

No-Reflow Phenomenon During Treatment of Coronary In-Stent Restenosis With a Paclitaxel-Coated Balloon Catheter

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Drug-eluting balloon (DEB) with angioplasty a paclitaxel-coated balloon catheter is an effective treatment option in patients with in-stent restenosis (ISR) after a drug-eluting stent (DES). We describe a case in which 'no-reflow' phenomenon developed after DEB angioplasty of a DES ISR lesion. Coronary flow was restored after intracoronary administration of nicorandil. (**Korean Circ J 2012;42:431-433**)

KEY WORDS: Complications; Coronary restenosis; No-reflow phenomenon.

Introduction

Drug-eluting balloon (DEB) angioplasty with a paclitaxel-coated balloon catheter is an effective treatment option in patients with in-stent restenosis (ISR) after a drug-eluting stent (DES). We describe a case in which the 'no-reflow' phenomenon developed after DEB angioplasty of a DES ISR lesion. Coronary flow was restored after intracoronary administration of nicorandil.

Case

A 74-year-old man with a history of hypertension and on regular medication for 10 years had accelerating angina for 2 weeks. Six months earlier, he had accelerating chest pain for 1 month, which necessitated admission. His right coronary angiogram revealed diffuse severe stenosis involving the proximal to distal right coronary

artery (RCA) (Fig. 1A), which was treated with two overlapping DESs extending from the distal to the proximal RCA (3.0×38 mm and 3.0×30 mm, Endeavor™ Resolute™ stent; Medtronic Vascular, Santa Rosa, CA, USA) (Fig. 1B). A platelet function assay showed 588 ARU and P2Y12 inhibition was 244 PRU (34%). He was discharged with dual antiplatelet therapy.

Six months after the index procedure, he had recurrent chest pain and a repeat angiogram showed diffuse ISR with Thrombolysis in Myocardial Infarction (TIMI) 2 distal flow (Fig. 1C) with pressure damping despite the use of a 5 Fr guiding catheter. Percutaneous coronary intervention was attempted. After balloon dilation with a 2.0 mm balloon, intravascular ultrasound revealed diffuse neointimal proliferation, but neither stent fracture nor overlap free segments were present. Sequential predilation of the distal to proximal RCA was performed with a 3.0×20 mm balloon. After balloon dilation with a 3.0 mm balloon, the RCA showed a stent-like result (less than 20% diameter stenosis with TIMI 3 flow) (Fig. 2A). DEB ballooning was done at the mid to distal RCA with a SeQuent® Please (B. Braun Medical Inc., Melsungen, Germany) paclitaxel-eluting balloon 3.0×30 mm deployed at 8 atm/40 seconds (Fig. 2B). After DEB ballooning, a no-reflow phenomenon developed with chest pain (Fig. 2C). After intracoronary administration of 5 mg of nicorandil (dissolved in 10 mL of 0.9% saline), the distal flow was restored gradually. The final angiogram, taken 5 minutes after development of the no-reflow, showed TIMI 3 flow (Fig. 2D).

The following cardiac enzyme and troponin remained within the normal range. The patient had an uneventful recovery and was discharged home on the following day.

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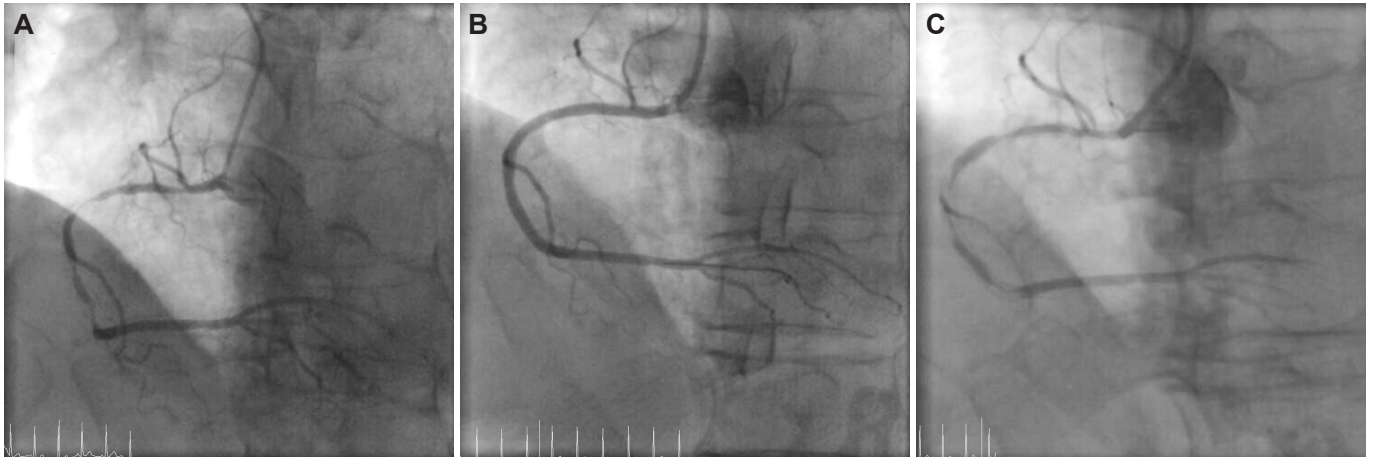


Fig. 1. Right coronary angiogram. A: right coronary angiogram shows diffuse severe stenosis involving proximal to distal right coronary artery (RCA). B: final result of initial percutaneous coronary intervention using two overlapping stents. C: follow-up right coronary angiogram shows diffuse severe in-stent restenosis involving proximal to distal RCA.

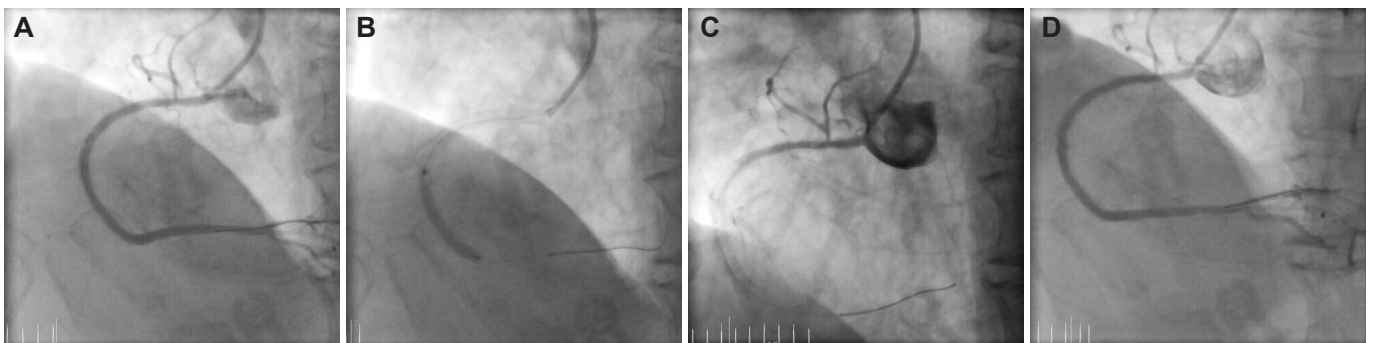


Fig. 2. Right coronary angiogram. A: after balloon dilation with a 3.0 mm balloon, the right coronary artery shows stent-like result (less than 20% diameter stenosis with Thrombolysis in Myocardial Infarction 3 flow). B: drug-eluting balloon (DEB) ballooning with a paclitaxel-eluting balloon 3.0x30 mm deployed at 8 atm/40 seconds. C: after DEB ballooning, the coronary angiogram shows no-reflow phenomenon. D: final angiogram shows restoration of distal flow after intracoronary nicorandil.

Discussion

Treatment of coronary ISR with a paclitaxel-coated balloon catheter is known to be at least as effective as a paclitaxel-eluting stent¹⁾ without the disadvantages of the polymeric matrix that may induce inflammation and thrombosis.²⁾ The DEBs used in this case are coated with the free drug. To enhance the dissolution of the drug, a small amount of radiographic contrast agent is added to the coating.²⁻⁴⁾

In this case, the angiogram after the predilation with a 3.0 mm balloon showed normal distal flow, but after DEB inflation for 40 seconds, a no-reflow phenomenon developed. Thus, although it remains possible that the findings were coincidental, it is suggested that a 'no-reflow' phenomenon can develop in some patients treated with a DEB. The no-reflow phenomenon was originally described in patients with ST-segment elevation myocardial infarction (STEMI) to describe microvascular obstruction and reduced myocardial flow after opening an occluded artery.⁵⁾⁶⁾ The pathogenesis of no-

reflow is heterogenous, but distal embolization, ischemia-reperfusion injury, increased microvascular impedance to flow or microvascular spasm was suggested. One possible explanation of no-reflow after DEB angioplasty is related to paclitaxel. A recent study of paclitaxel-coated balloons in a porcine model showed that the paclitaxel-coated balloon is associated with impaired vasodilatory responses to acetylcholine distal to the treated segments.⁷⁾ The other possible explanation is related to the coating. The coating of a DEB contains a non-ionic water-soluble monomeric contrast agent (iopromide), which may cause vasospasm⁸⁾ or coronary vasoconstrictive response in atherosclerotic segments in patients with coronary artery disease.⁹⁾ Recent clinical studies have demonstrated the beneficial effects of nicorandil, an adenosine triphosphate-sensitive potassium channel opener, on no-reflow in patients with STEMI¹⁰⁾¹¹⁾ or during rotational atherectomy.¹²⁾ The no-reflow phenomenon disappeared after nicorandil administration in this case. This suggests that nicorandil could be helpful in eliminating the no-reflow phenomenon in such a case.

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