Acute Aortic Dissection with Intimal Layer Prolapse into the Left Ventricle

William Whitley, MD*
Kenichi A. Tanaka, MD*
Edward P. Chen, MD†
Kathryn E. Glas, MD, FASE, MBA*

A 34-year-old male presented with acute onset of searing chest pain and was preoperatively diagnosed with a Type A dissection limited to the ascending aorta and arch. His preoperative troponin levels were not elevated. The patient was scheduled for urgent repair of a Type A ascending aorta and transverse arch dissection under hypothermic circulatory arrest using selective antegrade cerebral perfusion. The intraoperative transesophageal echocardiogram (TEE) examination was performed using the Philips 5500 ultrasound machine with a Philips OmniPlane III ultrasound probe.

Multiple views of the left ventricle (LV) revealed a large intimal flap, prolapsing several centimeters into the LV outflow tract during diastole. Severe (4+) aortic insufficiency (AI) was diagnosed with color flow Doppler, but regurgitant flow was contained within the prolapsing, intimal “sock.” No evidence of regurgitant flow beyond the prolapsed intimal layer in the LV outflow tract was demonstrated (Fig. 1). The LV was dilated with moderate, global hypokinesis. No regional wall motion abnormalities were noted and the ejection fraction was estimated at 40%.

Careful comparison of the aortic valve (AV) in midesophageal (ME) long axis, and ME AV short axis (SAX) views suggested functional, bicuspid leaflet excursion, mild thickening, and no significant leaflet calcification or stenosis. The aorta was 2.6 cm at the AV annulus, 4.8 cm at the sinus of Valsalva, 7.2 cm at the sino-tubular junction, and larger than 7.5 cm in the visualized portion of the ascending aorta.

Surgical inspection confirmed the diagnosis of bicuspid AV. The left/right coronary cusp was partially fused with a congenital cleft from the midportion to the free leaflet edge. The intima of the sinus of Valsalva was 80% circumferentially torn, with an anchor point surrounding the left main coronary ostia. The surgeon performed a valve-sparing aortic root replacement using the David V re-implantation technique with 32-mm Gelweave Valsalva graft (Vascutek USA Inc). The valve annulus was reduced in circumference with an aortic valvuloplasty, and the AV cusp cleft was closed with interrupted sutures. A button re-implantation of the left coronary ostia into the graft was possible. The right coronary ostium was partially disrupted, and a saphenous vein graft bypass was performed.

The patient was successfully weaned after 304 min of cardiopulmonary bypass, including 27 min of deep hypothermic circulatory arrest. Moderate inotropic support was required. The cardiac function was depressed from baseline to an estimated 30% ejection fraction. No new-onset regional wall motion abnormalities were demonstrated.

The postcardiopulmonary bypass TEE examination revealed a functional bicuspid valve with good excursion of leaflets and no subsequent aortic insufficiency. Planimetry of the effective orifice area measured 2.10 cm² in the ME AV SAX view. This planimetry measurement closely correlated with the calculated effective orifice area of 2.20 cm² using the continuity equation.

The patient’s postoperative course was uneventful. Transthoracic echocardiogram prior to discharge from the hospital showed an ejection fraction of 40%–45% with no AI.

**DISCUSSION**

Our case demonstrates an acute ascending aorta dissection associated with a functional bicuspid AV.
The TEE examination was remarkable for intimal prolapse into the LV, an uncommon cause of aortic insufficiency.

Bicuspid AV occurs in 1%–2% of the population and is the second most common cause of aortic stenosis in older patients. Aortic enlargement occurs more rapidly than a trileaflet AV with the equivalent degrees of stenosis. Ascending aortic dissections occur up to 10 times the rate of normal patients with similar poststenotic hemodynamic variables, strongly implying an inherent weakness in the aortic wall that is not otherwise clearly understood (1).

Intimal prolapse after dissection starts as a total, or near-total, circumferential tear in the ascending aorta. The plane of intimal dissection is random. The dissection can travel proximally to the AV, or distally, toward the aortic arch. The freely-floating intimal sleeve can then invert upon itself at a tether point. This has been described as “intimo-intimal intussusception.” The clinical sequelae and the TEE presentations are quite different, depending on the plane of dissection.

Most frequently, ascending aortic dissections induce AI by disrupting the annulus of the aorta. The TEE examination might demonstrate a prolapsing AV cusp or annular dilation, with loss of leaflet coaptation. The mechanism of AI with intussusception is different. If the intimal tear dissectes proximally toward the AV, the free-floating intimal sleeve may prolapse through the valve (Fig. 2, diagram A). The diastolic obstruction of AV coaptation can cause various degrees of AI. Rosenzweig et al. (2) described six cases of intimal prolapse with significant AI. All appeared to have circumferential ascending aortic intimal dehiscence. The incidence of intimal prolapse was <2% of the ascending aortic dissections examined with TEE at their institution up to 1996. In another case report (3), coronary ischemia was associated with a major myocardial event when the prolapsing flap obstructed diastolic blood flow to the coronary ostia. Before diagnosis by TEE, thrombolytic therapy was initiated for presumed coronary artery thrombosis.

Distal dissection of the intimal layer can form a “wind sock” inversion of the intimal layer into the aortic arch and descending aorta (Fig. 2, diagram B). The clinical scenario of stroke associated with dissection is typically associated with dissection of true lumen away from the orifice of the aortic arch vessels. Intimal intussusception is frequently associated with neurological deficits by a different mechanism. The large surface area of intima can obstruct the aortic lumen, or the free flap may isolate the otherwise normal ostia of the transverse aortic arch vessels from blood flow (3).

Computed tomography scanning, echocardiography, magnetic resonance imaging, and aortography are all valid diagnostic tools to diagnose and qualify aortic dissection. TEE has the advantage of portability, making it ideal for unstable patients in the emergency setting. TEE is operator-dependent, but can be highly sensitive (97%–99%) for the identification of Type A dissection with acceptable specificity (77% and 100%) (4).

TEE is superior for the diagnosis of dissection with distal intimo-intimal intussusception. The lack of an intimal flap in the ascending aorta is a potential source of false negative error; several reports note the failure of computed tomography scanning to identify the inversion of the thin intimal layer in the distal arch (4). Careful examinations of the aortic arch in the upper esophageal aortic arch long axis and upper esophageal aortic arch SAX are necessary to document the freely mobile intimal edge. The high sensitivity and portability make TEE an excellent first choice in diagnosing this emergent disease state.

The goals of TEE for aortic dissection are as follows:
1. Differentiate the true and false lumen.
2. Determine aortic valve function and integrity.
3. Locate intimal tears and flow patterns in the aorta.

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4. Assess for pericardial and pleural effusions.
5. Determine coronary ostia and arch vessel involvement.

REFERENCES