

# Intraoperative Epicardial Sonography as a Useful Adjunct to Repair of Coronary Artery Dissection

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**C**ORONARY ARTERY DISSECTIONS are rare but potentially life threatening.<sup>1,2</sup> They can occur either spontaneously or as a complication of percutaneous coronary interventions.<sup>1,3</sup> Management can be either catheter based or surgical and is determined by the extent of the dissection, hemodynamic status, and the number and extent of the vessels involved.<sup>1,2</sup> The case presented here involves a patient with a catheter-induced dissection of the left anterior descending (LAD) artery, which was managed with off-pump coronary artery bypass graft surgery. The authors highlight the use of epiaortic sonography to image the coronary artery before and after repair.

## CASE REPORT

A 61-year-old man with a past medical history of systemic hypertension presented with a 1-month history of exertional chest pain and shortness of breath. A cardiac nuclear stress test showed exercise-induced anteroseptal, apical, and inferoposterior ischemia with a left ventricular ejection fraction of 36%. Coronary arteriography then was performed showing triple-vessel coronary artery disease. There were chronic total occlusions of the right coronary artery and the mid-LAD. The obtuse marginal arteries 1 and 2 also were found to have 50% to 60% stenosis. No obvious collaterals were shown on the coronary angiogram. The patient initially refused coronary artery bypass graft (CABG) surgery.

The LAD lesion was crossed with a guidewire, but attempts at angioplasty resulted in an iatrogenic LAD dissection (Fig 1). The procedure was aborted, and the patient was referred for urgent surgery. He remained hemodynamically stable. Intraoperatively, the transesophageal echocardiogram (TEE) showed +1 mitral regurgitation and inferior septal hypokinesis. Upon inspection of the epicardial surface, the midportion of the LAD had a bluish discoloration. An L15-7io epiaortic probe (Phillips Medical, Andover, MA) was placed into a sterile sheath

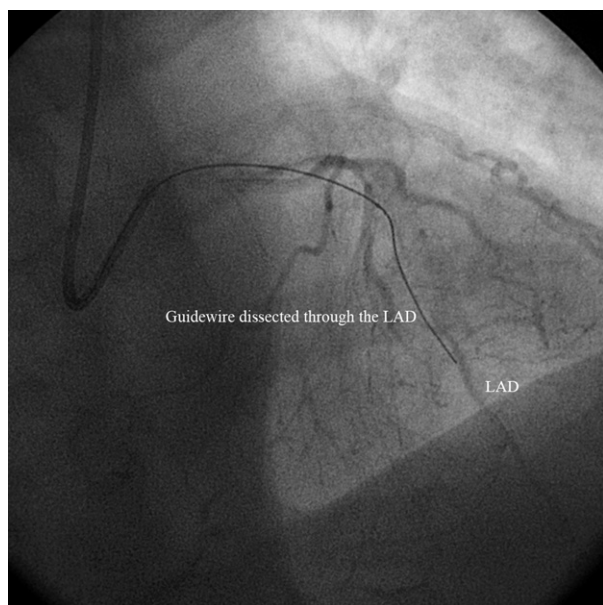


Fig 1. A cardiac catheterization image of LAD dissection.

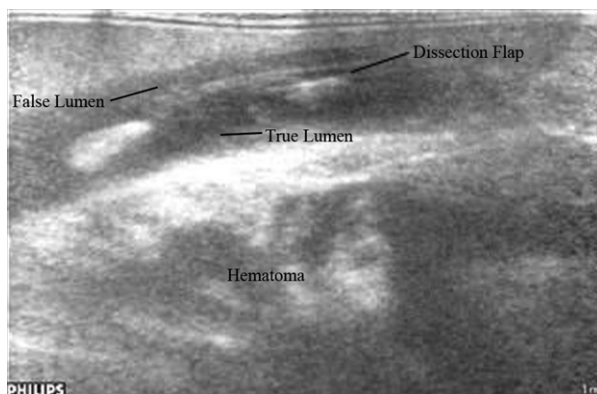


Fig 2. Epiaortic sonography visualizes the intramural hematoma and mid-LAD dissection.

and used to evaluate the vessel. A dissection and intramural hematoma were visualized originating in the midportion of the LAD with no flow in the false lumen (Figs 2 and 3). The LAD was stabilized and opened (Fig 4). The layers of the wall at the site of the arteriotomy were reapproximated to eliminate the false lumen. A left internal mammary artery to LAD anastomosis then was constructed. Repeat ultrasound evaluation showed excellent laminar flow through the anastomosis and in the distal LAD (Fig 5). The right internal mammary artery then was anastomosed to the right coronary artery, and vein grafts were placed to the 2 obtuse marginal arteries. The immediate postprocedure TEE showed no significant change. The patient remained hemodynamically stable with no postoperative electrocardiographic or enzymatic changes and had an uneventful postoperative recovery. He remains asymptomatic 3 years after surgery.

## DISCUSSION

Coronary artery dissections are a rare but well-recognized life-threatening condition.<sup>1,3-5</sup> They are classified as either spontaneous or catheter-induced.<sup>1,3</sup> These patients typically present in the form of acute coronary syndrome with unstable angina or myocardial infarction with ST-segment changes on the electrocardiogram.<sup>1</sup> Early diagnosis via angiography is of the utmost importance. In this patient, probably because of the pre-existing complete total occlusion of the LAD, ischemic changes did not occur.

Catheter-induced coronary artery dissection is a rare but well-recognized complication of percutaneous coronary intervention. The true incidence may be unknown because there is

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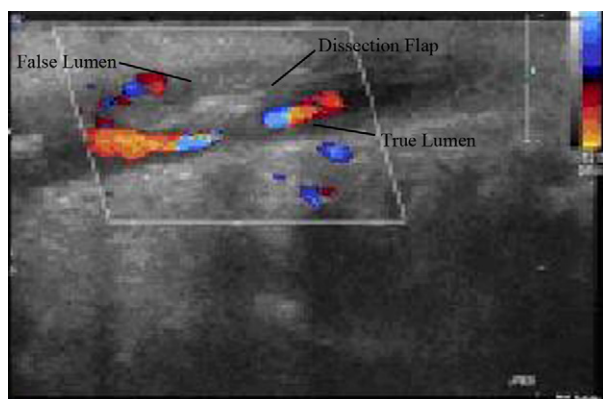
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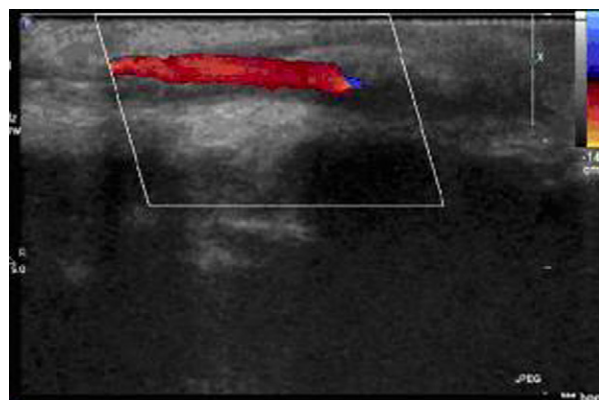
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**Fig 3.** Color flow showing the dissection with no flow through the false lumen and flow acceleration through the true lumen.

some suggestion that it may be an underreported complication.<sup>3-5</sup> Once a dissection occurs, it can lead to progressive stenosis, refractory angina, and distal compromise to the arterial bed with myocardial ischemia. Urgent revascularization must be performed by either CABG or stenting. CABG surgery is the treatment of choice when there is extensive dissection or hemodynamic instability refractory to stent placement. In this patient, the lesion could not be crossed with a wire once the dissection had occurred, and, therefore, catheter-based options were not feasible.

Epicardial scanning is superior to digital palpation in assessing the ascending aorta for atheromatous plaque and aids in the prevention of perioperative stroke.<sup>6-10</sup> Therefore, it has become the standard of care in many institutions. Guidelines specifically addressing epicardial scanning have been introduced to clinical practice.<sup>11</sup> Epicardial ultrasound has been reported to be a useful tool in locating intramyocardial target coronary

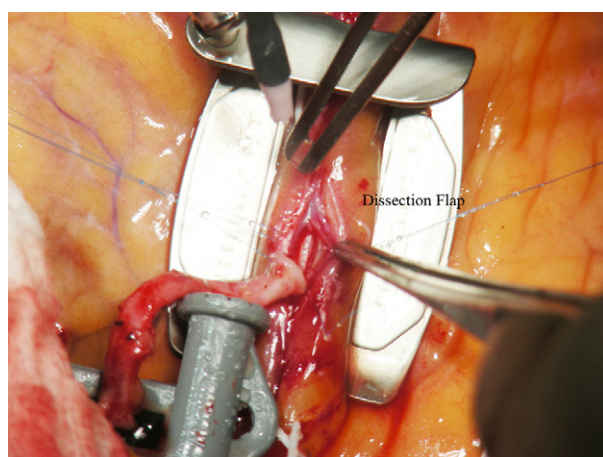


**Fig 5.** The epicardial ultrasound used to visualize postrepair results. Color flow showing good laminar flow within the distal LAD.

arteries. It also can be used to select an optimal anastomotic site.<sup>12</sup> Guidelines addressing epicardial echocardiography also have been established by the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists.<sup>13</sup> Qualitative and quantitative assessment of vessel flow can serve as intraoperative documentation of graft patency.<sup>10,12,14</sup> The use of epicardial sonography is a logical and convenient use of available technology. In this patient, the intraoperative confirmation of laminar flow was extremely helpful given the complexity of the anastomosis. The differentiation between laminar and turbulent flow easily can be determined by knowledge of the Nyquist limit (12 cm/s) and visual inspection of the color-flow (CF) map. Multiple aliasing phenomena occurring within the map leading to a mosaic-like picture indicate turbulent flow, whereas a homogeneous pattern represents laminar flow. The differentiation between spasm and dissection requires not only inspection of the CF map (because both can result in turbulent flow) but also an inspection of the 2-dimensional image. A dissection can be differentiated from spasm by the presence of a dissection flap. To the best of the authors' knowledge, the use of epicardial sonography to guide and assess the repair of coronary dissections has not been described in the literature.

## CONCLUSIONS

Early recognition and appropriate management are vital in patients with coronary artery dissections. Catheter-based interventions are appropriate in stable patients with limited dissection and can serve successfully as a bridge by stabilizing a patient for surgical intervention. Surgical management with CABG surgery is the treatment of choice in patients who are hemodynamically unstable, those with mainstem or multivessel involvement, and those in whom stenting has failed. As shown in this case, epicardial sonography is a useful intraoperative tool that can be used to evaluate the extent of disease and the flow in epicardial vessels before and after intervention. As such, epicardial scanning is a valuable tool to guide surgical decision making and the documentation of intraoperative results.



**Fig 4.** An intraoperative picture of the LAD opened and stabilized during the off-pump coronary artery bypass graft repair.

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