Intranuclear rod myopathy

Intranuclear rod myopathy is a disorder that primarily affects skeletal muscles, which are muscles that the body uses for movement. People with intranuclear rod myopathy have severe muscle weakness (myopathy) and poor muscle tone (hypotonia) throughout the body. Signs and symptoms of this condition are apparent in infancy and include feeding and swallowing difficulties, a weak cry, and difficulty with controlling head movements. Affected babies are sometimes described as "floppy" and may be unable to move on their own.

The severe muscle weakness that occurs in intranuclear rod myopathy also affects the muscles used for breathing. Individuals with this disorder may take shallow breaths (hypoventilate), especially during sleep, resulting in a shortage of oxygen and a buildup of carbon dioxide in the blood. Frequent respiratory infections and life-threatening breathing difficulties can occur. Because of the respiratory problems, most affected individuals do not survive past infancy. Those who do survive have delayed development of motor skills such as sitting, crawling, standing, and walking.

The name intranuclear rod myopathy comes from characteristic abnormal rod-shaped structures that can be seen in the nucleus of muscle cells when muscle tissue is viewed under a microscope.

Frequency

Intranuclear rod myopathy is a rare disorder that has been identified in only a small number of individuals. Its exact prevalence is unknown.

Causes

Intranuclear rod myopathy is caused by a mutation in the \textit{ACTA1} gene. This gene provides instructions for making a protein called skeletal alpha (\(\alpha\))-actin, which is part of the actin protein family. Actin proteins are important for cell movement and the tensing of muscle fibers (muscle contraction). Thin filaments made up of actin molecules and thick filaments made up of another protein called myosin are the primary components of muscle fibers and are important for muscle contraction. Attachment (binding) and release of the overlapping thick and thin filaments allows them to move relative to each other so that the muscles can contract.

\textit{ACTA1} gene mutations that cause intranuclear rod myopathy result in the accumulation of rods of skeletal \(\alpha\)-actin in the nucleus of muscle cells. Normally, most actin is found in the fluid surrounding the nucleus (the cytoplasm), with small amounts in the nucleus itself. Researchers suggest that the \textit{ACTA1} gene mutations that cause intranuclear rod myopathy may interfere with the normal transport of actin between the nucleus and
the cytoplasm, resulting in the accumulation of actin in the nucleus and the formation of intranuclear rods. Abnormal accumulation of actin in the nucleus of muscle cells and a corresponding reduction of available actin in muscle fibers may impair muscle contraction and lead to the muscle weakness seen in intranuclear rod myopathy.

In some people with intranuclear rod myopathy, no ACTA1 gene mutations have been identified. The cause of the disorder in these individuals is unknown.

Inheritance Pattern

Intranuclear rod myopathy is an autosomal dominant condition, which means one copy of the altered gene in each cell is sufficient to cause the disorder. Most cases are not inherited; they result from new mutations in the gene and occur in people with no history of the disorder in their family.

Other Names for This Condition

- intranuclear nemaline rod myopathy
- nemaline myopathy with exclusively intranuclear rods

Diagnosis & Management

Genetic Testing Information

- What is genetic testing?
  /primer/testing/genetictesting
- Genetic Testing Registry: Nemaline myopathy 3

Research Studies from ClinicalTrials.gov

- ClinicalTrials.gov
  https://clinicaltrials.gov/ct2/results?cond=%22intranuclear+rod+myopathy%22+OR+%22Myopathies%22+Structural%22+Congenital

Additional Information & Resources

Health Information from MedlinePlus

- Health Topic: Muscle Disorders
  https://medlineplus.gov/muscledisorders.html

Additional NIH Resources

- National Institute of Neurological Disorders and Stroke: Congenital Myopathy Information Page
  https://www.ninds.nih.gov/Disorders/All-Disorders/Congenital-Myopathy-Information-Page
Educational Resources

- MalaCards: intranuclear rod myopathy
  https://www.malacards.org/card/intranuclear_rod_myopathy
- Washington University in St. Louis Neuromuscular Disease Center
  https://neuromuscular.wustl.edu/syncm.html#inrod

Patient Support and Advocacy Resources

- Muscular Dystrophy Association
  https://www.mda.org/
- Muscular Dystrophy Canada
  http://muscle.ca/
- Muscular Dystrophy UK
  https://www.musculardystrophyuk.org/

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28intranuclear+rod+myopathy+%5BTIAB%5D%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D

Catalog of Genes and Diseases from OMIM

- NEMALINE MYOPATHY 3
  http://omim.org/entry/161800

Medical Genetics Database from MedGen

- Intranuclear Rod Myopathy

Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/19562689
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  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/18574571

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/12921789

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/12775505

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