Congenital insensitivity to pain with anhidrosis

Congenital insensitivity to pain with anhidrosis (CIPA) has two characteristic features: the inability to feel pain and temperature, and decreased or absent sweating (anhidrosis). This condition is also known as hereditary sensory and autonomic neuropathy type IV. The signs and symptoms of CIPA appear early, usually at birth or during infancy, but with careful medical attention, affected individuals can live into adulthood.

An inability to feel pain and temperature often leads to repeated severe injuries. Unintentional self-injury is common in people with CIPA, typically by biting the tongue, lips, or fingers, which may lead to spontaneous amputation of the affected area. In addition, people with CIPA heal slowly from skin and bone injuries. Repeated trauma can lead to chronic bone infections (osteomyelitis) or a condition called Charcot joints, in which the bones and tissue surrounding joints are destroyed.

Normally, sweating helps cool the body temperature. However, in people with CIPA, anhidrosis often causes recurrent, extremely high fevers (hyperpyrexia) and seizures brought on by high temperature (febrile seizures).

In addition to the characteristic features, there are other signs and symptoms of CIPA. Many affected individuals have thick, leathery skin (lichenification) on the palms of their hands or misshapen fingernails or toenails. They can also have patches on their scalp where hair does not grow (hypotrichosis). About half of people with CIPA show signs of hyperactivity or emotional instability, and many affected individuals have intellectual disability. Some people with CIPA have weak muscle tone (hypotonia) when they are young, but muscle strength and tone become more normal as they get older.

Frequency

CIPA is a rare condition; however, the prevalence is unknown.

Causes

Mutations in the NTRK1 gene cause CIPA. The NTRK1 gene provides instructions for making a receptor protein that attaches (binds) to another protein called NGFβ. The NTRK1 receptor is important for the survival of nerve cells (neurons).

The NTRK1 receptor is found on the surface of cells, particularly neurons that transmit pain, temperature, and touch sensations (sensory neurons). When the NGFβ protein binds to the NTRK1 receptor, signals are transmitted inside the cell that tell the cell to grow and divide, and that help it survive. Mutations in the NTRK1 gene lead to a protein that cannot transmit signals. Without the proper signaling, neurons die by a process of self-destruction called apoptosis. Loss of sensory neurons leads to the inability to feel
pain in people with CIPA. In addition, people with CIPA lose the nerves leading to their sweat glands, which causes the anhidrosis seen in affected individuals.

**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**

- CIPA
- hereditary insensitivity to pain with anhidrosis
- hereditary sensory and autonomic neuropathy type IV
- hereditary sensory and autonomic neuropathy, type 4
- HSAN type IV
- HSAN4

**Diagnosis & Management**

**Genetic Testing Information**

- What is genetic testing?
  /primer/testing/genetictesting
- Genetic Testing Registry: Hereditary insensitivity to pain with anhidrosis

**Research Studies from ClinicalTrials.gov**

- ClinicalTrials.gov
  https://clinicaltrials.gov/ct2/results?cond=%22congenital+insensitivity+to+pain+with+anhidrosis%22+OR+%22Hereditary+Sensory+Autonomic+Neuropathy%2C+Type+IV%22+OR+%22Type+IV%2C+HSAN%22

**Other Diagnosis and Management Resources**

- GeneReview: NTRK1 Congenital Insensitivity to Pain with Anhidrosis
  https://www.ncbi.nlm.nih.gov/books/NBK1769
Additional Information & Resources

Health Information from MedlinePlus

• Encyclopedia: Osteomyelitis
  https://medlineplus.gov/ency/article/000437.htm

• Encyclopedia: Sweating - absent
  https://medlineplus.gov/ency/article/003219.htm

• Health Topic: Degenerative Nerve Diseases
  https://medlineplus.gov/degenerativenervedisorders.html

• Health Topic: Peripheral Nerve Disorders
  https://medlineplus.gov/peripheralnervedisorders.html

Genetic and Rare Diseases Information Center

• Congenital insensitivity to pain with anhidrosis

Additional NIH Resources

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

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

• National Institutes of Health Rare Diseases Clinical Research Network: The Inherited Neuropathies Consortium
  https://www.rarediseasesnetwork.org/cms/inc/Healthcare-Professionals/CMT

Educational Resources

• MalaCards: insensitivity to pain, congenital, with anhidrosis
  https://www.malacards.org/card/insensitivity_to_pain_congenital_with_anhidrosis

• Orphanet: Hereditary sensory and autonomic neuropathy type 4
  https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=642

• University of Chicago Center for Peripheral Neuropathy
  http://peripheralneuropathycenter.uchicago.edu/
Patient Support and Advocacy Resources

• National Organization for Rare Disorders (NORD): Hereditary Sensory and Autonomic Neuropathy, Type IV

• The Foundation for Peripheral Neuropathy
  https://www.foundationforpn.org/

Clinical Information from GeneReviews

• NTRK1 Congenital Insensitivity to Pain with Anhidrosis
  https://www.ncbi.nlm.nih.gov/books/NBK1769

Scientific Articles on PubMed

• PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28Hereditary+Sensory+and+Autonomic+Neuropathies%5BMMAJ%5D%29+AND+%28%28congenital+insensitivity+to+pain+with+anhidrosis%5BTIAB%5D%29+OR+%28hsan+type+iv%5BTIAB%5D%29+OR+%28hereditary+sensory+autonomic+neuropathy+type+iv%5BTIAB%5D%29+OR+%28hsan4%5BTIAB%5D%29+OR+%28cipa%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

• INSENSITIVITY TO PAIN, CONGENITAL, WITH ANHIDROSIS
  http://omim.org/entry/256800

Sources for This Summary

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/8696348

• Indo Y. Molecular basis of congenital insensitivity to pain with anhidrosis (CIPA): mutations and polymorphisms in TRKA (NTRK1) gene encoding the receptor tyrosine kinase for nerve growth factor. Hum Mutat. 2001 Dec;18(6):462-71. Review.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/11748840

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/10851172

  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/11719521
_Citation on PubMed:_ https://www.ncbi.nlm.nih.gov/pubmed/16969157

_Citation on PubMed:_ https://www.ncbi.nlm.nih.gov/pubmed/16183296

Reprinted from Genetics Home Reference:

Reviewed: May 2011
Published: August 17, 2020

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