Transesophageal Echocardiographic Diagnosis of Intraaortic Thrombus during Coarctation Repair

BRIAN K. THWAILTES, M.D.,* JOHN M. STAMATOS, M.D.,† FRANK D. CROWL, M.D.,‡ AMRAM J. COHEN, M.D.;‡ MARINA V. VERNALIS, D.O.,§ PATRICK A. CAMBIER, M.D.¶

Transesophageal echocardiography (TEE) is useful as an intraoperative monitoring tool for evaluation of aortic pathology and valve function as well as detection of atrial and ventricular masses, venous air emboli, and ventricular wall motion abnormalities.¹ Surgical repair of coarctation of the aorta has been associated with postoperative hypertension, transient renal dysfunction, spinal cord ischemia, and paraplegia.²,³ Thromboembolic phenomena have previously been implicated but not documented as the cause of any of these postoperative complications. This paper describes a case of the intraoperative detection by TEE of a thrombus in the descending aorta following the repair of an aortic coarctation.

CASE REPORT

The patient was a 15-yr-old boy referred to our center for evaluation of upper extremity hypertension and diminished lower extremity pulses. On admission, his right arm blood pressure was 142/80 mmHg and his right leg pressure was 107/67 mmHg. A transthoracic echocardiogram demonstrated normal valvular morphology and ventricular function and an abnormal narrowing of the aortic isthmus. Cardiac catheterization revealed a postdural coarctation of the aorta with a pressure gradient of 60 mmHg. Balloon angioplasty was attempted but failed to significantly reduce the pressure gradient.

Preoperatively, the patient was not taking any medications. Laboratory studies to include a coagulation profile were normal. In the operating room, routine monitors including an electrocardiogram, pulse oximeter probe, blood pressure cuff, and precordial stethoscope were placed. Anesthesia was induced with 3 mg/kg sodium thiopental and maintained with 10 μg/kg fentanyl and isoflurane. Vecuronium was used for muscle relaxation. A right radial and a right dorsalis pedis arterial catheter along with a right internal jugular catheter were inserted. The trachea was intubated with a 39-Fr double-lumen endotracheal tube.

The patient was placed in right lateral decubitus, and a Hewlett-Packard 5-MHz TEE probe was inserted into the esophagus. Isolated right lung ventilation was initiated and tolerated well by the patient. The left chest was entered through the fourth intercostal space, and a 5-cm segment of narrowed aortic isthmus was identified. Echocardiographic examination of the aorta at this time clearly demonstrated the area of narrowing of the aorta and no evidence of thrombus. The transverse aortic arch was occluded between the left carotid and subclavian arteries, and a crossclamp was applied on the descending aorta below the coarctation. The patient was not anticoagulated prior to the application of the aortic crossclamp. The aorta was opened; no thrombus was present; and repair of the coarctation was undertaken with a lateral patch aortoplasty using a synthetic Hemashield patch placed in the anterior medial aspect of the aorta. Aortic crossclamp time was 56 min.

Intraoperative TEE after crossclamp removal revealed a freely mobile, echo-producing mass characteristic of thrombus in the descending aorta several centimeters distal to the transverse aortic arch (fig. 1). The thrombus appeared serpiginous and was tethered at one end to the aortic wall. The demonstration of this thrombus led to the decision to reexplore the aorta. The crossclamp was reapplied, and the Hemashield graft was incised. An intraaortic thrombus was identified and removed, and the graft incision was closed. Repeat TEE examination of the aorta then demonstrated a minute residual thrombus at the site of repair, and the operative procedure was concluded.

Postoperatively the patient received a heparin infusion sufficient to increase the partial thromboplastin time to approximately twice normal. A follow-up TEE examination was performed on the 3rd postoperative day to examine the aortic patch site. No residual intraluminal thrombus was seen, and the heparin infusion was stopped at that time. The patient's postoperative course was uncomplicated except for mild hypotension. The patient was discharged home on the 7th postoperative day.

DISCUSSION

TEE has been shown to be effective in the diagnosis of a broad range of cardiac and aortic pathology. It has been used to identify atrial masses⁴ to evaluate the adequacy of atrial septal defect repair,⁵ to study flow patterns across native and prosthetic valves,⁶,⁷ and to monitor intraoperative myocardial ischemia by evaluating ventricular wall motion abnormalities.⁸ Its use in evaluating thoracic aortic disease is also well proven. Karalis et al. detected atherosclerotic debris in the thoracic aorta of 7% of 556 patients undergoing TEE and furthermore noted that 31% of those with debris went on to develop evidence of arterial embolism.⁹ Several authors have written about the utility of TEE in the diagnosis and evaluation of thoracic aortic dissections. In a large multicenter study, Erbel and colleagues demonstrated that TEE was more sensitive in the
diagnosis of thoracic aortic dissections than were either aortography or computed tomography.\(^\text{10}\) Troianos et al. recently revealed an intraoperative diagnosis of ascending aortic dissection after cardiac surgery using TEE.\(^\text{11}\) Likewise, in patients with blunt chest trauma, Sparks et al. showed TEE to be as sensitive and more specific than aortography in the diagnosis of traumatic aortic rupture.\(^\text{12}\) Detection of thrombus in the aorta has been demonstrated by Bergin,\(^\text{13}\) who described a descending aortic thrombus at the level of the diaphragm by TEE 14 days after multiple gunshot wounds. Although the aorta is difficult to visualize using transthoracic echocardiography, the ascending aorta, aortic arch, and descending aorta are well visualized by TEE. The midascending aortic arch, however, is poorly visualized with a standard single-plane probe because of the air-filled trachea. This blind spot can be eliminated or diminished with the use of a biplane probe.

This case report demonstrates a new application of intraoperative TEE. The detection of a large tethered thrombus at the site of a coarctation repair led to the immediate surgical reexploration and evacuation of the aorta. It is possible that preoperative angioplasty may have disrupted the intima and predisposed the patient to thrombus formation; however, a thrombus was not detected before application of the crossclamp. This report also demonstrates that unrecognized thrombus formation can occur intraoperatively and may account for some of the postoperative complications that have been reported after coarctation repair. It is unclear if the duration of crossclamp had any effect on the thrombus formation. Further investigation into the natural history of the coarctation repair is needed to determine if thrombus formation is a frequent occurrence and if anticoagulation prior to aortic crossclamp would prevent the formation of thrombus.

REFERENCES