

The Not-So-Sweet Hidden Threat of Diabetic Ketoacidosis

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Objectives

1. Discuss the pathophysiology of euglycemic diabetic ketoacidosis (EDKA).
2. Recognize risk factors associated with euglycemic diabetic ketoacidosis (EDKA).
3. Identify the typical presenting symptoms and diagnostic criteria for EDKA.
4. Develop an appropriate plan of care for a patient diagnosed with EDKA.

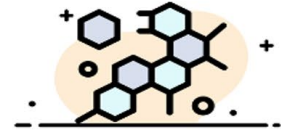
Euglycemic Diabetic Ketoacidosis is a condition characterized by **normoglycemia** in the setting of **anion gap metabolic acidosis**.

Pathophysiology

Carbohydrate Deficit



Decreased Insulin Production



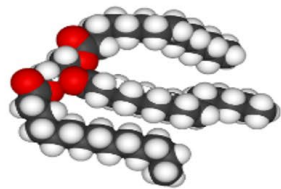
Excess Counter Regulatory Hormones



Anorexia, Vomiting, Osmotic Diuresis

Increased Glucagon/Insulin Ratio

Lipolysis



Increased Free Fatty Acids

Anion Gap Metabolic Acidosis

Mr. Heath Barr

Mr. Barr is a 48yo male, with a history of DM, who presents to the ED with a 12-hour history of nausea and vomiting. He states he woke during the night with vomiting and has had multiple episodes since. He denies diarrhea. He has no pain or fever. He states, "I just feel weak and tired".

Upon further questioning, he states he has been trying to lose weight with intermittent fasting and exercise for the past 10 days.

He states his blood sugar when he checked last night was 160.

Vital Signs

HR: 122

BP: 118/72

RR: 24

O2 Sat: 98% on RA

Temp: 98.7

Mr. Barr

History

Past Medical History

Type II DM
HTN

Surgical History

None

Social History

Non-smoker
Drinks occasionally
No illicit drug use

Current Medications

Lisinopril 10 mg daily
"Pills" for his diabetes

Mr. Barr

Physical Exam

General: Appears fatigued, alert, and oriented.

HEENT: Mucous membranes pink and slightly dry appearing.

Cardiovascular: Tachycardia without murmurs.

Respiratory: Clear to auscultation bilaterally.

Abdomen: Generalized abdominal tenderness, no rebound or guarding.

Extremities: No edema.

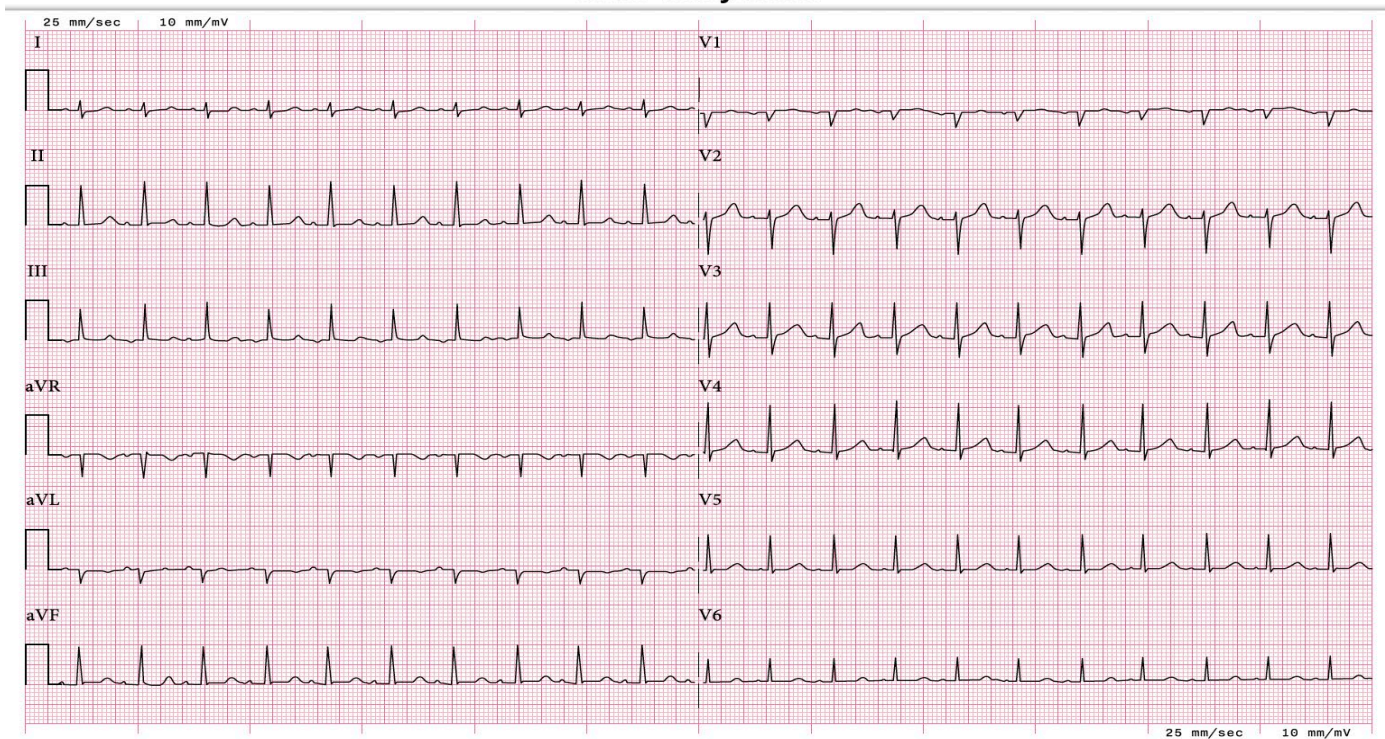
Neurological: No focal deficits.

Mr. Barr

Diagnostic Results

EKG

Sinus Tachycardia



Mr. Barr

Diagnostic Results

Chest X-Ray



Mr. Barr

Diagnostic Results

Complete Blood Count

Parameter	Result	Reference Range
White Blood Cell Count	21.2 x 10³/μL	4.0 - 11.0 x 10 ³ /μL
Hemoglobin	15.8 g/dL	12.0 - 16.0 g/dL (Female) / 13.5 - 17.5 g/dL (Male)
Hematocrit	46%	36% - 46% (Female) / 41% - 53% (Male)
Platelets	250 x 10 ³ /μL	150 - 450 x 10 ³ /μL
MVC	90 fL	80 - 100 fL
MCH	30 pg	27 - 33 pg
MCHC	34 g/dL	32 - 36 g/dL
Red Blood Cell Count	5.2 x 10 ⁶ /μL	4.2 - 5.4 x 10 ⁶ /μL (Female) / 4.7 - 6.1 x 10 ⁶ /μL (Male)

Mr. Barr

Diagnostics

Comprehensive Metabolic Panel

Parameter	Result	Reference Range
Glucose	140 mg/dL	70 - 99 mg/dL
BUN	30 mg/dL	7 - 20 mg/dL
Creatinine	1.6 mg/dL	0.6 - 1.2 mg/dL
Sodium	130 mmol/L	135 - 145 mmol/L
Potassium	5.2 mmol/L	3.5 - 5.0 mmol/L
Chloride	95 mmol/L	98 - 107 mmol/L
CO2	12 mmol/L	22 - 28 mmol/L
Anion Gap	23 mEq/L	4-12 mEq/L

Parameter	Result	Reference Range
Calcium	8.5 mg/dL	8.5 - 10.2 mg/dL
Albumin	3.8 g/dL	3.5 - 5.0 g/dL
Total Protein	7.0 g/dL	6.0 - 8.3 g/dL
AST	22 U/L	8 - 40 U/L
ALT	18 U/L	7 - 56 U/L
Alk Phos	85 U/L	44 - 147 U/L
Bilirubin, Total	0.8 mg/dL	0.1 - 1.2 mg/dL

Mr. Barr

Diagnostics

Urinalysis

Parameter	Result	Reference Range
Appearance	Cloudy	Clear
Color	Amber	Pale Yellow to Amber
Specific Gravity	1.030	1.005 – 1.030
pH	5.0	4.5 – 8
Glucose	Trace	Negative
Ketones	Large	Negative
Protein	Trace	Negative to Trace
Blood	Negative	Negative

Parameter	Result	Reference Range
Leukocyte Esterase	Negative	Negative
Nitrites	Negative	Negative
WBC	0-2 per HPF	0-5 per HPF
RBC	0-2 per HPF	0-3 per HPF
Bacteria	None	None
Casts	None	None
Crystals	None	None

Mr. Barr

Diagnostics

Lactic Acid

Parameter	Result	Reference Range
Lactic Acid	4.3 mmol/L	<2.0 mmol/L

Blood Cultures

Parameter	Result	Reference Range
Blood Culture	Pending	No Growth

Mr. Barr

Diagnostics

ABG

Parameter	Result	Reference Range
pH	7.25	7.35 – 7.45
PaCO ₂	25 mmHg	35 – 45 mmHg
PaO ₂	96 mmHg	80 – 100 mmHg
HCO ₃ ⁻	12 mmol/L	22 – 26 mmol/L
Base Excess	-12 mmol/L	-2 – +2 mmol/l
SaO ₂	97%	95% – 100%

Beta-Hydroxybutyrate

Parameter	Result	Reference Range
BHB	4.5 mmol/L	<0.6 mmol/L

Risk Factors

EDKA Risk Factors

Fasting/
Starvation

Dehydration

Pancreatitis

Infection/
Illness

Cocaine
Toxicity

ACS

Stroke

Ketogenic Diet

Bariatric
Surgery

Surgery

Insulin Pump
Use

Pregnancy

Gastroparesis

Cirrhosis

Alcohol Use

Trauma

Excessive
Physical
Activity

SGLT2
Inhibitor Use

Mr. Barr

EDKA Risk Factors

Fasting/ Starvation	Dehydration	Pancreatitis	Infection/ Illness	Cocaine Toxicity
ACS	Stroke	Ketogenic Diet	Bariatric Surgery	Surgery
Insulin Pump Use	Pregnancy	Gastroparesis	Cirrhosis	Alcohol Use
	Trauma	Excessive Physical Activity	SGLT2 Inhibitor Use	

Clinical Presentation

EDKA Clinical Presentation

Fatigue

Malaise

Decreased
Appetite

Nausea

Vomiting

Dyspnea

Dehydration

Abdominal
pain

Kussmaul
respirations

Fruity breath

Tachycardia

Hypotension

Altered LOC

Dry mucous
membranes

Poor skin
turgor

Delayed
capillary refill

Mr. Barr

Clinical Presentation

Fatigue	Malaise	Decreased Appetite	Nausea	Vomiting
Dyspnea	Dehydration	Abdominal pain	Kussmaul respirations	Fruity breath
Tachycardia	Hypotension	Altered LOC	Dry mucous membranes	Poor skin turgor
		Delayed capillary refill		

Diagnosics

EDKA Diagnostics

Complete Blood
Count

Comprehensive
Metabolic Panel

ABG/Serum pH

Beta-
Hydroxybutyrate

Urinalysis

Other
Diagnostics as
Indicated

Mr. Barr

Diagnostics

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Treatment

EDKA Treatment



Intravenous crystalloid fluids



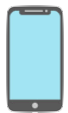
Insulin therapy with early glucose administration until the acidosis resolves and the anion gap closes.



Correct electrolyte abnormalities as indicated



Identify and treat the underlying cause



Consultation for admission

Education

EDKA Education

For patients taking SGLT2 Inhibitors

- Hold medication for 3-5 days prior to planned surgeries.
- Avoid low-calorie diets/ prolonged fasting
- Hold medication prior to strenuous exercise
- Sick day management

Avoid excessive alcohol intake

Avoid dehydration

Key Take-Aways

Unfortunately, a normal glucose level causes the diagnosis of EDKA to be delayed in almost 50% of patients.

Therefore, EDKA should be included in the differential list for all patients with the risk factors and symptoms presented.



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Thank you!

References

