Ketoacidosis as a primary manifestation of COVID-19
Kwasica ketonowa jako główny objaw COVID-19

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Abstract
Introduction: Diabetic ketoacidosis is the most important metabolic emergency in children. Children mimic many syndromes with a combination of nonspecific symptoms during the COVID-19 pandemic. Many syndromes are triggered by changes in children's body conditions. Reporting specific cases can improve the diagnosis process. The present study reports an 18-month-old paediatric case of COVID-19 who presented ketoacidosis (DKA) symptoms.

Case presentation: The case is an 18-month-old child with fever and diarrhoea from 3 days before, who did not respond to outpatient treatment. On the day of the visit, he suffered from deep and abdominal breathing and decreased level of consciousness and sugar levels at admission of 420 mg/dl. He was then admitted with the initial diagnosis of DKA and had a positive PCR test result for COVID-19.

Conclusions: Considering the non-specific symptoms of COVID-19, general practitioners and paediatricians are recommended that special attention be paid to these symptoms, especially those that are similar to life-threatening syndromes. They also should not easily ignore these symptoms and follow up patients and their recovery status and, if patients do not recover, consider the risk of COVID-19 given the current COVID-19 pandemic.

Key words: COVID-19, ketoacidosis, type 1 diabetes, children.
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147

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(PICU) in addition to insulin therapy and DKA treatment. Within 10 days of hospitalization, the patient recovered and was finally discharged in good general condition. COVID-19 seems to have caused such conditions in the patient and was the main cause of such conditions.

Conclusions

Both environmental and genetic factors are involved in the development of type 1 diabetes. Environmental factors such as viral infections can damage the pancreas and cause diabetes (10). Other environmental factors include vitamin D deficiency, prenatal factors, cow’s milk (in children under 2 years of age with a genetic predisposition), and viral infections such as cytomegalovirus (CMV), rubella, coxsackie B, and mumps (lymphocyte infiltration destroys beta cells). In fact, type 1 diabetes is a type of T cell-dependent disease. Genetic factors including DR4 and HLA-DR3 are found in 90% of diabetic children [3, 8].

Clinical symptoms of diabetes include polyuria, polydipsia, polyphagia, and weight loss. If ketoacidosis is present, other symptoms may be added. Other symptoms include lethargy and drowsiness (due to hyperosmolarity and decreased cerebral blood flow), tachypnoea and Kussmaul respiration (due to acidosis), fruity-smelling breath (due to acetone), abdominal pain, vomiting, and abdominal distention (due to dehydration, mesenteric ischaemia). On the other hand, serum TG rises due to insulin deficiency, and pancreatitis develops (hypokalaemia-related ileus also causes abdominal pain). Children with DKA have at least 10% dehydration. These children must have azotaemia and high serum BUN and Cr levels. On the other hand, the serum WBC is high (leukocytosis), and the serum sodium level is variable hyperlipidaemia can lead to false hyponatraemia. If a DKA child has a high fever, he/she may have an infection and should undergo antibiotics treatment. If DKA persist for 36 to 48 hours, there is either incorrect treatment or the patient suffers from sepsis and DKA at the same time [11]. With regard to the young boy and the sudden occurrence of such conditions presented in the present study, the patient’s condition and symptoms seem to be a new manifestation of COVID-19 disease. A case-report study showed that an 8-year-old boy with no previous history of the disease developed diarrhoea and abdominal pain and there was no response to treatment

Table I. Laboratory tests

| Variables     | Preliminary test | Discharge | Variables     | Preliminary test | Discharge |
|---------------|------------------|-----------|---------------|------------------|-----------|
| FBS           | 420              | 105       | BE            | -30              | 0.4       |
| WBC           | 31200            | 14800     | HCO3          | 1.8              | 23        |
| RBC           | 4.3              | 4.32      | PO2           | 111              | 147       |
| Hb            | 9.4              | 10.4      | PCO2          | 10               | 33        |
| Hct           | 31               | 32.2      | K             | 17.3             | 3.5       |
| MCV           | 72.1             | 75.5      | Ph            | 6.90             | 7.45      |
| MCH           | 21.9             | 22        | Cr            | 0.7              | 0.4       |
| MCHC          | 30.3             | 32.3      | Bun           | 150              | 136       |
| Pt            | 595000           | 540,000   | K             | 4.9              | 4.4       |
| P             | 3.4              | 3         | Na            | 150              | 136       |
| Mg            | 2                | 2.2       | Urinary Analysis |             |
| Ca            | 9.9              | 4.4       | Ph            | 5                | 5         |
| ESR           | 5                | 5         | SG            | 1.030            | 1.015     |
| CRP           | 3+               | Neg       | pr            | neg              | neg       |
| BGRh          | A+               | Glucose   | 2+            | neg              | neg       |
| COVID-19 IgM (EIA) | 3.7 (positive > 1.1) | Keton | 2+ | neg |
| COVID-19 IgG (EIA) | 0.2 (negative < 0.9) | Blood | Neg | neg |
after 3 days of supportive treatment. On the fourth day, he developed respiratory symptoms [12] and was admitted to the emergency department with an initial diagnosis of DKA [12].

General practitioners and paediatricians are advised to pay special attention to the nonspecific symptoms of COVID-19, especially those that are similar to life-threatening syndromes. They also should not easily ignore these symptoms and should follow up patients and their recovery status and, if patients do not recover, consider the risk of COVID-19, given the current COVID-19 pandemic.

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