Mucopolysaccharidosis type I

Mucopolysaccharidosis type I (MPS I) is a condition that affects many parts of the body. This disorder was once divided into three separate syndromes: Hurler syndrome (MPS I-H), Hurler-Scheie syndrome (MPS I-H/S), and Scheie syndrome (MPS I-S), listed from most to least severe. Because there is so much overlap between each of these three syndromes, MPS I is currently divided into the severe and attenuated types.

Children with MPS I often have no signs or symptoms of the condition at birth, although some have a soft out-pouching around the belly-button (umbilical hernia) or lower abdomen (inguinal hernia). People with severe MPS I generally begin to show other signs and symptoms of the disorder within the first year of life, while those with the attenuated form have milder features that develop later in childhood.

Individuals with MPS I may have a large head (macrocephaly), a buildup of fluid in the brain (hydrocephalus), heart valve abnormalities, distinctive-looking facial features that are described as "coarse," an enlarged liver and spleen (hepatosplenomegaly), and a large tongue (macroglossia). Vocal cords can also enlarge, resulting in a deep, hoarse voice. The airway may become narrow in some people with MPS I, causing frequent upper respiratory infections and short pauses in breathing during sleep (sleep apnea).

People with MPS I often develop clouding of the clear covering of the eye (cornea), which can cause significant vision loss. Affected individuals may also have hearing loss and recurrent ear infections.

Some individuals with MPS I have short stature and joint deformities (contractures) that affect mobility. Most people with the severe form of the disorder also have dysostosis multiplex, which refers to multiple skeletal abnormalities seen on x-ray. Carpal tunnel syndrome develops in many children with this disorder and is characterized by numbness, tingling, and weakness in the hand and fingers. Narrowing of the spinal canal (spinal stenosis) in the neck can compress and damage the spinal cord.

While both forms of MPS I can affect many different organs and tissues, people with severe MPS I experience a decline in intellectual function and a more rapid disease progression. Developmental delay is usually present by age 1, and severely affected individuals eventually lose basic functional skills (developmentally regress). Children with this form of the disorder usually have a shortened lifespan, sometimes living only into late childhood. Individuals with attenuated MPS I typically live into adulthood and may or may not have a shortened lifespan. Some people with the attenuated type have learning disabilities, while others have no intellectual impairments. Heart disease and airway obstruction are major causes of death in people with both types of MPS I.
Frequency
Severe MPS I occurs in approximately 1 in 100,000 newborns. Attenuated MPS I is less common and occurs in about 1 in 500,000 newborns.

Causes
Mutations in the \textit{IDUA} gene cause MPS I. The \textit{IDUA} gene provides instructions for producing an enzyme that is involved in the breakdown of large sugar molecules called glycosaminoglycans (GAGs). GAGs were originally called mucopolysaccharides, which is where this condition gets its name. Mutations in the \textit{IDUA} gene reduce or completely eliminate the function of the IDUA enzyme. The lack of IDUA enzyme activity leads to the accumulation of GAGs within cells, specifically inside the lysosomes. Lysosomes are compartments in the cell that digest and recycle different types of molecules. Conditions that cause molecules to build up inside the lysosomes, including MPS I, are called lysosomal storage disorders. The accumulation of GAGs increases the size of the lysosomes, which is why many tissues and organs are enlarged in this disorder. Researchers believe that the GAGs may also interfere with the functions of other proteins inside the lysosomes and disrupt the movement of molecules inside the cell.

Inheritance Pattern
This condition is inherited in an autosomal recessive pattern, which means both copies of the gene in each cell have mutations. The parents of an individual with an autosomal recessive condition each carry one copy of the mutated gene, but they typically do not show signs and symptoms of the condition.

Other Names for This Condition
- Hurler-Scheie syndrome
- Hurler syndrome
- IDUA deficiency
- MPS I
- MPS I H
- MPS I H-S
- MPS I S
- mucopolysaccharidosis I
- Scheie syndrome
Diagnosis & Management

Genetic Testing Information

- What is genetic testing?
  /primer/testing/genetictesting

- Genetic Testing Registry: Mucopolysaccharidosis type I

Research Studies from ClinicalTrials.gov

- ClinicalTrials.gov
  https://clinicaltrials.gov/ct2/results?cond=%22Mucopolysaccharidosis+type+I%22

Other Diagnosis and Management Resources

- Baby’s First Test
  https://www.babysfirsttest.org/newborn-screening/conditions/mucopolysaccharidosis-type-i

- GeneReview: Mucopolysaccharidosis Type I
  https://www.ncbi.nlm.nih.gov/books/NBK1162

- MedlinePlus Encyclopedia: Hurler Syndrome
  https://medlineplus.gov/ency/article/001204.htm

- MedlinePlus Encyclopedia: Mucopolysaccharides
  https://medlineplus.gov/ency/article/002263.htm

- MedlinePlus Encyclopedia: Scheie Syndrome
  https://medlineplus.gov/ency/article/001246.htm

- National MPS Society: Treatments
  https://mpssociety.org/learn/treatments/

Additional Information & Resources

Health Information from MedlinePlus

- Encyclopedia: Hurler Syndrome
  https://medlineplus.gov/ency/article/001204.htm

- Encyclopedia: Mucopolysaccharides
  https://medlineplus.gov/ency/article/002263.htm

- Encyclopedia: Scheie Syndrome
  https://medlineplus.gov/ency/article/001246.htm

- Health Topic: Carbohydrate Metabolism Disorders
  https://medlineplus.gov/carbohydratemetabolismdisorders.html

- Health Topic: Genetic Brain Disorders
  https://medlineplus.gov/geneticbraindisorders.html
Genetic and Rare Diseases Information Center

• Mucopolysaccharidosis type I
  https://rarediseases.info.nih.gov/diseases/10335/mucopolysaccharidosis-type-i

Additional NIH Resources

• National Institute of Neurological Disorders and Stroke: Mucopolysaccharidoses Fact Sheet
  https://www.ninds.nih.gov/Disorders/All-Disorders/Mucopolysaccharidoses-Information-Page

Educational Resources

• Emory University Lysosomal Storage Disease Center

• Lurie Children's Hospital of Chicago
  https://www.luriechildrens.org/en/specialties-conditions/mucopolysaccharidoses/

• Orphanet: Mucopolysaccharidosis type 1
  https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=579

Patient Support and Advocacy Resources

• Canadian MPS Society
  http://www.mpssociety.ca/

• Lysosomal Diseases New Zealand
  https://www.ldnz.org.nz/

• Medical Home Portal
  https://www.medicalhomeportal.org/diagnoses-and-conditions/mucopolysaccharidosis-type-i

• National MPS Society
  https://mpssociety.org/

• National Organization for Rare Disorders (NORD)
  https://rarediseases.org/rare-diseases/mucopolysaccharidosis-type-i/

• The MPS Society (UK)
  https://www.mpssociety.org.uk/mps-i-hurler

Clinical Information from GeneReviews

• Mucopolysaccharidosis Type I
  https://www.ncbi.nlm.nih.gov/books/NBK1162
Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28Mucopolysaccharidosis+I%5BMAJR%5D%29+AND+%28Mucopolysaccharidosis+type+I%5BTIAB%5D%29+AND+english%5BLang%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D

Catalog of Genes and Diseases from OMIM

- HURLER-SCHEIE SYNDROME
  http://omim.org/entry/607015
- HURLER SYNDROME
  http://omim.org/entry/607014
- SCHEIE SYNDROME
  http://omim.org/entry/607016

Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/22527994
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20301341
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/18201392
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/18796143
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2553763/
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/15126981
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17336562
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/12865757

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16188808

Reprinted from Genetics Home Reference:

Reviewed: December 2012
Published: March 31, 2020

Lister Hill National Center for Biomedical Communications
U.S. National Library of Medicine
National Institutes of Health
Department of Health & Human Services