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Short communication

# Coronary artery rupture during high-pressure post-dilatation of coronary stent in a heavily calcified lesion of an ectatic right coronary artery

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ABSTRACT

Coronary artery perforation (CAP) is a rare but feared complication of percutaneous coronary intervention. With the use of novel instruments, including hydrophilic and ultrarigid guidewires, rotablator devices, and cutting balloons, the success rate of intervention for coronary artery chronic total occlusion (CTOs) and calcified lesions has increased. Along with these changes, the risk of CAP has also increased. In this case report, we present a tip III CAP due to high-pressure postdilatation of coronary stent in a heavily calcified lesion of an ectatic right coronary artery.



## Introduction

Coronary artery perforation (CAP) is a rare and serious complication of percutaneous coronary intervention (PCI).[1] The reported incidence of CAP ranges from 0.1% to 3%, with a mortality ranging from 7% to 17%.[2,3] With the use of novel instruments, including hydrophilic and ultrarigid guidewires, rotablator devices, and cutting balloons, the success rate of intervention for coronary artery chronic total occlusion (CTOs) and calcified lesions have increased. Along with these changes, the risk of CAP has also increased. The treatment of these patients can involve prolonged balloon inflation with perfusion balloons, coil embolization,[4] and implantation of polytetrafluoroethylene (PTFE)-covered stents.[5]

In this case report, we present a tip III CAP due to high-pressure post-dilatation of implanted coronary stent in a heavily calcified lesion of an ectatic mid right coronary artery (RCA).

## Case report

A 75-year-old man was referred to our clinic complaining of chest pain, dyspnea, and pneumonia during the last week, with the past medical history of chronic obstructive pulmonary disease (COPD), hypertension, and diabetes mellitus without any history of coronary artery disease. He was admitted due to the high levels of troponin and dynamical electrocardiographic changes. Transthoracic echocardiography showed a dilated left ventricle with depressed systolic function and regional wall motion abnormality (ejection fraction was 40%), with mild mitral and tricuspid regurgitation. The estimated pulmonary artery systolic pressure was significantly elevated at 60 mmHg. High dose antibiotherapy was started and he transferred to the catheter laboratory on the second day of admission due to high risk nature of NSTEMI (increasing troponin levels) and persistent heart failure symptoms despite of medical therapy. Coronary angiography revealed a severe lesion (80% stenosis) in the proximal left anterior descending artery (LAD) and a bifurcation lesion involving a large first diagonal branch and severe calcified lesion (99% stenosis) at the mid region of the right coronary artery (Fig. 1). Due to the high risk nature of the procedure he refused coronary artery bypass grafting surgery. Because of his clinical instability, we decided to perform percutaneous coronary intervention of the ectatic right coronary artery and elective PCI for LAD and first diagonal branch true bifurcation lesion. First, the right coronary artery lesion which considered as the culprit lesion was crossed softly with a 0.014-inch floopy guidewire, and predilatation was performed using a 3.0 × 12 mm compliant coronary balloon catheter (Simpass ® Plus PTCA Balloon Dilatation Catheter). After predilatation, a 5.0 × 16 mm bare metal stent (Liberte® Bare-Metal Coronary Stents) was deployed at the nominal (10 atm) pressure recommended by the manufacturer. A subsequent coronary angiography revealed a 40% residual stenosis in the mid segment of implanted stent (Fig. 2). Thus, we performed a post dilatation with a 5.0 × 12 mm (Apollo® Brosmed Balloon Dilatation Catheter) non-compliant coronary balloon catheter. After the postdilatation, patient's clinical condition worsened with accompanied chest pain, severe hypotension, bradycardia, and dyspnea. Control coronary angiography images demonstrated a massive and pulsatile

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**Fig. 1.** Severe calcified lesion in mid portion of right coronary artery with right anterior oblique view.

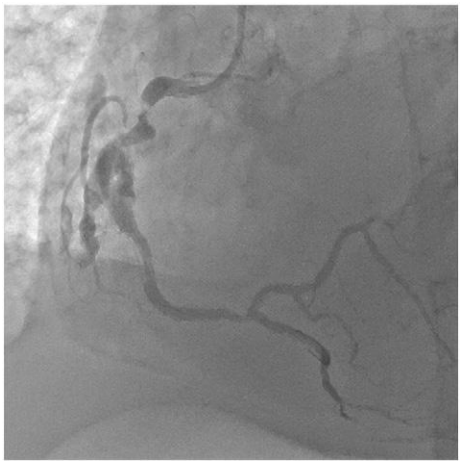

**Fig. 3.** Radiocontrast agent extravasation from the implanted stent portion of right coronary artery into the pericardial space.

radiocontrast agent extravasation from the implanted stent portion of right coronary artery into the pericardial space (Fig. 3). Immediately, we inflated a 5.0 × 10 mm (Simpass ® Plus PTCA Balloon Dilatation Catheter) compliant coronary balloon within the implanted stent to block blood extravasation to the pericardial sac. At the same time, echocardiogram also confirmed the presence of the small amounts of pericardial effusion without signs of pericardial tamponade. Blood pressure was increased with intravenous serum physiologic and dopamin infusion. After the hemodynamic stabilization of the patient, control coronary angiography showed continued extravasation. Because of the clinical instability, we attempted to stop the leakage by using a PTFE covered stent. Thus, we implanted a 4.0 × 16 mm PTFE covered stent (Graftmaster® RX Coronary Stent Graft System, Abbott Vascular) (Fig. 4). Due to the continued extravasaton, a 3.5 × 16 mm PTFE-covered stent was implanted distally in an overlap manner. A smaller diameter graft stent was used because a second large diameter one was not available at the moment. The result was satisfactory with no pericardial opacification anymore (Fig. 5). The patient was transferred to the coronary intensive care unit with a normal blood pressure. Control echocardiography revealed a small amount of pericardial effusion. There was no any increase in the pericardial effusion amount observed in the 12 and 24 h after the procedure. A week later, follow-up echocardiography showed complete disappearance of effusion. The patient did not suffer from repeated chest pain, and there was no electrocardiographical change or high levels of troponin and the patient was discharged at the seventh postoperative day.

## Discussion

Coronary artery perforation is a rare but feared complication of PCI. Several factors can be associated with these conditions: (1) clinical variables: advanced age, female sex, renal dysfunction, and non-ST-segment elevation myocardial infarction; (2) angiographic factors: chronic total occlusion, coronary artery calcification, tortuous vessels, target lesions in the circumflex and right coronary arteries, diffuse target lesions (above 20 mm), and eccentric lesions; (3) technique-associated factors: use of hydrophilic/extrastiff wires, atherectomy devices, increased balloon to artery ratio, intravascular ultrasound guided PCI, optimization and high-pressure stent postdilatation, percutaneous excimer laser coronary angioplasty, and cutting balloons.[6–8]

Ellis and colleagues classified coronary perforation into three types: Type I, extraluminal crater without extravasation; Type II, pericardial or myocardial blush without contrast jet extravasation; Type III, perforation ≥ 1-mm diameter with contrast streaming; and cavity spilling (CS).[9] Type I and II perforations are predominately caused by hydrophilic and stiff wires, and their course is usually mildly symptomatic and does not require pericardial drainage or surgical intervention.[10] Type III perforations are more often associated with stent placement by over dilatation or oversized stent placement as might be the cause in our case or during aggressive usage of athero-ablative devices. Major adverse clinical outcomes including cardiac tamponade occur more frequently in patients with Type III perforations.

**Fig. 2.** Right coronary artery after the stent implantation with a residual 40% lesion in right anterior oblique view.

**Fig. 4.** Right coronary artery and minimal radiocontrast agent extravasation after the first covered stent implantation in right anterior oblique view.

**Fig. 5.** Right coronary artery after the procedure and second covered stent with no radiocontrast agent extravasation.

The therapeutic alternatives for CAP include prolonged inflation with either the angioplasty balloon or a perfusion catheter as soon as the perforation is recognized to prevent further blood extravasation. Perfusion balloons having a perfusion lumen communicating with the blood vessel lumen will occlude the hole, while attempting to seal the defect, permit distal vessel perfusion and reduce the ischemia during the prolonged inflation. Stent grafts for emergency implantation in case of CAP must be an obligatory inventory of catheterization laboratories. The PTFE-coated stent is a safe and effective alternative that can be used for sealing a major CAP and obviating cardiac surgery. The utilization of synthetic graft stent is less invasive, faster, and more effective when compared to surgical interventions and is generally considered to be the gold standard in the management of CAP.[5] Other alternatives include emergency bypass surgery for drainage and artery repair in situations where hemostasis cannot be achieved by prolonged balloon inflation, and in patients with hemodynamic compromise who do not respond to pericardiocentesis.[8] Rare cases, especially those with CAP of distal part of vessels, may require microcoil embolization.[4] Additively, recent studies showed that the double guide catheter technique is a new approach for coronary perforation, which is helpful to reduce the duration of uncontrolled hemorrhage through the perforation and deliver the graft stent to the target site.[11,12]

In the presented case, we implanted the stent in a calcified lesion of the ectatic RCA at a high pressure that was lower than the burst pressure of the stent recommended by the manufacturer, and it seemed that the mid part of stent did not expand enough due to heavily calcification. Hence, in consequence of performed high-pressure stent postdilatation, oversizing of stent, calcified, and possibly ectatic nature of the vessel were the main reasons to CAP as the index vessel diameter was probably about 4.5 mm. We performed immediately prolonged balloon inflation and then covered stenting with two PTFE stents to close the perforation, which eventually proved to be successful in the management of CAP in our case.

In conclusion, type III CAP is a dramatic, feared, and lethal complication of PCI, but it can be managed successfully by immediate diagnosis and prompt treatment, which involves sealing of the perforation or rupture by prolonged balloon inflation and covered stents. Our case is unique in that it occurred in a highly calcified lesion within an ectatic vessel.

## Conflict of interest

None.

## Acknowledgments

None.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at http://dx.doi.org/10.1016/j.ijcac.2016.04.003.

## References

1. Javaid A, Buch AN, Satler LF, et al. Management and outcomes of coronary artery perforation during percutaneous coronary intervention. *Am J Cardiol* 2006;**98**(7):911–914.
2. Dippel EJ, Kereiakes DJ, Tramuta DA, et al. Coronary perforation during percutaneous coronary intervention in the era of abciximab platelet glycoprotein IIb/IIIa blockade: an algorithm for percutaneous management. *Catheter Cardiovasc Interv* 2001;**52**(3):279–286.
3. Fasseas P, Orford JL, Panetta CJ, et al. Incidence, correlates, management, and clinical outcome of coronary perforation: analysis of 16,298 procedures. *Am Heart J* 2004;**147**(1):140–145.
4. Gaxiola E, Browne KF. Coronary artery perforation repair using microcoil embolization. *Catheter Cardiovasc Diagn* 1998;**43**(4):474–476.
5. Briguori C, Nishida T, Anzuini A, Di Mario C, Grube E, Colombo A. Emergency polytetrafluoroethylene-covered stent implantation to treat coronary ruptures. *Circulation* 2000;**102**(25):3028–3031 (19).
6. Al-Mukhaini M, Panduranga P, Sulaiman K, Riyami AA, Deeb M, Riyami MB. Coronary perforation and covered stents: an update and review. *Heart Views* 2011;**12**(2):63–70.
7. Litvack F, Eigler N, Margolis J, et al. Percutaneous excimer laser coronary angioplasty: results in the first consecutive 3,000 patients. The ELCA investigators. *J Am Coll Cardiol* 1994;**23**(2):323–329.
8. Gruberg L, Pinnow E, Flood R, et al. Incidence, management, and outcome of coronary artery perforation during percutaneous coronary intervention. *Am J Cardiol* 2000;**86**(6):680–682 (15).
9. Ellis SG, Ajluni S, Arnold AZ, et al. Increased coronary perforation in the new device era. Incidence, classification, management and outcome. *Circulation* 1994;**90**:2725–2730.
10. Copeland KA, Hopkins JT, Weintraub WS, Rahman E. Long-term follow-up of polytetrafluoroethylene-covered stents implanted during percutaneous coronary intervention for management of acute coronary perforation. *Catheter Cardiovasc Interv* 2012;**80**(1):53–57 (1).
11. Rodriguez-Santamarta M, Estevez-Loureiro R, Cuellas C, et al. Double guide catheter technique for sealing an iatrogenic coronary perforation. *Res Cardiovasc Med* 2016;**5**(2)e31388 (Mar 5).
12. Röther J, Tröbs M, Ludwig J, Achenbach S, Schlundt C. Treatment and outcome of coronary artery perforations using a dual guiding catheter technique. *Int J Cardiol* 2015;**201**:479–483 (Dec 15).