



Hypertension

Hypertension is abnormally high blood pressure in the arteries, which are the blood vessels that carry blood from the heart to the rest of the body. As the heart beats, it forces blood through the arteries to deliver nutrients and oxygen to the rest of the body. The strength of the blood pushing against the artery walls is blood pressure, which is measured in units called millimeters of mercury (mmHg). The top number in a blood pressure reading is the pressure when the heart pumps (systolic blood pressure), and the bottom number is the pressure between heart beats (diastolic blood pressure). In adults, a normal blood pressure measurement is about 120/80 mmHg. Blood pressure is considered high when the measurement is 130/80 mmHg or greater.

Hypertension usually has no symptoms, and many affected individuals do not know they have the condition. However, hypertension is a major risk factor for heart disease, stroke, kidney failure, and eye problems. When blood pressure is elevated, the heart and arteries have to work harder than normal to pump blood through the body. The extra work thickens the muscles of the heart and arteries and hardens or damages artery walls. As a result, the flow of blood and oxygen to the heart and other organs is reduced. Damage to the heart caused by the extra work and a lack of oxygen causes heart disease. In addition, damage to the arteries increases the risk of blood clots that block the flow of blood to the heart, causing a heart attack, or to the brain, causing a type of stroke known as an ischemic stroke. Another type of stroke, called a hemorrhagic stroke, can occur when a weakened blood vessel in the brain bursts. Damage to blood vessels in the kidneys impairs their ability to filter waste and remove fluid, leading to kidney failure. Problems with blood flow in the arteries of the eyes can lead to vision loss.

In rare cases, dangerously high blood pressure can cause severe headaches, confusion, shortness of breath, chest pain, or nosebleeds.

In about 95 percent of cases, the cause of hypertension is unknown. These cases are classified as essential hypertension. When hypertension results from an underlying condition, such as blood vessel defects that reduce blood flow; kidney disorders, which alter the amount of fluids and salts in the body; or problems with hormone-producing glands called the adrenal glands or the thyroid gland, it is classified as secondary hypertension. Hypertension is a key feature of some rare genetic disorders, including familial hyperaldosteronism, pseudohypoaldosteronism type 2, Liddle syndrome, Bartter syndrome, Gitelman syndrome, and tumors known as paragangliomas.

Frequency

Hypertension affects an estimated 29 percent of adults in the United States. Prevalence of the condition increases with age, and approximately 63 percent of people over

age 60 are affected. In African Americans, the condition is more common, starts at a younger age, and is more severe than in other populations.

Causes

Hypertension can have a variety of causes. Secondary hypertension results from other disorders that raise blood pressure in addition to other problems. Rare, genetic forms of hypertension are caused by mutations in particular genes, many of which help control the balance of fluids and salts in the body and affect blood pressure. The causes of essential hypertension, however, are not well understood. Essential hypertension is a complex condition with a variety of factors, both genetic and environmental, contributing to its development.

More than 100 genetic variations have been associated with essential hypertension. While these variations have been found more commonly in people with essential hypertension than in unaffected individuals, none are common causes of the condition.

The most-studied genetic association in essential hypertension is with genes involved in the renin-angiotensin-aldosterone system. The renin-angiotensin-aldosterone system is a step-wise process that produces hormones to regulate blood pressure and the balance of fluids and salts in the body. Because these genes play an integral role in normal blood pressure control, researchers suspect that variations in them might impair blood pressure control and contribute to hypertension.

Other genes associated with essential hypertension are important for the normal function of the lining of blood vessels (the vascular endothelium). Changes in these genes are thought to impair this cell layer (endothelial dysfunction). Such changes may result in vessels that are abnormally constricted or narrowed, which raises blood pressure. Still other genes have been linked to hypertension risk, although the roles most of them play in development of the condition are still unclear.

Environmental factors also contribute to hypertension. In addition to race and age, activity level, alcohol consumption, and salt intake influence blood pressure. Other disorders, such as obesity, diabetes, and obstructive sleep apnea also increase the risk of developing hypertension.

Researchers suspect epigenetic changes to the DNA also play a role in development of essential hypertension. Epigenetic changes modify DNA without changing the DNA sequence. They can affect gene activity and the production of proteins, which may influence blood pressure.

Inheritance Pattern

Hypertension tends to run in families. Individuals whose parents have hypertension have an elevated risk of developing the condition, particularly if both parents are affected. However, the inheritance pattern is unknown.

Rare, genetic forms of hypertension follow the inheritance pattern of the individual condition.

Other Names for This Condition

- essential hypertension
- high blood pressure
- primary hypertension

Diagnosis & Management

Formal Diagnostic Criteria

- American College of Cardiology: Ten Points to Remember, 2017 Guideline for High Blood Pressure in Adults
<https://www.acc.org/latest-in-cardiology/ten-points-to-remember/2017/11/09/11/41/2017-guideline-for-high-blood-pressure-in-adults>
- U.S. Preventive Services Task Force: Screening for High Blood Pressure in Adults
<https://www.uspreventiveservicestaskforce.org/Home/GetFileByID/2351>
- Whelton PK, Carey RM, Aronow WS, Casey DE Jr, Collins KJ, Dennison Himmelfarb C, DePalma SM, Gidding S, Jamerson KA, Jones DW, MacLaughlin EJ, Muntner P, Ovbigele B, Smith SC Jr, Spencer CC, Stafford RS, Taler SJ, Thomas RJ, Williams KA Sr, Williamson JD, Wright JT Jr. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation*. 2018 Oct 23;138(17):e484-e594. doi: 10.1161/CIR.0000000000000596.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/30354654>

Formal Treatment/Management Guidelines

- American College of Cardiology: Ten Points to Remember, 2017 Guideline for High Blood Pressure in Adults
<https://www.acc.org/latest-in-cardiology/ten-points-to-remember/2017/11/09/11/41/2017-guideline-for-high-blood-pressure-in-adults>
- Cochrane Reviews: First-Line Drugs for Hypertension
<https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD001841.pub3/full?highlightAbstract=withdrawn%7Chypertens%7Chypertension>
- Whelton PK, Carey RM, Aronow WS, Casey DE Jr, Collins KJ, Dennison Himmelfarb C, DePalma SM, Gidding S, Jamerson KA, Jones DW, MacLaughlin EJ, Muntner P, Ovbigele B, Smith SC Jr, Spencer CC, Stafford RS, Taler SJ, Thomas RJ, Williams KA Sr, Williamson JD, Wright JT Jr. 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines. *Circulation*. 2018 Oct 23;138(17):e484-e594. doi: 10.1161/CIR.0000000000000596.
Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/30354654>

Genetic Testing Information

- What is genetic testing?
</primer/testing/genetic-testing>
- Genetic Testing Registry: Essential hypertension
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C0085580/>
- Genetic Testing Registry: Hypertension, essential 1
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1858967/>
- Genetic Testing Registry: Hypertension, essential 2
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1858497/>
- Genetic Testing Registry: Hypertension, essential 3
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1846430/>
- Genetic Testing Registry: Hypertension, essential 4
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1837479/>
- Genetic Testing Registry: Hypertension, essential 5
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1853227/>
- Genetic Testing Registry: Hypertension, essential 6
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1853226/>

- Genetic Testing Registry: Hypertension, essential 7
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1970439/>
- Genetic Testing Registry: Hypertension, essential 8
<https://www.ncbi.nlm.nih.gov/gtr/conditions/C1970244/>

Research Studies from ClinicalTrials.gov

- ClinicalTrials.gov
<https://clinicaltrials.gov/ct2/results?cond=%22hypertension%22>

Other Diagnosis and Management Resources

- American Heart Association: 2017 Hypertension Clinical Guidelines
https://professional.heart.org/professional/ScienceNews/UCM_496965_2017-Hypertension-Clinical-Guidelines.jsp
- Centers for Disease Control and Prevention: Controlling Blood Pressure
<https://www.cdc.gov/bloodpressure/control.htm>
- Texas Heart Institute
<https://www.texasheart.org/heart-health/heart-information-center/topics/high-blood-pressure-hypertension/>

Additional Information & Resources

Health Information from MedlinePlus

- Encyclopedia: Controlling Your High Blood Pressure
<https://medlineplus.gov/ency/patientinstructions/000101.htm>
- Encyclopedia: High Blood Pressure-Adults
<https://medlineplus.gov/ency/article/000468.htm>
- Encyclopedia: High Blood Pressure and Eye Disease
<https://medlineplus.gov/ency/article/000999.htm>
- Encyclopedia: Hypertensive Heart Disease
<https://medlineplus.gov/ency/article/000163.htm>
- Health Topic: Blood Pressure Medicines
<https://medlineplus.gov/bloodpressuremedicines.html>
- Health Topic: DASH Eating Plan
<https://medlineplus.gov/dasheatingplan.html>
- Health Topic: High Blood Pressure
<https://medlineplus.gov/highbloodpressure.html>
- Health Topic: How to Prevent High Blood Pressure
<https://medlineplus.gov/howtopreventhighbloodpressure.html>

Genetic and Rare Diseases Information Center

- Pediatric hypertension
<https://rarediseases.info.nih.gov/diseases/11921/pediatric-hypertension>

Additional NIH Resources

- National Heart, Lung, and Blood Institute
<https://www.nhlbi.nih.gov/health-topics/high-blood-pressure>
- National Institute of Diabetes and Digestive and Kidney Diseases: High Blood Pressure and Kidney Disease
<https://www.niddk.nih.gov/health-information/kidney-disease/high-blood-pressure>

Educational Resources

- American Heart Association: HBP and the Cardiovascular System Animated Learning Module
https://watchlearnlive.heart.org/CVML_Player.php?moduleSelect=highbp&uid=1317
- American Heart Association: Understanding Blood Pressure Readings
<https://www.heart.org/en/health-topics/high-blood-pressure/understanding-blood-pressure-readings>
- Centers for Disease Control and Prevention: High Blood Pressure
<https://www.cdc.gov/bloodpressure/index.htm>
- Georgetown University Medical Center: Hypertension: Secondary Causes
<https://medicine.georgetown.edu/divisions/nephrology/knowledge/secondary-hypertension>
- KidsHealth from Nemours
<https://kidshealth.org/en/teens/hypertension.html>
- MalaCards: hypertension, essential
https://www.malacards.org/card/hypertension_essential
- Merck Manual Consumer Version
<https://www.merckmanuals.com/home/heart-and-blood-vessel-disorders/high-blood-pressure/high-blood-pressure>
- Oregon State University: Endothelial Dysfunction
<https://lpi.oregonstate.edu/mic/health-disease/endothelial-dysfunction>
- Orphanet: Genetic hypertension
https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=156629

- Orphanet: NON RARE IN EUROPE: Essential hypertension
https://www.orpha.net/consor/cgi-bin/OC_Exp.php?Lng=EN&Expert=243761
- Texas Heart Institute
<https://www.texasheart.org/heart-health/heart-information-center/topics/high-blood-pressure-hypertension/>

Patient Support and Advocacy Resources

- American Heart Association
<https://www.heart.org/en/health-topics/high-blood-pressure>
- American Medical Association
<https://www.ama-assn.org/delivering-care/hypertension>

Scientific Articles on PubMed

- PubMed
<https://www.ncbi.nlm.nih.gov/pubmed?term=%28Essential+Hypertension%5BMAJR%5D%29+AND+%28hypertension%5BTIAB%5D%29+AND+english%5Bla%5D+AND+human%5Bmh%5D+AND+%22last+360+days%22%5Bdp%5D>

Catalog of Genes and Diseases from OMIM

- HYPERTENSION, ESSENTIAL
<http://omim.org/entry/145500>
- HYPERTENSION, ESSENTIAL, SUSCEPTIBILITY TO, 1
<http://omim.org/entry/603918>
- HYPERTENSION, ESSENTIAL, SUSCEPTIBILITY TO, 2
<http://omim.org/entry/604329>
- HYPERTENSION, ESSENTIAL, SUSCEPTIBILITY TO, 3
<http://omim.org/entry/607329>
- HYPERTENSION, ESSENTIAL, SUSCEPTIBILITY TO, 4
<http://omim.org/entry/608742>
- HYPERTENSION, ESSENTIAL, SUSCEPTIBILITY TO, 5
<http://omim.org/entry/610261>
- HYPERTENSION, ESSENTIAL, SUSCEPTIBILITY TO, 6
<http://omim.org/entry/610262>
- HYPERTENSION, ESSENTIAL, SUSCEPTIBILITY TO, 7
<http://omim.org/entry/610948>
- HYPERTENSION, ESSENTIAL, SUSCEPTIBILITY TO, 8
<http://omim.org/entry/611014>

Medical Genetics Database from MedGen

- Essential hypertension
<https://www.ncbi.nlm.nih.gov/medgen/88442>

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Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/19838132>
- Padmanabhan S, Aman A, Dominiczak AF. Genomics of hypertension. *Pharmacol Res.* 2017 Jul;121:219-229. doi: 10.1016/j.phrs.2017.04.031. Epub 2017 May 8. Review.
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- Saxena T, Ali AO, Saxena M. Pathophysiology of essential hypertension: an update. *Expert Rev Cardiovasc Ther.* 2018 Dec;16(12):879-887. doi: 10.1080/14779072.2018.1540301.
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Citation on PubMed: <https://www.ncbi.nlm.nih.gov/pubmed/27028574>
- Wise IA, Charchar FJ. Epigenetic Modifications in Essential Hypertension. *Int J Mol Sci.* 2016 Mar 25;17(4):451. doi: 10.3390/ijms17040451. Review.
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Free article on PubMed Central: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4848907/>

Reprinted from Genetics Home Reference:
<https://ghr.nlm.nih.gov/condition/hypertension>

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