

Appendicitis

The appendix is a dead-end pouch off the large intestine that gets blocked, swells up, and dies from blood loss; if it bursts, bacteria flood the belly.

THE ONE-LINE TRUTH

When the appendix tube gets blocked, pressure rises inside it, blood flow drops, bacteria multiply, the wall dies, and if it ruptures, germs spill into the belly.

The chain — how it unfolds

1. Appendix lumen becomes obstructed — why: A fecalith (stone-like piece of stool), lymphoid hyperplasia (swollen immune tissue from a recent viral or bacterial infection like gastroenteritis), or rarely a tumor blocks the narrow opening where the appendix drains into the cecum, trapping mucus and bacteria inside the closed tube. Per ACS 2021, fecaliths are seen on CT in 20–30% of adult cases but are present histologically (under the microscope after surgery) in up to 40%.
2. Intraluminal pressure rises — why: Mucus-secreting cells in the appendix wall keep making mucus even after the exit is blocked, and bacteria multiply rapidly in the trapped fluid— pressure inside the tube climbs like air pumped into a closed balloon. Normal appendiceal pressure is near zero; obstruction can raise it above 60 mm Hg within hours.
3. Venous and lymphatic drainage is compressed; starved blood flow (ischemia) begins — why: Rising pressure squeezes thin-walled veins and lymphatic vessels in the appendix wall first (arteries have thicker, muscular walls and resist compression longer), so blood and lymph fluid cannot drain out; the wall becomes congested, swollen, and starved of oxygen (ischemia). Venous pressures are only 5–10 mm Hg, so they collapse early.
4. Vague periumbilical pain begins — why: Starved blood flow (Ischemia) and stretching of the appendix wall stimulate visceral pain fibers (deep, poorly localized nerve pathways from the gut supplied by sympathetic nerves traveling with the superior mesenteric artery), which the brain interprets as dull, crampy pain around the umbilicus (belly button) because the appendix and midgut share the same embryonic nerve supply (T10 dermatome).

5. Bacterial overgrowth accelerates; the wall becomes dead (necrotic) — why: Blood-starved (Ischemic) tissue loses its oxygen supply, so aerobic bacteria (bacteria that need oxygen) die off and anaerobic bacteria (like *Bacteroides fragilis*, *E. coli*, and *Peptostreptococcus* species) thrive, releasing toxins and enzymes (proteases, lipases) that digest the dying appendix wall from the inside. Per IDSA 2010, polymicrobial infection (multiple bacteria types) is the rule.
6. Inflammation spreads to the parietal peritoneum; pain migrates to the right lower quadrant — why: As the outer surface of the dead (necrotic) appendix touches the peritoneum (the sensitive lining of the belly wall), somatic pain fibers (precise, sharp nerve pathways supplied by spinal nerves T10–L1) are activated, shifting pain from vague and central to sharp and localized over McBurney point (one-third the distance from the anterior superior iliac spine to the umbilicus). This migration typically occurs 12–24 hours after symptom onset.
7. Fever, anorexia (loss of appetite), nausea, vomiting, and a high white blood cell count (leukocytosis) appear — why: Bacterial toxins and inflammatory cytokines (chemical messengers like interleukin-1, interleukin-6, and tumor tissue death (necrosis) factor- α) enter the bloodstream, triggering the hypothalamus (the brain's thermostat) to raise body temperature (fever, usually 100–102°F in uncomplicated appendicitis), suppressing appetite centers in the brain (anorexia), irritating the chemoreceptor trigger zone in the brainstem (nausea and vomiting), and stimulating the bone marrow to release more white blood cells (leukocytosis, typically 10,000–18,000 cells/ μ L with left shift).
8. Right lower quadrant tenderness, guarding, and rebound tenderness develop — why: The inflamed appendix and surrounding peritoneum are extremely sensitive; pressing on the area stretches inflamed tissue (direct tenderness at McBurney point), and belly muscles contract involuntarily to protect the area (guarding, a reflex you cannot control); releasing pressure suddenly lets inflamed peritoneum snap back, causing sharp pain (rebound tenderness or Blumberg sign). Rovsing sign (pain in the right lower quadrant when you press the left side) and psoas sign (pain when lifting the right leg against resistance, because the inflamed appendix lies on the psoas muscle) also appear.

Spot it — what you see, and why

- Belly-button pain that moves to the lower-right side: At first, the swollen, blocked appendix loses blood flow (ischemia — not enough blood is reaching the tissue to feed it). This pulls on deep nerves inside your belly (visceral nerves) that can't pinpoint exactly where the trouble is, so you feel dull, achy pain around your belly button. Hours later, the infection spreads to the thin lining that wraps your belly organs (the peritoneum). Now sharp-sensing surface nerves (somatic nerves) wake up and tell your brain exactly where it hurts — right over the appendix in your lower-right belly.

- No appetite (you don't want to eat at all): When bacteria multiply inside the blocked appendix, your immune cells release alarm chemicals called cytokines (like interleukin-1 — a messenger that tells your body infection is here). These chemicals travel through your blood to a control center in your brain (the hypothalamus — the brain's thermostat and hunger headquarters) and turn off your hunger signals. Your body does this on purpose during infection so you rest instead of using energy to digest food.
- Feeling sick to your stomach and throwing up: The same alarm chemicals (inflammatory mediators — infection-fighting molecules) float up to a vomit-control spot in your brainstem (the chemoreceptor trigger zone — the brain's nausea switch in the medulla) and flip it on. Also, the swollen, blocked appendix presses on nearby gut nerves (vagal fibers — the wandering nerve that connects your gut to your brain) that tell your stomach and intestines to stop moving forward and sometimes reverse — so you vomit.
- Low fever (100–101°F at first; higher if the appendix bursts): Bacteria and your immune cells dump fever-causing molecules (pyrogens — heat-makers like interleukin-1 and TNF-alpha) into your blood. These reset your brain's thermostat (in the hypothalamus) a few degrees higher, making your body warm up to slow down germs. If your temperature climbs above 102°F, it usually means the appendix has ruptured and infection is spreading everywhere (peritonitis — inflammation of the belly lining).
- Tenderness at McBurney's point (lower-right belly, about one-third the way from your hip bone to your belly button): The inflamed appendix sits right under that spot. When a doctor presses there, the pressure squeezes the swollen appendix and its irritated covering (the peritoneum — the slippery lining that wraps your belly organs), firing sharp pain signals through surface nerves (somatic nerves — nerves in the belly wall that feel touch and pain). It's the single most reliable spot to find appendix pain.
- Your belly muscles tighten up on their own when touched (guarding), or your whole belly feels rock-hard (rigidity): When the peritoneum (belly lining) gets inflamed, nerves in your spine automatically tell your abdominal muscles (the muscles in your belly wall) to contract and lock down, trying to protect the sore area — like splinting a broken bone. If your entire belly turns board-hard, it means the appendix has burst and infection is everywhere (diffuse peritonitis — inflammation spread across the whole belly lining) — a surgical emergency.

Red flags — act now

- Board-hard belly everywhere (diffuse rigidity) — the appendix has burst and bacteria are spreading through your whole abdomen (diffuse peritonitis — infection all over the belly lining); you need emergency surgery right now.

- Fever above 102°F plus a racing heart (over 120 beats per minute) or low blood pressure (top number under 90) — your body is losing the fight against infection (sepsis — a whole-body response to infection that can shut down organs); you need IV fluids, powerful antibiotics, and close monitoring in the hospital, possibly the ICU.
- Your pain suddenly gets better for a few minutes, then comes roaring back worse and spreads everywhere — classic sign the appendix just popped; when it bursts, pressure drops and pain eases briefly, then bacteria flood your belly and pain explodes.
- Confusion, extreme sleepiness, or not making sense — your brain isn't getting enough oxygen or your blood is poisoned by infection (septic shock — dangerously low blood pressure from infection); life-threatening without immediate treatment.
- Pregnant beyond the first three months with right-sided or unusual belly pain — the growing uterus pushes the appendix upward and hides the usual signs; a burst appendix is more dangerous for both mom and baby, so any belly pain in pregnancy needs urgent evaluation.

Treat it — in this order

1. Make the patient NPO (nothing by mouth) and start IV fluids with normal saline or lactated Ringer's solution → NPO means no food or drink. Keeping the stomach empty lowers the risk the patient will vomit and breathe stomach contents into the lungs (aspiration), especially if surgery or a breathing tube (endotracheal intubation) is needed. IV fluids replace water and salts (sodium, chloride, potassium) lost from fever, vomiting, and not drinking, which keeps blood pressure up, blood flowing to the kidneys and brain, and urine output normal.
2. Give IV antibiotics that cover gram-negative rods and anaerobic bacteria—such as ceftriaxone (a cephalosporin) plus metronidazole, or piperacillin-tazobactam alone—per Infectious Diseases Society of America (IDSA) 2010 and Surgical Infection Society 2010 guidelines → The blocked appendix fills with bacteria from the gut, mainly *Escherichia coli* (*E. coli*, a gram-negative rod that lives in the intestines) and *Bacteroides* (an anaerobic bacterium that lives in the colon and does not need oxygen). Antibiotics kill these germs, lower the total bacterial load, reduce the chance the appendix will burst, and cut the risk of infection after surgery—like wound infection, abscess inside the belly, or bloodstream infection (sepsis).

3. Perform appendectomy (surgical removal of the appendix) within 12 to 24 hours, preferably by laparoscopy (using a camera and small cuts), per American College of Surgeons 2020 guidelines → Taking out the appendix removes the source of infection and stops the disease from progressing. Laparoscopic surgery uses three or four tiny incisions (each less than one centimeter) and a camera to see inside, which means less pain, less scarring, a shorter hospital stay (often same-day or one night), and faster return to normal activity than open surgery (one larger cut). Removing the appendix prevents it from bursting, forming an abscess, or causing peritonitis (infection of the whole belly lining) or sepsis (infection spreading through the bloodstream).
4. Give pain medicine (such as IV acetaminophen, ketorolac, or opioids like morphine or fentanyl) and anti-nausea medicine (such as ondansetron, a serotonin blocker) → Pain medicine blocks pain signals traveling from the belly to the spinal cord and brain, making the patient comfortable. Ketorolac is an NSAID (non-steroidal anti-inflammatory drug) that blocks prostaglandins (chemicals that trigger pain and inflammation). Opioids bind to receptors in the spinal cord and brain that dampen pain signals. Anti-nausea medicine (ondansetron) blocks serotonin receptors (a type of chemical messenger) in the brainstem's vomiting center, stopping nausea and vomiting. Modern evidence (multiple randomized trials, summarized in American College of Emergency Physicians 2016 guidelines) shows that giving pain medicine does not hide exam findings or delay diagnosis—it is safe and humane.
5. If the appendix has burst and formed a walled-off abscess (pocket of pus surrounded by a thick capsule), place a drain through the skin (percutaneous drainage) guided by ultrasound or CT, give antibiotics for seven to ten days, and remove the appendix six to ten weeks later (interval appendectomy)—per American College of Surgeons 2020 guidelines for complicated appendicitis → Draining the pus lowers pressure, removes infection and toxins, and controls sepsis. Antibiotics plus drainage let the inflammation cool down, the immune system wall off remaining infection, and the tissues heal enough that surgery becomes safer. Waiting six to ten weeks to remove the appendix (called interval or delayed appendectomy) lowers the chance of complications like bleeding, bowel injury, or needing a bigger incision to see through scarred, stuck-together tissue. About 70–80% of patients do well with this two-stage approach (drain-and-wait, then operate).

Your top priorities at the bedside

1. Make the patient NPO (nothing by mouth—no food, water, gum, or ice chips) and hang a sign above the bed. — why: The patient will need general anesthesia for surgery within hours; food or liquid in the stomach increases the risk of aspiration (breathing vomit into the lungs) during intubation, which can cause pneumonia or death.

2. Start a large-bore IV (18-gauge or bigger) and run normal saline or lactated Ringer's solution at 125 to 150 mL per hour in adults. — why: Patients are usually dehydrated from vomiting and not drinking; IV fluids maintain blood pressure and organ blood flow (perfusion) (blood flow), prevent septic shock, and provide access for emergency medications and anesthesia.
3. Give IV antibiotics exactly as ordered—common regimens include ceftriaxone 1 to 2 grams plus metronidazole 500 mg, or piperacillin-tazobactam 3.375 grams—within one hour of the order. — why: Bacteria are multiplying inside the blocked appendix and may already be in the bloodstream; early antibiotics reduce the bacterial load, lower the risk of post-operative abscess (pus pocket), and prevent sepsis from worsening.