CONDITION

Diabetic hyperglycemic hyperosmolar syndrome

Diabetic hyperglycemic hyperosmolar syndrome is an emergency diabetes complication involving very high blood sugar and severe dehydration.

WHAT IT IS
Severe diabetes complication causing extreme blood sugar and dehydration

BODY SYSTEM
Hormones and metabolism

MAIN SYMPTOMS
Extreme thirst, frequent urination, weakness, confusion

WHAT CAUSES IT
Insulin shortage, usually with illness or missed treatment

HOW IT IS DIAGNOSED
Blood glucose, ketone, acidity, electrolyte, and osmolality tests

MAIN TREATMENT
Hospital fluids, electrolytes, insulin, and trigger treatment

CAN IT BE CURED?
Yes - acute episode can resolve with treatment

IS IT AN EMERGENCY?
Yes - suspected symptoms need emergency care

LONG-TERM OUTLOOK
Serious without treatment; recovery common with prompt hospital care

Overview

Diabetic hyperglycemic hyperosmolar syndrome is usually shortened to HHS. Most medical guidance uses the term hyperosmolar hyperglycemic state .

HHS happens when blood sugar becomes extremely high. The kidneys try to remove the extra sugar through urine, taking large amounts of water with it. This causes severe dehydration. The blood becomes unusually concentrated, which is described as hyperosmolar .

HHS usually develops over several days and sometimes longer. It most often affects people with type 2 diabetes, particularly older adults, but it can occur at other ages and in other types of diabetes. For some people, HHS is the first sign that they have diabetes.

HHS can affect the brain, kidneys, circulation, and other organs. It requires emergency hospital treatment. The immediate episode can resolve, but any underlying diabetes still needs ongoing care.

Symptoms

Early symptoms often come from high blood sugar and increasing fluid loss. They may include:

As dehydration becomes more severe, the skin and mouth may feel very dry. A person may have a fast heartbeat, low blood pressure, or eventually pass little urine despite having urinated frequently earlier.

Changes in brain function are an important sign of HHS. These can include unusual sleepiness, confusion, irritability, difficulty speaking, poor coordination, seizures, or loss of consciousness. These symptoms can resemble a stroke, and a stroke can also trigger HHS. They need emergency assessment.

Unlike diabetic ketoacidosis, or DKA, HHS usually does not cause large amounts of ketones or marked blood acidity. Ketones are chemicals made when the body breaks down fat for energy. However, HHS and DKA can overlap, so symptoms alone cannot reliably separate them.

- Intense thirst and a dry mouth
- Urinating much more than usual
- Tiredness, weakness, or leg cramps
- Blurred vision
- Nausea or reduced appetite

Causes and risk factors

HHS develops when the body does not have enough effective insulin to control blood sugar, but still has enough insulin to limit the production of ketones. Insulin is the hormone that helps glucose move from the blood into cells.

An infection is a common trigger. Pneumonia, urinary infections, and other illnesses can raise levels of stress hormones that work against insulin. Fever, vomiting, diarrhea, or reduced drinking can make dehydration worse.

Other possible triggers include:

Older and frail adults are at greater risk because thirst may be less noticeable and getting

water may be difficult. Kidney or heart problems can make both dehydration and treatment more complicated.

HHS is not contagious. Family history can increase the chance of developing type 2 diabetes, but HHS itself is not directly inherited.

- Missing diabetes medicines or being unable to take them
- Diabetes that has not yet been diagnosed
- A heart attack, stroke, surgery, or another major physical stress
- Medicines that can raise blood sugar, such as corticosteroids and some antipsychotic medicines
- Limited access to water or needing help to drink
- Problems managing diabetes because of memory, mobility, vision, or social difficulties

Diagnosis

HHS is confirmed with urgent blood tests rather than symptoms alone. Tests measure blood glucose, salts such as sodium and potassium, kidney function, ketones, and the blood's acidity.

Clinicians also assess osmolality , a measure of how concentrated the blood is. Current consensus criteria describe HHS as:

Some people meet the criteria for both HHS and DKA. This mixed presentation affects treatment and monitoring.

Further tests look for the trigger. These may include urine tests, cultures for infection, a chest X-ray, an electrocardiogram to check the heart, or brain imaging when stroke or another neurological problem is possible. An HbA1c blood test can show whether blood sugar was high during the previous two to three months.

- Blood glucose of at least 600 mg/dL, or 33.3 mmol/L
- Raised effective or total blood osmolality
- No substantial build-up of ketones
- No marked metabolic acidosis, meaning the blood is not strongly acidic

Treatment and management

HHS is treated in hospital, often in an emergency department and then a closely monitored

ward. Intensive care may be needed when there are severe changes in consciousness, unstable blood pressure, major electrolyte problems, or another critical illness.

The main treatments are intravenous fluids, insulin, and careful management of electrolytes. Electrolytes are minerals, including sodium and potassium, that help control nerves, muscles, and fluid balance.

Fluids are usually started first because severe dehydration is central to HHS. Replacing water improves circulation and may lower blood sugar even before insulin is given. People with heart or kidney problems may need a slower or more closely adjusted approach.

Insulin is given under close monitoring to bring glucose down in a controlled way. It may be started after initial fluid replacement unless significant ketones or acidosis require earlier insulin treatment. Glucose, sodium, potassium, osmolality, urine output, and vital signs are checked repeatedly.

Treatment must not lower glucose or blood concentration too quickly. Sudden changes can cause dangerous shifts of water between the blood and brain. Potassium or other electrolytes may be replaced according to blood results.

The trigger is treated at the same time. This may involve antibiotics like amoxicillin or doxycycline for a bacterial infection or treatment for a heart attack, stroke, or another illness. Because dehydration and immobility can increase the risk of blood clots, clot prevention may be used when appropriate.

Before discharge, the diabetes treatment plan is reviewed. Some people need insulin after HHS, at least for a time. Others may later use different diabetes medicines. Changes should be based on follow-up assessment rather than stopping or adjusting treatment without advice.

Complications

Severe dehydration can reduce blood flow to the kidneys, causing acute kidney injury. This often improves with treatment, although recovery may be less complete when kidney disease was already present.

Other possible complications include:

Treatment can also cause low blood sugar or low potassium. Rarely, overly rapid correction may contribute to swelling in the brain or damage related to rapid changes in sodium concentration. Careful hospital monitoring helps reduce these risks.

HHS can be fatal, especially when treatment is delayed or it occurs alongside severe infection, stroke, heart disease, or frailty.

- Blood clots in the legs, lungs, heart, or brain
- Seizures or prolonged changes in alertness
- Breakdown of muscle tissue, called rhabdomyolysis
- Abnormal heart rhythms from electrolyte disturbances
- Circulatory failure and injury to major organs

Prevention

Not every episode can be prevented. HHS may be the first sign of previously unrecognized diabetes, and serious illness can sometimes cause a crisis despite appropriate care.

If you have diabetes, prevention focuses on noticing rising glucose and dehydration early. Follow your personal sick-day plan when you are unwell. This usually explains how often to check glucose, when to check ketones, how to stay hydrated, and when to seek help. Do not stop insulin unless a clinician specifically tells you to do so.

Take diabetes medicines as agreed and arrange routine reviews. Ask for help early if side effects, cost, memory problems, vision difficulties, or trouble using equipment are making treatment difficult.

During illness, drink suitable fluids if you can do so safely. If heart or kidney disease limits how much you should drink, follow the fluid advice given for that condition.

Relatives or caregivers may need to help monitor drinking, urination, glucose, and alertness when a person is frail or cannot manage diabetes independently. A clear written plan can help them recognize when urgent care is needed.

Living with it and what to expect

Hospital treatment usually continues until dehydration, blood concentration, glucose, and electrolyte problems have improved and you can safely eat and drink. Mental alertness may recover more gradually than the glucose level. Recovery time is influenced by the illness that triggered HHS and by your health before the episode.

After discharge, follow-up should review glucose readings, medicines, kidney function, and the likely trigger. If diabetes was newly diagnosed, you may need education about glucose monitoring, medicines, food, and what to do during illness.

Having HHS once does not mean it will definitely happen again. Recurrence is more likely if

blood sugar remains very high, medicines cannot be taken, dehydration develops, or the practical cause of the first episode is not addressed.

Over months and years, your outlook is mainly shaped by diabetes control, other medical conditions, and whether future illnesses are managed promptly. Most people who recover can return to their usual activities, although frailty, stroke, severe infection, or organ injury may lead to longer-term support needs.

When to get medical help

Call emergency services now if someone with diabetes or possible diabetes has confusion, marked drowsiness, a seizure, fainting, new trouble speaking or moving, or cannot be woken normally. Do not give food, drink, or medicine to someone who is not fully alert.

Emergency assessment is also needed for very high glucose accompanied by severe thirst, repeated urination, worsening weakness, vomiting, inability to drink, or signs of major dehydration. Do not try to manage suspected HHS at home.

Seek same-day medical advice during illness if your glucose remains much higher than your usual range despite following your sick-day plan, you cannot keep fluids down, or you are unsure how to take your diabetes medicines safely.

Routine follow-up is appropriate after recovery to review diabetes control, medicines, glucose-monitoring supplies, and your sick-day plan. Contact your usual diabetes team sooner if practical problems are preventing you from following the plan.

Common questions

How high is blood sugar in HHS?

The diagnostic threshold is generally at least 600 mg/dL, or 33.3 mmol/L. A reading below this does not rule out another serious glucose emergency. Symptoms, ketones, acidity, hydration, and blood concentration also matter.

Is HHS the same as diabetic ketoacidosis?

No. Both are diabetes emergencies, but DKA involves substantial ketone production and acidic blood. HHS usually involves more severe dehydration and blood concentration, with little or no marked acidosis. Some people have features of both.

Can HHS happen if I did not know I had diabetes?

Yes. HHS can be the first recognized sign of type 2 diabetes. An illness or medicine that raises

glucose may reveal diabetes that had not previously caused clear symptoms.

Can I treat HHS at home with insulin and water?

No. HHS requires hospital tests, intravenous fluids, controlled insulin treatment, and frequent monitoring. Taking extra insulin or drinking large amounts without assessment cannot safely correct major dehydration and electrolyte changes.

How long does recovery take?

Glucose and dehydration may improve over hours to days, but full recovery can take longer. Age, frailty, kidney function, mental changes, and the underlying trigger all affect the course. Follow-up may continue after discharge.

Can HHS happen again?

Yes, but recurrence is not inevitable. A sick-day plan, reliable access to medicines and fluids, glucose monitoring, and early help during illness can reduce the risk.

Sources

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