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Case Reports

Coronary Artery Dissection Caused by Exit of the Guidewire Through the Distal Perfusion Sidehole of an Auto-Perfusion Angioplasty Balloon Catheter

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A previously unrecognized cause of coronary artery dissection is reported. A 67-year-old woman underwent angioplasty of the right coronary artery using an autoperfusion balloon catheter. Dissection occurred because the balloon catheter was advanced while the guidewire exited from one of the distal perfusion sideholes. © 1994 Wiley-Liss, Inc.

Key words: coronary angioplasty, coronary dissection, perfusion balloon

INTRODUCTION

A variety of approaches have been developed to alleviate myocardial ischemia during percutaneous transluminal coronary angioplasty (PTCA) [1]. The intra-aortic balloon pump (IABP) [2,3] and percutaneous cardiopulmonary support (CPS) [4,5] devices provide systemic circulatory support, but may not enhance perfusion of the ischemic myocardium during balloon inflations. Techniques that have been shown to ameliorate regional myocardial ischemia during prolonged balloon inflations include distal perfusion with a perfluorochemical [6], or with blood via auto-perfusion balloon catheters [7–10] or an active perfusion pump [11,12]. The auto-perfusion balloon catheter is the simplest and least expensive method of supporting the ischemic myocardium and obviates the potential peripheral vascular complications of IABP or CPS. The case that follows illustrates a complication of the autoperfusion catheter that we had not previously encountered.

CASE REPORT

A 67-year-old woman with coronary artery disease, hypertension, hypercholesterolemia, and a history of four-vessel bypass surgery underwent cardiac catheterization because of a positive exercise test. The left ventriculogram showed an ejection fraction of 60% with hypokinesis of the anterolateral segment. Coronary angiography showed a 70% stenosis of the left main coronary artery, total occlusions of the proximal left anterior descending (LAD) and left circumflex (CIRC) coronary arteries, and a 70% stenosis of the midright coronary artery (RCA). Collaterals to the LAD and CIRC arose from the RCA. The left internal mammary artery graft to the LAD had a 40% distal anastomotic stenosis. The three vein grafts were occluded. Angioplasty of the RCA was performed using an 8 French R4 guiding catheter (USCI, Billerica, MA), a 0.014″ Hyperflex guidewire (USCI), and 3.0 mm RX perfusion balloon catheter (ACS, Santa Clara, CA). During balloon inflations there was moderate reduction of the arterial blood pressure, which resolved after each inflation. There was a 30% residual stenosis after PTCA.

The patient was re-hospitalized for angina at rest 5 months after PTCA. Cardiac catheterization demonstrated a 90% stenosis of the RCA at the site of the previous PTCA. An intra-aortic balloon pump was inserted before attempting PTCA of the RCA because of the hypotension observed during the previous PTCA. Repeat PTCA of the RCA was performed using an 8 French R4 sidehold guiding catheter (USCI), a 0.014″ Phantom guidewire (USCI), and 3.0 mm RX perfusion balloon catheter (ACS). The guidewire was withdrawn to

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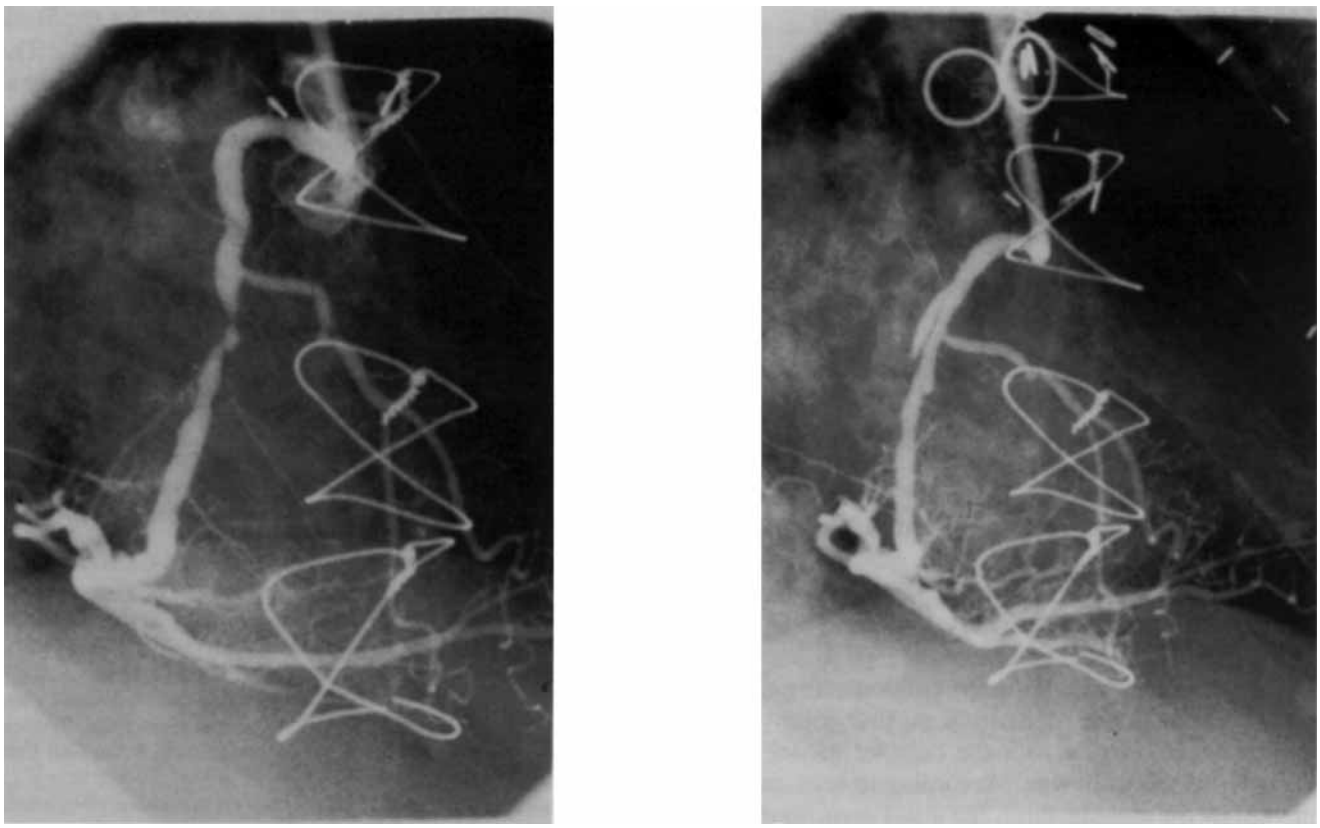

Fig. 1. Left panel: stenosis of midright coronary artery before coronary angioplasty. Right panel: dissection of midright coronary artery after coronary angioplasty.

facilitate perfusion during balloon inflation. After successive inflations of six and seven bars for 90 sec each, the guidewire was advanced distal to the stenosis and the balloon catheter was withdrawn into the guiding catheter. When the balloon catheter was then advanced to perform an additional inflation, it could not be advanced beyond the proximal RCA into the stenosis. Angiography demonstrated a deep intimal dissection of the proximal RCA (Fig. 1). Exit of the guidewire from a distal perfusion sidehole was suspected. Both the balloon catheter and guidewire were removed to avoid the possibility that the wire would unravel. Inspection of the guidewire and catheter confirmed that the wire exited from a distal perfusion sidehole.

The guidewire and balloon catheter were re-inserted, and the dissection was treated with successive inflations of four bars for 10 min and 20 min. The final residual stenosis was 20%, and there was TIMI 3 flow. Nevertheless, the patient experienced recurrent episodes of angina at rest despite treatment with intravenous nitroglycerin and heparin and the intra-aortic balloon pump. Therefore, she underwent bypass surgery 5 days after PTCA and received a single saphenous vein graft to the distal RCA. She was discharged from the hospital 10 days after surgery.

DISCUSSION

The efficacy and safety of the autoperfusion balloon catheter was investigated by Muhlestein et al. [9]. In a series of 62 consecutive patients, there was no evidence of hemolysis or myocardial necrosis after a mean inflation time of 14 min [9]. Several trends in interventional cardiology may led to the increased use of auto-perfusion balloon catheters by PTCA operators and an increased possibility of the complication described in this case report. Recent clinical reports have demonstrated the relative safety and efficacy of PTCA in patients with multivessel CAD [13], with total occlusion of a contralateral coronary artery [14], or with impaired left ventricular function [15,16]. Prolonged inflations using a perfusion balloon catheter have been advocated as a treatment for major coronary dissections after PTCA [7,10]. Also, preliminary data have suggested that prolonged balloon inflations may result in improved angiographic results and lower rates of dissection in patients with complex

TABLE I. Perfusion Catheter Flow Rates (ml/min)

	Stack Perfusion®	Stack Perfusion Long®	Stack 40-S™	RX Perfusion™	RX Perfusion 30 mm Long	RX Flow-track™40
No wire	60	55	40	60	55	40
0.010	45	40	25	45	40	25
0.014	40	35	20	40	35	20
0.018	30	25	15	30	25	15

stenosis morphology [17]. A recent review of perfusion angioplasty by Kereiakes et al. [18] recommended the use of a perfusion balloon catheter in the following situations: (1) proximal segment of a large vessel, (2) increased myocardial oxygen demand (e.g., left ventricular hypertrophy), (3) severe left ventricular dysfunction when the target vessel supplies the residual viable myocardium, (4) stenoses with complex morphology, (5) treatment of dissection and abrupt closure, and (6) as a bridge to surgery after unsuccessful PTCA.

There are six ACS perfusion balloon catheters available for clinical use. The distal perfusion provided by these catheters varies with the catheter model and the diameter of the guidewire. According to tests conducted in vitro by the manufacturer, the distal perfusion by a 3.0 mm RX perfusion catheter is decreased 33% by a 0.014″ guidewire and 50% by a 0.018″ guidewire. Therefore, withdrawal of the guidewire proximal to the perfusion sideholes is recommended during balloon inflation. In this case, after the first two inflations, the guidewire was again advanced distal to the lesion and the balloon catheter was withdrawn to visualize the dilated segment. Unaware that the guidewire had been advanced through a distal perfusion sidehole, we inadvertently dissected the proximal coronary artery when we attempted again to advance the balloon catheter to perform a third inflation. This represents a complication of the auto-perfusion angioplasty balloon catheter that we had not previously encountered in our cardiac catheterization laboratory.

The complication experienced in this case can be avoided in several ways. First, restricted mobility of the wire and increased resistance to wire motion should alert the operator that the wire may have exited a sidehole and that the catheter should not be advanced over the wire. A second approach is to use a 0.018″ guidewire to reduce the chance that the tip of the wire will exit from the distal perfusion sideholes. Third, rather than withdrawing the guidewire, it can be maintained distal to the catheter tip, but the presence of the guidewire across the perfusion sideholes limits distal flow to the ischemic myocardium (Table I). Finally, a recent model of the RX perfusion catheter, the RX Flowtrack 40™, has smaller distal perfusion sideholes than the other perfusion catheters (0.014″ for the RX Flowtrack 40 vs. 0.021″ for the Stack 40S and 0.025″ for all other perfusion catheters). The smaller perfusion sideholes do not reduce the maximal flow rate that can be achieved, but reduce the probability of the complication described in this case report.

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