Starvation Ketoacidosis in Pregnancy and COVID-19

1. Euglycemic Diabetic Ketoacidosis With COVID-19 Infection in Patients With Type 2 Diabetes Taking SGLT2 Inhibitors.

Author(s): Vitale, Rebecca J; Valtis, Yannis K; McDonnell, Marie E; Palermo, Nadine E; Fisher, Naomi D L

Source: AACE clinical case reports; 2021; vol. 7 (no. 1); p. 10-13

Publication Date: 2021

Publication Type(s): Case Reports

PubMedID: 33521255

Available at AACE clinical case reports - from Unpaywall

Abstract: Objective: Diabetes mellitus is associated with poor outcomes in severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection. Diabetic ketoacidosis (DKA) has also been reported to occur with this virus. A cluster of cases of euglycemic DKA (euDKA) was identified in patients with type 2 diabetes mellitus using sodium-glucose cotransporter-2 inhibitors (SGLT2is) who developed SARS-CoV-2 infection. Methods: The cases were identified by the authors while providing clinical care, and details were collected. Results: Five cases of euDKA, presenting with glucose levels <300 mg/dL, were identified over the course of 2 months by the endocrinology consult service. All patients had a history of type 2 diabetes mellitus with no known history of DKA. All were taking SGLT2is. Oral antihyperglycemic medications were stopped for all patients on admission. All received intravenous insulin infusion to treat DKA before being transitioned to a subcutaneous insulin regimen. SGLT2i use was discontinued for all patients who were discharged. Conclusion: EuDKA has been seen in the setting of acute illness in patients using SGLT2is, but this cluster of cases suggests that there is a specific association with SARS-CoV-2 infection. In addition to the known risk of euDKA with SGLT2i use, coronavirus disease 2019-specific mechanisms may include a direct toxic effect of the virus on the pancreatic islets, an accelerated inflammatory response promoting ketosis, and the diuretic effect of SGLT2i in conjunction with anorexia and vomiting. It is crucial to counsel patients to stop SGLT2is when sick, especially if SARS-CoV-2 infection is suspected.
2. Euglycemic diabetic ketoacidosis associated with empagliflozin use in the course of the SARS-Cov-2 pandemic

**Author(s):** Ozer O.; Yorulmaz G.
**Source:** Journal of the College of Physicians and Surgeons Pakistan; 2021; vol. 30 (no. 10)
**Publication Date:** 2021
**Publication Type(s):** Article

**Abstract:** Sodium glucose cotransporter 2 (SGLT2) inhibitors are among the new generation oral anti-diabetic drugs that have started to be used in the treatment of type 2 diabetes mellitus. Although these drugs are highly beneficial, life-threatening side effects such as euglycemic diabetic ketoacidosis (eDKA) are reported with their use. In eDKA, metabolic acidosis and anion gap appear in blood gases and serum glucose in less than 200 mg/dl. This can delay diagnosis and treatment. In our case, a 42-year female presented to the Emergency Room with nausea and vomiting. It was observed that the patient had been using empagliflozin for a year. Her blood gas analyses and laboratory tests showed metabolic acidosis and ketosis. The patient was initially suspected to be a case of coronavirus disease-2019 (COVID-19) complicating the course of diabetes, finally it was diagnosed as a case of eDKA due to empagliflozin use. We noticed that during the current pandemic, some other diagnoses can be missed or their diagnosis can be delayed. Copyright © 2020 College of Physicians and Surgeons Pakistan. All rights reserved.

Database: EMBASE

3. Euglycemic DKA (euDKA) as a presentation of COVID-19

**Author(s):** Dass B.; Beck A.; Holmes C.; Morton G.
**Source:** Clinical Case Reports; Jan 2021; vol. 9 (no. 1); p. 395-398
**Publication Date:** Jan 2021
**Publication Type(s):** Article

**Available at Clinical Case Reports - from Europe PubMed Central - Open Access**
**Available at Clinical Case Reports - from ProQuest (Health Research Premium) - NHS Version**
**Available at Clinical Case Reports - from Unpaywall**

**Abstract:** COVID-19 in the setting of SGLT2 inhibitor use may precipitate euglycemic DKA separate from known acute viral illness and dehydration precipitants. There should be consideration of proactive discontinuation of these medications in these patients. Copyright © 2020 The Authors. Clinical Case Reports published by John Wiley & Sons Ltd.

Database: EMBASE
4. COVID-19 Precipitating Euglycaemic Diabetic Ketoacidosis with SGLT2 Inhibitor Use.

**Author(s):** Fang, Jiali; Genco, Matthew; Caskey, Rachel N  
**Source:** European journal of case reports in internal medicine; 2020; vol. 7 (no. 11); p. 001943  
**Publication Date:** 2020  
**Publication Type(s):** Journal Article  
**PubMedID:** 33194873  
**Abstract:** Objective To describe a patient who developed euglycaemic diabetic ketoacidosis (DKA) in the setting of SGLT2 inhibitor use precipitated by COVID-19. Patient and methods A 52-year-old male with type II diabetes on empagliflozin and no history of DKA presented with symptoms of COVID-19 as well as laboratory findings consistent with euglycaemic DKA. His hospital course was complicated by recurrent episodes of euglycaemic DKA as well as hyperglycaemic DKA. Conclusion SGLT2 inhibitors should be held as early as possible in COVID-19 cases due to the risk of euglycaemic DKA. These patients should also have more intense glucose monitoring. Learning points COVID-19 can precipitate euglycaemic DKA in diabetic patients taking SGLT2 inhibitors. Clinicians should be cognizant that the effects of SGLT2 inhibitors can persist for more than 72 hours after the last dose. Diabetic patients with COVID-19 require closer strict glucose monitoring to reduce the risk of DKA.

**Database:** Medline

5. Starvation-induced metabolic acidosis in a COVID-19-infected pregnant patient

**Author(s):** Mustafa M.R.  
**Source:** Journal of the American Society of Nephrology; 2020; vol. 31; p. 805  
**Publication Date:** 2020  
**Publication Type(s):** Conference Abstract  
**Abstract:** Introduction: Suffolk County in NY was hardest hit with COVID-19. We present a case of a pregnant female with COVID 19 infection and high anion gap acidosis. Case Description: 34 yo female, 33 weeks twin pregnancy, a/w fever, SOB and polyuria. Her oral intake was poor. She was positive for COVID 19. Her T - 100 F, O2 sat 99% with O2 by NC at 2 L. She had bibasilar crackles. Both babies were moving. CXR showed multifocal pneumonia. Nephrology was consulted for metabolic acidosis. A diagnosis of starvation ketosis of pregnancy was made due to anion gap acidosis, high serum beta-hydroxybutyrate and ketonueia. Dextrose 5% with sodium bicarbonate was given. She had C section, remained intubated for 24 hours, recovered well and was discharged on hospital day 7. Discussion(s): Almost 15% of pregnant patients develop server COVID 19, Pregnant patients with COVID infection are a higher risk group.

**Database:** EMBASE
6. A Case of Euglycemic Diabetic Ketoacidosis in a Patient With Type 2 Diabetes Mellitus and COVID-19.

**Author(s):** Morrison, Nathan; Barnett, Katherine; Tantum, Julianna; Morrison, Hannah K; Whalen, Michael

**Source:** Cureus; Dec 2020; vol. 12 (no. 12); p. e12029

**Publication Date:** Dec 2020

**Publication Type(s):** Case Reports

**PubMedID:** 33457131

Available at [Cureus](https://cureus.com) - from Europe PubMed Central - Open Access

Available at [Cureus](https://cureus.com) - from ProQuest (Health Research Premium) - NHS Version

Available at [Cureus](https://cureus.com) - from Unpaywall

**Abstract:** Diabetic ketoacidosis (DKA) can cause significant morbidity and mortality in patients with type 1 or type 2 diabetes mellitus. DKA causes an approximate annual hospitalization rate of 6.3% and in-hospital case-fatality rate of 0.4%. A subset of DKA cases termed euglycemic diabetic ketoacidosis (eu-DKA) is characterized by euglycemia (<200 mg/dL), high anion gap metabolic acidosis, and an increased plasma ketone concentration. This clinical syndrome comprises approximately 2.6% to 3.2% of total DKA admissions, making it a rare condition. In this case report, a male patient was diagnosed with coronavirus disease 2019 (COVID-19) three days prior to arriving at the emergency department. Upon evaluation, he displayed severe acidemia and was diagnosed with eu-DKA. He was started on intravenous regular insulin and D5 one-half normal saline, which markedly improved his metabolic status. Notably, his admission was uncomplicated by respiratory symptoms of COVID-19. It is proposed that his eu-DKA was catalyzed by his recent COVID-19 infection. Recent studies that have shown COVID-19 may increase lipolysis and induce ketogenesis in susceptible patients.

**Database:** Medline

**Author(s):** Batista, Daniel Valente; Vieira, Carla Antoniana Ferreira de Almeida; Costa, Thomaz Alexandre; Lima, Eduardo Gomes

**Source:** Diabetology international; Oct 2020; p. 1-4

**Publication Date:** Oct 2020

**Publication Type(s):** Case Reports

**PubMedID:** 33133998

Available at Diabetology international - from SpringerLink - Medicine

Available at Diabetology international - from Unpaywall

**Abstract:** Type 2 diabetes mellitus (DM) patients are at high risk for the development of severe COVID-19. Euglycemic diabetic ketoacidosis (eu-DKA) is a rare life-threatening complication associated with the use of SGLT2 inhibitor that may be unnoticed, particularly in a pandemic setting, due to the absence of significant hyperglycemia, delaying its treatment. In this report, we describe a case of a 56-year-old patient who presented an elevated anion gap metabolic acidosis during a SARS-CoV-2 infection and was diagnosed with SGLT2-associated eu glycemic diabetic ketoacidosis. COVID-19 may increase patients' insulin demand, present gastrointestinal symptoms, and increase the production of ketone bodies. This situation can be worsened in susceptible diabetic patients on SGLT2 inhibitors, due to the persistent glycosuria, which can cause volume depletion. Recently some authors recommended that insulin-deficient patients or those using SGLT2 inhibitors should monitor for ketosis using available home testing kits in case of infections and should discontinue the medication in case of COVID-19. Given the increased use of this drug class in the management of type 2 DM patients due to its reduction of cardiovascular risk, we set out to emphasize the importance for the medical community to consider the possibility of eu-DKA on SARS-CoV-2-infected patients using SGLT2 inhibitors, so physicians can provide these patients with appropriate therapy promptly.

**Database:** Medline


**Author(s):** Marina, Djordje; Mathiesen, Elisabeth R; Klose, Marianne; Pedersen, Berit Woetmann; Ringholm, Lene

**Source:** Acta diabetologica; Oct 2020; vol. 57 (no. 10); p. 1267-1270

**Publication Date:** Oct 2020

**Publication Type(s):** Journal Article

**PubMedID:** 32607650

Available at Acta diabetologica - from SpringerLink - JUSTICE Consortium Package

**Database:** Medline
9. SEVERE STARVATION KETOSIS DURING EARLY SECOND TRIMESTER PREGNANCY: A CASE REPORT

Author(s): Ali A.; Adejo E.; Pesola G.
Source: Chest; Oct 2020; vol. 158 (no. 4)
Publication Date: Oct 2020
Publication Type(s): Conference Abstract

Abstract: SESSION TITLE: Medical Student/Resident Critical Care Posters SESSION TYPE: Med Student/Res Case Rep Postr PRESENTED ON: October 18-21, 2020 INTRODUCTION: Severe starvation ketoacidosis (SKA) is rare with the majority of cases described in the third trimester of pregnancy. Here, we present a case of severe SKA in early second trimester of pregnancy that readily responded to treatment. CASE PRESENTATION: A 36-year-old female with a past medical history of Charcot-Marie-Tooth Disease and gastro-esophageal reflux disease (GERD) presented to the emergency department of our hospital with a one week history of non bilious and non bloody vomiting without associated abdominal pain. She had no history of diabetes mellitus or hypertension. She was not on regular medications. She occasionally smoked marijuana but denied alcohol, cigarette smoking or drug use. Initial Physical exam revealed; Blood pressure 106/56 mmHg, Heart rate 102 beats/min, Temp 98.0 F, Respiratory rate 22 cycles/min and body mass index (BMI) of 29 kg/m2. Examination was otherwise normal except for weakness of upper extremities (consistent with her underlying condition). Initial laboratory work-up was significant for a serum bicarbonate of 6 mmol/L (ref range 22-28 mmol/L), pH 7.30, pCO2 18 mmHg, lactate 1.1 (ref range 0.3-1.3 mmol/L), sodium 137 (ref range 135-145 mmol/L), potassium 3.3 (ref range 3.5-5 mmol/L), chloride 108 (ref range 98-107 mmol/L), anion gap 23 (ref range 6-18 mEq/L), phosphorus 1.8 (ref range 2.5-4 mg/dl), magnesium 1.7 (ref range 1.6-2.6 mg/dl), BUN; 1.0 mg/dL, creatinine of 0.3 mg/dL, glucose 85 mg/dL, beta hydroxy-butyrate 3.57 (normal <0.27 mmol/L) and urine ketones 3+ positive. Her serum lipase was normal. Pregnancy test was positive (the patient was not aware of being pregnant). The patient was assessed by the obstetric team and a pelvic Ultrasound validated a 14 weeks viable pregnancy. Urine drug screen was negative. Serum drug screen was negative for salicylates, alcohol, and acetaminophen. A diagnosis of severe starvation ketoacidosis was made and the patient was admitted to the medical intensive care unit (MICU). She was started on intravenous Dextrose 5%/Lactated Ringer and electrolytes were replaced. Thiamine, folic acid along with a brief period of sodium bicarbonate were given intravenously. Within 36 hours of admission serum bicarbonate increased to 22 mmol and pH normalized. DISCUSSION: In non-pregnant population, starvation ketoacidosis (SKA) takes several weeks to develop and is usually mild to moderate with serum bicarbonate in the teens at worst. Third trimester pregnancy is known to result in severe SKA which can start to develop within 12-24 hours of starvation. In our patient, her early second trimester pregnancy also resulted in a severe metabolic acidosis with very low serum bicarbonate. Therefore, this condition can also occur before the third trimester of pregnancy. CONCLUSION(S): Severe starvation ketoacidosis can occur in earlier weeks of pregnancy. Intravenous dextrose and isotonic fluids are the mainstay of treatment. Reference #1: 1. Mubarik, A., Jupalli, A., Iqbal, A., Iqbal, A. M., Muddassir, S., & Eddib, A. (2019). Isolated Starvation Ketoacidosis: A Rare Cause of Severe Metabolic Acidosis Presenting with a pH Less than 7. Cureus. Reference #2: 2. Parker, J. A., & Conway, D. L. (2007). Diabetic Ketoacidosis in Pregnancy. Obstetrics and Gynecology Clinics of North America, 34(3), 533-543. Reference #3: 3. Chausse, J. M., Paruk, F., Motilall, S., Soma-Pillay, P., & Ndaba, S. (2018). Starvation ketoacidosis in pregnancy presenting as euglycaemic, high anion gap metabolic acidosis: A case report highlighting the significance of early recognition and prompt intervention. South African Medical Journal, 108(8), 636. DISCLOSURES: No relevant relationships by Elizabeth Adejo, source=Web Response No relevant relationships by Abdulla Ali, source=Web
10. Euglycaemic ketoacidosis during gestational diabetes with concomitant COVID-19 infection.

**Author(s):** Smati, Sarra; Mahot, Pascale; Bourdiol, Alexandre; Ploteau, Stéphane; Hadjadj, Samy; Cariou, Bertrand

**Source:** Diabetes & metabolism; Jul 2020 ; p. 101181

**Publication Date:** Jul 2020

**Publication Type(s):** Letter

**PubMedID:** 32738403

Available at Diabetes & metabolism - from Unpaywall

**Database:** Medline


**Author(s):** Oriot, Philippe; Hermans, Michel P

**Source:** Acta clinica Belgica; Jun 2020 ; p. 1-5

**Publication Date:** Jun 2020

**Publication Type(s):** Journal Article

**PubMedID:** 32544373

Available at Acta clinica Belgica - from Unpaywall

**Abstract:** OBJECTIVE Recent publications on Coronavirus Disease-2019 (COVID-19) report that diabetic people with or without co-morbidities are at higher risk of developing severe and/or fatal illnesses. METHOD AND RESULT We report the first case of a 60-year-old man with a 27-year history of type 1 diabetes mellitus, infected by SARS-CoV-2 presenting with an euglycaemic ketoacidosis and an acute respiratory distress syndrome. CONCLUSION This case report reminds us of the importance of adjusting more recent glucose-lowering drugs, including sodium-glucose cotransporter 2 inhibitors, in the overall management of type 1 diabetic individuals during the ongoing COVID-19 outbreak. ABBREVIATIONS COVID-19: Coronavirus disease 2019 (SARS-CoV-2) virus, T1DM: Type 1 diabetes mellitus, T2DM: Type 2 diabetes mellitus, SGLT2i: Sodium-glucose cotransporter 2 inhibitor, DKA: diabetic ketoacidosis, euDKA: euglycaemic diabetic ketoacidosis.

**Database:** Medline

**Author(s):** Yaron, Marianna; Shalit, Roi; Kreiser, Doron; Cukierman-Yaffe, Tali; Yoeli, Rakefet

**Source:** European journal of obstetrics, gynecology, and reproductive biology; May 2020; vol. 248; p. 257-258

**Publication Date:** May 2020

**Publication Type(s):** Letter Case Reports

**PubMedID:** 32171603

**Database:** Medline


**Author(s):** Choy K.H.

**Source:** Internal Medicine Journal; May 2020; vol. 50; p. 15-16

**Publication Date:** May 2020

**Publication Type(s):** Conference Abstract

Available at Internal Medicine Journal - from Wiley Online Library Science, Technology and Medicine Collection 2019

Available at Internal Medicine Journal - from Unpaywall

**Abstract:** Background: Lactation ketoacidosis is a rare cause of high anion gap metabolic acidosis (HAGMA). We report a case of lactation ketoacidosis in a non-diabetic postpartum woman. The pathophysiology of this condition is presented here. Case Presentation: A 20-year-old twelve weeks postpartum woman who was exclusively breastfeeding her child presented with two days of severe nausea and vomiting. Following the delivery of her child, she had been having irregular small meals with minimal calorie intake per day. Her pregnancy and medical history were unremarkable. She was not on any regular medications and denied any alcohol consumption or toxin ingestion. There was no history of eating disorder. Physical examination revealed tachycardia (heart rate: 119 beats per minute) and mild epigastric tenderness with a soft abdomen. She had a normal body mass index and exhibited no signs of malnutrition. Investigations revealed severe non-diabetic ketoacidosis: pH, 7.13; anion gap, 25 mmol/L; pCO2, 25 mmHg; bicarbonate, 8 mmol/L; plasma glucose, 4.4 mmol/L; and point-of-care ketone, 5.7 mmol/L. Other causes of raised anion gap metabolic acidosis were excluded: lactate was normal and further history did not reveal any alcohol or toxin ingestion. Creatinine level was mildly raised at 99 mumol/L (30-90 mumol/L), indicating pre-renal renal impairment. Full blood count, lipase and liver enzymes were unremarkable. Outcome(s): A diagnosis of lactation ketoacidosis was made. Dextrose 5% infusion was promptly administered. Symptomatic and biochemical improvement occurred within the first 12 hours of admission. On day two of her hospital admission, the patient was discharged home with advice to ensure enough energy intake and to avoid prolonged fasts while breastfeeding. Discussion(s): The differential diagnosis for high anion gap metabolic acidosis is broad. Lactation ketoacidosis is a rare cause of raised anion gap metabolic acidosis precipitated by starvation-induced reversal of the normal glucagon: insulin ratio with ongoing obligate caloric loss from breastfeeding. While fasting under ordinary circumstances produces mild acidosis at maximum, it can be dangerous during lactation. The increased energy requirements of lactation cause enhanced gluconeogenesis, decreased insulin secretion, lipolysis and can subsequently induce ketogenesis. There is an energy loss of approximately 500 kcal per day more than non-lactating women as a result of breastfeeding. The metabolic demands of
breastfeeding coupled with carbohydrate deficiency put lactating women at risk of ketoacidosis.2,3 There have been only a few reported cases of lactation ketoacidosis and precipitating factors include fasting in the context of an acute illness and low-carbohydrate diets. Energy replacement and rehydration resulted in complete symptomatic and biochemical resolution in all cases.1-4

Conclusion(s): This case highlights the importance of lactation ketoacidosis as a differential diagnosis of raised anion gap metabolic acidosis. Awareness of this potential cause of ketoacidosis is vital for early recognition and appropriate management. Glucose administration is the mainstay of treatment. Education regarding the nutrition requirements during breastfeeding is essential.

Database: EMBASE


Author(s): Muppidi, Vijayadershan; Meegada, Sreenath; Challa, Tejo; Siddamreddy, Suman; Samal, Subhankar

Source: Cureus; Mar 2020; vol. 12 (no. 3); p. e7331

Publication Date: Mar 2020

Publication Type(s): Case Reports

PubMedID: 32313772

Available at Cureus - from Europe PubMed Central - Open Access

Available at Cureus - from ProQuest (Health Research Premium) - NHS Version

Available at Cureus - from Unpaywall

Abstract: Diabetic ketoacidosis (DKA) is a life-threatening diabetic complication and medical emergency. Euglycemic DKA (EKDA) is a variant of DKA with normal range glucose levels. The condition can be difficult to diagnose due to the misleading euglycemic levels. Pregnancy, infection, low-calorie intake, and use of insulin are some of the common etiologies of EKDA. We report a case of a young, pregnant female, with type I diabetes mellitus, in her third trimester admitted with EKDA. The EKDA was triggered by urinary tract infection (UTI), and the patient had other etiologies that have predisposed her to EKDA. Along with the case presentation, we discuss the common etiologies, pathophysiology, and management of EKDA. Euglycemic DKA is a life-threatening emergency that needs to be recognized early and treated aggressively, especially in pregnant patients, to avoid deleterious effects to maternal and fetal health.

Database: Medline
15. Euglycemic Diabetic Ketoacidosis in Pregnancy.

**Author(s):** de Alencar, Júlio César Garcia; da Silva, Geovane Wiegelling; Ribeiro, Sabrina Correa da Costa; Marchini, Júlio Flavio Meirelles; Neto, Rodrigo Antonio Brandao; de Souza, Heraldo Possolo

**Source:** Clinical practice and cases in emergency medicine; Feb 2020; vol. 4 (no. 1); p. 26-28

**Publication Date:** Feb 2020

**Publication Type(s):** Case Reports

**PubMedID:** 32064418

Available at [Clinical practice and cases in emergency medicine](#) - from ProQuest (Health Research Premium) - NHS Version

Available at [Clinical practice and cases in emergency medicine](#) - from Unpaywall

**Abstract:** The clinical presentation of diabetic ketoacidosis in pregnancy (DKP) is similar to that observed in nonpregnant women, although reports suggest the presenting blood glucose level may not be as high. It is hypothesized that lower, maternal fasting glucose levels are a result of both the fetus and the placenta consuming glucose. We report the case of a 38-year-old woman gravida 2, para 0, abortion 1 with type 1 diabetes who had euglycemic diabetic ketoacidosis and review the literature on DKP, with a focus on diagnosis, treatment, and monitoring of the mother and fetus.

**Database:** Medline


**Author(s):** Jaber, Johnny F; Standley, Matthew; Reddy, Raju

**Source:** Case reports in critical care; 2019; vol. 2019; p. 8769714

**Publication Date:** 2019

**Publication Type(s):** Case Reports

**PubMedID:** 31531246

Available at [Case reports in critical care](#) - from Europe PubMed Central - Open Access

Available at [Case reports in critical care](#) - from Hindawi Open Access Journals

Available at [Case reports in critical care](#) - from Unpaywall

**Abstract:** Diabetic ketoacidosis (DKA) in pregnancy is associated with high fetal mortality rates. A small percentage of DKA occurs in the absence of high glucose levels seen in traditional DKA. Prompt recognition and management is crucial. We report a case of a 30-year-old pregnant woman with type 1 diabetes mellitus admitted with euglycemic DKA (blood glucose <200 mg/dL). Initial laboratory testing revealed a severe anion gap acidosis with pH 7.11, anion gap 23, elevated β-hydroxybutyric acid of 9.60 mmol/L, and a blood glucose of 183 mg/dL—surprisingly low given her severe acidosis. The ketoacidosis persisted despite high doses of glucose and insulin infusions. Due to nonresolving acidosis, her hospital course was complicated by spontaneous intrauterine fetal demise. Euglycemia and severe acidosis continued to persist until delivery of fetus and placenta occurred. It was observed that the insulin sensitivity dramatically increased after delivery of fetus and placenta leading to rapid correction of ketoacidosis. This case highlights that severe ketonemia can occur despite the absence of severely elevated glucose levels. We discuss the mechanism that leads to this pathophysiologic state and summarize previously published case reports about euglycemic DKA in pregnancy.

**Database:** Medline
17. Severe acidemia in pregnancy with de novo acute myeloid leukemia

Author(s): Vega K.L.; Melendez I.E.O.; Cintron-Rosa F.B.; Lopez S.C.; Rivera-Bermudez C.G.

Source: Journal of the American Society of Nephrology; 2019; vol. 30 ; p. 1208-1209

Publication Date: 2019

Publication Type(s): Conference Abstract

Abstract: Introduction: Starvation ketoacidosis is an important cause of acidosis in pregnancy, specifically after the second trimester. A day of severe vomiting is enough to trigger this serious disorder and its presence should prompt physician to seek for exacerbating causes. We present a case of severe metabolic acidosis in a pregnant woman with underlying acute myeloid leukemia (AML). Case Description: A 28-year-old woman at 35 weeks of gestation with a 5-day history of vomiting, pelvic and back pain, and dysuria was transferred to our institution with acidemia, pyelonephritis, suspected acute leukemia and preterm labor. Volume repletion with Lactated Ringer’s solution and empiric antibiotherapy were given but acidosis worsened. Pregnancy was complicated at 28 weeks by nephrolithiasis with associated right-sided hydronephrosis requiring JJ placement. Physical exam revealed tachypnea, tachycardia and right costovertebral angle tenderness. Pertinent blood laboratory results were WBC 18 (109/l), blasts 74 (109/l), ANC 965 cells/l, Hgb 10.5 g/dl, platelets 124 (109/l), pH 7.21, pCO2 < 12.9 mmHg, HCO3 4.8 mmol/l, potassium 4.4 mmol/l, anion gap (AG) 28.5 mmol/l, delta ratio 0.8, creatinine 0.51 mg/dl, glucose 97 mg/dl, L-lactate 6.2 mg/dl and moderate ketones. Urinalysis showed pH 5, ketones 150, pyuria, hematuria, no glucose, and AG 67. Intravenous bicarbonate in dextrose was started and 24 hours after, patient had significant improvement of acidosis and was able to initiate oral intake, which lead to its resolution. Vaginal delivery was successfully achieved 4 days after our initial evaluation. Bone marrow was performed revealing AML. Discussion(s): Pregnancy associated starvation ketoacidosis is mediated by relative insulin deficiency and enhanced lipolysis. Carbohydrate in dextrose solution more than bicarbonate administration lead to improvement of AG metabolic acidosis as the culprit of the disturbance was starvation. Our patient had life-threatening acidemia that can be explained by poor oral intake concomitantly with immunosuppressed state and infectious process leading to preterm labor. RTA was considered but in the setting of high urine unmeasured anions due to ketoacidosis, urine AG was not reliable. Identification of acidemia etiology and rapid treatment was paramount to avoid further fetal and maternal complications including fetal demise.

Database: EMBASE

18. A case of euglycemic diabetic ketoacidosis in a pregnant patient

Author(s): Reddy R.; Jaber J.

Source: American Journal of Respiratory and Critical Care Medicine; May 2019; vol. 199 (no. 9)

Publication Date: May 2019

Publication Type(s): Conference Abstract

Abstract: Euglycemic diabetic ketoacidosis (EDKA) is biochemical triad consisting of blood glucose < 200 mg/dL, increased anion gap metabolic acidosis and ketonemia. The incidence of EDKA is reportedly between 0.8-1.1% of all pregnant DKA cases. The presence of euglycemia makes it a diagnostic challenge since it masquerades underlying ketonemia. As a result, EDKA can frequently go
unrecognized. Prompt recognition of EDKA is critical in pregnancy since perinatal mortality in untreated diabetic ketoacidosis (DKA) is as high as 35%. We report a case of EDKA in a pregnant woman and discuss the management challenges in a patient with euglycemia and a high ketone burden. Our case is a 30-year-old G2P0101 woman who presented at 32 weeks, 3 days gestational age with a past medical history of type 1 diabetes mellitus on an insulin pump and seizures who presented with a 2-day history of nausea and vomiting. On exam, she appeared uncomfortable and had Kussmaul breathing. Fetal heart monitoring showed absent variability and recurrent late decelerations. Admission labs were significant for blood glucose of 165 mg/dL, pH 7.11, anion gap (AG) 23 and beta-hydroxybutyrate (BHA) 9.6 mmol/L (normal 0.02 - 0.27 mmol/L). Due to absence of hyperglycemia, she was started on a low dose insulin drip. Her hospital course was complicated by worsening acidosis, more frequent late decelerations, and eventually respiratory distress requiring intubation. Due to severe acidosis, the patient was not a surgical candidate for emergent fetal evacuation. Unfortunately, the patient experienced an intrauterine fetal demise due to persistent acidosis. The patient’s hyperglycemia began to worsen and her insulin dosing was increased appropriately. Her acidosis, AG and ketonemia then improved. The decision was made to induce labor. She had a spontaneous vaginal delivery and was extubated on postpartum day 2. This case highlights the diagnostic challenge of DKA in the absence of hyperglycemia. Euglycemia in the mother is a result of increased glucose uptake by the fetoplacental unit. This occurs due to an upregulation of placental glucose transporter type 1 receptor during the third trimester. As a result of increased glucose uptake by the fetus, venous blood glucose levels can be normal despite a high ketone burden, posing a formidable diagnostic challenge. Despite euglycemia, patients require high doses of insulin and dextrose to treat the ketonemia. Because the acidemia takes much longer to correct, insulin should be continued even in a euglycemic state.

Database: EMBASE

19. Nondiabetic ketoacidosis in a pregnant woman due to acute starvation with concomitant influenza A (H1N1) and respiratory failure.
Author(s): Skalley, G; Rodríguez-Villar, S
Source: Revista espanola de anestesiologia y reanimacion; 2018; vol. 65 (no. 7); p. 407-412
Publication Date: 2018
Publication Type(s): Case Reports Journal Article
PubMedID: 29500057
Abstract: Threatening refractory metabolic acidosis due to short-term starvation nondiabetic ketoacidosis is rarely reported. Severe ketoacidosis due to starvation itself is a rare occurrence, and more so in pregnancy with a concomitant stressful clinical situation. This case report presents a nondiabetic woman admitted in intensive care for respiratory failure type 1 during the third trimester of pregnancy with a severe metabolic acidosis refractory to medical treatment. We diagnosed the patient with acute starvation ketoacidosis based on her history and the absence of other causes of high anion gap metabolic acidosis after doing a rigorous analysis of her acid-base disorder.
Database: Medline
20. Euglycemic Diabetic Ketoacidosis in the ICU: 3 Case Reports and Review of Literature.

Author(s): Lucero, Pablo; Chapela, Sebastián

Source: Case reports in critical care; 2018; vol. 2018 ; p. 1747850

Publication Date: 2018

Publication Type(s): Case Reports

PubMedID: 30364093

Available at Case reports in critical care - from Europe PubMed Central - Open Access

Available at Case reports in critical care - from Hindawi Open Access Journals

Available at Case reports in critical care - from Unpaywall

Abstract: Diabetic ketoacidosis (DKA) is an acute complication of diabetes mellitus, both type I and type II, as well as other types with diabetes such as gestational diabetes mellitus. It is characterized by blood glucose levels greater than 250 mg/dL and metabolic acidosis (pH < 7.3 and serum bicarbonate < 15 mEq/dL) with an increased anion gap and the presence of ketone bodies in the blood or urine. Within this pathology, there is a subgroup of pathologies which are characterized by being present with no signs of hyperglycemia, posing a diagnostic challenge due to the absence of the main sign of the pathology and the diversity of their pathophysiology. In this article, we will present 3 clinical cases with 3 different forms of clinical presentation: a case of DKA in pregnancy, a case of DKA associated with the use of sodium-glucose cotransporter 2 (SGLT-2) inhibitors, and a third case related to sepsis, together with a narrative review of the literature on the topic.

Database: Medline

21. Starvation ketoacidosis in pregnancy presenting as euglycaemic, high anion gap metabolic acidosis: A case report highlighting the significance of early recognition and prompt intervention.

Author(s): Chausse, J M; Paruk, F; Motilall, S; Soma-Pillay, P; Ndaba, S

Source: South African medical journal = Suid-Afrikaanse tydskrif vir geneeskunde; Jul 2018; vol. 108 (no. 8); p. 636-639

Publication Date: Jul 2018

Publication Type(s): Case Reports Journal Article

PubMedID: 30182878

Available at South African medical journal = Suid-Afrikaanse tydskrif vir geneeskunde - from Unpaywall

Abstract: Starvation ketoacidosis (SKA) constitutes an important consideration in the pregnant patient who presents with profound metabolic acidosis. Pregnancy-related changes predispose the patient to develop SKA following relatively short periods (12 - 14 hours) of 'starvation'. Patients also typically look clinically well in relation to the significant metabolic derangements that accompany the condition. Prompt recognition and early institution of appropriate therapy is therefore extremely important in terms of optimising maternal and fetal outcome. We describe a pregnant patient with SKA who presented with profound euglycaemic ketoacidosis that resolved rapidly following the early initiation of appropriate therapy. Furthermore, appropriate therapy resulted in our patient avoiding the need for an emergency caesarean section, which is often reported in this scenario. The ensuing discussion addresses SKA in pregnancy, the unique features of our patient, and management considerations from a maternal and fetal perspective. We also discuss the various causes of
ketoacidosis such as diabetic ketoacidosis (DKA), euglycaemic DKA, alcohol-induced euglycaemic ketoacidosis and SKA in pregnant patients.

Database: Medline

22. Acute starvation ketoacidosis in pregnancy with severe hypertriglyceridemia: A case report.

Author(s): Hui, Li; Shuying, Li

Source: Medicine; May 2018; vol. 97 (no. 19); p. e0609

Publication Date: May 2018

Publication Type(s): Case Reports Journal Article

PubMedID: 29742696

Available at Medicine - from Europe PubMed Central - Open Access
Available at Medicine - from IngentaConnect - Open Access
Available at Medicine - from Ovid (Journals @ Ovid)
Available at Medicine - from Ovid (Journals @ Ovid) - London Health Libraries
Available at Medicine - from Ovid (LWW Total Access Collection 2019 - with Neurology)
Available at Medicine - from Unpaywall

Abstract:
RATIONALE: Pregnant women are more prone to ketosis due to the relative insulin resistance, accelerated lipolysis and increased free fatty acids. PATIENT CONCERNS: We report a pregnant woman with hyperlipidemia, who experienced severe metabolic acidosis after a short period of starvation. DIAGNOSES: Based on her clinical symptoms, exclusion diagnosis and therapeutic diagnosis, her condition was diagnosed as starvation ketoacidosis. INTERVENTIONS: An emergency caesarean section under general anesthesia was implemented 2 hours after her admission. The metabolic acidosis was treated with fluid resuscitation using compound sodium lactate, bicarbonate, and 5% dextrose together with insulin 6U. OUTCOMES: Both mother and baby were discharged clinically well.

LESSONS: Starvation ketoacidosis may happen in special patient who was in pregnancy and with severe hypertriglyceridemia, after just one day fasting and vomiting.

Database: Medline
23. Euglycaemic ketoacidosis in a non-diabetic primigravida following an appendicectomy.

**Author(s):** Dikowita, Dinushi Dilanka; Kumanan, Thirunavukarasu; Muhunthan, Kopalasuntharam; Arulmoli, Janaki

**Source:** SAGE open medical case reports; 2017; vol. 5; p. 2050313X17700743

**Publication Date:** 2017

**Publication Type(s):** Case Reports

**PubMedID:** 28540053

Available at [SAGE open medical case reports](https://open.sagepub.com) - from Europe PubMed Central - Open Access

Available at [SAGE open medical case reports](https://open.sagepub.com) - from Unpaywall

**Abstract:** Pregnancy creates significant alterations in energy metabolism which itself is a physiological adaptation to provide continuous flow of energy metabolites to the foetus. The state of insulin resistance created by hormonal changes in pregnancy enables free flow of glucose to the foetus and allows its absorption through facilitated diffusion. As glucose is preferentially available for the foetus, maternal fasting glucose level would be less than that of a non-pregnant state and in contrast plasma ketones and free fatty acids levels are elevated, resulting in a state of accelerated starvation. These metabolic alterations place a pregnant woman at a higher risk of developing euglycaemic ketoacidosis when allowed to fast for prolonged periods due to medical, surgical and psychological reasons. We report a rare case of euglycaemic ketoacidosis causing severe increased anion gap metabolic acidosis in a non-diabetic mother following surgery for appendicitis at a gestation of 27 weeks.

**Database:** Medline

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24. Life threatening starvation ketoacidosis in pregnancy

**Author(s):** Harrison J.A.; Churchill S.; Stacey M.; Collis R.

**Source:** International Journal of Obstetric Anesthesia; May 2017; vol. 31

**Publication Date:** May 2017

**Publication Type(s):** Conference Abstract

Available at [International Journal of Obstetric Anesthesia](https://www.sciencedirect.com) - from Unpaywall

**Abstract:** Introduction: Severe metabolic acidosis in pregnancy can have significant consequences for mother and fetus. We describe a case of life-threatening metabolic ketoacidosis with normal lactate and a high anion gap in a previously healthy non-diabetic woman. Case report: A 28-year-old woman was admitted at 35 weeks of gestation with severe vomiting of uncertain aetiology, although she had required antiemetics, omeprazole and ranitidine during pregnancy. Urine dipstick revealed ++ ketones. She was managed with intravenous antiemetics including hydrocortisone and crystalloids. On day 4 her condition deteriorated over 4 hours: respiratory rate increased from 18 to 32 breaths/min, heart rate from 90 to 140 beats/min. Arterial blood gas showed: pH 7.15, PO2 16.7, PCO2 1.34, Cl 110, HCO3 7.5, B.E.-24.5, lactate 1.4, anion gap 22.5. Urine dipstick showed +++ ketones and blood ketones were 6.5. Fluid resuscitation with 10% dextrose and 1.4% bicarbonate was given on the advice of an intensivist with some immediate improvement and an emergency caesarean section performed under spinal anaesthesia. A live male infant was delivered in good condition with cord blood pH 7.29 but a BE of-15.5. Immediately after delivery she felt better and was able to tolerate sugary drinks without vomiting. The next day her blood gas showed pH 7.35,
PCO2 4.15, HCO3 18.3, B.E.-7.8 and no ketosis. Discussion(s): Severe starvation ketoacidosis is a rare emergency of pregnancy and our case demonstrates rapid decompensation with the need for urgent resuscitation and delivery. Pregnancy induces a respiratory alkalosis with a compensatory metabolic acidosis with low bicarbonate from renal compensation. This reduces buffer capacity should the mother become acutely unwell.1 Insulin resistance of pregnancy leads to accelerated ketoacidosis during starvation, 2 and in our case may have been exacerbated by administration of corticosteroids. We also hypothesise that the reduced acidity of vomit, because of her antacid medication, may have exacerbated her acidosis. This case demonstrates the importance of glucose administration for ketosis in pregnancy, and giving intravenous dextrose on admission may have avoided this emergency. It demonstrated the rapidity of decompensation and the need for urgent resuscitation with advice from an intensivist. We also feel that with a partly compensatory respiratory alkalosis with a PCO2 of 1.34, a rise in CO2 during mechanical ventilation, should she have had a general anaesthetic, may have led to a catastrophic and life-threatening fall in her pH and was therefore avoided.

Database: EMBASE

25. Starvation ketoacidosis
Author(s): Frise C.J.; Mackillop L.
Source: Journal of the Intensive Care Society; Nov 2016; vol. 17 (no. 4); p. 356
Publication Date: Nov 2016
Publication Type(s): Article
Available at Journal of the Intensive Care Society - from Unpaywall
Database: EMBASE

26. Ketoacidosis in diabetic pregnancy
Author(s): Dalfra M.G.; Burlina S.; Sartore G.; Lapolla A.
Source: Journal of Maternal-Fetal and Neonatal Medicine; Sep 2016; vol. 29 (no. 17); p. 2889-2895
Publication Date: Sep 2016
Publication Type(s): Review
PubMedID: 26461169
Abstract:Abstract: Diabetic ketoacidosis (DKA) is a serious medical and obstetrical emergency previously considered typical of type 1 diabetes but now reported also in type 2 and GDM patients. Although it is a fairly rare condition, DKA in pregnancy can compromise both fetus and mother. Metabolic changes occurring during pregnancy predispose to DKA in fact it can develop even in setting of normoglycemia. This article will provide the reader with information regarding the pathophysiology underlying DKA, in particular euglycemic DKA, and will provide information regarding all possible effects of ketones on the fetus. Copyright © 2015 Taylor & Francis.
Database: EMBASE
27. Short-term starvation with a near-fatal asthma attack induced ketoacidosis in a nondiabetic pregnant woman: A case report.

Author(s): Wei, Kuang-Yu; Chang, Shan-Yueh; Wang, Sheng-Huei; Su, Her-Young; Tsai, Chen-Liang

Source: Medicine; Jun 2016; vol. 95 (no. 26); p. e4042

Publication Date: Jun 2016

Publication Type(s): Case Reports Journal Article

PubMedID: 27368034

Available at Medicine - from Europe PubMed Central - Open Access
Available at Medicine - from Ovid (Journals @ Ovid) - London Health Libraries
Available at Medicine - from Ovid (LWW Total Access Collection 2019 - with Neurology)
Available at Medicine - from Unpaywall

Abstract: Life-threatening refractory metabolic acidosis due to starvation ketoacidosis is rarely reported, even among nondiabetic pregnant women, and may be overlooked. Furthermore, stressful situations may increase the acidosis severity. In the present case, a nondiabetic multiparous woman was admitted for a near-fatal asthma attack and vomiting during the third trimester of pregnancy. She was intubated and rapidly developed high anion gap metabolic acidosis. We diagnosed the patient with starvation ketoacidosis based on vomiting with concomitant periods of stress during pregnancy and the absence of other causes of high anion gap metabolic acidosis. She responded poorly to standard treatment, although the ketoacidosis and asthma promptly resolved after an emergency caesarean section. The patient and her baby were safely discharged. Short-term starvation, if it occurs during periods of stress and medication, can result in life-threatening ketoacidosis, even among nondiabetic women during the third trimester of pregnancy. Awareness of this condition may facilitate prompt recognition and proactive treatment for dietary and stress control, and emergent interventions may also improve outcomes.

Database: Medline
28. Life-threatening ketoacidosis in a pregnant woman with psychotic disorder.

**Author(s):** Frise, Charlotte; Attwood, Ben; Watkinson, Peter; Mackillop, Lucy

**Source:** Obstetric medicine; Mar 2016; vol. 9 (no. 1); p. 46-49

**Publication Date:** Mar 2016

**Publication Type(s):** Case Reports

**PubMedID:** 27512491

Available at Obstetric medicine - from Europe PubMed Central - Open Access

Available at Obstetric medicine - from Unpaywall

**Abstract:** Pregnancy is an insulin resistant state. Hyperglycaemia and gestational diabetes mellitus are well-recognised complications even in women without existing metabolic syndrome or obesity. Pregnant women also appear to be more vulnerable to ketoacidosis, particularly after short periods of reduced oral intake in the third trimester, and may present with very severe starvation ketoacidosis, prompting emergent delivery. We present a case of a woman with a background of depression and psychotic episodes. Olanzapine had been commenced after a psychotic episode at 20 weeks’ gestation. Gestational diabetes mellitus was diagnosed at 28 weeks, and she was then admitted at 31 weeks with severe euglycaemic ketoacidosis following a short period of vomiting. She underwent caesarean section when the metabolic disturbances did not resolve with medical treatment. We believe atypical antipsychotic therapy contributed to the profound insulin resistance seen here, and that obstetricians, physicians and psychiatrists must be aware of the risks conferred by these agents in pregnancy.

**Database:** Medline
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