

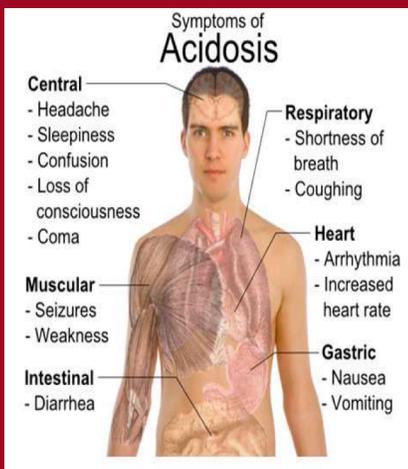
EM CASE OF THE WEEK

BROWARD HEALTH MEDICAL CENTER DEPARTMENT OF EMERGENCY MEDICINE

Diabetic Ketoacidosis (DKA)

A patient with a past medical history of Diabetes Mellitus and a seizure disorder presents with nausea and vomiting for one day associated with some weakness and dizziness. She had noticed that her blood sugar readings had been high for the past several days, but states she had been compliant with her diabetic medication. VS are T of 98.2, HR 108, RR 20, BP 148/83, and O2 100% on room air. Labs reveal a blood glucose of 426 mg/dL, WBC of 11.90×10^3 , Na^+ of 129, CO_2 9mmol/L, Anion Gap of 22, urine glucose >1000, urine ketones >150. The patient continues to vomit in the ER. What is your next best course of action?

- Treat the elevated WBC with empiric antibiotics
- Start IV NaHCO_3 in order to treat and correct the metabolic acidosis
- Begin infusing 1L of NaCl 0.9%
- Immediately begin giving IV Insulin to correct the hyperglycemia.



Diabetic Ketoacidosis is a life-threatening condition that can occur in either Type 1 or Type 2 diabetics. It can require ICU admission if it is serious enough, therefore it is important to know the signs, symptoms, diagnostic criteria, and treatment of DKA.

EM CASE OF THE MONTH

EM Case of the Month is a monthly “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.



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Take Home Points

- Diabetic Ketoacidosis is a life-threatening metabolic disturbance that may occur in either Type 1 or Type 2 diabetics, must be treated promptly, and may require ICU admission.
- The initial goal of therapy is correction of fluid loss with either Normal Saline or Lactated Ringer's solution.
- Lab values indicative of DKA include: plasma glucose >250 mg/dL, bicarbonate <15 mEq/L, pH <7.3, and ketonemia.
- When treating DKA it is important to monitor serum glucose, anion gap, electrolytes, and bicarbonate.
- Recovery is defined as plasma glucose <200 mg/dL, bicarb >17, and pH >7.3.

Diabetic Ketoacidosis (DKA)

The correct answer is C, begin infusing 1L of NaCl 0.9%. The next best course of action is to begin treating the fluid loss with either NS or Lactated Ringer's solution. This is especially important in our patient as she has been vomiting and therefore losing fluids and electrolytes. The next steps in treatment of DKA is to begin insulin therapy to correct the hyperglycemia, correct any electrolyte disturbances, especially potassium, correction of the acid-base balance, and then treatment of the underlying cause of DKA, ie. Infection, non-compliance with medications, etc.

The main goals of treatment of DKA are as follows:

1. Correction of fluid loss
2. Correction of hyperglycemia
3. Correction of electrolyte imbalance, especially K⁺
4. Correction of acid-base balance
5. Treatment of concurrent infection, if present

What are the clinical features of DKA?

- Dehydration, hypotension, tachycardia, nausea, vomiting, abdominal pain, Kussmaul respirations, breath may have fruity odor (due to acetone production), polydipsia, polyuria, malaise, weakness, fatigue, altered consciousness or disorientation, possibly signs of infection (ie. Fever, chills, coughing, dysuria, etc).

What are some physical exam signs of DKA?

- Dry skin and decreased skin turgor, dry mucous membranes, labored respirations, overall ill appearance, tachycardia, hypotension, hypothermia, fever (if infection present), decreased reflexes.

How do we diagnose DKA?

- Diagnosis of DKA is based on clinical presentation and the following lab values: Serum glucose >250mg/dL, bicarb <15mEq/L, pH <7.3, ketonemia.

For a list of educational lectures, grand rounds, workshops, and didactics please visit

<http://www.BrowardER.com>

and click on the "Conference" link. All are welcome to attend !

So what are some causes of DKA?

- Non-compliance with medications
- Infection
- Pregnancy
- Hyperthyroidism
- Substance abuse
- Certain medications, ie. Steroids, Thiazide diuretics, Antipsychotics, Sympathomimetics
- GI Bleed
- Surgery
- Major trauma
- Pulmonary embolism
- MI
- Heat-related illness
- Pancreatitis
- Cerebrovascular accident

Differential Diagnosis of DKA:

- Alcoholic ketoacidosis
- Starvation ketoacidosis
- Renal failure
- Lactic acidosis
- Ingestion of salicylates, ethylene glycol, or methanol

Initial Diagnostic Testing Includes:

- Serum glucose levels
- Serum electrolyte levels (eg, potassium, sodium, chloride, magnesium, calcium, phosphorus)
- Bicarbonate levels
- Amylase and lipase levels
- Urine dipstick
- Ketone levels
- Serum or capillary beta-hydroxybutyrate levels
- ABG measurements
- CBC count
- BUN and creatinine levels
- Urine and blood cultures if concurrent infection is suspected
- ECG (or telemetry in patients with comorbidities)

Back to our patient...

As previously mentioned, our patient was found to be tachycardic with otherwise stable vital signs. The patient's serum glucose was found to be 426 mg/dL. WBC of 11.90×10^3 , Na^+ of 129, CO_2 9 mmol/L, Anion Gap of 22, urine glucose >1000, urine ketones >150. Her Arterial Blood Gas revealed a pH of 7.0, pCO_2 of 32 mmHg, pO_2 of 36 mmHg, and an HCO_3^- of 8 mmHg. The patient was admitted to the intensive care unit where she was monitored closely and treated for her DKA. Endocrinology was consulted and followed her closely during her hospital stay. In addition, the endocrinologist started the patient on insulin in addition to her Metformin to better control her blood sugar.

Conclusion

Diabetic Ketoacidosis is an acute, major, life-threatening condition that generally occurs in Type 1 diabetics but may also occur in Type 2 diabetics. It is characterized by hyperglycemia, ketosis and ketonuria, and acidosis. DKA is diagnosed based on clinical presentation and lab values, including a blood glucose of >250 mg/dL, bicarbonate <15 mEq/L, pH <7.3, and ketonemia. The goals of treatment are correction of fluid imbalance, correction of hyperglycemia, correction of electrolyte disturbances, correction of acid-base balance, and treatment of any concurrent infection or other underlying cause. The two most common complications that occur when treating DKA are hypoglycemia and hypokalemia. Therefore it is important to closely monitor the patient's glucose level and potassium level. Monitoring for hypokalemia is particularly important, as it may lead to deadly arrhythmias. It is important to correct any underlying hypokalemia using potassium chloride to prevent these arrhythmias. Guidelines state that if the potassium is greater than 6mEq/L, no potassium replacement is needed. If potassium is 4.5-6mEq/L, administration of potassium chloride at 10mEq/h is indicated. If the potassium is 3-4.5mEq/L, administration of potassium chloride at 20mEq/h is indicated. Potassium levels should be monitored hourly, and infusion of potassium chloride should be stopped if the potassium reaches 5mEq/L. DKA is considered to be resolved once the glucose level is <200mg/dL, serum bicarbonate is >18mEq/L, and pH is >7.3.

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