Case Report

New-Onset Diabetic Ketoacidosis Precipitated by COVID-19 in Children: a case report

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Background and Aims. There is increasing evidence that the 2019 coronavirus disease (COVID-19) has considered as a potential trigger virus for the development of diabetes mellitus in children. This can occur even in patients without factors predisposing to impaired glucose metabolism like obesity. Here, we report a rare case of diabetic ketoacidosis revealing new-onset diabetes and precipitated by COVID-19. The relationship between type 1 diabetes mellitus and COVID-19 is discussed. Results: A 13 years old girl developed symptoms suggestive of diabetic ketoacidosis preceded by polyuria, polydipsia, and lethargy. There is a documented COVID-19 infection in her parents. An asymptomatic infection was detected on the basis of a reverse transcription polymerase chain reaction (RT-PCR). She responded well to treatment, including rehydration regimens and intravenous insulin. On the 4th day of her hospitalization, she was transferred to several injections of subcutaneous insulin with therapeutic and nutritional education from the parents. Conclusion. COVID-19 can induce acute onset diabetes and diabetic ketoacidosis in children. More research data are needed to improve our knowledge of this constellation and to guide the most appropriate therapies.

1. Introduction

The clinical spectrum of COVID-19 varies from mild forms to death. COVID-19 has unpredictable effects on many organs. The impact of COVID-19 on endocrine systems is understudied, and its specific metabolic complications are not yet fully understood. Since the start of this pandemic, a large number of published scientific reports have almost all shown that patients with diabetes mellitus (DM) face a more severe form of COVID-19 with a high death rate [1]. All over the world, a high prevalence of diabetic ketoacidosis revealing type 1 diabetes on COVID-19 infection has been reported in children and also in adults. Interestingly, “new-onset” hyperglycemia and “new-onset” DM are now emerging as probable complications of COVID-19. This suggests the hypothesis that SARS-CoV-2 infection could either precipitate a new type of DM by destruction of pancreatic cells or could trigger new pathophysiological mechanisms linked to DM(2) . That hypothesis requires large multicenter studies to confirm it.

Here, we report a case of a girl with acute diabetes and diabetic ketoacidosis, precipitated by corona- virus disease 2019 (COVID-19); she was treated and then followed for 4 weeks to assess the balance of diabetes. The detailed history, anthropometry, laboratory tests, imaging studies, treatment administered, and clinical course have been documented.

Case report

a 13 years old girl with no specific past medical history, was admitted to the hospital with lethargy , somnolence, and poly urea for 6 days duration proceeding admission. She had a flu like illness with low-grade fever during that time. There is no family history of type1 DM, nor autoimmune disease. Her mother and sister had positive PCR of covid -19 few days ago before the girl presentation. At admission, the girl was hemodynamically stable. At admission, she was hemodynamically stable but mildly tachycardic and drowsy without neurological deficit.

She had mild dehydration and had tachypnea of acidosis (Kussmaul's breathing) with normal saturation at 98%. Her temperature was 37.5°C, weight was 35 kg and height 140cm. The remainder of the clinical examination did not find any source of infection. Her capillary blood sugar was 350mg/dl, and the urine strips showed 3 sugar crosses and 3 keton bodies crosses. This is in favor of diabetic ketoacidosis. The initial laboratory assessment, summarized in Table 1, noted hyperglycemia, acidosis, normal blood count, and a negative CRP. The ion gram noted hyponatremia at 130 mEq/L . HbA1c was normal, antibody of glutamic acid decarboxylase was positive. Chest X-ray was normal. Nasopharyngeal COVID-19 PCR and SARS-CoV-2 antibody test returned positive. her GUE 3 days prior to admission was normal with no sugar nor keton bodies.

She received rehydration and intravenous insulin therapy with correction of hyponatremia and close clinical monitoring. Correction of DKA was achieved in approximately 48hours after the start of treatment. On the 2nd day, she had disturbed consciousness level and given intravenous mannitol 20%, on the 3rd day she gained her consciousness , her brain ct scan was normal ,on the 4th day the diet was started with 3 main meals and a snack, and intravenous insulin was replaced by subcutaneous insulin (Lantus (glargine) in the form of basal insulin and Novorapid (insulin aspart) as mealtime insulin). Blood glucose was regularly monitored, and parent diabetes education was provided. No specific COVID-19 treatment was given, and the control COVID-19 PCR came back negative on day 10of hospitalization. Twelve days after her hospitalization, she was discharged with a diagnosis of new-onset type 1 diabetes and a concomitant COVID-19 infection.

Table 1 main biological assessment

measures	Reference range	case
White cell count (per μL) Neutrophil count (per μL) Lymphocyte count (per μL) Platelet count (per μL) Hematocrit (%)	4000-10,000 1500-8000 1000-7000 150,000-450,000 F:37-47	5000 3000 1000 200,000 39%
HbA1c (%)	<6.5	6
Anti gad ab		+ve
PCR OF COVID 19		+ve
Blood urea (g/L) Creatinine (mg/dL)	15-45 0,1-2,8	normal
SARS-CoV-2 antibody test		+ve
CRP		-ve

Discussion

Globally, from the outbreak in December 2019 through January 1, 2021, 81,658,440 confirmed cases of COVID-19, including 1,802,206 deaths, have been reported to the WHO [3]. An epidemiological study conducted in China showed that 90% of 731 laboratory-confirmed COVID-19 patients under the age of 18 had asymptomatic, mild, or moderate infection, making it relatively mild than adult infection [4]. Type 1 diabetes mellitus (T1DM) or type 2 diabetes mellitus (T2DM) and underlying cardiovascular disease are considered risk factors for increased disease severity and mortality from coronavirus 2019 (COVID-19) [5]

Diabetic ketoacidosis (DKA) is a metabolic disorder caused by total or partial insulin deficiency that can be life- threatening in the absence or delay in treatment [6]. It is more common in children under 5 years old. DKA is defined biochemically as venous pH<7.3 or serum

bicarbonate concentration <15mmol/L, serum glucose concentration >11 mmol/L (>200 mg/dL) associated with ketonemia, glycosuria, and ketonuria [7].

Information regarding the occurrence of type 1 diabetes during COVID-19 infection in children is evolving rapidly as data continue to emerge around the world. In a retrospective study in China, 42 (6.4%) patients admitted with COVID-19 had ketosis, of which only 15 (35.7%) had known diabetes [8]. A German study found a significant increase in diabetic ketoacidosis and severe ketoacidosis at diabetes diagnosis in children and adolescents during the COVID-19 pandemic [9]. The causes of this increase can be multifactorial and can be explained by reduced medical services and the fear of COVID-19 contamination and therefore of approaching the healthcare system [9].

Infections are often considered the most common triggering factor for DKA in known cases diabetes. It is believed that certain viral diseases can precipitate type 1 autoimmune diabetes in genetically predisposed patients [10]. New-onset hyperglycemia has been described as the result of various infections, including HIV [11]. Serologic evidence of infection and viral isolation in the pancreas has been reported in a few cases of newly diagnosed diabetes [10, 12]. Interactions between COVID-19 infection and the renin-angiotensin-aldosterone system (RAAS) could explain the pathophysiology of DKA. The presence of angiotensin- converting enzyme 2 (ACE2) in significant amount in the endocrine part of the pancreas suggests that the coronavirus enters the islets using ACE2 as a receptor and causes destruction of these islets leading to acute diabetes mellitus [13]. In addition, the aberrant immunity elicited by SARS- CoV-2 may induce autoimmune destruction of pancreatic islet cells mimicking the pathogenesis of insulin-dependent diabetes [14].

Fluid infusion should be done with caution to avoid worsening the acute respiratory distress syndrome as angiotensin increases pulmonary vascular permeability and potentiates lung parenchyma damage [15].

However , there is a case series of two toddlers who developed insulin-dependent diabetes with DKA a few months after the diagnosis and treatment of Kawasaki disease [16]. These cases support the relationship between postinfection COVID-19 inflammation and pancreatic endocrine dysfunction leading to diabetes.

However, no one can confirm whether blood sugar disorders secondary to COVID-19 disease persist or go away when the infection clears. Does COVID-19 unmask the silently existing DM rather than induce the new DM in these patients , although for our patient and during about 18 months of follow up still she needs insulin subcutaneous injections regularly to control her blood sugar [17].

Finely it is very important to address the urgent problems of children like metabolic risks as hyperglycemia before the emergence of DKA

Conclusion

There is a hypothesis of a potential diabetogenic effect of COVID-19 in addition to the stress response often associated with serious illness. COVID-19 can also unmask existing DM by worsening its metabolic complications in some patients. An Extensive additional research is needed to confirm the reality of this hypothesis.

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