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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.

Introduction

Diabetes is a metabolic disease characterized by hyperglycaemia [1]. Diabetic ketoacidosis is the most important metabolic emergency in children, affecting 20–40% of children with type 1 diabetes upon referral to hospitals. Diabetic ketoacidosis (DKA) is usually uncomplicated if diagnosed early and treated appropriately [2, 3]. Various studies have reported that 16–55.3% of children with diabetes mellitus present with DKA [4–8].

The prevalence of COVID-19 is reported to be much lower in children than in adults. The majority of patients have mild symptoms, while some patients are asymptomatic. There is limited information on clinical manifestations among children. Therefore, reporting specific cases can improve the diagnosis process [9].

The present study presents a report on an 18-month-old COVID-19 child who exhibited DKA symptoms.

Case presentation

The case is an 18-month-old male patient weighing 10 kg, who developed high fever, and frequent low-volume blood- and mucus-free diarrhoea from 3 days before the visit. He did not respond to outpatient treatment. From the night before the visit, he exhibited a reduction in consciousness level, and deep and abdominal breathing. He also has no history of illness or hospitalization. The patient's parents had no history of diabetes, but the patient's uncle and aunt had a history of type 2 diabetes.

The patient had tachycardia, and fever upon admission (PR: 170, RR: 36, T: 38.8). Pulmonary auscultation showed bilateral wheezes, crackles, and rales. Sugar level at admission was 420 mg/dl. The patient was treated with an initial diagnosis of DKA. Because it is unusual to observe DKA at this age, the presence of fever was also investigated as the cause of such a condition. Preliminary tests showed leukocytosis, ketoacidosis, and hyperglycaemia (Table 1). Brain CT scan was normal. Due to the COVID-19 pandemic, the patient was suspected of having COVID-19. The patient had a positive nasopharyngeal RT-PCR. Chest CT scan also showed evidence in favour of COVID-19. IgM and IgG antibody responses to COVID-19 were measured by enzyme-linked immunosorbent assay (ELISA), and the results were positive for IgM (3.7) and negative for IgG (0.2). The patient underwent meropenem, vancomycin, azithromycin, vitamin C, dexamethasone (low dose), and pantoprazole treatment during hospitalization in the intensive care unit

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Table I. Laboratory tests

Variables	Preliminary test	Discharge	Variables	Preliminary test	Discharge
FBS	420	105	BE	–30	0.4
WBC	31200	14800			
RBC	4.3	4.32	HCO3	1.8	23
Hb	9.4	10.4	PO2	111	147
Hct	31	32.2	PCO2	10	33
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	17.3	3.5
Plt	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
COVID-19IgM (EIA)	3.7 (positive > 1.1)		Keton	2+	neg
COVID-19 IgG (EIA)	0.2 (negative < 0.9)		Blood	Neg	neg

(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

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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