CONDITION

Respiratory alkalosis

Respiratory alkalosis is a blood chemistry change caused by breathing out carbon dioxide faster than the body produces it.

WHAT IT IS
Low blood carbon dioxide caused by overbreathing

BODY SYSTEM
Lungs, blood, and kidneys

MAIN SYMPTOMS
Light-headedness, tingling, breathlessness, muscle cramps

WHAT CAUSES IT
Hyperventilation from illness, altitude, pain, or anxiety

HOW IT IS DIAGNOSED
Blood gas testing and blood electrolyte tests

MAIN TREATMENT
Treatment of the cause and supported breathing

CAN IT BE CURED?
Sometimes - reversible causes can be corrected

IS IT AN EMERGENCY?
Sometimes - sudden severe breathlessness or fainting

LONG-TERM OUTLOOK
Usually good when the cause is treatable

Overview

Respiratory alkalosis is an acid-base imbalance in the blood. It happens when you breathe out carbon dioxide faster than your body makes it. This lowers the amount of carbon dioxide in your blood and makes the blood more alkaline, meaning less acidic.

This pattern is usually caused by breathing more deeply or quickly than your body needs. This is called hyperventilation . Hyperventilation may be obvious, but sometimes the breathing rate looks normal while each breath is unusually deep.

Respiratory alkalosis is a condition rather than a disease by itself. The cause may be temporary, such as pain, fever, anxiety, or being at high altitude. It can also occur with conditions that reduce oxygen levels or affect the lungs, brain, liver, or metabolism.

Your kidneys help control blood acidity. If respiratory alkalosis continues for several days or longer, they remove more bicarbonate, an alkaline substance, through the urine. This compensation brings the blood pH closer to normal, although the carbon dioxide level remains low.

The importance of respiratory alkalosis depends mainly on what is causing it. A brief episode related to anxiety may settle without lasting harm. Sudden unexplained hyperventilation, however, can also occur with serious problems such as a blood clot in the lung, severe infection, or drug toxicity.

Symptoms

Mild respiratory alkalosis may not cause any symptoms. When symptoms occur, they may come from the low carbon dioxide level, the rapid breathing, or the underlying condition.

Possible symptoms include:

Symptoms can begin quickly during an acute episode. Tingling and cramping happen partly because alkalosis temporarily reduces the amount of calcium available for nerves and muscles, even when the total calcium level is normal.

Symptoms alone cannot show whether respiratory alkalosis is present or identify its cause. Breathlessness, chest discomfort, dizziness, and tingling can have many explanations.

- Light-headedness, dizziness, or feeling faint
- Tingling or numbness around the mouth, hands, or feet
- Breathlessness or a feeling that you cannot get a satisfying breath
- Chest tightness, a fast heartbeat, or awareness of your heartbeat
- Hand or foot cramps, trembling, or muscle spasms
- Difficulty concentrating, confusion, or unusual tiredness

Causes and risk factors

Respiratory alkalosis results from breathing more than the body needs to remove the carbon dioxide it produces.

Possible causes include:

Hyperventilation can also be the body's necessary response to another acid-base problem. For example, someone with diabetic ketoacidosis may breathe deeply to remove carbon dioxide

and reduce excess acid. This is not a simple primary respiratory alkalosis, and trying to slow that breathing could be harmful.

- Low oxygen levels: Pneumonia, a severe asthma flare, a blood clot in the lung, heart or lung disease, and high altitude can make the body breathe harder.
- Fever or severe infection: Fever increases breathing, while sepsis can directly stimulate the brain's breathing centre.
- Pain, fear, or anxiety: Acute distress and panic attacks can cause rapid or deep breathing. Anxiety should not automatically be assumed when symptoms are new or unexplained.
- Pregnancy: Hormonal changes commonly increase breathing and produce a mild, long-lasting respiratory alkalosis. This is usually a normal adjustment.
- Brain conditions: Stroke, head injury, brain infection, or other problems affecting the breathing centre may cause hyperventilation.
- Liver disease: Advanced liver disease can stimulate faster or deeper breathing.
- Medicines and substances: Early salicylate toxicity, such as from too much aspirin, can cause respiratory alkalosis. Some other medicines may also affect breathing.
- Mechanical ventilation: A ventilator may remove too much carbon dioxide if breathing support is greater than the body needs.

Diagnosis

Respiratory alkalosis is confirmed with a blood gas test . This measures blood pH, carbon dioxide, oxygen, and bicarbonate.

An arterial blood gas uses blood from an artery, usually at the wrist. It provides the most direct information about carbon dioxide and oxygen levels. A venous blood gas, taken from a vein, may provide useful initial information in some situations, but it does not assess oxygen in the same way.

The typical pattern is a low carbon dioxide level with a pH that is higher than normal. If the condition has been present for longer, kidney compensation lowers bicarbonate and may bring the pH closer to the normal range.

The results must be interpreted together. A low carbon dioxide level can be part of a mixed acid-base disorder rather than respiratory alkalosis alone.

Finding the cause may involve:

Your symptoms, medical history, pregnancy status, medicines, recent travel to altitude, and the timing of the episode all help guide testing.

- Measuring oxygen levels with a finger sensor and blood gas
- Blood tests for electrolytes, blood sugar, kidney or liver function, and signs of infection
- An electrocardiogram to examine heart rhythm
- Chest imaging when a lung problem is possible
- Tests for medicines or toxins when exposure is suspected
- Further testing for a blood clot, infection, or neurological condition when symptoms suggest one

Treatment and management

Treatment focuses on the cause rather than simply raising the carbon dioxide level. Respiratory alkalosis often improves once the trigger is corrected.

For example, care may include treatment for infection, asthma, fever, pain, a blood clot, or another lung or heart condition. Oxygen may be used when the oxygen level is low. If mechanical ventilation is contributing, the healthcare team can adjust the ventilator.

When anxiety-related hyperventilation has been identified after other important causes are considered, calm coaching and controlled breathing may help. Treatment for repeated panic or anxiety episodes can include psychological therapy, breathing skills, and, when appropriate, medicine prescribed as part of a wider care plan.

Do not breathe into a paper bag. This may lower the oxygen level and can be dangerous if hyperventilation is being caused by a heart, lung, metabolic, or neurological problem.

Suspected salicylate toxicity needs urgent medical assessment. Treatment is based on the amount taken, symptoms, blood test results, and the body's acid-base pattern.

Respiratory alkalosis itself rarely requires long-term treatment when its cause is brief and reversible. Persistent or repeated episodes need follow-up aimed at the underlying condition.

Complications

Brief, mild respiratory alkalosis often resolves without complications. More marked or sudden changes can reduce blood flow to the brain, causing dizziness, fainting, confusion, or, rarely, seizures.

Changes in available calcium and shifts in potassium can contribute to muscle cramps, spasms, or abnormal heart rhythms. These effects are more concerning in people with significant heart

disease or other electrolyte problems.

In many cases, the underlying cause presents the greater risk. A blood clot in the lung, severe infection, low oxygen level, poisoning, or acute brain condition needs prompt treatment even if the alkalosis itself appears mild.

Prevention

Respiratory alkalosis cannot always be prevented. It may be a normal adjustment during pregnancy or an unavoidable response to illness, low oxygen, or high altitude.

Some episodes may be less likely with appropriate management of asthma, heart or lung disease, fever, pain, and anxiety. If you travel to high altitude, gradual ascent gives your body more time to adjust, although some respiratory alkalosis is expected there.

Take medicines only as directed and keep salicylate-containing products away from children. If you use breathing support at home, follow the monitoring and equipment plan provided by your care team.

If you have repeated anxiety-related hyperventilation, learning controlled breathing with a qualified professional may help. New symptoms should not be assumed to be anxiety without appropriate assessment.

Living with it and what to expect

An acute episode may improve within minutes or hours once breathing settles or the trigger is treated. Respiratory alkalosis caused by infection, a lung problem, or another illness may continue until that condition improves.

When it lasts for days or longer, the kidneys gradually compensate by lowering bicarbonate. This reduces the change in blood pH but does not remove the cause of the increased breathing.

Long-term effects and follow-up depend on the underlying problem. Mild pregnancy-related or altitude-related changes usually do not require treatment for the alkalosis itself. Chronic lung, liver, heart, or neurological conditions may need ongoing monitoring.

Most people with a reversible cause return to their usual activities after the cause is addressed. Repeated episodes, continuing breathlessness, or persistent abnormal blood tests may require further investigation rather than repeated treatment of symptoms alone.

When to get medical help

Seek emergency help for:

These symptoms may reflect the cause of the breathing change rather than respiratory alkalosis itself.

Arrange prompt medical assessment for a first unexplained episode of persistent rapid or deep breathing, especially with fever, cough, wheezing, a fast heartbeat, or reduced exercise tolerance. New symptoms after surgery, a long period of immobility, or a long journey also need prompt assessment because these can be risk factors for a blood clot.

Routine follow-up is appropriate if respiratory alkalosis was found during testing and you are otherwise stable. Follow-up may include reviewing medicines, checking whether symptoms have returned, and repeating blood or breathing tests when needed.

- Sudden or severe difficulty breathing
- Chest pain, fainting, severe confusion, or a seizure
- Blue, grey, or unusually pale lips or skin
- New weakness on one side, facial drooping, or trouble speaking
- Suspected overdose or poisoning, including too much aspirin
- Rapid breathing with severe illness, extreme drowsiness, or inability to stay awake

Common questions

Is respiratory alkalosis the same as hyperventilation?

Not exactly. Hyperventilation means breathing out more carbon dioxide than the body produces. Respiratory alkalosis is the resulting blood chemistry change. Hyperventilation does not always produce marked alkalosis, especially when another acid-base problem is present.

Can anxiety cause respiratory alkalosis?

Yes. Anxiety and panic can cause rapid or deep breathing that lowers carbon dioxide. However, chest pain, breathlessness, dizziness, or a first episode of hyperventilation should not automatically be attributed to anxiety. Similar symptoms can occur with heart, lung, metabolic, and neurological conditions.

Is respiratory alkalosis dangerous?

A mild, short-lived episode is often not dangerous. Severe or sudden alkalosis can cause fainting, confusion, muscle spasms, or heart rhythm problems. The condition causing it may be

more serious than the alkalosis.

How long does respiratory alkalosis last?

It may last only minutes during a brief hyperventilation episode. It can continue for days or longer when caused by pregnancy, high altitude, ongoing illness, or a chronic medical condition. The blood pH may move closer to normal as the kidneys compensate.

Can respiratory alkalosis be cured?

It can often be corrected when the cause is reversible, such as pain, fever, a treatable infection, or temporary hyperventilation. When it results from a chronic condition or a normal body adjustment, management focuses on the cause and monitoring rather than a separate cure.

Should I breathe into a paper bag?

No. Paper-bag breathing can reduce oxygen and delay treatment of a serious heart, lung, or metabolic condition. If breathing symptoms are severe, new, or unexplained, seek medical assessment instead.

Sources

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