

Commentary

Diabetic ketoacidosis at presentation of type 1 diabetes in children in Canada during the COVID-19 pandemic

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Abstract

Type 1 diabetes is a common chronic illness in childhood. Diabetic ketoacidosis (DKA) is the leading cause of morbidity and mortality in children with type 1 diabetes. Early recognition of symptoms of diabetes and immediate initiation of treatment are important factors in preventing DKA at first presentation. We describe the numbers of children presenting with DKA at initial diagnosis across eight Canadian paediatric centres during the COVID-19 pandemic (March 15, 2020 to July 31, 2020) and compare this to the same time period in 2019. Comparing the pre-COVID to the COVID-19 time period, presentation in DKA increased from 36.4% to 55.0% ($P < 0.0001$) and presentation in severe DKA from 37.0% to 48.3% ($P = 0.044$). These findings are concerning and emphasize the importance of awareness of the signs and symptoms of diabetes. In addition, these findings raise concern about access to appropriate and timely care during the COVID-19 pandemic.

Keywords: *Children; Diabetic ketoacidosis; Type 1 diabetes*

Type 1 diabetes is one of the most common chronic illnesses in childhood and the incidence in Canada is amongst the highest in the world (1). Diabetic ketoacidosis (DKA) is the leading cause of morbidity and mortality in children with diabetes (2) and presentation in DKA at diagnosis is associated with poorer long-term glycaemic control (3).

Since the start of the COVID-19 pandemic in Canada, it has been our impression that there has been an increase in the severity of presentation of children with newly diagnosed type 1 diabetes. This impression has been reinforced by recent reports from Europe and the USA indicating an increase in DKA and severity of acidosis in children with type 1 diabetes at diagnosis (4–6). However, a report from Australia did not find a similar increase in DKA at presentation during COVID-19 (7). In order to confirm or refute our impression, and raise awareness among health care providers and the community if

appropriate, we looked at presentation in DKA at diagnosis in children with type 1 diabetes during the COVID-19 pandemic in Canada.

Across Canada, states of emergency related to COVID-19 were declared by the provinces and territories between March 13 and March 27, 2020. We thus reviewed the numbers of newly diagnosed children with type 1 diabetes, presentation in DKA and severity of DKA from March 15 through July 31, 2020 from eight paediatric tertiary care centres (BC Children's Hospital, Vancouver; Alberta Children's Hospital, Calgary; Stollery Children's Hospital, Edmonton; Winnipeg Children's Hospital, Winnipeg; Hospital for Sick Children, Toronto; Children's Hospital of Eastern Ontario, Ottawa; Montreal Children's Hospital, Montreal; and IWK Health Centre, Halifax). We compared these numbers to the same time period in 2019. DKA

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was defined as a pH <7.3 and HCO₃ < 15 mmol/L and severe DKA as a pH < 7.1.

Two hundred and sixty children were newly diagnosed with type 1 diabetes during the study period. This compares to 236 during the same period in 2019. The percent of children presenting in DKA was significantly higher in 2020 compared to the same time period in 2019 (55.0% [143/260] versus 36.4% [86/236]; P<0.0001). In addition, there was also an increase in the percentage of children presenting in severe DKA in the 2020 period compared to the same period in 2019 (48.3% [69/143] versus 33.3% [29/86]; P=0.044).

Our findings confirm those in a report from Germany that demonstrated an increase in DKA at presentation from 23.5% to 44.7% and severe DKA from 13.9% to 19.7% during the COVID-19 pandemic (4). We saw similar increases, though our rates are higher. Additional data from Italy indicates an increase in those presenting in severe DKA from 36% (pre-COVID) to 44.3% during the COVID-19 pandemic, comparable to our findings (5).

Our findings raise concern about the potential impact of the COVID-19 pandemic on the health of children presenting with type 1 diabetes. It is possible that there is hesitancy among families to seek medical care given the importance of social isolation during the pandemic. It is also possible that the move toward virtual medical visits may have contributed to the increase in DKA seen, given the limitations of such visits. The higher rates of severe DKA warrants effective prevention efforts as these patients are at the highest risk for serious consequences of DKA including cerebral injury and death. Severe DKA is managed in an intensive care setting and thus adds additional burden on a potentially scarce resource during a pandemic.

We also note unacceptably high rates of DKA at presentation of type 1 diabetes in the pre-COVID 19 period. Rates of DKA at first presentation of type 1 diabetes in children vary considerably around the world with an inverse relationship reported between the background incidence of type 1 diabetes and the frequency of DKA at presentation (8). In a multicentre report from the USA, Europe, and Australia, the rate of DKA at presentation ranged from 19% to 43.8% (9). The incidence of type 1 diabetes in Canada is among the highest in the world (10). Despite this, the rate of DKA at presentation of type 1 diabetes in Canadian children continues to be high and there is some evidence that the rate is increasing (11,12). These high rates continue to occur despite evidence of successful programs aimed at decreasing the frequency of DKA at presentation of type 1 diabetes in children. Over 20 years ago, an Italian public health campaign aimed at teachers, parents, students, schools, and paediatricians demonstrated a dramatic decrease in DKA at presentation from 78 to 12.5% (13). Similarly, a 2-year diabetes awareness campaign in Australia focusing on child care centres, schools and physician offices resulted in a decrease in children presenting in DKA from 37.5% to 13.8% (14).

It is important to note that we only looked at the rates of DKA in children who presented with type 1 diabetes. Type 2 diabetes is being seen with increased frequency in children in Canada. Whether or not the COVID-19 pandemic is associated with increased frequency of presentation in DKA in children with type 2 diabetes is not known but this report raises concerns and demands increased vigilance in all children.

Our findings highlight the importance of encouraging families to seek care if they have concerns about their children's health. Increased awareness of hyperglycemia symptoms (polyuria, polydipsia, nocturia, enuresis, and weight loss), among both the public and health care providers, is important. The urgency of immediate referral to an emergency department or paediatric diabetes service must be emphasized. As health care providers we must also strive to decrease barriers to accessing appropriate care for families. Longer term, systematic surveillance of potential impacts of the COVID-19 pandemic on children with diabetes is warranted.

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