Is Transesophageal Echocardiography the New Standard for Diagnosing Dissecting Aortic Aneurysms?

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Aortic dissection is a medical or surgical emergency, or both, that is catastrophic if not diagnosed and treated promptly. In untreated patients with acute aortic dissection, the mortality rate is 60% within 24 h of presentation, 80% within 2 weeks and 90% within 3 months (1). Chronic dissection can occur in 10% of patients and may be found incidentally without an antecedent history of severe chest pain or can present with symptoms of congestive heart failure (2-4). In addition to aortic rupture, complications include pericardial tamponade, aortic regurgitation and coronary dissection with development of acute myocardial infarction. The incidence of pericardial effusion is 5% to 21% (5); aortic regurgitation has been reported to occur in 35% of patients with aortic dissection, but may be as high as 62% in DeBakey type I and type II (type A) aortic dissections (5,6).

Myocardial wall motion abnormalities related to myocardial infarction occur in 1% to 4% of patients (5,6).

Two-dimensional echocardiography and Doppler echocardiography. To increase the sensitivity and specificity of two-dimensional echocardiography in the diagnosis of aortic dissection, optimal visualization of the entire aorta is required and multiple on- and off-axis views from multiple imaging planes should be obtained (7,8). The hallmark of aortic dissection by transthoracic two-dimensional echocardiography is the demonstration of an abnormal linear echo in the lumen of the aorta in more than one scan plane (7-9). The linear echo may be stationary or have undulating motion. Additional echocardiographic and Doppler findings include dilation of the aorta, aortic regurgitation and pericardial effusion, although minor additional criteria have also been described (5,10). A variety of conditions may lead to false positive diagnoses that include reverberating artifacts from calcific aortic valve disease or a sclerotic aortic root, catheter in the right ventricular outflow tract or pulmonary artery, fluid in the transverse pericardial sinus, intramural aortic abscess or intramyocardial abscess and dilated sinus of Valsalva (10).

With the addition of Doppler color flow mapping, imaging of the entry site (and, on occasion, exit site) and false and true lumen flow patterns and semiquantitation of the degree of aortic regurgitation are possible (11,12). The disadvantages of two-dimensional echocardiography include its inability to image the aorta adequately (in up to 15% of patients) (9), especially the descending aorta for DeBakey (Type III or Type B) aortic dissection. Even though a modified apical approach has been introduced to visualize the entire descending thoracic aorta (13), visualization of the intimal flap is not always possible. Notwithstanding these limitations, the sensitivity of two-dimensional echocardiography has been reported to range between 79% and 100% and the specificity is 90% (7,9,14).

Transesophageal echocardiography. Transesophageal echocardiography provides a new acoustic window to interrogate the ascending aorta, arch, descending and abdominal aorta and branches of the aorta (15) and can readily be performed within 15 min (6). Because of the proximity of the transducer to the posterior cardiac structures and aorta, high quality images are obtained. The technique in evaluating patients with suspected aortic dissection has been extensively described by several investigators (6,15-20). Most studies (15,16) have utilized single plane sector scanning probes that enable medial to lateral scanning, and cross-sectional images of the aorta at multiple levels are obtained. In the current issue of the Journal, Hashimoto et al. (17) describe a biplane scanning technique utilizing a longitudinal scanning probe that provided a scanning plane parallel to the axis of the probe. This allowed visualization of the aorta in a longitudinal manner, as compared with the lateral scanning technique; therefore, a more complete view of the aorta is obtained. However, two different probe insertions were required, a factor that may add to the length of the procedure. With the addition of color flow mapping, high velocity jets or turbulent flow through entry sites can be detected (11,15,17). Comparing the results of transthoracic and transesophageal echocardiography in 22 patients, an intimal flap was detected in 100% by transesophageal echocardiography in all four segments of the aorta (i.e., in ascending aorta, aortic arch, thoracic descending aorta and upper abdominal aorta) compared with an average 50% detection rate by transthoracic echocardiography (17). In addition, the entry site was detected in 100% of cases using the trans-
esophageal as compared with 42% by the transthoracic approach. In another, larger reported study of 164 patients with suspected aortic dissection (82 proved), Erbel et al. (6) compared transesophageal with transthoracic echocardiography, as well as with angiography and computed tomographic scanning. Transesophageal echocardiography improved the sensitivity to 99% and specificity to 98%. Only one false negative result occurred in a patient with type II dissection, and in that instance angiography also failed to demonstrate the dissection. Two false positive studies were reported as a result of reverberations within the ascending aorta (6). The distinction between aortic dissection and a perforated atherosclerotic plaque with an intimal hematoma may not always be possible by conventional transthoracic or transesophageal echocardiography. Limitations of the latter approach include a blind zone involving the upper portion of the ascending aorta that occurs as a result of the overlying air-filled trachea. In addition, transesophageal echocardiography is contraindicated in patients with underlying esophageal disorders. Side effects are rare, occurring in 1% of patients, and include asthma and transient AV block (19).

Comparison of echo-Doppler echocardiography with other diagnostic techniques. High resolution computed tomography combined with dynamic scanning is accurate in detecting the intimal flap. Thickening of the aortic wall and calcification in the intima is more reliably predicted with computed tomographic scanning than with aortography or nuclear magnetic resonance (NMR) imaging. However, X-ray computed tomography is not capable of recognizing entrant and reentrant sites (16). Studies are obtained within 30 to 60 min and, although pericardial effusion can be recognized, aortic regurgitation cannot be evaluated accurately. Patients undergoing X-ray computed tomography require a contrast agent to visualize the intimal flap, and this may be a limiting factor in patients with chronic renal disease. Nevertheless, computed tomography has been found to be 83% to 100% sensitive and 92% to 100% specific (16,21–25). NMR imaging does not require any contrast medium and allows clear differentiation of blood flow signals from vessel wall signals and can demonstrate the intimal flap (26–29). In addition, true and false channels are well delineated. The ability to visualize the entire aorta and its branches in three planes (transverse, coronal and sagittal sections) makes this technique most attractive. Gating and the use of a multi-echo, multislice technique add to the sensitivity. However, the ability to separate slow flow in a false lumen from thrombus formation is not always possible. Other disadvantages of NMR imaging include length of study (20 to 40 min), its use only in hemodynamically stable and noncritically ill patients not being treated with ventilators and contraindications to its usage in patients with a metallic prosthetic valve or pacemaker. To date, no extensive study has been performed to assess the sensitivity and specificity of NMR imaging in the diagnosis of acute aortic dissection.

Aortography is one of the most reliable techniques in diagnosing aortic dissection, but limitations due to structural overlap, complications of cardiac catheterization and the use of contrast injection as well as high cost are limiting factors. Although several investigators have reported a sensitivity of 91% to 100% and a specificity of 100% (30), a recent study (6) reported a sensitivity of 88% and a specificity of 94%. In addition, angiography does not permit direct detection of thrombus formation or visualization of a false lumen when it is completely thrombosed (31). Nevertheless, aortography does provide important information with regard to side branch vessels and coronary artery involvement.

Conclusions. Transesophageal echocardiography, especially using two different sector scanning probes and Doppler color flow mapping, provides accurate anatomic information in patients with aortic dissection. This approach complements transthoracic echocardiography, especially for imaging the distal thoracic aorta. Intimal flaps, entrance sites, differentiation of true from false lumen, semiquantitation of aortic regurgitation, detection of pericardial effusion and recognition of wall motion abnormalities make transesophageal echocardiography with color flow mapping an expedient technique in evaluating patients with suspected aortic dissection.

References


