CONDITION

Respiratory acidosis

Respiratory acidosis is a buildup of carbon dioxide that makes the blood too acidic because breathing is not removing enough carbon dioxide.

WHAT IT IS
Excess carbon dioxide causing acidic blood

BODY SYSTEM
Lungs and breathing

MAIN SYMPTOMS
Headache, sleepiness, confusion, shortness of breath

WHAT CAUSES IT
Too little ventilation from lung, brain, nerve, or muscle problems

HOW IT IS DIAGNOSED
Blood gas testing showing high carbon dioxide

MAIN TREATMENT
Restore ventilation and treat the cause

CAN IT BE CURED?
Sometimes - if the underlying cause reverses

IS IT AN EMERGENCY?
Sometimes - severe breathlessness, confusion, or reduced alertness

LONG-TERM OUTLOOK
Often manageable; outlook follows the underlying condition

Overview

Respiratory acidosis happens when your breathing does not remove enough carbon dioxide from your body. Carbon dioxide is a waste gas made by cells. Your lungs normally remove it when you breathe out.

When carbon dioxide builds up, it combines with water in the blood and forms an acid. This lowers the blood's pH, meaning the blood becomes more acidic than normal. A high carbon dioxide level is also called hypercapnia .

Respiratory acidosis is not a single disease. It is a condition caused by another problem that reduces ventilation-the movement of air into and out of the lungs. You may still appear to be breathing, but your breaths may be too slow, too shallow, or too ineffective to clear carbon dioxide.

The condition can be acute or chronic. Acute respiratory acidosis develops over minutes or hours. The kidneys have little time to adjust, so the blood may become acidic quickly. This can be an emergency.

Chronic respiratory acidosis develops over days, months, or years. The kidneys partly compensate by keeping more bicarbonate, a substance that helps control acidity. Because of this adjustment, some people have few symptoms even when their carbon dioxide remains high.

A person can also have an acute worsening on top of chronic respiratory acidosis. This may happen during a chest infection, a flare of lung disease, or a problem with breathing support.

Symptoms

Symptoms depend on how high the carbon dioxide level is, how quickly it rose, and what caused it. Mild or slowly developing respiratory acidosis may cause few obvious symptoms.

Possible symptoms include:

A rapid or severe rise in carbon dioxide can reduce alertness. A person may become very drowsy, difficult to wake, or unconscious. Seizures can occur in severe cases.

Symptoms of the underlying condition may be more noticeable than the acidosis itself. For example, a lung infection may cause fever and cough, while a severe asthma or chronic obstructive pulmonary disease flare may cause wheezing and chest tightness.

Low oxygen can occur at the same time, but high carbon dioxide and low oxygen are not the same problem. A fingertip pulse oximeter estimates oxygen levels. It does not measure carbon dioxide and cannot rule out respiratory acidosis.

- Shortness of breath or shallow breathing
- Headache, especially after waking
- Daytime sleepiness or unusual tiredness
- Difficulty concentrating
- Confusion or restlessness
- Flushed or warm skin
- Shaking or muscle twitches

Causes and risk factors

Respiratory acidosis develops when ventilation is too low for the body's needs. This can happen for several reasons.

Lung and airway conditions can make it difficult to move air effectively. These include chronic obstructive pulmonary disease, severe asthma, pneumonia, fluid in the lungs, or a blocked airway. In severe attacks, tired breathing muscles may no longer move enough air.

Problems affecting the brain's control of breathing can slow or suppress breathing. Examples include a head injury, stroke, severe illness, or medicines and drugs that cause sedation. Opioids like oxycodone or morphine are an important cause because they can slow breathing to a dangerous level.

Nerve and muscle conditions can weaken the muscles needed for breathing. Examples include motor neurone disease, muscular dystrophy, myasthenia gravis, spinal cord injury, and some nerve disorders.

Conditions that restrict the movement of the chest may also reduce ventilation. These include major chest wall changes and severe obesity. Obesity hypoventilation syndrome occurs when a person with obesity does not breathe enough to maintain a normal carbon dioxide level, including while awake.

Obstructive sleep apnoea repeatedly blocks the upper airway during sleep. It does not always cause daytime respiratory acidosis, but the risk is higher when it occurs with obesity hypoventilation, lung disease, or sedating medicines.

Risk is also higher after surgery or anaesthesia, particularly when pain, sedatives, or existing lung disease reduce deep breathing. A breathing machine that is not providing enough ventilation can also allow carbon dioxide to rise.

Diagnosis

Respiratory acidosis is confirmed with a blood gas test. This measures the blood's pH, carbon dioxide, oxygen, and bicarbonate levels.

An arterial blood gas uses blood from an artery, usually at the wrist. It gives the most direct information about oxygen, carbon dioxide, and acidity. A venous blood gas, taken from a vein, may be used as an initial test in some settings, but an arterial sample may still be needed.

The key findings are a raised carbon dioxide level and an acidic or partly compensated pH. A higher bicarbonate level can suggest that the kidneys have had time to adjust, which supports chronic rather than purely acute respiratory acidosis. Blood gas results must be interpreted together because other acid-base problems can occur at the same time.

Further tests look for the cause and assess its severity. These may include:

A normal pulse oximeter reading does not exclude high carbon dioxide. Carbon dioxide must be assessed with an appropriate blood gas or another carbon dioxide monitoring method.

- Oxygen measurement and continuous heart monitoring
- Chest imaging, such as an X-ray
- Blood tests for infection, kidney function, and other conditions
- Lung function tests when the situation is stable
- Sleep studies for suspected sleep-related breathing problems
- Tests of nerve or muscle function
- Medicine or toxicology testing when an overdose is possible

Treatment and management

Treatment aims to improve ventilation and address the condition causing it. The urgency depends on the blood gas results, symptoms, and how quickly the problem developed.

In acute respiratory acidosis, the immediate priority is keeping the airway open and supporting breathing. Oxygen is given when the oxygen level is low. People at risk of retaining carbon dioxide may need carefully monitored oxygen, but oxygen should not be withheld during an emergency.

Treatment of the cause may include medicines to open narrowed airways, treatment for a lung infection, removal of an airway blockage, or an antidote for certain drug effects. These treatments are chosen according to the specific cause rather than the carbon dioxide level alone.

Some people need non-invasive ventilation. This uses a close-fitting face or nasal mask to provide pressurised air and assist each breath. Bi-level positive airway pressure, often called BiPAP, is one form. It can reduce the effort of breathing and help remove carbon dioxide.

If mask ventilation is unsuitable or does not provide enough support, a breathing tube and mechanical ventilator may be needed. This is more likely when a person cannot protect their airway, is becoming less alert, or has severe breathing failure.

Chronic respiratory acidosis is managed by treating the long-term breathing problem. Care may involve inhaled treatment for lung disease, smoking support, pulmonary rehabilitation, treatment of sleep-disordered breathing, or assisted ventilation during sleep. Selected people with chronic neuromuscular disease, obesity hypoventilation, or chronic lung disease may use

ventilation at home.

Carbon dioxide usually needs to be corrected in a controlled way, especially when it has been high for a long time. Treatment focuses on safe ventilation and the underlying cause rather than trying to change the blood's acidity by itself.

Complications

Severe acute respiratory acidosis can affect the brain, heart, and circulation. Possible complications include reduced consciousness, seizures, abnormal heart rhythms, and low blood pressure. Respiratory arrest can occur if breathing becomes too weak or stops.

Low oxygen may accompany high carbon dioxide and can damage organs if it is severe or prolonged.

Long-term breathing disorders can place strain on the heart and lungs. Some people develop pulmonary hypertension, which is high blood pressure in the blood vessels of the lungs, or right-sided heart problems. These complications are often related to the underlying lung disease and long-term low oxygen, not respiratory acidosis alone.

Repeated episodes may lead to hospital admissions or a need for more breathing support. Recognising changes early can help prevent some episodes from becoming severe.

Prevention

Respiratory acidosis cannot always be prevented. Some causes, including inherited muscle disorders, spinal injuries, and progressive neurological conditions, are not preventable.

When risk can be reduced, prevention focuses on the underlying cause. This may include following a long-term lung treatment plan, avoiding smoking, attending recommended respiratory or sleep follow-up, and using prescribed breathing equipment consistently.

Sedating medicines, alcohol, and other substances can suppress breathing, especially when combined. Take prescribed sedating medicines only as directed, and do not combine them with alcohol or non-prescribed drugs. Keep opioid medicines away from children and anyone for whom they were not prescribed.

If you use home oxygen or assisted ventilation, do not change its settings without advice from the service overseeing the equipment. Report mask leaks, poor fit, new morning headaches, or increasing daytime sleepiness.

Vaccination and prompt assessment of respiratory infections may reduce the chance of an

infection triggering breathing failure in people with chronic lung or muscle conditions.

Living with it and what to expect

A single acute episode may resolve when its cause is reversed, such as after treatment of an infection, airway narrowing, or medicine effect. Recovery time depends on the illness and whether other organs were affected.

Chronic respiratory acidosis may continue for months or years if the underlying condition remains. The kidneys can partly compensate, but this does not remove the breathing problem. Some people feel well at their usual carbon dioxide level, while others have fatigue, headaches, poor sleep, or limited physical activity.

Long-term care may include blood gas checks, lung or sleep testing, and reviews of oxygen or ventilation equipment. Follow-up is used to identify gradual changes rather than because every abnormal carbon dioxide result is an emergency.

Many people continue everyday activities with treatment and planned support. Progressive lung, nerve, or muscle conditions may lead to increasing help with breathing over time. The course is shaped mainly by the underlying condition, general health, and response to treatment, so it cannot be predicted from a carbon dioxide result alone.

When to get medical help

Call emergency services if you or someone else has:

If opioid overdose may be involved, use naloxone if it is available and you have been shown how, then call emergency services. Its effects may wear off before the opioid does.

Seek prompt medical assessment for new or worsening breathlessness, morning headaches, daytime sleepiness, or difficulty using prescribed breathing support. These symptoms are not always caused by respiratory acidosis, but they may need testing.

Routine follow-up is appropriate when symptoms are stable and you are attending planned reviews for a chronic lung, sleep, nerve, or muscle condition. Contact the service overseeing home ventilation if equipment becomes uncomfortable, leaks, alarms repeatedly, or no longer seems effective.

- Severe or rapidly worsening trouble breathing
- New confusion, collapse, or unusual behaviour

- Extreme sleepiness or difficulty waking
- Blue, grey, or unusually pale lips or skin
- A seizure
- Slow or shallow breathing after possible opioid or sedative use

Common questions

Is respiratory acidosis the same as low oxygen?

No. Respiratory acidosis is caused by too much carbon dioxide. Low oxygen is a separate problem, although both can happen together. A pulse oximeter measures oxygen, not carbon dioxide.

Can anxiety cause respiratory acidosis?

Anxiety more often causes fast breathing, which lowers carbon dioxide and may cause respiratory alkalosis-the opposite acid-base change. Respiratory acidosis occurs when breathing is not removing enough carbon dioxide.

Can oxygen make respiratory acidosis worse?

In some people with chronic carbon dioxide retention, uncontrolled high-concentration oxygen can contribute to a further rise in carbon dioxide. Oxygen is still important when levels are low. Healthcare teams monitor it and choose an appropriate target rather than withholding it.

Can respiratory acidosis go away completely?

It can go away when a reversible cause is corrected. Examples include some medicine effects, airway narrowing, or an infection. It may remain or return when caused by chronic lung, nerve, muscle, or chest wall disease.

What does high carbon dioxide feel like?

It may cause headache, sleepiness, breathlessness, confusion, or a flushed feeling. Slow increases may cause few symptoms. Symptoms alone cannot confirm the level; a blood gas test is needed.

Is respiratory acidosis the same as COPD?

No. COPD is a long-term lung disease. It can cause respiratory acidosis during a severe flare or in advanced disease, but many people with COPD do not have persistent respiratory acidosis.

Sources



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