CONDITION

Alport syndrome

Learn how Alport syndrome affects the kidneys, hearing, and eyes, including its genetic causes, diagnosis, treatment, monitoring, and family considerations.

WHAT IT IS
Inherited collagen disorder mainly affecting kidneys

BODY SYSTEM
Kidneys, hearing and vision

MAIN SYMPTOMS
Blood in urine, protein in urine, hearing loss, eye changes

WHAT CAUSES IT
Inherited gene changes

HOW IT IS DIAGNOSED
Genetic testing or kidney biopsy

MAIN TREATMENT
Kidney-protective medicines and monitoring

CAN IT BE CURED?
No, underlying collagen change uncorrectable

IS IT AN EMERGENCY?
Sometimes, inability to urinate

LONG-TERM OUTLOOK
Variable, may progress to kidney failure

Overview

Alport syndrome is an inherited condition that mainly affects the kidneys. It can also affect hearing and certain structures in the eyes. The condition develops because of changes in genes that help make type IV collagen, a protein that supports tissues in these organs.

In the kidneys, type IV collagen is part of the glomerular basement membrane. This thin layer helps the kidneys filter waste and extra fluid from the blood while keeping blood cells and important proteins in the body. In Alport syndrome, the membrane is not formed normally. Blood may leak into the urine, and kidney function may gradually decline.

The course of Alport syndrome varies widely. Some people develop serious kidney disease during childhood or early adulthood. Others maintain kidney function for much longer. The specific gene change, inheritance pattern, sex, protein levels in the urine, blood pressure, and

access to early treatment can all influence the outlook.

Alport syndrome matters because kidney damage may begin before a person feels unwell. Early diagnosis allows treatment and monitoring that may slow the loss of kidney function. A diagnosis can also help relatives understand whether they should consider testing.

Symptoms

Blood in the urine, called hematuria , is often the earliest sign. The amount may be too small to see and may only appear on a urine test. Some people occasionally have pink, red, or brown urine, especially during an infection or after strenuous activity. Visible blood in urine can have many causes and should be assessed rather than assumed to be from Alport syndrome.

As kidney damage progresses, protein may leak into the urine. This is known as proteinuria or albuminuria . It may cause persistently foamy urine, although urine appearance alone cannot measure protein levels.

Later kidney-related symptoms can include swelling around the eyes, feet, or ankles; high blood pressure; tiredness; nausea; reduced appetite; and changes in urination. These symptoms are not specific to Alport syndrome and often do not appear until kidney function has declined.

Hearing loss is usually sensorineural, meaning it results from changes in the inner ear rather than blocked sound transmission. It often affects both ears and may first make it difficult to hear higher-pitched sounds or understand speech in a noisy setting. Hearing loss is not present at birth in most affected people and may develop during later childhood or adulthood.

Eye findings can include:

Not everyone develops hearing or eye problems. Their absence does not rule out Alport syndrome.

- Anterior lenticonus , in which the front of the eye's lens becomes cone-shaped and affects vision
- Small pale spots on the retina, called dot-and-fleck retinopathy, which often do not reduce vision
- Corneal changes that may cause eye discomfort, light sensitivity, or repeated irritation

Causes and risk factors

Alport syndrome is caused by disease-related changes in the COL4A3 , COL4A4 , or COL4A5

genes. These genes provide instructions for making parts of type IV collagen.

The condition can be inherited in several ways.

X-linked Alport syndrome results from a change in the COL4A5 gene on the X chromosome. It is the most common inheritance pattern. People with one X chromosome often have a higher risk of earlier kidney failure. People with two X chromosomes may have a milder course, but they can still develop protein in the urine, hearing loss, high blood pressure, or kidney failure. They should not be viewed only as unaffected "carriers."

Autosomal recessive Alport syndrome occurs when a person inherits two disease-related changes in COL4A3 or COL4A4, usually one from each parent. Parents with one changed copy may have blood in the urine or other kidney findings but often have less severe disease.

Autosomal dominant Alport syndrome can occur when one changed copy of COL4A3 or COL4A4 is sufficient to cause disease. Kidney problems are often later or more variable than in recessive disease, but close monitoring remains important.

Some families have more complex combinations of gene changes. Genetic testing and counseling can clarify the likely inheritance pattern, although a test cannot always predict exactly how quickly the condition will progress.

A family history of persistent blood in the urine, unexplained kidney failure, hearing loss with kidney disease, or a kidney transplant at a young age may raise suspicion. However, a person can have Alport syndrome without a known family history because relatives may have mild symptoms, the gene change may be new, or family medical information may be limited.

Diagnosis

Evaluation usually begins with a medical and family history, blood pressure measurement, and urine testing. A urinalysis can identify blood and protein. A urine albumin-to-creatinine or protein-to-creatinine ratio measures how much protein is being lost.

Blood tests measure creatinine and estimate the glomerular filtration rate, or eGFR . The eGFR is an estimate of how well the kidneys filter blood. Results are interpreted over time because a single value does not show the rate of change.

Genetic testing is an important way to confirm Alport syndrome. Testing generally looks for changes in COL4A3, COL4A4, and COL4A5. Results can help identify the inheritance pattern, guide testing for relatives, and support decisions about potential related kidney donors. A genetics professional can explain possible results, including uncertain findings.

If genetic testing does not provide an answer or is unavailable, a kidney biopsy may be

considered. During a biopsy, a small sample of kidney tissue is removed and examined. Specialized microscopy may show thinning, splitting, or layering of the glomerular basement membrane. Testing for type IV collagen in kidney or, in selected cases, skin tissue may offer additional information.

Other evaluations may include a formal hearing test and a detailed eye examination. These assessments can detect changes before they noticeably affect daily life.

Several conditions can cause blood or protein in the urine. Clinicians may evaluate for urinary infections, kidney stones, IgA nephropathy, other inherited collagen disorders, and non-kidney sources of bleeding. Persistent hematuria should not be diagnosed from symptoms alone.

Treatment and management

There is currently no treatment that corrects the underlying collagen change. Management focuses on protecting kidney function, controlling complications, and addressing hearing or eye problems.

Medicines that block the renin-angiotensin-aldosterone system are central to kidney protection. These include angiotensin-converting enzyme inhibitors like lisinopril or ramipril, known as ACE inhibitors, and angiotensin receptor blockers, known as ARBs. They can lower blood pressure and reduce protein leakage through the kidneys. Starting treatment early in an appropriate patient may delay kidney failure, including when protein in the urine appears before symptoms.

These medicines require professional supervision. Kidney function and potassium levels are usually checked after treatment begins and after relevant changes. ACE inhibitors and ARBs can harm a developing fetus, so pregnancy plans, contraception, and medication changes should be discussed with the treating clinician before conception. They should not be stopped or changed without medical guidance unless an urgent treating professional advises it.

Some people with chronic kidney disease may be considered for other kidney-protective medicines, depending on their age, kidney function, protein in the urine, and other medical conditions. Evidence specific to Alport syndrome continues to develop, so a nephrologist should explain the likely benefits and uncertainties.

Everyday kidney care may include keeping blood pressure within an agreed target, avoiding tobacco, staying physically active, and following nutrition advice suited to the stage of kidney disease. A clinician may recommend limiting sodium, especially when blood pressure or swelling is present. Extreme high-protein diets may not be appropriate for some people with kidney disease.

Nonsteroidal anti-inflammatory drugs, such as ibuprofen and naproxen, can worsen kidney function in some situations. People with Alport syndrome should ask their clinician or pharmacist which pain medicines are appropriate. All healthcare professionals should know about the kidney condition before prescribing medicines or ordering tests that may affect the kidneys.

Hearing aids can improve communication when hearing loss develops. Some people with severe loss may benefit from cochlear implants. School or workplace accommodations, such as preferential seating or assistive listening devices, can also help.

An ophthalmologist can manage eye complications with corrective lenses, protection for the cornea, or surgery when needed. Retinal spots alone often do not require treatment.

If kidney failure develops, dialysis can replace part of the kidneys' filtering function. Kidney transplantation is generally an effective treatment because the transplanted kidney has normal type IV collagen. Alport syndrome does not usually recur in the new kidney. A rare anti-glomerular basement membrane reaction can occur after transplantation and requires specialist care.

Relatives being considered as kidney donors need careful kidney and genetic evaluation. A family member with a disease-related gene change may have future kidney risks even if current test results appear normal.

Complications

The main complication is chronic kidney disease that may progress to kidney failure. Proteinuria and high blood pressure can increase as kidney damage advances. Kidney failure requires dialysis or transplantation to sustain health.

Hearing loss may affect speech development, education, employment, relationships, and safety if it is not recognized. Regular assessment and early hearing support can reduce these effects.

Eye complications may change focusing ability or cause corneal pain. Significant loss of vision is less common, but new visual symptoms still need assessment.

Alport syndrome can also affect emotional well-being. A diagnosis may create concerns about future kidney health, pregnancy, children, or relatives. Genetic counseling and support from a kidney care team or patient organization may help people make informed decisions.

Follow up

Follow-up is usually coordinated by a nephrologist, a doctor who specializes in kidney disease. The schedule depends on age, genetic findings, blood pressure, protein in the urine, kidney function, and treatment.

Routine monitoring may include:

Children may also need monitoring of growth, school performance, and hearing-related communication. Adults planning a pregnancy should request preconception review because kidney disease, high blood pressure, and some kidney medicines can affect pregnancy care.

Contact the treating clinician promptly for a clear increase in swelling, a marked change in urination, repeated visible blood in the urine, new hearing difficulty, persistent eye pain, or worsening vision. Visible blood accompanied by fever, severe side or back pain, clots, or difficulty passing urine needs timely assessment because another condition may be responsible.

Seek emergency care for severe shortness of breath, chest pain, fainting, confusion, a seizure, inability to urinate, or rapidly worsening swelling with breathing difficulty. These symptoms are not routine features to wait for at a scheduled visit.

- Blood pressure checks
- Urine testing for blood and protein
- Creatinine, eGFR, and potassium blood tests
- Hearing assessments
- Eye examinations when recommended
- Review of medicines, pregnancy plans, and family testing

Sources

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