptococcus pneumoniae* and *Neisseria meningitidis*.

Call the emergency medical service with a doctor. General medical measures until the arrival of the emergency services are:

- Oxygen given by mask.
- Introduction a cannula to the vein (i. v.); fail - entrance to the bone marrow (i. o.).
- We take blood to determine the bacterial disease - attempts to do so must not delay treatment, which always takes precedence!).
- We take a sample of capillary blood to determine CRP.
- Start infusion of 0.9% NaCl solution at 60 ml/hour if bradycardia is < 60/min regardless of age and at the same time decrease in systolic blood pressure, we administer adrenaline 0.01 mg/kg i. v. (i. o.); if we do not have i.v. or i.o\*.
- Input, we apply intramuscularly (in case of suspected invasive meningococcal infection (we administer ceftriaxone (50 mg/kg for dose regardless of age), always within 30 minutes of first contact with the patient.
- In case of failure of vital signs (unconsciousness with a reactivity, apnoea or gasping, bradycardia or circulation arrest) we start cardiopulmonary resuscitation.

- During the implementation of treatment measures inform parents.

### Conclusion

20,000,000 of them die every year on Earth from severe infections, sepsis, including 6,000,000 children under the age of 10. In the Czech Republic, around 500 children under the age of 10 die each year = about 2% of the total mortality rate. Sepsis is a rare cause of death in children, isolated cases. Timely knowledge of life-threatening infections, sepsis, at first contact with a child in primary care with the help of the procedures referred to in this article, has an indisputable part of this extremely favorable situation.

However, many decades of general vaccination of the child population, including vaccines against deadly infections, are crucial, with > 90% of the > immunized. Thus, some infectious diseases were almost eradicated, so that young doctors could not meet them.

Due to the increasing activity of vaccine rejects, vaccination against some infections falls below 90% and "old" deadly infections return, for example, epiglottitis acuta induced by *Haemophilus influenzae b*. That's why we need to get back to these forgotten infection.

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