Hypertrophic Cardiomyopathy

A Guide for Patients
Hypertrophic Cardiomyopathy

What is Hypertrophic Cardiomyopathy?
Hypertrophic cardiomyopathy (HCM) is the most common inherited heart disease. Approximately 1 in 500 people in the general population have HCM, and it affects individuals of both sexes and of all ethnicities. HCM is a disorder in which the muscle fibers of the heart increase in size (hypertrophy) and can be replaced by connective and fatty tissue, resulting in thicker walls of the heart. This increased thickness reduces the heart’s ability to pump blood efficiently, which can lead to heart failure or cardiac arrest in severe cases. It is the most common cause of sudden cardiac death among trained athletes.

What are the symptoms of HCM?
Many patients with HCM are asymptomatic. However, for those who are symptomatic, the warning signs can include any of the following:

- Shortness of breath
- Dizziness
- Fainting
- Palpitations
- Chest pain
- Exercise intolerance or fatigue

What causes HCM?
HCM is primarily caused by an abnormality (mutation) in one of the genes that is important in determining how the heart forms and functions. More than 700 mutations in 17 genes have been associated with HCM. The genetic form of HCM is usually inherited in an autosomal dominant manner, so a person with HCM generally has a 50 percent chance of passing the genetic defect on to each of his or her children. Although HCM is inherited, increased thickness of the heart muscle can also be acquired as a result of normal aging, hypertension, or valvular heart disease.
How is HCM diagnosed?
For patients who are asymptomatic, HCM may first be detected during a routine physical exam (if a physician finds a murmur) or by an electrocardiogram (ECG). However, physicians usually diagnose HCM using imaging techniques such as echocardiography (taking a sonogram of the heart) or cardiac magnetic resonance imaging (MRI) to detect thickening of the heart muscle. A patient’s medical and family histories are essential in evaluating genetic causes of HCM. Genetic testing can then be used to confirm the clinical diagnosis.

How is HCM treated?
The clinical management of HCM depends on the severity of the disease and the patient’s symptoms. Initially, therapy includes medications such as beta blockers, verapamil, disopyramide, and diuretics. Some patients require surgery to remove a portion of the thickened heart muscle (myomectomy) or to have a pacemaker or defibrillator placed. For patients whose symptoms do not respond to these treatments, a cardiac transplant can be an option. Physicians may restrict HCM patients from participating in high-stress physical activities such as competitive sports. Family members at risk for HCM may be closely monitored using routine tests.
Genetic testing for Hypertrophic Cardiomyopathy

How is genetic testing for HCM performed?
The HCM genetic test is a blood test ordered by a physician. GeneDx will extract DNA and analyze it by specifically searching for mutations in the genes that are associated with HCM. After the test is complete (in about six to eight weeks), the results are then sent to the physician who ordered the test. The physician will explain the test results to the patient.

What makes the GeneDx test different from others?
GeneDx offers a comprehensive genetic test for HCM. Heart thickening, which is the key symptom in HCM, can also be caused by certain multisystem disorders involving the heart muscle. Therefore, GeneDx tests not only for genes associated directly with HCM, but also genes associated with disorders such as amyloidosis, Danon disease, and Fabry disease. Distinguishing the different genetic causes of heart muscle thickening is extremely important, as the treatment for HCM differs markedly from the treatment for other conditions. GeneDx also performs free testing for family members if it will help us interpret a patient’s results; for instance, if it is unclear if a suspected mutation is actually causing HCM in the patient. In such circumstances, GeneDx will also evaluate a large panel of normal individuals to determine if the gene variant is benign.

Who should undergo genetic testing for HCM?
- A patient with a clinical diagnosis of HCM
- Family members of a patient who has a disease-causing mutation (although these individuals need only be tested for the mutation that the patient has)
- Parents may consider prenatal testing when one of them has a HCM gene mutation
How is genetic testing for HCM helpful?
- To confirm the clinical diagnosis of HCM, especially when the condition is clinically ambiguous
- To identify family members who are at risk of developing HCM
- To distinguish HCM from athlete’s heart syndrome and other conditions
- To make informed family planning decisions

How long does it take to complete the genetic test?
It usually takes six to eight weeks to complete the test (from the time we receive the blood sample to the time a physician receives the results). It can take longer if GeneDx has to study clinically normal individuals or test family members to interpret results.

What type of test results can I expect?
Three types of results are possible:

- A **positive result** indicates that we found a disease-causing mutation in one of the genes associated with HCM. This finding confirms the diagnosis of HCM and provides valuable information to family members. All first-degree relatives (i.e., children, siblings, parents) of the patient are then offered diagnostic or predictive genetic testing to determine their individual risks of developing HCM. If a family member has the mutation but is asymptomatic, he or she is at risk for HCM and should be monitored closely. If a family member does not have the mutation, he or she is not considered to be at risk for HCM.

- A **negative result** indicates that we did not find a disease-causing mutation in one of the genes associated with HCM. However, this does not rule out HCM, and the patient should be managed according to his or her clinical symptoms. A possible reason for a negative result is that the patient has a mutation in a gene or part of a gene that is not included in the panel of genes that we test. When a result for a patient with HCM is negative, predictive genetic testing of family members will not be informative and is therefore not warranted. Careful review of the patient’s family history may help determine if his or her disease is genetic so that family members can have their hearts evaluated as necessary.
A variant of unknown significance (VOUS) result indicates an inconclusive finding. This happens when we find a new DNA abnormality (i.e., one that has never been seen in an individual with HCM), but it is unclear if that change causes HCM. A VOUS report is sent only after GeneDx has confirmed that a large panel of clinically normal individuals does not carry the variant. To further clarify the clinical significance of the VOUS, it may be helpful to test the patient’s family members. If an affected relative also has the variant, it is more likely that the variant causes disease. The more affected family members who carry the VOUS, the greater the likelihood that the VOUS is responsible for HCM in that family.

How will I learn my test results?
Your physician will share your results with you and discuss them in the context of your health care.

Will my insurance cover this test?
GeneDx accepts all commercial insurance, and you will be responsible for only the co-pay, co-insurance, and unmet deductible dictated by your insurance carrier to a maximum out-of-pocket expense to the patient of $500. GeneDx will bill your insurance company and appeal for payment. Currently, GeneDx does not accept Medicare or Medicaid. For more information, call us at 301-519-2100, x 6727.

What if I do not have insurance?
For patients who do not have health insurance or cannot afford to pay the full cost of testing, GeneDx provides a generous financial assistance program, including a significantly discounted price. For more information, call us at 301-519-2100, x 6106.

Do my family members need to be tested?
If you have a disease-causing mutation in one of the HCM genes, your family members can be tested for that specific mutation. If you have a VOUS, GeneDx may ask to test your family members at no additional cost if it is necessary to interpret your test results.
**Does GeneDx test family members?**
Yes, GeneDx offers mutation-specific testing (a known familial mutation) for family members of any patient who has been shown by GeneDx to have a genetic mutation. For more information, please call one of our genetic counselors at 301-519-2100.

**How does testing of family members differ from full HCM panel testing in a patient?**
The first HCM patient in a family to be tested typically requires analysis of all 17 genes in the HCM panel. Once a disease-causing mutation(s) is identified in a specific gene(s), family members are tested only for that specific mutation. This costs significantly less than testing the family members using the full genetic panel.

**Does GeneDx perform prenatal testing?**
Yes, GeneDx can provide prenatal testing for a known familial mutation(s) in any gene, for families who have had previous testing at GeneDx. For more information, please call one of our genetic counselors at 301-519-2100.

**Can my health insurer or employer discriminate against me based on my test results?**
No, The Genetic Information Nondiscrimination Act of 2008, also referred to as GINA, is a federal law that protects Americans from discrimination by health insurance companies and employers based on their genetic information. The President signed the act into federal law on May 21, 2008. The parts of the law relating to health insurers will take effect by May 2009, and those relating to employers will take effect by November 2009. **However, this law does not cover life insurance, disability insurance, or long-term care insurance.** For more information, please visit http://www.genome.gov/10002328.
Where can I find more information?

You can find more information at the following websites:

- **GeneDx cardiology page:** [www.genedx.com/cardiology](http://www.genedx.com/cardiology)
- **Hypertrophic Cardiomyopathy Association,** a patient organization focusing solely on HCM: [www.4hcm.org](http://www.4hcm.org)
- **Children’s Cardiomyopathy Foundation,** a patient support organization for children with cardiomyopathy: [www.childrenscardiomyopathy.org](http://www.childrenscardiomyopathy.org)
- **Cardiomyopathy Association,** a patient organization focusing on a variety of cardiomyopathies, including HCM: [www.cardiomyopathy.org](http://www.cardiomyopathy.org)
- **Gene Reviews,** a database of genetic diseases: [www.geneclinics.org](http://www.geneclinics.org)
- **National Society of Genetic Counselors,** an organization that can help you find a counselor near you: [www.nsgc.org](http://www.nsgc.org)

About GeneDx

GeneDx is a highly respected company that specializes in genetic testing for rare inherited disorders. Two scientists from the National Institutes of Health (NIH) founded the company in the year 2000 to address the needs of patients and clinicians concerned with rare inherited disorders. Currently, GeneDx offers testing for more than 200 rare Mendelian disorders, using DNA sequencing and deletion/duplication analysis of the associated gene(s). GeneDx also offers oligonucleotide microarray-based testing for detecting chromosomal abnormalities, testing for autism spectrum disorders, and testing for various forms of cardiomyopathy. At GeneDx, our technical services are matched by our scientific expertise and customer support. Our growing staff includes more than 12 experts in molecular and clinical genetics, and five genetic counselors who are just a phone call or email away. We invite you to visit our website [www.genedx.com](http://www.genedx.com) to learn more about us and the services we offer.