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Hypertrophic cardiomyopathy (HCM) is a complex but relatively common form of genetic heart muscle disease that occurs in 1 out of 500 people, but often goes undiagnosed in the community, and has caused some confusion to both patients and physicians periodically over the years. HCM is the most common cause of heart-related sudden death in people under 30 years of age, and it can also be responsible for exercise disability at almost any age. HCM occurs equally in both sexes and has been reported in many races. Although HCM is a chronic disease without a known cure, a number of treatments are now available to alter its course.

The Many Names and Other Sources of Uncertainty

Much of the confusion about HCM, as well as the limited awareness about the condition in the general public, comes from factors such as the vast array of complex names and acronyms given to the disease (over 75 in number), and its infrequent occurrence in cardiology practice. Patient support and advocacy groups have closed the information gap by using the internet, facilitating more effective communication between interested parties independent of geography (Hypertrophic Cardiomyopathy Association [HCMA] web site is available at http://www.4HCM.org; phone (973) 983-7429 or (877) 329-4262).

How Is HCM Diagnosed?

HCM is usually identified by an echocardiogram that produces ultrasound images of the thickened wall of the heart muscle (hypertrophy of the left ventricle). This is usually most prominent in the ventricular septum (the wall separating the left and right ventricles), but is not accompanied by an enlarged cavity. Normal thickness of the left ventricle is 12 mm or less; in HCM, the thickness is usually 15 mm or more, although we know that some people who carry a mutant HCM gene may have normal wall thickness.

In HCM patients, hypertrophy does not usually appear on echocardiogram until early adolescence and then may increase dramatically until the end of the accelerated growth period. However, since hypertrophy may not begin until middle age, we now suggest that some relatives of those with diagnosed HCM should be checked with an echocardiogram periodically well past adolescence. Small differences in wall thickness reported to adult patients from one clinic visit to another are usually not clinically important; technical factors such as the angle of the sound-wave beam can account for such variations. Sometimes modestly increased thickness must be distinguished from the innocent consequences of athletic training (athlete's heart) or high blood pressure.

Echocardiograms will also show whether (partial) obstruction of blood flow from left ventricle into aorta, caused by forward motion of the mitral valve, is present (and to what degree), and also whether there is abnormal leakage through the mitral valve. Invasive cardiac catheterization or electrophysiological studies are now rarely necessary. The ECG usually shows a wide variety of abnormalities but is of limited value in HCM, with the exception of family screening.

Your physician may suspect HCM by the presence of a heart murmur, new symptoms, abnormal ECG, or family history. Physical examinations alone, including those prior to participation in sports, are not reliable for identifying HCM because about 75% of patients do not have obstruction to the outflow of blood from the left ventricle and a loud heart murmur is therefore absent.

Inheritance

HCM is caused by mutations in any one of 10 genes and appears in 50% of individuals in each generation. The mutant genes that cause HCM influence certain proteins that are part of the heart muscle. Therefore, when

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HCM is diagnosed, all close relatives are advised to have an echocardiogram. While analysis of DNA is the most certain method for diagnosing HCM, it is time-consuming, expensive, confined to research-oriented laboratories, and cannot yet play a role in routine day-to-day decisions for patients. Gene therapy would be a daunting task and is not presently a realistic expectation to become a cure for HCM.

General Outlook and What to Expect From HCM

HCM is unique because it may be identified during any phase of life, from infancy to old age (sometimes over 90 years). While its potential adverse consequences have been emphasized for years, particularly the possibility of sudden death, a more appropriately balanced perspective on HCM has emerged.

It is a myth that HCM represents a generally unfavorable disease. Its risks have probably been exaggerated to many patients. In fact, realistic mortality rates for HCM are only about 1% per year and are not dissimilar to the general US adult population for all causes. Therefore, HCM frequently causes no or only mild disability over a lifetime, and many patients achieve normal life expectancy (some without even being aware of their disease). Therefore, many HCM patients deserve reassurance about their prognosis.

Sudden Death

Sudden and unexpected death is the most devastating and unpredictable complication of HCM, but only a minority of patients are actually at risk. Sudden death in HCM may occur without warning signs and is caused by lethal heart rhythm disturbances (called ventricular tachycardia and ventricular fibrillation) that probably originate from the disorganized heart muscle structure or from small scars. Patients are rarely aware of rhythm abnormalities that may precede sudden death; however, fluttering, pounding, or skipped beats (palpitations), as well as dizziness and fainting, should always be reported to the cardiologist.

While sudden death occurs most commonly in children and young adults, the risk extends into mid-life and beyond (although less frequently). Reaching a particular age does not therefore confer immunity from sudden death. Sometimes sudden collapse occurs with vigorous exertion on the athletic field; athletes with HCM should be disqualified from most organized sports to reduce their risk.

A number of risk factors for sudden death have been identified, although most patients will never experience a life-threatening rhythm. HCM patients should have a clinical risk assessment with history and physical examination, echocardiography, 24-hour ECG recording (Holter monitor), and exercise testing, and should be routinely evaluated by a cardiologist about every 12 months.

WHO IS AT RISK?

- Patients with a prior cardiac arrest (“heart stoppage”).
- Patients with one or more family members with sudden death caused by HCM, particularly when closely related.
- Patients who experience fainting (syncope) that is otherwise unexplained, particularly when it is related to physical activity, occurs repeatedly, or appears in young people.
- Patients with brief episodes of rapid heart beat (ventricular tachycardia) shown on Holter monitor when present on several recordings.
- Patients whose blood pressure fails to rise during exercise testing, particularly in those younger than 50 years of age.
- Patients with extreme thickness of left ventricular wall (30 mm or more) on echocardiogram.

Symptoms

Some patients with HCM develop shortness of breath and chest discomfort, as well as fainting, dizziness, palpitations, and fatigue, with physical activity. Symptoms may begin at any age and often do not appear until mid-life (30s or 40s). Symptoms can develop at different rates, with long periods of stability, and often vary from day-to-day; severe exercise limitation is, however, uncommon. Occasionally, patients may be unable to sleep in a flat position or may awaken short of breath.

HCM involves a unique form of heart failure in which the heart muscle is often not dilated and flabby, but rather is stiff and has normal pumping capacity. Shortness of breath results from the high pressures in the heart chambers and can be controlled with β-blockers, verapamil, or disopyramide. Although any patient with HCM can develop symptoms, those with obstruction to the outflow of blood from the left ventricle are most likely to experience severe disability.

Patients with obstruction should take antibiotics before dental procedures to prevent blood-borne infection of the mitral valve. Women with HCM generally experience little difficulty during pregnancy and delivery, with the exception of some of those with advanced disease.

Atrial Fibrillation

Atrial fibrillation occurs frequently in HCM and accounts for many unexpected hospitalizations and unscheduled work loss. Atrial fibrillation can be well tolerated and does not increase the risk of sudden death. In older patients, it may cause heart failure and stroke (clots can form in the enlarged and fibrillating atrium and travel to the brain). Because of the risk for stroke, anticoagulants are usually recommended. It may be necessary to control heart rate with drugs, or restore normal heart rhythm with an electric shock, or with medications.

Treatment

The implantable cardioverter-defibrillator (ICD) is the most reliable and effective treatment for HCM patients at high-risk. It has the potential to alter the disease course by automatically sensing and terminating lethal disturbances of heart rhythm, often in young people with little or no symp-

toms. ICDs are clearly warranted for those who survive a cardiac arrest, but should also be considered as a preventive measure for other high-risk HCM patients after taking into consideration the strength of their risk factors(s), the level of risk acceptable to patient and family, and the access to ICDs.

Should symptoms worsen despite medications and the patient's lifestyle become unacceptable, major decisions about treatment depend on whether blood flow obstruction is also present. For those patients, the most standard option is the septal myectomy operation, in which the surgeon removes a small amount of muscle from the upper part of the septum. At experienced centers, myectomy has low operative mortality, and most patients experience long-lasting improvement in their capacity for physical activity. This is due to the return of pressures within the heart to the normal range and the elimination of mitral valve leakage.

For those patients who do not have ready access to major centers experienced with this operation, or who have unacceptable risk because of other medical conditions, advanced age, or previous heart surgery (or are insufficiently motivated for operation), 2 other treatment options are potential alternatives to a septal myectomy. Pacemakers may improve symptoms and reduce obstruction in some HCM patients, particularly those of advanced age. The data from several controlled trials suggest, however, that improvement with pacing is often largely a placebo effect.

The septal ablation technique has been developed, in which a small amount of absolute alcohol is introduced into a small coronary artery branch for the purpose of destroying heart muscle in the septum, leading to reduced obstruction and symptoms. Alcohol ablation and septal myectomy have similar risks. However, ablation is a new technique, follow-up of patients is relatively brief, and there is some concern that the permanent scar produced within the septum could eventually generate serious rhythm disturbances and actually increase risk for sudden death.

Treatment options are more limited for patients having severe symptoms without obstruction, such as those reaching the "end-stage" phase in which pumping capacity becomes impaired. Such patients may become candidates for a heart transplant.

Common Misconceptions About HCM

- *With HCM will my life be shortened?* Probably not, although the disease can have important implications for some patients. HCM is compatible with normal life expectancy, often with few if any complications.
- *I am afraid my heart will continue to enlarge until something bad happens.* Usually the thickening process in HCM ceases by the time full growth and maturity is achieved (at about age 17 to 18). There are extraordinary exceptions, but this rule covers about 90% to 95% of the relevant clinical situations.
- *Will injection of alcohol into my septum be a cure?* Alcohol septal ablation is a promising alternative to surgery that can decrease obstruction and symptoms. However, HCM is a chronic disease, and none of the available treatments can be regarded as a "cure."
- *My cardiologist says I have obstruction and need a major procedure, but I feel fine.* Obstruction can have consequences over long periods of time and may need to be relieved. However, major interventions such as surgery and alcohol ablation are not justified unless patients also have symptoms that significantly limit their lifestyle.

Continued

- *I am afraid I am getting worse; my obstruction went from 20 (mm Hg) to 30 (mm Hg);* or, *I am getting better; my gradient went from 30 (mm Hg) to 20 (mm Hg).* Patients should be aware that obstruction in HCM can change under a variety of circumstances from day-to-day (even hour-to-hour); therefore, small variations in either direction should not be taken as evidence of worsening or improvement in their disease.
- *I have been told that I may need surgery, but that it is dangerous. I think I would like to try something safer.* Actually, in experienced hands, surgery has a risk of only 1% to 2% (and even less in recent years), which is similar to that for alcohol septal ablation.
- *I have heard that HCM is more common in men.* HCM is transmitted as a dominant trait and precisely one-half of those who inherit the gene are men and one half are women. However, HCM often goes unrecognized in women, who represent only about 40% to 45% of those patients in published clinical studies.

Additional Resources

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