Omenn syndrome

Omenn syndrome is an inherited disorder of the immune system (immunodeficiency). Omenn syndrome is one of several forms of severe combined immunodeficiency (SCID), a group of disorders that cause individuals to have virtually no immune protection from bacteria, viruses, and fungi. Individuals with SCID are prone to repeated and persistent infections that can be very serious or life-threatening. Infants with Omenn syndrome typically experience pneumonia and chronic diarrhea. Often the organisms that cause infection in people with this disorder are described as opportunistic because they ordinarily do not cause illness in healthy people.

In addition to immunodeficiency, children with Omenn syndrome develop autoimmunity, in which the immune system attacks the body's own tissues and organs. This abnormal immune reaction can cause very red skin (erythroderma), hair loss (alopecia), and an enlarged liver and spleen (hepatosplenomegaly). In addition, affected individuals have enlargement of tissues that produce infection-fighting white blood cells called lymphocytes. These include the thymus, which is a gland located behind the breastbone, and lymph nodes, which are found throughout the body.

If not treated in a way that restores immune function, children with Omenn syndrome usually survive only until age 1 or 2.

Frequency

Overall, the various forms of SCID are estimated to affect 1 in 75,000 to 100,000 newborns. The exact prevalence of Omenn syndrome is unknown.

Genetic Changes

Mutations in several genes involved in immune system function can cause Omenn syndrome. The two most frequent causes are mutations in the *RAG1* and *RAG2* genes. These genes provide instructions for making proteins that are active in two types of lymphocytes called B cells and T cells. To help fight infections, B cells and T cells have special proteins on their surface that help them recognize foreign invaders; these proteins must be somewhat different from each other to be able to recognize a wide variety of substances. The RAG1 and RAG2 proteins help increase the diversity of proteins that are on the surface of these cells.

RAG1 and *RAG2* gene mutations that cause Omenn syndrome drastically reduce the respective protein's function. As a result, the diversity of proteins on the surface of B cells and T cells is severely limited, impairing the cells' ability to recognize foreign invaders and fight infections. The abnormal B cells and T cells result in the frequent, life-threatening infections of Omenn syndrome. The decrease in lymphocyte function

leads to a reduction in the numbers of B cells. The number of T cells is typically normal, although they are highly similar because they are derived from just a few functional precursor cells. The abnormal T cells attack the body's own cells and tissues, accounting for the autoimmune features of Omenn syndrome.

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

- familial reticuloendotheliosis
- histiocytic medullary reticulosis
- Omenn's syndrome

Diagnosis & Management

Formal Diagnostic Criteria

- Al-Herz W, Bousfiha A, Casanova JL, Chatila T, Conley ME, Cunningham-Rundles C, Etzioni A, Franco JL, Gaspar HB, Holland SM, Klein C, Nonoyama S, Ochs HD, Oksenhendler E, Picard C, Puck JM, Sullivan K, Tang ML. Primary immunodeficiency diseases: an update on the classification from the international union of immunological societies expert committee for primary immunodeficiency. Front Immunol. 2014 Apr 22;5:162. doi: 10.3389/fimmu.2014.00162. Erratum in: Front Immunol. 2014;5:460.
  Citation on PubMed: https://www.ncbi.nlm.nih.gov/pubmed/24795713
  Free article on PubMed Central: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4001072/

Genetic Testing

- Genetic Testing Registry: Histiocytic medullary reticulosis
  https://www.ncbi.nlm.nih.gov/gtr/conditions/C1801959/

Other Diagnosis and Management Resources

- MedlinePlus Encyclopedia: B and T Cell Screen
  https://medlineplus.gov/ency/article/003329.htm
- MedlinePlus Encyclopedia: Immunodeficiency Disorders
  https://medlineplus.gov/ency/article/000818.htm
- Rare Diseases Clinical Research Network: Primary Immune Deficiency Treatment Consortium
  https://www.rarediseasesnetwork.org/cms/pidtc/Learn-More/Disorder-Definitions#SCID

General Information from MedlinePlus

- Diagnostic Tests
  https://medlineplus.gov/diagnostictests.html
- Drug Therapy
  https://medlineplus.gov/drugtherapy.html
- Genetic Counseling
  https://medlineplus.gov/geneticcounseling.html
- Palliative Care
  https://medlineplus.gov/palliativecare.html
- Surgery and Rehabilitation
  https://medlineplus.gov/surgeryandrehabilitation.html

Additional Information & Resources

MedlinePlus

- Encyclopedia: Agammaglobulinemia
  https://medlineplus.gov/ency/article/001307.htm
- Encyclopedia: B and T Cell Screen
  https://medlineplus.gov/ency/article/003329.htm
- Encyclopedia: Immune Response
  https://medlineplus.gov/ency/article/000821.htm
- Encyclopedia: Immunodeficiency Disorders
  https://medlineplus.gov/ency/article/000818.htm
- Health Topic: Immune System and Disorders
  https://medlineplus.gov/immunesystemanddisorders.html

Genetic and Rare Diseases Information Center

- Omenn syndrome
  https://rarediseases.info.nih.gov/diseases/8198/omenn-syndrome

Additional NIH Resources

- National Institute of Allergy and Infectious Diseases: Primary Immune Deficiency Diseases
  https://www.niaid.nih.gov/diseases-conditions/primary-immune-deficiency-diseases-pidds

Educational Resources

- Boston Children's Hospital: Severe Combined Immunodeficiency (SCID) in Children
  http://www.childrenshospital.org/conditions-and-treatments/conditions/s/severe-combined-immunodeficiency-scid/
- Disease InfoSearch: Omenn syndrome
  http://www.diseaseinfosearch.org/Omenn+syndrome/5354
- Great Ormond Street Hospital for Children (UK): Severe Combined Immunodeficiency
  http://www.gosh.nhs.uk/medical-information-0/search-medical-conditions/severe-combined-immunodeficiency-scid
- Johns Hopkins Medicine: Disorders of the Immune System
  http://www.hopkinsmedicine.org/healthlibrary/conditions/adult/arthritis_and_other_rheumatic_diseases/disorders_of_the_immune_system_134,123/
- KidsHealth from Nemours: Severe Combined Immunodeficiency
  http://kidshealth.org/en/parents/severe-immunodeficiency.html
- MalaCards: omenn syndrome
  http://www.malacards.org/card/omenn_syndrome
- Merck Manual Consumer Version: Severe Combined Immunodeficiency
  http://www.merckmanuals.com/home/immune-disorders/immunodeficiency-disorders/severe-combined-immunodeficiency-scid
- Orphanet: Omenn syndrome
  http://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=39041
- Seattle Children's Hospital: Severe Combined Immunodeficiency
  http://www.seattlechildrens.org/kids-health/parents/diseases-and-conditions/allergies-and-the-immune-system/severe-combined-immunodeficiency/

Patient Support and Advocacy Resources

- Immune Deficiency Foundation
  http://primaryimmune.org/
- National Organization for Rare Disorders (NORD): Severe Combined Immunodeficiency
  https://rarediseases.org/rare-diseases/severe-combined-immunodeficiency/
- Rare Diseases Clinical Research Network: Primary Immune Deficiency Treatment Consortium
  https://www.rarediseasesnetwork.org/cms/pidtc/Learn-More/Disorder-Definitions#SCID

ClinicalTrials.gov

- ClinicalTrials.gov
  https://clinicaltrials.gov/ct2/results?cond=%22Omenn+syndrome%22+OR+%22Severe+Combined+Immunodeficiency%22

Scientific Articles on PubMed

- PubMed
  https://www.ncbi.nlm.nih.gov/pubmed?term=%28Severe+Combined+Immunodeficiency%5BMAJR%5D%29+AND+%28Omenn+syndrome%5BTIAB%5D%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+3600+days%22%5Bdp%5D

OMIM

- OMENN SYNDROME
  http://omim.org/entry/603554

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