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Case Report

# Efficacy of Drug-Eluting Balloon in the Treatment of Ostial Left Anterior Descending Artery In-Stent Restenosis

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**ABSTRACT**

Percutaneous coronary intervention with drug-eluting balloons has emerged as an adjunctive strategy in the setting of Interventional Cardiology. When compared to drug-eluting stents, drug-eluting balloons offer advantages such as immediate and homogeneous drug release in the arterial wall, absence of polymers that can induce chronic inflammatory reactions, and the potential for using dual antiplatelet therapy for a shorter period of time. Furthermore, in some situations, additional stenting is not desirable, which turns this modality into an interesting option. We report the case of a patient with acute coronary syndrome in whom this intervention was chosen to treat an ostial left anterior descending artery in-stent restenosis.

**DESCRIPTORS**: Coronary restenosis. Percutaneous coronary intervention. Angioplasty, balloon. Paclitaxel.

**RESUMO**

**Eficácia do Balão Farmacológico no Tratamento de Reestenose Intra-Stent em Óstio da Artéria Descendente Anterior**

A intervenção coronariana percutânea com balão farmacológico surgiu como estratégia adjunta no cenário da Cardiologia Intervencionista. Em comparação com o stent farmacológico, o balão farmacológico oferece vantagens, como a liberação imediata e homogênea do fármaco na parede arterial, a ausência de polímeros que podem induzir a reações inflamatórias crônicas e o potencial de utilizar a dupla anti-agregação plaquetária por menor tempo. Além disso, em algumas situações, não são desejáveis implantes adicionais de stents, o que torna essa modalidade uma opção interessante. Relatamos aqui o caso de uma paciente em síndrome coronariana aguda, em que foi feita a opção por esse tipo de intervenção em uma reestenose de stent não farmacológico em óstio de artéria descendente anterior.

**DESCRITORES:** Reestenose coronária. Intervenção coronária percutânea. Angioplastia com balão. Paclitaxel.

The drug-eluting balloon has been standing out as a promising feature in the therapeutic armamentarium of interventional cardiology.[1] It is known that prolonged release medication is essential for inhibiting neointimal proliferation promoted by drug-eluting stents.[2] However, about 85% of the vessel area which receives the stent is not covered by the device's stems, resulting in lower concentrations of antiproliferative drug in these regions.[3] Compared to drug-eluting stents, the drug-eluting balloon offers advantages, such as an immediate and homogeneous release of the drug in the arterial wall, the absence of polymers that can induce chronic inflammatory reactions, and the potential for use of dual antiplatelet therapy for a shorter time.[4]

The idea that drug-eluting balloons have certain indications where stenting procedures are not desirable is quite reasonable; for example, when an in-stent restenosis occurs, in cases of small caliber vessels, diffuse injuries, or bifurcations.[5] Another growing indication for the drug-eluting balloon is its use in peripheral vessels, with promising results.[6]

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## CASE REPORT

A female patient, 39 years old, hypertensive and a smoker, was admitted with a diagnosis of medium-risk unstable angina. The coronary angiography revealed a severe lesion in the ostium of the left anterior descending artery, treated with a bare-metal stent (3.0 × 12 mm), with immediate satisfactory angiographic result (Figures 1A and B). Asymptomatic after five months, the patient was readmitted with high-risk unstable angina. A new coronary angiography showed diffuse in-stent restenosis (Figures 2A and B).

The myocardial revascularization surgery indication was considered because the patient had low surgical risk (EuroSCORE II: 1.23%), [7] by the complexity of the procedure due to the possibility of stent placement in the distal left main coronary trunk, and because it was a recurrent lesion. The joint decision of this cardiology team (clinical, interventional, and surgical) was in favor of a percutaneous coronary intervention with a paclitaxel-eluting balloon. The procedure consisted of predilation with a 3.0 × 20 mm Mytra® semi-compliant balloon (Scitech, Goiânia, Brazil) at 16 atm, followed by a 3.5 × 25 mm Pantera Lux® paclitaxel-eluting balloon (Biotronik, Bulach, Switzerland) at 14 atm, maintaining the insufflation for 90 seconds (Figures 2C and D).

During the in-hospital evolution, the patient suffered a procedure-related infarct (type 4a), with no other complications, and was discharged to outpatient follow-up. After seven months, the patient returned to the service in an asymptomatic state for a scheduled study, demonstrating maintenance of the angiographic result obtained by the procedure (Figures 3A and B).

## DISCUSSION

In this report, the use of a drug-eluting balloon was an effective alternative for the treatment of in-stent restenosis in a left anterior descending artery ostium. Preclinical[8,9] and randomized[1,9,10] studies consistently demonstrate that paclitaxel, in a matrix of soluble additives attached to the balloon, reduces neointimal formation, late lumen loss, restenosis, and target vessel revascularization in patients with restenotic lesions.

In the first-in-man randomized study, Treatment of In-Stent Restenosis by Paclitaxel Coated PTCA Balloons (PACCOCATH ISR), Scheller et al.[1] evaluated the use of a paclitaxel-eluting balloon (Orbus X, Bavaria Medizin Technologie GmbH–Oberpfaffenhofen, Germany) in comparison to a conventional balloon for the treatment of in-stent restenosis. The patients received preprocedural acetylsalicylic acid (ASA) and clopidogrel (loading dose of 300 to 600 mg, maintenance dose of 75 mg/day), with maintenance for one month, followed by ASA 100 mg indefinitely. At 6 months, the angiography showed that the late lumen loss measured 0.03 ± 0.48 mm vs. 0.74 ± 0.86 mm ($p$ = 0.002) and that the binary restenosis rate was 5% vs. 43% ($p$ = 0.002), respectively. At 12 months, the rate of major adverse cardiac events was 4% vs. 31% ($p$ = 0.01), a difference that occurred mainly due to the reduced need for revascularization of the target lesion.

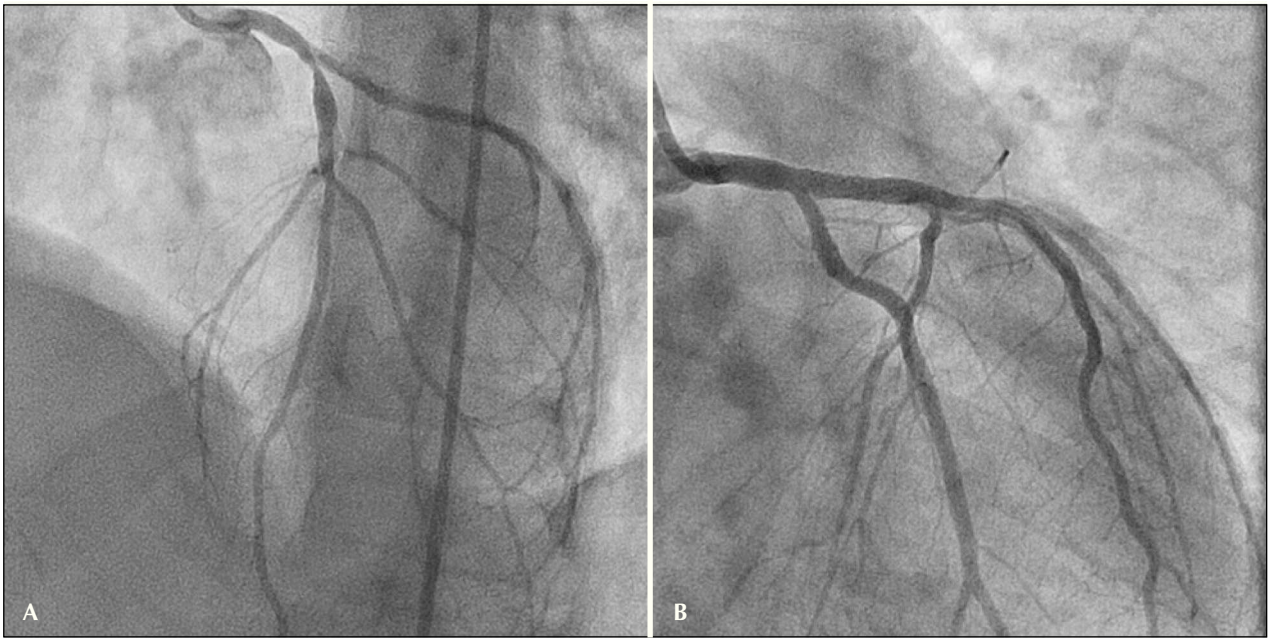


**Figure 1** – Percutaneous coronary intervention index. (A) Injury in the ostium of the left anterior descending artery. (B) Result after bare-stent implantation.

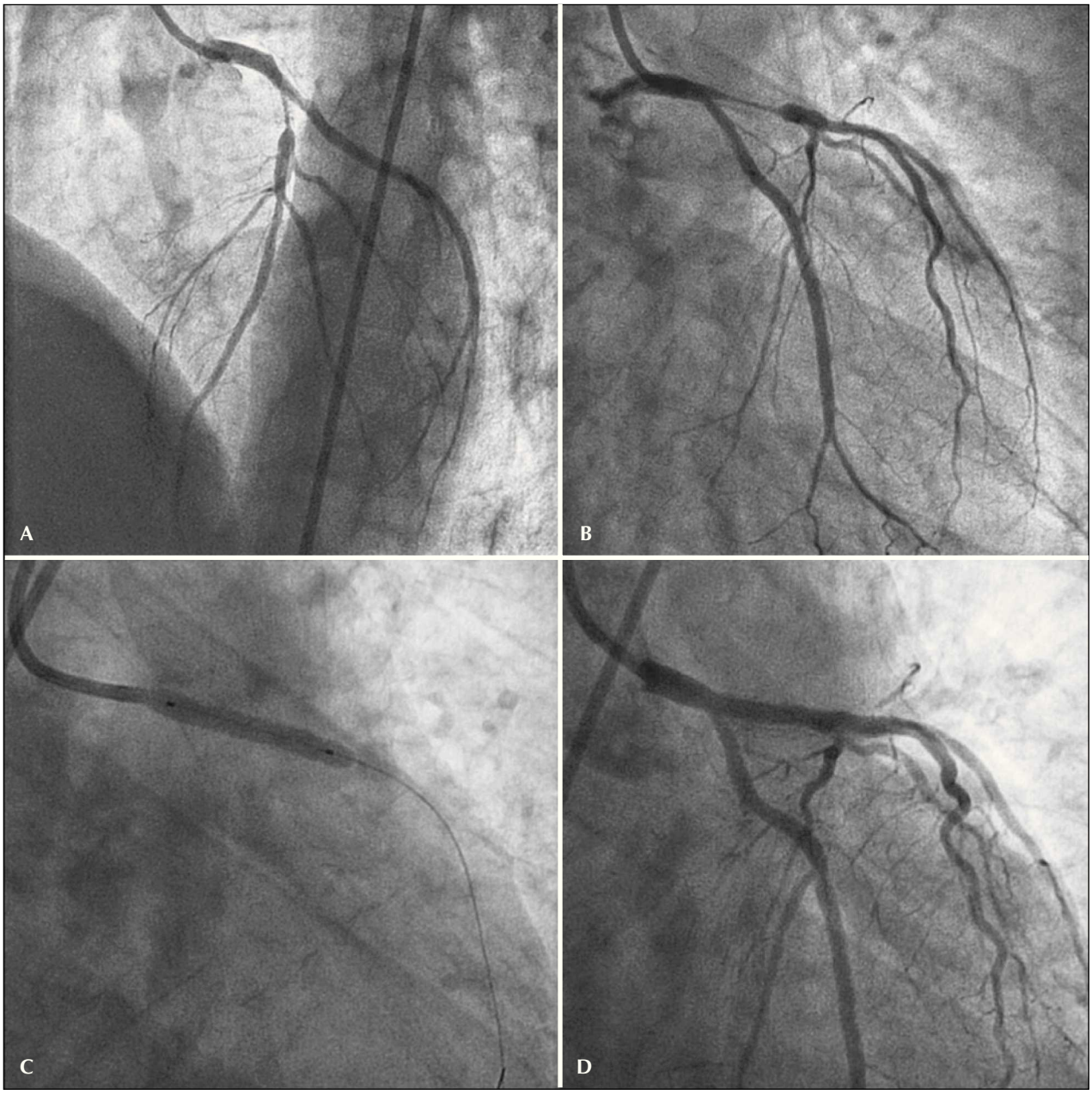


**Figure 2** – Treatment of in-stent restenosis. (A and B) Diffuse in-stent restenosis in the ostium and proximal portion of the left anterior descending artery. (C and D) Intervention with drug-eluting balloon.

Subsequently, in the study Paclitaxel-Eluting PTCA-Balloon Catheter in Coronary Artery Disease II (PEPCAD II), Unverdorben et al.[11] compared a second-generation paclitaxel-coated balloon (B. Braun Melsungen AG, Vascular Systems, Berlin, Germany) versus the Taxus® Liberté® paclitaxel-eluting stent in the treatment of bare-metal stent restenosis. The patients received pre-procedural ASA and clopidogrel (loading dose of 300 to 600 mg, maintenance of 75 mg/day), with maintenance for three months in the balloon-treated group and for 6 months in the stent-treated group, followed by ASA 100 mg indefinitely. After 6 months, the late luminal loss in the segment was 0.17 ± 0.42 mm vs. 0.38 ± 0.61 mm ($p$ = 0.03), resulting in a binary restenosis rate of 7% and 20%, respectively ($p$ = 0.06). After 12 months, the rate of major adverse cardiac events was

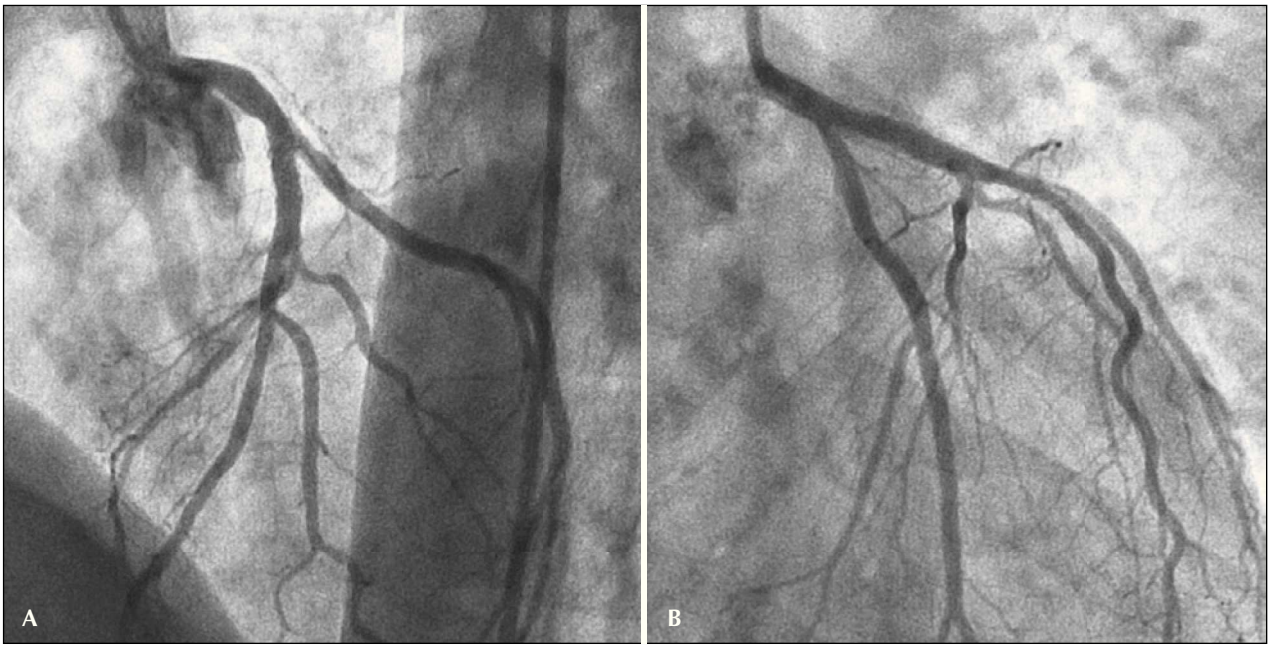


**Figure 3** – Angiographic control seven months post-intervention.

9% vs. 22% ($p$ = 0.08), and the difference occurred primarily due to a reduced need for repeat coronary artery bypass graft (CABG) (6% vs. 15%; $p$ = 0.15).[11]

Based on the results of PACCOCATH ISR and PEPCAD II studies, guidelines for CABG from the European Society of Cardiology/European Association for Cardio-Thoracic Surgery have provided a Class 2A recommendation (level of evidence B) for this modality in the treatment of bare-metal stent restenosis.[12]

Recently, in the randomized study RIBS V (Restenosis Intra-stent of Bare Metal Stents: Paclitaxel-eluting Balloon vs. Everolimus-eluting Stent.), Alfonso et al.[13] compared the SeQuent® Please paclitaxel-eluting balloon (B. Braun Surgical, Melsungen, Germany) versus the Xience Prime® everolimus-eluting stent (Abbott Vascular, Abbott Park, United States) for treating in-stent restenosis. A total of 189 patients with bare-metal stent restenosis were included. All patients were pre-treated with ASA and clopidogrel. Clopidogrel (75 mg/day) was recommended for the months after the drug-eluting balloon and for 12 months after the stent; and ASA was maintained indefinitely. In a late angiography, those patients in the group treated with the stent had a smaller lumen diameter in the segment (2.01 mm ± 0.6 vs. 2.36 ± 0.6 mm; $p < 0.001$) and a significantly higher stenosis diameter in the segment (25 ± 20% vs. 13 ± 17%; $p < 0.001$). However, the late lumen loss (0.14 ± 0.5 vs. 0.04 ± 0.5 mm; $P$ = 0.14) and the binary restenosis rate (9.5% vs. 4.7%; $P$ = 0.22) in the segment were low, and were similar in both groups. The occurrence of combined clinical events (cardiac death, myocardial infarction, and target-vessel CABG) after 1 year was 6% vs. 8% ($p$ = 0.60), and the need for target-vessel CABG was 2% vs. 6% ($p$ = 0.17), respectively.

The value of a drug-eluting balloon in patients with drug-eluting stent restenosis was also established.[14,16] A randomized multicenter study confirmed the superiority of thedrug-eluting balloon versus angioplasty with use of a conventional balloon.[14] The randomized multicenter study Intra-coronary Stenting and Angiographic Results: Drug Eluting Stents for In-Stent Restenosis 3 (ISAR-DESIRE 3)[15] investigated the efficacy of a drug-eluting balloon, a paclitaxel-eluting stent, and a conventional balloon in patients with drug-eluting stent restenosis. The study demonstrated not only the non-inferiority of the drug-eluting balloon as compared with the paclitaxel-eluting stent, but also the superiority of these two strategies compared to conventional balloon angioplasty. Additionally, a recent randomized study suggested that the drug-eluting balloon is more effective in patients with bare-metal stent restenosis than in those with drug-eluting stent restenosis.[16]

## CONFLICTS OF INTEREST

The authors declare no conflicts of interest.

## FUNDING SOURCE

None.

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