CONDITION

X-linked adult spinal muscular atrophy

X-linked adult spinal muscular atrophy is an inherited condition causing slowly progressive muscle weakness, usually beginning in adulthood.

WHAT IT IS
Inherited adult-onset motor nerve and muscle condition

BODY SYSTEM
Nervous system and muscles

MAIN SYMPTOMS
Muscle weakness, cramps, tremor, swallowing difficulty

WHAT CAUSES IT
Inherited androgen receptor gene expansion

HOW IT IS DIAGNOSED
Androgen receptor gene testing

MAIN TREATMENT
Rehabilitation, symptom control, and supportive care

CAN IT BE CURED?
No - current treatments cannot remove the genetic cause

IS IT AN EMERGENCY?
Sometimes - severe choking or breathing trouble

LONG-TERM OUTLOOK
Usually slow progression over years or decades

Overview

X-linked adult spinal muscular atrophy is an inherited condition that damages motor neurons. These nerve cells carry signals from the spinal cord and lower part of the brain to the muscles. As motor neurons stop working, muscles gradually become weaker and smaller.

The medical name is spinal and bulbar muscular atrophy, or SBMA. "Bulbar" refers to nerves controlling speech, chewing, and swallowing. The condition is also sometimes called Kennedy disease.

Symptoms usually begin in adulthood and progress slowly. Weakness often starts in the legs or around the hips before affecting the arms, face, throat, and breathing muscles. Muscle cramps, shaking hands, and small muscle twitches may appear before clear weakness.

The condition mainly affects males because the altered gene is on the X chromosome. Females who carry the genetic change usually have no symptoms or much milder symptoms.

X-linked adult spinal muscular atrophy is not the same as the more common childhood forms of spinal muscular atrophy. It is also different from amyotrophic lateral sclerosis, or ALS, although some symptoms can look similar. Genetic testing can distinguish these conditions.

Symptoms

Symptoms most often develop between early and late adulthood. The age at which they begin and the rate of change are different for each person.

Early symptoms may include:

Weakness usually affects muscles close to the centre of the body first, such as the thighs, hips, shoulders, and upper arms. It may be more noticeable on one side at first. As weakness progresses, walking may become harder and falls may become more frequent.

Weakness in the face and throat can cause a quieter or nasal-sounding voice. Some people have difficulty chewing, moving food around the mouth, or swallowing. Liquids may enter the airway, causing coughing or choking.

Other possible features include enlarged breast tissue in males, reduced fertility, smaller testicles, or erectile difficulties. These occur because the condition affects how cells respond to androgens, which are hormones such as testosterone.

Some people develop reduced sensation in their feet or hands. Diabetes, high cholesterol, and fatty liver are also more common in people with this condition.

Thinking, memory, bladder control, and bowel control are not usually directly affected.

- Muscle cramps, especially after activity
- Shaking or trembling of the hands
- Small muscle twitches under the skin
- Tiredness or heaviness in the legs
- Difficulty running, climbing stairs, or getting up from a chair

Causes and risk factors

X-linked adult spinal muscular atrophy is caused by a change in the AR gene. This gene provides instructions for making the androgen receptor, a protein that allows cells to respond

to hormones such as testosterone.

The genetic change is an expanded section of DNA called a CAG repeat. The altered androgen receptor protein builds up inside certain cells and gradually damages motor neurons. Androgen hormones help drive this process, which is one reason males are much more likely to develop significant symptoms.

The condition follows an X-linked pattern of inheritance. Males usually have one X chromosome, so an altered AR gene on that chromosome can cause the condition. Females usually have two X chromosomes, and the second working copy often limits the effects.

A man with the altered gene passes it to all his daughters and none of his sons. A woman who carries the altered gene has a 1 in 2 chance of passing it on in each pregnancy. Sons who inherit it are likely to develop the condition later in life. Daughters who inherit it are carriers and may occasionally develop mild symptoms.

The main risk factor is inheriting the altered gene. Exercise, diet, work, injuries, or personal choices do not cause the condition. A family history may not always be obvious because symptoms can begin late or relatives may have been given a different diagnosis.

Diagnosis

Diagnosis usually begins with a review of your symptoms, their timing, and your family history. A neurological examination checks muscle strength, reflexes, sensation, walking, and signs of muscle wasting or twitching.

A blood test that examines the AR gene confirms the diagnosis. It looks for the expanded CAG repeat responsible for the condition.

Other tests may help assess its effects or rule out conditions with similar symptoms. These can include:

Creatine kinase is an enzyme released by muscle. Its level may be raised, but this result cannot confirm the condition by itself.

Because genetic test results can affect relatives, genetic counselling may be offered before and after testing. A genetic counsellor can explain possible results, inheritance, privacy concerns, and choices about sharing information with family members.

- Electromyography, which measures electrical activity in muscles
- Nerve conduction studies, which test how well nerves carry signals
- Blood tests, including creatine kinase, liver, glucose, and cholesterol tests

- Swallowing or breathing assessments when these functions are affected

Treatment and management

There is currently no treatment that removes the genetic change or reliably stops progression. Care focuses on maintaining independence, managing symptoms, and reducing complications.

A physiotherapist can suggest suitable strengthening, stretching, and aerobic activity. Moderate, low-impact exercise may support fitness and mobility, but severe fatigue, prolonged pain, or marked weakness after exercise can mean the activity was too demanding.

An occupational therapist can help with everyday activities, work adjustments, home access, and equipment. Braces, walking aids, powered mobility devices, or grab rails may become useful as weakness changes.

Speech and language therapists assess speech and swallowing. Management may include safer swallowing techniques, changes to food texture, communication equipment, or other support. If swallowing becomes unsafe or maintaining nutrition is difficult, tube feeding may be discussed.

Breathing function may be checked during follow-up, particularly if you have weak coughing, breathlessness when lying down, morning headaches, or daytime sleepiness. Assisted coughing or non-invasive ventilation through a mask may help some people.

Medicines may be used for specific problems such as pain, troublesome cramps, tremor, diabetes, or abnormal cholesterol. Treatment may also be offered for breast enlargement, fertility concerns, or sexual difficulties.

Testosterone does not correct the underlying problem and may increase the harmful effects of the altered androgen receptor. Do not start testosterone or bodybuilding hormones to treat weakness. If testosterone has been prescribed for another reason, discuss it with the prescribing clinician rather than stopping it on your own.

Hormone-blocking treatments have been studied, but they have not shown enough consistent benefit to be routine treatment for everyone.

Complications

Progressive leg weakness can lead to falls, injuries, and eventual loss of independent walking. Reduced movement may also contribute to joint stiffness and reduced physical fitness.

Swallowing weakness can allow food, drink, or saliva to enter the lungs. This is called

aspiration. It can cause chest infections, including aspiration pneumonia. Swallowing problems may also lead to weight loss, dehydration, or lengthy mealtimes.

Weakness of the breathing muscles is usually less prominent than in some other motor neuron conditions, but it can occur. A weak cough can make it harder to clear mucus during a respiratory infection.

Other possible complications include diabetes, fatty liver, abnormal cholesterol levels, infertility, and distress related to physical or sexual changes. Reduced independence may also affect employment, relationships, and emotional well-being.

Regular assessment can identify many of these problems before they become severe.

Prevention

X-linked adult spinal muscular atrophy cannot be prevented through lifestyle changes because it is caused by an inherited genetic alteration.

If the altered AR gene is present in your family, genetic counselling can explain the chance of passing it on. Options may include testing adult relatives, testing during pregnancy, or in vitro fertilisation with testing of embryos before pregnancy. These are personal choices, and counselling does not require you to pursue testing or reproductive treatment.

Exercise, a balanced diet, avoiding smoking, and managing diabetes or cholesterol can support general health. They do not prevent the underlying condition, but they may reduce additional strain on mobility, breathing, and cardiovascular health.

Living with it and what to expect

X-linked adult spinal muscular atrophy usually changes slowly over years or decades. Some people remain independently mobile for many years, while others eventually need a cane, walker, wheelchair, or help with daily tasks. Age at onset does not predict the exact course for an individual.

Muscle strength that has already been lost usually does not return fully. Rehabilitation focuses on using remaining strength efficiently, avoiding preventable injuries, and adapting activities as needs change.

Speech and swallowing problems may appear later than leg weakness, but this is not guaranteed. Reporting coughing during meals, weight loss, or changes in speech allows these functions to be assessed promptly.

Many people continue working, driving, travelling, and taking part in family or social life, sometimes with practical adjustments. Planning ahead for accessibility and mobility equipment can make changes less disruptive.

Life expectancy is often close to that of the general population, but serious swallowing or breathing complications can affect health and survival. Aspiration pneumonia is an important long-term risk. Ongoing monitoring of swallowing, breathing, mobility, and metabolic health helps guide care.

Routine follow-up may involve neurology, rehabilitation, respiratory care, nutrition, speech and swallowing services, and primary care. The timing of appointments is based on symptoms and functional changes rather than a single fixed schedule.

When to get medical help

Arrange a routine appointment if you develop gradually increasing weakness, muscle cramps, shaking, falls, or difficulty with stairs and daily activities. These symptoms have many possible causes and need proper assessment rather than self-diagnosis.

Contact your healthcare team promptly if you notice:

Seek urgent medical care if swallowing problems prevent you from taking fluids, or if you have a chest infection with worsening breathing.

Call emergency services for severe breathing difficulty, prolonged choking, blue or grey lips, loss of consciousness, or inability to clear a blocked airway. Sudden weakness on one side, facial drooping, or sudden speech difficulty is not a typical progression of this condition and should be treated as a possible stroke emergency.

- New coughing or choking during meals
- Unplanned weight loss or difficulty drinking enough
- Increasing falls or loss of mobility
- A weaker cough or repeated chest infections
- Breathlessness when lying flat
- Morning headaches or unusual daytime sleepiness

Common questions

Is X-linked adult spinal muscular atrophy the same as spinal muscular atrophy in children?

No. Childhood spinal muscular atrophy is usually linked to the SMN1 gene and has a different inheritance pattern. X-linked adult spinal muscular atrophy is caused by an expanded section of the AR gene and generally begins in adulthood.

Is it the same as ALS?

No. Both conditions can cause motor neuron loss and muscle weakness, but X-linked adult spinal muscular atrophy usually progresses more slowly. Hormone-related features, sensory changes, and the genetic test result also help distinguish it from ALS.

Can women develop symptoms?

Yes, but significant weakness is uncommon. Some female carriers develop cramps, tremor, mild weakness, or other symptoms later in life. A woman with symptoms still needs assessment because these problems can have other causes.

Will my children inherit it?

An affected father passes the altered gene to all his daughters and none of his sons. A female carrier has a 1 in 2 chance of passing it on in each pregnancy. Genetic counselling can explain how this applies to a particular family.

Can exercise make the condition worse?

Appropriate exercise is not known to cause the genetic condition or make it suddenly progress. Moderate activity may help maintain fitness and function. Exercise that causes marked exhaustion, prolonged pain, or lasting loss of strength may be excessive and should be adjusted with rehabilitation advice.

Does testosterone treatment improve muscle strength?

Testosterone is not an established treatment and may worsen the harmful activity of the altered androgen receptor. Anabolic steroids and testosterone supplements should not be used to treat this condition. Prescribed hormone treatment should be reviewed with the clinician managing it.

Sources

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