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Case Report CARDIOLOGY

The successful management of type III coronary perforation

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ABSTRACT

The coronary artery perforation during percutaneous coronary intervention is a nightmare for interventional cardiologists and is always hard to manage timely and properly. We present a 60-year-old male with periprocedural coronary perforation during ST-segment elevation myocardial infarction. A coronary balloon was inflated in the proximal left anterior descending (LAD) artery just after perforation and the 600 cc of hemorrhagic fluid was drained with the pericardial drainage set. The covered stent was deployed in the LAD and he was discharged on the 7th day. At an 18-month follow-up, he is on dual-antiplatelet therapy and the exercise stress test shows no ischemic changes.

Keywords: Coronary artery perforation; coronary covered stent; primary percutaneous coronary intervention.

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The coronary artery perforation during the percutaneous coronary intervention (PCI) is a nightmare for interventional cardiologists and is always hard to manage timely and properly. In general, coronary artery perforations are classified into three types based on their severity, which are type I (extraluminal crater), type II (myocardial or pericardial blushing), and type III (cavity spilling) [1]. We present a case of successfully managed type III coronary perforation.

CASE REPORT

A 60-year-old male patient presented with 2 h of chest pain. The electrocardiography revealed ST-segment elevation in leads V1 through V6. The patient was hemodynamically stable with the blood pressure of 125/75 mmHg. The patient had no history of chronic disease. In the emergency department, 180 mg of Ticagrelor and 300 mg chewable aspirin were administered, and the patient was taken to the catheter laboratory for primary PCI. The coronary angiogram showed the total occlusion of the anterior descending (LAD) artery at the level of the diagonal artery (Fig. 1A and Video 1). Intravenous Heparin (100/IU per kg) was administered. After percutaneous transluminal coronary angioplasty, 3.0 × 33 mm, and 3.0 × 20 mm drug-eluting stents were deployed in telescopic fashion (Fig. 1B and Video 2). After deploying stent, we performed post-dilation with a non-compliant (NC) coronary balloon (3.5 × 12 mm). After then, the type 3 LAD coronary perforation was seen in the control angiogram (Fig. 2 and Video 3). The NC balloon was inflated just proximal to the LAD stent immediately. Protamine sulfate was used to reverse the anticoagulant effects of heparin. Within a few seconds, the patient became hemodynamically unstable with the blood pressure of 60/40 mmHg. The transthoracic echocardiogram (TTE) showed cardiac tamponade and an emergency pericardiocentesis was performed,

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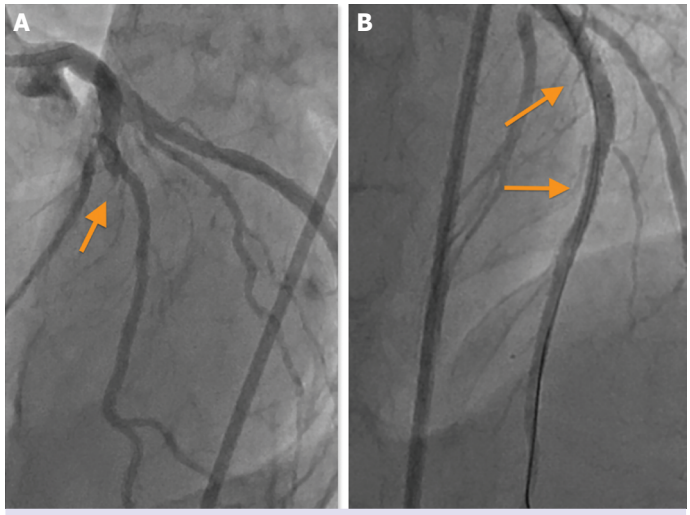

Figure 1. **(A)** The angiogram shows total occlusion of the left anterior descending (LAD) artery (the arrow shows the level of occluded area). **(B)** The angiogram after deploying stents in the LAD (the arrows show coronary stents).

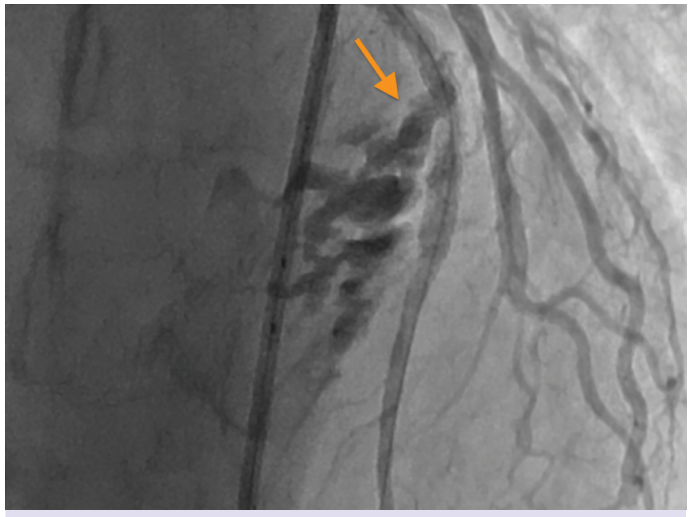

Figure 2. TThe angiogram revealed the coronary artery perforation (the arrow shows the spilling into the chamber).

with immediate drainage of 600 mL of hemorrhagic fluid. After 10 min, the control angiogram revealed no leakage in the LAD and coronary covered stent (3.0 × 19 mm) advanced through the same catheter without using the double (pin-pong) guiding technique (Video 4). The left-ventricular ejection fraction (LVEF) was determined as 27% by the biplane Simpson method and there was no pericardial effusion. He became stable with the blood pressure of 110/70 mm Hg and he was transferred to the coronary care unit without inotropic support. Patient's consent was obtained for this

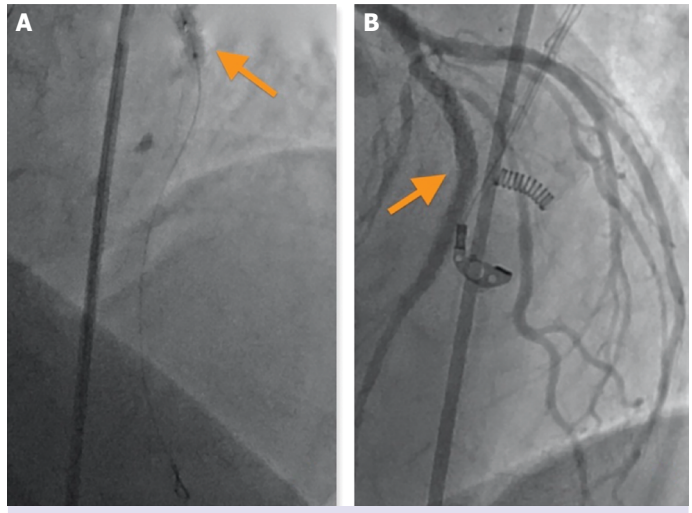

Figure 3. **(A)** The coronary balloon was inflated at the proximal LAD immediately. **(B)** The angiogram after deploying covered stent shows no leakage in the LAD.

case study. He was discharged from the hospital after 7 days. At a 1-month follow-up, he was still on aspirin (81 mg/day), Ticagrelor (90 mg b.i.d.), metoprolol (50 mg/day), ramipril (2.5 mg/day), and atorvastatin (80 mg/day), and he has no symptom. The control TTE revealed LVEF of 42% and showed mild apical septum and apex hypokinesia. At an 18-month follow-up, he is on dual antiplatelet therapy (aspirin 81 mg/day and clopidogrel 75 mg/day) and he has no symptom. The exercise treadmill test showed no ST-segment deviation and he was able to achieve 12 metabolic equivalents of task. The LVEF was determined as 48% by the biplane Simpson method.

DISCUSSION

Coronary artery perforation is a rare complication of elective and primary PCI. The mortality rate depends on the severity of perforation and its' management. The treatment methods could range from conservative monitoring to covered stents and open-heart surgery. The coronary artery perforations are classified into three types as type I, type II, and type III [1, 2]. The type I and II perforations can be managed conservatively with hemodynamic monitoring and close observation [3, 4]. The type III perforations can be managed with covered stents and surgery [3–5] as in our case. The possible risk factors have been classified as clinical, angiographic, and technique associated. The clinical risk factors include advanced age [1], chronic kidney

disease [6], female gender [7], and history of coronary artery bypass grafting [8]. The angiographic factors include chronic total occlusion [9, 10], coronary artery calcification [4, 10], tortuosity, and long lesions (>20 mm) [4, 10]. The technique associated factors are the use of hydrophilic/extra stiff wires [4, 5], atherectomy devices [7, 9], cutting balloons [11], intravascular ultrasound-guided PCI [12], and increased balloon to artery ratio [1, 13]. In our case, the patient did not have any of the aforementioned risk factors. The perforation was seen at the overlapping area, which might be caused by stent strut fracture.

The prolonged balloon inflation is one of the first things to do, then the hemodynamic and echocardiographic assessment must be performed [1, 4]. The heparin should be reversed with protamine sulfate as soon as possible. The hemodynamic compromise is usually seen in types II and III perforations. Some operators suggest using two guiding catheters through dual access to advance covered stent without losing time and the control of bleeding [14]. In our case, we did not use the second guiding catheter when we did not see any leak from the artery after prolonged balloon inflation; then, we advanced the covered stent and deployed the overlapping area. Al-Lamee et al. [15] showed that the success rates of prolonged inflation, covered stent, surgery, and coil embolization in type III coronary artery perforation were 55%, 85%, 44%, and 100%, respectively.

The long-term patency of covered coronary stents is poor compared with standard coronary stents due to higher rates of subacute thrombosis and restenosis [16]. The possible cause might be delayed endothelialization which could result in-stent thrombosis. Therefore, long-term dual antiplatelet therapy seems reasonable. Our patient is still on dual antiplatelet (aspirin and clopidogrel) therapy over 18 months of follow-up.

Conclusions

The risk factors of coronary artery perforation have been well-established, but it can be seen even though there are no risk factors. Precautions should be taken to minimize the risk of perforation while using stiff/hydrophilic wires. The early detection, immediate prolonged coronary balloon inflation, and reversal of heparin are the cornerstones of the management. The use of covered stent can be life-saving and must be available in all catheterization laboratories.

Video Legends

Video 1: The angiogram shows total occlusion of the left anterior descending (LAD) artery.

Video 2: The angiogram after deploying telescoping stents in the LAD.

Video 3: The angiogram shows type III perforation in the LAD at the level of overlapping stent zone.

Video 4: The angiogram after deploying covered stent shows no leakage in the LAD.

Informed Consent: Written informed consent was obtained from the patient for the publication of the case report and the accompanying images.

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