EDITORIALS

Hypertrophic Subaortic Stenosis in the "Real World"

Most articles detailing the clinical features of idiopathic hypertrophic subaortic stenosis are concerned with congenital and inherited aspects of the disease, and patients recognized to have this disorder are often children or young adults. Indeed, Braunwald states in Hurst’s textbook of cardiology, “The ages of patients range from birth to 85 years, but most commonly, IHSS is a disease of young adults, with the majority of the patients in the third and fourth decades.” Nevertheless, certain reports have recently stressed the frequency with which this disease occurs in the elderly.

When one examines patterns of this disease in the community hospital, as opposed to the specialty referral center, one gains a contrasting view of its nature; there is a heavy preponderance of elderly patients (over the age of 50 years), the vast majority of whom are women with a history of hypertension. Our data agree closely with those of other studies, and in those patients in whom adequate historical data were available, the hypertension usually antedated the discovery of a cardiac murmur by several years.

Symptoms attributable to the subaortic stenosis per se are often relatively mild, ie, pain in the chest or dyspnea, but syncope was uncommon. The typical murmur was occasionally brought to light by certain types of therapy, such as administration of digitalis or the induction of a brisk diuresis. Unfortunately, our experience also agrees with that of others, which indicates that in the elderly the correct diagnosis is usually not suspected at the bedside. Most are thought erroneously to have some form of mitral regurgitation, especially papillary muscle dysfunction. Contrary to popular belief, the long apical murmur of idiopathic hypertrophic subaortic stenosis is not usually confused with that of valvular aortic stenosis.

Since many of our patients had mild and stable clinical features, the majority of these patients were not subjected to invasive study; however, the accuracy of the noninvasive diagnosis was confirmed in all subjects who also underwent cardiac catheterization. These results have added further support to our conviction that idiopathic hypertrophic subaortic stenosis can be accurately diagnosed with noninvasive means alone.

The effect of age and blood pressure upon the ventricular architecture is pertinent. Imataka et al found a 4 percent incidence of asymmetric septal hypertrophy among 497 random cardiac patients, as determined by echocardiograms. These investigators found a higher incidence (10.1 percent) of this disorder in those patients over 60 years of age, and hypertension was associated with 80 percent (16/20) of all cases with asymmetric septal hypertrophy. The reported incidence of asymmetric septal hypertrophy among patients with hypertension varies widely, ranging from 1 to 47 percent, but probably runs around 4 percent. Moreover, Savage et al also noted a tendency for the septum to show increasing thickness with advancing age within the group with hypertension; however, in neither of these studies was the incidence of subvalvular obstruction studied, although Savage et al observed the presence of systolic anterior motion in one patient with concentric left ventricular hypertrophy. On the other hand, Krasnow and Stein demonstrated definite evidence for muscular subvalvular obstruction in about 0.85 percent of all their hospitalized patients who were studied. These reports serve to show that conditions from which subvalvular obstruction is likely to occur are quite common in elderly hypertensive patients and that actual subvalvular obstruction also may be quite common, were it recognized routinely by the clinician.

In recent years, much attention has been devoted to the use of echocardiograms in the diagnosis of both asymmetric septal hypertrophy and idiopathic hypertrophic subaortic stenosis. It has long been apparent that in the group with asymmetric septal hypertrophy, individuals may or may not manifest subvalvular obstruction, even with provocation with inotrophic agents such as isoproterenol. More recently, we are learning that all patients with subaortic obstruction may not have asymmetric septal hypertrophy, but rather concentric left ventricular hyper-
trophy may be the finding, especially in the elderly. Certain studies have even identified cases in which the thickness of both the septum and posterior wall were normal and associated with systolic anterior motion and subvalvular obstruction. Some of these patients had abnormally large ejection fractions, suggesting that in some cases, dynamic obstruction of left ventricular outflow may be evoked by abnormal dynamics of left ventricular ejection, rather than hypertrophy. Supporting this concept is the observation that subvalvular obstruction has even been shown to occur in a patient with hypovolemic shock without asymmetric septal hypertrophy by echocardiogram and with a normal heart at autopsy. Also, both normal animals and humans have displayed obstruction with administration of isoproterenol. Therefore, the echocardiographic finding of asymmetric septal hypertrophy is a useful sign for a general category of disease (or diseases); however, the finding of systolic anterior motion of the mitral valve is necessary to signify the likelihood of subvalvular obstruction, although such anterior mitral motion may be recorded in the absence of a subvalvular pressure gradient. Moreover, as mentioned, this latter finding is not specific for any one disease, as previously thought. It may simply indicate any patient in whom the dynamics in the left ventricular outflow tract have become altered sufficiently to place the mitral leaflet into a position resulting in potential or actual obstruction of outflow.

In contrast to the echocardiogram, the phonocardiogram (with arterial and apical pulses), in our experience, usually permits one to make the diagnosis of actual subaortic obstruction with a high degree of accuracy, although one must occasionally resort to administration of inotropic agents such as isoproterenol or amyl nitrite to bring out the specific abnormalities of the pulse and murmur. While the phonocardiogram is highly specific for making the diagnosis of subaortic obstruction, it obviously can only diagnose this condition in patients with a resting or provokable gradient and will not indicate which of these patients have asymmetric septal hypertrophy with or without obstruction. Nevertheless, the value of the phonocardiogram has not received adequate emphasis in recent years, and it should be used in conjunction with echocardiograms to confirm the presence of subvalvular obstruction. This test may be critical in patients in whom technically clear echocardiograms are not obtainable or in whom the results are equivocal. Studies such as those outlined previously have opened a few important questions:

Is idiopathic hypertrophic subaortic stenosis in the elderly the same disease as that in the young? The frequent association of hypertension with muscular subvalvar stenosis in the elderly suggests that this may represent a totally different condition from idiopathic hypertrophic subaortic stenosis in the young. Muscular subaortic stenosis and subvalvular obstruction may be acquired in those predisposed in some way (genetically or otherwise) to the effect of hypertension. Hypertension might simply produce a substrate for the development of either asymmetric or concentric hypertrophy, which, in turn, eventually narrows the left ventricular outflow tract and repositions the mitral anterior leaflet where it will be induced in some way (possibly through the Venturi effect) to obstruct the left ventricular outflow tract. The frequent lack of a demonstrated familial tendency in this group also favors the concept that this type of subaortic stenosis is an entity apart from the usual forms of this disease. In his initial description of this disease in 1957, Brock suggested that subvalvular obstruction might be an acquired entity secondary to hypertension. Of his three cases, two were women (aged 58 and 63 years) in whom hypertension and concentric left ventricular hypertrophy were found. This led Brock to conclude, “It can be demonstrated conclusively that functional subvalvular stenosis occurs as a result of muscular hypertrophy; the chief cause of this is hypertrophy due to systemic hypertension.”

Can muscular subaortic stenosis be a nonspecific manifestation of several cardiac conditions? Several other conditions besides hypertension which are capable of inducing left ventricular hypertrophy can also be associated with subaortic stenosis; examples of this include valvular and fixed subvalvular aortic stenosis, aortic insufficienty, Friedreich's ataxia, glycogen storage disease, and coarctation of the aorta. Moreover, Burford et al showed that muscular subaortic stenosis (with concentric hypertrophy) can be produced in dogs by banding of the aorta. These observations suggest that left ventricular hypertrophy represents a common factor inducing the development of subaortic stenosis. The clinical course and prognosis may, under such circumstances, depend primarily upon the underlying cause of the ventricular hypertrophy; and this, in turn, would account for a relatively benign clinical course in many of our elderly patients with chronic stable hypertension. On the other hand, one could easily conceive that subaortic obstruction, if sufficiently severe and sustained, could induce a vicious cycle of more left ventricular hypertrophy, which then brings about more obstruction and clinical worsening. This might explain why in some series of elderly patients, relatively severe disease was commonly
encountered. Another possible explanation for the commonly associated hypertension is that the elevation of the blood pressure might develop in some way as a "defense" against the subvalvular stenosis and might ameliorate the manifestations of the disease until later in life; however, our observation that hypertension was usually present before the murmur was discovered provides some evidence against this theory. Finally, it is possible that both hypertension and idiopathic hypertrophic subaortic stenosis are inherited together but have no pathogenetic association. This latter hypothesis is difficult to refute, but the fact that the older individuals with both hypertension and subaortic stenosis have little or no detectable family history of idiopathic hypertrophic subaortic stenosis militates against this theory.

From these observations, one is led to hypothesize that hypertrophic subaortic stenosis may represent a manifestation of two major groups; one group could represent part of the picture of congenital (obstructive) cardiomyopathy, in which a primary process of ventricular hypertrophy localizes sufficiently in the outflow tract of the left ventricle (especially in the septal region) to produce an element of obstruction, with all its consequences. This condition affects primarily the young, with its incidence probably peaking in the fourth decade of life. The terms, "idiopathic" and "cardiomyopathy," might best be applied to this category. The second group of patients with muscular subaortic stenosis, by far the most common, probably usually represents a phenomenon secondary to left ventricular hypertrophy which is often concentric and induced by other diseases. Systemic hypertension, by virtue of its high incidence in this country, would be expected to produce the greatest number of patients falling within this category. It occurs primarily in the older age groups, peaking in the sixth to seventh decade of life. Rather than "idiopathic" hypertrophic subaortic stenosis, we would consider labelling this entity secondary muscular subaortic stenosis, acquired as a result of a condition which produces left ventricular hypertrophy. Since, as mentioned previously, hypertrophy is not absolutely necessary for the production of a subvalvular gradient, perhaps we should consider a less specific name for this syndrome, for instance, "dynamic subaortic obstruction." Following this designation, the underlying cause could be stated when possible, i.e., dynamic subaortic obstruction secondary to hypertensive cardiac hypertrophy, or secondary to idiopathic cardiomyopathy.

If subaortic stenosis secondary to hypertension does represent a separate entity distinct from the syndrome of idiopathic hypertrophic subaortic stenosis in the young, then we are in need of additional information about its nature. First, what are the macroscopic and microscopic features of the septum and posterior left ventricular wall? Although most histologic information displays the same microscopic disruption of the septal myofibrils as described in the congenital variety, it is of interest that Maron et al described one patient, a 57-year-old man, who had a history of hypertension, muscular subaortic stenosis with concentric hypertrophy, no related family history, and no evidence of disorganized cardiac cells in histologic specimens from the septal region. Disorganized cells are considered by some to be a hallmark of the hereditary variety of idiopathic hypertrophic subaortic stenosis. Buckley et al, on the other hand, believe that this cellular architecture may be a nonspecific manifestation of any condition which imposes a pressure load upon the heart.

Does the dominance of women truly indicate a real genetic difference, or does it simply mean that women are more apt to have smaller left ventricular outflow tracts to begin with or to develop left ventricular hypertrophy more concentrated in the region of the left ventricular outflow tract? Alternatively, is it possible that women are better able to tolerate this disease throughout their earlier years, in order to selectively outlast their male counterparts to reach the advanced age groups? Finally, what is the true incidence of this disorder? With the high incidence of hypertension in our population, one can easily conceive of a very common occurrence of this obstructive complication, thus explaining our observed dominance of these patients within the overall group of those patients with subaortic stenosis in a community hospital. Our impression is that the disease is very common in older patients, that it is frequently missed by the practicing physician, and that its incidence will ultimately prove far higher than even suggested by the foregoing discussion.

In conclusion, the practicing physician should be alert to the possibility of muscular subaortic stenosis in elderly patients, especially in women with a history of hypertension, particularly if they possess a murmur of relatively recent onset. Simple screening procedures (eg, the Valsalva maneuver, prompt squatting, and inhalation of amyl nitrite) should be employed extensively, especially in distinguishing this murmur from that due to mitral insufficiency, with which it is most commonly confused. The clinician is then in a good position to know which patients require noninvasive testing to confirm the diagnosis. Cardiac catheterization seldom should be required simply to make a diagnosis, but probably should best be reserved for those patients in whom surgery is contemplated, in whom noninvasive stud-
ies are inconclusive, or in whom other cardiac disease is suspected or present.

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REFERENCES


Pulmonary Resection and Postoperative Pulmonary Function

Recent information has been extremely valuable in the preoperative assessment for thoracotomy of the patient with lung cancer. Because the patient with bronchogenic carcinoma often has concomitant obstructive airway disease, pulmonary reserve may be severely limited. The extent of surgery necessary to successfully resect the cancer is not predictable and it is therefore prudent to evaluate each patient for pneumonectomy and hope that lesser surgery will suffice.

The first step of this assessment is to evaluate the total function of both lungs.12 Although a battery of tests is usually performed, certain tests and limits seem to stand out. An MVV of less than 50 percent of predicted and FEV1 less than 2.0 liters have been shown repeatedly to indicate a high risk to the patient.8 Also, any patient who has carbon dioxide retention has respiratory failure with both lungs intact and will not tolerate resection.

Since the contribution of the non-cancerous lung to overall pulmonary function can vary considerably, the amount of function that would be lost after pneumonectomy would influence any surgical decision. So-called "split" function studies were designed to assess pulmonary function on the right versus the left side. Differential bronchospirometry,5 temporary unilateral balloon occlusion6 tests, and radiospriometry7 can provide this information.

That less invasive means can be used with satisfactory results is now commonly accepted. Ventilation-perfusion scans are now performed at many