



Successful Management of an Iatrogenic Left Main Coronary Artery Occlusion during Coronary Angiography: A Case Report and Brief Review



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ABSTRACT

Abrupt left main coronary artery (LMCA) closure during diagnostic coronary angiography is a rare but catastrophic event with a poor prognosis. Emergency reperfusion of the LMCA with hemodynamic support should be the primary goal in patients with acute LMCA occlusion. Emergency coronary artery bypass graft surgery may be effective but time-consuming, and carries the risk of extensive and irreversible myocardial damage. We describe a case of abrupt closure of the LMCA due to plaque rupture by a diagnostic angiographic catheter without visible dissection following coronary angiography that was successfully treated with bail-out stenting during cardiopulmonary resuscitation.

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1. Introduction

Diagnostic coronary angiography can precipitate acute left main coronary artery (LMCA) closure, leading to cardiac arrest and sudden death. In a retrospective survey, left main disease and catheter induced trauma were the most important risk factor for and mechanism of death during diagnostic catheterization [1, 2].

We present the case of a 76-year-old man with acute total occlusion of the LMCA that developed cardiac arrest shortly after diagnostic coronary angiography. The patient was successfully treated with emergency left main bail-out stenting while cardiopulmonary resuscitation was being performed.

2. Case description

A 76-year-old male patient was admitted with the diagnosis of non-ST-elevation acute coronary syndrome. His past medical history

included diabetes mellitus and hypertension. On echocardiography, left ventricular function was preserved and neither hypokinesia nor valvular heart disease was observed. Diagnostic coronary angiography through the right femoral artery with a 6F Left Judkins 4.0 catheter revealed significant LMCA disease and severe ostial stenosis of the left circumflex coronary artery (LCX) with antegrade flow (Fig. 1A and B, Videos 1 and 2). There was no significant stenosis in the right coronary artery (RCA). Patient was scheduled for urgent coronary artery bypass graft (CABG) surgery and a surgical team was informed. After coronary angiography was completed and while the patient was being transferred to the coronary care unit he became hypotensive, asystolic, and unresponsive. Cardiopulmonary resuscitation was started with the positive inotropic support. Control coronary angiography showed complete occlusion of the LMCA. The ostium of the LMCA was engaged with a 6F Left Judkins 3.5 guide catheter and the lesion was crossed with a 0.014-in. floppy guide wire (Abbott Corporation, San Francisco, California). Pre-dilation was performed with a 3.0 × 15 mm Simpax balloon (Simeks Medical Device Company, Istanbul, Turkey) followed by placement of a 3.5 × 20 mm drug-coated stent (Boston Scientific Corporation, Marlborough, USA) with ongoing cardiopulmonary resuscitation (Fig. 2A and B). A 2.75 × 28 mm drug-coated stent

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(Boston Scientific Corporation, Marlborough, USA) was also placed to mid-left anterior descending artery (LAD). Thrombolysis In Myocardial Infarction (TIMI) flow grade 3 was achieved with gradual hemodynamic improvement (Fig. 3, Video 3). Intravenous abciximab was administered and continued for 12 h. Due to patient's good hemodynamic recovery and left ventricular assist devices were not available we did not use intra-aortic balloon pump (IABP) or the Impella. The patient was discharged 6 days later on long-term daily doses of aspirin 100 mg and ticagrelor twice 90 mg. After one-month follow up, he was asymptomatic and was continued on dual antiplatelet therapy.

3. Discussion

Iatrogenic LMCA occlusion is rare during coronary angiography but may be catastrophic if not immediately recognized and managed. LMCA occlusion during diagnostic coronary angiography can be associated with several risk factors such as ostial lesion location, LMCA calcification, forceful contrast medium injection, sharp LMCA angulation and LMCA instrumentation [3]. The use of smaller diagnostic catheter (e.g., less than 5F) and careful monitoring of the hemodynamic instability are the preventive measures that should be taken during diagnostic coronary angiography. In the presence of ostial stenosis, the mechanical trauma caused by the catheter tip during engaging or vigorous injection of contrast medium at the site of an ulcerated plaque may serve as an entry point for pulsatile blood flow (e.g., micro-dissection) as in the present case [4].

The mortality risk of diagnostic cardiac catheterization in patients with left main disease is high [5]. Devlin et al. [5] reviewed cardiac catheterization records over a 9 year period and patients dying during or within 24 h were identified. They reported that in 90% of left main deaths, the mechanism was dissection and in 93% of these cases the end of the catheter contacted the left main lesion on the first injection. In a study by Gordon et al. [6], the end-of-catheter to lesion distance was the only procedural variable that correlated with complications. They found that when this distance was 6 mm or less the complication rate was 24% and was only 3% when this distance was >6 mm.

About 5% of patients undergoing coronary angiography have significant disease of the left main coronary artery. When a left main ostial disease is identified, an initial nonselective injection of the ostium in a left anterior oblique view, coaxial positioning of the catheter in the left main stem trunk, a shallow oblique projection for visualization of the entire left main stem without foreshortening and for clarification of the relationship of the end of the catheter to a lesion and upsizing to a larger French size catheter are the technical approaches that should be considered for the prevention of abrupt LMCA closure [5].

Intravascular ultrasonography (IVUS), as an essential adjunctive device for determining hemodynamic significance of angiographically intermediate lesions, may lead to acute coronary occlusion over the target lesion examined. Cardiologists performing IVUS examination should be aware of this rare but potentially serious complication especially in patients with a distal unstable lesion in a small artery [7].

There are many case reports of iatrogenic dissections of LMCA secondary to guide catheter manipulations which were managed by percutaneous coronary interventions (PCIs) [1–4]. However, the management of LMCA occlusion may be challenging due to poor visualization of the LMCA ostium and guidewire entering the false lumen in case of left main dissection. The initial goal should be to restore flow without wasting time other than an optimal angiographic result. In the absence of left main flow, prompt stenting from the left main into the LAD may be the best initial strategy as in the present case. Although prompt stenting is the best choice in cases of severe hemodynamic deterioration, this procedure can be failed due to false lumen stent placement [8]. Although we could not use, IVUS or optical coherence tomography (OCT) imaging (for optimal stent positioning and ostial covering) and left ventricular support devices, such as IABP and the Impella should be also considered in cases of cardiogenic shock or cardiac arrest. However, it should be noted that there is conflicting evidence of the benefit of IABP in cardiogenic shock [9].

In the present case, left main ostial stenosis appeared to be very critical and there was no collateral blood flow from RCA to LCX and LAD. Although primary left main and mid-LAD PCI might be safe for the patient, we decided surgery due to high SYNTAX score (36.5). Indeed, in a study in which 1800 patients with left main trunk lesions were randomly assigned to treatment with CABG or PCI using a drug-eluted stent, Morice et al. [10] reported no significant difference in overall mortality. However, revascularization rate over a 5-year observation period was 21.6% for PCI and 15.5% for CABG; therefore, CABG was significantly superior. In a recent systematic review and meta-analysis, PCI and CABG showed comparable safety in patients with LMCA stenosis and low to intermediate-complexity coronary artery disease. However, repeat revascularization was more common after PCI [11]. The PRECOMBAT trial showed comparable outcomes at 1 and 2 years in patients with left main disease treated with CABG or PCI [12].

In the current American College of Cardiology/American Heart Association/Society of Cardiovascular Angiography and Interventions guidelines, patients with acute coronary syndromes with left main disease as the culprit who are not surgical candidates and in patients with acute ST-segment elevation myocardial infarction in whom the left main is the culprit also have Class IIa indications for PCI [13]. The most recent European revascularization guidelines reiterate the contraindication to the elective treatment of left main coronary artery disease with

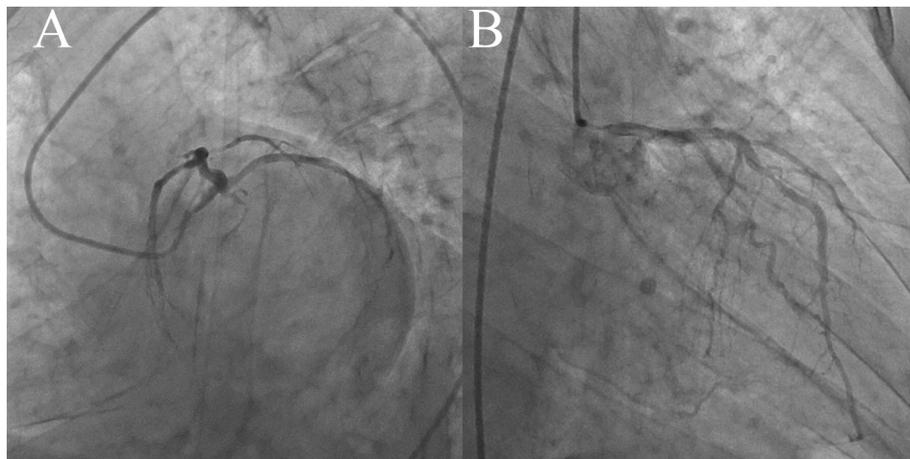


Fig. 1. A and B: Severe stenosis in the left main and left circumflex coronary arteries.

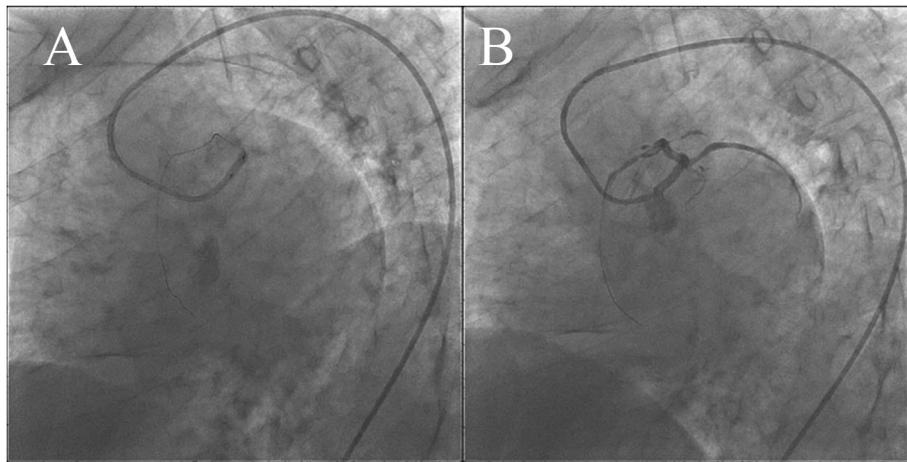


Fig. 2. A and B: Left main coronary artery ballooning and stenting.

PCI, in case of high anatomical complexity (SYNTAX >32) in patients who have an acceptable surgical risk [14]. On the other hand, the American societies' guidelines recommend CABG for the treatment of left main coronary artery disease and suggest PCI as an alternative in patients with an increased surgical risk and an amenable anatomy [13]. Recognizing the complexity of this high-risk subgroup, current guidelines advocate for use of the Heart Team approach for decision-making. This involves evaluation by both a surgeon and an interventional cardiologist who together determine the best revascularization strategy, taking into account patient comorbidities and the technical issues of PCI versus CABG for that patient. However, in some cases like the present, lack of collaterals from RCA to LAD and LCX may support to consider early revascularization with PCI instead of waiting for CABG due to increased mortality risk. The interventional cardiologist should consider either urgent PCI or at least hemodynamic supporting device placement while waiting surgery.

4. Conclusion

The present case highlights that patients with significant LMCA disease should be closely monitored after coronary angiography and emergently undergo control angiography if they develop hemodynamic collapse. Furthermore, delaying femoral artery sheath removal until few hours after completion of coronary angiography and monitoring the

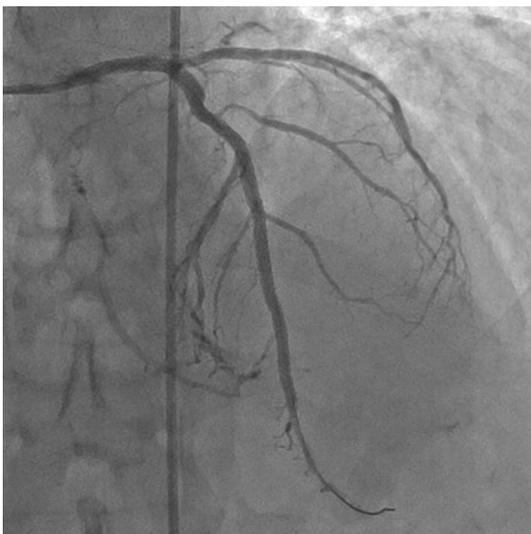


Fig. 3. Final angiography.

patient for a few minutes on cardiac catheterization table before transfer to a hospital bed may be also considered. Limiting the number of injections after left main stem disease is identified will also reduce the risk of vessel trauma. Because surgery is not immediately available, PCI to limit the extent and duration of ischemia remains the only bail-out option for these patients. As a main limitation of the present case, if available IVUS or OCT imaging should be considered after emergency stenting to proper sizing and apposition of the stent and to delineate the underlying etiology of the abrupt closure. Finally, it is important to note that the interventionalist contemplating left main PCI should be comfortable with the management of aorto-ostial disease, coronary calcification, and strategies for management of complex bifurcations and the use of rotational atherectomy, intravascular ultrasound, and hemodynamic support devices.

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.carrev.2018.07.007>.

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