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MINI-FOCUS ISSUE: CORONARIES

ADVANCED

CASE REPORT: CLINICAL CASE

Rotational Atherectomy Induced Coronary Perforation of Right Coronary Artery Draining into Middle Cardiac Vein

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ABSTRACT

Ellis Type III cavity spilling coronary perforation is a rare complication. We report to our knowledge, the first case of rotational atherectomy induced Type III cavity spilling coronary perforation of right posterior descending artery draining into middle cardiac vein, successfully managed by covered stent deployment. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2020;2:1688–91) © 2020 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 48-year-old man presented with progressively worsening exertional chest pain and dyspnea, which had been occurring predominantly at rest for the previous 2 weeks.

PAST MEDICAL HISTORY

The patient had a prior history of hypertension, myocardial infarction, and percutaneous coronary interventions in left anterior descending artery, left circumflex artery, and distal right coronary artery (RCA).

LEARNING OBJECTIVES

- To recognize coronary perforation as potential complication associated with rotational atherectomy especially in small arteries.
- To understanding the acute management of Type III cavity spilling perforation.

DIFFERENTIAL DIAGNOSIS

The differential diagnosis for chest pain includes acute coronary syndrome, aortic dissection, pulmonary embolism, panic disorder, and gastroesophageal reflux disease.

INVESTIGATIONS

Physical examination, electrocardiography, and laboratory results, including troponin, were unremarkable. Transthoracic echocardiogram revealed preserved ejection fraction of 60% along with hypokinesis of basal inferior and inferolateral wall. For further evaluation of the unstable angina, the patient underwent invasive coronary angiography via right radial artery. Angiography revealed patent stents in the left anterior descending artery and left circumflex artery, and 70% in-stent restenosis of distal RCA with severely calcified subtotal occlusion of right posterior descending artery (RPDA) (**Figure 1A**, Video 1).

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MANAGEMENT

Given the worsening chest pain, decision was made to proceed with percutaneous coronary intervention. A 6-F internal mammary guide catheter (Mach 1, Boston Scientific, Marlborough, Massachusetts) was used to engage RCA. After successful PTCA to distal RCA in-stent restenosis, a Gaia-2 wire (Asahi Intec, Tokyo, Japan) was used to cross the subtotal occlusion in RPDA with support of a Teleport microcatheter (Orbus Neich, Fort Lauderdale, Florida), which was used subsequently to exchange with a 0.014-inch Run-through wire (Terumo, Tokyo, Japan) after dilation with a 1.0 × 5.0-mm Sapphire II Pro balloon (Orbus Neich). This was followed by serial dilatation with 2.25 × 20-mm noncompliant balloon as well as atherotomy with 2.25 × 6.0-mm Wolverine cutting balloon (Boston Scientific) at high pressure; however, there was incomplete balloon expansion in the RPDA lesion (**Figure 1B**, Video 2) and thus a decision was made to proceed with rotational atherectomy for further plaque modification. The workhorse wire was exchanged with a 0.009-inch RotaWire Floppy (Boston Scientific) using a Teleport microcatheter (Orbus Neich). The 1.25-mm burr was subsequently advanced over the wire to a position proximal to the lesion (**Figure 1C**). The rotational speed was set at the conventional range (160,000 rotations/min) with a total of 3 runs with each run time <20 s. Post atherectomy RCA angiography showed Type III cavity spilling (CS) coronary perforation of RPDA draining into the middle cardiac vein and coronary sinus (**Figure 1D**, Video 3). The patient remained hemodynamically stable, with no chest pain or electrocardiography changes. Emergent bedside transthoracic echocardiogram excluded any pericardial effusion or tamponade physiology. Anticoagulation (Heparin) was not reversed. The perforation persisted despite prolonged (>12 min) balloon inflation using 2.25 × 20.0-mm noncompliant balloon. Given the extent of perforation, the decision was made to implant a covered stent. A PK Papyrus (Biotronik AG, Bülach, Switzerland) covered stent 2.5 × 15.0 mm was

ABBREVIATIONS AND ACRONYMS

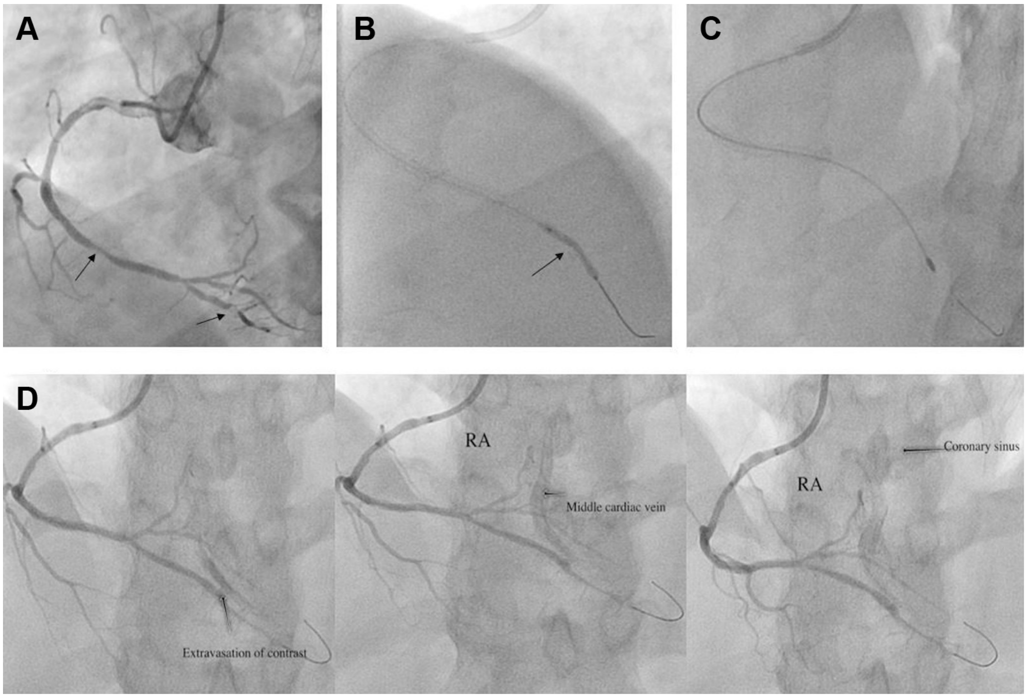
CP = coronary perforation

CS = cavity spilling

RCA = right coronary artery

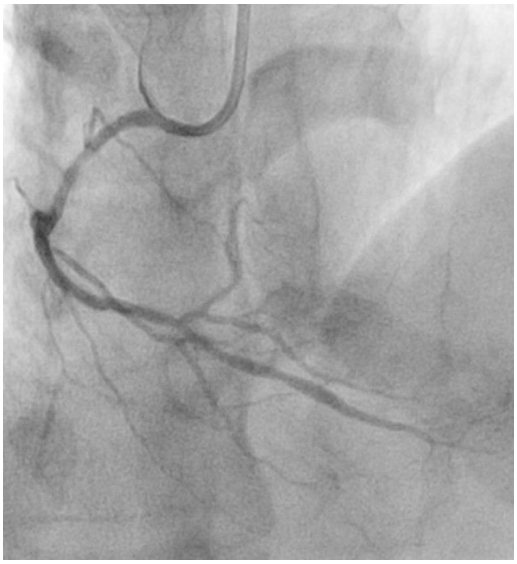
RPDA = right posterior descending artery

FIGURE 1 **Percutaneous Revascularization of RPDA Using Rotablation**



(A) Significant in-stent restenosis in distal right coronary artery (RCA) and calcific lesion in right posterior descending artery (RPDA). **(B)** Undilatable lesion **(arrow)** in RPDA despite high pressure balloon inflation. **(C)** A 1.25-mm burr with RotaWire Floppy was used to cross the lesion. **(D)** RCA angiography showed development of Type III cavity spilling coronary perforation of RPDA draining into the middle cardiac vein and coronary sinus.

FIGURE 2 Final Angiogram of Right Posterior Descending Artery Post-Stent Graft Deployment



Final angiogram after stent graft deployment showing successful sealing of the perforation.

deployed in the RPDA, but perforation persisted, as there were multiple jets. Thus, another 2.5 × 15-mm Papyrus stent graft was deployed in RPDA distal to the first covered stent in an overlapping fashion, which successfully sealed the perforation (**Figure 2**, Video 4).

DISCUSSION

We hereby describe a case of rotational atherectomy induced Type III CS coronary perforation (CP) and its acute management.

Ellis classification is the most commonly used classification method of CPs (1). Previous studies have reported combined incidence of all kinds of CPs to be 0.1% to 3.0% (2-5) with reported incidence of Type III CS CP being 3.0% to 3.3% (1,3). Several patient, angiographic, and technical factors, including older age, female sex, Type C lesions, calcified arteries, tortuous and angulated vessels, previous coronary bypass grafts, balloon/stent oversizing, and use of atheroablative devices, have been identified as predictors of CPs (1-5).

Non-CS type III perforations frequently require pericardiocentesis, covered stenting, and/or emergent surgery. On the other hand, type III CS perforations usually have a favorable prognosis, as they seldom lead to acute hemodynamic compromise or ischemia (6,7). In our case, the posterior descending artery (PDA) was a small- to moderate-size vessel that was underfilled due to chronic subtotal occlusion. Considering the lesion under expansion after PTCA and cutting balloon, we decided to proceed with rotational atherectomy for optimal lesion preparation before stent placement. Therefore, a 1.25-mm burr (the smallest available burr) was chosen, and atherectomy was executed considering risks versus benefits involving this small-moderate size vessel. The Intravascular Lithotripsy System (Shockwave Medical, Santa Clara, California) could have been an alternative strategy but was unavailable in our laboratory, so it was not considered. Use of rotational atherectomy in PDA resulted in the dreaded complication of coronary perforation. Although rotational atherectomy in small- to moderate-size vessels can be safely performed in the hands of experienced and skilled operators, the operator should be well prepared and consider these risks. The perforation resulted in a coronary arteriovenous fistula from RPDA to middle cardiac vein draining into the coronary sinus, without hemodynamic instability, or ischemic changes. The middle cardiac vein is one of the coronary sinus tributary veins that arises in the left ventricle apex and travels in the posterior interventricular grove along with the RPDA and drains into the coronary sinus (8).

There is no consensus to manage type III CS perforations, and management of these coronary artery fistulas can be addressed with different approaches. Prolonged perfusion balloon inflation may treat some of them and previous reports have described spontaneous closure of some of these iatrogenic coronary artery fistulas. Patients with these fistulas can remain asymptomatic in 50% to 60% of cases, but can also lead to progressive development of dyspnea and heart failure symptoms when a significant amount of left to right shunt develops over time (8). Considering a large amount of shunt, we decided to proceed with covered stent implantation to seal the perforation after prolonged balloon inflation failed to do so. We used a PK Papyrus covered stent, which provides greater flexibility and smaller crossing profile and successfully sealed the perforation (9,10).

FOLLOW-UP

The patient was discharged home the following day after a repeat transthoracic echocardiogram showed preserved ejection fraction and no pericardial effusion. Post-percutaneous coronary intervention peak troponin was 4 ng/ml and peak creatine kinase-MB was 31 IU/l.

CONCLUSIONS

We hereby describe a rare case of rotational atherectomy-associated Type III CS CP of RCA- posterior descending artery draining into the middle cardiac vein and its management.

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KEY WORDS coronary perforation, covered stent, Ellis Type III cavity spilling, middle cardiac vein, rotational atherectomy

APPENDIX For supplemental videos, please see the online version of this paper.