Euglycemic DKA: It is not a Myth-A Case Report to Review its Management

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Introduction

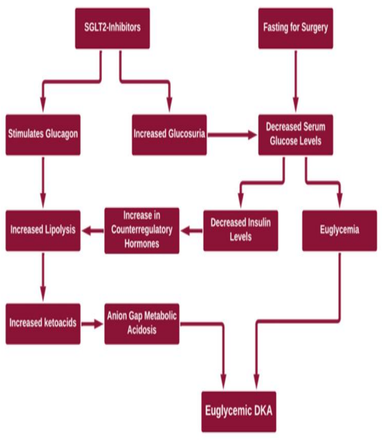
Euglycemic DKA (euDKA) is a diabetic emergency that occurs in both type 1 (T1DM) or type 2 (T2DM) diabetes mellitus. This syndrome presents with a clinical triad of relative euglycemia, metabolic acidosis and ketosis. It can present a diagnostic challenge for physicians due to the variety of etiologies seen with relative euglycemia often resulting in delayed diagnosis.
It was initially described in the literature in 1973 among the T1DM patient population by Munro et al. Almost 50 years later the recognition and incidence of euDKA has grown with the introduction of sodium/glucose cotransporter-2 (SGLT-2) inhibitors in diabetic management and its Increasing off-label use. SGLT2 inhibitors is a class of medications which includes **Canagliflozin-Invokana, Dapagliflozin-Farxiga, Empagliflozin-Jardiance and Ertugliflozin-Steglatro** have demonstrated cardioprotective and renoprotective effects. Zelniker et al noted in large scale randomized control trials, SGLT2 inhibitors did reduce the risk of hospitalizations for heart failure and often decrease the risk of CV death. In parallel, SGLT2 inhibitors also reduced the risk of end-stage renal events, including need for dialysis or renal transplantation.
With increasing indications and frequency of use of SGLT2i, it is likely the SGLT2i-associated euDKA will continue to increase in prevalence.

Pathophysiology and Etiologies

Underlying pathophysiology of euDKA includes an absolute insulin deficiency or relative insulin deficiency with severe insulin resistance.

Underlying mechanism of euDKA reduced glucose availability production during a fasting state (typically associated with some stressor) and/or increased urinary glucose excretion associated with excess counter-regulatory hormones.

Etiologies:
Anorexia/fasting state pre-operative
Gastroparesis
Glycogen storage disease
Infection/sepsis
Insulin pump use
Intoxication/Ingestion (ETOH, Cocaine)
Intra-abdominal pathology (gastroenteritis Pancreatitis)
Medications: SGLT2 inhibitors
Keto diet initiation
Liver disease
Pregnancy
Renal Disease
Surgery



Long, B., MD et al.

Case Report

54-year-old male with past medical history- HPTN, T2DM who presented with 1 week worsening bilateral hand/foot paresthesia found to have severe central canal stenosis
C4-5 w/chronic appearing cord compression and associated syrinx now transferred to ICU s/p C3-6 PSF with C4-5 laminectomy.
Home medications: Metformin, Lisinopril, Januvia, Farxiga

POST-OP REPORT

-No intraoperative surgical complications
-Volume Resuscitation s/p 4L crystalloid, 1.5L albumin, 2 amp sodium bicarb, intraoperative antibiotic
-EBL 250, UO 1L
-Per ASA ongoing metabolic acidosis unclear etiology
-Left intubated d/t worsening metabolic acidosis and inability to maintain respiratory compensation

INITIAL PATIENT ASSESSMENT

-Remains intubated
-Sedated on Propofol infusion
-Initial presented on Neo synephrine infusion for goal MAP>65
-Transitioned to PCV 14/6
-Following simple commands, no new neurologic deficits noted
- Physical examination unremarkable

RECENT LABS/DATA

Initial Post operative ABG:
ph-7.23/pCO2-33/pO2-344/HCO3-14
BE-14
Ical 1.13 Lactic Acid 2.5
Hgb 10.3

Intra operative ABG:
ph-7.18/pCO2-32/pO2-330/HCO3-12
BE-16
Ical 1.12 Lactic Acid 2.4
Hbg 11

UPDATED LABS

Sodium 143 Potassium 5 Chloride 110 CO2-12
BUN/CREA 22/0.69
Glucose 165 Beta-hydroxybutyrate 8.65 mmol/L (normal range <0.5 mmol/L)
WBC 12.5 H/H 11/33.4 PLT 157
ABG: ph-7.24/pCO2 31/pO2-236/HCO3 14/BE-14 (Fio2 50%)
Ical 1.13 Glucose 160, Lactic Acid 2.1, Hbg 11.4

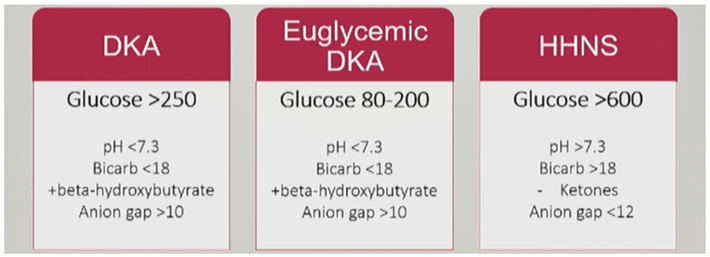
TREATMENT

SGLT2i should be discontinued with consideration of restarting after resolution of euDKA.
Principles in Management: Correct Fluid and Electrolyte loss to Re-establish Carbohydrate Metabolism.
IV fluids, IV Insulin and Electrolyte Replacement.
**No established algorithm for euDKA-follow DKA protocol.
If Potassium greater than 3.5 ok to initiate Insulin gtt at a rate of 0.05-01 units/kg/hour management of ketosis.
IV dextrose is essential in patients with euDKA to avoid hypoglycemia.
D5W should be administered concurrently with Insulin gtt. D10W recommended if hypoglycemia occurs Despite infusion of D5W
Insulin is utilized to resolve ketoacidosis, insulin infusion recommendation even if patients do not Use insulin for home glucose control.
Typically sodium bicarbonate is unnecessary.
Frequent lab monitoring every 4 hours, BMP, Ionized Cal, Magnesium, Phosphate, Lactic Acid
Hourly glucose monitoring
Monitor for acid base balance/anion gap to close.
Anion gap is closed transition to long acting insulin with 2 hours cross over.

OUTCOME-POST OPERATIVE DAY #1

-pH stabilized within hours of insulin infusion
-Extubated in AM post improving acid/base balance with closing anion gap
-Glucose remained 125-165

Diagnostic Criteria



The American College of Endocrinology recommends using a serum pH, and beta-hydroxybutyrate as diagnostic tools in the assessment of euDKA.
Beta-hydroxybutyrate >3.8 mmol/L in adults.
Urine ketones can be utilized however lower specificity and sensitivity for euDKA diagnosis.
Urine ketones may be reabsorbed rather then excreted in the urine in the setting of SGTL2i use

Dutta, S., et al (2022): Euglycemic diabetic ketoacidosis associated with SGLT2 inhibitors: A systematic review and quantitative analysis.

Discussion

-Clinicians should consider euDKA inpatients with nausea, vomiting malaise or fatigue in the setting of ETOH use, chronic liver disease, starvation, pregnancy, infection or SGLT2i use.
-A glucose <250 should not be used to exclude DKA emergency
-If euDKA is suspected serum pH, HCO3, beta-hydroxybutyrate should be obtained
-Treatment includes intravenous fluids, insulin, glucose as well as management of the underlying Etiology
-When caring for patients being referred for surgery it is important to advise patients to STOP their SGLT2i 3-4 days prior to surgery to minimize the risk of post-operative ketoacidosis and urinary tract Infections (Kumar et al.).

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Disclosures

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