Choroideremia

Choroideremia is a condition characterized by progressive vision loss that mainly affects males. The first symptom of this condition is usually an impairment of night vision (night blindness), which can occur in early childhood. A progressive narrowing of the field of vision (tunnel vision) follows, as well as a decrease in the ability to see details (visual acuity). These vision problems are due to an ongoing loss of cells (atrophy) in the specialized light-sensitive tissue that lines the back of the eye (retina) and a nearby network of blood vessels (the choroid). The vision impairment in choroideremia worsens over time, but the progression varies among affected individuals. However, all individuals with this condition will develop blindness, most commonly in late adulthood.

Frequency

The prevalence of choroideremia is estimated to be 1 in 50,000 to 100,000 people. However, it is likely that this condition is underdiagnosed because of its similarities to other eye disorders. Choroideremia is thought to account for approximately 4 percent of all blindness.

Causes

Mutations in the CHM gene cause choroideremia. The CHM gene provides instructions for producing the Rab escort protein-1 (REP-1). As an escort protein, REP-1 attaches to molecules called Rab proteins within the cell and directs them to the membranes of various cell compartments (organelles). Rab proteins are involved in the movement of proteins and organelles within cells (intracellular trafficking). Mutations in the CHM gene lead to an absence of REP-1 protein or the production of a REP-1 protein that cannot carry out its protein escort function. This lack of functional REP-1 prevents Rab proteins from reaching and attaching (binding) to the organelle membranes. Without the aid of Rab proteins in intracellular trafficking, cells die prematurely.

The REP-1 protein is active (expressed) throughout the body, as is a similar protein, REP-2. Research suggests that when REP-1 is absent or nonfunctional, REP-2 can perform the protein escort duties of REP-1 in many of the body’s tissues. Very little REP-2 protein is present in the retina, however, so it cannot compensate for the loss of REP-1 in this tissue. Loss of REP-1 function and subsequent misplacement of Rab proteins within the cells of the retina causes the progressive vision loss characteristic of choroideremia.
Inheritance Pattern

Choroideremia is inherited in an X-linked recessive pattern. The \textit{CHM} gene is located on the X chromosome, which is one of the two sex chromosomes. In males (who have only one X chromosome), one altered copy of the gene in each cell is sufficient to cause the condition. In females (who have two X chromosomes), a mutation must be present in both copies of the gene to cause the disorder. Males are affected by X-linked recessive disorders much more frequently than females. A characteristic of X-linked inheritance is that fathers cannot pass X-linked traits to their sons.

In X-linked recessive inheritance, a female with one mutated copy of the gene in each cell is called a carrier. She can pass on the altered gene, but usually does not experience signs and symptoms of the disorder. Females who carry a \textit{CHM} mutation may show small areas of cell loss within the retina that can be observed during a thorough eye examination. These changes can impair vision later in life.

Other Names for This Condition

• choroidal sclerosis
• progressive tapetochoroidal dystrophy
• TCD

Diagnosis & Management

Genetic Testing Information

• What is genetic testing? /primer/testing/genetictesting
• Genetic Testing Registry: Choroideremia

Research Studies from ClinicalTrials.gov

• ClinicalTrials.gov
  https://clinicaltrials.gov/ct2/results?cond=%22Choroideremia%22+OR+%22choroideremia%22

Other Diagnosis and Management Resources

• GeneReview: Choroideremia
  https://www.ncbi.nlm.nih.gov/books/NBK1337
• MedlinePlus Encyclopedia: Vision - night blindness
  https://medlineplus.gov/ency/article/003039.htm
• MedlinePlus Encyclopedia: Visual field
  https://medlineplus.gov/ency/article/003879.htm
Additional Information & Resources

Health Information from MedlinePlus

- Encyclopedia: Vision - night blindness
  https://medlineplus.gov/ency/article/003039.htm
- Encyclopedia: Visual field
  https://medlineplus.gov/ency/article/003879.htm
- Health Topic: Eye Diseases
  https://medlineplus.gov/eyediseases.html
- Health Topic: Retinal Disorders
  https://medlineplus.gov/retinaldisorders.html
- Health Topic: Vision Impairment and Blindness
  https://medlineplus.gov/visionimpairmentandblindness.html

Genetic and Rare Diseases Information Center

- Choroideremia
  https://rarediseases.info.nih.gov/diseases/6061/choroideremia

Additional NIH Resources

- National Eye Institute: Diagram of the Eye
  https://nei.nih.gov/health/eyediagram/

Educational Resources

- MalaCards: choroideremia
  https://www.malacards.org/card/choroideremia
- Orphanet: Choroideremia
  https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=180
- The Choroideremia Research Foundation: What is Choroideremia?
  https://www.curechm.org/what-is-choroideremia

Patient Support and Advocacy Resources

- Foundation Fighting Blindness
  https://www.fightingblindness.org/diseases/choroideremia
- National Organization for Rare Disorders (NORD)
  https://rarediseases.org/rare-diseases/choroideremia/
- The Choroideremia Research Foundation
  https://www.curechm.org/
Clinical Information from GeneReviews

• Choroideremia
  https://www.ncbi.nlm.nih.gov/books/NBK1337

Scientific Articles on PubMed

• PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28choroideremia%5BTIAB%5D%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+1800+days%22%5Bdp%5D

Catalog of Genes and Diseases from OMIM

• CHOROIDEREMIA
  http://omim.org/entry/303100

Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/18385043

• McTaggart KE, Tran M, Mah DY, Lai SW, Nesslinger NJ, MacDonald IM. Mutational analysis of patients with the diagnosis of choroideremia. Hum Mutat. 2002 Sep;20(3):189-96.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/12203991

  Citation on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1771148/

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/17333094

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/18087237

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/12827496

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