

Opportunistic Infections in Immunocompromised Patients

OI (infection) in weak immune people — depends on what type of weakness and what you see.

THE ONE-LINE TRUTH

HIV (CD4-driven), transplant (time-based), neutropenic (low white cells), complement (body defense), B-cell.

The chain — how it unfolds

1. HIV/AIDS: PJP, Toxo, CMV, MAC, cryptococcal bugs. — why: HIV destroys CD4 cells (the body's quarterback), so the immune army loses its orders and cannot rally against rare bugs like PJP, Toxo, CMV, MAC, and Cryptococcus.
2. Transplant: times above. — why: After transplant, doctors give immune-killing drugs to prevent organ rejection, so the body loses its ability to fight even common bugs—the timing of infection tells you which drug broke which defense.
3. Neutropenic: bacterial, fungal bugs. — why: Low neutrophils (young white cell soldiers) means no first-line defenders to stop bacteria and fungi from setting up camp in the blood and lungs.
4. No spleen: covered bacteria (*S. pneumo*, *H. flu*, *N. meningitidis*). — why: No spleen means losing the main filtration station and IgG factory for covered bacteria, so *S. pneumo*, *H. flu*, and *N. meningitidis* run wild.
5. Complement low: *Neisseria* bugs. — why: Low complement (the body's chemical alarm and tag-marking system) means *Neisseria* bacteria do not get tagged or killed, so they slip through to cause meningitis.
6. B-cell low: covered bugs, *Giardia*. — why: Low B-cells (the antibody factory) means no IgA or IgG shields against covered bacteria and *Giardia* parasites, so these bugs colonize gut and blood.
7. None of this is random. — why: No single broken step is random—each type of immunity loss opens the door to a specific set of bugs, so reading the bug list backwards tells you exactly which defense is down.

Spot it — what you see, and why

- Fever that won't go away or keeps coming back: Germs that a healthy immune system would stop easily now grow unchecked because the body's defense army (white blood cells and antibodies) is too weak or too few to fight them off, so the body stays on high alert and keeps raising its temperature to try to slow the invaders.
- Pneumonia with cough, shortness of breath, and low oxygen: Fungi like *Pneumocystis* or viruses like CMV can settle deep in the lungs' air sacs, where they cause swelling and fill the sacs with fluid and debris, making it harder for oxygen to cross into the blood—healthy lungs would clear these germs before they took hold.
- White patches or sores in the mouth or throat (thrush): *Candida*, a yeast that normally lives quietly in the mouth, overgrows into thick white coatings when the immune system can't keep its numbers in check, turning the mouth's lining red and sore underneath.
- Diarrhea that lasts for weeks: Parasites like *Cryptosporidium* or bacteria like *Salmonella* invade the intestine's lining and damage the cells that absorb water and nutrients, so the gut leaks watery fluid constantly because the immune system can't clear the infection.
- Blurry vision or floating spots in one or both eyes: Cytomegalovirus (CMV) can infect the retina—the light-sensing layer at the back of the eye—and cause patches of dead tissue that blur vision or create blind spots because the immune system can't stop the virus from spreading there.
- Painful blisters or rash on the skin, often in a strip along one side of the body: Varicella-zoster virus (the chickenpox virus) hides in nerve roots and wakes up when the immune system weakens, traveling down the nerve and causing painful blisters along the skin that nerve supplies (shingles).

Red flags — act now

- New or worsening confusion, seizures, or severe headache—may signal brain infection (meningitis or encephalitis)
- Shortness of breath with low oxygen levels—may be life-threatening pneumonia from *Pneumocystis*, CMV, or fungi
- Sudden vision loss or blurry vision—may be CMV retinitis that can cause permanent blindness if not treated fast
- High fever with very low blood pressure or fast heart rate—may be sepsis (infection in the bloodstream spreading everywhere)
- Severe abdominal pain or blood in the stool—may be invasive gut infection or perforation (a hole in the intestine)

Treat it — in this order

1. Start or optimize antiretroviral therapy (ART) immediately → ART stops HIV from killing CD4 cells (the helper T-cells that run the immune system). Over weeks to months, the CD4 count rises and the body regains the ability to fight infections on its own. This is the only way to truly fix the broken immune system in HIV patients.
2. Give TMP-SMX (trimethoprim-sulfamethoxazole) prevention (prophylaxis) when CD4 <200 → TMP-SMX blocks two enzymes that *Pneumocystis jirovecii* (the PJP fungus) and *Toxoplasma gondii* (the brain parasite) need to survive. This prevents these bugs from causing pneumonia or brain abscesses before the immune system can recover.
3. Give azithromycin (or clarithromycin) prevention (prophylaxis) when CD4 <50 → Azithromycin stops *Mycobacterium avium* complex (MAC) from spreading through the blood and gut. MAC is a slow, tough bacterium that the immune system at CD4 <50 cannot control, and it causes fevers, night sweats, diarrhea, and wasting.
4. Start valganciclovir (oral) or ganciclovir (IV) for active CMV disease → These antiviral drugs block the enzyme CMV uses to copy its DNA, stopping the virus from destroying the retina (causing blindness), colon (causing bloody diarrhea), or esophagus (causing painful swallowing). They halt disease progression until the immune system recovers.
5. Give amphotericin B (induction) then fluconazole (consolidation and maintenance) for cryptococcal meningitis → Amphotericin B punches holes in the fungal cell wall of *Cryptococcus neoformans*, killing it in the brain and spinal fluid. Fluconazole then keeps levels low and prevents relapse. This stops the fungus from causing brain swelling, coma, and death.

Your top priorities at the bedside

1. Place patient in private room with contact precautions if neutropenic (absolute neutrophil count below 500) or standard precautions if HIV alone, and enforce strict handwashing for all visitors and staff — why: Neutropenic patients cannot fight bacteria from unwashed hands or shared surfaces; even normal skin bacteria can cause fatal bloodstream infections when neutrophil count (infection-fighting white cells) is very low; handwashing is the single best way to prevent hospital-acquired infections in immunocompromised patients
2. Monitor temperature every 4 hours and notify provider immediately if temperature rises above 100.4°F (38°C), even without other symptoms — why: Immunocompromised patients cannot mount normal inflammatory response (body swelling and pus), so fever may be the only sign of life-threatening infection; neutropenic fever needs blood cultures and broad-spectrum antibiotics within 1 hour because bacterial sepsis (bloodstream infection) can progress to shock and death in hours

3. Assess respiratory rate, oxygen saturation, and work of breathing every 4 hours; report respiratory rate above 20, oxygen below 92 percent, or new shortness of breath immediately — why: PJP pneumonia causes progressive low oxygen in the blood (hypoxemia) (low blood oxygen) that can drop suddenly; patients may have clear lungs on exam but severe oxygen need; early recognition and oxygen support prevents respiratory failure; PJP is the most common serious opportunistic infection in AIDS patients