Hypertrophic Obstructive Cardiomyopathy and Coronary Artery Spasm*

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Three patients had hypertrophic obstructive cardiomyopathy and coronary artery spasm. The clinical diagnosis of hypertrophic obstructive cardiomyopathy, in all patients, was confirmed by echocardiography and angiography. Significant spasm of the right coronary artery was demonstrated in each patient by selective coronary arteriography. One patient had atherosclerotic obstructive three vessel disease, while the other two showed no evidence of any fixed organic narrowing of the coronary arteries. ST segment elevation in the inferior ECG leads was documented in two of the patients in association with coronary spasm.

Hypertrophic obstructive cardiomyopathy is a disorder characterized by asymmetric hypertrophy of the interventricular septum associated with systolic anterior motion of the mitral valve leading to left ventricular outflow tract obstruction. Its major clinical features consist of angina, rhythm disturbances, presyncope and/or syncope, and congestive failure in later stages. Chest pain in these patients has been thought to result from a functional inadequacy of the coronary circulation to meet increased oxygen demands of the increased ventricular muscle mass and development of obstruction to left ventricular outflow. Although these mechanisms may explain chest pain in some patients, recently, other associated conditions have been found including coronary artery disease and septal artery perforator compression.1,2 We believe that vasospasm of the coronary arteries should also be considered as a potential cause of angina and syncope in such patients. This report describes three patients with hypertrophic obstructive cardiomyopathy who manifested evidence of significant coronary artery spasm proven at cardiac catheterization.

CASE REPORTS

CASE 1

A 64-year-old man was admitted with a two-month history of retrosternal pain, frequently precipitated by exertion. The pain was described as a tightness that occasionally occurring at rest and usually relieved by nitroglycerin. On the morning of admission, the patient had a syncopal episode after taking two nitroglycerin tablets for an episode of severe chest pain. The physical examination revealed blood pressure of 150/90 mm Hg and evidence of mild left ventricular prominence. The resting ECG revealed left ventricular hypertrophy. One ECG, however, during a spontaneous episode of chest pain (while the patient was awaiting treadmill testing), showed ST segment elevation in leads 2, 3 and aVF which resolved after administration of nitroglycerin. An echocardiogram demonstrated typical asymmetric septal hypertrophy with a septal posterior wall ratio of 2:1. There was no systolic anterior motion of the mitral valve. Cardiac catheterization showed no outflow gradient at rest, but postventricular premature beats showed a gradient of 130 mm Hg. The left ventriculogram revealed almost complete end systolic cavitory obliteration. No mitral regurgitation was observed. Coronary angiography revealed no demonstrable atherosclerosis. Focal spasm of the right coronary artery was visualized just distal to the acute marginal branch (Fig 1). No pain or ST segment changes were noted during the spasm. This completely disappeared following administration of two nitroglycerin tablets (Fig 2). The patient was placed on propranolol hydrochloride (Inderal), 20 mg four times daily, with marked symptomatic improvement.

CASE 2

A 52-year-old woman was admitted for evaluation of chest pain. Two weeks prior to admission, she awoke with severe left arm and chest pain associated with a "smothering" sensation. Following that, she noted dyspnea on exertion and four episodes of chest pain unrelated to physical activity. She experienced no syncopal spells. On admission, the blood pressure was 130/80 mm Hg. Cardiac examination revealed an S4 and a grade 2/6 harsh systolic murmur which increased in intensity during the Valsalva maneuver. The ECG was normal. An echocardiogram demonstrated asymmetric septal hypertrophy with septal to posterior wall ratio of 1.8 and mid-systolic closure of the aortic valve. Cardiac catheterization performed while the patient was receiving propranolol, 10 mg four times daily, revealed no resting gradient. A gradient of 20 mm Hg was noted following ventricular premature beats. Typical pulse bisfer...

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Figure 1. Case 1. Right coronary arteriogram (left anterior oblique projection). Note marked focal spasm just distal to the acute marginal branch (arrow) as well as diffuse narrowing of the vessel. A right anterior oblique projection (not shown) similarly demonstrated focal spasm.

Figure 2. Case 1. Post nitroglycerin showing almost complete reversal of the spasm.

Figure 3. Case 2. (A) ST segment elevation in leads 2 and 3 during chest pain. Note complete reversal post nitroglycerin (B).

Hypertrophic Obstructive Cardiomyopathy

Histologically, cardiomyopathy of the hypertrophic type with myocardial fibrosis is demonstrated. The clinical features of this syndrome include ventricular arrhythmias, decreased cardiac output, and ventricular murmurs. The clinical findings of this case are consistent with myocardial fibrosis. The clinical features of this syndrome include ventricular arrhythmias, decreased cardiac output, and ventricular murmurs. The clinical findings of this case are consistent with myocardial fibrosis. The clinical features of this syndrome include ventricular arrhythmias, decreased cardiac output, and ventricular murmurs. The clinical findings of this case are consistent with myocardial fibrosis.
A 52-year-old man presented with a 15-year history of exertional as well as nocturnal chest pain. He had occasional episodes of syncope, some of them occurring at rest and associated with precordial pain. Most of the episodes were relieved by nitroglycerin and/or rest. The blood pressure was normal. The cardiac examination revealed an S4 and a grade 2/6 systolic ejection murmur at the apex and left lower sternal border. The murmur increased in intensity during the Valsalva maneuver. The ECG demonstrated asymmetric septal hypertrophy and systolic anterior motion of the mitral valve. Cardiac catheterization revealed no resting gradient; however, a maximal intraventricular gradient of 160 mm Hg was observed following ventricular premature beats. Left ventricular angiogram revealed marked hypercontractility with mid-systolic ventricular cavity obliteration and 2+ mitral regurgitation. The coronary arteriogram revealed high grade fixed lesions in all three vessels. Right coronary injection revealed total occlusion of the vessel proximal to the acute marginal branch. After administration of one nitroglycerin tablet, the middle and distal right coronary artery was visualized. The patient was discharged on a regimen of isosorbide dinitrate (Isordil). 5 mg every four hours, sublingual, and propranolol, 10 mg four times daily with some symptomatic improvement.

**DISCUSSION**

The three patients herein described had echocardiographic, hemodynamic, and angiographic evidence of hypertrophic obstructive cardiomyopathy. All of them had chest pains with one or more episodes of pain occurring at rest. One of them had episodes of syncope occurring at rest associated with chest pain. Evidence of coronary artery spasm consisted of pain associated with ST segment elevation in two patients with angiographic demonstration of spasm in all three. Catheter induced spasm was unlikely for the following reasons: (1) spasm occurred in association with pain and ST segment elevation in two patients, not usually observed in catheter spasm, and (2) the spasm occurred remote from the catheter's tip in the two
patients and at the tip in association with diffuse spasm in the third patient. The latter patient also had pain and ST segment elevation.

Until recently, the occurrence of angina and syncope in hypertrophic obstructive cardiomyopathy was believed to be due to the development of left ventricular outflow tract obstruction and to the demand of the hypertrophied myocardium exceeding its blood supply. In a recent review of 118 patients with idiopathic hypertrophic subaortic stenosis, Landani et al. found that 20 percent of their patients had co-existent coronary arteriosclerosis. No mention of coronary vasospasm was made.

Occurrence of coronary artery spasm in association with hypertrophic obstructive cardiomyopathy previously has not been recognized. The three patients described herein demonstrated exertional angina as well as certain features of variant angina with episodic rest and nocturnal chest pains. One gave a history of episodes of syncope at rest associated with development of chest pain. The role of coronary artery spasm in the genesis of these patients’ symptoms of chest pain and syncope is not clear and conceivably could be fortuitous. It has been suggested, however, that patients with hypertrophic obstructive cardiomyopathy have an abnormal myocardial response to normal levels of catecholamines. This finding is supported by the experimental observations that subhypertensive norepinephrine infusion can produce left ventricular hypertrophy and increased ejection fractions in dogs. Left ventricular hypertrophy and increased ejection fraction are characteristic of hypertrophic obstructive cardiomyopathy. Yasue et al. have shown coronary artery spasm on angiography induced by subcutaneous injections of epinephrine. Thus, if the mechanism for hypertrophic obstructive cardiomyopathy is increased myocardial responsiveness to catecholamines, it is possible that the coronary arteries of these patients may behave in a similar fashion and be prone to vasospasm.

The symptoms of angina and syncope in patients with hypertrophic obstructive cardiomyopathy have been demonstrated to occur regardless of the presence or absence of left ventricular outflow tract obstruction. In addition, sudden death may occur as the initial manifestation of the disease and has occurred in the asymptomatic relatives of patients known to have hypertrophic obstructive cardiomyopathy. Thus, the mechanism for symptoms of angina, syncope, and sudden death in some patients is unclear and raises the distinct possibility that coronary artery spasm may be the cause.

In summary, we postulate that coronary artery spasm may play a significant pathologic role in some patients with hypertrophic obstructive cardiomyopathy, causing symptoms of chest pain, rhythm disturbances, syncope, and even sudden death. Further studies will be required to clearly establish the magnitude of the role of coronary artery spasm in the pathophysiology of this disorder.

REFERENCES