Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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Letters to the editor

Euglycaemic ketoacidosis during gestational diabetes with concomitant COVID-19 infection

Ketoacidosis is a severe acute complication usually arising in patients with type 1 diabetes (T1D) due to insulin deficiency. Although ketoacidosis is uncommon during pregnancy, its consequences can be serious and lead to fetal death.

A 36-year-old woman (gravida 9, para 7) from the Democratic Republic of the Congo was admitted at 32 weeks of gestation to the intensive care unit (ICU) for coronavirus disease 2019 (COVID-19) infection. Her biochemical characteristics on admission are detailed in Table 1. She presented with severe euglycaemic metabolic acidosis and significant ketonaemia (15.3 mmol/L), and had gestational diabetes treated only with dietary measures, with an HbA1c at 6.1% (43.2 mmol/mol) on admission. She presented with a 3-day history of abdominal pain with nausea and vomiting associated with non-febrile dyspnoea. Because of the respiratory symptoms, COVID-19 was suspected and confirmed by polymerase chain reaction (PCR) positive for severe acute respiratory syndrome-related coronavirus 2 (SARS-CoV-2).

Treatment included intravenous normal saline, alkalinization with intravenous bicarbonates and insulin infusion (for 24 h). Due to suspected preeclampsia, the patient underwent emergency caesarean section and delivered a female infant weighing 2445 g. Plasma insulin, C-peptide, glucagon and free fatty acid levels were assessed 2 days after delivery and showed no indications of insulin deficiency or metabolic failure (Table 1).

Table 1
Patient's clinical and biochemical parameters on admission and 2 days later.

Data assessed on admission:	
Age (years)	36
Body mass index (kg/m^2) before pregnancy	35.2
Blood glucose (mmol/L)	6.2
HbA1c [% (mmol/mol)]	6.1 (43.2)
Haemoglobin (g/dL)	9.8
Arterial pH	7.22 (7.36–7.42)
PaCO2 (kPa)	1.9 (4.8–5.8)
PaO2 (kPa)	14.0 (10.0–13.0)
Bicarbonates (mmol/L)	5.8 (23.0–27.0)
Lactates (mmol/L)	1.1 (0.6–2.4)
Serum ketones[a] (mmol/L)	15.4 (<0.5)
Aspartate aminotransferase (% ULN)	2.1
Alanine aminotransferase (% ULN)	1.3
γ-glutamyltransferase (% ULN)	1.5
Data assessed 2 days after admission:	
Insulin (μU/mL)	19.5 (2.0–17.0)
C-peptide (ng/mL)	5.2 (0.4–4.0)
Glucagon[b] (ng/L)	188 (<209)
Free fatty acids[b] (μmol/L)	724 (250–800)

Normal laboratory values are presented in parentheses unless otherwise stated. HbA1c, glycated haemoglobin; PaCO2/PaO2, partial pressure of carbon dioxide/oxygen; ULN, upper limit of normal.
[a] β-serum ketones were measured using test strips.
[b] Measured after 12-h fasting.

Here, in this case report of a patient developing severe euglycaemic ketoacidosis during the third trimester of pregnancy, several risk factors were identified: gestational diabetes; acute starvation due to vomiting; and COVID-19 infection. While it has been well established that diabetes is one of the main comorbidities associated with severe forms of COVID-19, it remains unclear whether COVID-19 increases the risk of diabetic ketoacidosis. One case of inaugural ketoacidosis in T1D precipitated by COVID-19 infection has recently been reported [1] as well as a case series of diabetic ketoacidosis during COVID-19 infection [2]. Moreover, in a retrospective cohort of 658 patients hospitalized for COVID-19 [3], 42 (6.4%) presented with ketosis on admission. Of those patients, only 15 (35%) had a history of diabetes.

During pregnancy, the production of certain hormones (prolactin, human placental lactogen, progesterone, cortisol) promotes insulin resistance and increases the risk of ketoacidosis. In addition, as reported here and by others, normal blood glucose levels can also be associated with ketoacidosis. Several mechanisms may contribute to this phenomenon. During pregnancy, glycogenolysis, lipolysis and ketogenesis are all increased during fasting [4]. These physiological changes can lead to accelerated starvation, with the result that diabetic ketoacidosis develops more quickly and at lower levels of blood glucose than in non-pregnant women. Furthermore, several cases of euglycaemic ketoacidosis in pregnant women have been reported. Starvation ketoacidosis is caused by short periods of fasting and may be precipitated by stressful conditions, such as a viral infectious disease [5].

In conclusion, pregnancy must be considered a high-risk period for euglycaemic ketoacidosis even in non-diabetic women, particularly when associated with other stress factors such as an infectious disease. Ketone testing should be performed systematically in cases of vomiting in the third trimester to quickly establish the correct diagnosis and provide the appropriate treatment. In the context of COVID-19, which can worsen the clinical situation, all diabetologists should be especially aware of the possibility of euglycaemic ketoacidosis.

Conflicts of interest

None.

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