

Salicylate Toxicity

A plain-English guide for you and your family

WHAT IS HAPPENING

Aspirin is normally broken down in the liver and then filtered out by the kidneys. When you take a safe dose, this system keeps the drug from building up. But when you take too much aspirin—whether by accident or on purpose—the liver runs out of the enzymes it needs to break the drug down safely. At that point, aspirin starts piling up in your blood. It sneaks into your cells and wrecks the mitochondria, the tiny power plants that make energy. Instead of turning food into stored energy (called ATP), the mitochondria start burning everything as heat. Your brain senses this chaos and triggers fast, deep breathing to try to blow off the acid building up in your blood. At first, that hard breathing makes your blood too alkaline (called respiratory alkalosis (blowing off too much carbon dioxide)). But as more aspirin floods in, it dumps so much acid into your blood that your body can't keep up, and your blood turns acidic (metabolic too much acid in the blood (acidosis)). Now you have both problems at once. Your ears ring because aspirin poisons the hearing nerve. You feel sick and throw up because aspirin irritates your stomach. You get hot because your cells are burning energy as waste heat. Your thinking gets foggy because acid and heat damage your brain. Your lungs can fill with fluid, your blood sugar can drop, and in the worst cases, you can slip into a coma. Every one of these signs points back to one thing: aspirin is poisoning your cell power plants and your body is fighting hard to survive.

What you might feel

- Breathing very fast and deep
- Ringing in the ears (tinnitus)
- Nausea and throwing up
- Confusion or acting strange
- Very high body temperature (hyperthermia)
- Blood that is both too basic and too acidic (mixed acid-base disorder)
- Sweating a lot
- Low blood sugar (hypoglycemia)
- Seizures

Call the doctor right away if...

- Confusion, slurred speech, or not responding normally
- Body temperature above 104°F (40°C)
- Seizure or uncontrolled shaking
- Very fast or very slow breathing, or gasping for air
- Heart racing or blood pressure dropping (shock)

What the care team will do

- Place patient on continuous cardiorespiratory monitor and pulse oximetry; obtain venous or arterial blood gas immediately
- Start two large-bore IV lines; give normal saline bolus 10 to 20 mL/kg over 1 hour, then continuous infusion at 200 to 300 mL/hour
- Check fingerstick blood sugar immediately and repeat every 1 to 2 hours; give dextrose 1 amp (25 grams D50) IV push if glucose under 60 mg/dL, then add dextrose to all IV fluids
- Draw blood for salicylate level, complete metabolic panel with potassium, and lactate; repeat salicylate level every 2 to 4 hours until level is dropping
- Give sodium bicarbonate 1 to 2 mEq/kg IV push over 5 minutes, then start continuous drip at 150 mEq in 1 liter D5W at 150 to 200 mL/hour; check urine pH every 2 hours with goal 7.5 to 8.0
- Add potassium chloride 20 to 40 mEq to each liter of IV fluid; recheck potassium every 2 to 4 hours with goal 4.0 to 4.5 mEq/L
- Measure temperature every 30 minutes; apply cooling blankets and ice packs to groin and armpits if temperature over 102°F; never give acetaminophen for fever
- Call nephrology (kidney doctor) immediately if salicylate level over 100 mg/dL, pH under 7.20, kidney injury with creatinine over 2.0, pulmonary edema (fluid flooding the lungs) (fluid in lungs), seizures, or coma

Medicines you may be given — and why

Activated charcoal

Charcoal is a super-sticky powder that grabs onto salicylate molecules (the aspirin or aspirin-like drug) sitting in the stomach and intestines, trapping them like velcro so they can't cross into the bloodstream. Once trapped, the charcoal and poison leave together in a bowel movement.

Intravenous (IV) dextrose (sugar solution)

Salicylate poisons the mitochondria (the tiny power plants inside every cell that turn sugar and oxygen into energy). Even though blood sugar may measure normal, the cells can't USE that sugar properly, so the brain and body act as if they are starving. Giving dextrose through an IV floods the blood with extra sugar, pushing more fuel into cells to partly make up for the poisoned energy factories and prevent dangerous low blood sugar (hypoglycemia), especially in the brain.

Intravenous (IV) sodium bicarbonate

Salicylate is a weak acid. When blood and urine are acidic, salicylate stays in a form that easily crosses cell membranes, letting it pile up inside the brain and other organs where it does the most harm. Sodium bicarbonate makes the blood and urine more alkaline (higher pH). In alkaline urine, salicylate gets trapped in an ionized (charged) form that cannot cross back out of the kidney tubules, so it is flushed out in the urine much faster. Alkaline blood also helps keep salicylate out of the brain and reduces the dangerous acid build-up (metabolic too much acid in the blood (acidosis)) caused by the poison.

Intravenous (IV) potassium chloride or potassium phosphate

Salicylate poisoning causes the body to lose large amounts of potassium in the urine because the kidneys are trying to balance the acid-base disturbance and the fast breathing (which blows off carbon dioxide and makes blood temporarily alkaline). Low potassium (hypokalemia) prevents the kidneys from making urine alkaline — even if you give sodium bicarbonate, the urine pH will not rise because the kidneys hold onto hydrogen ions (acid) to conserve potassium. Replacing potassium allows alkalization to work, speeds salicylate elimination, and prevents dangerous heart rhythms caused by low potassium.

Hemodialysis

Hemodialysis is a procedure where blood is pumped out of the body through a special filter (dialyzer) that removes salicylate and other toxins, then returns the cleaned blood. The dialyzer contains thousands of tiny hollow fibers; blood flows through the fibers while a cleansing fluid (dialysate) flows around them. Salicylate, which is a small molecule, crosses from the blood into the dialysate and is discarded. Dialysis is the FASTEST way to remove salicylate when the poisoning is life-threatening and the kidneys cannot eliminate it quickly enough, even with alkalization.

Intravenous (IV) normal saline or lactated Ringer's solution

Salicylate poisoning causes fluid loss through sweating (from high fever and increased metabolism), vomiting, and fast breathing. This dehydration reduces blood flow to the kidneys, which slows the elimination of salicylate. IV fluids restore blood volume, improve kidney blood

flow, and help the kidneys flush out salicylate, especially once urine is alkalinized with bicarbonate. Fluids also dilute the salicylate concentration in the blood and support blood pressure.

Where this information comes from

- EXTRIP (Extracorporeal Treatments in Poisoning) Workgroup 2015 Salicylate Guideline
- American Academy of Clinical Toxicology
- UpToDate Clinical Decision Support
- Poisoning and Drug Overdose, 7th Edition (Olson)

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