

Aplastic Anemia

Aplastic anemia is when the bone marrow shuts down completely and stops making all three kinds of blood cells at once.

THE ONE-LINE TRUTH

The bone marrow factory stops making red cells, white cells, and platelets — usually because the body's own immune cells attack the stem cells or toxic chemicals and drugs destroy them.

The chain — how it unfolds

1. Hematopoietic stem cells in the bone marrow are destroyed or suppressed. — why: Cytotoxic T lymphocytes attack the stem cells (autoimmune, most common cause, about 70% of cases), or drugs (chloramphenicol, sulfonamides, NSAIDs), viruses (hepatitis, parvovirus B19), chemicals (benzene), radiation, or inherited defects (Fanconi anemia, dyskeratosis congenita) directly kill or poison the stem cells. The factory that makes all blood cells shuts down at the source.
2. Production of red blood cells, white blood cells, and platelets all drop together (pancytopenia). — why: All three cell lines come from the same pool of stem cells. When the stem cells are gone, every assembly line in the marrow factory stops at once—this is why you see low counts in all three types, not just one.
3. Hemoglobin falls below 10 g/dL (normal is 12–16 for women, 14–18 for men), often down to 6–8 g/dL in severe cases. Reticulocytes (immature red cells) are low (<1% or <40,000 per microliter), showing the marrow is not trying to replace the lost red cells. — why: Red blood cells live about 120 days. With no new red cells being made, the old ones die off naturally and are not replaced. Oxygen-carrying capacity drops, so tissues become oxygen-starved (hypoxic) (starved for oxygen). The patient feels exhausted, looks pale (especially in the palms, nail beds, and inside the eyelids), may have headaches, dizziness, and shortness of breath with mild activity. The heart beats faster (tachycardia) to pump the remaining red cells around faster and try to deliver enough oxygen.

4. Absolute neutrophil count (ANC) falls below 1,500 per microliter (normal is 1,500–8,000), then often below 500 in severe cases (severe dangerously low infection-fighting cells (neutropenia)). — why: Neutrophils only live 6–8 hours in the bloodstream—they are the first responders to bacterial and fungal infections, so they must be replaced constantly. With no new neutrophils made, the immune defense collapses within days. Bacteria from the gut (*E. coli*, *Klebsiella*, *Pseudomonas*), mouth (*Streptococcus viridans*), and skin (*Staphylococcus aureus*) break through, and fungi (*Candida*, *Aspergillus*) invade. The patient gets recurrent infections—fever, mouth sores (oral ulcers), skin infections, pneumonia, bloodstream infections (sepsis)—and infections spread fast because there are no neutrophils to wall them off.
5. Platelet count falls below 50,000 per microliter (normal is 150,000–400,000), then often below 20,000 or even below 10,000 in severe cases. — why: Platelets live 7–10 days. With no new platelets made, the clotting system fails. The patient sees easy bruising (purpura—purple patches on the skin), pinpoint bleeding spots (petechiae) (tiny red or purple dots, like pinpoints, especially on the lower legs and inside the mouth), nosebleeds (epistaxis), bleeding gums, heavy or prolonged menstrual periods (menorrhagia), and blood in the urine (hematuria) or stool (melena, bright red blood in the stool (hematochezia)). Below 10,000, spontaneous bleeding into the brain (intracranial bleeding (hemorrhage)), lungs (pulmonary bleeding), or gut becomes a life-threatening risk.
6. The spleen and liver stay normal size (no an enlarged spleen (splenomegaly), no an enlarged liver (hepatomegaly)) on physical exam. — why: The problem in aplastic anemia is not overproduction or buildup of abnormal cells (like in leukemia, lymphoma, or myelofibrosis) and not extra destruction of cells in the spleen (like in destroying red blood cells (hemolytic) anemia). The problem is absence of cell production—the marrow is empty or nearly empty, so there is nothing extra to fill or enlarge the spleen. A normal-sized spleen is an important clue that helps separate aplastic anemia from other causes of low counts of all blood cells (pancytopenia).
7. Bone marrow biopsy shows hypocellular marrow (cellularity <25%, often <10% in severe cases) with mostly fat cells and very few blood cell precursors. The remaining cells look normal (no blasts, no abnormal shapes), ruling out leukemia or myelodysplastic syndrome at the time of diagnosis. — why: With the stem cells gone, the marrow space is replaced by fat (adipocytes). The biopsy confirms the diagnosis and rules out other causes of low counts of all blood cells (pancytopenia)—leukemia (which would show packed marrow full of immature blast cells), myelodysplastic syndrome (which shows abnormal, dysplastic cells), and myelofibrosis (which shows scar tissue replacing the marrow).

8. The patient presents with fatigue, pale skin (pallor) (pale skin), easy bruising and bleeding (petechiae, nosebleeds, heavy periods), and recurrent infections (fever, mouth sores, pneumonia). Every symptom traces back to the broken marrow upstream. — why: Fatigue and pale skin (pallor) come from tissue low oxygen (hypoxia) (low red cells mean not enough oxygen reaches the muscles, brain, and organs). Bruising, pinpoint bleeding spots (petechiae), and bleeding come from failed clotting (low platelets mean the body cannot plug small leaks in blood vessels). Recurrent infections come from absent immune defense (low neutrophils mean bacteria and fungi break through unchecked). All three problems happen at once because all three cell types depend on the same stem cell factory, and that factory is shut down.

Spot it — what you see, and why

- Fatigue and getting tired quickly during activity: The bone marrow stops making enough red blood cells. Red cells carry oxygen using a protein called hemoglobin (it's like tiny oxygen trucks in your blood). When you don't have enough red cells, your muscles and brain don't get the oxygen they need, so you feel exhausted even doing normal things like walking upstairs.
- Pale skin, pale inside of eyelids, and pale nail beds: Hemoglobin is what makes blood red. When red blood cells drop, there's less red color flowing through your skin and the thin tissues inside your mouth and eyelids. So you look washed out or pale instead of pink.
- Easy bruising and tiny red or purple dots on the skin (petechiae): The bone marrow stops making enough platelets (tiny cell fragments that plug holes in blood vessels like quick-dry cement). Without enough platelets, even a light bump causes a bruise. Tiny blood vessels leak and make pinpoint red spots, especially on the legs and arms.
- Bleeding gums, nosebleeds, or very heavy menstrual periods: Platelets normally rush to any break in a blood vessel and form a plug to stop bleeding. When platelet counts are low, bleeding in the nose, mouth, or uterus doesn't stop quickly. The blood just keeps oozing because there aren't enough platelets to seal the leak.
- Getting infections over and over (like skin infections, pneumonia, or mouth sores): The bone marrow stops making enough white blood cells called neutrophils (the soldiers that kill bacteria and fungi). Without these infection fighters, germs can invade your skin, lungs, or mouth and cause infections that keep coming back or get serious fast.
- Fever with no clear cause: When your neutrophil count drops very low (below 500 cells per microliter—normal is 1,500 or higher), bacteria can sneak into your bloodstream and spread through your body. Your immune system can't fight back well, so you get a fever even though doctors can't always find exactly where the infection started.

Red flags — act now

- Fever (temperature 100.4°F or 38°C or higher) when your absolute neutrophil count is below 500/ μ L—this is neutropenic fever and means you could have a life-threatening bloodstream infection (sepsis). You need emergency IV antibiotics right away.
- Platelet count below 10,000/ μ L—very high risk of bleeding inside your skull (intracranial bleeding (hemorrhage)) or other organs without any warning. You may need an urgent platelet transfusion.
- Sudden severe headache, confusion, slurred speech, one-sided weakness, or vision changes—these can mean bleeding inside your brain from low platelets. This is a medical emergency.
- Blood counts dropping fast over days to weeks—this suggests very severe aplastic anemia or the bone marrow disease is changing into something worse like myelodysplastic syndrome or leukemia. Needs urgent specialist evaluation.
- Chest pain, extreme shortness of breath, or confusion—these mean your heart or brain is starving for oxygen because of severe anemia, and you need immediate care and possibly a blood transfusion.

Treat it — in this order

1. Allogeneic hematopoietic stem cell transplant from a matched sibling or matched unrelated donor → Replaces the patient's destroyed or attacked stem cells with healthy donor stem cells. The new stem cells settle in the marrow and restart normal production of red cells, white cells, and platelets permanently. This is the only cure.
2. Immunosuppressive therapy: horse or rabbit anti-thymocyte globulin (ATG) plus cyclosporine, often with eltrombopag (a pill that signals the marrow to make more platelets) → Stops cytotoxic T cells (immune cells that kill other cells) from attacking the stem cells. When the attack stops, surviving stem cells can grow back and restart blood cell production. About 60–70% of patients respond within 3–6 months.
3. Red blood cell transfusions and platelet transfusions, with iron chelation (deferasirox or deferoxamine) if ferritin rises above 1000 ng/mL → Red cell transfusions bring hemoglobin up temporarily so tissues get enough oxygen and the heart does not fail from overwork. Platelet transfusions keep the platelet count above 10,000/ μ L (or above 50,000/ μ L before procedures) to prevent life-threatening bleeding in the brain or gut.

4. Preventive (Prophylactic) antibiotics (like levofloxacin or ciprofloxacin) and antifungals (like fluconazole or posaconazole) when absolute neutrophil count is below 500 cells/ μ L → Prevents bacterial and fungal infections that can turn deadly fast when neutrophils are too low to fight back. If fever develops, switch immediately to empiric broad-spectrum antibiotics (like cefepime or piperacillin-tazobactam) to cover *Pseudomonas* and other aggressive bacteria.
5. Granulocyte colony-stimulating factor (G-CSF, like filgrastim) during active severe infection → Pushes any remaining marrow precursors to churn out neutrophils faster, raising the count temporarily to help fight infection. Used only during life-threatening infection, not routinely.

Your top priorities at the bedside

1. Monitor temperature every 4 hours and immediately report any reading of 100.4°F (38°C) or higher to the provider, then prepare for stat blood cultures from two sites and rapid start of broad-spectrum IV antibiotics within 1 hour. — why: Neutropenic fever is the number one cause of death in aplastic anemia. When the absolute neutrophil count (infection-fighting white blood cells) is below 500/ μ L, bacteria in the blood (bacteremia) can turn into septic shock in 2 to 6 hours. Every hour of delay in antibiotics increases death risk by 10 to 20 percent.
2. Check platelet count daily and inspect skin, gums, and all body fluids for signs of bleeding every shift. Hold all injections, rectal temperatures, and suppositories if platelets are below 20,000/ μ L. Keep the bed in low position and pad side rails if platelets drop below 10,000/ μ L. — why: Platelets plug holes in blood vessels. When platelets fall below 10,000/ μ L, spontaneous bleeding (bleeding without injury) can happen anywhere—especially in the brain (intracranial bleeding (hemorrhage)). Even small trauma like a needle stick or bumping the head can cause life-threatening bleeding.
3. Use strict neutropenic precautions: private room, all visitors and staff wash hands with soap for 20 seconds or alcohol gel before entering, no fresh flowers or plants, no raw fruits or vegetables, and anyone with cold symptoms stays out. — why: When neutrophils (bacteria-fighting white blood cells) are very low, normal bacteria from the environment, food, or other people can cause deadly infections. Fungi in soil (from plants) and bacteria on uncooked food are especially dangerous because the body has almost no defense.