Use of Perforated Balloon Technique to Deliver Intracoronary Adenosine in Patient with Slow Flow/No Flow Syndrome: A Case Report

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Abstract

Coronary no-reûow (NRF) following percutaneous coronary intervention (PCI) is infrequent but one of the most serious complication which results from impaired flow of microvascular bed. It is associated with adverse outcome if flow is not restored. Several pharmacological and non-pharmacological interventions have been used to treat this situation. We will describe the use of perforated balloon (PBT) for intracoronary (IC) adenosine administration and its effects on outcome during slow flow/no flow in patient undergoing PCI in the setting of ACS. This technique enables rapid and cost-effective treatment of no-reflow phenomenon during PCI for ACS.

Keywords: No-reflow phenomenon, Percutaneous coronary intervention, Perforated balloon technique

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Introduction:

Slow flow or No-reflow is an undesirable result of percutaneous coronary interventions (PCI).[1] Intracoronary (IC) vasodilators such as verapamil, nitroprusside, or adenosine are being administered for the treatment of no-reflow via the guiding catheter, but sometimes distal flow restoration is not satisfactory especially in patients with TIMI 0 flow. Vasoactive drug administration at the distal part of the coronary artery is suggested as a treatment option for no-reflow and some distal infusion catheters and over-the-wire (OTW) balloon catheters are being used for this purpose.[2, 3, 4] However, OTW catheters need long guide wires and changing a short wire with a long wire has the risk of wire loss. Distal infusion catheters are special catheters for drug infusion at various vascular sites, but these catheters are not always available. Monorail balloon catheters are the most widely used catheters in routine clinical practice. Here, we describe one case of successful no-reflow management by previously used monorail balloon as a hand-made distal infusion catheter.

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Case report:

A 68-year-old male patient was taken to catheterization laboratory at the fourth hour of his central chest pain with the diagnosis of acute anterior STEMI. The patient was pretreated with acetylsalicylic acid 300mg, Ticagrelor 180 mg and unfractionated heparin 100 Unit/kg. Infarct related artery was left anterior descending artery (LAD), Figure 1(a). Total occlusion was crossed with a 0.014 inch Runthrough floppy wire and daughtering of the lesion was done with 2.0/20mm monorail balloon. After balloon daughtering angiogram showed TIMI II flow with good distal landing zone (Figure 1(b). Then 2.75 × 28 mm drug eluting stent (DES) was deployed, Figure 1(c). No post

dilatation was done. After stenting no-reflow developed. Intracoronary adenosine (300 mcg) was administered through guide catheter but distal flow could not be restored, Figure 1(d). Therefore we decided to give adenosine at the distal part of LAD and the previously used 2.0/20mm monorail balloon was retrieved and perforated with a needle at six different sites. The perforated balloon was flushed from the hub with adenosine solution (12 mcg/ml) and bubbles were removed, Figures 2(a) and 2(b). Adenosine solution was made by mixing 1 ample adenosine (1 ample =6 mg) in 500 ml normal saline (12 mcg/ml). Then it was injected to the distal part of the LAD and 250 mcg adenosine was injected via the balloon by inflation-deflation device. Control angiography revealed TIMI 3 flow,Figure 1(e). Then the procedure was terminated without any other complication.

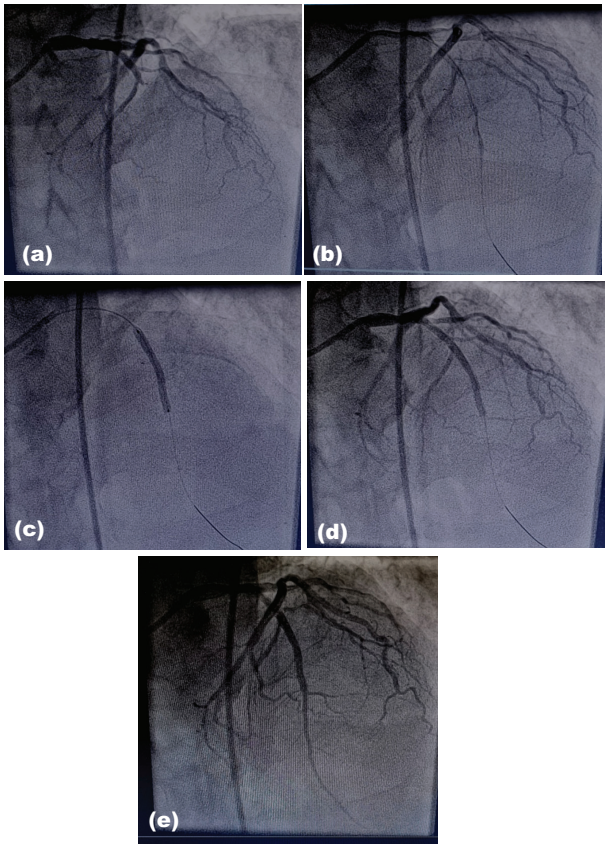

Figure 1: *(a) angiogram of the patient showing LAD was 100% blocked. (b) Runthrough floppy wire was crossed the lesion followed by balloon daughtering. (c) Direct DES was deployed in LAD (No predilatation or post dilatation was done). (d) No-reflow developed. (e) 2.0/20mm monorail balloon was perforated and was inserted to the distal part of the LAD; afterwards 250 mcg adenosine was injected via the balloon. Successful distal flow was restored.*

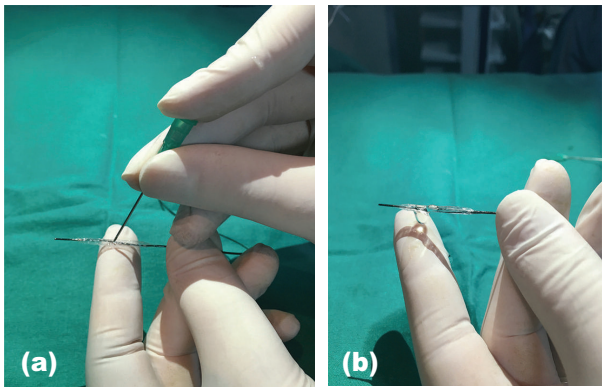

Figure 2: *Preparation of balloon before distal infusion. (a) First the balloon is filled with saline and perforated with a needle from perpendicular at 6 different sites. It is important to not cross the opposite layer of the balloon. (b) The perforated balloon is flushed from the hub with adenosine solution and the bubbles were removed.*

Discussion:

Slow flow / No-reflow increases mortality and hospital stay in acute MI patients.[5] Distal microembolization, endothelial dysfunction, and reperfusion injury (by increasing the microvascular resistance) are the proposed mechanisms of no-reflow.[6] Antiplatelet agents, thrombus aspiration, distal embolic protection devices, and vasodilator drugs can be used for prevention and treatment of no-reflow.[7] Intra coronary vasodilator administration through the guiding catheter is frequently performed to resolve no-reflow. But it is obvious that administered vasodilator agents cannot penetrate to the coronary microcirculation especially in patients with TIMI 0 flow because there is no blood flow at the distal part of the vessel. In addition, when vasodilator drug is administered by the guiding catheter, it penetrates to other coronary territories and the vasodilator drug concentration dilutes.

Administration of the vasodilator drugs at the distal part of the coronary artery can deal with these problems and vasoactive drug efficacy can be increased at the distal part of the coronary artery. OTW balloon catheters and distal infusion catheters have been used for this purpose and positive results were reported with distal vasodilator drug injection.[8, 9, 10] However these two types of catheters have some disadvantages. Distal infusion catheters (like ClearWay, Atrium Medical Corporation, Hudson, NH, USA/multifunction probing catheter, Boston Scientific Corporation, Boston, MA) are suitable for drug administration at the distal part of coronary artery, but these catheters are not routinely found in most of the cathlab. OTW balloons are not the first choices in daily

practice and need a long guidewire. Wire exchange for OTW balloon usage has the risk of wire loss and failure of rewiring, a very risky situation for the operator. Monorail balloons are frequently used in daily practice. They are easily retrievable and they can be used with short guidewires. Here, we have described successful usage of a monorail balloon for distal vasodilator drug infusion. There may be some safety concerns about inserting a perforated balloon to the distal part of the coronary and drug infusion through this balloon, but we did not encounter any complication with this method and reached successful results. Flushing the perforated balloon from the hub takes away the risk of air bubble embolism. Perforating the balloon form multiple sites reduces the risk of coronary dissection due to saline flow because injected saline's pressure is reduced by multiple holes. In addition, this method does not impose an additional cost to the procedure. Health expenditure is very important all around the world. We think that distal drug infusion with this method is safe and effective at least like other catheters; whereby use of new catheter and raising the cost of the procedure become unnecessary.

Conclusion:

Perforation of a monorail balloon with a needle and using as a distal infusion catheter can be used for no-reflow treatment. We achieved favorable results with this off-label usage. This method is always available, easy, and safe and has no additional cost.

Conflict of Interest:

The authors declare that there is no conflict of interests regarding the publication of this paper.

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