

Trauma and Hemorrhage

Stop the bleeding first, give blood products early for big bleeds (class III and IV shock), and watch for the lethal triad: too cold, too acidic, and clotting that doesn't work.

THE ONE-LINE TRUTH

Trauma breaks blood vessels and organs; bleeding (hemorrhage) (uncontrolled bleeding) drains the body's blood supply and causes shock (not enough blood pressure to feed vital organs).

The chain — how it unfolds

1. Trauma tears open a blood vessel (artery, vein, or organ like the spleen or liver). — why: The closed loop of pipes springs a leak. Blood pours out — externally onto the ground or internally into the chest, belly, pelvis, or thigh where you cannot see it.
2. Circulating blood volume drops (hypovolemia). — why: The tank empties. Less blood returns to the heart each beat, so each pump pushes out less blood (low stroke volume). Blood pressure starts to fall.
3. The brainstem detects falling pressure and triggers a sympathetic storm (adrenaline flood). — why: The body's survival reflex kicks in. Epinephrine and norepinephrine squeeze blood vessels and race the heart to try to keep pressure up and protect the brain and heart.
4. Heart rate climbs (tachycardia) and skin gets cold, pale, and sweaty (peripheral vasoconstriction). — why: The heart races to pump more blood per minute even though each beat is nearly empty. Blood is pulled away from the skin, gut, and kidneys to keep the brain and heart alive. The patient looks anxious and feels cold and clammy.
5. If bleeding continues, compensation fails and blood pressure crashes (decompensated shock). — why: The heart is pumping an empty tank — no amount of squeezing or racing can push blood that is not there. Pressure drops, brain and kidneys starve, confusion and low urine output appear.
6. The body gets cold (hypothermia), acidic (lactic too much acid in the blood (acidosis)), and clotting stops (coagulopathy) — the lethal triad. — why: Exposed wounds and cold IV fluids drop core temperature. Cells burning fuel without oxygen make lactic acid. Clotting factors and platelets are used up and diluted by IV fluids. Cold and acid poison the clotting enzymes, so bleeding becomes unstoppable.

7. Without rapid bleeding (hemorrhage) control and blood transfusion, multi-organ failure and cardiac arrest follow. — why: The brain, heart, kidneys, and gut all starve. Too much acid in the blood (Acidosis) stops the heart from beating effectively. The patient dies from exsanguination (bleeding out) or irreversible shock.
8. Reversal requires three things at once: stop the bleeding (surgery, pressure, tourniquet), replace lost blood with balanced blood products (1:1:1 ratio of red cells, plasma, platelets), and prevent or reverse hypothermia (warm fluids, warm the room, cover the patient). — why: Fixing only one part fails — you must close the leak, refill the tank with real blood (not just saline), and keep the clotting machinery warm and working. Do all three fast, and the dominoes reverse: pressure comes up, heart slows down, organs wake up, clotting restarts, and the patient survives.

Spot it — what you see, and why

- Fast heart rate (tachycardia) — the heart beats faster than 100 times per minute: When blood volume drops, the body's alarm system (the brainstem and sympathetic nerves) tells the heart to pump faster to try to keep enough oxygen reaching the brain and vital organs—like a pump speeding up when the tank is low.
- Low blood pressure (hypotension) — top number below 90: With less blood in the system, pressure in the arteries falls because there isn't enough fluid pushing against the vessel walls—like water pressure dropping in a leaky hose.
- Cool, pale, clammy skin: The body shuts blood flow away from the skin to save oxygen for the brain and heart (vasoconstriction driven by norepinephrine and other stress hormones), and fear triggers sweat glands, making skin cold and damp.
- Confusion, restlessness, or anxiety: The brain needs a constant supply of oxygen-rich blood; when blood pressure drops, less oxygen reaches the cerebral cortex (the thinking part) and neurons fire erratically, causing foggy thinking and agitation.
- Weak or absent pulses in the arms or legs: Severe blood loss means less volume is available to travel through peripheral arteries, so pulses at the wrist or ankle feel faint or disappear—like turning down the faucet until water barely trickles out.
- Little or no urine output (oliguria): The kidneys filter blood to make urine; when blood flow drops, less fluid reaches the glomeruli (the kidney's tiny filters), so urine production slows or stops—the body is prioritizing survival over waste removal.

Red flags — act now

- Blood pressure top number below 90 despite giving fluids (suggests massive ongoing bleeding or shock)
- Confused, drowsy, or unresponsive (means the brain is starving for oxygen)

- No urine for hours (sign the kidneys are shutting down from poor blood flow)
- Abdomen rigid and painful, or flanks bruised (may mean internal bleeding in belly or behind the gut)
- Breathing very fast or gasping, lips or fingers turning blue (severe oxygen shortage)

Treat it — in this order

1. Perform ABCDE survey (Airway, Breathing, Circulation, Disability, Exposure) in the first 60 seconds → Finds the life-threatening problem in order of what kills fastest. You check if the airway is open, if the lungs are moving air, if the heart is pumping blood, if the brain is awake, and if there is hidden bleeding under clothes. This roadmap tells you what to fix first.
2. Apply tourniquet high and tight on an arm or leg if bleeding does not stop with direct pressure → Squeezes the artery shut above the wound so blood stops pouring out. This saves the blood volume the body has left and buys time to get the patient to surgery. Modern tourniquets can stay on safely for 2–3 hours.
3. Give blood products in balanced 1:1:1 ratio (packed red blood cells : plasma : platelets) instead of crystalloid alone → Refills the blood volume with real blood that carries oxygen and contains the clotting factors and platelets the body needs to seal leaks. Balanced resuscitation keeps the blood thick enough to clot and prevents diluting away the clotting system. This reverses shock and stops trauma-induced impaired blood clotting (coagulopathy).
4. Permissive low blood pressure (hypotension): keep systolic blood pressure at 80–90 mmHg until bleeding is controlled (except in traumatic brain injury) → Lowers the pressure inside the blood vessels so less blood leaks out of the hole. High pressure before the leak is fixed blows off clots and makes bleeding worse. Permissive low blood pressure (hypotension) buys time and reduces total blood loss until surgery.
5. Give tranexamic acid (TXA) 1 gram IV over 10 minutes, then 1 gram over 8 hours, within 3 hours of injury → Blocks the enzyme (plasmin) that breaks down blood clots. TXA tells the body to protect clots that are forming and keep them sealed longer. This reduces bleeding and improves survival in trauma patients, especially in the first hour.

Your top priorities at the bedside

1. Open the airway with chin-lift or jaw-thrust while holding the neck still and give 100 percent oxygen by non-rebreather mask or bag-valve-mask — why: The brain dies in 4 to 6 minutes without oxygen and cervical spine (neck bone) injury happens in 2 to 3 percent of trauma so moving the neck wrong can cut the spinal cord

2. Apply direct pressure or tourniquet to any visible bleeding from arms or legs and tighten tourniquet until bleeding completely stops — why: External bleeding (hemorrhage) (outside bleeding) you can see kills fast and tourniquets stop arterial bleeding (bleeding from high-pressure blood vessels) that pressure alone cannot control and can stay on safely for 2 hours
3. Start two large-bore IV lines with 18-gauge or 16-gauge needles and draw blood for type-and-cross, hemoglobin, lactate, and coagulation tests before giving any fluids — why: Big IV catheters (plastic tubes in veins) let blood products flow fast and baseline labs tell starting hemoglobin and if the patient has impaired blood clotting (coagulopathy) and lactate above 4 signals shock from poor oxygen delivery to tissues