

# EM CASE OF THE WEEK.

BROWARD HEALTH MEDICAL CENTER  
DEPARTMENT OF EMERGENCY MEDICINE



Care Warriors

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## Diabetic Ketoacidosis

A 67-year-old male presents to the emergency department complaining of weakness. His past medical history is pertinent for type II diabetes mellitus, dyslipidemia, and hypertension. He states the weakness has been getting worse to the point where he has trouble getting out of bed. He admits to having a fever, nausea, several episodes of vomiting, and shortness of breath during this time. Patient also states he has not had "a big appetite" and cannot recall the last time he took his medications. On review of systems patient endorses dysuria. He denies any symptoms of chest pain, palpitations, cough, and headache. Vital signs are:

Temperature	37°C (98.6°F)
Blood pressure	98/60 mmHg
Heart rate	106 bpm
Respiratory rate	24/min

On physical exam, the patient is ill-appearing with a dry oral mucosa and tenderness to palpation in the epigastric area. Beside glucose is 572 mg/dL. Which of the following is the most appropriate initial management for this patient's condition?

- A. Draw labs to determine electrolyte levels
- B. Isotonic saline infusion
- C. Urine analysis and culture
- D. Low-dose IV insulin
- E. Potassium replacement

### "5 I's" that Cause DKA and HHS

1. Infection
2. Infarction
3. Infant on board
4. Indiscretion with diet
5. Insulin lack

The patient endorses dysuria which may indicate an underlying urinary tract infection. The combination of poor adherence to his medication and a UTI should prompt the provider to consider the possibility of an underlying diabetic emergency. Other common causes of infection seen in diabetic patients include pneumonia and cellulitis.

*EM Case of the Week is a weekly "pop quiz" for ED staff.*

The goal is to educate all ED personnel by sharing common pearls and pitfalls involving the care of ED patients. We intend on providing better patient care through better education for our nurses and staff.

BROWARD HEALTH MEDICAL CENTER

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The correct answer is B. The initial treatment of DKA is infusion of isotonic saline which will expand extracellular volume and stabilize the patient's cardiovascular status.

Fluids also increase the body's responsiveness to insulin by

- Lowering plasma osmolality
- Reducing vasoconstriction and improving perfusion
- Reducing stress hormone levels

### Differential Diagnosis

Other diagnoses to consider in the setting of suspected DKA may include:

- Acute pancreatitis
- Alcoholic and fasting ketoacidosis
- Hyperosmolar hyperglycemic syndrome
- Salicylate toxicity
- Septic shock

### Standard Evaluation

1. Assess ABC's
2. Assess volume status
3. Obtain lab work
  - a. Serum glucose
  - b. UA and urine ketones
  - c. Serum electrolytes
  - d. BUN and creatinine
  - e. Plasma osmolality
  - f. Venous blood gas
  - g. EKG

In our patient, the physician also ordered urine cultures, lipase, and a chest X-ray.

### Laboratory Findings

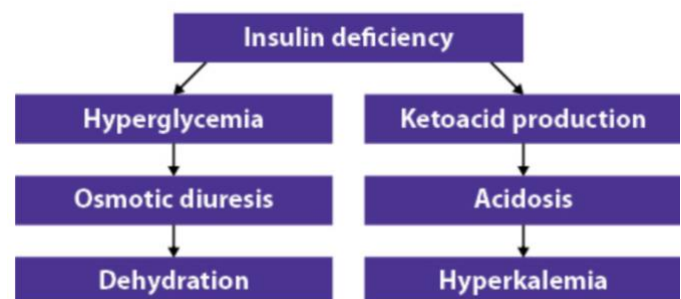
- Serum glucose between 250 mg/dL – 800 mg/dL
- Anion gap metabolic acidosis
- Ketonemia
- Dehydration
- Potassium deficit

Our patient met diagnostic criteria for DKA, which is characterized by a triad of hyperglycemia, anion gap metabolic acidosis, and ketonemia. Urine analysis and culture confirmed a UTI. Lipase and CXR were unremarkable.

### Pathogenesis

Diabetic ketoacidosis is caused by a relative or absolute deficiency in insulin. Despite having elevated glucose levels in the blood, movement of glucose into tissue such as muscle and fat is impaired. This results in the release of glucagon and stress hormones which initiate a cascade of catabolic processes.

Patients in DKA also commonly develop a large total body potassium deficit, however serum potassium concentration is often normal or elevated at presentation. This discrepancy can be attributed to the deficiency in insulin, which normally moves potassium into cells, and, hyperosmolality. It is important to evaluate a patient's potassium level prior to initiating IV insulin treatment to avoid life-threatening muscle weakness and cardiac arrhythmias.



For a list of educational lectures, grand rounds, workshops, and didactics please visit [BrowardER.com](http://BrowardER.com) and **click** on the **"Conference"** link.

*All are welcome to attend!*

## Treatment

1. Fluid replacement with isotonic saline (0.9% NaCl)
  2. Potassium replacement
  3. IV insulin
  4. Sodium bicarbonate\*
- \*Use is controversial. Beneficial to correct metabolic acidosis in a handful of patients

## Diabetic Ketoacidosis vs. Hyperosmolar Hyperglycemic Syndrome

In general, HHS is characterized by a greater degree of hyperglycemia and the absence of ketoacidosis when compared to DKA.

### Typical laboratory characteristics of DKA and HHS\*

	DKA			HHS
	Mild	Moderate	Severe	
Plasma glucose (mg/dL)	>250	>250	>250	>600
Plasma glucose (mmol/L)	>13.9	>13.9	>13.9	>33.3
Arterial pH	7.25 to 7.30	7.00 to 7.24	<7.00	>7.30
Serum bicarbonate (mEq/L)	15 to 18	10 to <15	<10	>18
Urine ketones <sup>¶</sup>	Positive	Positive	Positive	Small
Serum ketones - Nitroprusside reaction	Positive	Positive	Positive	≤ Small
Serum ketones - Enzymatic assay of beta hydroxybutyrate (normal range <0.6 mmol/L) <sup>Δ</sup>	3 to 4 mmol/L	4 to 8 mmol/L	>8 mmol/L	<0.6 mmol/L
Effective serum osmolality (mOsm/kg) <sup>◇</sup>	Variable	Variable	Variable	>320
Anion gap <sup>§</sup>	>10	>12	>12	Variable
Alteration in sensoria or mental obtundation	Alert	Alert/drowsy	Stupor/coma	Stupor/coma

DKA: diabetic ketoacidosis; HHS: hyperosmolar hyperglycemic state.

\* There may be considerable diagnostic overlap between DKA and HHS.

¶ Nitroprusside reaction method.

Δ Many assays for beta hydroxybutyrate can only report markedly elevated values as >6.0 mmol/L.

◇ Calculation:  $2[\text{measured Na (mEq/L)}] + \text{glucose (mg/dL)} / 18$ .

§ Calculation:  $(\text{Na}^+) - (\text{Cl}^- + \text{HCO}_3^-)$  (mEq/L).

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## ABOUT THE AUTHOR

This month's case was written by Areeba Imam. Areeba is a 4<sup>th</sup> year medical student from FIU HWCOM. She did her emergency medicine rotation at BHMC in September 2020. Areeba plans on pursuing Emergency Medicine after graduation.

## REFERENCES

Barrett, E., 2016. Diabetic Ketoacidosis: Diagnosis And Treatment. [online] Taylor & Francis. Available at: <<https://www.tandfonline.com/doi/abs/10.1080/21548331.1984.11702796>> [Accessed 14 September 2020].

Dingle, MD, E., 2020. Assessment & Treatment Of Five Diabetic Emergencies - JEMS. [online] JEMS. Available at: <<https://www.jems.com/2018/05/01/assessment-treatment-of-five-diabetic-emergencies/>> [Accessed 14 September 2020].

Hirsch, I., 2020. Uptodate. [online] Uptodate.com. Available at: <<https://www.uptodate.com/contents/diabetic-ketoacidosis-and-hyperosmolar-hyperglycemic-state-in-adults-clinical-features-evaluation-and-diagnosis>> [Accessed 14 September 2020].

Umpierrez, G., 2002. Diabetic Ketoacidosis and Hyperglycemic Hyperosmolar syndrome. [online] American Diabetes Association. Available at: <<https://spectrum.diabetesjournals.org/content/15/1/28.full-text.pdf>> [Accessed 14 September 2020].