

Trauma and Hemorrhage

A plain-English guide for you and your family

WHAT IS HAPPENING

Your blood vessels are like pipes that carry oxygen and fuel to every part of your body. When trauma — a car crash, a fall, a gunshot, a stab wound, or a crush — tears open those pipes, blood pours out faster than the body can replace it. That is bleeding (hemorrhage). As the tank empties, blood pressure drops and the heart races to try to push what little blood remains to the brain and heart. The skin gets cold and pale because blood is pulled away from the surface to protect the core. If bleeding continues, the body gets so cold, so acidic, and so bad at clotting that even surgery cannot stop the bleeding — that deadly combination is called the lethal triad. The only way to save a life is to stop the leak (surgery, pressure, or a tourniquet), pour back what was lost (blood, plasma, and platelets in balanced amounts), and keep the body warm. Every minute counts, because once shock tips into the lethal triad, the window to reverse it slams shut.

What you might feel

- Fast heart rate (tachycardia) — the heart beats faster than 100 times per minute
- Low blood pressure (hypotension) — top number below 90
- Cool, pale, clammy skin
- Confusion, restlessness, or anxiety
- Weak or absent pulses in the arms or legs
- Little or no urine output (oliguria)
- Visible bleeding from a wound, or blood pooling under the skin (bruising)
- Swollen, tender abdomen or flanks
- Shortness of breath or fast breathing (tachypnea)
- Thirst

Call the doctor right away if...

- 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)

What the care team will do

- 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
- Apply direct pressure or tourniquet to any visible bleeding from arms or legs and tighten tourniquet until bleeding completely stops
- 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
- Give 1 unit packed red blood cells with 1 unit plasma with 1 unit platelets in 1:1:1 ratio and limit crystalloid fluids like normal saline to less than 1 liter total
- Keep systolic blood pressure at 80 to 90 mmHg until bleeding is controlled unless patient has head injury or spinal cord injury then keep systolic above 110 mmHg
- Give tranexamic acid 1 gram IV over 10 minutes then 1 gram over 8 hours if injury happened less than 3 hours ago
- Expose the entire body by cutting off all clothes and log-roll to inspect the back then cover with warm blankets and turn up room heat
- Monitor vital signs every 5 minutes and watch for narrowing pulse pressure (top number minus bottom number less than 30) and rising heart rate above 120

Medicines you may be given — and why

Packed red blood cells (PRBCs)

Replaces the red cells that carry oxygen throughout your body. When you lose a lot of blood, you lose both the liquid part and the oxygen-carrying red cells inside it. Giving packed red blood cells refills your supply of oxygen carriers so every organ can keep working.

Fresh frozen plasma (FFP)

Replaces clotting factors (proteins your liver makes that help blood clot). Major bleeding washes out these proteins. Fresh frozen plasma is the liquid part of blood, frozen right after donation to keep all the clotting proteins alive. When thawed and given, it refills your supply so your blood can clot again.

Platelets

Replaces platelets (the tiny disk-shaped cells that form the first plug when a blood vessel tears). Major bleeding uses up and washes away platelets. Giving platelet transfusions refills the supply so your body can form plugs at injury sites and stop bleeding.

Cryoprecipitate

Replaces fibrinogen (the clotting protein that forms the mesh of a blood clot). Massive bleeding washes out fibrinogen faster than other clotting factors. Cryoprecipitate is made by thawing plasma and collecting the part that settles out in the cold. That part is rich in fibrinogen, Factor VIII, and von Willebrand factor. Giving cryo quickly rebuilds the fibrinogen level so clots can form.

Tranexamic acid (TXA)

Stops the body from breaking down clots too early. When you are injured, your body forms clots to stop bleeding, but it also releases enzymes (proteins that act like scissors) to dissolve clots later. In major trauma, this dissolving process starts too early and breaks down clots before bleeding is controlled. Tranexamic acid blocks the enzyme plasmin (the scissors that cut up fibrin clots), so the clots you make can stay in place and do their job.

Calcium (calcium chloride or calcium gluconate)

Replaces calcium (a mineral your body needs for muscles to squeeze and for clotting factors to work). Massive transfusion of stored blood products floods the body with citrate (a preservative that binds calcium and locks it away). Without enough free calcium, the heart muscle cannot squeeze strongly, blood vessels cannot tighten, and clotting slows down. Giving calcium unlocks the citrate and restores the free calcium level.

Pelvic binder

A wide fabric strap wrapped snugly around the pelvis (the bony ring at your hips). When the pelvis bones break, the ring opens up, the volume inside grows, and blood vessels torn by the fracture bleed heavily into that new space. The binder squeezes the pelvis back together, closes the extra space, and puts pressure on bleeding vessels so they clot.

Tourniquet

A tight band applied around an arm or leg above the site of severe bleeding. It squeezes blood vessels shut so no blood can flow past it. This completely stops bleeding from injuries below the tourniquet, buying time to get the patient to surgery.

Permissive low blood pressure (hypotension) strategy (keeping systolic BP 80-90 mmHg)

Deliberately keeps blood pressure lower than normal until bleeding is stopped surgically. When you push blood pressure up with fluids or pressors before the hole is fixed, the higher pressure blows clots off the torn vessel and makes bleeding worse (like turning up the water pressure in a leaky pipe). Keeping pressure at 80-90 systolic lets clots stay in place while still delivering enough blood to the brain and heart.

Resuscitative endovascular balloon blockage (occlusion) of the aorta (REBOA)

A balloon catheter threaded through a blood vessel in the groin up into the aorta (the body's main artery). The balloon is inflated to block blood flow below it. This stops bleeding in the belly or pelvis temporarily and pushes more blood to the heart and brain, buying time to get to the operating room.

Warming measures (forced-air warmer, warmed fluids, warmed operating room)

Keeps the patient's body temperature normal (around 98.6°F or 37°C). When you lose a lot of blood, your body loses heat, and cold IV fluids and blood products cool you further. A cold body cannot clot well (enzymes that make clots work slowly in the cold), the heart beats irregularly, and you are more likely to bleed to death. Warming the patient speeds up clotting and keeps the heart stable.

Sodium bicarbonate (baking soda)

Neutralizes lactic acid that builds up when tissues do not get enough oxygen. During shock, cells switch to a backup energy process that makes lactic acid as a waste product. Too much acid makes the blood acidic (acidosis), which stops clotting enzymes from working and weakens the heart. Giving sodium bicarbonate raises the blood pH (makes it less acidic) so clotting and heart function can recover.

Low-molecular-weight heparin (LMWH) or unfractionated heparin (once bleeding is controlled)

Prevents new clots from forming in the wrong places (like the veins in the legs or the lungs). Trauma patients lie still, their blood flow slows, and their clotting system is activated, raising the risk of a clot in a deep leg vein (deep vein thrombosis) (a clot in a leg vein) or pulmonary embolism (a clot lodging in a lung artery) (a clot that travels to the lungs). Heparin blocks part of the clotting cascade so clots do not form in veins. It does NOT break up clots; it only stops new ones.

Where this information comes from

- American College of Surgeons ATLS 10th Edition
- Eastern Association for the Surgery of Trauma (EAST) Guidelines
- American College of Emergency Physicians (ACEP)
- World Society of Emergency Surgery (WSES)

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