Two-dimensional Echocardiographic Evaluation of Aneurysms of the Descending Thoracic Aorta

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SUMMARY To determine the ability of two-dimensional echocardiography (2-D echo) to detect aneurysms and dissections of the descending thoracic aorta (DTA), we studied 15 patients, five with proved DTA dissections (group A) and 10 with proved aneurysms without dissection (group B), using 2-D echo in three recording positions: precordial, suprasternal and a modified apical. The DTA was visualized in 14 of 15 patients (93%); in each patient in group A, an intimal flap was recognized (in two patients only by the apical approach and in one patient by all approaches). The DTA was visualized in nine of 10 patients in group B; in each patient, the internal dimension of the DTA was enlarged (25-43 mm/m²). In one group B patient, aortic dissection was erroneously suspected because spurious echoes were present in the lumen; in another patient, 2-D echo failed to demonstrate a thrombotic stratification in the enlarged lumen. We conclude that 2-D echo using all available approaches appears to be a reliable technique for evaluating dissections and aneurysms of the DTA.

ACUTE DISSECTION of the aorta is an emergency that requires not only a prompt diagnosis, but also an accurate knowledge of the origin and the extension of the dissection to choose between medical and surgical therapy. Aortography is the most definitive method for diagnosing dissection and evaluating its extension. The feasibility of using two-dimensional echocardiography to examine the entire thoracic aorta has been assessed. The reliability of two-dimensional echocardiographic diagnosis of aneurysms and dissections has been proved for the ascending aorta, but experience with this technique in demonstrating aneurysms and dissections of the descending thoracic aorta (DTA) is very limited.

In this report, we present the two-dimensional echocardiographic findings in 15 consecutive patients with aneurysms or dissections of the DTA.

Materials and Methods

Fifteen consecutive patients, five with angiographically proved DTA dissection (group A) and 10 with angiographically proved DTA aneurysms without dissection (group B), were studied by two-dimensional echocardiography. Retrograde arterial catheterization was performed using the percutaneous femoral approach in four patients in group A and in seven patients in group B. In the remaining patients, catheterization was performed from the arm through a brachial arteriotomy.

Cineangiography was obtained in the anteroposterior and the 60° left anterior projections on 35-mm film at 60 frames/sec. After test injections of contrast material to determine the location of the catheter tip, the aorta was opacified with injections of 40–60 ml of Urografin (Schering) using a power injector directly connected to a pigtail catheter. An intimal flap floating in the lumen during the cardiac cycle was demonstrated in the five patients in group A; a low-pressure injection of contrast material into the false lumen helped to show its exact morphology and extension. A dissection extending from the aortic root to the aortiiliac bifurcation was demonstrated in two patients; in the three other patients, the dissection originated distal to the left subclavian artery and reached the iliac arteries in two patients and the renal arteries in the third. In the 10 patients in group B, aortography revealed aneurysms without dissection; in all 10 patients, the aneurysms were fusiform and involved most of the aortic circumference. In three patients, the aneurysms involved the entire thoracic aorta, in three the aortic arch and the DTA, and in four the DTA and a variable portion of the abdominal aorta.

Two-dimensional echocardiographic examinations were performed with a Toshiba SL-53 M phased-array system. The DTA was visualized in a transverse or oblique section in the precordial long-axis view and in a series of continuous short-axis views from the level of the ascending aorta to the level of the papillary muscles. Longitudinal views of the DTA were obtained from the precordium with the transducer placed several centimeters from the left sternal border. The plane of sweep was then oriented in a superoinferior direction and directed medially to visualize the DTA in its long axis. A long-axis view of the upper DTA was obtained with the transducer in the suprasternal notch and angled to obtain a plane passing between the right nipple and left scapular tip.

The DTA was also visualized by a modified apical approach used in our laboratory. The transducer was placed in the proximity of the apex, and the plane of sweep was primarily directed perpendicular to the sternal to image the short axis of the DTA; subsequently, the sweep plane was rotated 90° clockwise and directed medially to visualize longitudinally the lower part of the DTA (fig. 1). To substantiate these two modified apical views anatomically, a two-dimensional echocardiographic examination was performed during transfemoral diagnostic cardiac catheterization in five patients. The DTA was identified by visualizing, within the echo-free space interpreted as the DTA, the echoes reflected by the catheter after its introduction in the ascending aorta.

When the DTA was imaged, the gain settings were

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adjusted to ensure maximal resolution and image quality. The two-dimensional echocardiographic images were permanently recorded on a 1/2-inch videotape cassette for further analysis.

The success rate in visualizing the DTA with two-

Figure 1. Long-axis view of the descending aorta (DA) obtained from a modified apical approach. The DA is the tubular structure located behind the left ventricle (LV). A = anterior; I = inferior; P = posterior; S = superior.

Figure 2. Patient 2. Precordial long-axis echocardiogram in a patient with a type I dissection. An intimal flap separating the true from the false lumen of the aorta is visualized both in the ascending aorta (AO) and in the descending thoracic aorta (DTA). RV = right ventricle; IVS = interventricular septum; LV = left ventricle; LA = left atrium.

Figure 3. Apical long-axis view of the descending thoracic aorta (DTA) in the same patient as in figure 2. The arrows indicate the initial tear in the lumen. A = anterior; I = inferior; P = posterior; S = superior.

Figure 4. Apical short-axis view of the descending thoracic aorta (DTA) in patient 3. An intimal tear (arrow) separates the true lumen from the false lumen. LV = left ventricle; LA = left atrium; AO = ascending aorta.
dimensional echocardiography has been assessed in our laboratory. In 150 unselected, consecutive adult patients, the DTA was visualized by the precordial approach in 60% of patients and by the apical approach in 80%; in 80% of patients, the DTA was imaged at least by one approach.

The anteroposterior internal dimension of the DTA was measured during diastole in the precordial long-axis view; the DTA in this projection is generally located behind the atroventricular groove. Measurements were normalized for body surface. Two-dimensional echocardiographic examination was performed and interpreted before angiographic study in three patients in group A (patients 1, 2 and 3) and in seven patients in group B.

Computed tomography of the chest was performed with a second-generation-type scanner in seven patients in group B. With the patient supine, the entire chest was scanned; the slices were contiguous and 13 mm thick. Scanning was performed before and after peripheral injection of contrast material.

**Results**

Adequate-quality images of the DTA were obtained in 14 of 15 patients (93%).

**Group A**

The data from patients in group A are presented in table 1. Two-dimensional echocardiographic study clearly showed an intimal flap dividing the true lumen from the false lumen in all five patients. In four of the five cases, both short-axis and long-axis views of the DTA showing the intimal flap were obtained (figs. 2–4). In two patients, the DTA was imaged only by the apical approach, in one patient only by the precordial approach and in one patient by all approaches (precordial, suprasternal and apical).

The anatomic section of the DTA in patient 3, presumably obtained along the same echocardiographic plane illustrated in figure 4, is shown in the figure 5; the close similarity between the two images of the DTA is evident. In patient 5, the intimal tear was visualized only from the suprasternal approach (fig. 6), although the DTA was also visualized by the apical approach.

In the three patients studied before catheterization, a correct preangiographic diagnosis of dissection was made.

**Group B**

The DTA was visualized in nine of the 10 patients in group B. All the patients with computed tomographic or angiographic documentation of DTA aneurysms had an enlarged DTA internal dimension (25–43 mm/m²) at the cross-sectional echocardiographic study. In one patient, a dissection was erroneously suspected because spurious echoes in the lumen were interpreted as reflections by an intimal flap. These spurious echoes were not reproducible in other planes and were present only when the DTA was imaged longitudinally. In another patient, echocardiography (fig. 7) failed to demonstrate conspicuous thrombotic stratification in the DTA lumen that was, conversely, well demonstrated by aortography and computed tomography after an intravenous bolus injection of contrast material (fig. 8).

**Discussion**

Dissecting aortic aneurysms frequently involve the DTA. The ability of echocardiography to show dissections and aneurysms of the ascending aorta has been documented. Some authors have shown that the DTA can be visualized in different echocardiographic tomographic planes.

The success rate in visualizing the DTA by at least one approach (precordial or apical) among the 15 patients was 93%. This higher value (80% in unselected patients) can be explained by the closer contact be-

**Table 1. Patients with Dissection of the Descending Thoracic Aorta (Group A)**

<table>
<thead>
<tr>
<th>Pt</th>
<th>Age (years)</th>
<th>Sex</th>
<th>Type of dissection*</th>
<th>Main symptoms</th>
<th>Confirmed</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50</td>
<td>F</td>
<td>III</td>
<td>Chest pain</td>
<td>Angio</td>
<td>Died during surgery</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Heart failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>71</td>
<td>M</td>
<td>I</td>
<td>Heart failure</td>
<td>Angio</td>
<td>Died one day after angio</td>
</tr>
<tr>
<td>3</td>
<td>69</td>
<td>M</td>
<td>III</td>
<td>Heart failure</td>
<td>Angio; post-mortem study</td>
<td>Died</td>
</tr>
<tr>
<td>4</td>
<td>44</td>
<td>M</td>
<td>I</td>
<td>Chest pain</td>
<td>Angio</td>
<td>Alive and well after surgery</td>
</tr>
<tr>
<td>5</td>
<td>51</td>
<td>F</td>
<td>III</td>
<td>Chest pain</td>
<td>Angio</td>
<td>Alive and well, no surgery</td>
</tr>
</tbody>
</table>

*Type of dissection according to DeBakey's classification.

**FIGURE 5. Patient 3. Anatomic section of the descending thoracic aorta (DTA), obtained presumably along the same tomographic plane as in figure 7. The arrow indicates the intimal tear.**
Figure 6. Suprasternal notch echocardiogram of the upper descending thoracic aorta (DTA) in patient 5 (type III dissection). The intimal tear (arrows) leaves below the takeoff of the left subclavian artery (LSA).

Figure 7. Apical short-axis view of the descending thoracic aorta (DTA) in a group B patient. The DTA is markedly enlarged. LV = left ventricle; RV = right ventricle.

Figure 8. Computed tomographic scan of the chest after injection of contrast material (C) in the same patient as in figure 7. The separation (arrows) between the contrast material and the walls of the descending thoracic aorta is caused by the presence of thrombotic stratification (T) in the lumen.

tween the heart and the enlarged DTA in patients with aneurysms, which allow better ultrasound transmission to the DTA walls.

In each patient in group A, echocardiography allowed a correct diagnosis when all available approaches were used. However, the intimal flap was not visible in all the tomographic views of the DTA. Two factors could explain this lack of visualization. First, because of its spiral nature, the aortic tear can lie in a plane tangential or parallel to the echo beam, and so an artifactual dropout of echoes may occur. Second, it is not always possible to obtain adequate-quality tomographic sections in every patient, as there are many limiting technical factors.

A diagnosis of dissection can be considered certain only when the echoes presumably caused by the intimal flap are seen in at least two views of the DTA; a dissection can be only suspected when such echoes are visible in only one view. In fact, in one patient in group B, dissection was erroneously suspected from the presence of spurious echoes in the lumen, probably caused by too high a gain setting. These echoes were discontinuous, not reproducible and present only when the DTA was imaged longitudinally.

In another patient, two-dimensional echocardiography failed to demonstrate thrombus in the enlarged DTA lumen, probably because the gain setting was very low.

In conclusion, two-dimensional echocardiography in all the available approaches appears to be a reliable technique for evaluating aneurysms and dissections of the DTA. Studies of larger numbers of patients are required to assess the sensitivity and specificity of this method.

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