

## CONSERVATIVE APPROACH TO MANAGING CORONARY PERFORATION DURING RETROGRADE CHRONIC TOTAL OCCLUSION PERCUTANEOUS CORONARY INTERVENTION: A CASE REPORT

G. Goranov<sup>1</sup>, V. Doktorova<sup>2</sup>, P. Petrov<sup>3</sup>

<sup>1</sup>Section of Cardiology, First Department of Internal Medicine, Medical University – Plovdiv

<sup>2</sup>Department of Cardiovascular Surgery, Medical University – Plovdiv

<sup>3</sup>Department of Maxillofacial Surgery, Faculty of Dental Medicine, Medical University – Plovdiv

## КОНСЕРВАТИВНО ПОВЕДЕНИЕ ПРИ ПЕРФОРАЦИЯ НА ПОСТЕРО-ДЕСЦЕНДЕНТЕН КЛОН ПО ВРЕМЕ НА РЕТРОГРАДНА ПЕРКУТАННА КОРОНАРНА ИНТЕРВЕНЦИЯ НА ХРОНИЧНА ОКЛУЗИЯ: КЛИНИЧЕН СЛУЧАЙ

Г. Горанов<sup>1</sup>, В. Докторова<sup>2</sup>, П. Петров<sup>3</sup>

<sup>1</sup>Секция по кардиология, Първа катедра по вътрешни болести, Медицински университет – Пловдив

<sup>2</sup>Катедра по сърдечно-съдова хирургия, Медицински университет – Пловдив

<sup>3</sup>Катедра по лицево-челюстна хирургия, Факултет по дентална медицина, Медицински университет – Пловдив

### Abstract.

**Background:** Coronary artery perforation is a highly feared complication of chronic total occlusion (CTO) percutaneous coronary intervention (PCI) and can lead to pericardial effusion, tamponade, and, rarely, emergent cardiac surgery. Perforation of coronary artery or epicardial collaterals during retrograde CTO-PCI may be particularly challenging to treat, as embolization from both sides of the perforation may be required to control the bleeding. However, only conservative measures in selected cases can be effective. We report a case of distal posterior descending (PD) branch of left circumflex (LCX) artery vessel perforation that was managed conservatively with anticoagulation reversal. **Case Summary:** An 85-year-old Caucasian male patient, with a history of lateral and inferior myocardial infarction and previous PCI, underwent a planned coronary arteriography due to progressive angina. Coronary angiography revealed normal function of implanted drug eluting stents (DES) in the mid-LAD and in the proximal right coronary artery (RCA) and CTO of dominant LCX. A septal branch in the midsegment of LAD was supplying the distal PD of LCX retrogradely. After failed attempt at antegrade PCI for the LCX's CTO, the retrograde approach was tried. This intervention finally succeeded through the septal collateral but after removing the retrograde guidewire with the support of microcatheter, vessel perforation of distal PD of LCX was observed. This complication was successfully managed conservatively with anticoagulation reversal. Post-operatively, the patient had no complications and was stable at 6-month follow-up. **Discussion:** Coronary artery perforation can be managed conservatively only with anticoagulation reversal in selected cases.

### Key words:

percutaneous coronary intervention, chronic total occlusion, complications, coronary vessel perforation, case report

### Address

for correspondence: Georgi Goranov, MD, e-mail: georgigoranov@yahoo.com

### Резюме.

**Въведение:** Перфорацията на коронарната артерия е опасно усложнение на перкутанна коронарна интервенция (PCI) с хронична тотална оклузия (СТО) и може да доведе до перикарден излив, тампонада и рядко до спешна сърдечна хирургия. Перфорация на коронарна артерия или епикардни колатерали по време на ретроградна СТО-PCI може да е особено предизвикателна за лечение, тъй като е възможно да се наложи емболизация от двете страни на перфорацията за контролиране на кръвенето. Но в определени случаи само консервативните мерки могат да бъдат ефективни. Докладваме случай на дистален заден низходящ (PD) клон на перфорация на съд от лява циркумфлексна артерия (LCX), който е третиран консервативно с антикоагулационно обръщане. **Описание на случая:** 85-годишен пациент от бяла раса, с анамнеза за страничен и долен миокарден инфаркт и предишна

PCI, претърпя планирана коронарна ангиография поради прогресираща стенокардия. Коронарната ангиография разкрива нормална функция на имплантираните лекарство-излъчващи стентове (DES) в средната LAD и в проксималната дясна коронарна артерия (RCA) и СТО на доминиращ LCX. Септален клон в средния сегмент на LAD доставя дисталния PD на LCX ретроградно. След неуспешен опит за антеградна PCI за СТО на LCX, е изпробван ретрограден подход. Тази интервенция най-накрая успя през септалното обезпечение, но след отстраняване на ретроградния водач с помощта на микрокатетър, е наблюдавана съдова перфорация на дисталния PD на LCX. Усложнението е успешно овладяно консервативно с антикоагулантно обръщане. След операцията пациентът е без усложнения и е стабилен при 6-месечно проследяване. **Обсъждане:** В избрани случаи перфорацията на коронарната артерия може да се лекува консервативно само с антикоагулация

**Ключови думи:** перкутанна коронарна интервенция, хронична тотална оклузия, усложнения, перфорация на коронарен съд, клиничен случай

**Адрес за кореспонденция:** д-р Георги Горанов, e-mail: georgigoranov@yahoo.com

## INTRODUCTION

The successful completion of percutaneous coronary intervention (PCI) for chronic total occlusions (CTOs) has been linked to a decreased necessity for coronary artery bypass graft surgery (CABG), enhancements in left ventricular function, and improved long-term survival rates [1]. Over the past decade, advancements in specialized tools and the retrograde approach have boosted the success rates for recanalizing CTOs from 60% to 90% [2, 3]. However, these procedures carry a higher risk of complications compared to standard PCI. Possible complications include coronary artery perforation – with or without associated tamponade – caused by equipment exit or stent overdistention, thrombosis or occlusion of the vessel, excessive radiation exposure resulting in skin damage, complications related to vascular access, and contrast-induced nephropathy [4].

Particularly, perforations in the coronary artery or epicardial collaterals during retrograde CTO-PCI present significant treatment challenges, as managing the bleeding may necessitate embolization from both sides of the perforation [5]. Recently, thrombin injection has emerged as a proposed safe and effective method to address this complication [6]. Nonetheless, in select cases, this issue can be managed conservatively through anticoagulation reversal. In this report, we detail a case of vessel rupture occurring in the distal left circumflex artery-posterior descending (LCX-PD) branch following retrograde revascularization of a CTO in the LCX.

## CASE PRESENTATION

An 85-year-old male patient was admitted to the invasive cardiology department due to worsening angina. His medical history included lateral and inferior myocardial infarctions in 2004 and the implantation

of a permanent pacemaker in 2017 due to complete atrioventricular (AV) block. Upon physical examination, mild edema was noted in the lower extremities, while the rest of the examination results were normal. The electrocardiogram showed pacemaker spikes along with left bundle branch block (LBBB). A transthoracic echocardiogram revealed mildly reduced left ventricular function with an ejection fraction (EF) of 48%. The sizes and volumes of the left ventricle were normal, and there was mild mitral regurgitation.

Coronary angiography indicated significant stenosis in the mid-left anterior descending (LAD) artery and subtotal occlusion in the proximal segment of a small right coronary artery (RCA), along with a chronic total occlusion (CTO) in the dominant distal left circumflex artery (LCX). Although coronary artery bypass graft surgery was suggested, the patient declined the procedure. Instead, he underwent an uncomplicated stenting procedure for both the LAD and RCA. While there was alleviation of the angina symptoms at rest, there was no improvement in the functional class of heart failure. Symptoms of angina and heart failure persisted at minimal exertion. Staged intervention to recanalize the CTO in the LCX was scheduled to achieve complete coronary revascularization. Prior to the CTO procedure, angiography confirmed patent stents in the proximal RCA (Fig. 1A) and mid-LAD, while showing the CTO in the distal LCX (Fig. 1B). Notably, a septal branch was supplying the distal LCX via retrograde flow (Fig. 1 C, D).

After an unsuccessful antegrade attempt to cross the occlusion, a retrograde approach was initiated using a single 7-Fr XB 4.0 guiding catheter accessed through the femoral artery. A retrograde wire (Suoh 03, Asahi) was navigated through the septal collateral using a microcatheter (Finecross, Terumo), successfully reaching the distal CTO lesion (Fig. 2A). The retrograde wire was then exchanged for a Gaia First wire (Asahi) (Figure 2B), which successfully tra-

versed the CTO segment and entered the true lumen of the proximal segment of the LCX and left main (LM) artery (Fig. 2C). The microcatheter was advanced, crossing the occlusion from the retrograde route, and the stiff CTO guidewire was swapped for a Runthrough guidewire (Terumo), allowing passage into the antegrade catheter through the microcatheter (Fig. 2D).

A 300 cm RG3 wire was externalized using the microcatheter, followed by balloon predilatation of both the proximal and distal segments of the LCX. Two drug-eluting stents (2.5 x 28 mm and 2.5 x 48 mm) were successfully placed in the proximal and distal LCX with minimal overlap (Fig. 3A, 3B).

Post-dilatation of the implanted stents was conducted using a non-compliant balloon. A soft Runthrough wire (Terumo) was advanced into the distal segment of the LCX antegradely, and the RG3 wire was withdrawn using the microcatheter. However, angiography revealed perforation in the distal LCX-PD

branch, indicated by a focal jet of contrast extravasation (Fig. 4A, B).

Despite the perforation, the patient remained hemodynamically stable. To manage the situation, a balloon was inflated in the distal LCX to occlude antegrade blood flow for five minutes, while a microcatheter was positioned in the septal branch to limit retrograde blood flow through the collateral (Fig. 5A). Anticoagulation was reversed using protamine. Subsequent transthoracic echocardiograms performed over the next hour did not show any signs of pericardial effusion. The patient continued to be hemodynamically stable, and a repeat angiogram showed a reduction in contrast staining at the perforation site with no pericardial effusion (Fig. 5B). No further interventions were deemed necessary. The final angiogram (Fig. 5C, 5D) demonstrated normal blood flow in the distal LCX without any evidence of contrast extravasation. A follow-up echocardiogram the next day also confirmed the absence of pericardial effusion, and the patient had an uneventful recovery.

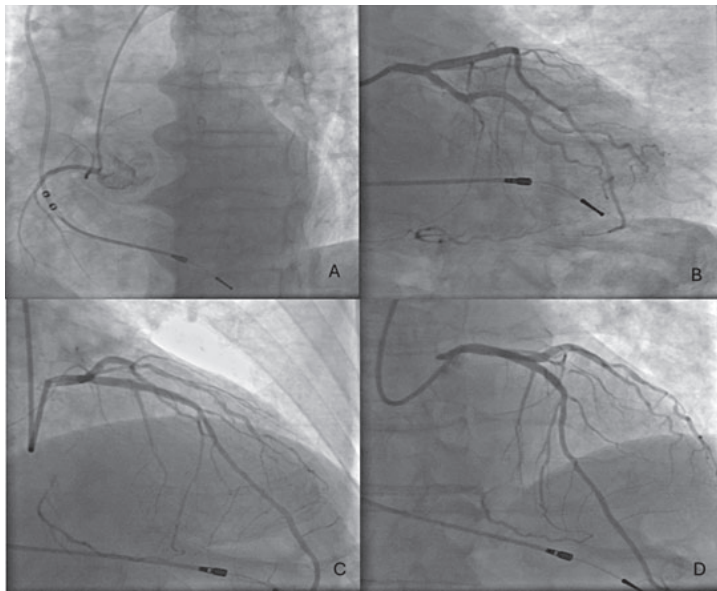


Fig. 1

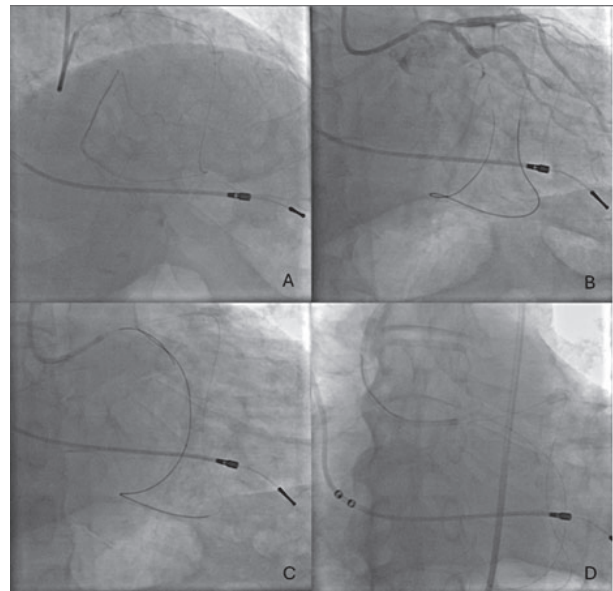


Fig. 2

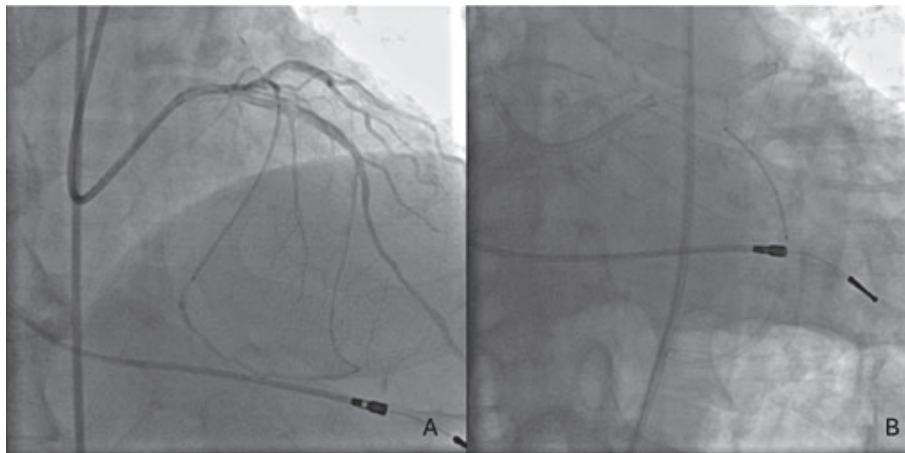


Fig. 3

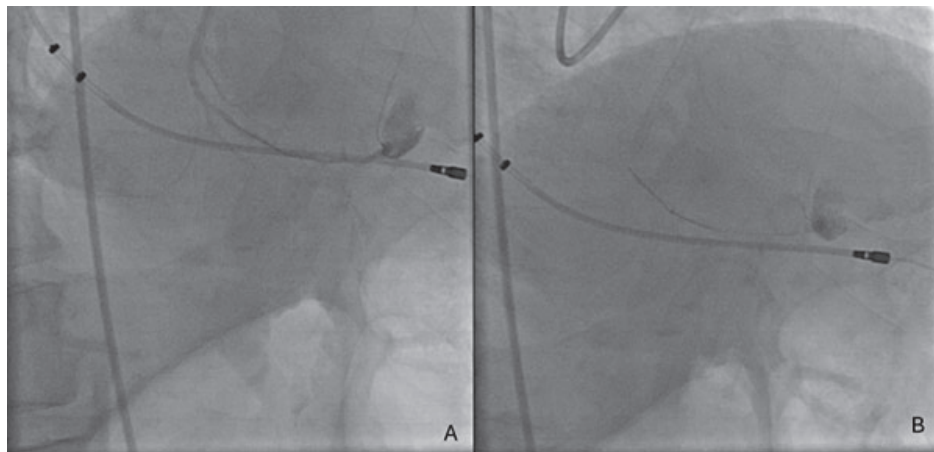


Fig. 4

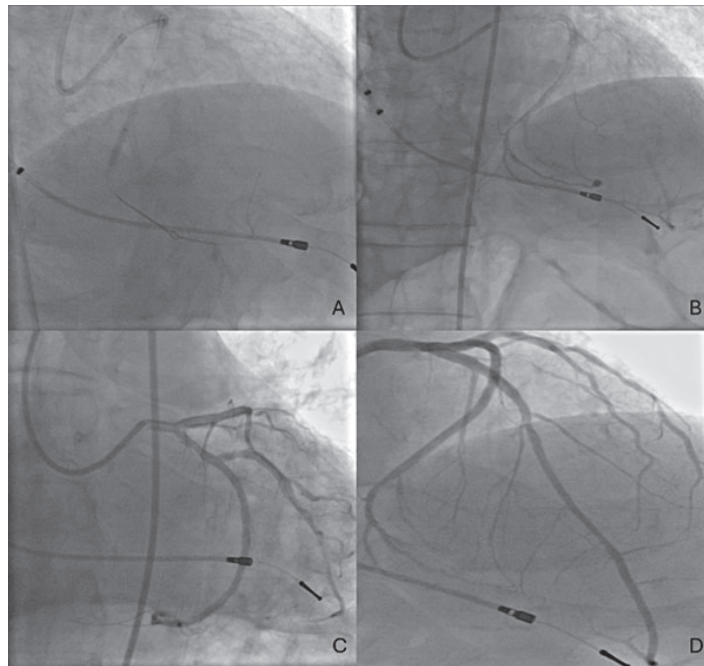


Fig. 5

The patient was discharged home 48 hours after the intervention and was asymptomatic and stable over 6 months of follow-up appointments.

## DISCUSSION

This case illustrates that coronary artery perforations that occur during chronic total occlusion percutaneous coronary interventions (CTO-PCI) can sometimes be managed conservatively, without the need for embolization or additional haemostatic procedures, aside from reversing anticoagulation.

The occurrence of perforations during CTO-PCI ranges from 1.3% to 13.6% [7-10]. However, the clinical implications of these perforations vary. For instance, a meta-analysis conducted by Patel et al. found that perforations happened in 3.4% of cases, but only 0.3% of patients developed tamponade [8]. Additionally, a Jap-

anese CTO registry indicated that around 75% of CTO-PCI perforations were resolved through observation alone. Nonetheless, 2.6% of patients did require some form of intervention for their perforations [10].

Coronary artery perforations are traditionally categorized according to the Ellis classification [11]. However, this classification does not account for epicardial and septal collateral perforations [12]. Typically, septal collateral perforations are self-limiting and do not necessitate treatment. In contrast, epicardial collateral or distal vessel perforations present a greater risk of tamponade and are generally treated with anticoagulation reversal and coil placement [5], where coils are deployed on both sides of the perforation [12]. In the case we are discussing, advancing a microcatheter through the collateral vessel, potentially with suction, may effectively control bleeding [5, 12]. Recent studies have also shown that injecting thrombin through a

small microcatheter can manage epicardial collateral perforations [6].

In this specific case, the prompt recognition of the perforation and the reversal of anticoagulation using protamine successfully managed the distal vessel perforation. The dual antiplatelet therapy the patient was already on, and the short duration of balloon inflation lowered the risk of acute stent thrombosis. Continuous monitoring through repeat echocardiography was crucial, allowing for real-time assessment of pericardial effusion. As no effusion was detected and the patient remained hemodynamically stable, a conservative approach was adopted. Follow-up angiography showed a decrease in contrast staining, indicating that no further intervention was required.

In conclusion, additional research is necessary to determine the angiographic features that could help differentiate patients who might benefit from interventions like vessel coiling or thrombin injection from those who can be managed conservatively.

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*No conflict of interest was declared*

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