

Gout

Gout happens when uric acid (a waste product from breaking down purines) builds up so high that it turns into monosodium urate crystals — tiny needle-shaped pieces that stab the inside of joints and trigger a furious inflammatory attack.

THE ONE-LINE TRUTH

Too much uric acid in the blood forms needle-sharp crystals in joints, causing sudden severe pain and swelling.

The chain — how it unfolds

1. Uric acid climbs above the solubility threshold (6.8 mg/dL) — why: Either too much purine breakdown (from diet, alcohol, or cell death) or too little kidney excretion (from kidney disease, diuretics, or dehydration) pushes blood uric acid past the point where it can stay dissolved, like adding too much sugar to cold tea.
2. Needle-shaped monosodium urate crystals form in the joint space, especially the big toe — why: Uric acid solidifies into sharp crystals in cooler, more acidic areas like the first metatarsophalangeal joint (big toe), where lower temperature reduces solubility even further and minor trauma seeds crystal formation.
3. Crystals land on the synovial membrane (joint lining) and are eaten by macrophages — why: The immune system recognizes the crystals as foreign invaders, so macrophages (cleaning cells) try to swallow and break them down, but the sharp needle edges pierce and rupture the macrophage from the inside.
4. Ruptured macrophages spill interleukin-1 β and activate the NLRP3 inflammasome — why: When the macrophage bursts, it releases interleukin-1 β (a powerful alarm chemical) that triggers a massive inflammatory response — calling in neutrophils (another type of white blood cell) and flooding the joint with inflammatory proteins.
5. Neutrophils swarm the joint, releasing enzymes and cytokines that cause redness, heat, swelling, and severe pain — why: This is the acute gout flare — the joint becomes red, hot, swollen, and exquisitely tender (often can't even touch a bedsheet) because neutrophils are dumping tissue-damaging enzymes to kill what they think is an infection.

6. Flare resolves over days to weeks as the inflammatory response winds down, but crystals remain — why: The body eventually clears some crystals and the immune response exhausts itself, but if blood uric acid stays high, crystals keep forming and the cycle repeats, leading to more frequent flares.
7. Chronic high uric acid deposits form tophi (lumpy urate collections) in joints, tendons, soft tissue, and kidneys — why: Repeated crystal deposition over months to years builds visible chalky nodules that slowly destroy cartilage and bone, deform joints, and clog kidney tubules, forming uric acid kidney stones and causing chronic kidney disease (urate nephropathy).
8. Joint damage, chronic pain, and kidney impairment become permanent without urate-lowering therapy — why: None of this is random — each domino falls because of the one before, all tracing back to the upstream break: blood uric acid concentration staying above the point where the body can keep it dissolved.

Spot it — what you see, and why

- Sudden, severe pain in one joint — often the big toe, ankle, or knee — that comes on at night or early morning: Uric acid crystals (sharp, needle-like pieces) have settled into the joint fluid. The body's immune cells rush in to attack them, releasing chemicals that cause swelling and pain. At night, body temperature drops slightly and fluid drains from joints, making the uric acid more likely to form crystals.
- The joint becomes hot, red, and swollen; the skin may look shiny and tight: The immune system sends white blood cells and fluid to the joint to fight the crystals, causing inflammation (the body's alarm response). Blood vessels widen to bring more defenders, which makes the skin red and warm. Fluid leaks into the joint, stretching the skin and making it look shiny.
- The joint is so tender that even a bedsheet touching it can hurt: Nerve endings in the inflamed joint are extremely sensitive. The inflammation chemicals (like prostaglandins and bradykinin) turn the pain dial way up, so even light touch feels unbearable.
- Pain and swelling usually peak within 12 to 24 hours: The immune attack reaches full force as more white blood cells arrive and release more inflammatory chemicals. After a day or so, the body starts to clean up the crystals and the attack begins to calm down.
- Attacks are triggered by alcohol (especially beer), red meat, shellfish, sugary drinks, water pills (diuretics), hospital stay, surgery, or starting uric-acid-lowering medicine: These triggers either raise uric acid levels quickly (alcohol, red meat, shellfish, sugary drinks block the kidneys from clearing uric acid; surgery and illness cause cells to break down, releasing purines that turn into uric acid) or cause sudden shifts in uric acid that shake crystals loose (starting uric-acid medicine drops levels fast, destabilizing old crystals). Dehydration during hospital stays concentrates uric acid in the blood.

- Firm, chalky lumps (tophi) under the skin near joints or on the ears: When uric acid stays high for years, crystals clump together into lumps called tophi (TOE-fie). The body walls them off with scar tissue. Tophi show that gout has been untreated for a long time.

Red flags — act now

- Fever above 100.4°F (38°C) with joint pain — could be a joint infection, not gout
- Joint pain in more than two joints at once, or pain that spreads quickly
- Severe pain that doesn't improve at all after three days of treatment
- Red, hot, swollen joint in someone with a weakened immune system (on steroids, chemotherapy, or HIV)

Treat it — in this order

1. Colchicine (1.2 mg, then 0.6 mg one hour later, then 0.6 mg once or twice daily), NSAIDs (indomethacin 50 mg three times daily or naproxen 500 mg twice daily), or corticosteroids (prednisone 30–40 mg daily for 5 days, or intra-articular injection) → Stops the immune system's attack on the uric acid crystals inside the joint. Colchicine blocks neutrophils (the white blood cells that swarm the crystals). NSAIDs block prostaglandins (chemicals that cause pain and swelling). Steroids shut down the whole inflammatory cascade. All three shrink the swelling, redness, and pain during an acute flare. This is the fire extinguisher — it puts out the flare fast.
2. Allopurinol (start 100 mg daily, increase slowly to 300–800 mg daily, target urate < 6 mg/dL) or febuxostat (start 40 mg daily, increase to 80 mg if needed) → Blocks xanthine oxidase, the enzyme that converts purines (from food and dying cells) into uric acid. This cuts down how much uric acid the body makes, so blood urate drops below the threshold where crystals form (6.8 mg/dL). Over months, existing crystals dissolve. This fixes the root problem. Allopurinol is first choice (cheaper, long track record). Febuxostat is second choice (more potent, safe if patient had mild allopurinol rash, but slight cardiovascular risk in some studies).
3. Probenecid (start 250 mg twice daily, increase to 500–1000 mg twice daily) → Blocks the kidney tubes from reabsorbing uric acid, so more urate gets flushed out in the pee and blood levels drop. This works best if the kidneys are healthy (eGFR > 50) and the patient is an underexcreter (most gout patients are). Must drink plenty of water to dilute the urine and prevent kidney stones.

4. Preventive (Prophylactic) colchicine (0.6 mg once or twice daily) or low-dose NSAID (naproxen 250 mg twice daily) for 3 to 6 months when starting or adjusting urate-lowering therapy → Prevents flares during the risky months when you are lowering urate and dissolving crystals. As blood urate drops, crystals start to break up and shed into the joint, which can trigger new flares (paradoxical flares). Prevention (Prophylaxis) keeps the immune system calm during this remodeling period. ACR and EULAR guidelines both recommend this.
5. Lifestyle changes: cut alcohol (especially beer and liquor), avoid purine-rich foods (red meat, organ meat, shellfish, high-fructose corn syrup drinks), lose weight if overweight, drink 2+ liters of water daily, avoid dehydration → Reduces the purine load entering the body (less raw material to make uric acid) and improves kidney urate excretion (better hydration helps kidneys flush urate, weight loss improves insulin resistance which helps kidneys work better). Tackles both sides of the imbalance: less urate made, more urate cleared. Can lower urate by 1 to 2 mg/dL in some patients.

Your top priorities at the bedside

1. Check temperature, heart rate, and blood pressure, and look at the affected joint for extreme redness, warmth, and swelling — why: Septic arthritis (joint infection) looks like gout but causes fever and very angry-looking joints; it needs emergency joint fluid removal and IV antibiotics within hours or the infection destroys cartilage and can spread to the bloodstream causing sepsis
2. Give the ordered anti-inflammatory medicine (colchicine, NSAID, or steroid) as soon as possible, ideally within 24 hours of symptom start — why: Gout pain comes from white blood cells swarming the uric acid crystals and releasing inflammatory chemicals; early treatment stops this cascade faster, shortens the attack from weeks to days, and reduces joint damage
3. Elevate the affected joint on pillows and keep bed sheets or blankets off the area using a bed cradle or box — why: The inflamed joint is so tender that even light touch from sheets causes severe pain; elevation reduces blood pooling and swelling by using gravity to drain fluid back toward the heart