

Diabetic Ketoacidosis (DKA) and Hyperosmolar Hyperglycemic State (HHS)



Diabetes Done Right™

Sugar is the body's main source of energy and we need it to survive. In fact, the brain consumes ~20% of the body's sugar. Too much of anything is a bad thing and sugar is no exception. High blood sugar (*hyperglycemia*) happens when blood sugar is high enough to harm you.

High blood sugar over a long period of time is the primary cause of most diabetes long term complications like kidney disease, blindness, amputations, heart attacks, strokes, peripheral arterial disease, and more.

Over the short term it can lead to life threatening diabetes emergencies like **Diabetic Ketoacidosis (DKA)** and **Hyperglycemic Hyperosmolar Syndrome (HHS)**.



Defining DKA

DKA is a diabetes emergency that is defined by high levels of ketones in the body. DKA can happen when the body doesn't have enough insulin. Without insulin, sugar can't get from the blood into the rest of the body.

The body is forced to get energy from a backup pathway. Fat is broken down in this backup pathway and ketones are released into the blood. Ketones are acidic and as they build up they cause the body to become more acidic.

DKA can affect anyone with diabetes but people with type 1 are at a higher risk because they produce very little, if any, insulin. In fact, DKA is the leading cause of death in people with type 1 who are under the age of 24.

Although blood sugar can get high in DKA, it typically does not get as high as in HHS. Additionally, it is the ketones that are dangerous in DKA.

Defining HHS

HHS is a diabetes emergency that is defined by very high blood sugar. In HHS the body makes enough insulin to use some blood sugar. This prevents the body from having to use the backup pathway. Therefore, no ketones are made and the body does not become acidic.

Even though there is some insulin being produced, there is not enough to bring down blood sugar to safe levels. Instead, blood sugar keeps climbing often to extremely high levels. This really high blood sugar leads to a "high osmolar state". This high osmolar state can force water to leave important organs like the brain as a way to lower blood sugar.

- Osmosis lowers blood sugar through dilution. It's like pouring water into a cup of orange juice to make it less sweet.

HHS is more common in older people with type 2.

Causes

There are a lot of things that can lead to DKA or HHS but the underlying cause is untreated and uncontrolled high blood sugar. Anything that can cause high blood sugar can lead to DKA or HHS. Some examples include:

- Overeating
- Severe dehydration

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- New medications, extra medications, or illicit drugs like cocaine
- Illnesses like an infection or heart attack
- A broken insulin pump, an inappropriate insulin regimen, or skipping insulin doses

A common scenario is a younger person who was previously unaware that they had diabetes. Because that person was not on any medications, their diabetes was uncontrolled and became severe enough to lead to DKA or HHS.

What They Feel Like

The symptoms of HHS and DKA are similar. They include:

- Extreme thirst that doesn't get better with drinking water
- Urinating a lot more than usual
- Nausea, vomiting, or stomach pain
- Weight loss
- Drowsiness, lethargy, confusion, or any change in mental status
- Fast breathing or shortness of breath
- In DKA, a sweet and fruity smelling breath (*caused by ketones*)

How They're Treated

Both of these diabetes emergencies should be treated in a hospital. Your healthcare provider will probably give you plenty of fluids, electrolytes, and insulin. Although you may be able to handle high blood sugar at home, do not attempt to self-treat DKA or HHS.

If you are concerned you have DKA or HHS you should reach out to your healthcare provider for guidance. Some people may be instructed to test for ketones.

Avoiding DKA & HHS

The best way to avoid DKA and HHS is with good diabetes management. This means physical activity, healthy eating, and medication management.

To avoid DKA and HHS:

- Stick to the insulin regimen outlined by your medical provider
- Measure blood sugar and urine ketones as instructed
- Be aware of sick days and new medications
- Reach out to a diabetes educator if part of a support program

Check out the Glucose Guards Hyperglycemia Action Plan to avoid the serious consequences of untreated hyperglycemia.