

## Case Report

# Successful distal administration of high doses of adenosine and nicardipine using export catheter for treatment of resistant no-reflow in a vein graft

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Received December 6, 2021; Accepted February 13, 2022; Epub February 15, 2022; Published February 28, 2022

**Abstract:** This case is the first case report describing successful administration of very high doses of distal adenosine administration using a simple export catheter for resistant no-reflow. This new application of export catheter is a very safe and easy to perform application to treat this condition and can be lifesaving. This case elaborates and discusses this new application in detail.

**Keywords:** No-reflow, percutaneous coronary intervention, slow-flow, export catheter, coronary intervention

### Introduction

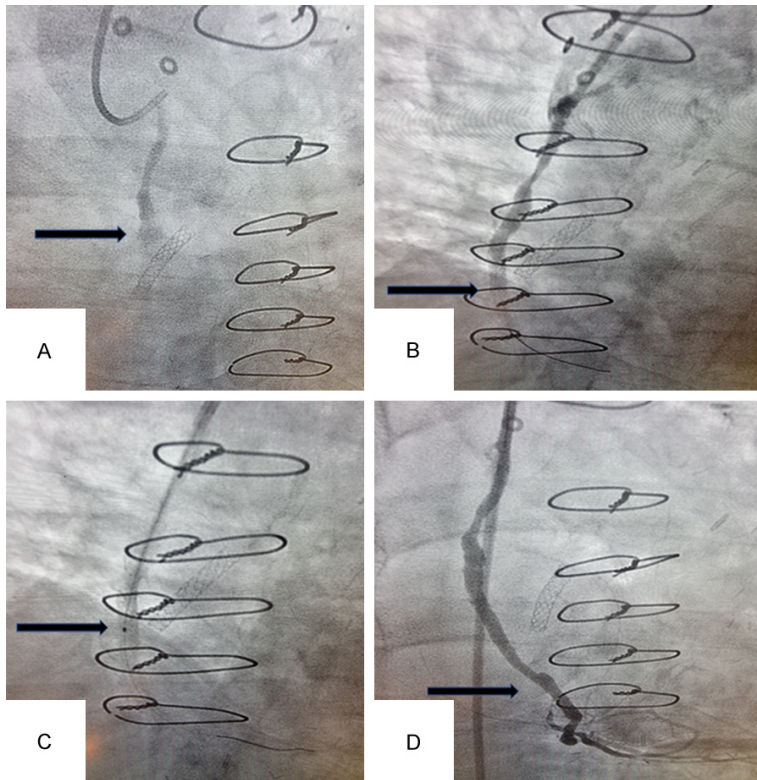
No-reflow is a serious condition requiring immediate attention. No-reflow is defined as a failure of establishing distal coronary flow despite appropriate treatment of obstruction. The prevalence is reported to be between 0.6% to 5% annually [1]. The incidence is highest in patients with the use of rotational atherectomy, SVG interventions, or in the setting of acute myocardial infarction and can be as high as 50% in cases involving a high thrombus burden [1]. Many modalities have been utilized for the treatment of no-reflow with limited success including injection of vasoactive drugs into the main coronaries. The main problem with this approach is the fact that active drugs cannot reach the distal coronary bed if injected proximally. Furthermore, proximal injection limits the doses of active drugs that can be given to a patient as it will cause more systemic effects. With the ability of the export catheter to inject active drugs distally, we can give high doses in very distal location of coronary branches to treat resistant no-reflow with higher success rate. In this manuscript, a successfully treated case of resistant no-reflow is reported using distal administration of very high doses of

active drugs via an export catheter with a review of the literature.

### Case report

A 66-year-old white male with a history of coronary bypass grafting more than 15 years ago presented with substernal chest pain occurring in the last 24 hours to the emergency department. His electrocardiogram (EKG) revealed infero-posterior ST-elevation myocardial infarction. After obtaining signed informed consent, the patient was taken to the cardiac catheterization laboratory. He was found to have 100% chronic occlusion of his right coronary and acute 100% occlusion of his mid saphenous vein graft (SVG) supplying his posterior descending artery. The decision was made to proceed with intervention due to persistent chest pain despite medical therapy (**Figure 1A**). A 6 French multipurpose guide catheter was used for intervention. The patient received aspirin and heparin in the emergency department. A weight-based bolus of bivalirudin was started with continuous intravenous infusion. A Balance Middle Weight 0.014-inch (Abbott Vascular, Santa Clara, California) wire was advanced across the lesion without any difficulty. Next, a euphoria 2.5×15 mm balloon was used

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**Figure 1.** Figure describing the entire case from inception to the end starting with initial angiogram showing 100% occluded vein graft with the occurrence of no-reflow after stenting and the resolution of no-reflow after injecting high doses of vasoactive drugs distally via export catheter. A: Angiogram (arrow) is showing 100% SVG occlusion. B: Arrow showing the occurrence of no-reflow after stenting. C: Arrow showing the tip of the Export catheter in the stent. D: Resolution of no-reflow with normal appearing distal vessel (arrow).

for pre-dilatation establishing thrombolysis in myocardial infarction (TIMI) 3 flow. Due to persistent residual high-grade disease, a 3.5×18 mm Onyx DES stent (Medtronic, Minneapolis, MN) was deployed in the lesion at 16 atm. Post stenting, severe no-reflow occurred with recurrent chest pain (**Figure 1B**). Administration of Intracoronary 60 to 100 micrograms of adenosine and 100 micrograms of nicardipine did not show any improvement in the flow. The decision was made to proceed with the distal administration of high doses of adenosine and nicardipine. An export thrombectomy catheter (Medtronic, Minneapolis, MN) was advanced into the stented area within seconds (**Figure 1C**) with the administration of 100 and 200 micrograms of adenosine and 200 micrograms of nicardipine distally with immediate normalization of the flow (**Figure 1D**) and complete resolution of chest pain. His echocardiogram revealed a normal ejection fraction with very mild basal inferior wall hypokinesia.

### Discussion

Treatment of no-reflow requires immediate attention and can be difficult with current therapeutic modalities. Resistant no-reflow not responding to common measures can be life-threatening. The incidence of resistant no-reflow is not known. Many therapeutic interventions are described in the literature including intracoronary administrations of adenosine, nitroprusside, verapamil, epinephrin, Glycoprotein IIb/IIIa inhibitors, etc. with various successes [1]. Unfortunately, morbidity and mortality remain high in patients with persistent no-reflow. However, distal administration of very high doses of adenosine or nicardipine or any vasoactive drugs with the availability of export catheter can be performed very easily and quickly in less than 30 seconds. It has been very successful in limited case reports but totally underutilized. Particularly the utility of export catheters for this purpose has never been

reported. We reported a successful case using over the balloon catheter at the time that export catheter was not available which is more time consuming and requires wire extension and removal of the coronary wire with the risk of rewiring problem [2]. A Clearway catheter (Atrium Medical, Hudson, NH) which is a rapid exchange balloon catheter has been successfully utilized for this purpose [3]. However, the large lumen of the export catheter and its availability in any cardiac catheterization lab, makes the export catheter an ideal catheter for this purpose. This case is the first case in the literature reporting the use of export catheter for high-dose distal adenosine and nicardipine administration. Despite very ease of use and high success rate, the interventional community is not aware of this life-saving use of an export catheter. We believe that this approach should be the standard of care in resistant no-reflows [4]. Due to a very short half-life of adenosine and distal administration of this drug,

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multiple very high doses can be administered safely. Any other vasoactive medications given distally can also be much more effective with this route of administration. A study using a perforated balloon in 24 patients was able to successfully deliver high doses of vasoactive drug distally [5, 6]. However, this technique is time-consuming and damages the angioplasty balloon with a theoretical risk of balloon material embolization or balloon entrapment. Furthermore, the newly created holes in the balloon certainly are smaller than the export catheter lumen. Therefore, export catheter use in this condition should remain the catheter of choice for this purpose. The author's experience using over-the-wire balloon catheters in this setting has been very positive before the availability of export catheters. Very high doses of up to 5 mg of adenosine have been given distally without much systemic side effect in this fashion. However, it is time-consuming and requires rewiring the lesion with a long wire or docking the short wire in order to utilize over the wire balloons. There are no randomized trials to prove our approach but common sense and reported case reports as mentioned in this discussion prove the concept. Randomized clinical trials would be helpful to definitely assess the safety and effectiveness of this approach.

### Disclosure of conflict of interest

None.

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