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Dissection of the Left Main Coronary Artery during Percutaneous Intervention: Successful Surgical Management

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ABSTRACT

Coronary dissection during diagnostic catheterization presents a therapeutic challenge. Medical management or percutaneous intervention may be an option in a stable patient. Unstable patients should promptly undergo surgical revascularization. We report on a patient in whom dissection of the left main coronary artery, the left anterior descending artery, and a diagonal branch occurred during catheterization. Clear signs of myocardial ischemia indicated immediate surgery. Coronary artery bypass grafting was carried out within a very short time frame and the patient survived. This case demonstrates the value of an expeditious surgical treatment strategy.

INTRODUCTION

Catheter-based coronary intervention is a common procedure performed on more than a million people per year in the United States and twice that number in the world [Smith 2006]. The associated complications include periprocedural myocardial infarction, stroke, coronary thrombosis, perforation, tamponade, and death. Breda et al [2008] alluded to 20% to 40% occurrence of coronary dissection. The incidence of emergency coronary artery bypass graft (CABG) for all complications is low but has been reported to be between 0.4% and 14% [Barakate 2003; Smith 2006]. Dissection of the left main coronary artery can lead to obstruction of flow to the whole left ventricle and therefore to catastrophic consequences. An attempt to treat the dissection with stent placement into the true lumen of the dissection may be justified, but surgical treatment is mostly required. Rarely medical management is successful [Alfonso 1997; Awadalla 2005]. We report a case involving dissection of the left main coronary artery and its management.

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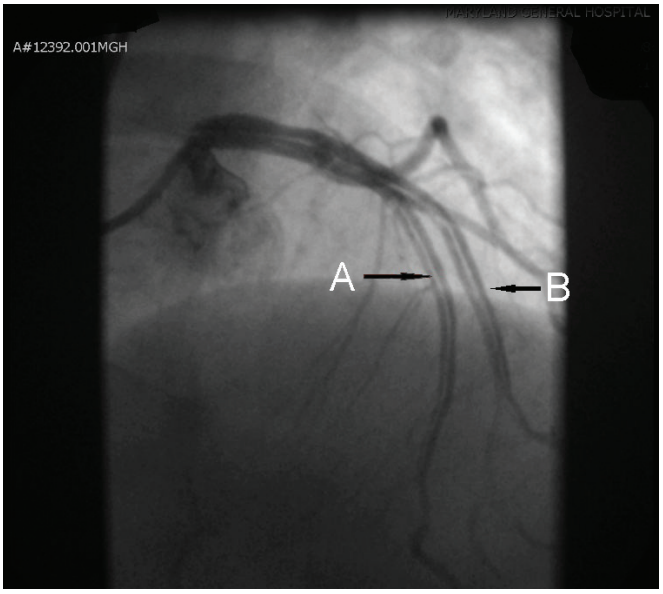
CASE REPORT

A 57-year-old man presented to an outside facility with complaints of left sided chest pain and headache for 4 days. His coronary artery disease risk factors included hypertension controlled by a beta-blocker and at least a 24-pack/year history of smoking. His initial noninvasive cardiac work up for myocardial infarction/ischemia and neurologic work-up was negative. The patient was admitted for observation for his persistent chest pain. Four days later, his chest discomfort persisted, and therefore he was scheduled for diagnostic coronary catheterization. During the procedure, the patient had sudden onset of severe chest pain with clear electocardiogram (ECG) signs of ischemia. Angiography identified dissection of the left main coronary, extending into the left anterior descending artery (LAD) and diagonal-1 with some residual flow (Figure). The patient was stabilized with nitroglycerin and heparin drips and emergently transferred directly to the operating room of our



Snapshot of left main coronary angiogram. The red arrow points to the dissection flap within the left anterior descending artery, and the black arrow marks the flap in the diagonal branch. The flap can be followed proximally to left main coronary artery.

Timeline from the diagnosis of dissection at the outside institution to the end of the operation at our institution

Event	Time Elapsed, min
Diagnosis to surgical incision	72
Surgical incision to cardioplegic arrest	31
Cardioplegic arrest to separation from heart–lung machine	148
Total	251 (4 h, 11 min)

institution. The patient underwent quadruple CABG using saphenous vein to LAD, posterior descending artery (PDA), obtuse marginal artery (OM), and diagonal-1 branches. The procedure was performed using heart–lung machine and cardioplegia. Anastomoses to the LAD and diagonal were performed following the identification of the true lumen. The patient tolerated the procedure well and essentially had unchanged ventricular function (ejection fraction [EF] > 50%). The timeline from the diagnosis of dissection at the outside institution to the end of the operation at our institution is described in the table. The postoperative course was unremarkable, and the patient was discharged on postoperative day 6. A pre-discharge ECG showed no new q-waves.

DISCUSSION

Coronary artery dissection is a well-recognized complication following percutaneous coronary intervention [Hermans 1993]. Although the incidence of coronary dissection is high, reported symptomatic dissection varies over a wide spectrum, with as high as half the diagnosed number. Management of coronary dissection should depend on extension of the dissection, residual flow in the true lumen, and the patient's symptoms and hemodynamic stability. Awadalla et al [2005] reported on 1 of the cases in their series that was managed medically. This patient had normal hemodynamics and was symptom free. A similar suggestion has been made by Alfonso et al [1997] in a stable and symptom-free patient. Lee and colleagues [2006] report on a case in which diagnosis of coronary dissection was made 9 months following initial intervention and was treated with a stent, suggesting a need for follow-up in conservatively managed patients. However, there are no specific guidelines for follow-up in these patients.

Patients with symptoms, hemodynamic instability, or angiographic evidence of retrograde dissection require emergent intervention. There are a few reported cases in which coronary dissection has been managed with a stent. Lee et al [2008] successfully managed a dissection involving the left main extending into its branches using stents after the patient refused surgery. Intravascular ultrasound was used before and after the intervention, which confirmed successful treatment. Stent placement was successfully performed in a patient who had right coronary dissection with associated chest pain and S-T changes [Boyle 2006].

Our patient fit the criteria of an unstable category. The coronary dissection extended into the LAD and diagonal artery, as evidenced by the angiogram and acute onset of chest pain and signs of myocardial ischemia on ECG. The patient, therefore, was deemed a poor candidate for a stent-based intervention and referred for emergent surgical revascularization. The patient was directly transported from the outside hospital to our operating room. Although it is well known that left internal mammary artery (LIMA) conduit to LAD is the optimal option, because of the patient's unstable condition, we believed it was essential to get the patient on heart–lung machine and provide cardioplegia protection to the ventricle and to place aortocoronary vein grafts in a timely manner. Several factors in making a decision with this patient's condition played a critical role in a good outcome, with preservation of ventricular function. Immediate diagnosis by the cardiologist with emergent transfer to a tertiary care center and residual flow in the dissected arteries were cardioprotective and prevented left ventricular dysfunction and malignant arrhythmias. Opting to institute mechanical cardiopulmonary bypass allowed mild hypothermia and delivery of cardioplegia, rather than losing valuable time to harvest the LIMA, providing additional protection to the myocardium.

Because of hemodynamic stability, our patient did not require circulatory support. Should the patient drift into a hemodynamically unstable condition, or even need cardiopulmonary resuscitation, implantation of a percutaneous circulatory assist system is advisable. A European group [Bonatti 1997] reported on a hemodynamically unstable left main dissection following angiography. The patient was briefly stabilized using a percutaneous mechanical assist and bridged to orthotopic heart transplant.

An alternative strategy to cardioplegic arrest of the heart on a heart–lung machine is to perform revascularization on the beating heart. Gur et al [2006] reported on a successful off-pump bypass of the right coronary artery dissection and removal of a long atherosclerotic plaque. One of the early cases of successful off-pump treatment of left main and LAD coronary dissection was performed by Bapat and colleagues [2003]. Because they observed aortic hematoma, the authors preferred the off-pump approach to avoid cross clamping the aorta and retrograde extension of the dissection. Off-pump bypass grafting has also been reported in patients who are at high risk of bleeding, either from aggressive preoperative antiplatelet therapy or blunt trauma [Capdeville 2001; Korach 2006].

Celik and coworkers [2001], in their case series of 9 patients, identified that the dissection was on the epicardial arc of the vessel, but these patients had primary spontaneous dissections. No clear information on the location of dissection is available for iatrogenic causes. These dissections can theoretically originate and propagate in any part of the artery. Identification of the true lumen following iatrogenic dissection of the coronary arteries can, therefore, be challenging. In our case, the dissection was located on the myocardial arc and could be easily identified. An adequate landing zone in a nondissected part of the target vessel could be found, and the bypass conduit was therefore sewn to the true lumen of the coronary artery. Because the course of an iatrogenic coronary dissection can be random and challenging, we believe that cardioplegic arrest gives a better overview over local pathology and a higher grade of surgical precision when suturing a bypass graft to a difficult target vessel.

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From our case we conclude that emergency coronary artery bypass grafting is a most effective way to treat iatrogenic left main coronary artery dissection. If residual coronary artery flow is present and if surgery is performed expeditiously, myocardial damage can be minimal. An immediate decision by the cardiologist to transfer the patient to surgery and fast direct transport to the operating room can enable survival in a difficult patient group.

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