Distal Emboli Protection Intervention in Native Coronary Artery Occlusion

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Introduction

Percutaneous coronary intervention (PCI) in acute myocardial infarction (MI) may be associated with distal embolization, particularly in lesions with large thrombus burden. As a consequence, patients may experience new or exacerbation of ST-segment elevation or chest pain, rhythm disturbances, or hypotension. Characteristic angiographic findings include slow or absent flow despite patent epicardial vessel ("no-reflow phenomenon") or cut-off of the distal vessel or side branches. Prevention of distal embolization is crucial, as this event is associated with increased morbidity and mortality (1,2). The two main strategies to prevent distal embolization include the administration of platelet glycoprotein IIb/IIIa receptor antagonists and the use of distal protection devices. While mechanical emboli protection devices have been shown to greatly improve outcomes following PCI of bypass grafts (3), no data is available on their efficacy in the native coronary circulation. The case of a patient with thrombotic occlusion of the left circumflex coronary artery (LCX) who underwent PCI with mechanical emboli protection and thrombus aspiration few days after MI illustrates the potential for thrombus reduction and distal protection in the native coronary circulation.

Case Description

A 53-year-old man was transferred for coronary angiography three days following subacute posterolateral MI. Electrocardiography revealed ST segment depressions in anterior derivations V1, V2 V3, V4 and T wave inversion in V5 V6, D1, aVL leads in the absence of Q waves or tall R waves in V1,V2. Laboratory analysis showed peak creatine kinase (CK) of 3191 U/l and CK-MB of 395 U/l on admission. Cardiovascular risk factors included hyperlipidemia, hypertension, and glucose intolerance. The antithrombotic regimen consisted of oral acetylsalicylic acid and unfractionated heparin infusion. Coronary angiography demonstrated total occlusion of proximal LCX, characterized by a large intraluminal filling defect suggestive of thrombus (Fig. 1). No other significant stenosis was detected and the left ventricular ejection fraction was 53%. After administration of abciximab 0.25 µg/kg bolus and 0.125 µg/kg/min infusion (ReoPro, Centocor, USA), and additional heparin, the achieved activated clotting time (ACT) was 250 seconds. The left coronary artery was engaged with a 7F Judkins left guiding catheter (Medtronic Zuma, Santa Rosa, CA). The occlusion was crossed with Magnum-Meier guidewire (Schneider, Zurich, Swit-

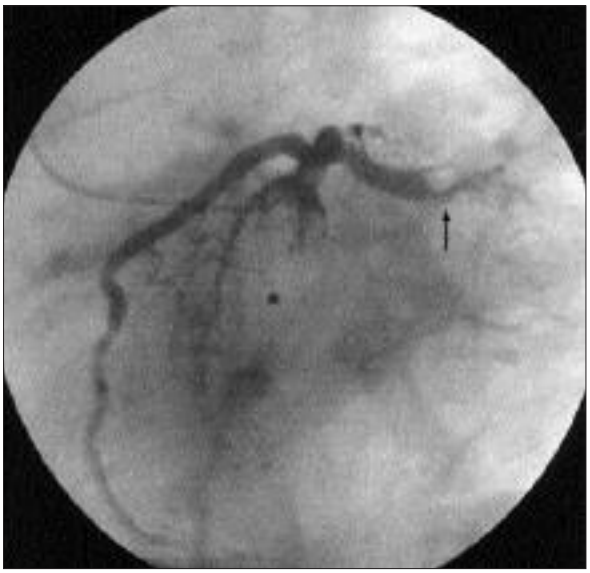

Figure 1. Intraluminal filling defect (arrow) suggesting thrombus in proximal left circumflex coronary artery (left-anterior-oblique/caudal view).

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zerland) and TIMI I flow was restored. Subsequently, a PercuSurge GuardWire (Medtronic, Santa Rosa, CA, USA) was advanced and positioned in the marginal branch. The distal protection balloon was then inflated to 3.0 mm and complete vessel occlusion at the site of the balloon was obtained, as confirmed by angiography. During distal balloon occlusion the Export catheter (Medtronic, Santa Rosa, CA, USA) was advanced and three aspiration passes were performed for a total of 31 ml of coronary blood. Following deflation of the distal balloon TIMI grade 3 flow was demonstrated in the LCX in the presence of a residual lesion. The Magnum-Meier guidewire was then removed and a 3.5/18 mm cobalt Driver stent (Medtronic, Santa Rosa, USA) was deployed at 12 atmosphere for 20 seconds under distal protection (Fig. 2). Two additional passes with the aspiration catheter were performed for a total of 25 ml of blood retrieved. Then the occlusion balloon was deflated and the wire removed. Final angiogram demonstrated no residual stenosis, TIMI grade 3 flow and no loss of major distal branches (Fig. 3 and 4). Several large pieces of thrombus measuring up to few millimeters could be aspirated (Fig. 5). Clopidogrel 300 mg orally was administered at the end of the intervention and abciximab infusion was continued for 12 hours. The patient remained asymptomatic throughout the procedure and no further enzyme elevation or ECG changes were subsequently detected. He was transferred to the referring hospital the next day on acetylsalicylic acid 100 mg/day lifelong and clopidogrel 75 mg/day for 1 year. As secondary prevention the patient was put on ACE-inhibitors, beta blockers, folic acid and statin.

Discussion

Among patients undergoing PCI for medically refractory non-ST segment elevation acute coronary syndromes, angiographic evidence of thrombus may be present in up to 40% of cases, while on angioscopy 90% of the culprit lesions have a thrombotic component (4). The presence of large thrombus load is a predictor of adverse events such as no-reflow (1, 2), MI, emergency coronary bypass surgery, and death (5). Despite the overall superiority of primary angioplasty in acute MI over fibrinolytic therapy (6) the optimal approach to lesions with large thrombus burden remains challenging.

Glycoprotein IIb/IIIa inhibitors have demonstrated beneficial effects in ST-elevation MI (7), albeit not in all studies (8). So far, the most effective emboli protection has been obtained by mechanical distal protection. The use of distal balloon occlusion, as in our case, during PCI of bypass grafts has been associated with an approximately 40% reduction in isc-

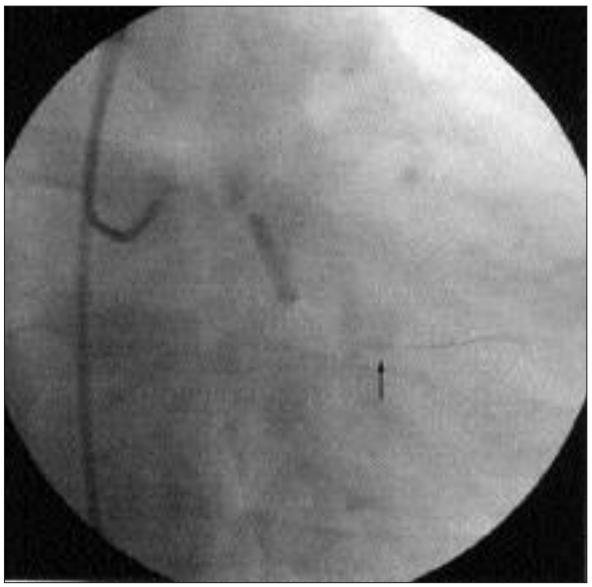

Figure 2. Distal balloon occlusion (arrow) while a proximal stent is being deployed (right-anterior-oblique/caudal view).

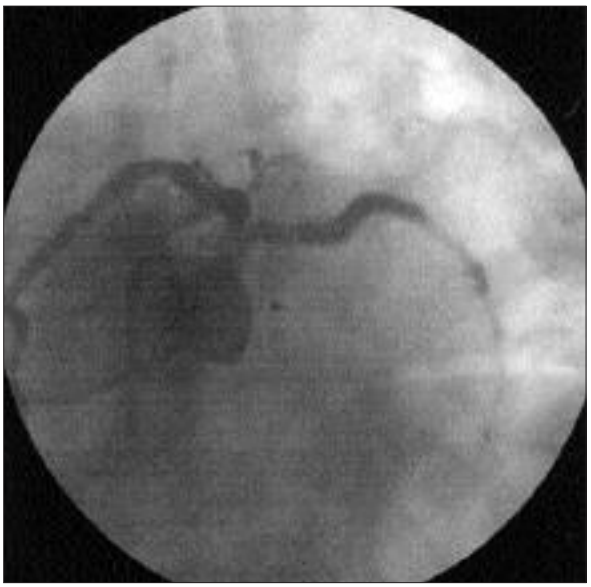

Figure 3. Final angiogram demonstrating no thrombus in the proximal left circumflex coronary artery (left-anterior-oblique/caudal view).

hemic complications (5). In the same setting, we have demonstrated that GP IIb/IIIa inhibitors were not efficacious (9). Similarly, distal emboli protection devices are considered a major break-through in carotid stenting (10). Although clinical trials are ongoing, no data are currently available on mechanical emboli protection in native coronary interventions. The case presented, characterized by unusual large thrombus burden, illustrates well the potential of such devices in the native circulation.

The PercuSurge GuardWire (Medtronic AVE, Santa Rosa, USA) is a 7F compatible device. The compliant distal occlusive balloon is mounted on a hydrotube that can function as a 0.014-inch steerable guidewire. Once its positioned distally to the target lesion, the balloon is inflated to arrest blood flow and angioplasty is performed. The debris suspended in the blood column are then aspirated with a catheter. The distal balloon is then deflated and flow restored. In acute MI distal balloon occlusion is usually well tolerated, as the vessel is frequently occluded at the beginning of the intervention. As in our case, the thrombus reduction obtained by aspiration is important. A drawback of the system is the impaired visualization of the lesion during distal balloon inflation and the inability to protect side branches located proximal to occlusive balloon.

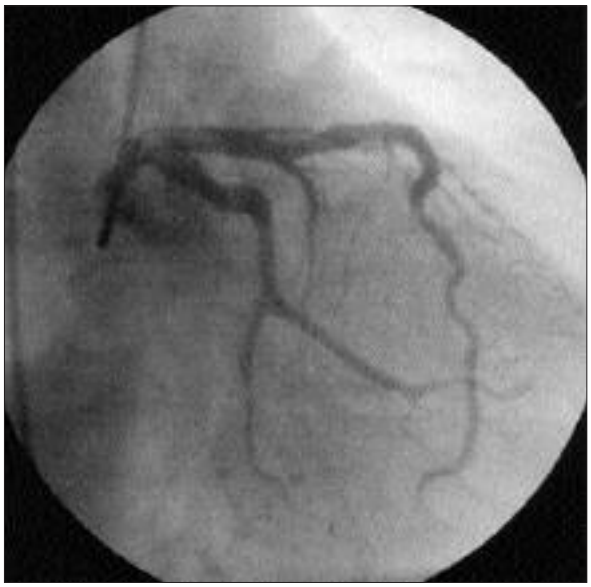

Figure 4. Final angiogram demonstrating no residual stenosis and no loss of major distal branches in the left circumflex coronary territory (right-anterior-oblique/caudal view).

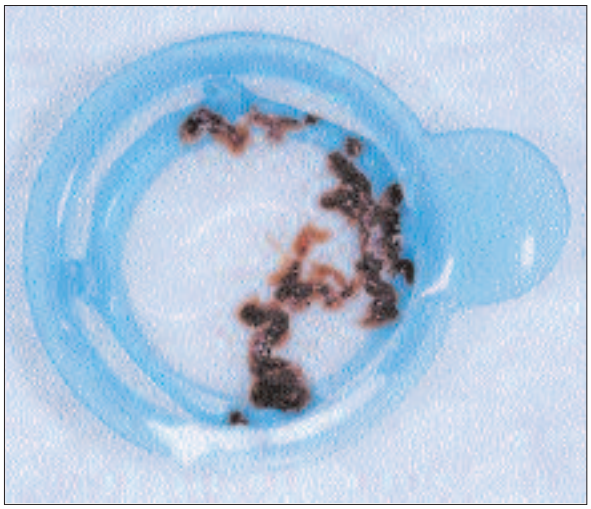

Figure 5. Thrombotic material aspirated during the procedure. Size of the container is 25mm.

Alternatively, mechanical thrombectomy devices such as Angiojet (Possis Medical, Inc. Minneapolis, Minnesota) may be considered for thrombus reduction. Accordingly, a preliminary report on 31 patients with acute MI suggested that this device may be safe and efficacious in this setting (11). Awaiting results of randomized trials, at our institution we use distal protection devices in combination with abciximab in virtually all patients presenting with acute MI. In our experience it is worthy to spend 20 additional minutes preparing and using the device instead of dealing with complications of distal embolization.

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