

# Sepsis bundle

The sepsis bundle is your first-hour checklist: measure lactate (a blood acid that shows low oxygen), draw blood cultures (to find the germ), start the right antibiotic, give IV fluids (to fill leaky vessels), and start vasopressors (squeeze medicines) if blood pressure stays low.

## THE ONE-LINE TRUTH

Sepsis is an infection that has triggered a harmful immune reaction, causing organs to fail — measured as a SOFA score of 2 or more.

## The chain — how it unfolds

1. Germ releases toxins (like endotoxin from bacteria) into the bloodstream. — why: These toxins are recognized by pattern receptors on immune cells, triggering a massive release of cytokines (TNF-alpha, IL-1, IL-6) that flood the whole body instead of staying local.
2. Fever or hypothermia (very low temperature). — why: Cytokines reset the hypothalamus (the brain's thermostat) to raise body temperature (fever, often over 100.4°F or 38°C) to slow germ growth, but in severe sepsis the thermostat can break and temperature drops below 96.8°F (36°C) — hypothermia is a red flag for shock.
3. Endothelium (blood vessel lining) is damaged, causing capillary leak and vasodilation. — why: Cytokines and nitric oxide punch holes in the endothelium and relax the smooth muscle around vessels, so fluid leaks into tissues (causing swelling and low blood volume) and vessels open wide (dropping blood pressure) — this is distributive shock.
4. A fast heart rate (Tachycardia) (heart rate over 100), fast breathing (tachypnea) (breathing over 20), and low blood pressure (hypotension) (systolic blood pressure under 90 or needing vasopressors). — why: The heart races and lungs work overtime to move blood that is not where it should be, and blood pressure drops because the pipes are too wide and half-empty — this triad is the clinical picture of septic shock.
5. Organs do not get enough oxygen, so lactate (lactic acid) rises above 2 mmol/L. — why: With poor blood flow and poisoned mitochondria, cells cannot burn glucose with oxygen (aerobic metabolism), so they switch to burning it without oxygen (anaerobic glycolysis), which makes lactate as a waste product — lactate is the blood test that shows tissue low oxygen (hypoxia) (oxygen starvation).

6. Confusion, decreased urine output, and organ failure (kidney, lung, liver). — why: The brain does not get enough oxygen so the patient becomes confused or unresponsive; the kidneys shut down (acute kidney injury, creatinine rises, urine drops below 0.5 mL/kg/hour); the lungs fill with leaked fluid (acute respiratory distress syndrome, ARDS); and the liver cannot clear waste (bilirubin and ammonia rise).
7. Without the sepsis bundle (antibiotics, fluids, vasopressors), the spiral deepens into multi-organ failure and death. — why: Each broken step feeds the next: more cytokines → more leak → less pressure → less oxygen → more lactate → more organ damage → more cytokines. The sepsis bundle breaks the cycle: antibiotics kill the germ (stopping the toxin source), IV fluids fill the leaky pipes, and vasopressors (norepinephrine is first-line) squeeze the vessels to raise pressure and push blood into organs again.
8. Early treatment (within 1 hour) cuts mortality; every hour of delay increases the chance of death. — why: The Surviving Sepsis Campaign and multiple trials show that the first hour is golden — measuring lactate shows how bad it is, blood cultures identify the germ for targeted antibiotics later, broad-spectrum antibiotics (like piperacillin-tazobactam or ceftriaxone plus vancomycin, depending on the source) start killing the germ immediately, 30 mL/kg IV crystalloid fluids (about 2 liters for an average adult) fill the volume deficit, and vasopressors (if mean arterial pressure stays below 65 mmHg) restore blood flow (perfusion) pressure so organs can recover instead of dying.

## Spot it — what you see, and why

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- Fast breathing (22 breaths per minute or more): The body tries to blow off carbon dioxide (a waste gas) and pull in more oxygen because infection and inflammation are making cells work harder and burn fuel faster.
- Confusion or being much sleepier than usual: The brain is not getting enough oxygen and glucose (sugar fuel) because blood pressure has dropped and tiny clots are clogging small blood vessels; toxins (poisons from bacteria) also irritate brain cells.
- Low blood pressure (systolic, the top number, below 100): Infection triggers the release of chemicals like cytokines (alarm signals from immune cells) that make blood vessels open wide and leak fluid; the heart can't pump hard enough to keep pressure normal.
- Very high or very low body temperature (above 101°F or below 96.8°F): The hypothalamus (the brain's thermostat) resets temperature higher to fight infection, or temperature drops dangerously low when the body can no longer keep up with the infection.
- Heart racing (more than 90 beats per minute): The heart pumps faster to try to deliver oxygen and nutrients to starving tissues when blood pressure is low and blood vessels are leaking.

- Making very little urine or none at all: The kidneys shut down because blood pressure is too low to push blood through their tiny filters, or clots are blocking the small vessels inside the kidneys.

## Red flags — act now

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- Systolic blood pressure below 90 despite giving fluids through an IV — the patient may need medicines (vasopressors like norepinephrine) to squeeze blood vessels and raise pressure.
- Urine output less than 0.5 mL per kilogram per hour for two hours — kidneys are failing and the patient may need dialysis (a machine that cleans the blood).
- Lactate (a waste chemical that builds up when cells burn fuel without enough oxygen) above 4 mmol/L — tissues are starving for oxygen and death risk is very high.
- New confusion, extreme sleepiness, or inability to wake the patient — the brain is not getting enough blood and oxygen.
- Breathing rate above 30 or needing a machine to breathe (mechanical ventilation) — the lungs are failing.

## Treat it — in this order

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1. Draw blood cultures (at least two sets) and check lactate before giving antibiotics → Blood cultures catch the germ before antibiotics kill it, so you know which bug you are fighting and can narrow therapy later. Lactate measures how badly cells are starving for oxygen right now — it is your baseline to track improvement.
2. Give broad-spectrum IV antibiotics within 1 hour of recognizing sepsis → Kills the bacteria making toxins that trigger the runaway immune attack. Every hour of delay raises the risk of death. Once cultures identify the germ, narrow to a targeted antibiotic to avoid resistance and side effects.
3. Give 30 mL per kg of IV crystalloid fluid (normal saline or lactated Ringer's) within 3 hours → Refills the blood vessels that are leaking fluid into tissues. This raises blood pressure and pushes oxygen-rich blood back to the brain, kidneys, and heart. Lactate should start to drop as cells get oxygen again.
4. Start norepinephrine (a vasopressor) if MAP stays under 65 mmHg after fluids → Tightens blood vessels that sepsis made too wide and floppy, so pressure climbs and blood flows to vital organs. Target MAP is 65 mmHg or higher to keep kidneys and brain alive.
5. Find and control the infection source (drain abscess, remove infected catheter or hardware, surgery for burst bowel or dead tissue) → Removes the germ factory so the immune system stops being triggered over and over. This is the only way to truly cure sepsis — antibiotics alone cannot reach pus pockets or dead tissue.

## Your top priorities at the bedside

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1. Draw blood cultures from two sites and serum lactate level before giving any antibiotics — why: Blood cultures identify the exact bacteria causing sepsis so we can narrow antibiotics later; lactate measures tissue oxygen debt and predicts mortality; both must be drawn before antibiotics or results become false negatives
2. Administer broad-spectrum IV antibiotics within 1 hour of sepsis recognition — why: Every hour delay in antibiotics increases mortality by 7 percent because bacteria multiply fast and release toxins that damage organs; broad coverage kills common bugs while culture results are pending
3. Start 30 mL per kg crystalloid IV fluid bolus within 3 hours using normal saline or lactated Ringer solution — why: Sepsis causes vasodilation (blood vessels widen) and capillary leak so fluid shifts out of vessels; rapid fluid replaces intravascular volume to restore blood pressure and blood flow (perfusion) (blood flow) to organs before they fail