

CLABSI

CLABSI means germs sneak into your blood by hitchhiking along a central line—the line is guilty until you prove it innocent.

THE ONE-LINE TRUTH

Bacteria crawl into the bloodstream through a central line (a large IV tube placed near the heart), causing a blood infection.

The chain — how it unfolds

1. Bacteria enter the bloodstream through the central line — why: Skin bacteria (commonly *Staphylococcus epidermidis*, a germ that lives harmlessly on everyone's skin, or *Staphylococcus aureus*, a more aggressive cousin) migrate along the catheter tract from the insertion site, or hands contaminate the catheter hub during access. Either way, bacteria break through the skin barrier into the sterile bloodstream—a place they should never be.
2. Bacteremia (bacteria in the blood) triggers a whole-body alarm — why: Bacterial cell walls contain toxins (endotoxins from gram-negative bacteria like *E. coli*, or peptidoglycan and lipoteichoic acid from gram-positive bacteria like Staph). These toxins activate immune cells (macrophages, neutrophils), which release chemical messengers (cytokines: $\text{TNF-}\alpha$, IL-1, IL-6) that sound the alarm throughout the body, causing fever, chills, and widespread inflammation.
3. Fever and rigors (violent shaking chills) appear — why: Cytokines travel to the brain and reset the body's thermostat (hypothalamus) to a higher temperature (fever, often 101–104°F). Your muscles shiver violently (rigors) to generate heat and reach that new set-point. This is your body trying to slow bacterial growth—most bacteria grow best at 98.6°F, so raising the temperature gives your immune system an edge.
4. A fast heart rate (Tachycardia) (fast heart rate) and fast breathing (tachypnea) (fast breathing) develop — why: Your heart races (often 100–140 beats per minute) to pump more blood, delivering oxygen and immune cells to infected tissues. Your lungs breathe faster (often 24–30 breaths per minute) to bring in oxygen and blow off carbon dioxide and lactic acid (a waste product made by oxygen-starved cells doing anaerobic metabolism). This keeps you stable temporarily.

5. Sepsis emerges if bacteria overwhelm your defenses — why: Uncontrolled bacterial multiplication and toxin release cause widespread vasodilation (blood vessels relax and widen, dropping blood pressure), capillary leak (fluid leaks out of blood vessels into tissues, causing swelling and dropping blood volume), and organ dysfunction from poor blood flow (hypoperfusion—organs starve for oxygen). This is sepsis: life-threatening organ dysfunction caused by the body's dysregulated (out-of-control) response to infection.
6. Septic shock occurs if blood pressure drops despite IV fluids — why: Massive vasodilation and capillary leak drop blood pressure so low (systolic under 90 or MAP under 65 mmHg) that organs—brain, kidneys, liver—do not get enough oxygen. Cells switch to anaerobic metabolism (burning fuel without oxygen), producing lactic acid (lactate over 2 mmol/L). You become confused (brain poor blood flow (hypoperfusion)), stop making urine (kidney poor blood flow), and your skin turns mottled or cold (peripheral shutdown). Without immediate treatment (fluids, antibiotics, pressors to squeeze blood vessels), multi-organ failure and death follow within hours.
7. Removing the line and starting antibiotics stops the cycle — why: Removing the catheter eliminates the biofilm reservoir—bacteria hiding in the slimy coating on the line surface that antibiotics cannot reach. Without the biofilm factory, the bacteria source is gone. Broad-spectrum IV antibiotics (such as vancomycin to cover Staph plus a gram-negative antibiotic like cefepime or piperacillin-tazobactam) kill circulating bacteria, stopping toxin release. Once the source is gone and antibiotics clear the bloodstream, your immune system regains control, inflammation calms, blood pressure stabilizes, and organs recover.
8. Blood cultures identify the germ and guide antibiotic choice — why: Before starting antibiotics, nurses draw blood cultures from the central line and a peripheral vein. If the same bacteria grow from both sites, and the central-line culture turns positive at least two hours earlier than the peripheral culture (differential time to positivity), the line is confirmed guilty. Culture results (usually available in 24–72 hours) identify the exact bacteria and tell doctors which antibiotics will kill it, allowing de-escalation from broad-spectrum to targeted therapy (antibiotic stewardship) and reducing side effects and resistance.

Spot it — what you see, and why

- Fever (temperature $\geq 38.0^{\circ}\text{C}$ or $\geq 100.4^{\circ}\text{F}$): Bacteria in the blood release toxins that tell the hypothalamus (the brain's thermostat) to turn up body heat. The higher temperature slows down bacteria and speeds up immune cells—like turning up the oven to kill germs.
- Rigors (severe shaking chills): Your muscles shake hard to make extra heat and match the new fever set-point. Rigors mean a big wave of bacteria just dumped into your bloodstream—your body feels the invasion and reacts fast.

- A fast heart rate (Tachycardia) (heart rate >90 beats per minute): The heart pumps faster to rush more blood, oxygen, and immune soldiers to the tissues under attack. It is like a fire engine speeding to a burning building.
- Low blood pressure (Hypotension) (systolic blood pressure <90 mmHg or drop ≥ 40 mmHg from baseline): Bacterial toxins force blood vessels to relax and widen, and fluid leaks out of the vessels into the tissues. Pressure inside the pipes (vessels) drops dangerously low. When IV fluids cannot bring it back up, that is septic shock—a life-threatening emergency.
- Altered mental status (confusion, drowsiness, agitation): Low blood pressure means not enough blood reaches the brain. Without enough oxygen and sugar (glucose), brain cells cannot work right—thinking gets foggy, and the person may seem confused or sleepy.
- Redness (Erythema) (redness), warmth, or pus at catheter insertion site: Bacteria growing on the catheter's outside surface infect the skin and tunnel where the line enters. The body sends extra blood (making it red and warm) and white blood cells (which form pus) to fight the invaders at the door.

Red flags — act now

- Low blood pressure (Hypotension) (systolic BP <90 mmHg) despite giving IV fluids—sign of septic shock
- Altered mental status (confusion, extreme sleepiness, or no response)—brain is not getting enough blood
- Low urine output (Oliguria) or no urine output (anuria) (urine output <0.5 mL/kg/hour or zero urine)—kidneys are failing
- Positive blood cultures still growing bacteria 72 hours or more after removing the line and starting antibiotics—may mean endocarditis (infection stuck to a heart valve) or a hidden abscess
- New heart murmur or embolic events (stroke, dead fingers or toes from clots)—bacteria may have seeded the heart valves (endocarditis)

Treat it — in this order

1. Draw paired blood cultures—one set from the central line and one set from a vein in the arm—before starting any antibiotics → If line blood grows bacteria at least 2 hours faster than arm blood, that proves the line itself is the source. This tells you whether to remove the line or try to save it with antibiotics.

2. Start IV antibiotics immediately: vancomycin (covers MRSA and coagulase-negative staph from skin) plus an anti-pseudomonal beta-lactam like cefepime, piperacillin-tazobactam, or meropenem → These antibiotics kill the most common CLABSI bacteria—skin organisms like *Staphylococcus aureus* and coagulase-negative staph, plus gram-negative rods like *Pseudomonas*. They stop bacteria from multiplying in the blood and worsening sepsis.
3. Remove the central line promptly if bacteria are *S. aureus*, *Candida* (fungus), gram-negative rods like *Pseudomonas*, or if fever and positive cultures persist 72 hours after starting antibiotics → Taking out the line removes the source where bacteria are hiding in biofilm and reproducing. This gives antibiotics a real chance to clear the bloodstream infection and prevents complications like endocarditis—infection of the heart valves—or septic thrombophlebitis, an infected clot in the vein.
4. Repeat blood cultures 2 to 4 days after starting antibiotics to confirm bacteremia—bacteria in the blood—is clearing → Negative repeat cultures show the antibiotics and line removal (if done) actually worked. You know the infection is clearing and not turning into complicated bacteremia, septic shock, or endocarditis.
5. Transthoracic or transesophageal echocardiogram—heart ultrasound—if *S. aureus* bacteremia is confirmed → This looks for vegetations—bacterial clumps stuck to heart valves causing endocarditis—which is a serious complication requiring 4 to 6 weeks of IV antibiotics instead of 2 weeks, and sometimes valve surgery.

Your top priorities at the bedside

1. Obtain two sets of blood cultures—one set drawn from the central line and one set from a peripheral vein in the arm—before any antibiotics are given. — why: Paired cultures (central and peripheral) help prove the central line is infected; if the central-line culture grows bacteria at least 2 hours before the arm culture, the line is the source. Drawing before antibiotics keeps bacteria alive so the lab can identify the exact germ and test which antibiotics kill it.
2. Start IV antibiotics within 1 hour: vancomycin to cover MRSA (methicillin-resistant *Staph aureus*) and coagulase-negative staph, plus an anti-pseudomonal beta-lactam like cefepime, piperacillin-tazobactam, or meropenem to cover gram-negative bacteria and *Pseudomonas*. — why: Every hour delay in antibiotics increases mortality (death rate) in sepsis by about 7%; vancomycin covers skin bacteria that enter through the catheter, and the beta-lactam covers gut and water bacteria that cause hospital infections.

3. Assess blood pressure, heart rate, respiratory rate, temperature, oxygen saturation, and mental status every 15 to 30 minutes until stable, and notify the physician immediately if systolic BP drops below 90 mmHg or patient becomes confused. — why: Septic shock develops when bacteria release toxins that dilate blood vessels, dropping blood pressure and starving organs of oxygen; early recognition lets the team give IV fluids (30 mL per kilogram bolus) and start vasopressors like norepinephrine before organs fail.