CONDITION

Atheroembolic renal disease

Learn how cholesterol crystals can block small kidney arteries, what symptoms may occur, how the condition is diagnosed, and how it is managed.

WHAT IT IS
Kidney damage from cholesterol crystal blockages

BODY SYSTEM
Kidneys and urinary system

MAIN SYMPTOMS
Reduced urine, swelling, fatigue, blue or purple toes

WHAT CAUSES IT
Cholesterol crystals from arterial plaque

HOW IT IS DIAGNOSED
Kidney, skin, or muscle biopsy

MAIN TREATMENT
Supportive kidney care and complication management

CAN IT BE CURED?
No, lodged crystals cannot be removed

IS IT AN EMERGENCY?
Sometimes, inability to pass urine

LONG-TERM OUTLOOK
Kidney function may improve, remain reduced, or progress to failure

Overview

Atheroembolic renal disease is kidney damage caused by tiny pieces of cholesterol-rich material that break away from plaque inside a large artery. Plaque is a buildup of cholesterol, fat, calcium, and other substances in an artery wall.

The loose material travels through the bloodstream and becomes stuck in small arteries within the kidneys. These blockages reduce blood flow and trigger inflammation. The condition is also called renal cholesterol crystal embolization.

Atheroembolic renal disease is different from a blood clot that suddenly blocks a main kidney artery. Cholesterol crystals usually scatter into many small vessels. Kidney function may worsen gradually over days or weeks rather than failing immediately.

The kidneys are often affected because they receive a large amount of blood directly from the aorta, the body's main artery. Cholesterol crystals may also travel to the skin, digestive tract, eyes, brain, or other organs. For this reason, atheroembolic renal disease can be part of a wider illness called cholesterol embolization syndrome.

The condition often appears after a procedure involving the aorta or other large arteries, such as coronary angiography, cardiac catheterization, or vascular surgery. It can also develop without a recent procedure.

Atheroembolic renal disease matters because the kidney injury can become long-lasting. It may also be a sign of widespread atherosclerosis, which is hardening and narrowing of the arteries throughout the body.

Symptoms

Some people have no clear symptoms at first. The initial sign may be an increase in creatinine, a blood test used to estimate kidney function. Changes often begin several days or weeks after an artery procedure, although timing varies.

Possible kidney-related symptoms include:

These symptoms are not specific to atheroembolic renal disease. Many other kidney and medical conditions can cause them.

Skin changes can provide an important clue. A person may develop a purple, blotchy, or netlike pattern called livedo reticularis, usually on the legs or feet. One or more toes may become blue or purple even though a pulse can still be felt in the foot. This is sometimes called blue toe syndrome. Small painful sores or areas of damaged skin may also occur.

If other organs are involved, symptoms may include muscle pain, fever, unintended weight loss, abdominal pain, diarrhea, or bleeding from the digestive tract. Cholesterol deposits may sometimes be visible in the small arteries at the back of the eye during an eye examination.

Contact a clinician promptly if urine output falls, swelling increases, or new blue or purple areas appear on the toes or feet, especially after an artery procedure.

Seek emergency care for chest pain, severe shortness of breath, fainting, sudden weakness or difficulty speaking, severe or persistent abdominal pain, a cold and very painful limb, or an inability to pass urine. These symptoms may have several causes, but they require immediate assessment.

- Producing less urine than usual
- Swelling in the legs, ankles, or around the eyes

- Fatigue, nausea, poor appetite, or difficulty concentrating
- New or more difficult-to-control high blood pressure

Causes and risk factors

Atheroembolic renal disease begins with atherosclerotic plaque, usually in the aorta or another large artery. When a plaque cracks or is disturbed, cholesterol crystals and other debris can enter the bloodstream. The crystals lodge in smaller kidney arteries that are too narrow for them to pass through.

The blockage is only part of the injury. The crystals also cause inflammation in the vessel walls. Over time, this reaction can lead to scarring and further loss of blood flow.

The condition may occur after:

Anticoagulant and clot-dissolving medicines have sometimes been associated with cholesterol embolization, but the relationship is complex. These medicines may be essential for conditions such as atrial fibrillation, a blood clot, or a mechanical heart valve. A person should not stop or change them without guidance from the prescribing clinician.

Risk is higher in people with extensive atherosclerosis. Factors linked to atherosclerosis include older age, smoking, high blood pressure, diabetes, high cholesterol, coronary artery disease, peripheral artery disease, and a history of stroke. Existing chronic kidney disease may increase the effect of any new kidney injury.

Having one or more risk factors does not mean that a person has or will develop atheroembolic renal disease.

- Cardiac catheterization or coronary angiography
- Procedures performed through an artery to treat narrowed or blocked blood vessels
- Surgery involving the aorta, heart, or major arteries
- Less commonly, severe plaque disruption that occurs without a procedure

Diagnosis

There is no single blood test that confirms atheroembolic renal disease. Diagnosis usually depends on the medical history, timing, physical examination, laboratory results, and exclusion of other causes of kidney injury.

A clinician will ask about recent angiography, catheter-based procedures, vascular surgery,

and medicines. The examination may focus on blood pressure, pulses, swelling, skin changes, and signs that other organs are affected.

Blood testing usually includes creatinine and an estimate of the kidneys' filtering ability. Additional tests may look for anemia or signs of inflammation. Some people have an increased number of eosinophils, a type of white blood cell involved in allergic and inflammatory reactions. Complement proteins in the blood may be low. These findings can support the diagnosis, but they are not specific and may be temporary.

A urine test may show blood or protein. The findings are often milder than those seen in diseases that primarily inflame the kidneys' filtering units.

Ultrasound can assess kidney size and help identify other problems, such as a urinary blockage. Imaging may also show extensive plaque in the aorta. However, a normal kidney ultrasound does not rule out cholesterol crystal embolization.

A kidney, skin, or muscle biopsy may sometimes be needed. During a biopsy, a small tissue sample is examined under a microscope. Characteristic spaces left by cholesterol crystals can support the diagnosis. Because emboli are scattered, a sample can miss them. Clinicians weigh this limitation against the risk of bleeding or other biopsy complications.

Further angiography is not routinely used only to confirm the diagnosis because another artery procedure could disturb additional plaque. Whether imaging is appropriate depends on the clinical situation.

Treatment and management

There is no medicine or procedure that can remove cholesterol crystals after they have entered the kidneys' small arteries. Treatment therefore focuses on supporting kidney function, managing complications, and reducing the chance of further artery damage.

The care team may adjust fluid and salt intake based on swelling, blood pressure, urine output, and heart function. Blood tests are repeated to monitor kidney function and electrolyte levels, including potassium. Medicines may need review because reduced kidney function can change how the body handles them.

Blood pressure treatment is important, but the safest approach depends on kidney function and other medical conditions. Clinicians may temporarily hold or adjust medicines during active kidney injury. Patients should not make these changes on their own.

A statin like atorvastatin or simvastatin may be used when appropriate to lower cardiovascular risk and help stabilize atherosclerotic plaque. Antiplatelet medicines may be needed for coronary, brain, or peripheral artery disease. These treatments manage the underlying vascular

disease; they do not dissolve cholesterol crystals already lodged in the kidneys.

Future procedures involving large arteries may be avoided or modified when reasonable. If another procedure is medically necessary, specialists can consider the person's vascular and kidney risks while planning it.

Corticosteroids and other anti-inflammatory treatments have been studied, but evidence of benefit is uncertain. They are not a proven standard treatment for every patient.

Dialysis may be needed if the kidneys cannot adequately remove waste, control potassium, manage acid levels, or regulate fluid balance. Dialysis may be temporary if kidney function improves, but some people require long-term treatment.

Smoking cessation, appropriate physical activity, and management of diabetes, cholesterol, and blood pressure can help reduce overall cardiovascular risk. These steps do not reverse existing emboli, but they are important because atherosclerosis often affects several parts of the body.

Complications

Kidney function may improve partially, remain reduced, or continue to worsen. Some people develop chronic kidney disease, meaning kidney damage or reduced kidney function that lasts for at least three months. Severe injury may lead to kidney failure requiring ongoing dialysis.

Fluid buildup can cause leg swelling, high blood pressure, or shortness of breath. Reduced kidney function can also lead to high potassium, acid buildup, anemia, and changes in bone and mineral balance.

Because cholesterol crystals can reach other organs, complications are not limited to the kidneys. Skin injury may progress to painful ulcers or tissue loss. Digestive-tract involvement can cause bleeding or reduced blood supply to the bowel. Brain involvement can cause a stroke or temporary stroke-like symptoms.

The underlying atherosclerosis also raises the risk of heart attack, stroke, and circulation problems in the legs. Follow-up therefore includes both kidney care and cardiovascular risk management.

Follow up

Early follow-up generally involves repeat blood tests, urine tests, blood pressure checks, and review of symptoms. The frequency depends on the severity and pace of the kidney injury. A

nephrologist, a doctor who specializes in kidney disease, may help guide monitoring and treatment.

At routine visits, the care team may review:

Keep an updated medicine list and tell every treating clinician about the kidney injury and suspected or confirmed cholesterol embolization. Do not stop anticoagulants like warfarin or apixaban , antiplatelet medicines, blood pressure drugs, or other prescribed treatments without medical advice.

Between visits, seek prompt medical guidance for worsening swelling, a major change in urine output, persistent vomiting, new confusion, or new blue or painful toes. Emergency symptoms such as chest pain, severe breathing difficulty, stroke symptoms, severe abdominal pain, or a cold and painful limb should not wait for a routine appointment.

- Changes in creatinine, potassium, and estimated kidney function
- Blood pressure, weight, swelling, and urine output
- Skin findings and symptoms involving other organs
- Medicines that may need adjustment for kidney function
- Management of smoking, diabetes, cholesterol, and vascular disease
- Planning for future angiography, surgery, or other artery procedures

Sources

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