Asymmetric Septal Hypertrophy in Patients on Long-Term Hemodialysis*

Abdul S. Abbasi, M.D.; James C. Slaughter, M.D.; and Marty W. Allen

Echocardiographic studies were performed in 23 hypertensive patients who were receiving therapy with long-term hemodialysis. Five patients (22 percent) had normal thickness of the left ventricular wall. Eleven (48 percent) had symmetric left ventricular hypertrophy, and seven (30 percent) showed asymmetric septal hypertrophy, with a ratio of septal to posterior wall thickness of 1.3 or greater. The latter group differed from patients with hypertrophic cardiomyopathy in that patients on long-term hemodialysis had a dilated left ventricular dimension, a relatively normal diastolic slope of the mitral valve, absence of systolic motion of the mitral valve, and a septal to posterior wall ratio of less than 1.5. A high incidence of asymmetric septal hypertrophy in this and other studies indicates that this condition is not specific for hypertrophic cardiomyopathy. We suggest that in addition to asymmetric septal hypertrophy, the diagnosis of hypertrophic cardiomyopathy should be made in the light of the clinical picture, as well as other echocardiographic features.

A symmetric septal hypertrophy is said to be the echocardiographic hallmark of hypertrophic cardiomyopathy; however, more recently, asymmetric septal hypertrophy has been reported with pulmonary hypertension and in patients with severe systemic hypertension. A relatively high incidence of asymmetric septal hypertrophy has also been described with congenital or acquired heart disease, as well as in normal athletes. In this communication, we report the findings in patients receiving long-term therapy with hemodialysis, in whom asymmetric septal hypertrophy was found with a high frequency.

Materials and Methods

Selection of Patients

Twenty-three consecutive patients receiving long-term therapy with hemodialysis who had a documented history of hypertension (diastolic blood pressure over 90 mm Hg) were included in this study. All of the patients had been receiving antihypertensive drugs. These patients had end-stage renal failure, with permanent peripheral arteriovenous shunts for long-term hemodialysis. There was no known cardiac disease or history of sudden death in their families. A soft systolic murmur between grades 1 to 3/6 was recorded at the lower left sternal border or apex in ten patients. The systolic murmur did not increase during the Valsalva maneuver in any patient. Echocardiographic studies were performed on the day of hemodialysis, prior to this procedure. Echocardiograms of the first-degree relatives of these patients were also recorded.

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Echocardiographic Technique

The echocardiograms were obtained with Hoffuel echocardiographic equipment and strip-chart recorder (Honeywell 1856), using a 2.25-MHz transducer with a 7.5-cm focus. The conventional motion-mode was used, as described in the literature. The patients were placed in the supine position with 30° left lateral rotation. The transducer was placed in the fourth or fifth left intercostal space close to the sternum. An attempt was made to record the mitral valve first from a place on the thoracic wall, with orientation of the beam perpendicular to the mitral valve. Several scans were then recorded from the root of the aorta to the left ventricular apex.

The following measurements were obtained: (1) left ventricular end-diastolic dimension at the peak of the R wave of a simultaneously recorded electrocardiogram; (2) early diastolic slope of the mitral valve (E-F slope); and (3) diastolic thickness of the posterior wall and interventricular septum at or just below the mitral valve. The latter two measurements were made prior to atrial systole. Left ventricular hypertrophy was diagnosed if the interventricular septal thickness was greater than 1.2 cm. If the ratio of the ventricular septal to posterior wall thickness was less than 1.3, the left ventricular hypertrophy was designated as symmetric. When the ratio of the ventricular septum to the posterior wall was 1.3 or greater, asymmetric septal hypertrophy was diagnosed.

Results

There were 12 men and 11 women. Their ages ranged from 20 to 60 years. Five patients (22 percent) showed no evidence of left ventricular hypertrophy. Eleven patients (48 percent) had symmetric left ventricular hypertrophy. Seven (30 percent) showed asymmetric septal hypertrophy.

The mean age, duration of therapy with hemodialysis, and blood pressure were compared in patients with symmetric left ventricular hypertrophy and
Table 1—Mean Age, Duration of Therapy with Hemodialysis, and Blood Pressure*  

<table>
<thead>
<tr>
<th>Data</th>
<th>Symmetric Left Ventricular Hypertrophy</th>
<th>Asymmetric Septal Hypertrophy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ratio of thickness of interventricular septum to left ventricular posterior wall</td>
<td>&lt;1.3</td>
<td>&gt;1.3</td>
</tr>
<tr>
<td>Age of patients, yr</td>
<td>40 ± 16</td>
<td>32 ± 12</td>
</tr>
<tr>
<td>Duration of therapy with hemodialysis, mo</td>
<td>31 ± 23</td>
<td>11 ± 10</td>
</tr>
<tr>
<td>Blood pressure, mm Hg</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Systolic</td>
<td>153 ± 16</td>
<td>181 ± 22</td>
</tr>
<tr>
<td>Diastolic</td>
<td>90 ± 7</td>
<td>104 ± 10</td>
</tr>
</tbody>
</table>

*Table values are means ± SD.

those with asymmetric septal hypertrophy (Table 1). There was no difference in age between the two groups. The mean duration of therapy with hemodialysis was longer in patients with symmetric left ventricular hypertrophy; however, this difference was mainly due to two patients who were receiving therapy with hemodialysis for more than four years. The blood pressures were significantly higher in patients with asymmetric septal hypertrophy.

The distribution of septal and posterior wall thicknesses, the size of the left ventricular cavity, and the diastolic slope of the mitral valve in the patients with asymmetric septal hypertrophy are shown in Table 2. The mean ratio of septal to posterior wall thickness obtained in this series was less than 1.5. The left ventricular dimension was greater than normal (normal, less than 5.4 cm) in all but one patient. The mean diastolic slope of the mitral valve was within normal limits (normal, 60 to 150 cm/sec), although in two cases, this slope was abnormally reduced.

**Discussion**

In two previous studies of patients with systemic hypertension and aortic stenosis,2,3 the ratio of the ventricular septum to the posterior left ventricular wall was found to be less than 1.3; however, one recent study4 reported a high incidence of asymmetric septal hypertrophy with ratios of 1.3 or higher in patients with malignant hypertension. Thus, the severity of hypertension may be a factor causing asymmetric septal hypertrophy. In the present study, patients with asymmetric septal hypertrophy tended to have higher blood pressures, as compared to those who had symmetric left ventricular hypertrophy. One added factor present in this series was the creation of arteriovenous fistulae, which in some way might be responsible for asymmetric septal hypertrophy; however, the duration of therapy with hemodialysis did not seem to distinguish between symmetric and asymmetric left ventricular hypertrophy. It is possible that the reduction in afterload by drugs may stimulate excessive release of catecholamines, which may induce septal hypertrophy. Asymmetric septal hypertrophy has been found in dogs exposed to long-term infusion of norepinephrine11 or nerve growth factor.12 Thus, it appears that a variety of stimuli may induce asymmetric septal hypertrophy.

In the present study, certain features (Fig 1) helped to distinguish the patient with asymmetric septal hypertrophy from patients with proven hypertrophic cardiomyopathy. Patients receiving therapy with hemodialysis had a left ventricular cavity that was usually larger than normal, while patients with hypertrophic cardiomyopathy tend to have relatively small left ventricular dimensions4 with a compromised left ventricular outflow tract.13,14 The diastolic slope of the mitral valve (E-F slope) was generally within normal limits in the patients being treated by hemodialysis. Furthermore, systolic anterior motion of the mitral valve was never seen in these patients. Although the ratio of septal to posterior wall thickness was 1.3 or higher, no ratio exceeded 1.5 in this series. The patients in this study were not submitted to cardiac catheterization; however, the absence of a family history of hypertrophic cardiomyopathy and the absence of septal hypertrophy in the members of the immediate family make it very unlikely that concomitant hypertrophic cardiomyopathy was present.

Asymmetric septal hypertrophy has been considered to be a sensitive marker of hypertrophic

Table 2—Data from Seven Patients with Asymmetric Septal Hypertrophy  

<table>
<thead>
<tr>
<th>Thickness, cm</th>
<th>Interventricular Septum</th>
<th>Left Ventricular Posterior Wall</th>
<th>Ratio*</th>
<th>Left Ventricular End-Diastolic Dimension, cm</th>
<th>E-F Slope, cm/sec</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case</td>
<td>1</td>
<td>1.8</td>
<td>1.3</td>
<td>1.38</td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>1.3</td>
<td>1.0</td>
<td>1.30</td>
<td>5.6</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1.5</td>
<td>1.1</td>
<td>1.36</td>
<td>5.8</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2.0</td>
<td>1.4</td>
<td>1.42</td>
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</tr>
<tr>
<td></td>
<td>5</td>
<td>1.4</td>
<td>1.0</td>
<td>1.40</td>
<td>6.5</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>1.3</td>
<td>1.0</td>
<td>1.30</td>
<td>4.8</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>1.5</td>
<td>1.1</td>
<td>1.36</td>
<td>5.6</td>
</tr>
<tr>
<td>Mean ± SD</td>
<td>1.5 ± 0.2</td>
<td>1.1 ± 0.2</td>
<td>1.4 ± 0.5</td>
<td>5.7 ± 0.5</td>
<td>70 ± 21</td>
</tr>
</tbody>
</table>

*Ratio of thickness of interventricular septum to left ventricular posterior wall.

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cardiomyopathy. It is becoming apparent, however, that asymmetric septal hypertrophy is by no means specific for this disease. In previous communications,\textsuperscript{5,11,13} we suggested that the combination of a higher ratio of septal to posterior wall thickness (1.5 or greater) with an absolute thickness of the septum of 1.5 cm or more may be more specific for hypertrophic cardiomyopathy. However, there are documented cases of hypertrophic cardiomyopathy with a septal to posterior wall ratio of 1.3 that will be missed by using the higher ratio as a criterion.\textsuperscript{6,7} Furthermore, a higher septal to posterior wall ratio has been found in patients without evidence for hypertrophic cardiomyopathy.\textsuperscript{5,8}

Although asymmetric septal hypertrophy is an essential feature of hypertrophic cardiomyopathy, it is nonspecific by itself. Therefore, we suggest that hypertrophic cardiomyopathy should not be diagnosed only on the basis of asymmetric septal hypertrophy. Echocardiographic features that should be considered as criteria include the following: (1) asymmetric septal hypertrophy;\textsuperscript{1,5} (2) a normal to small left ventricular cavity with an increased ejection fraction;\textsuperscript{1,5,12,13,15} (3) reduced septal motion, with normal to increased motion of the posterior wall;\textsuperscript{17} (4) systolic anterior motion of the mitral valve;\textsuperscript{14,16} (5) proximity of the mitral valve to the ventricular septum (reduced left ventricular outflow);\textsuperscript{10,13-16} (6) reduced diastolic slope of the mitral valve;\textsuperscript{1,14} and (7) midsystolic closure of the aortic valve.\textsuperscript{18} Both clinical and echocardiographic features should be considered, in addition to asymmetric septal hypertrophy (preferably with an absolute septal thickness of 1.5 cm or greater), for the diagnosis of hypertrophic cardiomyopathy. Finally, a proper technique for obtaining adequate echoes and for measuring the septal and posterior wall cannot be overemphasized.

\textbf{ADDENDUM}

Since the submission of this manuscript, asymmetric septal hypertrophy with a ratio of septal to posterior wall thickness higher than 1.5 has been noted in two patients receiving therapy with hemodialysis.

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