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The usefulness of determining C-reactive protein by using rapid test for the differentiation of infections in febrile children**

Przydatność oznaczania białka C-reaktywnego za pomocą szybkiego testu w różnicowaniu zakażeń u gorączkujących dzieci

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INTRODUCTION

A febrile child in the Hospital Emergency Department (HED) is often a major diagnostic and therapeutic challenge. Due to the not always characteristic clinical symptoms associated with fever in children, in the differential diagnosis of the majority of cases, acute infec-

S u m m a r y

Introduction. An ill child in the Hospital Emergency Department (HED) is a major diagnostic and therapeutic challenge. Serum levels of C-reactive protein (CRP), in correlation with the clinical condition of the patient, may be an important indicator of the etiology of the infection (viral or bacterial), which allows for the rationalization of treatment and prevents unnecessary antibiotic treatment.

Aim. Presentation of three cases where the CRP test had an impact on the treatment decisions.

Material and methods. The HED, Bielański Hospital performed 206 rapid diagnostic tests, aimed to differentiate infections. The paper will discuss three cases of patients where determining the CRP level allowed to take or change the diagnostic and therapeutic decisions.

Conclusions. The CRP rapid test was a valuable supplement to the history and physical examination in children with fever, and the test results had an impact on the treatment decisions.

S t r e s z c z e n i e

Wstęp. Gorączkujące dziecko w Szpitalnym Oddziale Ratunkowym (SOR) stanowi poważne wyzwanie diagnostyczne i terapeutyczne. Oznaczenie stężenia białka ostrej fazy (CRP), w korelacji ze stanem klinicznym pacjenta, może być ważnym wskaźnikiem oceny etiologii zakażenia (wirusowej lub bakteryjnej), co pozwala na racjonalizację leczenia i zapobiega niepotrzebnej antybiotykoterapii.

Cel pracy. Przedstawiamy troje pacjentów, u których badanie CRP miało wpływ na decyzje terapeutyczne.

Materiał i metody. W SOR Szpitala Bielańskiego wykonano 206 szybkich testów diagnostycznych celem różnicowania zakażenia. W pracy zostaną omówione 3 przypadki pacjentów, u których oznaczenia stężenia CRP pozwoli na podjęcie lub zmianę decyzji diagnostyczno-leczniczej.

Wnioski. Szybki test CRP stanowił cenne uzupełnienie wywiadu i badania przedmiotowego u dzieci gorączkujących, a uzyskane wyniki miały wpływ na decyzje terapeutyczne.

tions should be considered, both viral and bacterial. The distinction between a viral and a bacterial infection determines the appropriate treatment – which is particularly important in the era of the increasing bacterial resistance to antibiotics, leading to the need for a rationalization of therapy (1, 2). Due to the significance of the

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problem, attempts have been made to develop helpful algorithms. In April 2013, Ruud Nijman G et al. (3), on the basis of research conducted in two countries (the Netherlands and England) and three clinical centers, developed an algorithm for children in the emergency department. They found that the clinical parameters that should be taken in assessing the patient's state are: sex, respiratory and heart rate, height and duration of fever, capillary return, retraction of intercostal spaces during breathing, the overall appearance of the child, the oxygen saturation, and from among the laboratory parameters – the C-reactive protein level.

C-reactive protein (CRP) is a protein synthesized by the liver, the production of which is induced by an inflammation caused by an infection or a tissue destruction process (4). It means that the CRP level, in combination with the assessment of the patient's clinical state may be an effective method in determining the etiology of the infection (viral or bacterial), which then allows a rationalization of the treatment and prevents, for example, unnecessary antibiotic treatment. The determination of the CRP is usually performed in the blood serum obtained by taking venous blood. The waiting time for the test results depends on the efficiency of the procedures – delivery of the material to the laboratory, registration and obtaining the serum samples, the type of equipment used in the diagnostics, as well as the transfer time of the results to the doctor. In order to shorten the waiting time for the CRP test results, the rapid diagnostic test was developed (Orion Diagnostica).

AIM

Presentation of three cases of an infectious disease in which the CRP test performed using a rapid diagnostic method had a significant impact on the treatment decisions.

MATERIAL

At the Bielanski HED, in the period from November 2013 to May 2014, the rapid diagnostic test was performed in 206 children in order to differentiate the infection. Out of the total number of children tested using the assay, we selected three cases.

METHOD

The CRP concentration was determined by the immuno-turbidimetric method using the Quick Read Orion Diagnostica kit, in accordance with the instructions. The study was performed using capillary blood, drawn into the capillary after a puncture of the fingertip. The doctor was responsible for the correct performance of the test procedures. The result was known after about 2 minutes. The decision to do the test was taken by the HED doctor after the anamnesis and examining the patient. The staff had previously been trained to use the device.

CASE 1

Boy, 3.5 years old, feverish from admission day, 39°C. His mother was concerned about the

change in the child's behavior and the deterioration of his general condition. On admission the doctor rated the boy's condition as good. According to the records from the history, the child was "generally" healthy, no chronic diseases, not receiving any medication on a permanent basis, vaccinated according to the National Program of Immunization (NPI). However, in recent months the boy was often sick, a viral infection of the upper respiratory tract was recognized and treated symptomatically. The infection was in correlation with the start of his preschool education.

In a physical examination, catarrhal symptoms of an upper respiratory tract infection were found, with a bilateral redness of the eardrums and an impaired nasal obstruction caused by a large amount of thick mucus. A murmur over the lung fields was slightly sharpened. Apart from the above, no deviation from the norm was found. The oxygen saturation level was normal.

After an examination, the HED doctor decided to do the CRP rapid diagnostic test. The doctor took into consideration, among other things, the opinion of the mother, assessing the status of the child as worse than in previous cases of infection.

The CRP rapid test result was significantly increased (132 mg/l), which had a critical impact on the admission to the hospital. In the pediatric department, a test performed at a hospital laboratory (immunoturbidimetric method) confirmed the elevated CRP level (130.9 mg/l). Other signs of inflammation were also recognized, including an increased number of white blood cells (19.4 thousand/ml), with a predominance of neutrophils (74%) and a slight increase in the concentration of procalcitonin (0.78 ng/μl).

The radiological examination of the chest revealed an inflammatory thickening in the lung parenchyma. Pneumonia was diagnosed with a probable bacterial etiology, because we could not determine the etiological agent. When an antibiotic was used, a general improvement in the boy's condition was observed and the inflammatory parameters decreased rapidly in the coming days.

CASE 2

A 2-year, 9-month old girl was admitted to the hospital because of high fever that persisted for several hours prior to admission (40.9°C). The fever was accompanied by an occasional cough. There were also a few episodes of vomiting. The state of the child on admission was rated as good. The body temperature was normal. The physical examination revealed a throat inflammation and enlarged tonsils. Other abnormalities were not detected. The initial diagnosis was: an acute catarrhal infection of the upper respiratory tract. Due to the very high fever, the HED doctor decided to implement the CRP rapid test. The CRP level was slightly elevated (29 mg/l). The final diagnosis was: inflammation of the upper respiratory tract with a viral etiology. Symptomatic treatment was recommended and the

parents were instructed to report to the hospital in case of a recurrent fever or other abnormalities.

CASE 3

A 3-year-old girl was admitted to the hospital because of a persisting fever and cough for four days. On the day before the admission, after a particularly intense attack of coughing, vomiting appeared. On the admission, the body temperature was below 38°C. The child had had no previous serious infections, was immunized according to the NPI, and additionally against pneumococcal and meningococcal diseases. Her general condition at admission was good. The examination of the internal organs showed no deviations from the norm. The doctor examining the child, however, was alarmed by a single effusion on the skin of the face. Unable to exclude the participation of a bacterial factor in the etiology of the disease, the doctor decided to perform the rapid CRP test. The CRP concentration was only slightly elevated (34 mg/l). The final, diagnosis was an acute catarrhal inflammation of the upper respiratory tract. Symptomatic treatment was recommended. The girl was not hospitalized.

DISCUSSION

Elevated CRP concentration, higher than 10 mg/l, was found in 52.9% (109/206) of patients, including more than 40 mg/l in 16.5% (34/206) of patients. In the three above cases, determining the CRP level allowed to make an appropriate therapeutic decision. In the first case, the CRP rapid test determined the decision on hospitalization. The data in the history and the physical examination turned out to be insufficient here to distinguish a bacterial from a viral infection. In the second and third case, determining the CRP level helped to avoid hospitalization and unnecessary antimicrobial

therapy, although in these cases both the history (very high fever, cough, vomiting) and physical examination (petechiae) may have suggested a bacterial etiology. Our preliminary experience indicates that in the majority (83.5%) of children admitted to the HED with the symptoms of an acute upper respiratory tract infection, the CRP is normal or slightly increased (less than 40 mg/L). This observation confirms the dominance of a viral infection as a cause of acute inflammations of the upper respiratory tract in children.

The main advantage of the CRP assay using a rapid diagnostic test is the short waiting time for the test result, which allows an early initiation of appropriate proceedings immediately after examining the child (5). Unlike other authors, the costs of CRP rapid test were not less than the costs CRP had been made in laboratory, this is its main drawback (5). In spite of this, our practice shows that the CRP may be very useful, especially in the GP practice. Likewise considers Esposito (6) and Papaevangelou V (7), that the rapid QuikRead CRP test can be performed at the bedside or in an outpatient clinic and, in less than 5 min, gives the same quantitative results as those obtained using a more complex routine laboratory method. In Norway CRP was taken in 55% of the contacts (consultations and home visits), especially for age group 0-1 years (42% of the contacts) and 2-6 years (34%) (8).

CONCLUSIONS

Because fever in young children may initially be the only symptom of infection, both viral and bacterial, the rapid CRP test is a valuable addition to the diagnosis of children with fever and may have a significant impact on the therapeutic decisions. The rapid QuikRead CRP test can be performed in HED, an outpatient clinic in less than 5 min.

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