Procedure-Induced Dissection of Left Main Coronary Artery — a Treatable Nightmare of the Intervventional Cardiologist

I-Chang Hsieh
Department of Internal Medicine, Chang Gung Memorial Hospital, Chang Gung University College of Medicine, Taoyuan, Taiwan.

Previous studies have shown that the majority of cardiac catheter-related deaths occur in patients with: (1) poor condition prior to catheterization, (2) over 50% stenosis of the left main coronary artery (LMCA), and (3) severe three-vessel coronary artery disease. LMCA dissection is a rare but catastrophic complication during a catheter-based procedure. It is usually caused by injury related to manipulation of the catheter and coronary intervention for treating lesions in the LM or other vessels. Previous investigations reported an incidence of procedure-induced LMCA dissection of < 0.1%. Rarely, procedure-induced LMCA dissection will be associated with aortic root dissection. Iatrogenic dissection of the LMCA may compromise the blood supply leading to a large ischemic and lethal myocardial necrosis, and has been identified as a significant risk factor for increased peri-procedural mortality. Reported risk factors for acute procedure-induced LMCA dissection include the presence of atherosclerotic obstructive disease in the LMCA and an unusual location or anatomy of the LMCA that necessitates excessive manipulation of the catheter to achieve entry or results in the catheter tip against the vessel wall.

The typical clinical presentations that suggest LMCA dissection include the development of immediate chest pain, which is frequently associated with ischemic electrocardiographic changes, hypotension, and dysrhythmia. The onset of significant ischemia is determined by the rapidity of an expanding hematoma formation, which can critically compromise coronary blood flow. Therefore, the patient may present the symptoms immediately in the catheter laboratory or later in the recovery area/ward. The angiographic documentation of dissection is also important to earlier identify this complication.

The best means of minimizing the possibility of LMCA dissection is through careful evaluation and technique of procedure. Before cardiac catheterization, the identification of higher-risk patients is important. Some evidence demonstrates that the prevalence of LMCA is higher among the older age groups, in middle-aged women presenting with typical anginal symptoms, in the East Asian population, and in patients presenting with severe anginal symptoms who have low tolerance of exercise. Sometimes, the left ventriculogram can provide information on LMCA stenosis before a diagnostic catheter is engaged into LMCA. Currently, 64-slice computed tomography also offers a good screening tool for detecting LMCA stenosis before cardiac catheterization. Additionally, during the procedure, careful selection of a catheter that positions in the same three-dimensional plane as the LMCA is suggested. Use of a superior shaped and soft-as-possible guide wire and catheter is also advised. Furthermore, the guiding catheter, guide wire and balloon catheter should be advanced gently, because the guide wire and balloon catheter may cause trauma to the LMCA while exiting the guiding catheter.

The management of LMCA dissection is to restore LM coronary flow before hemodynamic deterioration occurs. Treatment options for this complication include intracoronary stenting and emergency coronary artery bypass grafting (CABG). CABG could be a choice of therapy for patients whose clinical and hemodynamic conditions are stable, and where a surgical team is available immediately. However, patients who develop rapid deterioration of hemodynamics often fail to survive even if CABG can be completed. Intracoronary stent implantation has the effect of repairing dissection and achieving rapid restoration of blood flow and hemodynamic stabilization, and can be a life-saving procedure in these circumstances. As we know, intracoronary stenting has been
shown to be effective in the treatment of coronary artery disease and angioplasty-related dissection. Although previous reports about emergent intracoronary stenting in procedure-induced LMCA dissection were limited and involved small series of patients, the immediate outcomes were quite good. Long-term vessel patency and clinical outcome for this group of patients has not been reported. However, experience from elective stenting in unprotected LMCA stenosis showed a high procedural success rate (98.9%), acceptable in-hospital major adverse cardiac events (1.1% with stent thrombosis with Q-wave myocardial infarction, 1.1% with emergency bypass surgery, and 0.4% with repeat coronary intervention), and good long-term survival rate (95%, 94% and 92% at 1, 2, and 3 years, respectively). Restenosis in unprotected LM stenting has been high and ranges from 21% to 34%, which was decreased to 7% in the era of drug-eluting stents, although Price et al. reported a restenosis of 42% at the distal bifurcation lesion.

The above studies indicate that prompt stent deployment may be a valuable procedure in patients with LMCA dissection and may reduce the mortality rate. Additionally, some technical pitfalls should be emphasized herein. Correct positioning of the wire in the true lumen of the distal vessel must be confirmed by angiography before further balloon dilation. The stent deployment in ostial dissection can be performed with the proximal edge slightly protruding outside the ostium, and the guiding catheter can be kept well out of the ostium so that the balloon will not be inflated within the guiding catheter. The whole interventional procedure should be simple, prompt, and careful. Immediate and successful stent implantation can improve myocardial ischemia and stabilize hemodynamics dramatically. Heparin is suggested for several days after the procedure in cases where thrombus is noted angiographically. Longer administration of aspirin and clopidogrel is also advised, especially if a drug-eluting stent has been implanted. Whether the patient should receive following CABG treatment after successful stent implantation is controversial. In our experience, emergent CABG is indicated in cases with chest pain or hemodynamic disturbance during or after interventional procedure. Another important issue is the percutaneous cardiopulmonary support which should be given in patients whose hemodynamics are critically unstable. This support and re-opening of the closed artery should be performed complementarily in the management of this critical situation. Intra-aortic balloon counterpulsation (IABP) should be considered in patients with a partially closed LMCA, and in those patients with hypotension but not cardiovascular collapse. When cardiovascular collapse develops due to LMCA dissection, the IABP is less useful to provide hemodynamic stability, as it is not a left ventricular assist device.

In conclusion, the best way to prevent procedure-induced LMCA dissection is through careful evaluation and technique of procedure, and prompt recognition of this complication followed by immediate stent implantation is a good option to provide the possible best outcome.

REFERENCES