

HHS · Hyperosmolar Hyperglycemic State

A plain-English guide for you and your family

WHAT IS HAPPENING

In hyperosmolar hyperglycemic state, the body's system for keeping blood sugar steady breaks down. Normally, the pancreas (a small organ behind the stomach) releases insulin, a hormone that acts like a key to unlock cells so sugar can move from the blood into the cells for energy. In type 2 diabetes, cells resist insulin — the lock gets sticky — so sugar builds up in the blood. When something extra stresses the body (an infection, a heart attack, a stroke, or stopping diabetes medicine), sugar climbs even higher, often above 600 mg/dL. The kidneys try to dump the excess sugar into urine, but sugar drags water with it, so the person loses gallons of fluid through urination. Blood becomes thick and concentrated, like syrup. The brain, starved of normal fluid and oxygen delivery, gets confused or shuts down. Unlike diabetic ketoacidosis (the acid crisis of missing insulin) (DKA), there is still just enough insulin on board to prevent the body from burning fat and making acid (ketones), so the blood stays less acidic. The danger is severe dehydration, blood clots from thick blood, brain swelling if fluids are replaced too fast, dangerously low potassium, and kidney failure. Treatment starts with gentle intravenous fluids to thin the blood and restore volume, then low-dose insulin to bring sugar down slowly — fixing it too fast can cause the brain to swell. Finding and treating the trigger (infection, heart problem, medicine mistake) is just as important as treating the sugar itself.

What you might feel

- Extreme thirst and dry mouth
- Peeing much more than usual
- Severe dehydration—dry skin, sunken eyes, fast heart rate
- Confusion, drowsiness, or trouble waking up
- Weakness and fatigue
- Warm, flushed skin with no sweating
- Nausea or belly pain
- Vision changes or blurry sight

Call the doctor right away if...

- Confusion, extreme drowsiness, or can't be woken up—the brain is shutting down from dehydration and sky-high sugar; this can lead to coma and death without emergency treatment.
- Blood pressure dropping or heart racing over 120 beats per minute at rest—the blood volume is dangerously low and the heart is struggling to keep organs alive.
- Seizure or one-sided weakness—severe dehydration and thick blood can trigger a stroke or seizure, especially in older adults.

What the care team will do

- Start two large-bore IV lines and hang normal saline at 1 to 1.5 liters per hour immediately
- Check fingerstick glucose and send lab work for basic metabolic panel with sodium and potassium before giving any insulin
- Monitor mental status and neurologic checks every hour, documenting any confusion, sleepiness, or seizure activity
- Replace potassium through IV fluids if level is between 3.3 and 5.3 mEq/L, and hold insulin if potassium drops below 3.3
- Start regular insulin infusion at 0.1 units per kilogram per hour only after fluids are running and potassium is safe
- Measure intake and output hourly, watching for urine output at least 0.5 mL per kilogram per hour
- Switch IV fluid from normal saline to half-normal saline when serum sodium normalizes or reaches 145 to 150 mEq/L
- Investigate and treat the underlying trigger with cultures, chest X-ray, EKG, urinalysis, and appropriate antibiotics or cardiac care

Medicines you may be given — and why

Intravenous fluids (normal saline 0.9% initially, then 0.45% saline)

HHS causes severe dehydration—the body loses huge amounts of water because sky-high blood sugar acts like a sponge in the bloodstream, pulling water out of cells and flushing it into the urine. IV fluids refill the pipes (blood vessels), restore blood volume, and bring down the dangerously thick, syrupy blood. Normal saline (salt water that matches the body's salt level) goes in first to rescue blood pressure and kidney flow. Once sodium starts dropping toward normal, we switch to half-normal saline (gentler, less salty) to keep refilling without overshooting sodium levels.

Potassium chloride (IV or oral potassium replacement)

Even though initial blood tests often show normal or even high potassium, the body's total potassium stores are severely depleted because high blood sugar and dehydration have flushed potassium out through the urine. Once insulin and fluids start working, potassium rushes from blood into cells, and blood potassium can drop dangerously low (hypokalemia), risking fatal heart rhythm problems. Replacing potassium before or alongside insulin keeps blood levels safe while cells refill their stores.

Regular insulin (IV continuous infusion)

In HHS, the body either makes too little insulin (in type 2 diabetes stressed by infection, heart attack, or other triggers) or cells resist insulin's signal, so glucose piles up in the blood instead of entering cells for energy. The liver also keeps dumping more glucose into the bloodstream because it doesn't sense insulin's 'stop' signal. IV regular insulin delivers the missing hormone directly into the bloodstream, unlocking cell doors to let glucose in, shutting off the liver's sugar factory, and gradually lowering blood glucose back toward normal.

Dextrose 5% in IV fluids (added once glucose approaches 250-300 mg/dL)

Once insulin brings blood sugar down near 250-300 mg/dL, the immediate danger is over, but the body is still severely dehydrated and osmolality (blood thickness) is still high. Stopping insulin too early lets glucose rebound. Adding dextrose (sugar water) to the IV allows insulin to keep running at a lower rate, clearing the thick blood and restoring normal brain and kidney function, without pushing glucose dangerously low.

Where this information comes from

- American Diabetes Association Standards of Care in Diabetes 2024
- Endocrine Society Clinical Practice Guideline on Hyperglycemic Crises
- ADA/EASD Consensus Report on Hyperglycemic Emergencies
- UpToDate Clinical Review: Hyperosmolar Hyperglycemic State

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