Acute Aortic Dissection

The Need for Rapid, Accurate, and Readily Available Diagnostic Strategies

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Aortic dissection may be fatal without early diagnosis and appropriate medical, surgical, or endovascular treatment. The presenting symptoms and signs are so myriad and nonspecific that dissection may be overlooked initially in up to 40% of cases. In addition, the diagnosis is established only postmortem in a substantial number of cases. Few other conditions demand such prompt diagnosis and treatment, because the mortality rate of untreated dissection approaches 1%/h during the first 48 hours, 80% at 14 days, and 90% at three months. If unrecognized and untreated, fewer than 10% of patients with proximal aortic dissection survive a year. Most patients succumb within the first 3 months, usually of acute aortic insufficiency, major branch vessel occlusion, or rupture into the pericardium, mediastinum, or left hemithorax. In 20 years of follow-up of 527 patients with aortic dissection, nearly 30% of late deaths were due to ruptured aortic aneurysm.

The most frequently used modalities to identify dissection and define the sites of origin and termination are computerized tomography (CT), transesophageal echocardiography (TEE), and magnetic resonance (MR) imaging. The primary diagnostic criterion for diagnosis of aortic dissection by CT is demonstration of two contrast-filled lumens separated by an intimal flap. The sensitivity of CT ranges from 93% to 100% and specificity from 87% to 100%. Inaccuracy may result from inadequate contrast opacification, nonvisualization of the intimal flap, artifacts extending across the aortic lumen that simulate an intimal flap, misinterpretation of adjacent vessels or prominent sinus of Valsalva as the flap, atelectasis, pleural thickening, or thrombosis of the false lumen. Multidetector-row CT scanners offer more rapid image acquisition, variable section thickness, 3-dimensional rendering, diminished helical artifacts, and smaller contrast requirements, overcoming many of the limitations discussed above.

The sensitivity and specificity of MR imaging for diagnosis of aortic dissection has been reported between 95% and 100%. Magnetic resonance angiography and imaging enables identification of the entry tear and the extent of dissection, defines the anatomy of the vessels arising from the aortic arch, visceral vessels and the iliac and common femoral arteries, and measurement of blood flow velocities in both the true and false lumens. When the false lumen is thrombosed, the dissection may be overlooked and give the appearance of an intact aneurysm. Other shortcomings are inaccessibility of the patient for 30 to 60 minutes during image acquisition and unsuitability of the method for those with implanted electronic devices.

TEE provides rapid multiplane imaging of the aorta and heart as well as assessment of flow dynamics. The examination can be performed soon after the patient presents to the emergency department and has a sensitivity of 95% to 98% and specificity of 63% to 96%. Limitations are that the coronary arteries and the arch vessels may not be adequately visualized, extension into the visceral or iliac arteries may go undetected, there is a blind spot in the proximal aortic arch, and the quality of the study is operator dependent.

Multidetector-row CT scanners offer more rapid image acquisition, variable section thickness, 3-dimensional rendering, diminished helical artifacts, and smaller contrast requirements, overcoming many of the limitations discussed above. These investigators developed an ELISA system for measuring SELAF in the serum that was accurate and reproducible. They also demonstrated the usefulness of measuring SELAF in the acute phase of aortic dissection. Soluble elastin fragments were measured shortly after admission in 25 patients with acute aortic dissection, 50 patients with acute myocardial infarction, 20 patients with chest pain and no AAD or MI, 40 hypertensive patients receiving no medica-
tion, and 474 healthy controls. Seventeen patients had proximal dissection, and 8 had distal dissection. The authors set the cutoff point for positively at the mean+3SD above the mean of healthy subjects and demonstrated that the specificity was 99.8% (473 of 474), the positive predictive value was 94.1% (16 of 17), and the negative predictive value was 98.8% (473 of 482).

These data provide compelling evidence that measurement of sELAF are accurate in excluding patients who do not have AAD and identifying those who do. However, before acceptance of this technique for the routine diagnosis of AAD, there are several issues that need to be addressed. This was a retrospective study; therefore, these data need to be confirmed in a prospective analysis of patients with acute aortic dissection. Secondly, the measurement of serum elastin fragments require 3 hours to perform. Because every minute counts in acute aortic dissection, one could make the argument that this test adds nothing to the current imaging modalities that are often available within minutes at most major medical centers. In addition, even if the diagnosis was made with 100% certainty with sELAF measurement, one would still need an imaging modality to determine the location of the dissection and thus the most appropriate therapy for an individual patient. However, if the test could be performed quickly, and was negative, it may preclude the need for an imaging study in some patients. In other words, if a rapid assay can be developed and prospective studies confirm the excellent negative predictive value of this test, measurement of sELAF could become the initial test to rule out acute aortic dissection.

Perhaps the most significant limitation of this methodology is that patients with acute aortic dissection with a thrombosed false lumen do not have elevations in sELAF. Detection of the false lumen is a limitation of some of the imaging techniques as well. The cornerstones of long-term management of survivors of acute aortic dissection are β-adrenergic blockade and meticulous blood pressure control. Regardless of the initial management strategy, patients should undergo periodic surveillance imaging by MR or CT every 6 to 12 months to monitor the diameter of the aorta the extent of dissection and the status of the repair that might require additional intervention. Clinical events or significant radiographic changes in the extent of dissection or diameter of the aorta warrant consideration for repair, because enlargement of the false channel and late rupture is the most common cause of death following the initial event.

Additional questions need to be answered regarding the role of sELAF in two other closely related conditions. A penetrating aortic ulcer is an ulcerated atheromatous lesion that disrupts the internal elastic lamina and erodes into the media. This may mimic or initiate aortic dissection, pseudoaneurysm formation, intramural hematoma or rupture.22 Accurate diagnosis of penetrating aortic ulcer is critical, because medical management with blood pressure and heart rate control in patients with uncomplicated ulceration are associated with a good outcome.23 Intramural hematoma constitutes a variant of aortic dissection in which no entry point or intimal flap can be identified. Optimum therapy for this condition is not known and complications such as aortic dissection and aortic rupture occur unpredictably.24 Whether the intramural hematoma arises from a small intimal tear or rupture of vasa vasorum within the aortic wall remains controversial.25 On a CT scan, intramural hematoma may appear as a crescent-shaped or circumferential thickening of the aortic wall with no flow in the space containing the hematoma. Up to 17% of patients with aortic dissection may have intramural hematoma, but only CT or MR imaging can make the distinction.

In a recent report, intramural hematoma progressed to aortic dissection in 45% of 66 patients, and mortality was 20% at 30 days. Late progression occurred in 21% and death in 17% of patients, yielding 1-, 2-, and 5-year survival rates of 76%, 73%, and 43%, respectively. Regardless of aortic diameter, type A intramural hematoma is more likely to progress, and early surgical intervention is recommended for such cases.24 It is not known if measuring sELAF is useful in diagnosing penetrating aortic ulcer or intramural hematoma before clear-cut aortic dissection develops.

While the measurement of sELAF is intriguing as an initial strategy for the diagnosis of AAD, further study is necessary to answer some of the questions posed above. At the present time, a high clinical suspicion followed by the imaging modality that can be obtained most rapidly is the most prudent approach to the diagnosis of acute aortic dissection.

References

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