Williams syndrome

Williams syndrome is a developmental disorder that affects many parts of the body. This condition is characterized by mild to moderate intellectual disability or learning problems, unique personality characteristics, distinctive facial features, and heart and blood vessel (cardiovascular) problems.

People with Williams syndrome typically have difficulty with visual-spatial tasks such as drawing and assembling puzzles, but they tend to do well on tasks that involve spoken language, music, and learning by repetition (rote memorization). Affected individuals have outgoing, engaging personalities and tend to take an extreme interest in other people. Attention deficit disorder (ADD), problems with anxiety, and phobias are common among people with this disorder.

Young children with Williams syndrome have distinctive facial features including a broad forehead, a short nose with a broad tip, full cheeks, and a wide mouth with full lips. Many affected people have dental problems such as teeth that are small, widely spaced, crooked, or missing. In older children and adults, the face appears longer and more gaunt.

A form of cardiovascular disease called supravalvular aortic stenosis (SVAS) occurs frequently in people with Williams syndrome. Supravalvular aortic stenosis is a narrowing of the large blood vessel that carries blood from the heart to the rest of the body (the aorta). If this condition is not treated, the aortic narrowing can lead to shortness of breath, chest pain, and heart failure. Other problems with the heart and blood vessels, including high blood pressure (hypertension), have also been reported in people with Williams syndrome.

Additional signs and symptoms of Williams syndrome include abnormalities of connective tissue (tissue that supports the body's joints and organs) such as joint problems and soft, loose skin. Affected people may also have increased calcium levels in the blood (hypercalcemia) in infancy, developmental delays, problems with coordination, and short stature. Medical problems involving the eyes and vision, the digestive tract, and the urinary system are also possible.

Frequency

Williams syndrome affects an estimated 1 in 7,500 to 10,000 people.

Causes

Williams syndrome is caused by the deletion of genetic material from a specific region of chromosome 7. The deleted region includes 26 to 28 genes, and researchers believe
that a loss of several of these genes probably contributes to the characteristic features of this disorder.

*CLIP2, ELN, GTF2I, GTF2IRD1,* and *LIMK1* are among the genes that are typically deleted in people with Williams syndrome. Researchers have found that loss of the *ELN* gene is associated with the connective tissue abnormalities and cardiovascular disease (specifically supravalvular aortic stenosis) found in many people with this disease. Studies suggest that deletion of *CLIP2, GTF2I, GTF2IRD1, LIMK1,* and perhaps other genes may help explain the characteristic difficulties with visual-spatial tasks, unique behavioral characteristics, and other cognitive difficulties seen in people with Williams syndrome. Loss of the *GTF2IRD1* gene may also contribute to the distinctive facial features often associated with this condition.

Researchers believe that the presence or absence of the *NCF1* gene on chromosome 7 is related to the risk of developing hypertension in people with Williams syndrome. When the *NCF1* gene is included in the part of the chromosome that is deleted, affected individuals are less likely to develop hypertension. Therefore, the loss of this gene appears to be a protective factor. People with Williams syndrome whose *NCF1* gene is not deleted have a higher risk of developing hypertension.

The relationship between other genes in the deleted region of chromosome 7 and the signs and symptoms of Williams syndrome is under investigation or unknown.

**Inheritance Pattern**

Most cases of Williams syndrome are not inherited but occur as random events during the formation of reproductive cells (eggs or sperm) in a parent of an affected individual. These cases occur in people with no history of the disorder in their family.

Williams syndrome is considered an autosomal dominant condition because one copy of the altered chromosome 7 in each cell is sufficient to cause the disorder. In a small percentage of cases, people with Williams syndrome inherit the chromosomal deletion from a parent with the condition.

**Other Names for This Condition**

- Beuren syndrome
- elfin facies syndrome
- elfin facies with hypercalcemia
- hypercalcemia-supravalvar aortic stenosis
- infantile hypercalcemia
- supravalvar aortic stenosis syndrome
- WBS
- Williams-Beuren syndrome
• WMS
• WS

Diagnosis & Management

Genetic Testing Information
• What is genetic testing?
  /primer/testing/genetictesting
• Genetic Testing Registry: Williams syndrome

Research Studies from ClinicalTrials.gov
• ClinicalTrials.gov
  https://clinicaltrials.gov/ct2/results?cond=%22williams+syndrome%22

Other Diagnosis and Management Resources
• GeneReview: Williams Syndrome
  https://www.ncbi.nlm.nih.gov/books/NBK1249
• MedlinePlus Encyclopedia: Williams Syndrome
  https://medlineplus.gov/ency/article/001116.htm

Additional Information & Resources

Health Information from MedlinePlus
• Encyclopedia: Williams Syndrome
  https://medlineplus.gov/ency/article/001116.htm
• Health Topic: Developmental Disabilities
  https://medlineplus.gov/developmentaldisabilities.html
• Health Topic: Heart Diseases
  https://medlineplus.gov/heartdiseases.html
• Health Topic: Neurologic Diseases
  https://medlineplus.gov/neurologicdiseases.html

Genetic and Rare Diseases Information Center
• Supravalvular aortic stenosis
• Williams syndrome
Additional NIH Resources

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

Educational Resources

• Genetic Science Learning Center, University of Utah
  https://learn.genetics.utah.edu/content/disorders/rearrangements/

• MalaCards: williams-beuren syndrome
  https://www.malacards.org/card/williams_beuren_syndrome

• Orphanet: Williams syndrome
  https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=904

• University of Michigan Health System
  http://www.med.umich.edu/yourchild/topics/williams.htm

Patient Support and Advocacy Resources

• Chromosome Disorder Outreach
  https://chromodisorder.org/

• National Organization for Rare Disorders (NORD)
  https://rarediseases.org/rare-diseases/williams-syndrome/

• Resource list from the University of Kansas Medical Center
  http://www.kumc.edu/gec/support/williams.html

• Williams Syndrome Association
  https://williams-syndrome.org/

Clinical Information from GeneReviews

• Williams Syndrome
  https://www.ncbi.nlm.nih.gov/books/NBK1249

Scientific Articles on PubMed

• PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28Williams+Syndrome%5BMAJR%5D%29+AND+%28Williams+syndrome%5BTIAB%5D%29+AND+english%5BLa%5D+AND+human%5Bmh%5D+AND+%22last+720+days%22%5Bdp%5D

Catalog of Genes and Diseases from OMIM

• WILLIAMS-BEUREN SYNDROME
  http://omim.org/entry/194050
Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16272111

- Carrasco X, Castillo S, Aravena T, Rothhammer P, Aboitiz F. Williams syndrome: pediatric, 
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/15730896

- Del Campo M, Antonell A, Magano LF, Muñoz FJ, Flores R, Bayés M, Pérez Jurado LA. 
  Hemizygosity at the NCF1 gene in patients with Williams-Beuren syndrome decreases their risk of 
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16532385 
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1424678/

- Eckert MA, Galaburda AM, Mills DL, Bellugi U, Korenberg JR, Reiss AL. The neurobiology of 
  63(16):1687-75. Review. 
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16810457

- Mervis CB, Becerra AM. Language and communicative development in Williams syndrome. Ment 
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17326109

- Meyer-Lindenberg A, Hariri AR, Munoz KE, Mervis CB, Mattay VS, Morris CA, Berman KF. Neural 
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16007084

- Meyer-Lindenberg A, Mervis CB, Berman KF. Neural mechanisms in Williams syndrome: a unique 
  Review. 
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16760918

  Ardinger HH, Wallace SE, Amemiya A, Bean LJH, Bird TD, Ledbetter N, Mefford HC, Smith RJH, 
  Stephens K, editors. GeneReviews® [Internet]. Seattle (WA): University of Washington, Seattle; 
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20301427

- Pober BR, Morris CA. Diagnosis and management of medical problems in adults with Williams- 
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17639596

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/20089974

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/19039520

- Tassabehji M, Hammond P, Karmiloff-Smith A, Thompson P, Thorgeirsson SS, Durkin ME, 
  Popescu NC, Hutton T, Metcalfe K, Rucka A, Stewart H, Read AP, Maconochie M, Donnai D. 
  GTF2IRD1 in craniofacial development of humans and mice. Science. 2005 Nov 18;310(5751): 
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/16293761