



Pulmonary arterial hypertension

Pulmonary arterial hypertension is a progressive disorder characterized by abnormally high blood pressure (hypertension) in the pulmonary artery, the blood vessel that carries blood from the heart to the lungs. Pulmonary arterial hypertension is one form of a broader condition known as pulmonary hypertension. Pulmonary hypertension occurs when most of the very small arteries throughout the lungs narrow in diameter, which increases the resistance to blood flow through the lungs. To overcome the increased resistance, blood pressure increases in the pulmonary artery and in the right ventricle of the heart, which is the chamber that pumps blood into the pulmonary artery. Ultimately, the increased blood pressure can damage the right ventricle of the heart.

Signs and symptoms of pulmonary arterial hypertension occur when increased blood pressure cannot fully overcome the elevated resistance. As a result, the flow of oxygenated blood from the lungs to the rest of the body is insufficient. Shortness of breath (dyspnea) during exertion and fainting spells are the most common symptoms of pulmonary arterial hypertension. People with this disorder may experience additional symptoms, particularly as the condition worsens. Other symptoms include dizziness, swelling (edema) of the ankles or legs, chest pain, and a rapid heart rate.

Frequency

In the United States, about 1,000 new cases of pulmonary arterial hypertension are diagnosed each year. This disorder is twice as common in females as in males.

Causes

Mutations in the *BMPR2* gene are the most common genetic cause of pulmonary arterial hypertension. This gene plays a role in regulating the number of cells in certain tissues. Researchers suggest that a mutation in this gene promotes cell division or prevents cell death, resulting in an overgrowth of cells in small arteries throughout the lungs. As a result, these arteries narrow in diameter, which increases the resistance to blood flow. Blood pressure in the pulmonary artery and the right ventricle of the heart increases to overcome the increased resistance to blood flow.

Mutations in several additional genes have also been found to cause pulmonary arterial hypertension, but they are much less common causes of the disorder than are *BMPR2* gene mutations. Variations in other genes may increase the risk of developing pulmonary arterial hypertension or modify the course of the disease (usually making it more severe). Changes in as-yet-unidentified genes may also be associated with this condition.

Although pulmonary arterial hypertension often occurs on its own, it can also be part of syndromes that affect many parts of the body. For example, this condition is

occasionally found in people with systemic scleroderma, systemic lupus erythematosus, critical congenital heart disease, or Down syndrome.

Researchers have also identified nongenetic factors that increase the risk of developing pulmonary arterial hypertension. These include certain drugs used as appetite suppressants and several illegal drugs, such as cocaine and methamphetamine. Pulmonary arterial hypertension is also a rare complication of certain infectious diseases, including HIV and schistosomiasis.

Inheritance Pattern

Pulmonary arterial hypertension is usually sporadic, which means it occurs in individuals with no known family history of the disorder. These non-familial cases are described as idiopathic pulmonary arterial hypertension. About 20 percent of these cases are caused by mutations in one of the genes known to be associated with the disease, but most of the time a causative gene mutation has not been identified.

Inherited cases of this disorder are known as familial pulmonary arterial hypertension. When the condition is inherited, it most often has an autosomal dominant pattern of inheritance, which means one copy of an altered gene in each cell is sufficient to cause the disorder. However, many people with an altered gene never develop pulmonary arterial hypertension; this phenomenon is called reduced penetrance.

Other Names for This Condition

- Ayerza syndrome
- familial primary pulmonary hypertension
- FPPH
- idiopathic pulmonary hypertension
- PAH
- PPH
- PPHT
- primary pulmonary hypertension
- sporadic primary pulmonary hypertension

Diagnosis & Management

Genetic Testing Information

- What is genetic testing?
[/primer/testing/genetictesting](#)
- Genetic Testing Registry: Idiopathic and/or familial pulmonary arterial hypertension
<https://www.ncbi.nlm.nih.gov/gtr/conditions/CN924911/>

- Genetic Testing Registry: Primary pulmonary hypertension
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C4552070/>
- Genetic Testing Registry: Primary pulmonary hypertension 2
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C3888002/>
- Genetic Testing Registry: Primary pulmonary hypertension 3
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C3809192/>
- Genetic Testing Registry: Primary pulmonary hypertension 4
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C3809198/>

Research Studies from ClinicalTrials.gov

- ClinicalTrials.gov
<https://clinicaltrials.gov/ct2/results?cond=%22pulmonary+arterial+hypertension%22+OR+%22primary+pulmonary+hypertension%22>

Other Diagnosis and Management Resources

- GeneReview: Heritable Pulmonary Arterial Hypertension
<https://www.ncbi.nlm.nih.gov/books/NBK1485>
- MedlinePlus Encyclopedia: Pulmonary hypertension
<https://medlineplus.gov/ency/article/000112.htm>

Additional Information & Resources

Health Information from MedlinePlus

- Encyclopedia: Pulmonary hypertension
<https://medlineplus.gov/ency/article/000112.htm>
- Health Topic: Pulmonary Hypertension
<https://medlineplus.gov/pulmonaryhypertension.html>

Genetic and Rare Diseases Information Center

- Pulmonary arterial hypertension
<https://rarediseases.info.nih.gov/diseases/7501/pulmonary-arterial-hypertension>

Additional NIH Resources

- National Heart, Lung, and Blood Institute
<https://www.nhlbi.nih.gov/health-topics/pulmonary-hypertension>

Educational Resources

- American Thoracic Society
<https://www.thoracic.org/patients/patient-resources/resources/pulmonary-hypertension.pdf>
- Boston Children's Hospital
<https://www.childrenshospital.org/conditions-and-treatments/conditions/p/pulmonary-hypertension>
- Centers for Disease Control and Prevention (CDC)
https://www.cdc.gov/DHDSP/data_statistics/fact_sheets/fs_pulmonary_hypertension.htm
- Cincinnati Children's Hospital Medical Center
<https://www.cincinnatichildrens.org/health/p/pulmonary-hypertension>
- MalaCards: heritable pulmonary arterial hypertension
https://www.malacards.org/card/heritable_pulmonary_arterial_hypertension
- Merck Manual Consumer Version
<https://www.merckmanuals.com/home/lung-and-airway-disorders/pulmonary-hypertension/pulmonary-hypertension>
- Ohio State University Medical Center
<https://wexnermedical.osu.edu/lung-pulmonary/pulmonary-hypertension>
- Orphanet: Heritable pulmonary arterial hypertension
https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=275777
- Orphanet: Idiopathic pulmonary arterial hypertension
https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=275766
- Orphanet: Idiopathic/heritable pulmonary arterial hypertension
https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=422
- Orphanet: Pulmonary arterial hypertension
https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=182090
- Pulmonary Hypertension Clinical & Research Team, Vanderbilt University School of Medicine: Resources
<https://www.vumc.org/pah/publication/resources>

Patient Support and Advocacy Resources

- American Heart Association
<https://www.heart.org/en/health-topics/high-blood-pressure/the-facts-about-high-blood-pressure/pulmonary-hypertension-high-blood-pressure-in-the-heart-to-lung-system>
- Pulmonary Hypertension Association
<https://phassociation.org/>
- RareConnect
<https://www.rareconnect.org/en/community/pulmonary-hypertension>

Clinical Information from GeneReviews

- Heritable Pulmonary Arterial Hypertension
<https://www.ncbi.nlm.nih.gov/books/NBK1485>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28%28primary+pulmonary+hypertension%5BTI%5D%29+OR+%28pulmonary+arterial+hypertension%5BTI%5D%29%29+AND+english%5BIa%5D+AND+human%5Bmh%5D+AND+%22last+360+days%22%5Bdp%5D>

Catalog of Genes and Diseases from OMIM

- PULMONARY HYPERTENSION, PRIMARY, 1
<http://omim.org/entry/178600>
- PULMONARY HYPERTENSION, PRIMARY, 2
<http://omim.org/entry/615342>
- PULMONARY HYPERTENSION, PRIMARY, 3
<http://omim.org/entry/615343>
- PULMONARY HYPERTENSION, PRIMARY, 4
<http://omim.org/entry/615344>

Medical Genetics Database from MedGen

- Primary pulmonary hypertension
<https://www.ncbi.nlm.nih.gov/medgen/1643124>

Sources for This Summary

- Austin ED, Loyd JE, Phillips JA III. Heritable Pulmonary Arterial Hypertension. 2002 Jul 18 [updated 2015 Jun 11]. In: Pagon RA, Adam MP, 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; 1993-2017. Available from <http://www.ncbi.nlm.nih.gov/books/NBK1485/>
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/20301658>
- Austin ED, Loyd JE. The genetics of pulmonary arterial hypertension. *Circ Res*. 2014 Jun 20;115(1):189-202. doi: 10.1161/CIRCRESAHA.115.303404. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/24951767>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4137413/>
- Machado RD, Aldred MA, James V, Harrison RE, Patel B, Schwalbe EC, Gruenig E, Janssen B, Koehler R, Seeger W, Eickelberg O, Olschewski H, Elliott CG, Glissmeyer E, Carlquist J, Kim M, Torbicki A, Fijalkowska A, Szewczyk G, Parma J, Abramowicz MJ, Galie N, Morisaki H, Kyotani S, Nakanishi N, Morisaki T, Humbert M, Simonneau G, Sitbon O, Soubrier F, Coulet F, Morrell NW, Trembath RC. Mutations of the TGF-beta type II receptor BMPR2 in pulmonary arterial hypertension. *Hum Mutat*. 2006 Feb;27(2):121-32.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/16429395>
- Machado RD, Southgate L, Eichstaedt CA, Aldred MA, Austin ED, Best DH, Chung WK, Benjamin N, Elliott CG, Eyries M, Fischer C, Gräf S, Hinderhofer K, Humbert M, Keiles SB, Loyd JE, Morrell NW, Newman JH, Soubrier F, Trembath RC, Viales RR, Grünig E. Pulmonary Arterial Hypertension: A Current Perspective on Established and Emerging Molecular Genetic Defects. *Hum Mutat*. 2015 Dec;36(12):1113-27. doi: 10.1002/humu.22904. Epub 2015 Oct 12. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/26387786>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4822159/>
- Montani D, Günther S, Dorfmueller P, Perros F, Girerd B, Garcia G, Jaïs X, Savale L, Artaud-Macari E, Price LC, Humbert M, Simonneau G, Sitbon O. Pulmonary arterial hypertension. *Orphanet J Rare Dis*. 2013 Jul 6;8:97. doi: 10.1186/1750-1172-8-97. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/23829793>
Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3750932/>
- Soubrier F, Chung WK, Machado R, Grünig E, Aldred M, Geraci M, Loyd JE, Elliott CG, Trembath RC, Newman JH, Humbert M. Genetics and genomics of pulmonary arterial hypertension. *J Am Coll Cardiol*. 2013 Dec 24;62(25 Suppl):D13-21. doi: 10.1016/j.jacc.2013.10.035. Review.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/24355637>

Reprinted from Genetics Home Reference:

<https://ghr.nlm.nih.gov/condition/pulmonary-arterial-hypertension>

Reviewed: January 2016

Published: March 31, 2020

Lister Hill National Center for Biomedical Communications

U.S. National Library of Medicine

National Institutes of Health

Department of Health & Human Services