CONDITION

Alkalosis

Learn how metabolic and respiratory alkalosis affect blood pH, what can cause them, how they are diagnosed, and when symptoms need urgent care.

WHAT IT IS
Process making blood less acidic

BODY SYSTEM
Blood, lungs and kidneys

MAIN SYMPTOMS
Dizziness, tingling, muscle cramps, fast heartbeat

WHAT CAUSES IT
Acid loss or excess carbon dioxide removal

HOW IT IS DIAGNOSED
Blood gas tests

MAIN TREATMENT
Treating the cause and correcting fluids and electrolytes

CAN IT BE CURED?
Sometimes - underlying cause can be corrected

IS IT AN EMERGENCY?
Sometimes - severe breathing difficulty or fainting

LONG-TERM OUTLOOK
Depends on the underlying cause

Overview

Alkalosis is a process that makes the blood less acidic than it should be. Blood acidity is measured using pH. The body normally keeps arterial blood pH within a narrow range, about 7.35 to 7.45. A pH above 7.45 is called alkalemia .

The terms are related but not identical. Alkalosis describes the body process that raises pH. Alkalemia describes the blood test result. A person can have an alkalosis process even when the measured pH is normal if another acid-base problem is occurring at the same time.

There are two main types:

The lungs and kidneys work together to control pH. The lungs adjust carbon dioxide within minutes. The kidneys adjust bicarbonate, acid, water, and electrolytes over hours to days.

When one system changes, the other usually tries to compensate. Compensation limits the pH change but may not return pH completely to normal.

Alkalosis matters because a significant pH change can affect nerves, muscles, heart rhythm, and oxygen delivery. It can also point to an underlying problem, such as prolonged vomiting, medication effects, low oxygen levels, infection, or a hormone disorder.

- Metabolic alkalosis usually involves an increase in bicarbonate, a substance that helps control acidity, or a loss of acid from the body.
- Respiratory alkalosis occurs when breathing removes carbon dioxide from the blood faster than the body produces it. Carbon dioxide acts like an acid in the bloodstream.

Symptoms

Mild alkalosis may cause no clear symptoms. When symptoms occur, they may result from the pH change, shifts in electrolytes such as potassium and calcium, or the condition causing the alkalosis.

Possible symptoms include:

Respiratory alkalosis caused by rapid breathing may develop quickly. A person may notice chest tightness, tingling, lightheadedness, or hand spasms. These symptoms can occur during anxiety or panic, but rapid breathing can also be caused by heart, lung, neurologic, or infectious conditions. It should not automatically be assumed to be anxiety.

More severe alkalemia can contribute to confusion, abnormal heart rhythms, fainting, or seizures. These effects are more likely when the pH rises quickly or when potassium, magnesium, or calcium levels are also abnormal.

Seek emergency care for severe trouble breathing, new chest pain, blue or gray lips, fainting, a seizure, marked confusion, sudden weakness, or symptoms of stroke. A rapid heartbeat accompanied by dizziness, chest pain, or fainting also needs urgent assessment.

Less severe symptoms that persist or keep returning should be discussed with a healthcare professional, especially when accompanied by ongoing vomiting, medication changes, poor food or fluid intake, or unexplained rapid breathing.

- Lightheadedness or dizziness
- Tingling around the mouth or in the hands and feet
- Muscle cramps, twitching, or weakness
- Nausea

- Headache
- Difficulty concentrating
- A feeling of breathlessness
- A fast or pounding heartbeat

Causes and risk factors

Metabolic and respiratory alkalosis have different causes. More than one cause can be present at the same time.

Metabolic alkalosis

Metabolic alkalosis often begins when the body loses acid, gains bicarbonate, or cannot remove excess bicarbonate through the kidneys.

Common causes include prolonged vomiting or drainage of stomach contents through a tube. Stomach fluid contains hydrochloric acid. Losing large amounts of it can raise blood bicarbonate and reduce chloride and fluid levels.

Loop and thiazide diuretics, sometimes called water pills, can also contribute. These medicines increase salt and water loss through the kidneys. The resulting changes in fluid, chloride, potassium, and hormone signals may allow alkalosis to continue.

Other possible causes include:

Antacids or supplements containing bicarbonate or carbonate can occasionally contribute, especially when taken in large amounts or combined with kidney disease. Baking soda should not be used as a medical treatment unless a healthcare professional has advised it.

Respiratory alkalosis

Respiratory alkalosis develops when a person breathes faster or more deeply than needed for the body's carbon dioxide production. This is called hyperventilation.

Possible triggers include:

Risk depends on the underlying cause rather than alkalosis alone. People with kidney disease may have more difficulty clearing an alkali load. Those taking diuretics or experiencing repeated vomiting are more likely to develop fluid, chloride, and potassium losses.

- Low potassium levels
- Excess activity of aldosterone or similar hormones, which can occur with some adrenal gland disorders

- Severe volume depletion, meaning reduced fluid in the bloodstream
- A large intake of bicarbonate or other absorbable alkali, particularly when kidney function is reduced
- Recovery from long-standing high carbon dioxide levels, sometimes called post-hypercapnic alkalosis
- Certain inherited disorders that affect kidney handling of salt and electrolytes
- Low blood oxygen from lung disease, high altitude, or another medical condition
- Pneumonia, asthma symptoms, or a blood clot in the lung
- Fever or a serious infection
- Pain
- Pregnancy-related changes in breathing
- Liver disease
- Conditions affecting the brain or breathing control centers
- Early salicylate toxicity
- Mechanical ventilation that removes too much carbon dioxide
- Anxiety or a panic episode

Diagnosis

Alkalosis is diagnosed using blood tests and an assessment of what may be causing the acid-base change. Symptoms alone cannot confirm it.

A blood gas test measures pH and carbon dioxide. It also estimates or measures bicarbonate. An arterial blood gas uses blood from an artery and can provide detailed information about oxygen levels. A venous blood gas may be enough for some acid-base assessments and is usually easier to collect.

Metabolic alkalosis generally shows an elevated bicarbonate level. Carbon dioxide may also rise because breathing slows as the body attempts to compensate.

Respiratory alkalosis generally shows a low carbon dioxide level. Over time, the kidneys compensate by releasing more bicarbonate into the urine. The expected blood test pattern therefore differs depending on whether respiratory alkalosis is recent or has lasted for several days.

Additional tests may include:

Urine chloride can help sort metabolic alkalosis into broad groups. A low level may support recent vomiting, stomach drainage, or certain forms of fluid and chloride loss. A higher level may occur with current diuretic use, excess mineralocorticoid activity, or some kidney disorders. Results must be interpreted in context because recent medicines and treatment can change them.

Clinicians also check whether the body's compensation fits the expected pattern. An unexpected result can suggest a mixed acid-base disorder , meaning more than one process is occurring.

- Blood levels of sodium, potassium, chloride, magnesium, calcium, glucose, and creatinine
- A urine chloride measurement
- An electrocardiogram to check heart rhythm
- Oxygen measurement with a pulse oximeter or blood gas
- Imaging or other tests when a heart, lung, brain, kidney, or hormone-related cause is suspected
- A medication, supplement, antacid, and substance-use review

Treatment and management

Treatment focuses on the cause and on correcting important fluid or electrolyte problems. The pH value is not treated in isolation.

For metabolic alkalosis related to vomiting, stomach drainage, or fluid and chloride loss, treatment may include controlling the source of fluid loss and replacing chloride-containing fluid and potassium. Replacement is guided by examination, kidney function, heart health, and laboratory results.

A clinician may review whether a diuretic like furosemide or hydrochlorothiazide is still needed or whether its plan should change. Patients should not stop a prescribed diuretic on their own, particularly when it is being used for heart failure, swelling, blood pressure, or kidney disease.

When excess aldosterone or a related hormone is involved, management targets the hormone disorder. Depending on the cause, this may involve specialist evaluation, medicine, or a procedure. Selected hospitalized patients may receive a medicine such as acetazolamide to increase bicarbonate loss through the kidneys, but it requires monitoring and is not appropriate for everyone.

Severe metabolic alkalemia sometimes requires intensive monitoring and specialized treatment. Direct acid infusion or dialysis is reserved for unusual, serious situations because

these treatments have important risks.

For respiratory alkalosis, treatment addresses the reason for rapid or deep breathing. This may include treating low oxygen, infection, fever, pain, a lung problem, or a medication or toxin exposure. A ventilator may need adjustment when mechanical ventilation is the cause.

When anxiety-related hyperventilation has been assessed and more serious causes are not suspected, calm reassurance and coached slower breathing may help. Breathing into a paper bag is not recommended because it can lower oxygen and may be dangerous if the cause is not anxiety.

Follow-up blood tests may be needed during treatment. Potassium, magnesium, chloride, kidney function, and heart rhythm can change as the underlying problem improves.

Complications

The risk of complications depends on how high the pH becomes, how rapidly it changes, and whether other medical problems are present.

Alkalemia can reduce the amount of ionized calcium available to tissues even when the total calcium level is normal. This may contribute to tingling, muscle cramps, twitching, or spasms.

Low potassium and magnesium may occur alongside metabolic alkalosis. These electrolyte changes can cause weakness and increase the risk of abnormal heart rhythms, especially in people with heart disease or those taking medicines that affect rhythm.

Significant alkalemia may affect blood flow and oxygen delivery to tissues. Severe cases can cause confusion, seizures, or reduced consciousness. Respiratory alkalosis caused by low oxygen or serious illness also carries risks from the underlying condition.

Follow up

Routine follow-up depends on the cause. A short-lived episode from an identified and corrected problem may only require repeat electrolyte or blood gas testing. Ongoing vomiting, diuretic use, kidney disease, or a suspected hormone disorder may require closer monitoring.

At follow-up, a clinician may review symptoms, blood pressure, hydration, medication use, kidney function, and electrolyte levels. Bring a complete list of prescription medicines, over-the-counter products, antacids, and supplements. Mention any use of baking soda or products containing bicarbonate or carbonate.

Contact a healthcare professional promptly if vomiting continues, you cannot keep fluids

down, muscle weakness worsens, or palpitations keep returning. Emergency symptoms include severe breathing difficulty, chest pain, fainting, a seizure, marked confusion, stroke-like symptoms, or a rapid or irregular heartbeat with dizziness.

Sources

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