Diabetic Ketoacidosis

The tank is full but the key is broken, so the body burns wood in the fireplace — and the smoke poisons the room.

THE ONE-LINE TRUTH

No insulin → sugar cannot enter cells → body burns fat for fuel → fat breakdown creates acids (ketones) that make the blood acidic.

The chain — how it unfolds

1. Insulin drops or disappears (missed dose, new undiagnosed type 1 diabetes, insulin pump failure, or illness). — why: No key, so the cell door stays locked. Sugar cannot enter.
2. Cells starve while blood sugar climbs sky-high. — why: Sugar is stuck in the blood with nowhere to go.
3. Liver makes even more sugar; body starts burning fat for emergency fuel. — why: The body thinks it is starving and tries to make fuel any way it can.
4. Ketones (acids from fat breakdown) build up in the blood. — why: Fat breakdown creates acid by-products faster than the body can clear them.
5. Blood becomes acidic (pH drops below 7.3). — why: Too many acid molecules, not enough buffer (bicarbonate) left to soak them up.
6. Kidneys pee out sugar and ketones → huge water and salt loss. — why: Osmotic diuresis — sugar drags water with it like a sponge. The body becomes dehydrated.
7. Dehydration sets in. Fast deep breathing (Kussmaul). Fruity breath (acetone). Belly pain. Confusion. — why: Every organ feels the acid burn and the fluid loss. The brain gets foggy. The gut cramps. The lungs work overtime.
8. If untreated → shock (dangerously low blood pressure), coma, brain swelling (cerebral swelling (edema)), and death. — why: The acid and severe dehydration become so extreme the body cannot recover on its own.

Spot it — what you see, and why

- Extreme thirst: High blood sugar spills into the urine and pulls water out with it like a sponge, so the body loses a lot of water and becomes very dry inside.

- Peeing constantly (polyuria): When blood sugar rises above 180, the kidneys cannot hold it back, so sugar spills into the urine and drags water along with it, making huge amounts of dilute pee.
- Nausea and vomiting: Ketones (acidic chemicals the body makes when it burns fat for fuel) and the acid itself irritate the stomach and trigger the vomit center in the brain.
- Belly pain: The acid irritates nerves in the belly wall and can slow the gut down; sometimes the pain is so sharp it looks like appendicitis or another surgical emergency.
- Deep, fast breathing (Kussmaul breathing): The lungs blow off carbon dioxide (CO_2) to raise the blood pH and fight the acid—this is the body's fastest emergency fix for too much acid in the blood (acidosis).
- Fruity or acetone breath: One of the ketones, acetone, evaporates through the lungs with each breath and smells like nail-polish remover or rotting fruit.

Red flags — act now

- Breathing slowing down or becoming shallow in a patient who is still acidotic—the respiratory muscles are tiring out and respiratory arrest may be next
- Sudden severe headache, worsening confusion, vomiting, or decline in mental status during treatment (especially in children under 18)—warns of cerebral swelling (edema), brain swelling that can be fatal
- Blood sugar dropping quickly but the anion gap still wide and bicarbonate still low—ketoacid is still being made or not cleared, do not stop insulin even if glucose is normal
- Chest pain, new trouble breathing, troponin elevation, or signs of heart failure—a heart attack or severe infection may have triggered the DKA and needs urgent treatment alongside DKA care
- Blood pressure staying low or dropping despite fluid—suggests septic shock, cardiogenic shock, or severe volume depletion; needs immediate ICU-level support

Treat it — in this order

1. IV fluids — normal saline (0.9% NaCl), 1 to 2 liters in the first hour, then 250 to 500 mL per hour → Refills the blood tank so organs (brain, kidneys, heart) get blood and oxygen again. Helps kidneys start flushing out the extra sugar and ketones through pee. Starts to improve the acid just by improving blood flow and kidney function. Guideline: give 15 to 20 mL per kilogram in the first hour in adults; 10 mL per kilogram over 1 hour in children (slower to prevent brain swelling).

2. Check potassium before starting insulin. If potassium is under 3.3 mEq/L, give potassium chloride (20 to 40 mEq) through the IV over 1 to 2 hours before starting insulin. → Prevents potassium from crashing to a deadly level (under 2.5 mEq/L). Insulin pushes potassium from blood into cells, so if you start with low potassium, insulin will drop it even further and the heart can stop (cardiac arrest). Guideline: do not start insulin until potassium is at least 3.3 mEq/L. Keep potassium between 4.0 and 5.0 mEq/L during treatment.
3. IV insulin — regular insulin drip at 0.1 units per kilogram per hour (or 0.14 units/kg bolus, then 0.1 units/kg/hour infusion). Start after fluids are running and potassium is safe. → Turns off the fat-burning that makes ketones. Lets cells open their doors (by activating glucose transporters) and start using sugar again instead of making acid. This is what actually fixes DKA. Guideline: aim for blood sugar to drop 50 to 75 mg/dL per hour and ketones to drop at least 1 mmol/L per hour. If not, increase insulin by 1 unit per hour.
4. Add dextrose (sugar) to the IV fluids when blood sugar drops below 200 to 250 mg/dL. Use 5% dextrose in half-normal saline (D5 1/2 NS) or 10% dextrose if sugar keeps dropping. → Keeps insulin running so it can keep clearing the acid and ketones, but prevents blood sugar from crashing too low (hypoglycemia). Acid and ketones clear slower than sugar drops, so you need to give sugar back to safely finish the job. Guideline: goal is to keep sugar between 150 and 200 mg/dL until DKA is resolved (pH over 7.3, bicarbonate over 18, anion gap under 12).
5. Treat the trigger — antibiotics for infection (e.g. ceftriaxone for pneumonia or UTI), aspirin and catheterization for heart attack, insulin education and social work for missed doses, etc. → Removes the reason DKA started in the first place. Without treating the trigger, DKA can come right back even if you fix the acid and sugar. For example, if pneumonia triggered DKA and you do not give antibiotics, the infection will keep stressing the body and ketones will keep rising.

Your top priorities at the bedside

1. Check potassium BEFORE the first insulin bolus or infusion — why: Insulin will drop K into cells. If K is already low, that can stop the heart.
2. Titrate fluids and insulin per protocol; hourly finger sticks — why: Sugar drops fast — need dextrose add-on when it hits 200.
3. Watch mental status every hour, especially in kids — why: Cerebral swelling (edema) can appear 4–12 hours into treatment.