

Hypothyroidism Severe

This is a life-threatening drop in thyroid hormone that shuts down the body's engine.

THE STORY IN ONE SENTENCE

This is a life-threatening drop in thyroid hormone that shuts down the body's engine.

“Myxedema coma needs IV levothyroxine right away. Give IV hydrocortisone to cover the adrenal glands. Keep the patient warm, breathing, and stable. Hunt for the trigger — infection, cold exposure, sedatives, heart attack, or stopping thyroid medicine.”

Normal anatomy — the body's job

The thyroid gland in your neck makes thyroid hormone (mainly T4 and T3), which acts like the body's gas pedal. Every single cell uses thyroid hormone to decide how fast to work. It tells your heart how fast to beat, your cells how much fuel to burn for heat, your brain how alert to stay, and your kidneys and liver how to process nutrients and waste. When thyroid hormone is at the right level, everything hums along smoothly.

BODY'S JOB

Thyroid hormone keeps your metabolism — the speed at which your body uses energy — running at a healthy pace. It keeps you warm, your heart strong, your mind sharp, and your organs doing their jobs on time. Without it, every system slows down like a phone with a dying battery.

1. The hypothalamus (deep in the brain) sends TRH (thyroid-releasing hormone) to the pituitary gland.
2. The pituitary gland (a pea-sized gland at the base of your brain) responds by releasing TSH (thyroid-stimulating hormone) into your blood.
3. TSH travels to the thyroid gland in your neck and tells it to make thyroid hormone: mostly T4 (thyroxine) and a little T3 (triiodothyronine).
4. T4 and T3 travel through your bloodstream to every cell in your body.

5. Inside each cell, T3 (the active form) docks onto receptors in the nucleus and turns on genes that control how fast the cell burns fuel, how much heat it makes, and how it does its job.
6. When thyroid hormone levels rise high enough, the brain senses it and slows TSH release — that's the feedback loop that keeps everything balanced.

What breaks

Severe hypothyroidism happens when the thyroid can't make enough hormone — usually because the gland itself is damaged or destroyed — and then something extra (a stressor) pushes the person over the edge into crisis.

CLINICAL TERM

Myxedema coma is profound hypothyroidism triggered by a physiologic stressor in a person with chronic, often undiagnosed or undertreated, primary hypothyroidism. The precipitating event (infection, cold exposure, sedatives, CNS depressants, trauma, surgery, MI, stroke, or abrupt cessation of levothyroxine) unmasks severe thyroid hormone deficiency. The result is multiorgan hypometabolism: hypothermia, a slow heart rate (bradycardia), hypoventilation, altered mental status, low sodium (hyponatremia), low blood sugar (hypoglycemia), and cardiovascular collapse.

How the body compensates

In the early stages, the body tries to protect vital organs by slowing everything down to save energy — heart rate drops, metabolism slows, and the person feels tired and cold. But there is no true compensation for severe thyroid hormone loss. Once the stressor hits, the body cannot keep up, and every system begins to fail together. Vital signs may look deceptively stable for a short window, but the patient is on a steep downhill slide. The key is to recognize the pattern early — because once myxedema coma sets in, mortality is 20 to 50 percent even with treatment.

1. Early on, the body tries to conserve energy: heart rate slows, blood pressure may stay normal or drop, and the person becomes lethargic and confused.
2. This looks like the body is coping, but it is really running on fumes — there is no reserve left.
3. As thyroid hormone drops further, the brain, heart, lungs, and kidneys all fail at once: hypothermia (core temp often below 95°F or 35°C), a slow heart rate (bradycardia), shallow breathing or respiratory failure, coma, low sodium (hyponatremia), and low blood sugar (hypoglycemia).

4. The cardiovascular system cannot maintain blood pressure, and cardiogenic shock or cardiac arrest can happen suddenly.
5. If the patient also has hidden adrenal insufficiency (the adrenal glands are exhausted or damaged), giving thyroid hormone alone can trigger life-threatening Addisonian crisis — so IV hydrocortisone must be given first or at the same time.
6. The dangerous middle is when vitals look stable but the patient is getting more confused, colder, and slower — that is the moment to act, not wait.
7. Watch the trajectory, not just the snapshot: a patient whose mental status is declining hour by hour, whose temperature is falling, or whose breathing is getting shallower is in trouble even if the blood pressure has not crashed yet.
8. Once full myxedema coma sets in — unresponsive, very cold, barely breathing — the window to reverse it narrows fast, and many patients do not survive despite aggressive care.

Domino effect

1. Thyroid hormone drops to a dangerously low level. — The thyroid gland (damaged by autoimmune disease, surgery, or radioactive iodine) can barely make any T4 or T3. A stressor like infection or cold pushes the person over the edge, and now there is almost no thyroid hormone in the blood to keep cells running.
2. Every cell in the body slows down its work. — Without thyroid hormone docking onto receptors in the cell nucleus, genes that control metabolism stay turned off. Cells stop burning fuel efficiently, so they make less energy and less heat.
3. Body temperature drops (hypothermia). — Cells are not burning fuel to make heat, and the hypothalamus (the brain's thermostat) is also running slow, so it does not trigger shivering or other warming responses. Core temperature falls below 95°F (35°C) and keeps dropping.
4. The heart beats very slowly (bradycardia) and weakly. — Thyroid hormone normally keeps the SA node (the heart's natural pacemaker) firing quickly and keeps heart muscle strong. Without it, the electrical signals slow down, the heart muscle contracts weakly, and cardiac output (the amount of blood pumped per minute) drops.
5. Breathing becomes shallow and slow (hypoventilation). — The brainstem respiratory centers (in the medulla) are sluggish because of low thyroid hormone, hypothermia, and poor blood flow. The diaphragm and chest muscles are weak. Carbon dioxide builds up in the blood (hypercapnia), and oxygen levels fall (hypoxemia). This can lead to respiratory failure.

6. Sodium level in the blood drops (hyponatremia). — The kidneys cannot excrete free water properly because of low cardiac output, and ADH (antidiuretic hormone, also called vasopressin) is released even when it should not be. Water is retained, diluting the sodium in the blood. Also, the cold and slow circulation damage the kidneys' ability to regulate salt balance.
7. Blood sugar falls (hypoglycemia). — The liver is not making new glucose efficiently (a process called gluconeogenesis that depends on thyroid hormone), and the adrenal glands may be failing too, so cortisol (which normally keeps blood sugar up) is low. With less fuel in the blood, the brain starts to starve.
8. The person becomes confused, then unresponsive (altered mental status or coma). — The brain is cold, low on oxygen, low on sodium, and low on glucose — all at once. Neurons (brain cells) cannot fire properly, so thinking slows, then stops. The person may be drowsy, confused, or slip into a deep coma.
9. Reflexes disappear or become very slow (delayed relaxation phase of deep tendon reflexes). — Cold and low thyroid hormone slow every nerve signal and muscle contraction in the body. When you tap a reflex, the muscle contracts but then takes a long time to relax — this is a classic sign doctors look for.
10. Blood pressure drops and the heart may stop (cardiovascular collapse). — The heart is beating too slowly and weakly to pump enough blood. Blood vessels are floppy because of low thyroid hormone and low cortisol. Eventually, organs shut down from lack of blood flow, and the patient can go into shock or cardiac arrest.

Symptoms · what the patient feels, and why

- Puffy face and swollen eyelids: When thyroid hormone (the body's speed-control messenger) runs very low, a thick gel called mucin (a sticky protein mix) piles up under the skin, especially around the eyes and cheeks, making the face look bloated even though it's not water or fat.
- Body temperature drops (hypothermia): Thyroid hormone tells every cell how fast to burn fuel. Without enough, cells slow down and make less heat, so body temperature can drop below 95°F—like turning the furnace way down.
- Heart rate slows way down (bradycardia): Thyroid hormone speeds up the heart's pacemaker cells. When levels crash, the heart beats slowly—often under 60 beats per minute—because those pacemaker cells lose their push.
- Extreme tiredness and confusion (altered mental status): The brain needs thyroid hormone to keep neurons firing quickly and to make enough energy. Severe shortage slows brain activity, so thinking gets foggy, speech slows, and some people slip into a sleepy, confused state or even a coma.

- Very slow reflexes (delayed relaxation phase): Muscles need thyroid hormone to relax quickly after they contract. Without it, the relaxation phase drags out—tap the knee and the leg kicks normally but takes several extra seconds to drop back down, like a slow-motion movie.
- Thick, dry skin and hair loss: Thyroid hormone keeps skin cells turning over and hair follicles growing. When it's very low, old skin cells pile up (making skin thick and rough), sweat glands shut down (making skin dry), and hair follicles go to sleep (so hair thins and falls out, especially the outer third of the eyebrows).
- Trouble breathing (hypoventilation): The brainstem's breathing center and the muscles that move the chest need thyroid hormone to stay alert and strong. Severe shortage weakens those muscles and dulls the brain's drive to breathe, so breaths become slow and shallow, letting carbon dioxide build up in the blood.
- Severe constipation or belly swelling: Thyroid hormone keeps the muscles in the intestine wall squeezing food along. Without enough, the gut slows to a crawl—food sits for days, water gets sucked back out, and stool becomes rock-hard. In extreme cases the bowel can swell or even stop moving (ileus).
- Low blood sodium (hyponatremia): Severe hypothyroidism makes the kidneys hold onto too much water (because a hormone called ADH—antidiuretic hormone—goes up and the kidneys can't clear water as fast). The extra water dilutes the sodium in the blood, so the number drops below 135, which can cause confusion and seizures if it falls very low.
- Scar on the front of the neck: A scar means the thyroid gland was removed by surgery in the past. Without a thyroid, the body can't make its own hormone, so if the person stops taking their levothyroxine pills (thyroid hormone replacement), levels crash to zero and severe hypothyroidism—or even myxedema coma—can happen within weeks.

Focused exam

- Core body temperature below 95°F (35°C) — hypothermia: Thyroid hormone acts like the body's furnace control. Without it, cells cannot burn fuel to make heat. When the core temperature drops this low, the body's engine has nearly stopped. This is one of the biggest red flags that hypothyroidism has become life-threatening.
- Heart rate below 50 beats per minute (bradycardia): Thyroid hormone tells the heart how fast to pump. Without enough hormone, the heart slows down like a car idling in neutral. A very slow heart in a cold, confused person strongly suggests severe hypothyroidism.
- Breathing is shallow, slow, or labored — hypoventilation: The muscles that move air in and out need thyroid hormone to work well. Without it, breathing becomes weak and slow. Carbon dioxide can build up in the blood, making confusion worse and eventually causing the person to stop breathing entirely.

- Confused, very sleepy, or cannot be woken up — altered mental status: The brain needs thyroid hormone to run. Severe hypothyroidism starves the brain of the energy it needs. When you see confusion plus cold body plus slow heart, you are looking at myxedema coma — the most dangerous form of hypothyroidism.
- Puffy face, hands, and skin that holds a dent when you press it — nonpitting swelling (edema): Without thyroid hormone, the body fills the skin with a thick gel made of sugar and protein. This puffiness is called myxedema. It is a sign that thyroid hormone has been low for weeks or months.
- Ankle reflex is very slow or absent — delayed relaxation phase: Thyroid hormone keeps nerves and muscles working at normal speed. When you tap the ankle or knee with a reflex hammer, the foot should kick and relax quickly. In severe hypothyroidism, the kick happens slowly or not at all — the muscle just hangs there. This delayed reflex is a classic clue.

Diagnostics · every test answers a question

- Thyroid-stimulating hormone (TSH) and free thyroxine (free T4) → Is the thyroid gland failing, and how severe is the hormone shortage?
- Serum sodium (Na^+) → Is the body holding too much water and diluting the blood?
- Arterial blood gas (ABG) or venous blood gas → Is carbon dioxide building up because breathing is too weak?
- Serum cortisol (random or morning level) → Is the adrenal gland also failing, or is it at risk of crashing when thyroid hormone is replaced?
- Complete blood count (CBC) → Is there an infection triggering the crash, or is the body too slow to make blood cells?
- Chest X-ray → Is there pneumonia or fluid in the lungs from heart failure?
- Creatine kinase (CK) and creatinine → Are the muscles breaking down, and are the kidneys working?

Treatment logic

- IV levothyroxine (T4) 200–400 mcg loading dose, then 50–100 mcg daily until the person can swallow pills → Replaces the missing thyroid hormone so every cell in the body can burn fuel again, make heat, and speed up. This is the root fix. The heart speeds up, the brain wakes up, and body temperature starts to climb over 24–48 hours. Without this, nothing else will save the person.

- IV hydrocortisone 100 mg every 8 hours (stress-dose steroids) → Protects the adrenal glands (which sit on top of the kidneys and make cortisol, the body's main stress hormone). When thyroid hormone is replaced suddenly, the adrenal glands must work harder. If they cannot keep up, blood pressure can crash — called adrenal crisis. Hydrocortisone prevents this and also treats hidden adrenal failure that severe hypothyroidism can mask.
- Slow passive rewarming with blankets and warm IV fluids (37°C normal saline) — avoid aggressive external heat → Brings the core body temperature up gently, usually 0.5–1°C per hour. A body that is too cold can develop dangerous heart rhythms (ventricular fibrillation) if warmed too fast. Passive rewarming keeps the heart stable while thyroid hormone restarts the body's internal furnace.
- Slow IV fluid replacement with hypertonic saline (3% NaCl) if sodium is very low (below 120 mEq/L) — raise sodium by no more than 6–8 mEq/L in 24 hours → Corrects the diluted blood caused by the kidney holding too much water. Raising sodium slowly wakes up the brain and heart without causing osmotic demyelination syndrome (brain cells swell and burst if sodium rises too fast). Also give IV normal saline to restore blood volume if the person is dehydrated.
- Find and treat the trigger: check for infection (blood cultures, urinalysis, chest X-ray) and give antibiotics if infection is present; review medications (stop drugs that suppress thyroid like amiodarone or lithium); ask about missed levothyroxine doses or recent surgery, heart attack, or stroke → Removes the reason the thyroid crashed in the first place. Infection (pneumonia, urinary tract infection, sepsis), skipped thyroid pills, surgery, or certain drugs are the most common triggers. Treating the infection or stopping the culprit drug prevents the person from crashing again once thyroid hormone is replaced.
- Intubation and mechanical ventilation if breathing is too shallow (PaCO₂ above 50–55 mmHg) or the person cannot protect their airway → Takes over the work of breathing and keeps oxygen flowing to the brain and heart while the body is cold and slow. It blows off the built-up carbon dioxide and prevents respiratory arrest. Buys time — usually 24–72 hours — for thyroid hormone to restart the breathing muscles.
- Avoid sedatives, narcotics, and anesthesia whenever possible → Prevents further slowing of the brain and breathing. The brain in severe hypothyroidism is extremely sensitive to any drug that causes drowsiness. Even a small dose of a painkiller or sedative can push the person from sleepy to unconscious or stop breathing entirely.

Medications

Levothyroxine (IV) · Synthetic thyroid hormone (T4 replacement)

Levothyroxine is man-made T4 (thyroxine), the main hormone your thyroid gland normally makes. When your thyroid has failed and you are in a myxedema coma (life-threatening

shutdown from almost no thyroid hormone), your cells are starving for this signal. Giving levothyroxine directly into the vein puts T4 back into your blood quickly so your body can use it to wake up your metabolism (how fast your cells burn fuel and make energy), warm you up, speed up your heart, and bring your brain back online. Some of the T4 will also turn into T3 (the more active form) inside your cells.

1. IV levothyroxine enters your bloodstream and travels to cells all over your body
2. Inside each cell, some T4 is converted by an enzyme (deiodinase) into T3, the hormone that does most of the work
3. T3 enters the cell nucleus and binds to thyroid hormone receptors
4. Those receptors then turn on genes that make proteins for energy production, heat generation, and cell growth
5. Over hours to days, your metabolism speeds up, your heart rate rises, your body temperature climbs, and your brain wakes up

SAFETY WATCH

DO NOT give the full IV dose if the patient has a weak or damaged heart—loading with 200–400 mcg can stress the heart and trigger a heart attack or dangerous rhythm. In older patients or those with known heart disease, start with 50–100 mcg and go slower. · ALWAYS give IV hydrocortisone (a steroid) BEFORE or at the same time as levothyroxine, because thyroid hormone speeds up how fast your body breaks down cortisol (your main stress hormone). If the adrenal glands (small glands on top of your kidneys that make cortisol) are also weak or failing, giving T4 alone can cause a life-threatening adrenal crisis (sudden collapse from no cortisol). · Monitor heart rhythm on a continuous ECG—rising thyroid hormone can unmask irregular heartbeats or cause chest pain if the heart has hidden blockages. · Warm the patient slowly (no more than 0.5°C per hour) because fast rewarming can drop blood pressure dangerously.

Liothyronine (IV T3, if available and patient is critically ill) · Synthetic thyroid hormone (T3 replacement)

Liothyronine is man-made T3 (triiodothyronine), the active form of thyroid hormone that works directly on your cells without needing conversion. In myxedema coma, your body's ability to turn T4 into T3 may be broken because you are so sick. Giving T3 directly gets the active hormone into your cells faster, which may speed recovery of your heart rate, blood pressure, and brain function. However, T3 is more powerful and riskier than T4, so it is used carefully and only in the sickest patients.

1. IV liothyronine enters the bloodstream and rapidly reaches cells

2. T3 crosses into the cell and goes straight to the nucleus, binding to thyroid hormone receptors
3. The receptors activate genes that ramp up energy production, heat, and cell activity
4. Effects on heart rate and metabolism may appear within hours, faster than T4 alone

SAFETY WATCH

ONLY use T3 in true myxedema coma when the patient is critically unstable and you need faster action; many experts skip it and use T4 alone because T3 carries higher risk. · DO NOT give large doses—typical IV T3 dose is 5–20 mcg as a loading dose, then 2.5–10 mcg every 8 hours. Too much can trigger a heart attack, dangerous arrhythmia (irregular heartbeat), or a sudden spike in metabolism that crashes blood pressure. · Give IV hydrocortisone FIRST to cover the adrenal glands before any thyroid hormone (T4 or T3). · Watch the heart continuously on a monitor—T3 can cause chest pain, fast heart rate (tachycardia), or irregular rhythm in patients with underlying heart disease. · If T3 is not available or the patient has significant heart disease, stick with T4 only and accept the slower recovery.

Hydrocortisone (IV) · Corticosteroid (synthetic cortisol)

Hydrocortisone is man-made cortisol, the main stress hormone your adrenal glands (small glands sitting on top of your kidneys) make to help your body handle shock, infection, and low blood pressure. In myxedema coma, your adrenal glands may also be weak or failing (this is called adrenal insufficiency), and starting thyroid hormone WITHOUT covering cortisol can push you into adrenal crisis—a sudden, life-threatening drop in blood pressure and collapse. Giving hydrocortisone protects you while the team sorts out whether your adrenals are working and replaces the cortisol your body needs to survive the stress.

1. IV hydrocortisone enters your bloodstream and travels to cells everywhere
2. It crosses into cells and binds to glucocorticoid receptors
3. The receptors move into the cell nucleus and turn on genes that tighten blood vessels, boost blood sugar, and dial down runaway inflammation
4. Blood pressure stabilizes, and your body can better handle the stress of severe illness and the metabolic push from thyroid hormone replacement

SAFETY WATCH

ALWAYS give hydrocortisone BEFORE or at the same time as thyroid hormone (T4 or T3)—never wait. Thyroid hormone speeds breakdown of cortisol, and if the adrenals cannot keep up, the patient can crash. · Standard dose is 100 mg IV every 8 hours until you confirm the adrenal glands are working (by checking a baseline cortisol level and doing a stimulation test when the patient is stable). · If adrenal function is normal, you can taper and stop hydrocortisone after a few days. If the patient has true adrenal insufficiency, they will need lifelong steroid replacement. · High-dose hydrocortisone for a short time is generally safe, but watch blood sugar (steroids raise glucose) and watch for stomach irritation or bleeding if the patient is on it for more than a few days.

Red flags

- Body temperature below 95°F (35°C) or person feels ice-cold to touch
- Confusion, extreme sleepiness, or won't wake up (myxedema coma)
- Breathing is very slow or shallow, lips turning blue
- Heart rate under 50 beats per minute or blood pressure dropping
- Recent infection, surgery, or missed many doses of thyroid medicine

Nursing priorities

1. Secure the airway and monitor respiratory rate every 15 minutes; keep intubation equipment at bedside — Severe hypothyroidism weakens the respiratory muscles and decreases the brain drive to breathe; patients can stop breathing suddenly due to carbon dioxide buildup and need emergency breathing tube placement
2. Place the patient on continuous cardiac monitoring and check vital signs every 15 minutes, watching for a slow heart rate (bradycardia) below 50 and low blood pressure (hypotension) — Low thyroid hormone slows the heart rate (bradycardia) and drops blood pressure because the heart muscle contracts weakly; severe a slow heart rate (bradycardia) can lead to cardiac arrest
3. Start passive rewarming with warm blankets and warmed IV fluids to 98.6°F; avoid active heating like warming blankets or hot packs — Hypothermia happens because metabolism is too slow to generate body heat; aggressive rewarming dilates blood vessels suddenly and can cause dangerous blood pressure drops and heart rhythm problems
4. Administer IV hydrocortisone 100 mg immediately before or with the first dose of levothyroxine — Severe hypothyroidism often coexists with adrenal insufficiency (low cortisol hormone); giving thyroid hormone first can trigger adrenal crisis with life-threatening shock if the adrenal glands cannot respond to increased metabolism

5. Give IV levothyroxine exactly as ordered through a dedicated line; never give as a bolus push faster than prescribed — IV levothyroxine replaces the missing thyroid hormone to restart metabolism; giving it too fast can overload the weakened heart and cause dangerous arrhythmias (irregular heart rhythms) or heart attack
6. Monitor hourly urine output and watch for fluid overload; listen to lung sounds every 2 hours for crackles — The heart pumps poorly in severe hypothyroidism and kidneys hold onto sodium and water; IV fluids can quickly cause pulmonary edema (fluid flooding the lungs) (fluid in the lungs) leading to respiratory failure
7. Assess neurological status using Glasgow Coma Scale every hour; notify provider immediately if score drops by 2 points — Brain function worsens as metabolism slows and carbon dioxide builds up; declining consciousness warns of impending coma and respiratory arrest requiring intubation
8. Draw blood cultures and start broad-spectrum antibiotics immediately if infection is suspected; do not wait for fever — Infection triggers most cases of myxedema coma; hypothyroid patients often cannot mount a fever response, so normal temperature does not rule out serious infection that needs urgent antibiotic treatment

Sources

- American Thyroid Association (ATA) 2014 Myxedema Coma Guideline
- Endocrine Society Clinical Practice Guideline on Hypothyroidism
- UpToDate / NEJM consensus reviews on severe hypothyroidism
- American Association of Clinical Endocrinologists (AACE) Thyroid Guidelines

Last reviewed: 2026-07-07