

CASE REPORTS

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False-positive Diagnosis of Aortic Dissection Associated with Femoral Cardiopulmonary Bypass

Christopher M. Watke, M.D.,* Fiona Clements, M.D.,† Donald D. Glower, M.D.,‡
Mark Stafford Smith, M.D., C.M., F.R.C.P.C.§

AORTIC dissection is a rare, catastrophic complication of cardiopulmonary bypass (CPB). In most reported cases of aortic dissection during cardiac surgery, the site of arterial cannulation is the origin of the dissection.¹ Experience with common femoral artery cannulation for standard CPB has demonstrated an incidence of retrograde ilioaortic dissection as high as 3% associated with significant morbidity and mortality.^{1,2} Some recently introduced cardiac surgical systems (e.g., PortAccess™, Heartport Inc., Palo Alto, CA) use femoral arterial cannulation for CPB and hence are at risk for retrograde ilioaortic dissection.³ We describe a case in which transesophageal echocardiography (TEE) findings prompted the incorrect diagnosis of descending aortic dissection during initiation of femoral CPB for mitral valve surgery.

Case Study

A 57-yr-old man with severe mitral regurgitation, congestive heart failure, and atrial fibrillation resulting from mitral valve prolapse was scheduled to undergo right thoracotomy for mitral valve repair. Preoperative cardiac catheterization confirmed mitral regurgitation and was otherwise unremarkable, including a normal ascending aorta. The patient had no other comorbidities and was noted on physical examination to have comparable blood pressures in both arms and normal femoral artery pulses bilaterally.

After uneventful induction of anesthesia and endotracheal intubation, a 5.0-MHz multiplanar TEE probe was inserted (Hewlett-Packard Sonos 2000, Hewlett-Packard Co., Palo Alto, CA). The pre-CPB TEE examination confirmed findings noted on the preoperative cardiac catheterization. In addition, the proximal ascending aortic and the descending thoracic aorta were well visualized showing no evidence of atherosclerotic disease.

After systemic heparin anticoagulation, a 24-French arterial cannula (Endoarterial Return Cannula, Heartport) was placed atraumatically in the right common femoral artery with direct surgical exposure, and a 28-French venous cannula was advanced into the right atrium from the right femoral vein. A centrifugal pump was placed between the venous cannula and the venous reservoir to increase venous drainage. The pump prime consisted of 1200 cc of Normosol (Abbott Laboratories, North Chicago, IL), 250 cc of 20% mannitol, 500 cc of 6% hydroxyethyl starch, 50 mEq of sodium bicarbonate, and 5000 U of heparin. As CPB was slowly initiated, TEE imaging at 45 cm from the teeth in the horizontal plane immediately demonstrated an echogenic region in the descending thoracic aorta apparently separated from the aortic lumen by a membrane. These TEE findings were believed to strongly suggest an evolving aortic dissection, and CPB was immediately discontinued. The observed TEE evidence of dissection rapidly disappeared, leaving a normal appearing descending aorta. No other clinical evidence during CPB initiation indicated aortic dissection. The in-line pump arterial pressures were normal throughout, as were the arterial pressure measured in the right radial artery, the pulse oximeter on the left thumb, and the bilateral middle cerebral artery transcranial doppler signals. CPB was cautiously reini-

* Fellow.

† Associate Clinical Professor.

‡ Associate Professor, Division of Cardiothoracic Surgery, Department of Surgery.

§ Assistant Professor.

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Address reprint requests to Dr. Stafford Smith: Box 3094, Duke University Medical Center, Durham, North Carolina 27710. Address electronic mail to: staff002@mc.duke.edu

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CASE REPORTS

tiated without difficulty; there was no further TEE evidence of aortic dissection. After successful mitral valve repair, the patient was easily weaned from CPB. The post-CPB examination demonstrated a normal ascending and descending aorta and no residual mitral regurgitation. Femoral artery pulses remained normal bilaterally. The patient did well postoperatively and was discharged 7 days after surgery.

Discussion

We present a case in which intraoperative TEE findings during initiation of femoral CPB led to the incorrect diagnosis of aortic dissection. During several subsequent cardiac surgical procedures at our institution, TEE interrogation of the descending thoracic aorta at initiation of femoral CPB has revealed that the "pseudodissection" phenomenon described previously is present to varying degrees in approximately 50% of such patients. Typically, TEE findings occur during the first 30–40 s after CPB initiation; initially "smoking" is noted in the aortic lumen, followed by development of an echodense "pseudo" false lumen and intimal flap. If initiation of CPB continues, the pseudo false lumen and intimal flap dissolve into turbulence and then disappear within approximately 30 s. A typical example is presented in the figure 1.

True aortic dissection is an important complication of cannulation for CPB, which is usually assessed by TEE; therefore, misleading TEE findings in this setting are a major concern. When initiating CPB *via* femoral arterial cannulation, practitioners should be aware of this phenomenon and correlate TEE observations with other clinical data before diagnosing aortic dissection. TEE has been shown to be a highly sensitive and specific (100% and 96.4%, respectively) noninvasive procedure to diagnose aortic dissections.^{4–6} Most false-positive TEE diagnoses of aortic dissection involve the ascending aorta, presumably because of the high incidence of linear artifacts in this area, which can mimic intimal flaps.^{7–9} Artifacts in the descending thoracic aorta are also common but are normally mirror artifacts, which do not mimic aortic dissection.⁷

We suggest that the TEE aortic "pseudo-dissection" is the result of two effects: (1) layering of blood with crystalloid pump-prime to produce a fluid interface simulating the intimal flap of aortic dissection, and (2) stasis of blood developing as cardiac ejection meets retrograde aortic blood flow from the femoral arterial cannula to produce an echodense "pseudo false lumen." Aortic blood flow stasis and reversal and crystalloid pump-prime bolus during initiation of CPB from femoral

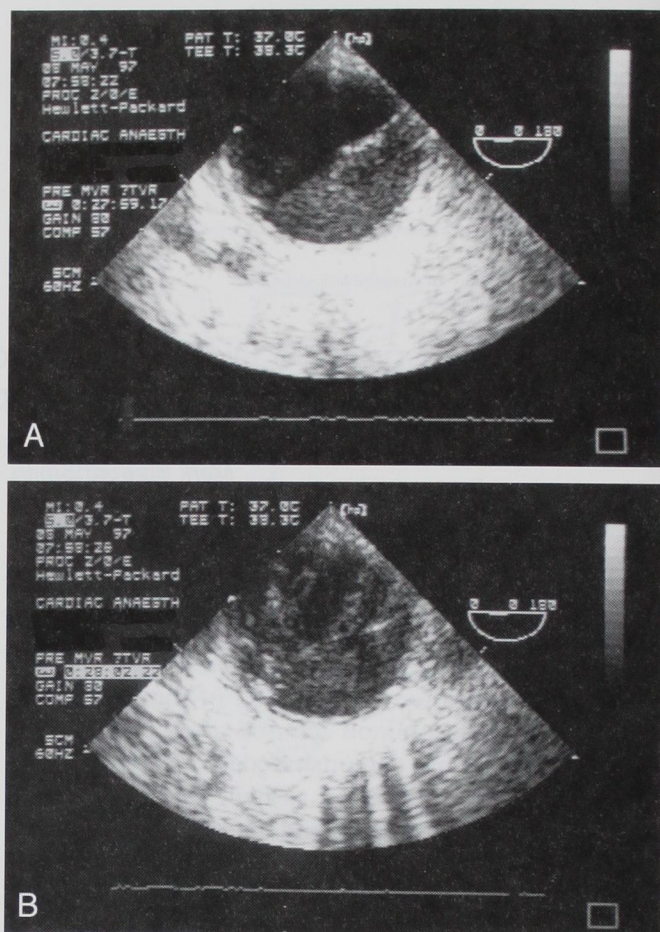


Fig. 1. Serial short axis TEE images of the descending thoracic aorta in a patient undergoing mitral valve surgery soon after initiation of CPB from a femoral artery cannula. The "pseudodissection" phenomenon described in the text is clearly seen including: (A) the "pseudo" intimal flap and false lumen; and (B) subsequent turbulence resulting in eventual dissolution of the "pseudodissection."

artery cannula are to be expected. We believe that the variable occurrence of this phenomenon is likely related to the rate at which CPB is initiated. Slower development of retrograde arterial inflow and slower left ventricular emptying may result in a longer duration of apparent fluid shifts in the descending aorta as retrograde flow meets anterograde left ventricular ejection.

This is the first report of a false-positive TEE diagnosis of aortic dissection during initiation of CPB with femoral artery cannulation. As the number of PortAccessTM minimally invasive cardiac procedures and concomitant use of femoral artery cannulation increases, so too may the occurrence of both true and "pseudo" aortic dissections.

CASE REPORTS

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