

Opioid emergency

Opioids turn off the brain's breathing switch and make the pupils tiny—naloxone flips that switch back on before the person runs out of oxygen.

THE ONE-LINE TRUTH

An opioid overdose shuts down breathing and shrinks pupils; naloxone wakes the brain back up and saves lives in minutes.

The chain — how it unfolds

1. Opioid drug floods mu receptors in the brainstem — why: When heroin, fentanyl, or a prescription opioid enters the bloodstream, it crosses into the brain within seconds and locks onto mu opioid receptors in the medulla (the breathing control center) and the reticular activating system (the wakefulness network). These receptors are G-protein-coupled receptors that normally help block pain signals, but when an opioid drug activates them in large numbers, they also shut down the neuron circuits that tell the lungs to breathe and keep you awake.
2. Breathing command turns off — why: The medulla normally fires rhythmic signals down the phrenic nerve to contract the diaphragm. When mu receptors there are flooded, those neurons stop firing—even though carbon dioxide is building up in the blood—so the breathing rate drops from a normal twelve to twenty breaths per minute down to four, two, or zero. The person takes shallow, irregular gasps (agonal breathing) or stops breathing altogether (apnea).
3. Pupils shrink to pinpoints — why: At the same time, mu receptors in the Edinger-Westphal nucleus (a tiny cluster in the midbrain that controls the parasympathetic nerve to the pupil) are activated, and the parasympathetic signal clamps the circular muscle of the iris tight. The pupils shrink to one to two millimeters—so small they look like pinpoints—and stay that way even in a dark room, because the usual light reflex is overridden by the opioid.
4. Consciousness fades — why: The reticular activating system, which keeps you awake and aware, is suppressed by opioid receptor activation. The person slips into a deep sleep (or coma) and cannot be roused by shouting, shaking, or painful stimuli. Their Glasgow Coma Scale score drops to 3 to 8 (a normal alert person scores 15), meaning eyes stay closed, no words come out, and there is little or no movement.

5. Oxygen falls, carbon dioxide climbs — why: Because the lungs aren't moving air, fresh oxygen stops entering the blood and carbon dioxide (the waste gas from metabolism) starts piling up. Oxygen saturation (SpO_2) drops from a healthy 95–100 percent down into the 80s, 70s, or lower. Carbon dioxide in the blood (measured as PaCO_2) climbs above the normal 35–45 mmHg, making the blood acidic (respiratory too much acid in the blood (acidosis)). The combination—low oxygen and high acid—is toxic to every organ.
6. Brain and heart start running out of oxygen — why: The brain uses about 20 percent of the body's oxygen even though it's only 2 percent of body weight, and brain cells can't store oxygen—they depend on a steady fresh supply every second. After three to four minutes without oxygen, brain cells begin to die (hypoxic brain injury). The heart muscle also needs oxygen to keep the electrical system firing; when oxygen runs low, the heart rate slows (bradycardia) and dangerous rhythms like pulseless electrical activity or asystole (flat line) can start.
7. Naloxone kicks opioid off the receptors — why: Naloxone is a competitive antagonist—it has a stronger grip on the mu opioid receptor than the opioid drug does, so when you give naloxone (by injection or nasal spray), it bumps the opioid off the receptor within two to three minutes. Once the receptors are free, the medulla starts sending the breathing command again, the reticular activating system wakes back up, and the pupils widen. The person gasps, starts breathing on their own, and their oxygen level climbs back toward normal. Blood pressure and heart rate stabilize, and consciousness returns—sometimes suddenly, which can leave the person confused or agitated because naloxone also blocks the pain relief and euphoria the opioid was providing.
8. Watch for re-sedation — why: Naloxone wears off in thirty to ninety minutes, but many opioids (especially long-acting ones like methadone, or ultra-potent ones like fentanyl) stay in the body longer. If the opioid outlasts the naloxone, the person can slip back into overdose after initially waking up. That's why every overdose patient must go to the hospital for monitoring, and sometimes a second or third dose of naloxone—or a continuous naloxone drip—is needed to keep them breathing until the opioid is fully cleared from the body.

Spot it — what you see, and why

- Pinpoint pupils (tiny pupils that look like dots): Opioids activate mu receptors in the brainstem (the brain's automatic control center), which clamp down the muscle inside the iris (the colored ring in your eye) and squeeze the pupil to a pinpoint — like turning a dial all the way down.

- Slow, shallow breathing (sometimes only 4–6 breaths per minute): Opioids quiet the respiratory center in the brainstem (the part that tells your lungs when to breathe), so the drive to take a breath weakens. Your body stops sensing rising carbon dioxide the way it should, and breathing slows to dangerous levels — like unplugging the alarm that tells you to breathe.
- Deep sleepiness or unresponsiveness (cannot be woken, or only wakes briefly): Opioids flood mu receptors all through the brain, turning down the volume on signals that keep you awake and aware. The whole brain slows, and the person drifts into a sleep so deep they may not respond even to a loud voice or a shake.
- Slow heart rate (bradycardia): Opioids boost the vagus nerve (the main brake on the heart), which slows the heartbeat. At the same time, low oxygen from slow breathing makes the heart pump more sluggishly — like a car engine sputtering when it doesn't get enough fuel.
- Low blood pressure (hypotension): Opioids relax blood vessels (by releasing histamine and quieting the sympathetic nervous system, your body's 'fight or flight' wiring), so pressure drops. Less oxygen also means the heart pumps weakly, lowering pressure even more.
- Blue or gray lips, fingernails, or skin (cyanosis): When breathing is too slow, oxygen in the blood drops below safe levels. Blood that doesn't carry enough oxygen looks darker and shows through the skin as a blue or gray color — like how a candle flame turns dim when it doesn't get enough air.

Red flags — act now

- Breathing fewer than 8 breaths per minute, or no breathing at all
- Cannot be woken even with a loud shout, shake, or sternal rub (rubbing the breastbone firmly)
- Blue or gray lips, face, or fingernails (sign of dangerously low oxygen)
- Choking, gurgling, or foaming at the mouth (airway is blocked or filling with fluid)
- No pulse or very weak pulse

Treat it — in this order

1. Naloxone (Narcan) 0.4–2 mg IV, IM, or intranasal; repeat every 2–3 minutes until breathing improves → Naloxone is a competitive antagonist—it kicks opioid molecules off the mu-opioid receptors in the brainstem's breathing center (the medulla) and the brain's alertness centers. Within seconds to minutes, the medulla starts sending breath signals again, the person wakes up, and pupils enlarge. This is the only drug that reverses the core opioid poisoning.

2. Bag-valve-mask ventilation or endotracheal intubation if naloxone does not restore breathing within 1–2 minutes → Manually pushing oxygen-rich air into the lungs (or securing the airway with a tube) keeps oxygen flowing to the brain and heart while you wait for naloxone to take effect. This buys critical time and prevents brain death from low oxygen (hypoxia).
3. Observe for at least 4–6 hours after the last naloxone dose; give repeat naloxone or start a naloxone infusion if respiratory rate drops again → Many opioids—especially methadone, extended-release oxycodone, and fentanyl analogs—last much longer than naloxone (half-life 30–90 minutes). Watching the person closely catches re-sedation early. A naloxone drip (typically two-thirds the waking bolus dose per hour) keeps receptors blocked if the opioid keeps circulating.
4. Continuous pulse oximetry and cardiac monitoring with frequent respiratory rate checks → Pulse oximetry shows real-time oxygen saturation (SpO₂); if it drops below 90%, you know oxygen delivery is failing. Monitoring respiratory rate (normal 12–20 breaths/min) and heart rhythm catches early warning signs—a slow heart rate (bradycardia), pauses in breathing (apnea), or arrhythmias—before the person crashes again.
5. Establish IV access and give normal saline bolus (500–1000 mL) if blood pressure is low; avoid benzodiazepines unless seizures or severe agitation occur → IV fluids increase blood volume and support blood pressure, helping oxygen and nutrients reach the brain, kidneys, and heart while the opioid clears. Skipping benzodiazepines prevents additive respiratory depression. If the person seizes or becomes dangerously agitated during naloxone withdrawal, a small dose of a short-acting benzo (like lorazepam 1–2 mg) can be given carefully.

Your top priorities at the bedside

1. Open the airway with head-tilt chin-lift or jaw-thrust maneuver and assess breathing rate and depth every 30 seconds — why: Opioids bind to receptors in the brainstem (the part of the brain that controls automatic breathing) and shut down the respiratory drive (signal to breathe), so airway patency (keeping the throat open) and ventilation (moving air in and out) are the first steps to prevent oxygen-starved (hypoxic) brain injury and cardiac arrest from lack of oxygen
2. Give naloxone 0.4 to 2 milligrams by intranasal, intramuscular, or intravenous route and repeat every 2 to 3 minutes until breathing improves to at least 12 breaths per minute — why: Naloxone is an opioid antagonist (a drug that blocks opioid receptors) and rapidly reverses respiratory depression (slowed breathing) by kicking opioids off their binding sites in the brain; repeat dosing is often needed because naloxone wears off in 30 to 90 minutes but many opioids last much longer

3. Start bag-valve-mask ventilation with 100 percent oxygen if the patient is not breathing adequately or naloxone does not restore spontaneous breathing within 1 to 2 minutes — why: Manual ventilation delivers oxygen directly to the lungs and prevents low oxygen in the blood (hypoxemia) (low blood oxygen) and hypercapnia (high carbon dioxide buildup), which cause brain swelling, seizures, and cardiac arrhythmias; waiting too long for naloxone to work risks irreversible brain damage