Coexistent Idiopathic Hypertrophic Subaortic Stenosis and Coronary Arterial Disease

By Stephen J. Gulotta, M.D., Robert I. Hamby, M.D., Alfred L. Aronson, M.D., and Kenneth Ewing, M.D.

SUMMARY
Coexistent idiopathic hypertrophic subaortic stenosis (IHSS) and coronary arterial disease (CAD) was found in 10 patients studied because of disabling angina. Only one had experienced consistent relief of angina with nitroglycerin. All had systolic murmurs which had been ascribed to valvular stenosis or papillary muscle dysfunction. Mean patient age was 57 years. Nine were males. All patients were shown to have the characteristic hemodynamic and angiographic findings of classical IHSS. Coronary cineangiography revealed severe CAD in each patient. Precatheterization diagnosis of combined IHSS and CAD was difficult to make unless a very well-documented history of prior myocardial infarction was available, and clinical evaluation revealed the typical auscultatory and pulse contour changes of IHSS. In six of the patients clinical evidence alone was not sufficient to diagnose combined disease with any certainty. There is a significant incidence of IHSS in the coronary disease-prone age group. The possible coexistence of the two diseases has not been appreciated previously. Patients with IHSS and angina should be evaluated for CAD as they may benefit if therapy is directed at both disorders. Patients with CAD, angina, and systolic murmurs should be evaluated for possible IHSS, especially if coronary artery surgery is contemplated, since such therapy may be inappropriate or incomplete.

Additional Indexing Words:
Angina Coronary artery surgery Papillary muscle dysfunction

ANGINA PECTORIS as a symptom of idiopathic hypertrophic subaortic stenosis (IHSS) has been clearly recognized ever since this syndrome began to receive widespread attention 15 years ago. Likewise, angina pectoris as a symptom of coronary arterial disease (CAD) has been recognized since Herrick’s original report.1 Although numerous reviews2–7 have described the clinical, hemodynamic, angiographic, and pathologic manifestations of IHSS, the possible coexistence of CAD in patients with angina appears to have received little attention. Apart from a brief communication from our group,8 a review of the available literature fails to reveal any previous reports describing such an association in patients with angina.

Although the diagnosis and symptomatology of IHSS is usually established prior to age 40 years, a significant number of patients are neither symptomatic nor recognized until the fifth, sixth, or even seventh decade.6 Since CAD is prevalent in the latter group of patients, it would indeed be surprising if the two diseases did not coexist and it seemed

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reasonable to suppose that careful scrutiny of this group would disclose a significant number of patients with combined IHSS and CAD.

During a 2-year period we studied 10 patients with IHSS and disabling angina who, by selective coronary arteriography, were also found to have severe CAD. Our observations on these patients form the basis of this report.

**Materials and Methods**

During the years 1969–1971, 15 patients with IHSS underwent cardiac catheterization and selective coronary angiography at North Shore Hospital. Seven patients were found to have coexistent severe CAD. Three patients studied at the Long Island Jewish Medical Center who were also found to have coexistent IHSS and CAD are included in this report.

All patients underwent right and left heart catheterization in the postabsorptive state following light sedation with intramuscular pentobarbital. The left heart was entered using the transseptal technic9 making certain that the catheter tip was passed just across the mitral valve and placed in the left ventricular inflow tract. The catheter was not advanced into the apex of the left ventricle, thereby avoiding the entrapment phenomenon which can cause unnecessary confusion and a mistaken diagnosis of outflow tract obstruction.10, 11 The coronary arteries were selectively opacified using the Sones technic.12

**Cardiac Catheterization Results**

The pertinent data are summarized in tables 1 and 2. All 10 patients with CAD had severe occlusive diseases (greater than 70% narrowing) of at least one major coronary vessel (fig. 1). Five patients had severe occlusive disease of two vessels, and one patient had severe triple-vessel disease. Two patients (E.M. and M.L.) had dominant left coronary systems. The cardiac index was reduced in only one patient and none had an increase in cardiac output.

Only three patients had significant left ventricular-aortic systolic gradients at rest. Pressure gradients across the left ventricular outflow track were evoked with induced premature ventricular beats, the Valsalva maneuver, amyl nitrite inhalation, or intravenous isoproterenol (fig. 2). The largest

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Cardiac Catheterization Data</th>
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<tr>
<td>Pressure (mm Hg)</td>
<td>PA</td>
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<tr>
<td>C0</td>
<td>CI</td>
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<tr>
<td>Peak LV-Ao aortic gradient</td>
<td>Ao (Hg)</td>
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<td>Rest</td>
<td>Vals</td>
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<td>Age (yr)</td>
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**Abbreviations**: Ao = aorta; CI = cardiac index; LVEDP = left ventricular end-diastolic pressure; PA = pulmonary artery; PCI = percutaneous coronary intervention; PESB = posterior extraventricular bundle; Vals = Valsalva maneuver.
Table 2
Results of Coronary Angiograms in 10 Patients

<table>
<thead>
<tr>
<th>Pt</th>
<th>Occlusion (%)</th>
<th>Mitral regurgitation</th>
<th>Proven MI</th>
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<tbody>
<tr>
<td>AF</td>
<td>80</td>
<td>80</td>
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<td>SJ</td>
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Abbreviations: Circ = left circumflex artery; LAD = left anterior descending artery; RCA = right coronary artery; MI = myocardial infarction.

Gradients were recorded in postextrasystolic beats in eight patients. The brachial arterial pulse pressure in all patients had the typical configuration described by Brachfeld and Gorlin,13,14 namely, a rapid upstroke, an abrupt drop in midsystole followed by a second smaller positive deflection and, finally, a sharp incisura. A systolic gradient across the right ventricular outflow tract was recorded in only one patient.

The resting left ventricular end-diastolic pressure was normal in two patients, mildly elevated (12–14 mm Hg) in two patients, and markedly elevated (greater than 20 mm Hg) in four patients.

Figure 1
(Top) Selective coronary angiography demonstrating 90% occlusion of the left anterior descending artery (LAD) in patient S.E. in both the left anterior oblique and right anterior oblique projections. (Bottom) Cine frames on patient H.M. show irregularities in proximal right coronary artery (RCA) but no severe obstruction (lower left). The arrow in the lower right panel points to an area of 80% occlusion of the LAD.
Left ventriculography was performed in the right anterior oblique projection in all patients, and also in the left anterior oblique position when deemed necessary. All patients had massive hypertrophy of the left ventricle and the decreased end-systolic volume (fig. 3) classically described in IHSS.\textsuperscript{15} The site of obstruction is not seen in figure 3 which is taken in the right anterior oblique projection. Outflow tract obstruction is thought to occur when the septal leaflet of the mitral valve impinges on the hypertrophied ventricular septum during systole and is best seen in the left anterior oblique and left lateral views.\textsuperscript{5} Mild mitral incompetence was present in six patients.

**Clinical Findings**

The clinical features of our cases were reviewed to determine if any characteristics were present which would enable easier recognition of patients having coexistent IHSS and CAD.

There were nine males and one female whose ages ranged from 46 to 69 years with a mean of 57.1 years. All patients had dyspnea of varying degree but only J.D., the patient with tight calcific mitral stenosis, had signs of overt congestive heart failure.

Of eight patients who had trials of sublingual nitroglycerin for relief of anginal pain, only one reported consistent symptomatic improvement, four experienced slight improvement occasionally, three had no improvement at all, and one actually experienced an increase in chest pain with the drug. Little is known about the effect of nitroglycerin on anginal pain due to IHSS so that the observed responses in our patients were not entirely

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**Figure 2**

*Simultaneous left ventricular and systemic arterial pressure tracings in four patients demonstrating the typical arterial pressure pulse and left ventricular outflow tract pressure gradients commonly seen in IHSS at rest, in the postextrasystolic beat, and during isoproterenol infusion.*

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helpful for sorting out those patients with IHSS who, in addition, had CAD. Nevertheless, these patients as a group responded less well to nitroglycerin than the patients with CAD alone.

Eight patients were placed on oral propranolol therapy ranging from 80 to 320 mg/day. Four had significant improvement of anginal symptoms, two had equivocal improvement, and two experienced intolerable side effects from the drug.

The quality and character of the murmurs in our patients and the response of the murmurs to the Valsalva maneuver or to pharmacologic agents were typical of uncomplicated IHSS and were, therefore, of no value in detecting the additional presence of CAD.

Neither the anteroposterior and lateral roentgenograms, nor the standard 12-lead electrocardiograms had sufficiently distinguishing features to clearly identify patients who had coexisting IHSS and CAD. Seven patients had electrocardiographic evidence of left ventricular hypertrophy. Two patients (P.A. and H.A.) had electrocardiographic patterns consistent with inferior wall infarction, and one (M.L.) had a tracing compatible with a true posterior wall infarction. Similar patterns have been reported in patients with IHSS without myocardial infarction and they are, therefore, not pathognomonic of complicating CAD.4 7 15

Eight patients had previous histories of myocardial infarction, but only five were well documented by a typical clinical picture with serial electrocardiographic and enzymatic

Figure 3

Left ventriculograms, right anterior oblique in end-diastole (top) and end-systole (bottom) in patients H.M. (left) and S.E. (right). Note the marked ventricular hypertrophy, the small end-systolic volume, and evidence of mitral regurgitation.
changes of acute myocardial infarction or by postmortem examination.

**Surgical Results**

Four patients underwent five coronary revascularization procedures at other institutions. Two (C.A. and P.A.) had gas endarterectomy of totally occluded right coronary arteries, and two (M.L. and A.F.) had venous bypass grafts to the left and right coronary systems. Patient A.F. had massive hypertrophy of the septum and left ventricular wall requiring extensive resection of the myocardium obstructing the left ventricular outflow tract. Following the wedge resection, the outflow tract gradient was abolished. Two patients (C.A. and M.L.) have had excellent clinical results with loss of angina, one (A.F.) died 2 days postsurgery, and one patient (P.A.) had no relief of symptoms. Restudy of the right coronary artery in this patient 3 months later demonstrated complete occlusion of the right coronary artery which had been successfully gas endarterec tomized at surgery. Another attempt at gas endarterectomy of the right coronary artery was also unsuccessful.

One patient (E.M.) died during surgery directed at his hypertrophic outflow tract lesion. A myomectomy was performed but the patient did not survive the procedure. Postmortem examination corroborated the presence of severe disease of the left anterior descending artery and, in addition, demonstrated severe septal thickening, marked left ventricular hypertrophy, and an old large apical infarct.

**Discussion**

All patients were referred for study with an initial diagnosis of angina pectoris due to CAD. Two of the 10 patients were also thought to have rheumatic heart disease with valvular aortic stenosis, and three were considered to have papillary muscle dysfunction resulting in mitral regurgitation. Precatheterization evaluation by at least one member of our team led to a correct diagnosis of IHSS in six patients. The diagnosis was pursued in the remaining four on the basis of a typical arterial pressure pulse noted during cardiac catheterization.

In four patients the diagnosis of coexistent CAD could be made on clinical grounds alone, while in the remaining six the diagnosis necessitated cardiac catheterization and selective coronary angiography.

That the combination of the two diseases is frequently overlooked is perhaps understandable when one considers that numerous articles and excellent reviews on IHSS fail to mention the possible presence of significant CAD and its potential role in the production of anginal symptoms in patients with IHSS. Angina has been ascribed to sudden increase in left ventricular outflow obstruction or to severe ventricular hypertrophy with a muscle mass proportionately greater than the available coronary blood flow. In a recent study where 14 patients (10 with angina) over the age of 60 years were shown to have IHSS, the possibility of coexisting CAD was not considered and coronary angiography was not performed. Few authors have commented specifically on the nature of the coronary arteries in IHSS. Two previous studies have concluded that the coronary arteries are normal in this disease.

While several reports have indicated that certain clinical states may frequently precede or even predispose to the development of IHSS, we have no evidence to suspect that CAD plays any etiologic role in the development of IHSS in our patient group. The diagnosis of coexisting CAD and IHSS is a difficult one to make and unless a high index of suspicion exists, it can be overlooked.

There is currently a great tendency to ascribe most apical systolic murmurs in patients with known CAD to mitral regurgitation secondary to papillary muscle dysfunction. Lesions such as IHSS are, therefore, not seriously considered. Likewise, in patients with proven hypertrophic outflow tract obstruction, anginal symptoms are considered to be typical of the syndrome, and a coronary arterial etiology is not specifically considered or sought, especially if beta-blockade therapy provides initial relief.
Clearly, failure to define the exact diagnosis can lead to therapeutic difficulties, particularly if cardiac surgery is contemplated. In view of the recent surgical advances in the treatment of left ventricular outflow tract obstruction and in coronary revascularization procedures, such oversight can easily lead to inappropriate or incomplete surgical therapy.

Based on our findings, we recommend that patients over 30 years of age, with presumed IHSS and angina pectoris undergoing hemodynamic and left ventricular arteriography, be studied with selective coronary arteriography so that the nature, distribution, and anatomy of the coronary arteries can be fully defined and assessed. Similarly, when patients with suspected CAD have atypical angina, obscure or changing murmurs, unusual response to therapy, brisk peripheral pulses or suggestive contours on tracings of the carotid or brachial arterial pressure pulse, appropriate measures should be taken before and during catheterization studies to assess the possibility of coexisting IHSS.

The detection of 10 patients with symptomatic IHSS and CAD during a 2-year period suggests that in the natural history of IHSS a significant number of patients survive to middle and advanced age, and develop coexistent CAD of sufficient severity to produce a complex clinical syndrome associated with mildly impaired left ventricular performance, disabling angina, abnormal electrocardiograms, and poor responsiveness to medical therapy.

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