CONDITION

Mucopolysaccharidosis type I

Mucopolysaccharidosis type I is an inherited condition that causes certain complex sugars to build up throughout the body.

WHAT IT IS
Inherited enzyme condition causing complex sugars to build up

BODY SYSTEM
Bones, joints, heart, breathing, eyes, ears, and brain

MAIN SYMPTOMS
Joint stiffness, skeletal changes, cloudy corneas, breathing problems

WHAT CAUSES IT
Inherited IDUA gene changes

HOW IT IS DIAGNOSED
Enzyme activity testing and genetic testing

MAIN TREATMENT
Enzyme replacement, stem cell transplant, and supportive care

CAN IT BE CURED?
No, treatments cannot remove all effects

IS IT AN EMERGENCY?
Sometimes, with severe breathing trouble or sudden weakness

LONG-TERM OUTLOOK
Early treatment helps; severe forms may shorten life

Overview

Mucopolysaccharidosis type I, or MPS I, is a rare inherited condition. It affects the way the body breaks down large sugar molecules called glycosaminoglycans, previously known as mucopolysaccharides.

People with MPS I have too little of an enzyme called alpha-L-iduronidase. Enzymes are proteins that carry out chemical tasks in cells. Without enough of this enzyme, glycosaminoglycans collect inside cells and gradually affect tissues and organs.

MPS I exists on a spectrum. "Severe MPS I," historically called Hurler syndrome, usually begins early in childhood and may affect development and thinking. "Attenuated MPS I," previously divided into Hurler-Scheie and Scheie syndromes, often progresses more slowly. These labels do not predict every person's course.

The condition can affect the bones, joints, heart, lungs, airway, eyes, ears, liver, spleen, and nervous system. Early diagnosis matters because some treatments work best before permanent organ or brain changes have developed.

Symptoms

Symptoms differ in age of onset, combination, and severity. A baby with severe MPS I may appear healthy at birth, with changes becoming clearer during infancy or early childhood. Attenuated MPS I may not be recognized until later childhood or adulthood.

Possible physical features include:

Bone and joint changes are known as dysostosis multiplex . This means that several bones develop an unusual shape. These changes can cause pain, reduced mobility, spinal curvature, hip problems, or pressure on nerves.

Breathing symptoms may include noisy breathing, frequent airway infections, sleep apnea, enlarged tonsils or adenoids, and shortness of breath. Sleep apnea means breathing repeatedly pauses or becomes shallow during sleep.

Clouding of the cornea, the clear front surface of the eye, can reduce vision. Hearing loss is also common and may be caused by repeated middle-ear infections, nerve damage, or both.

Heart changes may involve thickened or narrowed valves. Some people develop reduced heart function or narrowing of the coronary arteries, which supply the heart muscle.

In severe MPS I, developmental progress may slow and previously learned skills may be lost. Attenuated MPS I often does not cause major intellectual disability, although hearing, vision, fatigue, pain, and repeated absences from school can still affect learning.

Carpal tunnel syndrome can occur even in children. It results from pressure on a nerve at the wrist and may cause numbness, hand weakness, disturbed sleep, or reduced hand use.

- Stiff joints, limited movement, or claw-shaped hands
- Abnormal spine, chest, hip, or leg development
- Short stature or slowed growth
- A larger-than-usual head and gradually coarser facial features
- An enlarged liver or spleen, causing a swollen abdomen
- Umbilical or groin hernias
- Thick hair and skin

Causes and risk factors

MPS I is caused by harmful changes in the IDUA gene. This gene provides instructions for making alpha-L-iduronidase.

The condition is inherited in an autosomal recessive pattern. This means a person usually has a harmful IDUA gene change from each biological parent. Parents who carry one changed copy usually do not have MPS I.

When both biological parents are carriers, each pregnancy has:

These chances start again with each pregnancy. They do not change based on the outcome of an earlier pregnancy.

Having a sibling or close biological relative with MPS I raises the chance of carrying an IDUA gene change. The condition is not caused by diet, parenting, infection, or anything done during pregnancy.

- A 1 in 4 chance of a child having MPS I
- A 1 in 2 chance of a child being an unaffected carrier
- A 1 in 4 chance of a child inheriting neither changed copy

Diagnosis

Diagnosis usually starts with symptoms, examination findings, or an abnormal newborn screening result. Newborn screening for MPS I is available in some regions, but it is not offered everywhere. A screening result is not a diagnosis.

Urine testing may show raised glycosaminoglycans. This can support the diagnosis, but urine testing alone may miss some people and does not confirm MPS I.

Confirmation generally requires a blood or cell test showing low alpha-L-iduronidase activity. Genetic testing is used to identify harmful changes in both copies of the IDUA gene. Genetic results can confirm the diagnosis, help test relatives, and sometimes provide information about likely severity. They cannot always predict the exact course.

Further assessments establish which parts of the body are affected. These may include heart ultrasound, breathing and sleep studies, hearing and eye tests, developmental assessment, and imaging of the spine, hips, or brain.

Doctors may also test for other lysosomal storage conditions. These inherited conditions can cause overlapping symptoms but involve different enzymes.

Treatment and management

Care is usually coordinated by a metabolic or genetics team working with heart, lung, ear, eye, bone, brain, rehabilitation, and anesthesia specialists.

Enzyme replacement therapy supplies a manufactured version of the missing enzyme. Laronidase is given into a vein at regular intervals. It can improve or stabilize some effects outside the brain, including breathing capacity, walking endurance, liver size, and glycosaminoglycan levels.

Laronidase does not enter the brain in useful amounts, so it does not prevent cognitive decline in severe MPS I. Infusion reactions can occur, ranging from fever or rash to uncommon serious allergic reactions. Treatment is therefore given in a setting where reactions can be managed.

Hematopoietic stem cell transplantation , also called a bone marrow or blood stem cell transplant, may be considered for young children with severe MPS I. Donor cells can produce the missing enzyme. When completed early, transplantation can help preserve thinking and development and improve survival.

Transplantation has important risks, including infection, organ injury, rejection, and graft-versus-host disease, in which donor immune cells attack the recipient's tissues. It also does not reverse every established bone, eye, heart, or joint change.

Supportive treatment is tailored to the organs affected. It may include:

Anesthesia requires special planning. A narrowed airway, limited neck movement, spinal instability, lung problems, and heart changes can increase risk. Procedures are safest when the anesthesia team knows about MPS I and has access to appropriate airway and intensive-care support.

- Hearing aids or treatment for middle-ear fluid
- Glasses, visual support, or selected eye procedures
- Breathing support for sleep apnea
- Physiotherapy, occupational therapy, and mobility equipment
- Treatment for pain and carpal tunnel syndrome
- Heart monitoring and treatment of valve or heart-muscle problems
- Surgery for hernias, spinal pressure, hip problems, or enlarged tonsils

Complications

Glycosaminoglycan buildup can continue to affect organs over time, even during treatment. Regular monitoring is needed because some complications develop before they cause obvious symptoms.

Possible complications include heart valve narrowing or leakage, reduced heart function, coronary artery narrowing, chronic breathing problems, and severe sleep apnea.

Pressure on the spinal cord or nerves may cause pain, weakness, changes in walking, reduced hand function, or loss of bladder or bowel control. Instability where the skull meets the upper spine can also place the spinal cord at risk.

Progressive hearing loss and corneal clouding may limit communication and independence. Skeletal and joint changes can cause chronic pain, fatigue, reduced mobility, and difficulty with everyday tasks.

In severe MPS I, ongoing brain involvement can lead to loss of developmental skills. Early transplantation may reduce this risk, but outcomes are not identical for every child.

Prevention

MPS I cannot be prevented through lifestyle changes because it is inherited.

Genetic counseling can help people with MPS I, carriers, and their biological relatives understand inheritance and testing choices. When the family's IDUA gene changes are known, options may include carrier testing, testing during pregnancy, or testing embryos created through in vitro fertilization.

Newborn screening does not prevent MPS I, but it can identify some affected babies before symptoms appear. Early diagnosis can allow treatment and specialist monitoring to begin sooner.

Living with it and what to expect

MPS I is lifelong. Treatments may slow progression and improve certain symptoms, but they do not remove all existing effects. The course is strongly influenced by severity, age at diagnosis, organ involvement, and how early effective treatment begins.

People with attenuated MPS I may attend mainstream school, work, form relationships, and live independently or with practical support. They may still need long-term care for joint stiffness, pain, fatigue, hearing loss, vision changes, breathing problems, or heart disease.

Severe MPS I generally progresses more quickly. Early stem cell transplantation has improved

outcomes, especially for survival and cognitive development, but bone and joint problems often continue. Some children need mobility, communication, learning, or personal-care support as they grow.

Follow-up commonly includes regular checks of the heart, breathing during sleep, hearing, vision, spine, joints, hand nerves, growth, and development. These are routine appointments rather than signs that an emergency is expected.

School or workplace adjustments can help with reduced stamina, limited hand movement, hearing or vision difficulties, and time away for treatment. Physiotherapy and occupational therapy may focus on safe movement, useful equipment, and maintaining everyday skills rather than forcing stiff joints.

Emotional support can also matter. Living with a rare inherited condition may affect siblings, parents, partners, and decisions about future pregnancies. Specialist metabolic services and patient organizations can help families connect with practical and peer support.

When to get medical help

Arrange a routine appointment if there are new or gradually worsening changes such as increased snoring, daytime sleepiness, reduced exercise tolerance, joint pain, hand numbness, hearing difficulty, vision changes, or loss of mobility. Developmental slowing or loss of a previously learned skill also needs prompt assessment.

Seek urgent medical care for:

Call emergency services for severe trouble breathing, blue or grey lips, inability to stay awake, collapse, or a serious allergic reaction with facial swelling or breathing difficulty.

After a stem cell transplant, fever or signs of infection may require immediate assessment. Follow the transplant team's specific emergency plan.

- New weakness, numbness, or difficulty walking
- New loss of bladder or bowel control
- Severe neck or back pain, especially after an injury
- Fainting, chest pain, or a sudden major drop in stamina
- An infusion reaction that continues after the infusion has stopped

Common questions

Is MPS I the same as Hurler syndrome?

Hurler syndrome is the older name for severe MPS I. Hurler-Scheie and Scheie syndrome were names for less severe forms. Specialists now often use "severe" and "attenuated" MPS I because the condition forms a continuous spectrum.

Can someone with MPS I have normal intelligence?

Yes. Many people with attenuated MPS I have typical intellectual development. Severe MPS I can affect the brain and cause developmental slowing or loss of skills. Hearing and vision problems can also make a person's abilities appear lower than they are.

Can enzyme replacement therapy cure MPS I?

No. Laronidase can improve or stabilize several physical effects, but it does not reach the brain well and does not correct every bone, joint, eye, or heart change. Ongoing treatment and monitoring are usually needed.

Does a stem cell transplant cure MPS I?

A transplant can greatly change the course of severe MPS I, particularly when performed early, but it is not a complete cure. Established skeletal, eye, and heart problems may remain or progress, and transplantation itself carries significant risks.

Can MPS I be passed to my children?

Yes. A person with MPS I passes one changed IDUA gene copy to every biological child. Whether a child develops MPS I also depends on the other biological parent's IDUA genes. Genetic testing and counseling can clarify the chance for a particular family.

Why does MPS I affect so many parts of the body?

The missing enzyme is normally used in cells throughout the body. When glycosaminoglycans are not broken down, they build up in many tissues. This is why one condition can affect the skeleton, heart, airway, eyes, ears, and nervous system.

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